

BASIX Water Savings Monitoring

Sydney Water
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Glossary

ABS – Australian Bureau of Statistics.

Analysable sample – The subset of dwellings included in the full telephone survey sample whose consumption was analysed for the purpose of monitoring BASIX savings. The analysable sample satisfied appropriate additional criteria that meant it was valid to include their consumption in the analysis.

BASIX Benchmark – The “baseline” consumption for a dwelling against which BASIX measures savings. It is calculated by multiplying the pre-BASIX average NSW potable water consumption from the residential sector (247.5 litres of potable water per person per day) by the assumed number of occupants of the dwelling. The latter is based on the average number of occupants by dwelling type, number of bedrooms and location, calculated using data from the 2001 Census.

BASIX certificate – document specifying the sustainability measures that the proposed development will install to meet BASIX requirements for water savings.

BASIX Target – minimum reduction requirement for BASIX dwellings. The BASIX Target for water in Sydney Water’s area of operation is 40% less than the BASIX Benchmark.

BASIX Water Score – the dwelling’s estimated percentage potable water savings relative to its BASIX benchmark as estimated by the BASIX tool based on the sustainability measures nominated. The BASIX Water Score must be a minimum of 40 for a dwelling to satisfy BASIX requirements.

EP&A – NSW Environmental Planning & Assessment Act 1979.

Multi-unit dwellings – a dwelling with one or more dwellings or buildings above or below it, such as flat, unit or apartment.

Single dwelling – BASIX defines it as a dwelling which is separated from all other dwellings and other buildings (excluding a garage or carpark) by at least 0.5m.

Target consumption – the potable water consumption based on the benchmark consumption and the target reduction of 40%.

Telephone sample – the BASIX compliant Sydney Water customers who participated in the telephone recruitment survey for the purposes of the BASIX Monitoring Project.

Executive summary

BASIX, the Building Sustainability Index, is a planning policy requiring all new houses and residential units to be designed to use up to 40% less potable water and emit up to 40% fewer greenhouse gases than the average NSW dwelling. The BASIX policy is one of the NSW Government's key initiatives in promoting a water efficient future for New South Wales.

To ensure that BASIX is implemented as intended and to its full potential, Sydney Water and the Department of Planning are undertaking an in depth monitoring study under a data sharing agreement. The monitoring study will be conducted in several stages including analysis of compliance trends, water savings and on-ground site verification.

Sydney Water has prepared the BASIX Water Savings Monitoring Report to present the findings of Stage 2 of the BASIX monitoring study. Stage 2 involves monitoring the actual water savings of occupied BASIX dwellings using metered potable water consumption to determine whether dwellings are meeting their water reduction targets.

BASIX dwellings are performing close to the predicted 40% reduction target. Over the past two financial years, 2007-2008 and 2008-2009, the sample of BASIX single dwellings have saved 40.6% and 37.6%, respectively, relative to the BASIX benchmark consumption.

This is the second year that the BASIX water consumption monitoring has been reported. The BASIX water savings will be monitored and reported on an annual basis using the current framework. Each year the BASIX Water Savings Monitoring Report will be updated, replacing previous versions.

Introduction

In 2004 the NSW Government introduced BASIX, the Building Sustainability Index, a key planning policy requiring all new houses and units to be designed to use less potable water and emit fewer greenhouse gases. Reduction targets of up to 40% less water use and 40% fewer greenhouse gas emissions than the average NSW dwelling were set by BASIX.

BASIX was introduced in stages, commencing on 1 July 2004 for single dwellings in Sydney. In 2005, all single dwellings and multi-unit dwellings in NSW were incorporated into the scheme, and in 2006, BASIX was expanded to include renovations.

BASIX is administered under the Environmental Planning and Assessment Act 1979 and is managed by the NSW Department of Planning. Developed in consultation with industry groups, local government and utilities to be flexible, adaptable and responsive to each new home, BASIX avoids prescriptive measures and actions that do not result in a measurable reduction in water or greenhouse emissions.

BASIX is implemented through an interactive online assessment tool. The details of the proposed new dwelling, including the proposed water saving measures are entered in to the tool. The tool calculates the potable water use and compares this against the BASIX Benchmark consumption. The results are expressed as the percentage saving relative to this benchmark, this is expressed in terms of the BASIX Water Score. The Water Score needs to be at least 40 for a dwelling to be BASIX compliant.

The BASIX Benchmark against which savings are calculated is based on the pre-BASIX average residential consumption in NSW of 247.5 litres per person per day. To calculate the BASIX Benchmark for a proposed new dwelling, this number is multiplied by the assumed number of occupants. The latter is based on the dwelling type, number of bedrooms and location. This is converted into an average number of occupants using data from the 2001 ABS Census on the average number of occupants by dwelling type, number of bedrooms, and location.

Compliance with BASIX is checked as part of the building approvals process. All BASIX commitments are documented on a BASIX certificate and submitted as part of the dwelling's development application. The BASIX commitments must be fulfilled and checked by the principal certifying authority (building certifier) before the final occupation certificate is issued to the dwelling.

Background

The BASIX policy is one of the NSW Government's key initiatives in promoting a water efficient future for NSW. As with any other regulatory policy, the challenge with BASIX is to ensure that it is implemented as intended and to its full potential. To ensure that the outcomes of BASIX are in line with the desired outcomes, Sydney Water is working with the NSW Department of Planning on an in depth monitoring study.

The BASIX dwelling data, collected online as part of the application process, is stored in a database, providing detailed information on new housing stock design and location. This information has been fundamental to the BASIX monitoring study.

BASIX is being monitored in 3 key stages:

Stage 1: BASIX compliance trends

BASIX certificates were analysed by Department of Planning to determine the water, energy and thermal efficiency measures being nominated to meet the BASIX targets. The program commenced in 2006 and the outcomes to date are outlined in the *2004-05 Outcomes BASIX Ongoing Monitoring Program*, *BASIX 2005/06 Snapshot* and the *2005-08 Single Dwelling Outcomes BASIX Ongoing Monitoring Program* available on the Department of Planning's website.

Stage 2: BASIX water savings

Sydney Water is monitoring the metered potable water consumption of occupied BASIX dwellings to determine whether dwellings are meeting their water reduction targets. Analysis of the BASIX savings will be carried out on an ongoing basis to determine whether water savings are maintained and the effectiveness of specific compliance measures. This report presents the results of the monitoring study to date.

Stage 3: BASIX on-ground truthing

Sydney Water has been conducting site verification inspections on a sample of occupied BASIX dwellings to identify whether the water savings of BASIX (Stage 2 results) are being influenced by the installation, operation and use of the BASIX compliance measures. A total of 475 occupied BASIX homes were inspected to measure and test water efficiency and BASIX compliance. The information collected will help clarify whether the BASIX savings will be maintained in the long-term.

The findings of Stage 3 will be reported separately in 2010.

Scope of this report

The purpose of this report is to present the results of the Stage 2 monitoring program. The report covers the water savings analysis of a sample of BASIX occupied single dwellings in 2008-2009 and compares them to results for 2007-2008 as reported previously. This report replaces the *BASIX Monitoring Report: Water Savings for 2007-08* (Sydney Water, 2008).

Method

Sydney Water and Department of Planning have established a data sharing agreement to assess the effectiveness of the BASIX policy. Department of Planning provides the BASIX dwelling information such as address and BASIX Benchmark, BASIX Target and BASIX Water Score information for each dwelling. Sydney Water matches this data with its billing database to analyse the consumption of these dwellings.

A number of challenges were encountered in determining which properties to include in the analysis. If a BASIX certificate exists for a particular property address this does not constitute confirmation that the dwelling has been completed and occupied and therefore can be included in the analysis. For dwellings on new sites some of this information can be inferred from Sydney Water's property database. However, the exact date of occupation in particular remains hard to determine. In the case of new dwellings built on existing sites (knock-down rebuilds) even determining if the new dwelling has been completed is highly problematic. To overcome these challenges, a telephone survey of addresses with BASIX certificates was conducted to confirm if the dwelling had been completed and if so, if and when it was occupied.

The discussion below outlines the process used to select a sample, the representativeness and the analysis period.

Telephone survey sample

BASIX certificates were selected for inclusion in the survey if the address on the certificate could be matched to an address on Sydney Water's billing database. The property owner was contacted for the survey. This is because a tenant may not have been able to provide the necessary information (eg date of completion). The owner of the property was identified from the billing address for the property, which in the case of owner occupied properties is the same as the property address.

The telephone recruitment survey was subsequently carried out, and the following information was gathered:

- Year the dwelling was completed.
- Month and year it was first occupied.
- Number of occupants (in case of owner occupied properties only).

The survey was carried out in April 2008 by a specialised market research company. A total of 1,703 interviews were completed. In February 2009 a similar survey was carried out to recruit participants for Stage 3 of the BASIX monitoring study. These have been added to the 1,703 interviews completed in 2008 to arrive at a total of 1,881 completed interviews.

Analysable sample

Not all of the properties for which telephone survey interviews were completed could be included in the analysis. Some property owners did not give the research company permission to pass their details (name, property address) back to Sydney Water. Without those details Sydney Water cannot identify a property on the billing database. However, even if the property can be identified

there may be reasons it is not appropriate to include a particular dwelling in the analysis at this stage. The full selection criteria for a property to be included in the analysis of savings were:

1. Telephone interview completed.
2. Permission from the property owner to pass on details to Sydney Water.
3. Dwelling has been constructed and is complete, but the dwelling was not completed before January 2005. (Dwellings completed before January 2005 are unlikely to be BASIX dwellings).
4. Dwelling is occupied.
5. The number of dwellings on the property is no greater than one (only single dwellings are being included in this stage of the analysis therefore multiple dwellings on one property site have been excluded).
6. The property is classified with the appropriate property type on Sydney Water's billing database (eg, not classified as a unit block or agricultural property).
7. The dwelling was occupied before 1 July of financial year for which consumption will be analysed, eg occupied before 1 July 2007 when analysing 2007-08 consumption.
8. The dwelling has meter reads covering the full 12 months of the year being analysed.
9. BASIX Benchmark information is available.

The size of the analysable sample for 2007-08 and 2008-09 was 837 and 1,392 single dwellings, respectively. The size of the analysable sample will increase over time as more properties included in the full telephone sample satisfy selection criteria 7 and 8 outlined above. The table below provides the remaining sample size for 2008-2009 and 2007-2008 at each stage of the selection process.

Remaining sample size following application of successive selection criteria									
Sample	1. Survey completed	2. Customer permission to use survey	3. Completed BUT not completed before 2005	4. Occupied	5. Only one dwelling on property	6. Valid Sydney Water property type	7. Occupied before July of analysis year	8. Consumption data for whole analysis year	9. BASIX benchmark available
2007-2008	1,881	1,811	1,615	1,572	1,546	1,514	1,012	838	837
2008-2009						1,522	1,464	1,394	1,392

Water consumption analysis

To determine if BASIX is achieving its objective, the actual potable water consumption of each dwelling included in the the analysable sample is compared with the target consumption for that dwelling, ie the BASIX Benchmark consumption for that dwelling minus the BASIX Target saving of 40%.

To further verify the performance of BASIX the following analysis is also carried out and outlined in Appendix 1:

- Savings based on the actual occupancy of each dwelling (information gathered during the phone survey),
- Measured savings vs the BASIX Water Score, and
- Savings by BASIX certificate generation year.

Performance of BASIX dwellings

The analysable sample is performing close to the target of a 40% reduction from the BASIX Benchmark. Over the past two financial years 2007-2008 and 2008-2009 the sample dwellings have saved 40.6% and 37.6% respectively. Savings for 2008-2009 were slightly lower than the previous year. Water savings are expected to fluctuate from year to year, see the discussion under Influencing Factors.

Results	2007-2008	2008-2009
Analysable sample (number of dwellings)	837	1,392
Average BASIX benchmark consumption (kilolitres)	324	325
Average target potable water consumption (ie BASIX benchmark – 40%; kilolitres)	195	195
Average actual potable water consumption (kilolitres)	192	201
Average actual percentage savings relative to BASIX benchmark	40.6%	37.6%
95% confidence intervals	38.4 – 42.9 %	35.6 – 39.5 %

The full results of the water consumption analysis and savings are outlined in Appendix 1.

Influencing Factors

Ongoing monitoring is critical to determine the average BASIX savings and the long-term results of the policy. The BASIX water savings will fluctuate from year to year due to changing weather conditions and other factors such as water restrictions.

Virtually all BASIX single dwellings have an alternative water supply to meet the BASIX Target, with the great majority of BASIX dwelling having a rainwater tank. Dwellings with rainwater tanks will experience greater variability in savings than properties with a recycled water supply due to their rainfall dependence.

During years of low rainfall and high temperatures the savings from rainwater tanks will be reduced due to higher irrigation demands and reduced yields. The opposite is also true, with higher rainwater tank yield during relative wet and cool weather conditions.

The most important caveat on the BASIX results is that they have not been corrected for water restrictions. While the majority of BASIX dwellings have a rainwater tank, they may still have to rely on potable water for garden watering at certain times which would be subject to restrictions. Also, if a rainwater tank has potable water top up, water from the tank is subject to water restrictions. While recycled water supplied by Sydney Water is exempt from water restrictions, Sydney Water observed a reduction in recycled water consumption during water restrictions suggesting that even when customers have an exempt alternative supply, they still comply with restrictions to some extent.

It is reasonable to assume that the BASIX savings include some impact from restrictions. However determining the impact of water restrictions on the savings of BASIX dwellings is extremely difficult due to a lack of knowledge of the:

- proportion of dwellings that are exempt but where residents still comply with the restrictions (either voluntarily or because they are simply not aware they are exempt).
- proportion of dwellings aware that restrictions apply to a rainwater tank with potable water top up and their level of compliance with the restrictions.
- the extent to which behaviours adopted during water restrictions will revert to pre-restrictions practices once lifted.

For these reasons, the results have not been corrected for water restrictions. Water restrictions were lifted in June 2009 and replaced by permanent Water Wise Rules. Ongoing monitoring will determine if there was a significant impact of water restrictions on the performance of BASIX dwellings.

Conclusions

The BASIX policy is one of the NSW Government's key initiatives in promoting a water efficient future for NSW. To ensure that BASIX is implemented as intended and to its full potential, Sydney Water and Department of Planning are undertaking an in-depth monitoring study.

Results show BASIX dwellings are performing close to the predicted 40% reduction target. Over the past two financial years, 2007-2008 and 2008-2009, the sample of BASIX single dwellings have saved 40.6% and 37.6% respectively.

BASIX water savings will be monitored and reported on an annual basis to confirm the long-term policy achievements.

Appendix 1 Detailed Results

Sample Characteristics

To assess the representativeness of the analysable sample compared to the full telephone sample the two samples were compared on the following characteristics:

- Number of bedrooms.
- Number of occupants (estimates from BASIX tool and actual occupancy).
- BASIX benchmark consumption.
- Proportion of dual reticulation.
- Proportion of 2004-05 BASIX certificates.

This is only a check on the representativeness of the analysable sample relative to the telephone survey sample, not representativeness compared to all BASIX affected dwellings. In the absence of any population statistics for single dwellings covered by BASIX, it is not possible to check the representativeness of either the telephone survey sample or the analysable sample relative to the population.

The 2008-2009 analysable sample showed greater similarity to the full telephone sample than the 2007-2008 sample. As outlined in the table below the 2008-2009 analysable sample showed consistent occupancy rates and number of bedrooms to the full sample. Extremely slight variations in BASIX benchmark and proportion with dual reticulation exist between the 2008-2009 analysed sample and the full sample. The BASIX certificate generation year is also becoming more consistent with the full sample as more dwellings satisfy criteria relating to occupation date.

	2007-2008 sample (a)	2008-2009 sample (b)	Full sample (c)
Average BASIX benchmark consumption (litres/dwelling/day)	886	890	891
Average number of bedrooms (as per certificate)	4.4	4.5	4.5
Average occupancy			
1. As per BASIX occupancy/bedroom no	3.6	3.6	3.6
2. Survey results	3.8	3.8	3.8
Proportion with dual reticulation	13%	11%	10%
Year of BASIX certificate			
2004-2005	54%	41%	39%
2005-2006	45%	52%	50%
2006-2007 or 2007-2008	1%	7%	11%

(a) n=837

(b) n=1,392

(c) Full sample: All completed surveys where the number of dwellings on the property is 1 and the dwelling was not completed and not occupied before January 2005; n=1,599

BASIX water savings

Figures 1 and 2 show the distribution of measured water savings relative to the BASIX benchmark in 2007-08 and 2008-09. During 2008-2009 the analysed sample saved an average of 37.6% (95% confidence interval: 35.6% - 39.5%) from the BASIX benchmark, slightly below the BASIX Target. In 2007-2008 the analysed sample achieved 40.6% (95% confidence interval: 38.4% - 42.9%) from saving from the BASIX benchmark. The majority of the analysed dwellings achieved savings of 40% or more relative to the BASIX benchmark in both 2008-2009 and 2007-2008.

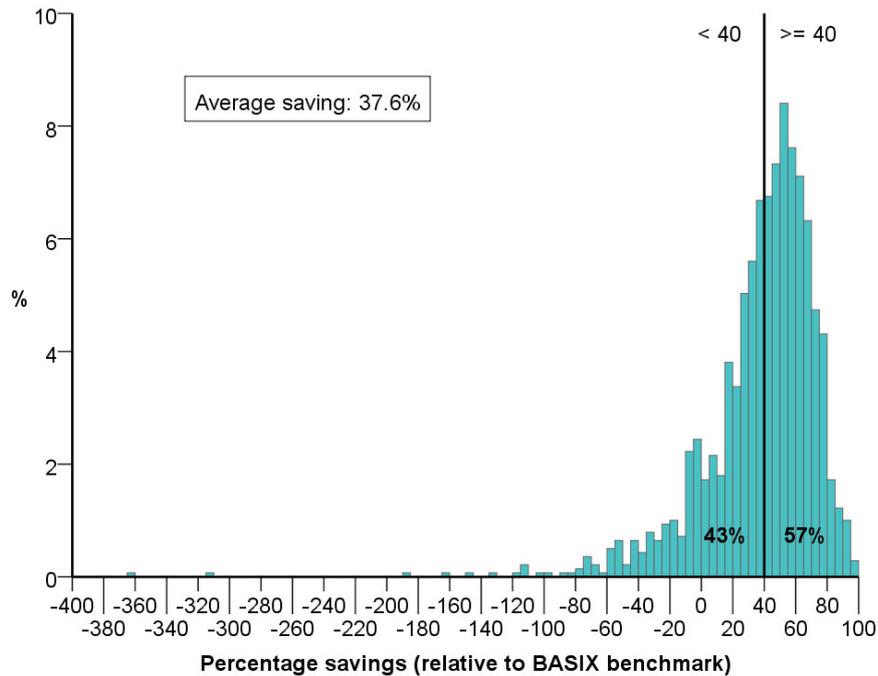


Figure 1. 2008-2009 water savings compared to BASIX Benchmark

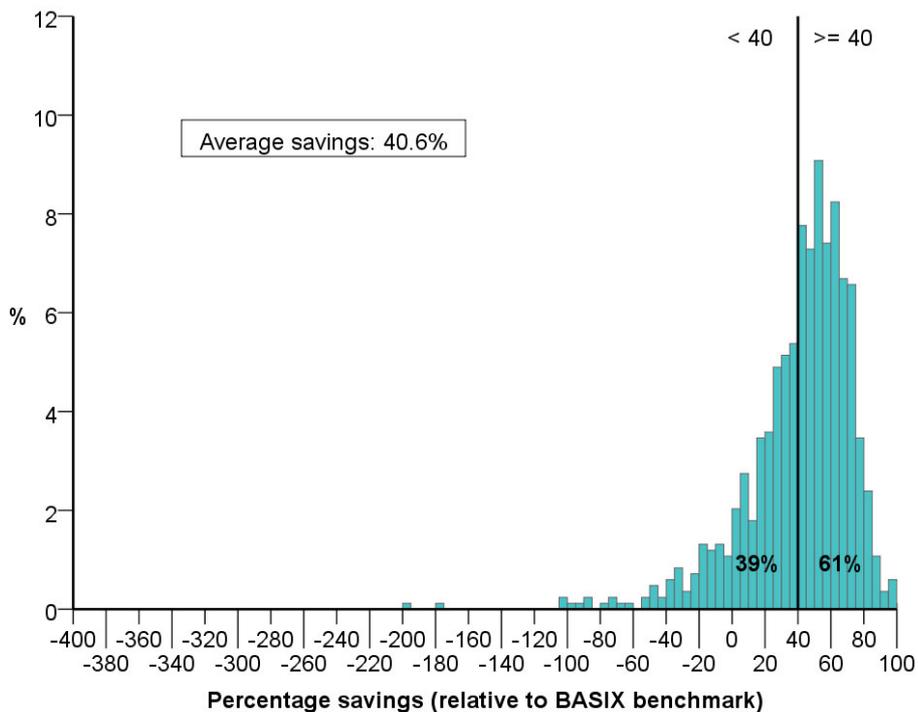


Figure 2. 2007-2008 water savings compared to BASIX Benchmark

Savings based on actual occupancy

The benchmark consumption was re-calculated using the actual occupancy as collected during the telephone survey. The actual occupancy is slightly higher than the assumed occupancy based on Census data (which is the basis for the BASIX Benchmark). Hence, the benchmark consumption based on the actual occupancy is slightly higher than the BASIX benchmark consumption. Relative to this new benchmark, the average savings were 39.1% in 2008-2009 and 42.2% in 2007-2008 (Shown in Figure 3 and Figure 4).

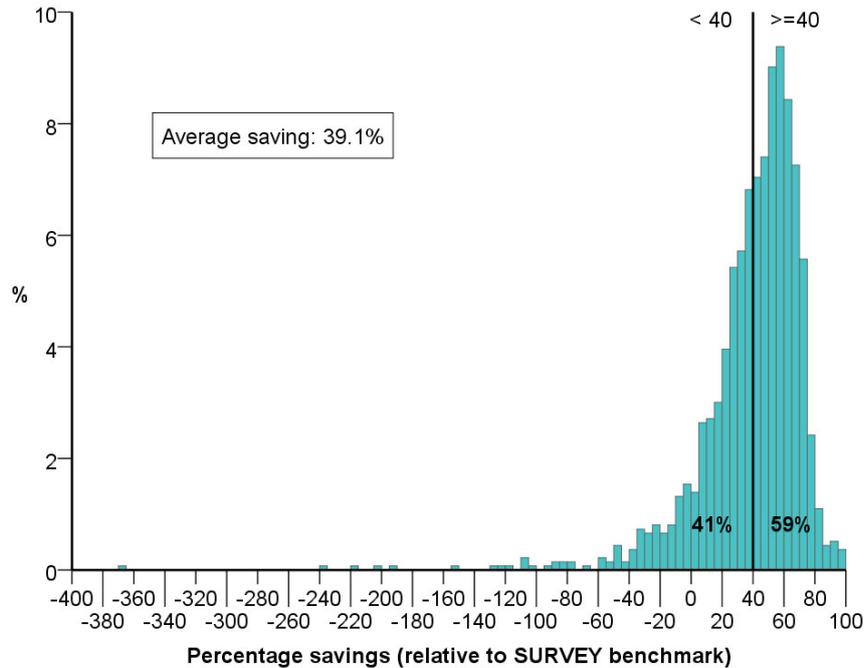


Figure 3. 2008-2009 water savings based on actual occupancy

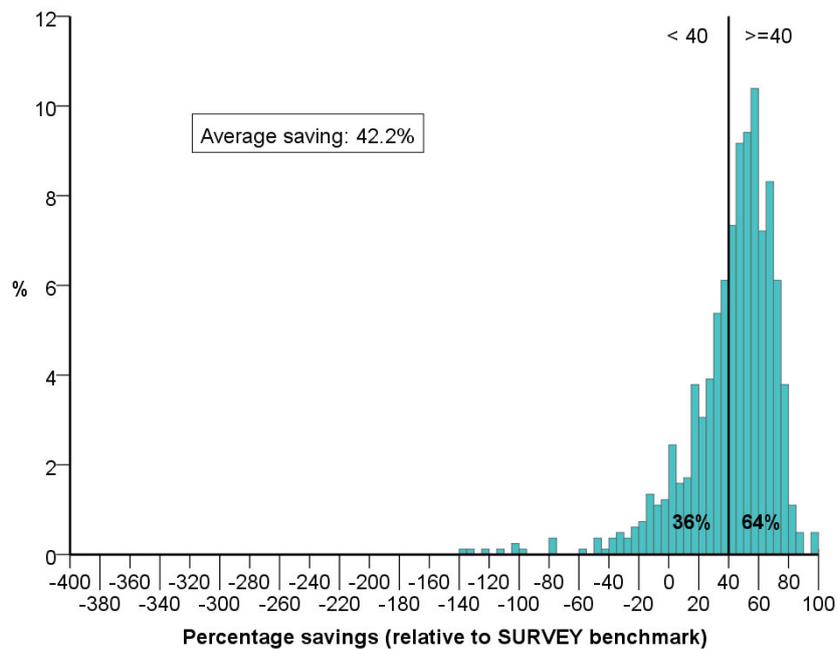


Figure 4. 2007-2008 water savings based on actual occupancy

Savings compared to predicted BASIX Water Score

The percentage savings based on actual consumption was compared to savings as predicted by the BASIX Water Score. The average Water Score for the analysed sample was 43%. As reported above, the actual savings were 37.6% in 2008-2009 and 40.6% in 2007-2008. Therefore, the analysed sample dwellings on average did not achieve the Water Score as predicted by BASIX in either year.

Saving by BASIX certificate year

BASIX savings show notable difference between BASIX certificates generated in 2004-2005 and certificates generated after July 2005. The latter exceeded the BASIX target savings of 40% in both 2007-08 and 2008-09 while the former did not achieve the target in either year.

	2004-2005 BASIX Certificates (n=570)	Post July 2005 BASIX Certificates (n=822)
Savings in 2008-2009	32.7%	40.9%
Savings in 2007-2008	36.7%	45.1%

Currently the analysed sample has a high proportion of dwellings with BASIX certificates generated in 2004-2005. As the sample of BASIX dwellings increases over time the proportion of 2004-2005 BASIX certificates will reduce. Based on the results from savings analysis to date, the smaller the proportion of 2004-05 BASIX certificates then the higher the average BASIX saving.

Substantial improvements to the BASIX tool were implemented in 2005-2006. Improvements to the BASIX tool as well as advancements in the integration of water saving technology into new dwelling design may explain the higher savings by dwellings with certificates issued after July 2005. If so, the water savings for certificates generated after July 2005 are likely to be more representative of the long-term performance of BASIX.