Five Year Outcomes Summary

BUILDING SUSTAINABILITY INDEX

NSW GOVERNMENT Planning
BASIX applies to all new homes in NSW

Since October 2005 the NSW Government’s BASIX program has required all new dwellings in the State to commit to mandatory water and emission (energy) reduction targets. A new home must use up to 40 per cent less water and emit up to 40 per cent fewer greenhouse gases than an average pre-BASIX home before development approval can be granted. New pools over 40,000 litres and renovations worth over $50,000 are also subject to BASIX.

This document summarises a series of reports from the BASIX ongoing monitoring program conducted between 2004 and 2009. The program ensures that BASIX delivers on its sustainability objectives, determines the scope for future changes, such as increasing energy, water and thermal comfort targets, and estimates future residential emissions and water consumption for NSW.

All reports published by the monitoring program are available for download from:  
www.basix.nsw.gov.au

BASIX has secured water and emission savings for over 120,000 new homes and improved the sustainability of a further 36,000 existing homes, including 5,570 new pools and spas

BASIX achievements

Before BASIX, local government was responsible for securing sustainable outcomes for residential development. In 2004, BASIX established one sustainability policy for all new homes, setting clear, comparable and measurable targets for cost-effective residential sustainability and freeing up council resources.

Significant impacts of BASIX include:

- the increased use of alternative water sources, particularly water tanks, to most new dwellings
- the significantly decreased use of inefficient electric storage hot water systems, and
- reduced energy demand to heat and cool new homes resulting in consistently high equivalent NatHERS star ratings.

As well as reducing water consumption and emissions, these improvements can provide utility bill savings of up to $228 a year for an average Sydney household at 2009 electricity prices.

BASIX has flow-on effects to the community, making sustainable systems more commonplace and affordable in the broader market, while encouraging industry innovation to meet raised consumer expectations for water and energy efficient housing.

BASIX ensures that all new dwellings in NSW will contribute to water and emission saving targets long after their construction, setting a high standard for adaptable, measurable and cost-effective sustainable housing policy in Australian residential development.
BASIX covers all dwelling types

BASIX has designed separate tools for single and multi-dwelling developers because energy and water consumption patterns vary significantly between these types of developments. The BASIX Multi-Dwelling Tool includes technologies specifically suited to larger residential developments, especially unit blocks with common areas such as car parks, lifts and shared gardens, which can consume significant amounts of water and energy.

28% of all new BASIX certificates to June 30 2009 were for unit homes

The importance of a specific tool to deal with units is illustrated in the increasing proportion of BASIX-certified unit homes, reflecting trends in NSW housing development towards denser dwelling types (see following graph).

BASIX certified homes in NSW

The BASIX Alterations and Additions Tool is designed to reduce energy demand for heating and cooling in new extensions; increase the energy efficiency of new lighting, hot water systems, spas and pools; and reduce water consumption for all new water fixtures, pools and spas.

The graph to the right shows the types of new works certified by BASIX over the 2006/07 to 2008/09 reporting periods. Whilst most alterations and additions were solely renovation works, 27 per cent of certificates were also used to assess new pools and spas.
**BASIX saves households money**

*BASIX is saving between $6.7 million and $25 million a year through lower household bills, emission reductions and avoided electricity network expansion*

Economic analysis conducted in 2009 estimated that to 2050, new BASIX certified dwellings will generate a positive benefit to New South Wales of between **$1.20 and $1.60 for every dollar spent** complying with BASIX, most of which accrues directly to individual householders through lower energy and water bills.

The total net benefits (minus compliance and administration costs) of BASIX for NSW to 2050 are estimated to lie within a range of **$294 million to $1.1 billion. Forty-six per cent** of these benefits are from BASIX certified dwellings already approved for development.

The following graph shows that the chief source of these benefits is household energy bill savings.

**Sources of net dollar benefits to NSW**

- **Household energy bill savings**, 69%
- **Environmental benefits**, 5%
- **Avoided network augmentation**, 4%
- **Household water bill savings**, 22%

The dollar value energy and water bill savings through BASIX compliance are estimated at between **$7,123 and $10,249** for an average four-bedroom Western Sydney household built in 2006, or between **$158 and $228 a year** to 2050 (an average home’s lifespan is estimated at around 40 years).

A two-bedroom Sydney high-rise unit, with lower occupancy and energy targets, can expect to save between **$3,273 and $3,451**, or between **$72 and $76** a year to 2050.

The estimated range of benefits is quite broad, due to a lack of sufficient data on energy uses attributed to factors outside the scope of BASIX commitments, especially the increasing penetration of appliances such as laptops and televisions and variable energy use behaviour for use of heating and cooling systems.

Further research with utility companies and universities is currently underway to improve the accuracy of future analysis.
Costs vary according to gas access and house size

The following graph shows the range of energy benefits and water benefits compared to BASIX compliance costs, presuming access to gas is available. Most new dwellings can expect to have their costs of compliance returned through energy and water bill savings.

### BASIX compliance costs and benefits to 2050

<table>
<thead>
<tr>
<th>Dwelling type</th>
<th>Maximum energy bill savings</th>
<th>Minimum energy bill savings</th>
<th>Water bill savings</th>
<th>Compliance costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Sydney house</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average regional NSW house</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Southern Highlands house</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Northern NSW house</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average multi dwelling attached house</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average low-rise unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average high-rise unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For an average new home, BASIX compliance represents between $287 to $368 a year in water and energy bill savings

Large houses are at a significant disadvantage in BASIX due to their high energy and water consumption, with a large 400m² house in Sydney estimated to cost over 2½ times that of an average Sydney house (240m²) to meet the same BASIX water and energy targets.

Substituting electricity with gas fuel sources is the most cost-effective approach to meet BASIX energy targets. This reflects the generally higher costs of some electric appliances where there are no gas alternatives and the relatively higher cost of solar or heat pump hot water systems as compared to gas hot water systems required to meet BASIX energy targets.

Access to gas reduces BASIX compliance costs by around 40 per cent for new houses and between 85 per cent and over 300 per cent for new units.
BASIX secures lifetime emission and water savings

By analysing the commitments made by developers under BASIX, it is possible to estimate the annual and ongoing greenhouse gas emissions and water consumption of new homes compared to pre-BASIX homes in NSW.

The following graphs show that through better residential building design and the use of more efficient systems and fixtures encouraged by BASIX, new homes in New South Wales will consume less water and emit less greenhouse gases over the lifetime of a home than existing pre-BASIX dwellings.

The average BASIX home is predicted to use **89,600 litres less** potable water per year, and emit over **2 fewer tonnes** of greenhouse gases than an average pre-BASIX dwelling. This is equivalent to each new BASIX home saving almost 150,000 bottles of water a year and reducing an average car's annual emissions by over 54 per cent.

**New BASIX homes are predicted to have already saved around 24.8 billion litres of water and emitted up to 693,000 fewer tonnes of greenhouse gases**

The cumulative effect of all BASIX homes approved for development to date is equivalent to the water used in over **9,000 Olympic swimming pools** and the annual emissions of over **31,000 cars** for 5 years.*

* Based on BASIX targets in dwellings certified between July 1 2004 and June 30 2009 and December 2009 ABS figures on new dwellings approved for development in NSW. 1 Olympic swimming pool = 2.5 million litres. Annual Australian car emissions = 4.36 tonnes of CO2e, per car, per year.
BASIX homes are outperforming their targets

Every new BASIX home is assigned mandatory targets of up to 40 per cent water and emissions savings compared to an average pre-BASIX home, varying by climate and unit block size. The tool determines whether these targets have been met based on commitments made by the developer in BASIX.

The following table compares targets and scores of new BASIX homes, and shows that the average BASIX home scores around **3 per cent** higher than its minimum water and energy saving requirements.

### BASIX performance

<table>
<thead>
<tr>
<th></th>
<th>Single dwellings</th>
<th>Multi-dwelling houses</th>
<th>Multi-dwelling units</th>
<th>All new BASIX homes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average target</td>
<td>Average score</td>
<td>Average target</td>
<td>Average score</td>
</tr>
<tr>
<td><strong>Energy</strong></td>
<td>36.7</td>
<td>40.7</td>
<td>37.8</td>
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<td></td>
<td>26.9</td>
<td>29.6</td>
<td>39.9</td>
<td>42.5</td>
</tr>
<tr>
<td></td>
<td>33.1</td>
<td>36.4</td>
<td>39.1</td>
<td>42.8</td>
</tr>
<tr>
<td><strong>Water</strong></td>
<td>38.1</td>
<td>44.4</td>
<td>38.9</td>
<td>41.0</td>
</tr>
<tr>
<td></td>
<td>39.9</td>
<td>42.5</td>
<td>39.1</td>
<td>42.8</td>
</tr>
<tr>
<td><strong>Thermal comfort</strong></td>
<td>5.0 stars</td>
<td>5.1 stars</td>
<td>5.4 stars</td>
<td>5.1 stars</td>
</tr>
</tbody>
</table>

*The energy target calculates emissions according to energy consumption and types of fuels used in the new home.*

**NSW Green State**

The 2010 NSW State Plan is committed to reducing greenhouse gas emissions by 60 per cent by 2050.

The BASIX program is the most significant contributor to the residential component of this target – by 2050 all new BASIX-certified dwellings are predicted to emit **102,000,000 fewer tonnes** of greenhouse gases than an equivalent number of pre-BASIX dwellings.

**New BASIX homes are predicted to emit an average of 37% fewer greenhouse gases per person than a pre-BASIX home**

NSW is also committed to saving 145 billion litres of water a year in Sydney by 2015 as part of its Metropolitan Water Plan. As of 2010, Sydney Water estimated that BASIX is already saving around **6 billion litres a year** in Sydney Water’s area of operation – around **4 per cent** of the total target.
BASIX reduces water consumption

In order to verify that the savings commitments in BASIX certificates are being translated into actual savings within the home, BASIX and Sydney Water measured the consumption of water in a sample of constructed BASIX houses.

This study found that BASIX dwellings in Sydney are achieving close to the water saving target of 40 per cent, with an average water saving of **39 per cent per person, per year** from the pre-BASIX benchmark.

Majority of dwellings connected to alternative water supply

84% of new BASIX homes use a tank or recycled water supply rather than mains water for toilets, laundry and/or irrigation

Rainwater tanks have been a consistently popular alternative to mains water consumption, with other alternative water sources, including stormwater and greywater recycling systems, showing much slower growth (see following graph). **97 per cent** of homes with alternative water used rainwater tanks - before BASIX was introduced, only around **12 per cent** of NSW dwellings sourced water from a rainwater tank.

Irrigation, toilets and washing machines made up over 55 per cent of average per capita mains water use preceding BASIX. This proportion is likely to have significantly decreased in new homes, as the majority of all gardens, toilets and laundries are now maintained in part or in full from an alternative water supply, as illustrated in the following graph.

The volume of tanks committed to in BASIX represents an alternative reservoir of over 360 million litres that would otherwise be lost as runoff to our stormwater systems
Reducing water demand with fixtures and appliances beyond minimum efficiency standards

Australia’s Water Efficiency Labelling Scheme (WELS) requires clothes washers, dishwashers, taps, toilets and showerheads to be registered and rated according to the amount of water they use.

The minimum WELS rating for toilets and taps is now three stars, but around 32 per cent of all new BASIX homes commit beyond these standards to taps rated four stars or higher, and 29 per cent committed to toilets rated four stars or higher. All new showerheads must be rated with the maximum WELS rating of 3 stars.

Over 75% of assessed alterations and additions included one or more new fixtures rated 3 WELS stars or higher

The following graph shows that growth in high performance taps and toilets has steadied, indicating further incentives may be required to keep improving fixture efficiencies.

Taps and toilets rated 4 stars or higher

Committing units to water efficient appliances

BASIX recognises that many units include pre-installed washing machines and dishwashers, and allows developers to commit to water-efficiency ratings on these appliances to help reduce consumption and meet BASIX water targets.

Minimum WELS performance standards on installed appliances have yet to become compulsory in Australia, but 31 per cent of clothes washers and 38 per cent of dishwashers installed to BASIX units had a WELS rating of four stars or higher. The lowest available rating for both products is one star.
BASIX reduces emissions

BASIX has helped drive a strong uptake of low greenhouse gas intensity technologies in NSW homes, particularly alternative energy sources for hot water systems, energy-efficient heating and cooling systems, and energy-efficient lighting.

In addition, BASIX encourages the inclusion of improved ‘thermal comfort’ and passive solar design at the design stage of projects, thus reducing reliance on energy for heating and cooling.

**Less than 1% of new homes in NSW use greenhouse gas intensive electric hot water systems**

A 2010 preliminary study of emissions savings in BASIX houses by Energy Australia suggests that a number of factors beyond the scope of BASIX are significantly influencing gross electricity consumption in new houses in Sydney.

The BASIX monitoring program is now collecting improved consumption data to more effectively verify emission reductions attributable to BASIX in the context of external factors such as:

- the increasing number, use and energy requirements of portable household appliances, particularly televisions and personal computers;
- the increased use of heating and cooling systems in spite of improved thermal comfort design, and
- fewer occupants in larger, more energy-intensive homes.

A December 2010 Independent Pricing and Regulatory Tribunal study also highlighted the need to better understand the factors that impact on potential emission savings. The study noted that energy consumption was particularly varied according to income, occupancy, gas availability and the number of appliances.

Measures taken in new BASIX homes to reduce electricity consumption are still predicted to result in significantly lower greenhouse gas emissions than if BASIX did not apply.

**Phasing out electric hot water systems**

High emission electric hot water systems were used in 67 per cent of pre-BASIX homes, and now feature in only 0.4 per cent of NSW homes. The following graph shows how the growing trend for alternative gas, solar and heat pump hot water system types in BASIX has almost entirely phased out high emission electric storage and instantaneous hot water systems.

**Trends in BASIX hot water systems**
Promoting solar energy

The following graph shows the increasing number of new homes sourcing some mains energy from independent solar power systems, rather than directly from the grid. Dwellings committing to solar systems (PV) for some mains power has risen from 1 per cent of all dwellings in 2004 to 5 per cent of dwellings in 2009. BASIX also rewards dwellings that use solar power for hot water and pool or spa heating.

25% of all new BASIX homes use solar for hot water compared to 3% preceding BASIX

BASIX homes with solar power

Over two thirds of heated pools and spas now use low-emission solar energy

Heating is selected for 50 per cent of new pools and spas in BASIX alterations and additions, 68 per cent of which now install a solar energy source, the lowest emission heating system available in BASIX. New pools are not permitted to install high emission electric resistance heating systems under BASIX.

Committing units to energy efficient appliances

BASIX recognises that many units have pre-installed whitegood appliances, particularly apartments intended for the rental and investment market. BASIX encourages unit developers to secure emission savings by committing to energy star rated appliances.

While there is no minimum performance standard for appliances, 83 per cent of all new unit dwellings now commit to a minimum energy efficiency rating for one or more pre-installed appliances, usually a dishwasher or clothes dryer.
BASIX improves the thermal comfort of homes

Reducing heating and cooling energy through good building design

For every new home in NSW, BASIX sets ‘thermal comfort caps’ - maximum allowable energy consumption for heating or cooling a dwelling to a comfortable temperature. These caps vary depending on type of dwelling and geographical location (climate zone).

BASIX calculates how much energy is required for heating and cooling a dwelling based on the design and construction materials of a new home, such as insulated ceilings and walls or how much performance glass is installed to better retain and deflect heat.

Improving these features can contribute significantly to meeting BASIX energy targets as over 13 per cent of average emissions in pre-BASIX homes were attributable to heating and cooling the home.

The average equivalent NatHERS rating for approved BASIX homes is 5.1 stars

Driving improvements in building material standards

Most thermal comfort energy consumption estimates are undertaken by certified assessors before being submitted to BASIX. However, 34 per cent of new single dwelling houses enter all design and construction details for assessment using the BASIX ‘Do It Yourself’ thermal comfort tool. This allows BASIX to identify trends in sustainable improvements made to meet BASIX thermal comfort requirements.

An example of such trends is the decline in unmodified clear glazing with aluminium frames, considered as industry standard preceding BASIX. Most BASIX homes are now installing better performing windows that retain and reflect more heat, such as double glazing or e-glass, thus reducing the need for additional heating or cooling (see following graph).
BASIX secures the sustainability of shared facilities and common areas

Pre-BASIX data indicated that up to 40 per cent of emissions for a unit dweller were attributable to common area energy use, and that occupants of unit dwellings emitted on average 1.4 times the per capita greenhouse gases of a house occupant. The primary common area contributors were continuous car park ventilation and round-the-clock incandescent or halogen lighting.

95% of all new unit projects feature some common area shared between residents

The following graph indicates some of the key improvements new developments are making to common areas to improve BASIX energy and water scores.

Common area efficiency improvements

- Energy efficient lighting
- Lighting controls (eg, sensors)
- Pool filter timer
- Maximum efficiency lifts
- Alternative irrigation supply to common gardens
- Ventilation controls (eg, monoxide monitors)
- Low-water use plants in common gardens
- Alternative irrigation supply to common gardens

The inclusion of common area assessment at the design stage also helps clarify responsibilities between owners and occupiers over future improvements to the property’s sustainability.
Each BASIX project provides its postcode and local government authority (LGA), which allows BASIX to identify how different housing needs across the State respond to BASIX requirements. LGAs with similar demographic and climatic conditions are combined into larger BASIX geographic regions (see following map).

The following table shows the distribution of certificates to June 30 2009. The Mid North Coast region, including Lake Macquarie, Newcastle City, Port Stephens, Great Lakes and Greater Taree councils, showed the highest activity outside of Sydney.

<table>
<thead>
<tr>
<th>Rank</th>
<th>BASIX region</th>
<th>Single dwellings</th>
<th>Multi-dwelling houses</th>
<th>Multi-dwelling units</th>
<th>Alterations and additions</th>
<th>Proportion of all BASIX certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sydney Metropolitan</td>
<td>38.1%</td>
<td>39.5%</td>
<td>75.5%</td>
<td>61.2%</td>
<td>50.8%</td>
</tr>
<tr>
<td>2</td>
<td>Mid North Coast</td>
<td>8.0%</td>
<td>14.0%</td>
<td>6.1%</td>
<td>6.7%</td>
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<td>3</td>
<td>South Coast</td>
<td>7.1%</td>
<td>5.0%</td>
<td>2.3%</td>
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<td>4</td>
<td>Northern Rivers</td>
<td>5.5%</td>
<td>3.6%</td>
<td>4.4%</td>
<td>4.5%</td>
<td>4.8%</td>
</tr>
<tr>
<td>5</td>
<td>Murray/Murrumbidge</td>
<td>6.9%</td>
<td>3.0%</td>
<td>0.6%</td>
<td>3.7%</td>
<td>4.5%</td>
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<tr>
<td>6</td>
<td>Hunter</td>
<td>5.7%</td>
<td>9.8%</td>
<td>0.4%</td>
<td>2.3%</td>
<td>4.4%</td>
</tr>
<tr>
<td>7</td>
<td>North Coast</td>
<td>5.7%</td>
<td>4.1%</td>
<td>2.6%</td>
<td>2.7%</td>
<td>4.3%</td>
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<td>8</td>
<td>Western</td>
<td>5.9%</td>
<td>6.7%</td>
<td>0.1%</td>
<td>2.9%</td>
<td>4.2%</td>
</tr>
<tr>
<td>9</td>
<td>Central Coast</td>
<td>4.2%</td>
<td>4.0%</td>
<td>4.4%</td>
<td>4.1%</td>
<td>4.2%</td>
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<td>10</td>
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<td>11</td>
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<td>2.9%</td>
<td>3.1%</td>
<td>3.4%</td>
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<tr>
<td>12</td>
<td>Northern Tablelands</td>
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<td>3.1%</td>
<td>0.1%</td>
<td>1.7%</td>
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<td>13</td>
<td>Other</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.01%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
Flexible sustainability options for different regions

BASIX varies water and energy targets across NSW according to dwelling type, climate and infrastructure (such as reticulated gas). This allows flexibility to achieve BASIX targets according to varying development preferences, such as the clear preference for units in Sydney and houses in regional NSW illustrated in the following graphs.

Over half of all BASIX certificates were for homes in the Sydney metropolitan area

The Sydney Metropolitan area is further divided into key sub-regions, as shown in the following table.

The most active region in the State was the Sydney inner suburbs sub-region, centred on the CBD and bounded by Manly and Ryde to the north, Auburn and Canterbury to the west, and Botany Bay to the south. BASIX certification here was primarily for renovations or new units, whilst in the outer suburbs, from Parramatta to Penrith in the west, Baulkham Hills to the north and Campbelltown and Camden to the south, BASIX was used for more new houses than anywhere else in NSW.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sydney sub-region</th>
<th>Single dwellings</th>
<th>Multi-dwelling houses</th>
<th>Multi-dwelling units</th>
<th>Alterations and additions</th>
<th>Proportion of all BASIX certificates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sydney Inner Suburbs</td>
<td>7.0%</td>
<td>9.8%</td>
<td>34.2%</td>
<td>30.7%</td>
<td>17.7%</td>
</tr>
<tr>
<td>2</td>
<td>Sydney Outer Suburbs</td>
<td>18.1%</td>
<td>17.8%</td>
<td>15.8%</td>
<td>9.0%</td>
<td>15.9%</td>
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<tr>
<td>3</td>
<td>Sydney North</td>
<td>5.2%</td>
<td>1.8%</td>
<td>13.5%</td>
<td>12.4%</td>
<td>7.9%</td>
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<tr>
<td>4</td>
<td>Sydney South</td>
<td>5.4%</td>
<td>8.7%</td>
<td>11.3%</td>
<td>6.1%</td>
<td>7.2%</td>
</tr>
<tr>
<td>5</td>
<td>Sydney Hinterland</td>
<td>2.5%</td>
<td>1.4%</td>
<td>0.7%</td>
<td>3.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td></td>
<td>Sydney Metropolitan</td>
<td>38.1%</td>
<td>39.5%</td>
<td>75.5%</td>
<td>61.2%</td>
<td>50.8%</td>
</tr>
</tbody>
</table>

Regional analysis can be integrated with other planning data, enhancing the capability of governments at all levels to respond to residential sustainability issues on a local basis. Closer regional analysis of commitments made to meet BASIX targets will be conducted at a later date.
This document is part of a series of reports from the ongoing BASIX Outcomes Monitoring Program, all of which are available for download from:

www.basix.nsw.gov.au

BASIX reporting program


September 2008 BASIX Multi-Unit Residential Cogeneration Demonstration Project (with MPI Engineering)

November 2008 2005-08 Single Dwelling Outcomes Report

December 2008 BASIX Water Savings for 2007-08 (with Sydney Water)

December 2009 BASIX Water Savings for 2008-09 (with Sydney Water)

March 2011 2006-09 Multi-Dwelling Outcomes Report

BASIX Post-Implementation Cost-Benefit Analysis (with NERA Economic Consulting)

BASIX Alterations and Additions Outcomes Summary

BASIX Five Year Outcomes Summary


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