2004-2005 Outcomes

BASIX Ongoing Monitoring Program

BASIX
Building Sustainability Index

NSW GOVERNMENT
Department of Planning

BASIX Ongoing Monitoring Program: 2004–2005 Outcomes

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Executive summary

The Department of Planning is undertaking an ongoing monitoring study of BASIX, in order to assess the level of water and energy savings achieved. The results of this study will be used to ensure the BASIX policy delivers on its sustainability objectives, as well as refine and improve data and key calculations in the BASIX tool, ensuring the long term success of the policy.

This report details the outcomes of the first stage of the Monitoring Program, looking at the commitments made at development application stage for single homes in Sydney from the first year of the implementation of the BASIX policy (July 2004 to July 2005), “BASIX 2004/05 Certificates”.

The aim of the report is to analyse the types of water, energy, and thermal comfort technologies installed through BASIX 2004/05 Certificates and therefore broadly monitor the impact of the BASIX policy on new residential developments in the first year of operation.

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Introduction

Introduced in 2004, BASIX (the Building Sustainability Index) is the NSW Government's key planning policy that requires all new homes to be designed to use up to 40% less potable water and produce up to 40% fewer greenhouse gas emissions than the average home.

BASIX is managed by the NSW Department of Planning (DoP) under the Environmental Planning and Assessment (EP&A) Act and has been developed over several years, in consultation with industry groups, practitioners and local government.

BASIX has been introduced across NSW in stages, according to housing type and location.

BASIX TIMELINE

1 July 2004	**1 July 2005**	**1 October 2005**	**1 October 2006**
Single homes in Sydney	All single homes in NSW	All multi-units in NSW	Major renovations in NSW

How does BASIX work?

BASIX is an on-line assessment tool, which is only available on the BASIX website, www.basix.nsw.gov.au. This is the first time the planning system has been delivered on-line. BASIX is free and accessible to all, but is typically used by developers, architects, building designers and owner builders of residential homes.

The BASIX tool has four main sections: Project Details, Water, Energy and Thermal Comfort. For the first year of BASIX implementation, the Water and Energy targets were set at 40% and 25% respectively. Since 1 July 2005, when BASIX was extended to apply across all NSW, the Water and Energy targets varied between 0% and 40%, according to location. This variation was introduced to allow BASIX to be responsive to climate, soil type, rainfall and evaporation rates, as well as building type.

The Thermal Comfort section of BASIX is a pass or fail option, depending on whether the design includes adequate levels of insulation, window shading and performance glass (where appropriate).

BASIX asks a broad range of questions relating to the design of the proposed home, the building materials and the efficiency of taps, toilets, showers and cooking appliances as well as the heating and cooling systems chosen.

This information is analysed to determine whether the home's design meets the BASIX water, energy and thermal comfort targets. These targets are based on the State's average water and energy per capita consumptions. This is referred to as the BASIX benchmark. The BASIX water and energy benchmarks used in the BASIX on-line program during this period were:

- 89,800 litres of water per person per year and
- 2,807 kg $CO_{2\text{-}e}$ per person per year.

Once the design passes these specific targets, the user prints a BASIX Certificate and submits this, with the development application, to council. See Appendix A for a sample BASIX Certificate.

BASIX relies on comprehensive data sets including resource demand, occupation levels and market penetration rates of technologies provided by utilities, state agencies and the Australian Bureau of Statistics. A comprehensive analysis of existing technologies has also been undertaken to ensure BASIX is contemporary and reflects best practice technologies relating to sustainability.

About the BASIX Monitoring Program

Monitoring the outcomes of BASIX has always been a critical component of the development of the BASIX policy; it is essential to determine whether the predicted energy and water savings are being achieved.

Prior to the introduction of BASIX, fundamental statistics regarding residential building and construction activity in NSW had never been collected in a consistent and regulated manner.

Since BASIX began in July 2004, data of this type is becoming available; including key information relating to the number of new homes built each year in NSW and their locations. In addition, significant data demonstrating the take-up of sustainable technologies such as solar hot water systems and rainwater tanks is now collected.

Aim

This aim of this report is to:

- Summarise the results of the BASIX 2004/05 Certificates generated in Sydney, during 1 July 2004 – 30 June 2005 including selected water and energy technologies and thermal building design features;
- Provide examples of previous and future change to the BASIX policy in relation to these outcomes; and
- Compare BASIX results to pre-BASIX studies, where relevant.

Because BASIX was introduced in stages, the monitoring process is also being conducted in corresponding phases, according to available data. It is important to note that because a Certificate is generated before the home design is approved by Council, a BASIX Certificate doesn't equate to an actual built home.

Annual reporting

As part of its long-term commitment to monitoring BASIX, the Department is working with NSW energy and water utilities[1] to access actual water and energy consumption data from BASIX homes. This data will be measured against the predicted BASIX target to accurately determine whether BASIX is delivering equitable and effective water and greenhouse gas reductions across NSW.

Future BASIX monitoring programs will also rely on a more complete and accurate BASIX data set, through the information contained in the BASIX Completion Receipt. This was introduced in July 2006, requiring Principal Certifying Authorities (private certifiers and NSW councils), to notify the Department each time an Occupation Certificate has been issued for a BASIX-compliant home. This will generate a conclusive data set for the Monitoring Program.

[1] Sydney Water, EnergyAustralia, Integral Energy, Agility, Country Energy and other regional water authorities.

2004/05 Outcomes

The first year of BASIX, (1 July 2004 – 30 June 2005), only affected single homes planned in Sydney. The data generated from this first year of Certificates provides a valuable set of dwelling-related data, including address, lot and plan number, home type, number of bedrooms, site area, landscaped area and total floor area.

In addition, BASIX captures all water and energy technology selections and the building design specifications that relates to the home. This data forms the basis of this report, which is the Department's best estimate of how BASIX has shaped the development of new single homes in Sydney during the 2004/05 period.

Reporting method

During the first year of BASIX, almost 12,000 BASIX Certificates were generated. These Certificates were analysed to remove duplicates, "practice runs" by users becoming familiar with the BASIX tool, and incomplete assessments. This left an 'improved' subset, of 6,558 BASIX 2004/05 Certificates (referred to in this report as Certificates) that forms the basis of this report.

This culling may have discarded real projects, or conversely, retained practice projects, and this may lead to some distortion of the findings. The robustness of future BASIX Certificate data, and therefore analysis, will be improved through the introduction of the BASIX Completion Receipt.

It should be noted that the sample size of the Certificates used in this study does not represent all new development applications filed during the first year of BASIX, as an exemption period was granted for building owners who entered into a contract with a builder prior to 1 July 2004.

This report is divided into four main sections: Project details, Water, Energy and Thermal Comfort – each relating to the key sections of the BASIX assessment tool.

Comparison analysis

Several external data sets were selected for comparison with the 2004/05 data to demonstrate changes in the uptake of water and energy saving technologies since the introduction of BASIX. These include the BIS Shrapnel 2002 report "*Attitudes of residential builders to energy issues and usage in Australia 2001/02"* and various ABS studies relating to energy and water.

BASIX Early Assessment Study

This study was a separate monitoring project, begun during the first year of BASIX implementation, to provide preliminary data concerning the take-up of various sustainable technologies and features. The study also assessed how readily the building design industry (i.e. architects, draftspersons and building designers) was adjusting to the need to show BASIX commitments on house design plans.

Between January and March 2005, 111 BASIX-affected homes (detached and dual occupancy homes) selected from 16 Sydney councils (from inner city to urban fringe), were assessed at the development application stage to determine whether BASIX commitments were being marked on design plans. Approximately 70% of these development applications were for typical project homes; the remainder were for more individual designs.

In general, project home companies were more consistent in terms of appropriate plan-marking. Dual occupancy applications were consistently poorer in standard than single home applications.

Despite the small sample size, in terms of BASIX commitments being made by development applicants, the results accorded very closely to the much larger number of homes assessed in the BASIX Monitoring Program, as described in this report.

Project details

The BASIX assessment process begins by asking the user to provide information on the proposed home's location and size.

The location determines the climate conditions (including rainfall and evaporation) of the site, and the expected number of people in the home.

During 2004/05, BASIX only applied to new homes in Sydney. Of the 6,558 Certificates analysed for this report, 59% were located in East Sydney and 41% in West Sydney.

BASIX uses the National Home Energy Rating Scheme (NatHERS) climate zone allocation to define East and West Sydney. East Sydney includes Hornsby, Ryde, City of Canada Bay, Strathfield, Canterbury, Hurstville and Sutherland. West Sydney includes Baulkam Hills, Parramatta, Auburn, Bankstown, Liverpool and Campbelltown.

Site area

The site area is the total area of land on which the proposed home will be built. The median site area[2] of each home was 556m^2.

TABLE 1. SITE AREA DISTRIBUTION

Site area range (m^2)	BASIX Certificates (%)
0 – 300	11.5
301 – 600	47.0
601 – 900	28.3
901 – 1200	6.3
1201 – 1500	1.5
>1500	5.5

SOURCE: BASIX 2004/05

Floor area

The gross floor area is the total area of the floor measured from the inside of external walls (ignoring the area occupied by internal walls). The average gross floor area in East Sydney was 249m^2. The West Sydney average gross floor area was slightly larger, at 261m^2.

TABLE 2. GROSS FLOOR AREA

Floor area (m^2)	BASIX Certificates (%)
0 – 100	2
101 – 200	34
201 – 300	36
301 – 400	20
401 – 500	5
>500	2

SOURCE: BASIX 2004/05

[2] The median site area is more representative than the average, as this figure was distorted by five sites that were larger than 1500m^2.

Bedroom Data

The average number of bedrooms was four. This is consistent with the trend towards increased floor area in new homes, with 50.7% of existing homes in NSW having three bedrooms[3].

TABLE 3. BEDROOM DATA

No. of bedrooms	BASIX Certificates (%)	Average gross floor area(m^2)
1	1	65
2	3	126
3	21	182
4	51	256
5	19	325
>5	5	396

SOURCE: BASIX 2004/05

Summary

Table 4 summarises the project details for Certificates generated in the first year of BASIX implementation.

TABLE 4. PROJECT DETAILS SUMMARY

BASIX Certificates	
Proportion in East Sydney	59%
Proportion in West Sydney	41%
Total number	6558
Site area	
Average	1360m^2
Median	556m^2
Roof area	
Average	208m^2
Median	194m^2
Gross floor area	
Average, East Sydney	249m^2
Average, West Sydney	261m^2
Median	238m^2

SOURCE: BASIX 2004/05

[3] ABS 2005

Water

The BASIX Water target sets a 40% reduction target in mains-supplied potable water consumption, compared to the average home. The average water benchmark used in BASIX in 2004/05 was 89,800 litres of water per person per year.

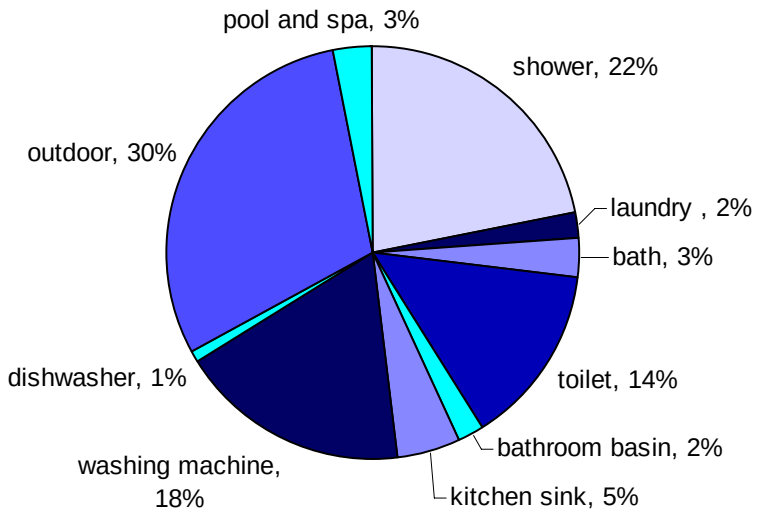
The BASIX Water section asks questions relating to the efficiencies of various household fixtures (showers, taps, toilets etc) and the source of the household's water supply.

The average home can achieve the BASIX Water 40 target by installing water efficient fixtures and an alternative water supply for garden, toilet and/or washing machine. A BASIX home can further reduce its water consumption (that is, over-comply with BASIX) by:

- installing maximum internal efficiencies and/or landscaping with low water use plants;
- increasing the number of internal connections to alternate water supply; or
- by harvesting more water onsite by increasing the storage volume and/or catchment area of the alternative water source.

Figure 1 details the breakdown of water consumption in the average home.

Figure 1. Where an average Sydney household uses its water



SOURCE: BASIX 2004/05

Figure 1 shows that outdoor use is the largest consumer of household water in Sydney, followed closely by showers, washing machines and toilets. Internal water consumption is approximately 70% of total household consumption, with external water demands consuming the remaining 30% of the average Sydney residential water demand.

Water Efficient Fixtures

BASIX requires the user to choose the efficiency rating of the various internal water fixtures. The choices made have a significant impact on the BASIX Water score.

TABLE 5. WATER FIXTURE COMMITMENTS

Internal water efficiencies	Commitment (%)
Showers (3A)	97.0
Toilets (3A)	96.4
Kitchen taps (3A)	95.0
Bathroom taps (3A)	88.8
Waterless toilet	0.5

SOURCE: BASIX 2004/05

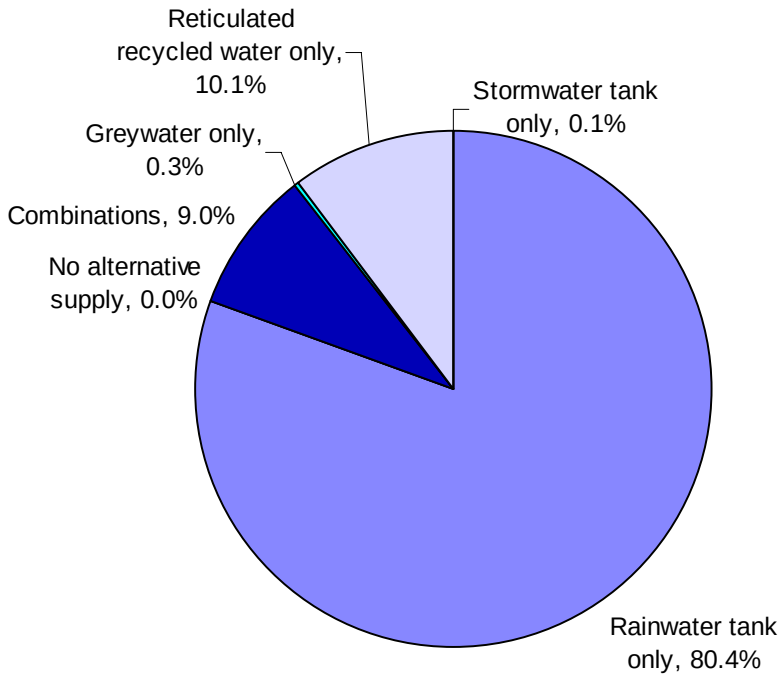
Alternative Water Supply

In BASIX 2004/05, the user could choose from the following compliance options when selecting an alternative water supply:

- rainwater tanks;
- stormwater tanks;
- reticulated recycled water; and
- greywater (treated and diverted).

Figure 2 summarises the breakdown of those selections.

Figure 2. Alternative Water Sources



SOURCE: BASIX 2004/05

All but one of the 6558 Certificates committed to an alternative water supply. The most popular alternative water source selected was the rainwater tank.

The breakdown of the alternative water source combinations is shown in Table 6.

TABLE 6. COMBINATIONS OF ALTERNATIVE WATER SOURCES

Rainwater & stormwater	50.9%
Rainwater & greywater	28.2%
Rainwater, stormwater & greywater	12.1%
Rainwater & reticulated recycled water	4.2%
Stormwater & greywater	2.4%
Rainwater, stormwater & reticulated recycled water	1.3%
Stormwater & reticulated recycled water	0.8%

SOURCE: BASIX 2004/05

The BASIX Water reduction target of 40% has resulted in almost 100% commitment to alternative water supply in 2004/05 BASIX homes.

Water Use

In BASIX 2004/05, the use of an alternative water supply was recognised for the garden, toilet and a connection to the cold tap of the washing machine. Table 7 shows the details.

TABLE 7. WATER USE COMMITMENTS

Source	Garden (%)	Toilet (%)	Washing machine (%)
Mains water only	0.7	11.1	44.0
Alternate water supply			
Rainwater tank only	80.3	77.6	53.0
Reticulated recycled water only	10.1	10.4	2.6
Greywater (treatment and diversion) only	0.6	0.9	0.4
Stormwater only	0.7	-	-
Combinations of water sources**	7.7	-	-
Total (for alternative water supply)	99.3	88.9	56.0

** Combinations of water sources are shown in Table 6

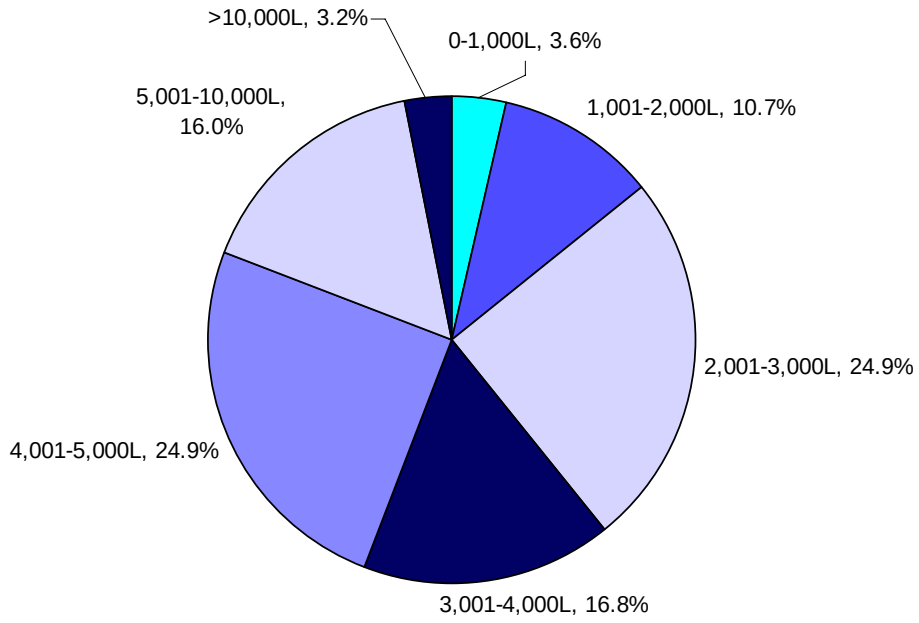
SOURCE: BASIX 2004/05

The high percentage of internal connections of both toilet and laundry for rainwater tanks reflects the savings awarded for these connections in BASIX. Connections to toilets and washing machines ensures that rain water is used consistently throughout the year, maximising potable water savings.

Rainwater tank size

In BASIX 2004/05, rainwater (stored in a rainwater tank), could be collected from all non-trafficable roof areas within the development site (including separate garages or sheds) and used for toilet flushing, washing machines and garden irrigation. A total of 89.2% of Certificates nominated rainwater tanks as an alternative source of water.

Figure 3. Rainwater tank volume



SOURCE: BASIX 2004/05

The savings from a rainwater tank are dependent on a variety of elements including climatic conditions (rainfall and evaporation), occupancy rates, tank size, catchment area, site area and number of connections.

BASIX offers flexibility in how the water target is met and has encouraged appropriate sized rainwater tanks and rainwater uses. The most widely selected rainwater tank size (2,000 to 5,000 litres) is in the optimum rainwater tank size range for Sydney[4]. The average size of all nominated tanks was approximately 4,800 litres.

The average rainwater tank size was approximately 4,600 litres for East Sydney and 5,200 litres for West Sydney. West Sydney experiences less rainfall and higher evaporation rates and homes in this region committed to a larger landscaped area on average compared to East Sydney.

The average roof area connected to a rainwater tank was 165.1m^2 in East Sydney (86.1% of the total roof area) and 190.7 m^2 in West Sydney (79.7% of the total roof area). For Sydney as a total, the average roof area connected to a rainwater tank was 174.2m^2 or 83.5% of total roof area.

Future analysis through the BASIX Water & Energy Monitoring Program will examine the effectiveness of each rainwater tank size by analysing factors such as home size, landscape size, catchment area, and external/internal connections.

[4] LHRCCRS 2002

Rainwater tank connections

Table 8 shows the analysis of the selected rainwater tank connections.

TABLE 8. RAINWATER TANK CONNECTIONS

Rainwater tank use	BASIX Certificates (%)
Toilet, washing machine, garden	47.8
Toilet, garden	37.7
Washing machine, garden	10.0
Garden only	2.7
Toilet and washing machine	1.3
Toilet only	0.3
Washing machine only	0.2

SOURCE: BASIX 2004/05

A total of 89.2% of homes committed to a rainwater tank as a substitute for mains potable water. Rainwater was nominated primarily for gardens (98.3%) and toilets (87.1%) and then washing machine connections (59.3%).

Reticulated alternative (recycled) water

During BASIX 2004/05, two reticulated recycled water schemes existed in Sydney: Rouse Hill, where recycled water is available for garden and toilet use and the Sydney Olympic Park Authority (SOPA) scheme, which permits recycled water to be used in the garden, toilet and laundry.

Analysis of the Certificates shows that 10.7% committed to reticulated recycled water use. Reticulated water was nominated primarily for garden (99.3%) and toilet (97.7%) and some laundries (24.4%).

Greywater treatment and diversion systems

BASIX 2004/05 defines a greywater treatment system as a system for the collection, treatment and storage of greywater. Greywater is wastewater not contaminated by human excrement. Greywater includes wastewater from a bath, shower, hand basin and laundry. Depending on the level of treatment, treated greywater can be used for garden irrigation and certain internal uses.

BASIX 2004/05 defines a greywater diversion system as a system for the diversion (but not the treatment or storage) of greywater. Greywater for diversion can be collected from the shower, hand basin, bath and laundry. Untreated, diverted greywater can be used for garden irrigation only, and must be connected to a sub-surface irrigation system.

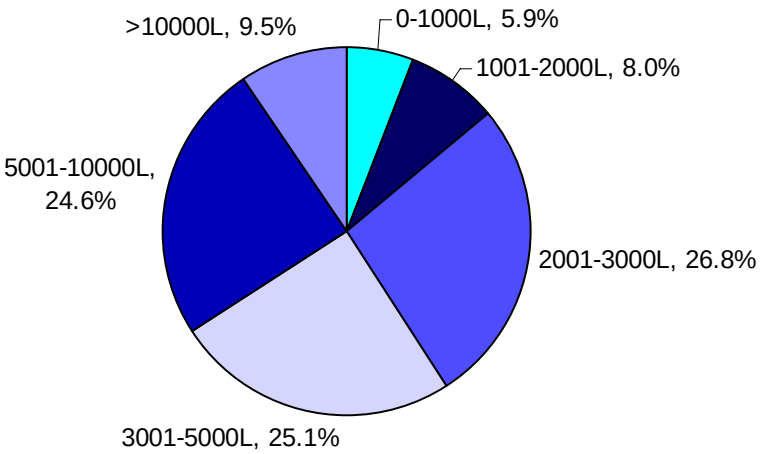
A total of 4.1% of Certificates committed to a greywater treatment system or a greywater diversion system. Of those, 63.5% nominated diverted systems, whilst 36.5% committed to treatment systems.

A total of 61.3% of greywater systems nominated water collection from the laundry and bathroom, 32.5% collection from laundry only, and 6.3% from the bathroom only.

Stormwater

BASIX 2004/05 defines a stormwater tank as a tank designed for the capture and storage of water collected from trafficable surfaces, including paved or ground surfaces. Figure 4 summarises the selection of stormwater tank volumes.

Figure 4. Stormwater tank volume



SOURCE: BASIX 2004/05

Of the 6.2% of Certificates that committed to installing a stormwater tank, the average size of the tank was 6,300 litres. Table 9 presents the average collection area diverted to the stormwater tank.

TABLE 9. STORMWATER COLLECTION COMMITMENTS

Location of collection area	Average diversion area m^2
Roof	44.7
Impervious areas	104.5
Garden areas	75.4

SOURCE: BASIX 2004/05

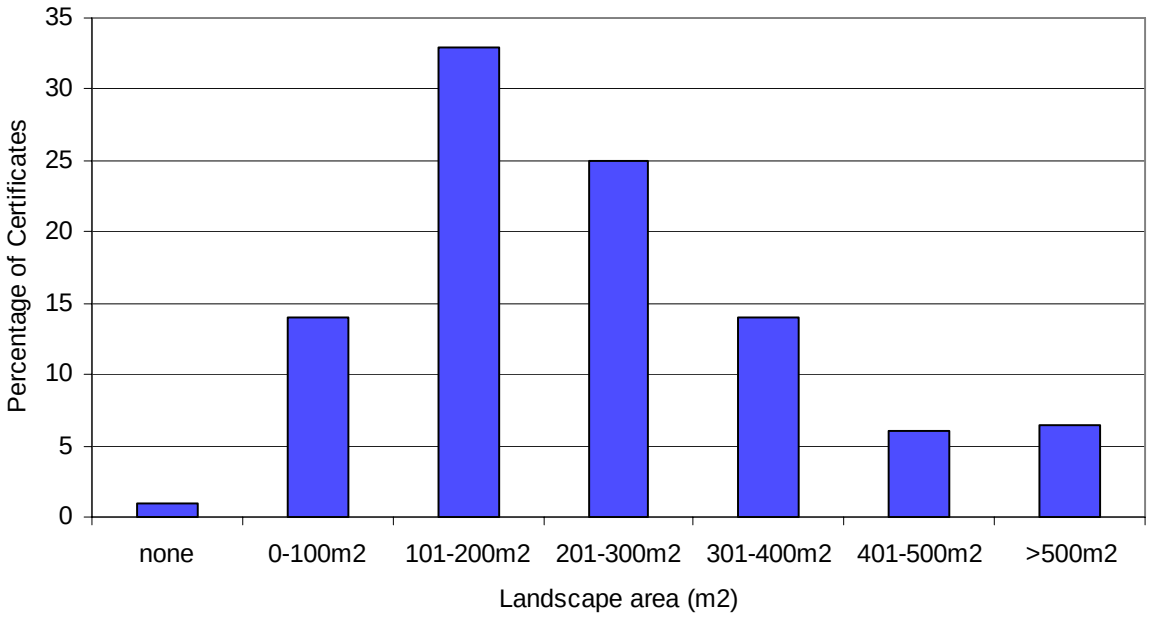
The stormwater results are likely to be influenced by the local council requirements for on-site stormwater management (detention purposes) rather than as a BASIX requirement. This is because the BASIX 2004/05 on-line program did not formally define stormwater tank 'storage' size and allowed the full stormwater tank size to be entered into BASIX, regardless of whether this water was to be reused or detained for slow release to the stormwater system.

BASIX now requires proponents to enter the volume of the stormwater tank available for household reuse. Stormwater volumes specified by local councils for onsite stormwater detention or retention must be in addition to the volume nominated as available for household storage and re-use in BASIX (refer to the BASIX Help Notes for further explanation).

Landscape

Landscaped areas in BASIX include areas of lawn, garden and (if nominated) areas of indigenous/low water use species. Figure 5 shows the distribution of the selected landscape areas.

Figure 5. Landscaped area



SOURCE: BASIX 2004/05

The average landscaped area nominated was 370.4 m^2 representing, on average, 41.6% of the site area. The majority of Certificates committed to between 100-300m^2 of landscaped area. A total of 32.3% of Certificates committed to indigenous and/or low water use plants.

Pool and spa

A pool or outdoor spa will substantially increase the water and energy consumption of a home, which will subsequently have to work harder to reach the BASIX targets. Installing a pool cover will greatly reduce evaporative water losses and hence improve the BASIX Water score.

A total of 11.9% of Certificates nominated to install a pool. The average pool volume was 41.8kL. Of these pools, 85.9% elected to install a pool cover. A total of 1.6% of the Certificates proposed the installation of a spa. The average spa volume was 3.9kL.

Summary

Table 10 summarises the water-use results and compares them to the BASIX Compliance Study, pre-BASIX new homes and the existing residential housing stock.

The BASIX Compliance Study comparison validates that the BASIX 2004/05 Certificates are consistent with a sample of new BASIX homes that have been approved and constructed. The pre-BASIX new homes and existing home data provides insight into the impact BASIX is having on housing stock. The final column 'Maximum BASIX score' outlines the approximate BASIX score for each technology to highlight the most effective water saving measure in BASIX.

TABLE 10. SUMMARY OF WATER SAVING COMMITMENTS

Water saving commitment	2004/05 Certificates (%)	Assessment Study (%)	Pre-BASIX new homes (%)	Existing homes (%)	Maximum BASIX score***
3A Showerhead	97	94	42	20*	8
3A Toilet	96	96	-	30*	6
3A Kitchen taps	95	92	21	10*	1
3A Bathroom taps	89	92	21	10*	1
Indigenous/low water use plants	32	32	-	14**	variable
Pool cover	86#	-	-	-	5
Rainwater tank	89	-	-	5**	18
Reticulated recycled water	11	-	-	<1**	21
Stormwater tank	6	-	-	<1**	12
Greywater diversion	2.7	-	-	<1**	5
Greywater treatment	1.6	-	-	<1**	16

12% of the 2004/05 BASIX Certificates nominated a pool. 86% of these committed to a pool cover.
* Sydney Water 2003 ** ABS 2004 *** Based on an average new Sydney home
SOURCE: BASIX 2004/05

BASIX 2004/05 Certificates vs BASIX Early Assessment Study

Results from the BASIX 2004/05 Certificates sampled for this report are within ± 5 of the results from the BASIX Early Assessment Study. This validates that the culled sample of BASIX 2004/05 Certificates give consistent results to a sample of 100 BASIX Certificates that have been approved and constructed. It also indicates that future studies of smaller samples of BASIX completed homes will give a fair representation of the full BASIX Certificate dataset.

BASIX 2004/05 Certificates vs pre-BASIX new homes data

The high penetration rate of BASIX water efficient fixtures in new BASIX homes (97% penetration of 3A showerheads and 89-95% penetration of 3A taps) is an excellent improvement on installations of pre-BASIX in new 2002 NSW homes: 42% penetration of efficient showerheads and 21% penetration of water efficient taps in new homes[5].

BASIX 2004/05 Certificates vs existing homes data

This comparison indicates that BASIX homes are being constructed to be significantly more water efficient than the average existing home. The penetration of internal water efficient fixtures in BASIX ranges between 89-97%, compared to that of existing homes which is 10-30% penetration[6]. Only 7% of existing homes use an alternative to mains potable water on their gardens, with 5% installing a rainwater tank and less than 1% have recycled or greywater[7]. This contrasts with BASIX results of 99% of gardens being watered with an alternative to mains water supply.

Maximum BASIX Scores

This column outlines the approximate BASIX score attributable to each technology; the higher the BASIX score, the more water efficient the technology is. It demonstrates that, for an average Sydney home, the BASIX Water 40 target can be met by a combination of internal water efficiencies (~16 points) combined with a moderate garden size or large garden with low water use plants (~5 points) plus connection to an alternative water supply (~20 points).

[5] BIS 2002;
[6] Sydney Water 2003
[7] ABS 2004

Energy

Household energy consumption is rising rapidly: in New South Wales, consumption is projected to be 38.4 % above 1990 levels by 2010. Australian residential greenhouse emissions are projected to increase by 16.7% above 1990 levels by 2010. By contrast, under the Kyoto Protocol, Australian emissions are to increase only 8% above 1990 levels[8].

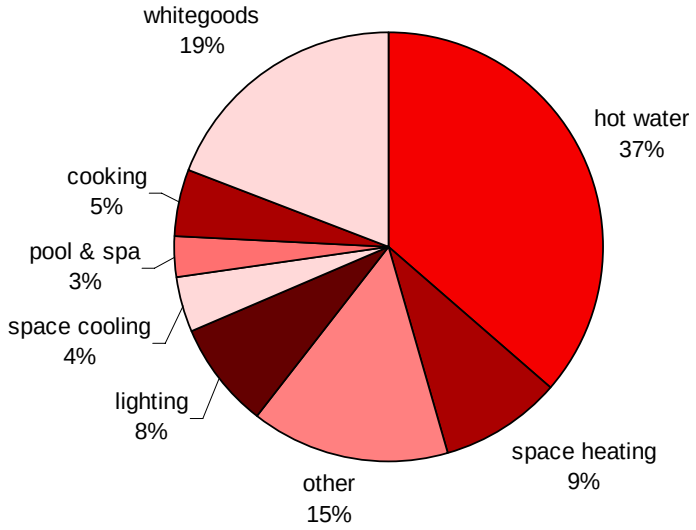
The aim of the BASIX Energy policy is to reduce greenhouse gas emissions from residential homes. Each new home in NSW must meet a reduction target compared to an average home. In 2004/05, the BASIX Energy target was 25, and BASIX Certificates were measured against a Sydney per capita greenhouse budget 'benchmark', for example, 2,807 kg CO2e-per person per year for a four bedroom house in East Sydney. This figure varied for different house sizes across East and West Sydney.

The program now applies across NSW, and since 1 July 2006, each home is required to meet a target of up to a 40% reduction of greenhouse gas emissions compared to the average NSW home. This target varies depending on location and home type.

The BASIX Energy section measures all the major technologies in the home that affect energy consumption. These include hot water, heating and cooling, lighting, and cooking. Within each category, the different efficiencies are modelled to reflect their impact on energy consumption.

Figure 6 shows the greenhouse gas emissions of an average pre-BASIX Sydney home from energy consumption[9].

Figure 6. Greenhouse gas emissions of an average Sydney dwelling



SOURCE: BASIX 2004/05

The average home could achieve the BASIX Energy 25 target by installing an efficient hot water system (eg solar, high efficiency gas or heat pump) and depending on the house size, some efficient lighting or heating and cooling. The biggest gains that can be made in any one area of domestic energy consumption are in hot water.

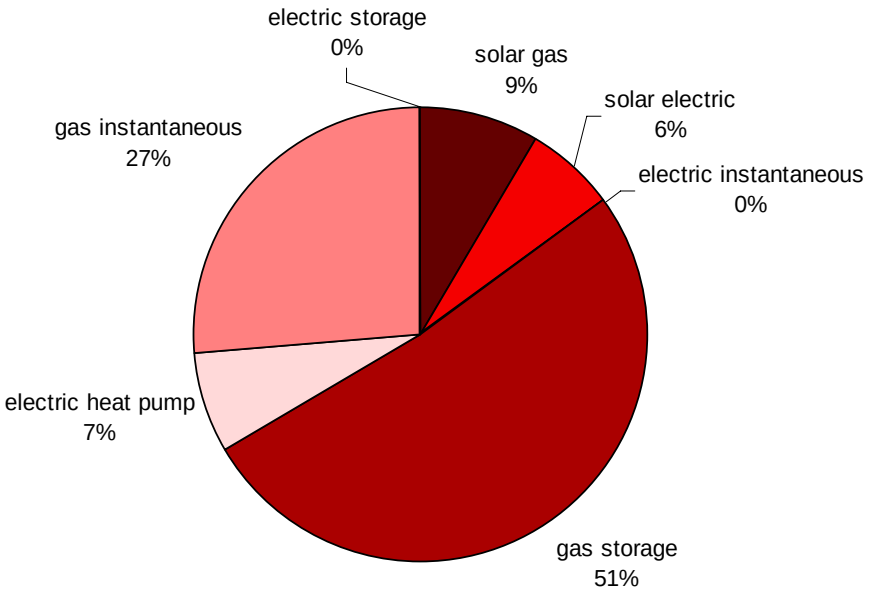
[8] (Australian Greenhouse Office, 1999. Australian Residential Building Sector Greenhouse Gas Emissions 1990-2010. Final Report, page 13).
[9] EnergyAustralia 2003

Hot water systems

For the average NSW home, hot water is responsible for the largest share of greenhouse emissions. All major water heating technologies are available for selection in the BASIX tool.

Because most existing homes in NSW use electric storage hot water (the most greenhouse intensive hot water system) selecting a solar, high efficiency gas or an electric heat pump hot water system in BASIX will reduce greenhouse gas emissions and help homes reach the energy target. Figure 7 summarises the types of hot water systems selected in BASIX 2004/05.

Figure 7. Hot water systems



SOURCE: BASIX 2004/05

Table 11 shows the breakdown of the energy efficiency ratings of the gas hot water systems.

TABLE 11. ENERGY EFFICIENCY RATINGS

Gas storage systems	%	Gas instantaneous systems	%
5 Star	30.9	5 star	52.6
4 & 4.5 star	31.4	4 star	23.6
3 & 3.5 star	34.1	3 star	23.8
below 3 stars	3.6		

SOURCE: BASIX 2004/05

As shown in Figure 7, gas hot water systems accounted for 78.1% of the selected hot water systems, followed by 14.9% of solar hot water systems and 7.0% electric heat pumps. Only 0.1% of BASIX Certificates committed to an electric instantaneous hot water system. No electric storage hot water systems were selected.

Because hot water is such a major component of domestic greenhouse emissions, 99.9% of BASIX certificates nominated an above-average efficiency hot water system. The selection of efficient hot water systems is a popular and cost effective option for greenhouse reduction.

Heating systems

All major heating technologies are offered for selection in the BASIX tool. These include:

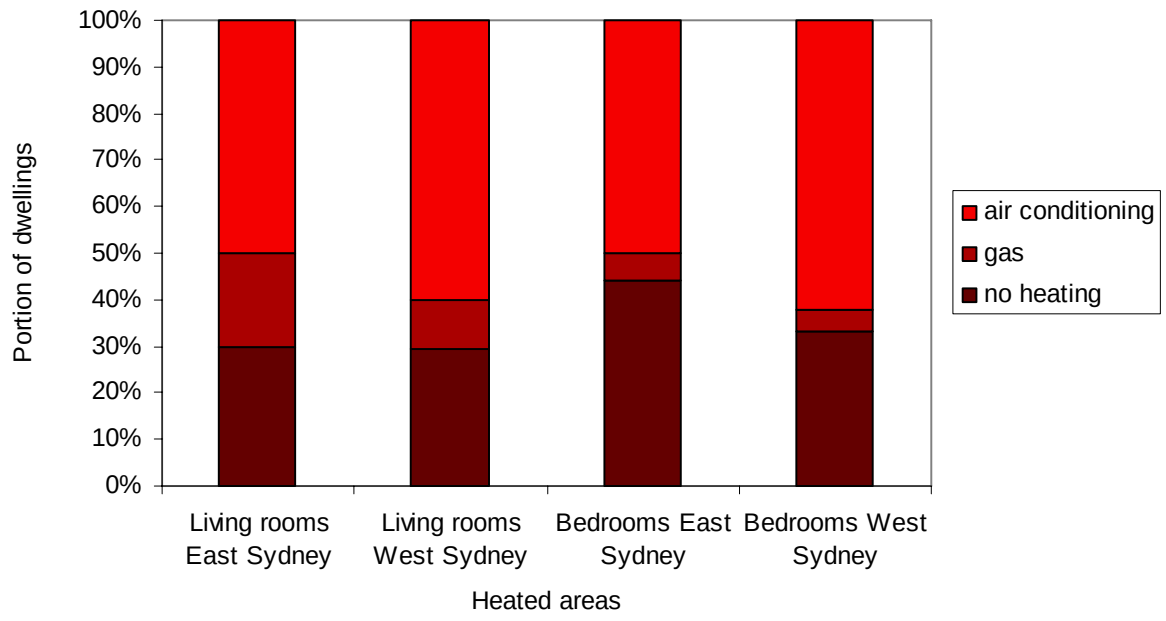
- Gas fixed flued;
- Gas hydronic (gas fuelled hot water heating systems);
- 1-phase air conditioning (reverse cycle);
- 3-phase air conditioning (reverse cycle);
- Electric floor slab.

Where applicable, these options are differentiated by the levels of efficiency available within the technology type, for example 1-6 stars for 1-phase air conditioning systems. There is also the option to install 'no active heating'.

Fixed flued gas heating, gas hydronic heating, or high efficiency reverse cycle air conditioning are the most energy efficient heating options in the BASIX tool. Under BASIX, homes are also encouraged to minimise their heating needs through good thermal comfort design (see Thermal Comfort section).

Figure 8 shows the selection made for heating systems by location (East and West Sydney) and home area (living room and bedroom).

Figure 8. Heated areas for East and West Sydney



SOURCE: BASIX 2004/05

Air conditioning was the most popular form of heating in both living and bedroom areas, followed by no active heating, then by fixed flued gas heating. Air-conditioning (reverse cycle) was nominated in 56% of all Certificates. In West Sydney, 62.6% of certificates nominated air conditioning for heating, while 51.5% nominated air conditioning for heating in East Sydney.

The proportion of 3-phase air conditioners was much higher than that of 1-phase air conditioners. Overall, 42.4% nominated 3-phase air-conditioning for heating, while 14.3 nominated 1-phase. In West Sydney, 52.2% nominated 3-phase air conditioners for heating, while 11.3% nominated 1-phase. In East Sydney, 35.7% nominated 2-phase air conditioners for heating, while 16.3% nominated 1-phase.

In Sydney, 38.7% (bedroom areas) and 29.0% (living areas) did not nominate an active heating system. Whilst 'no active heating' was offered in BASIX, this did not necessarily mean that there would be no greenhouse budget for heating the home.

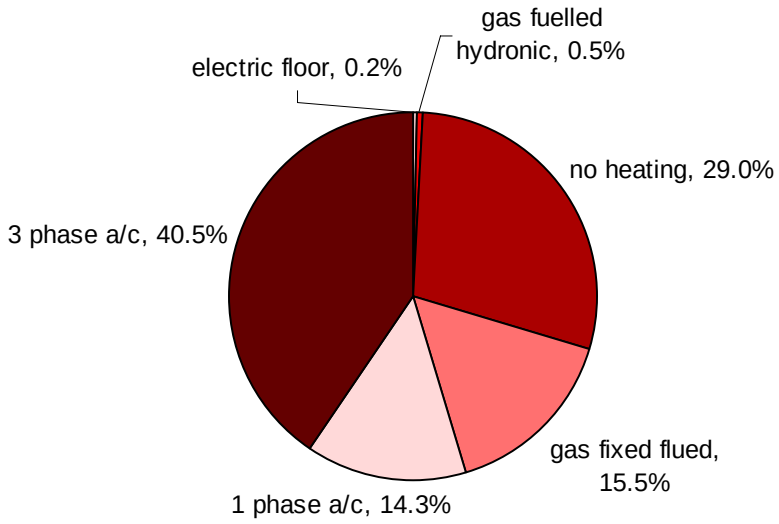
Unless the thermal performance of the home specified to BASIX was signifcantly below the thermal comfort caps, and 'no heating' was selected, BASIX assumes that some form of heating, (for example a greenhouse intensive electric bar radiators), would be installed at a later date and applies a heating load equivalent to a 1 star air conditioner.

Overall across Sydney, 15.5% nominated gas fixed flued heating. In East Sydney, 18.3% nominated gas fixed flued heating, while 11.3% nominated it in West Sydney. The selection of fixed flued gas heating was significantly higher in living rooms than bedrooms.

Heating systems in the living area

Figure 9 shows a similar breakdown for BASIX heating systems selected for living rooms, and their energy efficiency ratings.

Figure 9. Heating systems of living areas



SOURCE: BASIX 2004/05

Table 12 shows the breakdown of the energy efficiency ratings of the heating systems.

TABLE 12. ENERGY EFFICIENCY RATINGS

3 phase a/c EER rating	%	1 phase a/c	%	Gas fixed flued	%
>4.0	10.1	6 star	10.4	6 star	n/a
3.5-4.0	10.3	5 & 5.5 star	11.2	5 star	33.4
3.0-3.5	30.3	4 & 4.5 star	14.2	4 & 4.5 star	24.1
2.5-3.0	36.7	3 & 3.5 star	30.7	3 & 3.5 star	29.9
>2.5	12.5	2 & 2.5 star	9.5	2 & 2.5 star	4.9
		1 & 1.5 star	24.0	1 & 1.5 star	7.7

SOURCE: BASIX 2004/05

NOTE: The efficiency of 1-phase and 3-phase air-conditioning are measured differently. The efficiency of 1-phase air conditioners is usually measured in stars, ranging from 1 to 6. The efficiency of 3-phase air-conditioning, however, is measured by the Energy Efficiency Ratio (EER), which is the output power divided by the input power.

A total of 54.8% of Certificates selected to install air conditioning for heating living areas. 3-phase systems outnumbered small 1-phase systems by a ratio of almost 3 to 1.

The average efficiency selected for 1-phase air conditioning for living room heating was 3.3 stars. The average EER for 3-phase air conditioning for living room heating was 3.1.

Analysis shows that 15.5% of living areas were heated via a gas fixed flued heater. The average selected efficiency for these heaters was 3.9 stars In addition, 33.4% selected the maximum efficiency (5 stars) while only 6.8% selected the minimum efficiency (1 star).

A small percentage (0.5%) of heating systems for living areas were gas-fuelled hydronic (hot water) heaters. These, as well as gas fixed flued heaters, are the best heating technology for greenhouse gas reduction.

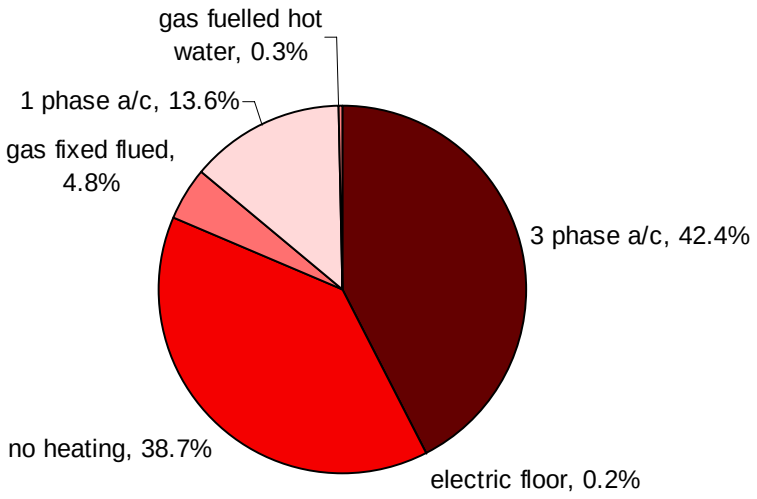
Electric floor slab heating is the most greenhouse intensive type of system to install. From the data, 0.2% of certificates nominated electric floor heating for living rooms.

As discussed above, 29.0% of Certificates did not nominate an active heating system for the living area.

Heating systems in the bedroom

Figure 10 summarises the BASIX space heating systems selected for bedrooms.

Figure 10. Heating systems in bedrooms



SOURCE: BASIX 2004/05

From Figure 10, 56% selected to install air conditioning (reverse cycle) for heating bedroom areas. Of these, large 3-phase systems outnumbered small 1-phase systems by 3:1.

Table 13 shows the energy efficiency ratings of the cooling system.

TABLE 13. ENERGY EFFICIENCY RATINGS

3 phase a/c EER rating	%	1 phase a/c	%	Gas fixed flued	%
>4.0	10.5	6 star	10.4	6 star	n/a
3.5-4.0	10.6	5 & 5.5 star	10.9	5 star	32.3
3.0-3.5	30.2	4 & 4.5 star	15.5	4 & 4.5 star	22.4
2.5-3.0	36.7	3 & 3.5 star	28.3	3 & 3.5 star	31.0
>2.5	11.9	2 & 2.5 star	10.0	2 & 2.5 star	3.8
		1 & 1.5 star	25.0	1 & 1.5 star	10.5

SOURCE: BASIX 2004/05

The average efficiency selected for 1-phase air conditioning for bedroom heating was 3.2 stars. The average EER for 3-phase air conditioning for bedroom heating was 3.1.

Analysis shows that 4.8% of bedroom areas were heated via a gas fixed flued heater. The average star rating chosen for these systems was 3.8. The maximum efficiency rating (5 stars) for the fixed flued heater was selected on 32.3% of certificates, while 9.3% selected the lowest (1 star).

Only 0.3% of heating systems for living areas were gas fuelled hydronic (hot water) heaters, which is a low intensive form of greenhouse heating.

A total of 0.2% of Certificates nominated electric floor heating for living rooms. Electric floor slab heating is the most greenhouse intensive type of heating system.

Heating Systems summary

Of all Certificates, 'no active heating' was nominated in 38.7% of bedroom areas and 29.0% of living areas. This figure may represent a commitment to better thermal design and passive heating.

Of the Certificates sampled, 56% selected to install air conditioning for heating bedroom areas and 54.8% for heating living areas. Whilst air conditioning is a problem from a peak demand management perspective, air conditioners are a more greenhouse efficient heating system than electric resistance heating, due to their high coefficient of performance (COP). Peak demand is not assessed by the BASIX tool.

For either living rooms or bedrooms, 42.4% of Certificates nominated 3–phase air conditioners as the heating system, and 14.3% selected 1-phase air conditioners. The ratio of 3-phase to 1-phase air conditioners installed in new Sydney homes is approximately 3 to 1.

Whilst space heating is an important component of household energy use, most applicants found that, because of the gains made in other areas, especially hot water, it was not necessary to select the highest efficiency heating system to meet the BASIX Energy 25 target. However, this may change as applicants are faced with the new BASIX Energy target, of up to 40% introduced on 1 July, 2006.

Cooling Systems

All major cooling technologies are modelled in the BASIX tool. These include:

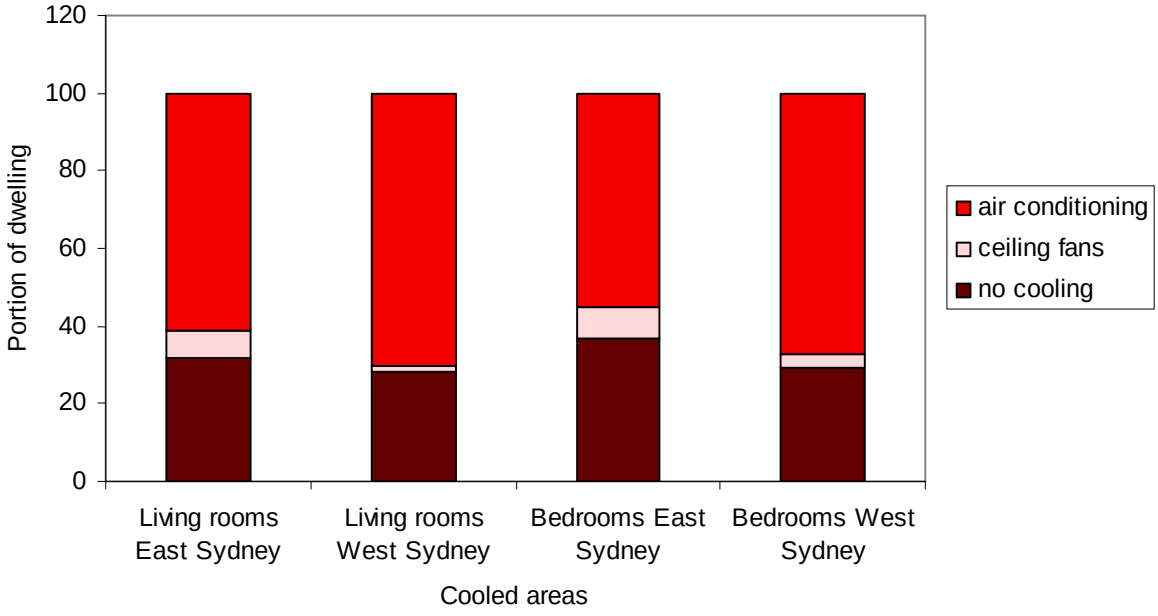
- Ceiling fans
- Evaporative cooling
- 1-phase air conditioning
- 3-phase air conditioning
- Air conditioning and ceiling fans

Where applicable, these options are differentiated by the different levels of efficiency available within the technology type, for example 1 - 6 stars for 1-phase air conditioning. There is also the option to install 'no active cooling'. Ceiling fans, evaporative cooling, or high efficiency air conditioning are the most energy efficient cooling options in BASIX.

Homes were also encouraged to minimise their cooling needs through good thermal comfort design.

Figure 11 provides a summary of cooling selections, in East and West Sydney.

Figure 11. Cooling in living areas and bedrooms



SOURCE: BASIX 2004/05

Air conditioning use was the most popular form of cooling selected in both living and bedroom areas, followed by no active cooling and then ceiling fans. Air-conditioning was nominated in 65.1% of all Certificates. In West Sydney, 70.1% nominated air conditioning for cooling, while 61.7% nominated air conditioning for cooling in East Sydney.

As was the case with heating, the proportion of 3-phase air conditioners was much higher than that of 1-phase air conditioners. A total of 44% nominated a 3-phase air conditioner of cooling, while 19.1% nominated 1-phase.

In West Sydney, 53.2% nominated 3-phase air conditioners for cooling, while 14.2% nominated were 1-phase. In East Sydney, 37.7% nominated 3-phase air conditioners for cooling, while 22.4% nominated 1-phase.

The cooling option with the lowest greenhouse emissions in BASIX is ceiling fans. Ceiling fans were selected by 5.9% of Certificates. Ceiling fans use was higher in East Sydney (7.4%) than in West Sydney (3.8%).

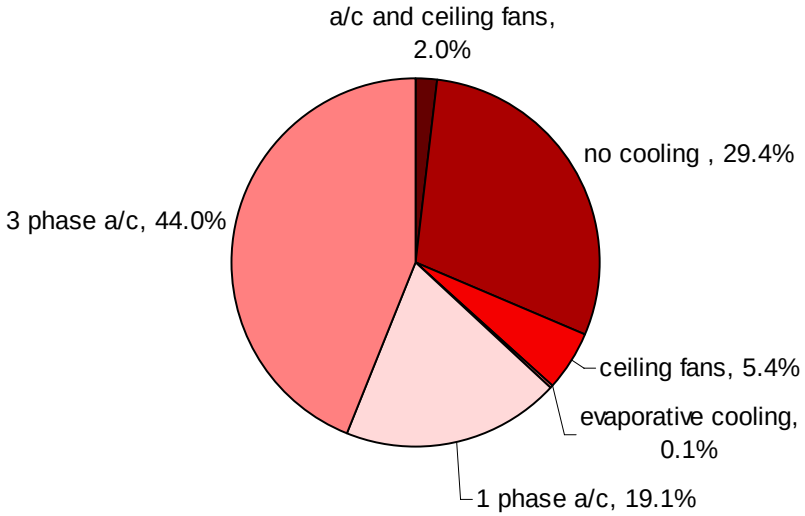
A total of 33% (in bedroom areas) and 29.4% (in living areas) of Certificates did not nominate an active cooling system. Whilst 'no active cooling' was offered in BASIX, this did not necessarily mean that there would be no greenhouse budget for cooling the home.

Unless the thermal performance of the home specified to BASIX was excellent, if "no cooling" is selected, a cooling load, equivalent to a 1 star air conditioner, would be applied to the home. This is because it is likely that some form of cooling, (for example a low star air conditioning system), would be installed at a later date.

Cooling Systems in the living area

Figure 12 shows the breakdown for cooling systems selected for living rooms. Table 14 shows the energy efficiency ratings.

Figure 12. Cooling systems of living areas



SOURCE: BASIX 2004/05

TABLE 14. ENERGY EFFICIENCY RATINGS

3 phase a/c EER rating	%	1 phase a/c	%
>4.0	11.3	6 star	11.0
3.5-4.0	10.3	5 & 5.5 star	12.5
3.0-3.5	21.6	4 & 4.5 star	18.1
2.5-3.0	43.9	3 & 3.5 star	30.6
>2.5	12.9	2 & 2.5 star	8.8
		1 & 1.5 star	19.0

SOURCE: BASIX 2004/05

From Figure 12, a total of 65.1% of Certificates selected to install air conditioning for cooling living areas. Of these, large 3-phase systems outnumbered small 1-phase systems by more than 2 to 1.

The average efficiency for 1-phase air conditioning for living room cooling was 3.4 stars. The average EER for 3-phase air conditioning for living room cooling was 3.1.

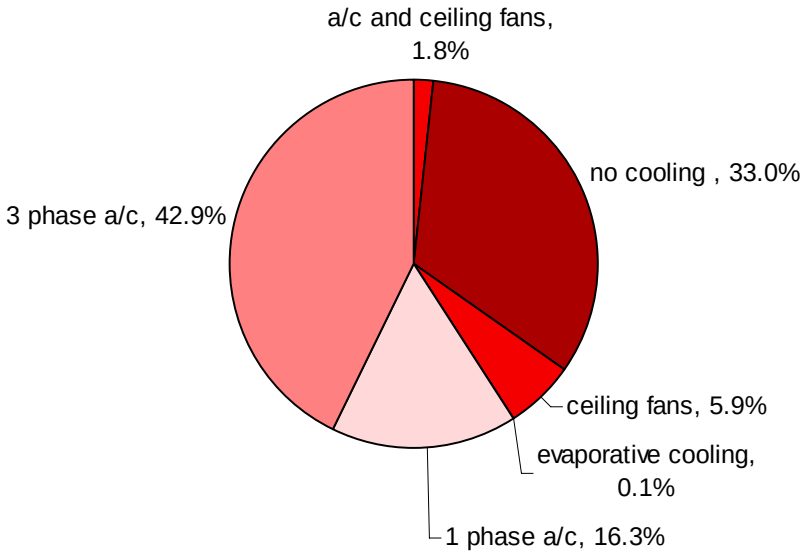
The remaining space cooling systems selected for living rooms were ceiling fans (5.4%), followed by a combination of air-conditioning and ceiling fans (2%) and lastly evaporative cooling (0.1%).

As discussed above, a total of 29.4% of Certificates did not nominate an active cooling system for the living rooms.

Cooling systems in the bedroom

Figure 13 summarises the cooling systems selected for bedrooms. Table 15 shows the energy efficiency ratings of the relevant systems.

Figure 13. Cooling systems of bedroom areas



SOURCE: BASIX 2004/05

TABLE 15. ENERGY EFFICIENCY RATINGS

3 phase a/c EER rating	%	1 phase a/c	%
>4.0	10.3	6 star	10.1
3.5-4.0	10.7	5 & 5.5 star	11.4
3.0-3.5	21.6	4 & 4.5 star	17.9
2.5-3.0	44.7	3 & 3.5 star	28.0
>2.5	12.7	2 & 2.5 star	10.2
		1 & 1.5 star	22.3

SOURCE: BASIX 2004/05

From Figure 13, 60.9% of Certificates selected air conditioning for cooling bedroom areas. Of these, 3-phase systems outnumbered small 1-phase systems by approximately 2.5 to 1.

The average efficiency chosen for 1-phase air conditioning for bedroom cooling was 3.3 stars. The average EER for 3-phase air conditioning for bedroom cooling was 3.1.

Cooling system summary

The remaining space cooling systems selected for bedrooms were ceiling fans (5.9%), followed by a combination of air-conditioning and ceiling fans (1.8%) and lastly evaporative cooling (0.1%).

For either living rooms or bedrooms, 44.0% of BASIX certificates nominated 3-phase air conditioners for cooling. A further 19.1% installed 1-phase air conditioners.

Evaporative cooling was only available in the West Sydney climate zone, and was only selected in only 0.1% of certificates. This technology also incurs a large water penalty in BASIX, and it is likely the low uptake of evaporative cooling was resulted from a combination of these two factors.

Whilst space cooling is an important component of household energy use, most applicants found that, because of the gains made in other areas, especially hot water, it was not necessary to select the highest efficiency cooling systems to meet the BASIX Energy 25 target. However, this may change as applicants achieve the new BASIX Energy target, which has increased to up to 40% as of 1 July, 2006. Future monitoring will determine if more emphasis is placed on the selection of energy efficient heating and cooling systems.

Cooking selections

Cooking accounts for approximately 5% of a household's greenhouse gas emissions. The selection of a gas oven and cooktop is the most greenhouse efficient cooking option (the highest BASIX scoring). Selecting an all electric cooktop and oven is the most greenhouse gas intensive and the gives the lowest BASIX score for cooking. Table 10 summarises the selected BASIX compliance options for cooking.

TABLE 16. COMMITMENTS TO COOLING FUEL TYPE AND TECHNOLOGY

Main cooking energy source	BASIX Certificates (%)
Gas cook top, electric oven	64.9
Gas cook top and oven	20.7
Electric cook top and oven	14.4

SOURCE: BASIX 2004/05

A total of 20.7% of homes chose to commit to an all gas cooktop and oven. The majority (64.9%) committed to cooking with a combination of a gas cook top and an electric oven. Finally, 14.4% committed to cooking with an all electric cooktop and oven.

Well ventilated refrigerator space

BASIX in 2004/05 defined a well ventilated fridge space as 'unenclosed' or 'only enclosed on three sides, including the rear and top'; or if the refrigerator is to be enclosed on three sides (not including the rear and top), air flow (equal to the air flow that would pass over the refrigerant coils were the refrigerator unenclosed) must be provided."

A well-ventilated fridge space will improve the efficiency of a fridge and consequently help the home to reach the BASIX Energy target. This selection is worth up to 2 points in BASIX.

A total of 63.1% of Certificates committed to a well ventilated refrigerator space.

There is some uncertainty regarding the level of compliance with this commitment, given the difficulty ensuring a well-ventilated refrigerator space is implemented in the constructed home. The BASIX Water and Energy Monitoring Project will monitor compliance with this commitment and review the assigned energy saving.

Natural lighting

In BASIX 2004/05, if direct natural lighting was selected for a particular room, it required a light source (either a window or skylight) to be part of the perimeter wall of the room. The skylight must be located in the roof directly above the room to help applicants reach the energy target.

BASIX does not recognise natural lighting that comes through a glazed panel or opening from an adjoining room. In addition, if selected for bathrooms/toilets, natural lighting had to be provided for every bathroom/toilet amenity in the home.

Selecting natural lighting for kitchens and bathrooms/toilets will help homes reach the BASIX Energy target. This was worth approximately 3 points in BASIX in 2004/05.

A total of 24.1% of Certificates nominated natural lighting (windows and/or skylights) in the kitchens and 21.5% in the bathrooms.

Table 17 outlines the proportions of homes that selected natural lighting in both the kitchen and bathroom.

TABLE 17. NATURAL LIGHTING SELECTIONS FOR KITCHEN AND BATHROOMS

Options for lighting	Kitchen (%)	All Bathrooms/Toilets (%)
No natural lighting	75.9	78.5
Window	22.9	19.4
Window and Skylight	1.0	1.6
Skylight	0.3	0.5

SOURCE: BASIX 2004/05

The commitment to provide natural lighting in kitchen and bathroom areas was low, with 75.9% of kitchens and 78.5% of bathrooms having no direct natural light. This may have been due to the strict definition of natural lighting in BASIX, which required all bathrooms (including en suites) and kitchens to have a window and/or a skylight as part of the perimeter wall.

Energy efficient lighting

Lighting is responsible for roughly 10% of the greenhouse gas emissions of a typical NSW household. Installing energy efficient lighting (fluorescent or compact fluorescent lamps) is a cost effective means of reducing greenhouse gas emissions and reaching the BASIX Energy target. In 2004/05, lighting was a voluntary section of BASIX.

Of all Certificates, 39.6% chose to complete the energy efficient lighting section.

TABLE 18. FLUORESCENT LIGHTING

Room	%*
Nominated energy efficient lighting	39.7
Kitchen	29.2
Bathrooms	29.0
Garage	33.3
Laundry	31.9
Hallways	26.3
>=1 living room	29.0
>=1 bedroom	27.7

SOURCE: BASIX 2004/05

*Note that this column does not add up to 100, as one certificate can nominate multiple areas for fluorescent light.

The above figure demonstrate that the majority of BASIX applicants did not need to install energy efficient lighting to meet the BASIX Energy 25 target, as they had made gains in other areas, especially hot water.

In time, as a greater array of energy efficient lighting products enter the market (for example, compact fluorescent lights for replacement of halogen down lights), fluorescent lighting may increasingly become a more cost effective and popular choice of BASIX compliance. The uptake of fluorescent lighting is expected to increase once the BASIX energy target is increased to 40.

It should be noted that the installation of energy efficient lighting in outdoor areas is not recognised by BASIX.

Pool and spa

The installation of a pool or spa will result in an increased consumption of water and energy, meaning a home with a pool has to work harder to reach the BASIX targets.

The main energy demand is from the pool filter pump. The pump of a typical backyard pool, if left constantly running, could use more electricity over a year than all the other appliances in the house combined. The best way to avoid this energy penalty is to install a pool pump timer to limit the operation of the pump to no more than 4 hours per day.

A pool was nominated in 11.9% of Certificates. The average pool volume was 41.8 kilolitres or 41,800 litres. A spa was nominated in 1.6% of Certificates. The average spa volume was 3.9 kilolitres or 3,900 litres. A total of 91.5% of swimming pool pumps were controlled by a timer.

Pools and spas can also consume considerable energy if they have a heating system. Of the 781 pools nominated, 93.0% committed to either no heating system or a solar heating system. Only 6.1% selected gas pool heating and 0.6% selected an electric heat pump. No Certificates committed to electric resistance spa heating (this option was not available for pool heating). Table 19 summarises the pool heating systems.

TABLE 19. HEATING SYSTEMS FOR NEW POOLS AND SPAS

Heating system	Pool (%)	Spa (%)
No pool heating system	62.7	57.8
Solar pool heating system	30.2	31.4
Gas pool heating system	6.1	6.9
Electric heat pump	0.6	2.0
Electric resistance	n/a	0.0

SOURCE: BASIX 2004/05

Almost all users with a pool committed to installing a pool pump timer. This represents significant energy savings for these applicants, in addition to assisting BASIX compliance. The results show BASIX is encouraging more efficient heating systems for spas and pools. Running costs are likely to be a factor in the decision to select efficient pool heating technologies.

Future monitoring could determine if pools or spas had been retrofitted with pool heating system and could also determine the success of occupant behaviour affected compliance options, such as pool pump filter timers and swimming pool covers.

Alternative energy

BASIX offers users the option to select a photovoltaic (PV) electricity-generating system. Photovoltaic systems offer significant greenhouse gas reductions, which equate to BASIX points. Approximately 1.0% of BASIX Certificates selected a photovoltaic system. Table 20 presents the different power output ratings of the nominated PV systems.

TABLE 20. PHOTOVOLTAIC GENERATING SYSTEMS

PV (peak kW)	BASIX Certificates (%)
0-0.5	10.9
0.5-1	43.8
1-2	26.6
>2	18.8

SOURCE: BASIX 2004/05

Future monitoring will be able to determine if the homes nominating PV in BASIX are doing so because of a personal commitment, or because of their energy intensive design (large homes with swimming pools, spas, air conditioning etc).

Summary

Table 21 summarises the results from this report and compares them to data (where it is available) from the BASIX Compliance Study, pre-BASIX new homes, and from the existing residential stock.

The comparison with the BASIX Compliance Study aims to validate that the BASIX Certificates are consistent with a sample of new BASIX homes that have been approved and constructed. Comparison with pre-BASIX new homes and existing home data can provide insights into the impact BASIX is having on housing stock, as well as identifying emerging trends in new home building.

The final column "Maximum BASIX score' outlines the approximate maximum BASIX score for each technology to highlight the most effective energy saving measures in BASIX.

BASIX Certificates are compared to new 2002 NSW homes and existing 2005 NSW homes.

TABLE 21. COMPARISON OF TECHNOLOGIES IN CERTIFICATES WITH PREVIOUS STUDIES IN NSW

Energy saving commitment	2004/05 Certificates (%)	Assessment Study (%)	Pre-BASIX new homes (%)	Existing homes@ (%)	Maximum BASIX score***
Gas hot water system	78.1	78	67	23.4	24
Electric heat pump	7.0	8	-	-	20
Solar hot water system	14.9	14	1	2.4	~30
Electric storage & Instantaneous hot water system	0.1	0	32	79.0	0
Air conditioning	65.1	64	49	50.3	3**
Ducted gas heating	15.5	20	11	3.9	5**
Ducted evaporative cooling	<1	1	3.5	7.6	4**
No cooling	28.4	33	-	40***	1**
Ceiling fans	5.9	12	-	-	3**
Gas cooktop & electric oven	64.9	57	-	-	1
Gas cooktop & gas oven	20.7	30	-	31.6****	2
Electric cooktop & Oven	14.4	13	-	68.0	-1
Lighting	39.7	55	-	55.2	5
Photovoltaics	1.0	0	-	0.1	Unlimited

* Based on an average new Sydney home; ** These scores are highly dependent on the heating and cooling loads entered into the thermal Comfort section of BASIX; *** This includes homes that use ceiling fans for cooling; **** Figure represents use of gas for cooking. Stove / oven type unspecified. @ABS, 2002.

SOURCE: BASIX 2004/05

BASIX 2004/05 Certificates & BASIX Early Assessment Study

There is a close alignment between the results from this report and those from the Early Assessment Study. This consistency indicates that BASIX commitments are honoured in the built home.

BASIX 2004/05 Certificates & pre-BASIX new homes data

The large decrease seen in the number of electric storage / instantaneous hot water systems, from 32% to 0.1% represents a significant reduction in greenhouse gas emissions. Similarly the increased uptake of gas, heat pump, and solar hot water systems indicate that BASIX has encouraged these technologies as an effective means to achieve the energy target.

The implementation of BASIX resulted in a substantial increased uptake of gas hot water systems (an increase of 11% in gas hot water systems), and an increase of 7% in heat pumps and 14% in solar hot water systems compared to new home installations pre-BASIX.

BASIX has encouraged the uptake of gas appliances across all energy consumption sectors, including hot water, heating, and cooking. This illustrates that 'fuel switching' from electricity to gas in a popular and cost effective means of BASIX compliance.

The uptake of evaporative cooling, on the greenhouse-friendly heating options, was lower than existing stock. The existing stock sample included inland NSW, where evaporative cooling is much more effective and more widely used. Since evaporative cooling was only available in the West Sydney climate alone, and it incurred a large water penalty, it was not a popular BASIX option.

Other factors and trends in addition to BASIX shape the building industry. For example, while an increase from 1% to 15% in the installation of solar hot water systems can be partially attributed to BASIX, the incentives of the Renewable Energy Certificate and other rebate schemes (introduced in 2001) were simultaneously encouraging the increased uptake of solar systems.

Similarly, an increase from 49% to 64% in the adoption of air conditioners is observed after the introduction of BASIX; however, the increase of air conditioner usage had already become a strong trend before the introduction of BASIX. Nevertheless, it is interesting to note that a mid to high efficiency air conditioner would usually rewards an applicant with more BASIX points than the 'no active cooling' option. In view that it might have been unnecessarily encouraging applicants to install air-conditioning, this policy has been changed in BASIX.

BASIX 2004/05 Certificates & existing homes data

Comparisons to existing home data show that BASIX homes are being constructed to be significantly more energy efficient than the average existing home. In particular, the shift to energy efficient technologies is seen most strongly in hot water and cooking. The reduction in the installation of electric storage hot water systems and the rise in the installation of gas, electric heat pump, and solar hot water systems is the most pronounced improvement. There was also a significant shift in the installation of electric cooktop and electric oven units.

Maximum BASIX scores

The column in Table 15 outlines the approximate BASIX score attributable to each technology. The more energy efficient the technology, the more BASIX points it can achieve. It demonstrates that, for an average Sydney home, the BASIX Energy 25 target can almost be met solely with an efficient hot water system (20 to 30 points), with a combination of high efficiency heating and cooling (8 points), energy efficient lighting (5 points), cooking (2 points), etc.

Benefits to sustainable technology industries

A non-prescriptive policy like BASIX gives developers the flexibility to select least cost of compliance technologies and design solutions. It gives all sustainable technologies a fair and equal opportunity to compete.

Other policies / circumstances influencing greenhouse gas reduction

In NSW, BASIX is the main mechanism for residential greenhouse gas reduction. There may be additional gains made in power generation (as announced by the NSW government). This may affect BASIX compliance, as the electricity becomes greener. Energy efficiency should, however, continue to be encouraged in the residential sector.

Overall Comments

The main area of residential greenhouse savings was hot water. Being the biggest component of domestic energy consumption, it is not surprising that hot water was the major component for BASIX compliance. Only 0.1% of homes selected a greenhouse intensive electric hot water system, with the majority moving to gas systems, and around one quarter selecting heat pump or solar systems. Because of the significant gains that could be made, hot water bore the biggest burden for the BASIX compliance for the majority of homes.

Since the Energy target has risen (on 1 July, 2006), it may mean that hot water will not be the only option for BASIX compliance. Applicants will need to adopt significant energy efficiency measures in other areas, particularly lighting, heating and cooling to achieve BASIX compliance.

Thermal Comfort

The BASIX Thermal Comfort section has three main aims:

1. Ensure thermal comfort for a home's occupants appropriate to the climate and season.
2. Provide the potential to reduce greenhouse gas emissions from artificial cooling and heating through good building design and use of appropriate construction materials.
3. Provide the potential to reduce demand for new, or upgraded, energy infrastructure by managing peak demand for energy required for cooling and heating.

The Thermal Comfort section doesn't have a single benchmark; instead an appropriate target is set for each climate zone.

In the first year of BASIX implementation, two alternative methods of compliance were offered within the Thermal Comfort Index; 'Simulation' and Deemed to Comply'. Only one of these methods needs to be selected in order to complete the Thermal Comfort page.

Simulation method

The Simulation method requires an Accredited Assessor to simulate the home with an approved House Energy Rating Software (e.g. NatHERS, FirstRate, BERS[10]). This Software assesses the building's thermal performance and generates heating and cooling thermal loads (measured in MJ/m^2. year). These loads are then entered into the BASIX on-line program on the Thermal Comfort page.

Thermal loads are the heating and cooling loads placed on the home by its fabric (i.e. its design, insulation, shading, glazing etc). The lower the load, the more the house can maintain comfortable conditions for the occupants without the need for air conditioning or heating.

In BASIX 2004/05, the Simulation method set a maximum total (heating & cooling) load to ensure a reasonable annual thermal performance; it also set a maximum cooling load to ensure an acceptable summer performance. These maximum loads are different for East and West Sydney, in recognition of the different climatic conditions and the extent to which house design can be expected to maintain levels of comfort throughout the year.

These limits are placed to ensure the building fabric is of a sufficient level of performance for its lifetime, regardless of the space heating and cooling appliances that will be installed over this period. The cooling and heating loads also influence the predicted cooling and heating energy load on the Energy page.

Smaller homes tend to have a higher surface area which can increase their heat gain and losses, increasing their thermal loads. While this effect is scientifically based, it ignores the fact that larger buildings use more energy on an absolute basis and tend to require less thermal design improvement of larger homes. To remove this bias and ensure all homes have appropriate thermal design features, the Simulation Method changes the maximum loads according to the floor area of the home.

Deemed to Comply (DTC) method

The Deemed to Comply method allows the user to enter construction details of their home directly into BASIX. In order to pass DTC, the applicant must agree to minimum standards for insulation, glazing and shading set by BASIX in response to the construction details.

BASIX assigns the maximum heating and cooling loads for a DTC compliant home; these loads influence the heating and cooling demand in the Energy Index. In 2004/05, the DTC method excluded homes with complex design features such as significant overshadowing or large skylight areas to maintain a simple assessment method for DTC. In the 2004/05 sample, a total of 76% of Certificates used the Simulation Method and 24% of Certificates used the Deemed to Comply Method.

[10] These have sometimes been inaccurately described as House Energy Rating tools, creating confusion as to how the results should be interpreted. They only assess the home's thermal performance and don't include energy use from any appliances.

Simulation method results

In the Simulation Method, the home's details are entered in to external software and a detailed description is not entered directly into BASIX; only minimal data is available for analysis, however this data will be available for future studies. The data entered comprises 'conditioned floor area', the selection of applicable suspended floor concessions and the loads generated by the external software. Conditioned floor area is approximately 20% less than Gross Floor Area which has been discussed in the Project Details section of this report.

Suspended Floor concession

The suspended floor concession is granted to suspended floors where the site slope is greater than 10%. This concession increases the maximum thermal loads (MJ/m^2.year) allowed for the home in recognition of the lower thermal performance of homes with suspended floors.

Of the 76% of homes that used the Simulation method in BASIX, 3.2% of Certificates claimed the suspended floor concession.

Thermal Comfort Compliance

Table 22 summarises the average heating and cooling load for East and West Sydney homes, and the proportion of the loads compared to the applicable maximum load (changes with floor area) to indicate the degree of over-compliance.

TABLE 22. SIMULATION METHOD: ANNUAL AVERAGE THERMAL LOADS

Average thermal load	Load (MJ/m^2.yr)	Average % reduction of loads compared to maximum load (%)
Cooling load, East Sydney	37	39
Cooling load, West Sydney	40	36
Total load, East Sydney	117	18
Total load, West Sydney	135	24

SOURCE: BASIX 2004/05

The results show that most homes had loads well under the maximum permitted load. The reason for this is that a separate maximum cooling load actually drives over compliance because homes rarely only just pass both the total and cooling maximum loads.

Deemed to Comply (DTC) results

A total of 24% of BASIX Certificates used the Deemed to Comply Method. Of these, approximately 69% of the homes that used DTC were in East Sydney. This low take-up reflects the limitation of DTC to assess a wider range of home types and designs. The DTC method was superseded by the D.I.Y. Method, introduced into BASIX in December 2005.

Users of DTC described key aspects of the home construction and glazing directly to BASIX, allowing a summary of that information to be provided below.

Construction

Ground floor

BASIX DTC required applicants to enter the floor construction type for the home. The type of floor has a large impact on the thermal performance of a home, and hence floor type influences the glazing stringency of the home and also determines the required insulation levels for suspended floors.

A total of 80% of BASIX DTC Certificates selected a concrete slab-on-ground as the primary source of floor construction, with 58% having only a concrete slab on ground (no secondary floor). A further 15% nominated elevated floor with an enclosed subfloor, and the remaining 5% selected elevated floor with an open subfloor.

Of the total sample, 30% nominated more than one floor types (i.e. both a primary and secondary floor type). In 2004/05, a total of 6% of BASIX DTC Certificates selected a suspended floor concession.

The data shows that slab on ground construction is still a very popular floor construction method, for 80% of BASIX DTC Certificates. Interestingly, the number of homes that had more than one floor construction type (30%) may reflect the availability of flat sites in Sydney for completely slab on ground construction.

Wall type

BASIX DTC required applicants to enter the primary wall type for their home. This information is used to calculate the required wall insulation to be added.

The predominate wall type selected by DTC homes was brick veneer (47%), followed by cavity brick (43%[11]). Fewer homes nominated timber, weather board or cement sheet (8%), and autoclaved aerated concrete (3%).

The wall type selected for attached homes differed to that of single homes, with the majority constructed of double brick (81%). Other wall construction types included single brick (14%), autoclaved aerated concrete (2%) and plasterboard (3%).

Homes that were built attached to a garage had wall construction of either single skin brick/concrete (57%) or plasterboard (43%).

Ceiling and roof

BASIX 2004/05 DTC applicants were required to nominate the roof type and roof colour (light, medium or dark) of the home. This information was used to determine ceiling and roof insulation requirements. For example, dark coloured roofs were required to install foil and roof ventilation.

A total of 81% of the DTC users nominated a large roof space (i.e. flat ceiling and pitched roof). The remaining 19% nominated a small roof space (flat roof or cathedral ceiling).

The most popular roof colour was medium shade (47%), followed by a light roof (27%) and a dark roof (26%). All dark roofs were required to have roof space ventilation. Of these, 79% chose wind-driven ventilators and 21% chose gable-end vents. While there is no pre-BASIX data to enable direct comparison, favouring of light and medium roof colour over dark roofs is a positive result.

Cross Ventilation

[11] 43% is significantly higher than the NSW average for 1999:2005 of 30.7%. (ABS,2005)

Cross Ventilation assists with increasing natural air flow to maintain comfortable temperatures in the home. Homes with cross ventilation were permitted a larger area of window glass as this ventilation would partially offset additional solar gains through the glass, which would otherwise tend to increases internal temperatures.

The 2004/05 BASIX tool only allowed the cross ventilation bonus in East Sydney where cooling sea breezes in summer are regularly available. The cross ventilation bonus was therefore available in the 69% of DTC applicants who were situated in Eastern Sydney. Subsequent versions of BASIX allowed cross ventilation in other regions, albeit with a lower bonus based on the lower likelihood of cooling breezes.

Table 23 breaks down the selection of cross ventilation bonus options.

TABLE 23. CROSS VENTILATION IN BASIX DTC CERTIFICATES

Type of cross ventilation	DTC BASIX Certificates in Eastern Sydney (%)
Living room cross ventilation only	9
Bedroom ventilation only	13
Both living and bedroom	51
No cross ventilation	27

SOURCE: BASIX 2004/05

The number of homes that claimed some form of cross ventilation bonus to increase total glass areas was higher than expected and it is not likely that 73% of East Sydney homes were well designed for natural ventilation. This outcome is likely to be a combination of criteria that were not sufficiently strict or detailed and data being entered that was not reflected in the home documentation. Subsequent versions of BASIX have more detailed and strict across ventilation data which was easier to certify.

Glazing and window shading

Glazing and window shading can have a large impact on a home's thermal comfort. Compliance using the DTC method required more shading and/or the use of performance glass than average industry practice prior to the introduction of BASIX.

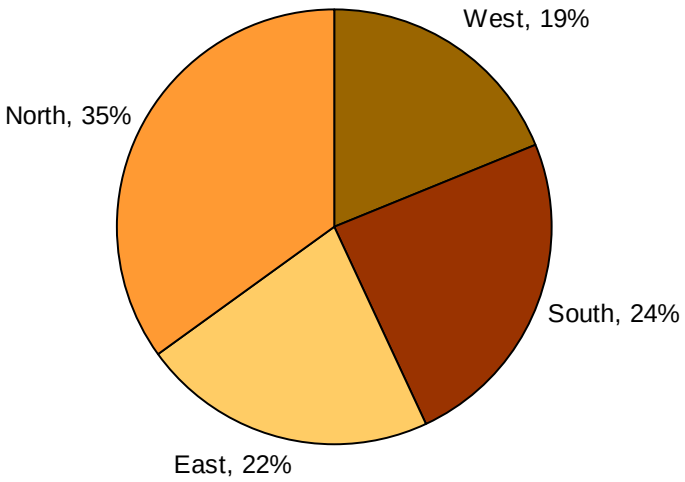
The DTC assessment of glazing and shading was designed for very simple homes. Different shading and glazing could be applied to each orientation (North, East, South, West sectors).

The proportion of allowable glass area facing each orientation increased if performance glass or shading was used. The total area of glass allowed for the home was increased when double glazing or pyrolytic low-e (a single glazing product with coating to reduce heat loss and gain) was used.

Shading and glazing

Figure 15 shows the total area of glass of all types in all homes that used DTC in each orientation. Given the restrictions on south, west and east glass in DTC, a bias towards beneficial north facing glazing is to be expected – i.e. only homes with reasonable passive solar orientation could pass DTC. Simulation Method data for comparison is not available.

Figure 15. Proportion of total glass area



SOURCE: BASIX 2004/05

Table 24 shows the selections made by DTC users for the various shading types available.

TABLE 24. SELECTED SHADING DEVICE TYPES

600-1100mm eaves (North façade Only)	67%
Vertical adjustable shading (North, East and West facades combined)	59%
>=600mm eaves (East and West facades combined)	54%
>=1800mm eaves (East and West facades combined)	16%

SOURCE: BASIX 2004/05

Table 25 lists the BASIX compliance options for glass in increasing order of U-value (low U-value means best control of heat flow).

TABLE 25. GLASS COMPLIANCE OPTIONS IN RANK OF U-VALUE

Abbreviation	Glass type
TD	Toned, double glass
TS	Toned, single glass
P L-E	Pyrolytic low-e glass
CD	Clear, double glass
CS	Clear, single glass

SOURCE: BASIX 2004/05

Table 26 summarises the BASIX shading compliance options, and their abbreviations.

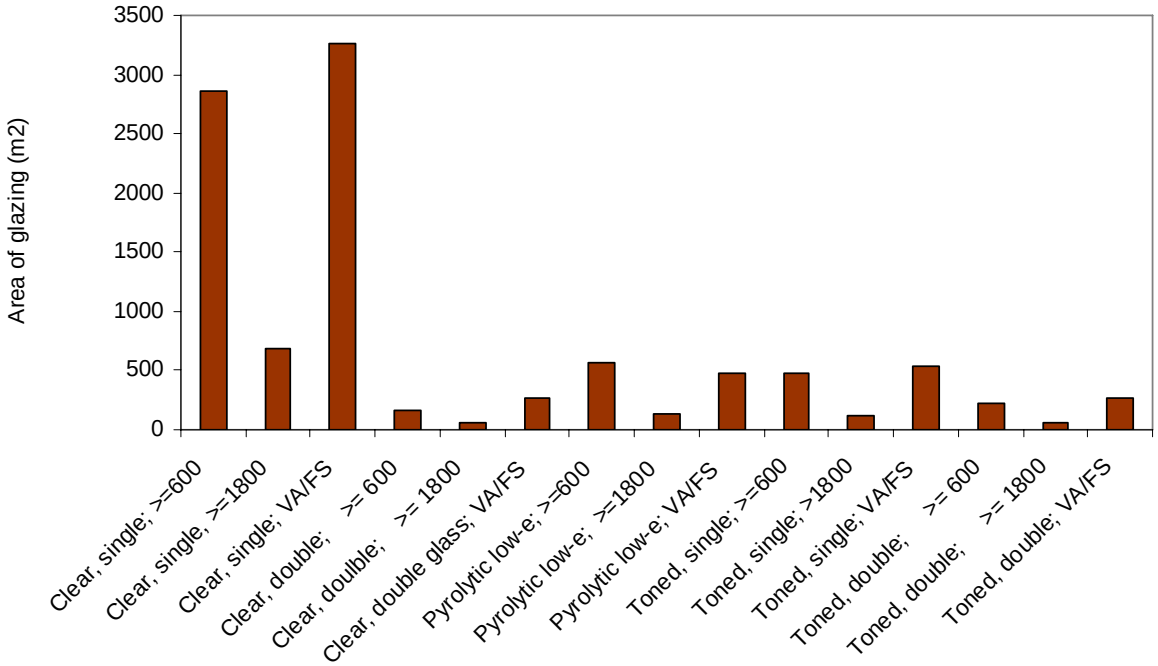
TABLE 26. SHADING COMPLIANCE OPTIONS

Abbreivation	Shading type
VAS	Vertical adjustable shading
VA/FS	Vertical adjustable / fixed shading
600-1100	600-1100 mm (north only
>=600	Eave projection >=600mm
>=800	Eave projection >=1800

SOURCE: BASIX 2004/05

Using the above abbreviations, Figure 16 details the total glazing area for each combination of glazing and shading for all BASIX Certificates with east facing glazing.

Figure 16. East facing glazing



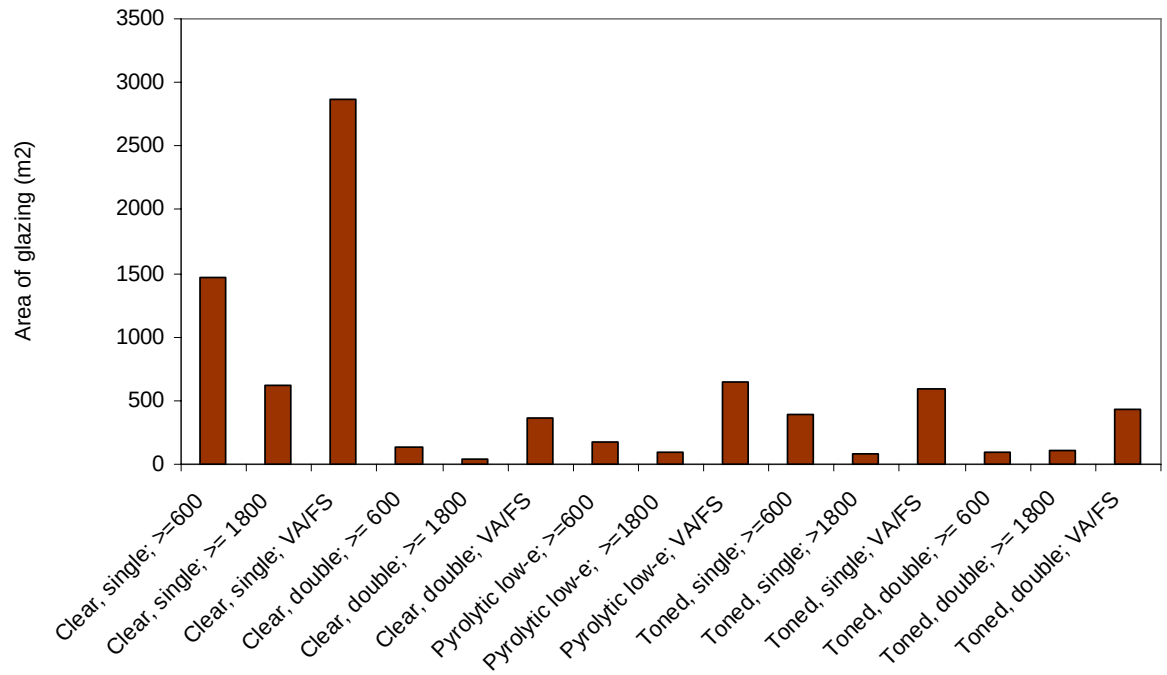
SOURCE: BASIX 2004/05

Of the DTC sample set with some east facing glazing, the predominant form of glazing was clear single glass with either vertical adjustable/fixed shading (3257m^2) or eaves/projections greater than 600mm (2862m^2). External vertical shading was popular as BASIX allowed a greater proportion of the total glass to face east compared to standard 600mm eaves.

There was some use of low-e and toned glass to allow moderate east facing glass instead of using external vertical shading. Some homes committed to double glazing or pyrolytic low-e glazing in order to increase the total area of glass allowed for the home.

Figure 17 details the total glazing area for each combination of glazing and shading for all BASIX Certificates with west facing glazing.

Figure 17. West facing glazing

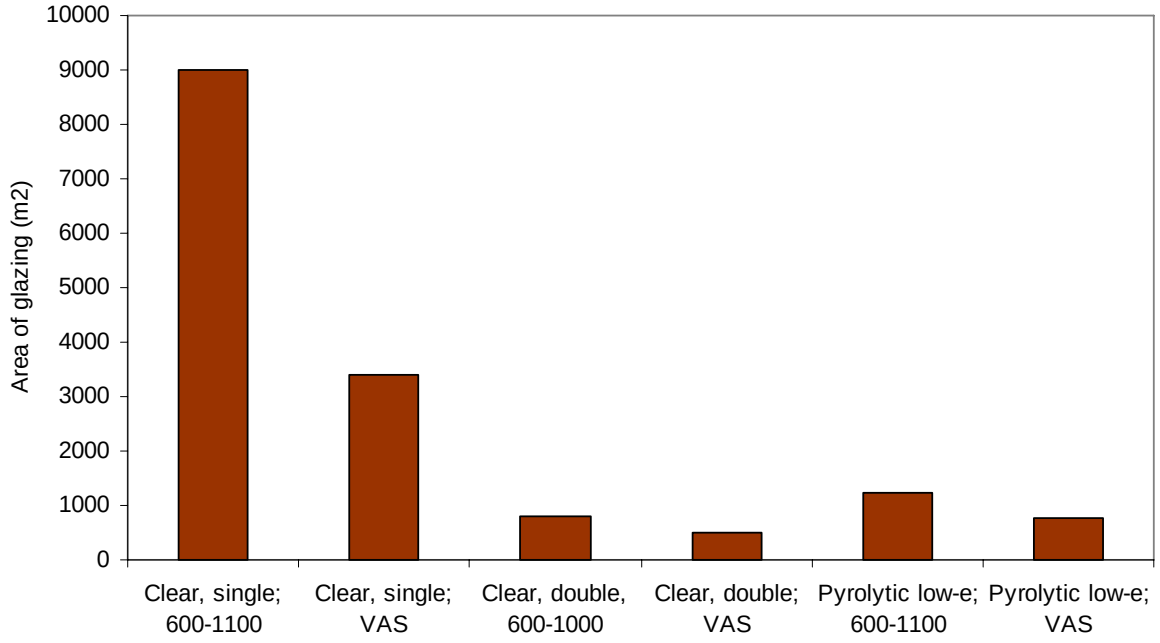


SOURCE: BASIX 2004/05

Most west-facing glazing nominated clear single glass with either vertical adjustable/fixed shading (2866m^2) or eaves/projections greater that 600mm (1464m^2). Vertical external shading was popular to permit larger west facing glass areas (compared to only 600mm eaves) without the need for performance glass. Others preferred a combination of less shading and more performance glass to allow greater areas of west facing glass.

Figure 18 details the total glazing area for each combination of glazing and shading for all BASIX Certificates with north-facing glazing.

Figure 18. North facing glazing

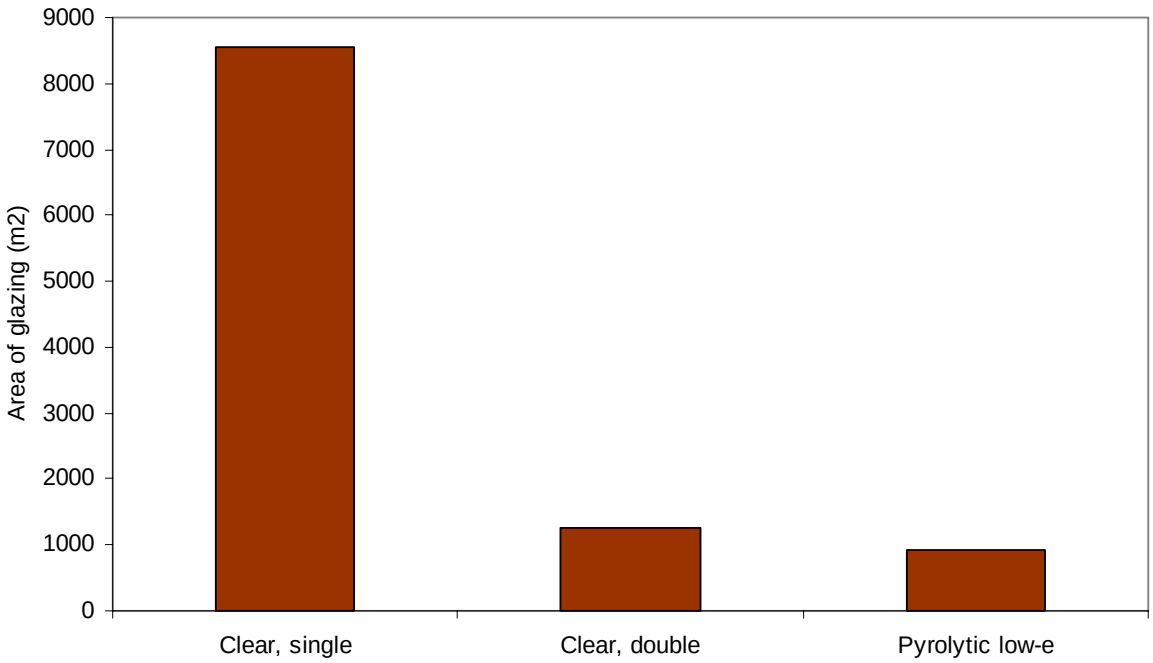


SOURCE: BASIX 2004/05

The most popular glazing and shading combination for north facing glass was clear single glass with eave/projections between 600 and 1100 mm (9010 m^2). Homes could pass with a large proportion of clear glass and a minimal eave unlike east and west orientations where more shading and/or performance glass was sometimes required to pass.

Figure 19 details the total glazing area for each combination of glazing (shading was not required) for all BASIX Certificates with south facing glazing.

Figure 19. South facing glazing



SOURCE: BASIX 2004/05

Where homes committed to south facing glazing, clear single glass was nominated most often (8558m^2), followed by clear double glass (1249m^2) and pyrolytic low-e glass (914m^2). BASIX did not require shading to south facing glass. If the proportion of glass compared to the total area of glass was high, double glazing or pyrolytic low-e glass was used to increase the maximum allowable glass to the south.

Table 27 indicates the proportion of homes that used some performance glass. Many of these homes only had performance glazing on one façade with standard single clear glass on other facades. These penetration rates are higher than figures from an ABS survey of pre-BASIX homes in 2005 where 3% of homes in the whole of NSW had some double glazing and 7.3% of homes had some tinted or solar control glazing.

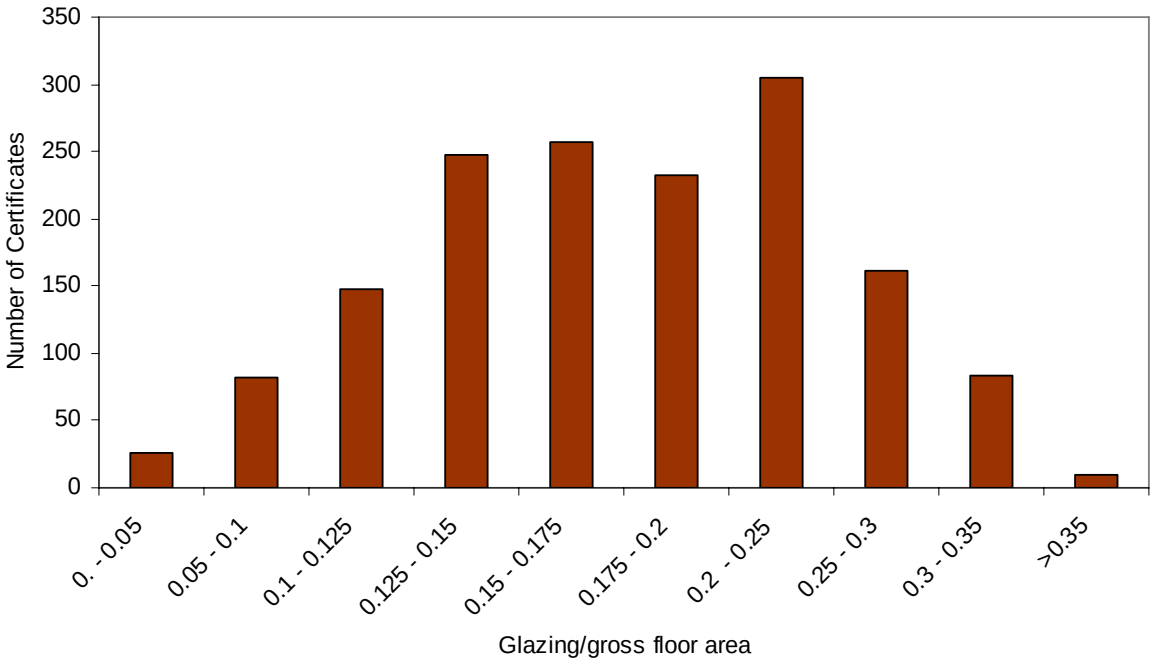
TABLE 27. TYPES OF PERFORMANCE GLASS USED

Type of performance glass	% of homes using this type of glass
Clear, double glass	12.8
Pyrolytic low-e glass	11.6
Toned, single glass	14.4
Toned, double glass	6.5

SOURCE: BASIX 2004/05

Figure 20 compares glazing area to gross floor area for the DTC sample.

Figure 20. DTC: glazing compared to gross floor area



SOURCE: BASIX 2004/05

The proportion of glass to floor area has a strong impact on thermal performance. The average glass to floor ratio is 0.185 which is lower than the national average of 0.23 (23%). This low glass ratio suggests most of the homes that were able to pass DTC were under-glazed and of a simple design.

Very few homes were able to pass with high ratios (above 0.35) even with performance glass. It is likely that some applicants switched to the Simulation method in Thermal Comfort if they had high glazing ratios, in order to access other compliance options such as increased insulation instead of improved glass performance.

The overwhelming majority of window and glazed door frames nominated aluminium frames (89.2% with only 10.8% selecting timber frames.

It appears that designers are giving greater consideration to external vertical shading (eg louvres and awnings) to achieve compliance than current industry practice. They are also using more performance glass to achieve compliance than traditionally has been included in residential buildings.

Insulation

For almost all designs and climates, insulation is essential as a starting point to achieve good thermal comfort. Insulation is mandatory in the DTC method for ceilings, walls and suspended floors. Insulation under medium and dark coloured roofs was also required to reduce summer heat gain.

Insulation was mandatory for all homes using DTC, therefore there is no Certificate data presented in this section. The insulation requirements in DTC for East and West Sydney are shown in Table 28.

TABLE 28. MANDATORY INSULATION LEVELS FOR DTC METHOD

Insulation location	East Sydney	West Sydney
Walls	R1.5 (added) (except double brick)	R1.5 (added (except double brick)
Ceilings	R2.5 (added)	R3.0 (added)
Medium or Dark Roofs	Foil or foil backed blanket	Foil or foil backed blanket

SOURCE: BASIX 2004/05

Summary

Table 29 summarises the Thermal Comfort – DTC results from this report. This comparison is to compare the BASIX data to pre-BASIX new homes and existing NSW homes (unless Sydney only is specified). There will be a difference in penetration comparing BASIX data for Sydney to all NSW data. Comparison with the BASIX On-ground Monitoring Project was not done as the sample of homes that used the DTC method was insufficient for proper statistical comparison purposes.

TABLE 29. BASIX THERMAL COMFORT DTC COMMITMENTS FOR EXISTING PRE-BASIX HOMES

Thermal Comfort DTC commitment	2004/05 DTC Certificates (%)	Pre-BASIX new homes (%)	Existing homes (%)
Floor construction		Not available	Not available
Wall construction			
Brick veneer + Double brick	90	Not available	83.3 (Sydney only)
Fibro cement	8	-	6.8 (Sydney only)
Glazing and shading			
Vertical external shading	59		27.7
Toned or pyrolytic single	26	Not available	7.3
Clear or toned double glazing	19.3	-	3
Insulation			
Ceiling	100	84	61.6
Wall	57	75	22.9[12]
Floor	20	4	0.025

SOURCE: BASIX 2004/05

Comparisons to existing home data shows the DTC compliant homes are designed with significantly greater insulation, performance glass and external shading than the existing housing stock.

[12] double brick walls (43% not required to be insulated in Sydney

Developments in BASIX

Since the expansion of BASIX across the state, and for all types of homes, various aspects of the policy have been improved.

Water

BASIX now acknowledges the water efficiency of fixtures using star ratings from the Water Efficiency and Labelling Standards (WELS) scheme, which became mandatory on 1 July 2006. BASIX now also recognises higher levels of efficient taps and toilets: up to 6 star kitchen and bathroom taps and 4 star toilets.

Stormwater, treated to a suitable quality, can now be used for garden, toilets, and laundry, as opposed to recognition of garden irrigation only in the 2004/05 BASIX. Rainwater can be nominated for toilet flushing, laundry, garden irrigation, hot water supply, pool and spa top up and all other household uses.

BASIX 2005/06 provides a validation mechanism for BASIX Certificates that select invalid uses for reticulated recycled water. The number of areas serviced with reticulated recycled water schemes for use for garden and toilets has also been expanded to include:

- Balling Heights development area
- Glenfield Road development area
- Ploughmans valley and North Orange development areas
- Perradenya Estate
- St Marys – Eastern Precinct
- Magenta Shores
- SeaScape Grove

Energy

The BASIX 2005/06 tool now recognises that air conditioning can be zoned servicing living rooms during the day and bedroom areas during the night but never heating these areas concurrently.

The BASIX 2005/06 tool now recognises wood combustion hot water systems used primarily in regional areas.

The BASIX Monitoring Program will look at heating and cooling in more detail including the impact of building design technology selection and occupant behaviour on actual energy consumption from acting heating and cooling systems.

The 2006/07 BASIX tool allows for wood combustion as a form of cooking. This is particularly relevant for regional areas of NSW. This tool also provides the option of nominating the number of bathrooms that will be naturally lit and rewards natural light and natural ventilation according to the number of bedrooms specified.

Thermal Comfort

The 2005/06 BASIX tool now includes maximum heating and cooling loads for all climates zones. The Simulation Method has a cross ventilation component to overcome shortcomings in the NatHERS software. The DTC Method has been removed and replaced with the DIY Method that allows greater flexibility in glazing and shading options. A Rapid Method was also provided which sets minimum insulation, shading and glass area standards for very simple homes; primarily in regional areas.

Conclusion

BASIX captures an enormous amount of useful home-related information, including planning related information such as home size, location and bedroom number. This data provides insight into the designs and technology selection of all new homes that are meeting the required water, energy and thermal comfort efficiency targets.

By setting performance-based targets, and maintaining the flexibility for homes to meet these targets, BASIX promotes a range of technologies and design solutions, rather than a prescriptive approach. By increasing the market penetration of sustainable technologies and indirectly increasing job growth, the sustainable technologies industry has also received a boost from the implementation of BASIX.

Summary of BASIX policy outcomes

Commitments made in the first year of BASIX (2004/05) have demonstrated solid improvements in residential sustainable design measures including:

- 100% commitment to alternative water sources and rainwater tanks in particular.
- 97% commitment to water efficient showers and toilets.
- Less than 1% dependence on mains water on gardens.
- Less than 1% dependence on electric storage and electric instantaneous hot water systems.
- Increased efficiency of energy heating and cooling appliances.
- Increased selection of energy efficient cooking systems, e.g. gas.
- All new homes have passed thermal comfort standards for heating and cooling, resulting in adequate levels of glazing, shading and insulation.

BASIX has also had extensive educational benefits; over 35 briefing and training sessions were held during the 2004/05 period, around the state for local government and industry practioners.

During its first year of operation, BASIX included on-line information for users, such as greenhouse and water footprint bars, indicative scoring against water and energy selections and energy and water end-use breakdown graphs. By this means, users of the BASIX website could more easily understand how to navigate the sustainability pathway in a way that best met their needs and aspirations. The BASIX Help Line received over 8500 calls and emails during the first year of operation.

Future monitoring

Future monitoring activities include the BASIX Water and Energy Monitoring Project which involves monitoring the performance of occupied BASIX homes, to investigate whether their actual water and energy consumption meets the expected targets, as predicted by the BASIX on-line program.

The State water and energy utilities will be working with the Department of Planning to collate the actual water and energy consumption of occupied BASIX homes against the water and energy commitments for each BASIX compliant home.

Behavioural and climate factors will be taken into account by Sydney Water during the analysis of actual water consumption data from new BASIX homes through the BASIX Water & Energy Monitoring Project.

The results of this study will be used to ensure that the BASIX policy is delivering on its sustainability objectives, and will also refine and improve data and key calculation in the BASIX on-line program to ensure the long term success of the policy.

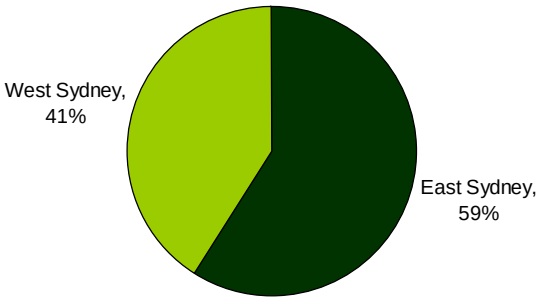
A non-prescriptive policy like BASIX gives developers the flexibility to select least cost of compliance technologies and design solutions. It gives all sustainable technologies a fair and equal opportunity to compete.

BASIX 2004/05 Snapshot

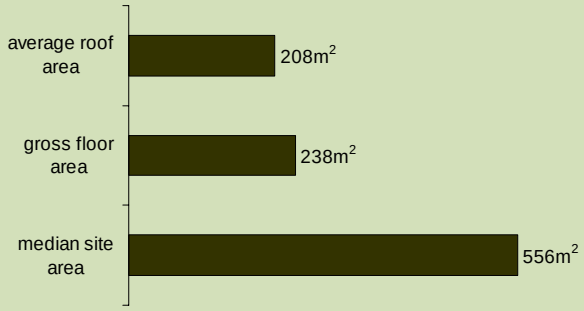
During the first year of BASIX, almost 12,000 BASIX Certificates were generated. Once duplicates and incomplete assessments were removed, a subset of 6,558 BASIX 2004/05 Certificates remained. These Certificates form the basis of this report.

It is important to note that because a Certificate is generated before the home design is approved by Council, a BASIX Certificate doesn't equate to an actual built home.

The location of the 6558 Certificates



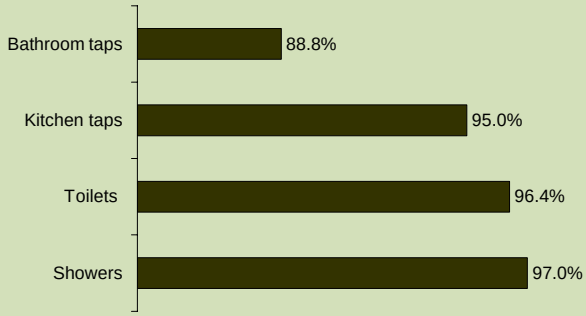
Project details



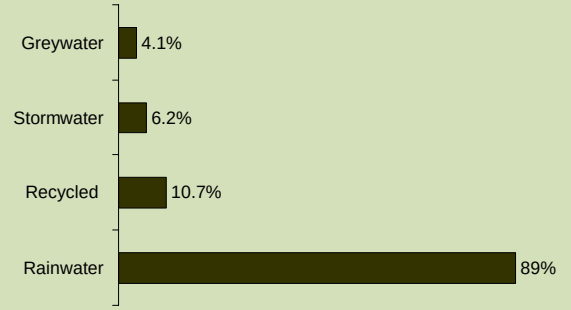
- The average number of bedrooms was 4;
- The average rainwater tank size was 4,800 litres;
- 6557 Certificates chose an alternative water supply;
- 64.9% committed to cooking with a gas cook top and an electric oven;
- 32.3% chose indigenous +/or low water use plants;
- 1% selected a photovoltaic system;
- The average pool volume was 41,800 litres;
- 85.9% elected to install a pool cover;
- 91.5% of swimming pool pumps had timers.

The take-up of sustainable technologies during 2004/05

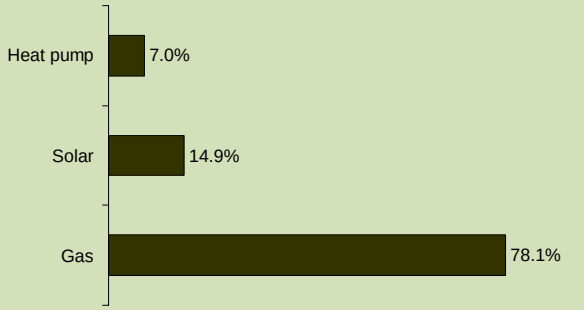
Take-up of 3A water efficient fixtures



Alternative water supply choices



Hot water system choices



What were the most popular building materials?

- Slab on ground for floor construction;
- Brick veneer for walls, closely followed by cavity brick; and
- A medium shade for the roof colour.

Glossary

The following fields and terms within BASIX are defined as follows unless contrary intention appears.

1A, 2A, 3A, 4A or 5A
in relation to a fitting, means a fitting rated to that level under *AS/NZS 6400:2003 Water efficient products rating and labelling*.

Accredited Assessor
means a person accredited by the Association of Building Sustainability Assessors(ABSA) or by another organisation accredited by DIPNR, to issue certificates in relation to a building's thermal performance.

Active cooling system
means a cooling system that is operated using either electricity or gas.

Active heating system
means a heating system that is operated using either electricity or gas.

Autoclaved aerated concrete
means autoclaved aerated concrete with a minimum thickness of 200mm.

BASIX Specification
means the document of that name, dated 25 June 2004, published by DIPNR. This document is available at www.basix.nsw.gov.au.

Common Wall
means a wall that is common to adjoining buildings.

Conditioned Floor Area
means the total area of all floors of a dwelling, measured from the internal face of the external walls, excluding the *floor area* of any laundry, store room, carparking area, and bathroom (which is not an ensuite).

Cooling Load
means the calculated amount of energy removed from the cooled spaces of the building annually, by artificial means, to maintain the desired temperatures in those spaces.

Coefficient of Performance (COP)
means the capacity of output divided by the power input.

Enclosed subfloor
in relation to an elevated floor, means a subfloor that is not an enclosed subfloor.

Energy Star Rating
means the Star Rating of an appliance as determined under the *Electricity Safety(Equipment Efficiency) Regulation 1999.*

EER (Energy Efficiency Ratio)
in relation to an air conditioning system, means the capacity output of the system divided by the power input, as specified by the manufacturer of the system.

Floor area
in relation to a room, means the room measured within the finished surfaces of the walls, and includes the area occupied by any cupboard or other built-in furniture, fixture or fitting.

Foil
means a reflective insulation with an emissivity of no more than 0.05 for the downward surface.

Gas Star Rating
means the Gas Energy Rating of an appliance determined from the energy consumption of the product measured under the relevant Australian Standard for the appliance. The star rating is indicated on the Gas Energy Rating Lable by the AGA (Australain Gas Association).

Glazing
means a transparent or transluscent element and its supporting frame located in the external fabric of the building, and includes a window and the glazed part of a door,but excludes *skylights*

Grey Water
means waste water that does not contain human excreta, such as water from the laundry or from the bathroom(but not toilet).

Greywater diversion system
means a system for the diversion (but not the treatment of storage)of greywater.

Greywater treatment system
means a system for the collection, treatment and storage of greywater.

Gross Floor Area
means the total *floor area* of the building measured from the outside of the external walls or the centre of a common wall. It excludes parts of the building for storage and car parking.

Ground floor
means the lowest *storey* or part thereof of the building that does not have a *habitable* room underneath.

Habitable room
means any room of a dwelling other than a bathroom, laundry, toilet, pantry, walk-in wardrobe, corridor, stair, lobby, photographic darkroom, clothes drying room and other space of a specialised nature occupied neither frequently or for extended periods.

Heating load
means the calculated amount of energy delivered to the heated spaces of the building annually, by artificial means, to maintain the desired temperatures in those spaces.

Indigenous species
means species of vegetation occurring at a place within its historically known natural range and forming part of the natural biological diversity of a place.

Large roof space
means a roof space, any of which has a gap of more than 400mm between the underside o fthe rafters and the top of the ceiling.

Landscape Area
means the part of the site that is not covered by buildings. Includes hard and soft landscaping.

Living Area
means *habitable room* that is not a bedroom.

Onsite recycled water
means *recycled water* that has been collected and treated for reuse.

Open subfloor
in relation to an elevated floor, means a subfloor that is not an enclosed subfloor.

Person
includes an individual, a firm, a body corporate, a partnership, a joint venture, or an unincorported body or association

Potable water
means water fit for human consumption

Primarily lit by
means over 90% of light fittings in room are fitted with fluorescent lamps, including the main light fitting.

Rainwater
means water discharged from non-trafficable roof areas within a development site.

Rainwater tank
A rainwater tank is a tank designed for the capture and storage of roof water. It includes other storage devices such as bladders or gutter storage

Recycled Water
means water such as *grey water, stormwater*, and other types of wastewater, that have been treated for reuse.

Reticulated recycled water
means recycled water that has been collected and treated at a central location and returned to individual lots for use.

Roof area
means the area of all roof surfaces measured to the outside of the gutters, excluding parapets and trafficable roof terraces and measured in the horizontal plane.

R-Value
means the thermal resistence(metres^2.K/W) of a component calculated by dividing its thickness by its thermal conductivity.

SEPP
State Environmental Planning Policy.

Significantly overshadowed
means 80% of the dwelling's total glazing in the north sector has solar access for less than 4 hours between 9am and 3pm on 22 June, due to adjacent buildings, structures, trees or landforms (other than those to be erected as part of the proposed development).

Site
means the land on which the proposed development is to be erected.

Skylight
means a window which is installed in a roof to permit natural light t enter the room below and is at an angle between 0 and 70 degrees measured from the horizontal plane.

Small Roof Space
means a roof space which is not a large roof space.

Star Rating
in relation to an electrical appliance, its *Energy Star Rating*, and in relation to a gas appliance, its *Gas Star Rating*.

StormWater
means water collected from trafficable surfaces, including paved or ground surfaces.

Storey
means a space within a building which is situated between one floor level and the floor level next above, or if there is not flor above, the ceiling or roof above, but not -

a. a space that contains only -
    i. a lift shaft, stairway or meter room; or
    ii. a bathroom, shower room, laundry, water closet, or other sanitary compartment; or
    iii. accomodation intended for not more than 3 vehicles; or
    iv. a combination of the above; or

b. a mezzanine.

Thermal Comfort Protocol
means the document of that name, dated 25 June 2004, published by DIPNR. This document is available at wwww.basix.nsw.gov.au.

Ventilation Opening
means an opening in the external wall, floor or roof of a building designed to allow air movement into or out of the building by natural means including a permanent opening, an openable part of a window, a door or other device which can be held open.

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