

Residential building sustainability (BASIX)

This section focuses on the sustainability measures for residential buildings in the policy. These are contained in Chapter 2 and Schedules 1 and 2 of the Sustainable Buildings SEPP, amendments to Sections 43 and 71 of the *Environmental Planning and Assessment (Development Certification and Fire Safety) Regulation 2021* and Sections 29 and 102 of the *Environmental Planning and Assessment Regulation 2021*.

What is BASIX?

The Sustainable Buildings SEPP establishes the policy for the application of the Building Sustainability Index (BASIX). BASIX is an important part of NSW's development application process. It mandates standards to achieve reductions in water and energy consumption and greenhouse gas emissions. BASIX applies to new houses and apartments, alterations and additions to residential developments with a construction cost of \$50,000 or more or installing swimming pools of 40,000 litres or more. The BASIX thermal performance standards ensure that homes stay cool in summer and warm in winter without using a large amount of energy.

BASIX was introduced on 1 July 2004 and was an Australian first in sustainability. Since its introduction, more than half a million NSW homes have met BASIX water and energy-saving standards. These homes are collectively estimated to have saved 340 billion litres of potable water, and reduced emissions equivalent to 12.3 million tonnes of carbon dioxide (CO₂). The water savings are equivalent to 135,000 Olympic-sized swimming pools and the CO₂ offset is equivalent to planting 40 million trees.

Why has the NSW Government increased BASIX standards?

BASIX water-saving standards for residential buildings have not increased under the 2022 policy changes. BASIX thermal performance and energy standards for new residential developments (in place since July 2017) have increased under the 2022 policy changes.

In 2019, the energy ministers of the federal, state and territory governments agreed to the Trajectory for Low Energy Buildings, a national plan that aims to achieve zero energy and zero carbon-ready buildings. The national plan proposes making cost-effective increases to the energy efficiency requirements of the National Construction Code for residential buildings from 2022 (NCC 2022).

The NSW Government has committed to the [Trajectory for Low Energy Buildings](#). To support this, it has set an aspirational target to achieve net zero emissions by 2050. The NSW Government also committed to halving emissions from 2005 levels by 2030 in its latest [implementation update](#) for Stage 1 of the Net Zero Plan. The policy changes coming into effect on 1 October 2023 bringing BASIX thermal performance and energy standards for NSW residential buildings in line with the energy efficiency requirements in the National Construction Code that will also commence on 1 October. The higher energy standards will also deliver strong government action towards our net zero target.

Where do the new BASIX standards apply?

The higher BASIX thermal performance and energy standards will apply to all new residential buildings across NSW from 1 October 2023, except for:

- homes in the North Coast climate zones
- small apartment buildings up to 5 storeys across NSW.

For homes in the North Coast climate zones and all small apartment buildings, modelling from the [cost-benefit analysis](#) by [ACIL Allen](#) shows that the benefits of energy bill savings from households that meet higher standards are not enough to cover the extra upfront costs. Before standards are reviewed again in the future, a new cost-benefit analysis will be done, and this may change whether small apartment buildings and North Coast climate zones are added.

However, a new requirement to calculate and report on the embodied emissions of building materials (materials index) will apply to all new residential buildings across NSW. This new reporting requirement will provide valuable data to inform future policy changes to support the NSW Net Zero Plan.

When will the new BASIX standards apply?

The higher thermal performance and energy standards will apply from 1 October 2023. BASIX assessments will also include the new materials index from 1 October 2023.

If I already have a BASIX certificate, will I need a new one?

Clarifications to the SEPP are proposed so that if you generate a BASIX certificate before 1 October 2023, you do not need a new BASIX certificate, provided you submit it with your development application or lodge it with your application for a complying development certificate within the three-month certificate validity period. In line with the current rules, you can revise the lodged certificate during the assessment period or after receiving development consent.

What other transitional arrangements are in place to help homeowners and industry adjust?

For applicants who have signed a building contract to construct a new single dwelling or dual occupancy before 1 October 2023, they will be able to apply to use the current standards, provided they submit their development application or lodge their application for a complying development certificate on the Planning Portal before 30 June 2024.

What are the changes to the BASIX thermal performance and energy standards for new residential developments?

We have increased the BASIX thermal performance and energy standards, except for homes in the North Coast climate zone and small apartment buildings of up to 5 storeys anywhere in NSW.

The higher BASIX thermal performance standards will be at least 7 stars, based on the star-rating scale defined by the [Nationwide House Energy Rating Scheme \(NatHERS\)](#). This is consistent with the energy efficiency requirements in the National Construction Code 2022. Currently, homes that comply with BASIX have been achieving 5.5 to 6 NatHERS stars on average.

The higher energy standards will vary with location and building types, as specified in Schedule 1 of the Sustainable Buildings SEPP. Different standards account for the variable climatic conditions across NSW and energy use from shared services (such as lifts) and common areas (such as lobbies and corridors) in apartment buildings.

The NSW electricity grid has, over time, become greener as we produce more electricity from renewable energy sources. This is recognised in the new energy standards which include an updated greenhouse emissions factor when we calculate the emissions from grid electricity consumption.

Why are the new thermal performance and energy standards different from those exhibited in 2021 under the proposed Design and Place SEPP?

Since we exhibited the proposed changes to BASIX standards in December 2021, we have undertaken further analysis of the thermal performance and energy standards to align with the final approach adopted in NCC 2022. Changes to the thermal performance and energy standards not only address some of the feedback from the public exhibition, but also improve consistency with the approach of deriving the heating and cooling limits in NCC 2022 and the NatHERS whole-of-home calculation methods.

Are there any changes to the standards for BASIX water or alterations and additions?

No, BASIX water standards for new homes and the standards for alterations and additions to residential buildings will stay the same across NSW. We will examine these standards in future reviews of BASIX. The next one is scheduled for 2025.

How can developers and homeowners meet the higher standards?

Developers and homeowners can choose from a range of measures to meet the proposed higher thermal performance and energy standards as part of the design for development approval.

Measures for a typical home to meet the higher standards may include:

- installing more insulation, improving the performance and location of windows, as well as using good air flow, shading and sunlight to cool and heat homes naturally
- selecting a more energy-efficient hot water system such as an electric heat pump or a solar hot water system
- installing photovoltaic panels to supplement a 5-star gas hot-water system commonly used to meet the current energy standards
- choosing a more efficient heating and cooling system, such as a 3-star reverse cycle air-conditioning system.

The free [Design for Place](#) designs from the Australian Government's [Your Home](#) sustainability website provides suggestions to help you achieve higher thermal performance.

Can I use NatHERS whole-of-home assessments to satisfy BASIX energy standards?

No, you cannot use NatHERS whole-of-home assessments to satisfy BASIX energy standards. Instead, BASIX will adopt the NatHERS whole-of-home calculation methods to calculate the energy consumption and greenhouse gas emissions of proposed residential developments. The BASIX energy standard is based on greenhouse gas emission reductions from the baseline amount. In contrast, NatHERS whole-of-home performance rating is based on the energy value defined by NCC 2022, or net cost to society.

Does the increased BASIX thermal performance standard mean dark roofs are banned? It will be harder to satisfy the higher BASIX thermal performance standards with a dark roof. To align with NCC 2022 Deemed-to-Satisfy Elemental provisions, dark roofs have been excluded for those using the DIY method in some climate zones, including in Greater Sydney. Dark roofs continue to be available under the DIY method for climate zones 9, 10 and 11.

Building designers can also still use the NatHERS simulation method to meet BASIX thermal standards if their clients prefer dark roofs. They will however need to compensate for the higher cooling loads by other means, such as better windows.

Will the higher standards increase the cost of construction?

Modelling from the [cost-benefit analysis](#) by ACIL Allen found that an average house in Western Sydney will cost an additional \$7,152 to satisfy the higher standards. For an average high-rise apartment unit, the cost is an additional \$831 to \$953. However, these costs over the lifetime of a

house are offset by lower ongoing energy bills, which will also increase the household's disposable income.

Before finalising the SEPP, the department undertook additional sensitivity testing to ensure that the standards included in the SEPP are cost-effective. For example, the upfront construction cost resulting from meeting higher standards are offset by the energy bill savings over the lifetime of a mortgage.

Are there energy bill savings from the higher standards?

Cheaper energy bills will result for occupants of homes that meet the higher thermal performance and energy standards. The department has estimated energy bill savings, based on forecast 2022 energy prices, will vary with locations and building types:

- occupants of new high-rise apartment blocks in suburban Sydney could save between \$105 and \$265 on yearly energy bills
- occupants of houses in Western Sydney could save about \$1070 on yearly energy bills. Households living in large houses in Western Sydney could save \$436 on yearly energy bills.
- energy bill savings for people living in regional areas vary with location. Those in Wagga Wagga could save up to \$421 and those in Dubbo could save \$1257 on yearly bills.

We recognise that energy bills have increased in 2022 and 2023 and that savings may be more significant. Energy bill savings will help reduce financial stress on households.

Does the higher BASIX standard allow all-electric homes?

Yes, homes with electric heat pump hot water systems, efficient reverse cycle air conditioners and induction cooktops can achieve the higher BASIX standard. These homes are net zero carbon-ready, meaning that they can achieve net zero emissions after renewable energy systems such as solar panels are installed to offset the greenhouse gas emissions from occupants.

How can I test the effect of the new BASIX standards on my design?

The department has developed the BASIX 'sandbox' tool to allow homeowners, developers and industry to trial different design options to help them achieve the new standards when they come into effect on 1 October 2023. The BASIX sandbox tool is a beta version of the BASIX tool that incorporates the new thermal performance and energy standards, and the new material index.

The sandbox tool was made publicly available to active BASIX users in December 2022. The sandbox tool can generate an informal (sample) BASIX report applying the updated requirements. However, you cannot lodge a development application or complying development certificate application with the informal BASIX report. BASIX certificates continue to be issued through the BASIX website.

Are you going to update the climate files to reflect the future climate?

The BASIX thermal performance standards are aligned with the Nationwide House Energy Rating Scheme (NatHERS) which uses the national NatHERS climate files, maintained by the NatHERS Administrator.

These climate files are developed from a complex process that divides the country into 69 climate zones. They are based on historic climate data, and have recently been updated to include data from 1990 to 2015, instead of the data previously used (1970 to 2005).

Updating the climate files, including the possibility of using modelled future climate predictions is a complex, national process managed by the NatHERS Administrator. As part of the stakeholder group, the department has discussed this issue with NatHERS Administrator, and continue to be involved in that discussion.

Is the installation of gas appliances in BASIX development going to be banned?

Under the higher standards, gas appliances continues to be available as a selection in the BASIX tool. However, as we are reducing the greenhouse gas emission factor from grid electricity (as we generate more from renewable sources), it will be easier for all-electric homes to meet the BASIX standards. This is expected to reduce the number of gas connections.

How can I use the BASIX sandbox tool to understand the new thermal performance standards?

The BASIX sandbox tool allows you to input the heating and cooling loads estimated from the NatHERS accredited software tools updated for NCC 2022. Beta versions of the updated NatHERS accredited software tools are available for research and testing purposes. They cannot be used to generate a NatHERS certificate for lodging a development application or complying development certificate with the BASIX certificate. You can visit the [NatHERS website](#) to find out more about the beta versions.

The Do-it-yourself (DIY) option to meet the new BASIX thermal performance standards for detached houses was made available in the sandbox tool in September 2023.

Why introduce a materials index for new residential developments?

The NSW Government's Net Zero Plan aims to reduce greenhouse gas emissions from buildings. To do this, we need to reduce the embodied emissions of the materials used in constructing new buildings and ensure that emissions stay low after buildings are constructed.

Embodied emissions are all greenhouse gas emissions such as carbon dioxide, methane, nitrous oxide, ozone, and fluorinated gases that are released as part of making a building material from extracting of the raw material to its fabrication.

According to Green Building Council of Australia 2021 report on Embodied Carbon & Embodied Energy in Australia's Buildings, emissions from building materials (such as bricks, concrete, and steel) will become a significant component of total emissions (85%) from the building sector.

The materials index in BASIX is an important first step to reducing the embodied emissions of new homes because it will not only allow the NSW Government to gather data on typical materials being used and their relative emission intensity but also send out a market signal in NSW.

In the changes to BASIX exhibited in December 2021, the department proposed to mandate a new material standard. Stakeholder feedback from that consultation process, as well as further testing of the proposed materials standard, revealed a complex relationship between the proposed standard and the existing thermal performance standard. As a result, a standard for embodied emissions from building materials will not apply initially, but users will still need to enter additional information in the BASIX tool to calculate embodied emissions of building materials.

This data will be invaluable in supporting our understanding of the relationship between the different BASIX indices further and will help us set an effective embodied emissions standard in the future.

How will the new materials index work?

BASIX users will be required to input data about the size of the dwelling and select what the floors, walls, ceiling, roof and glazing are to be constructed from. The BASIX material index calculator combines the input data with information on common construction assemblies, or a list of the materials that the dwelling will be made up of and the volume of each.

The BASIX calculator will then convert the volume of each construction material into embodied emissions based on the default data from the Environmental Performance in Construction (EPiC) database. The sum of embodied emissions from the floors, walls, ceiling and roof, glazing and doors will calculate the total embodied emissions for the house or unit building.

The total embodied emissions of the house or unit building will then be divided by the assumed number of occupants. This per capita value is compared with the average emissions, specific to different development types, to produce a score in terms of the percentage reduction from the average emissions. The assumed number of occupants is calculated using the correlation of occupancy data to floor area from the NatHERS whole-of-home calculation methods.

Why does BASIX use the EPiC database for calculating embodied emissions?

The Environmental Performance in Construction (EPiC) database is used to provide default embodied emissions data. It will be supplemented with more specific data for low emissions materials. Before deciding to draw data from the Environmental Performance in Construction (EPiC) database, BASIX considered all embodied emissions data types (process analysis, environmentally extended input-output analysis and hybrid analysis) based on how they met the following requirements:

- data availability and accessibility
- consistency, particularly regarding system boundaries (which processes in the lifecycle that are included and not included)
- completeness – whether it counts the full impact of the material
- transparency

Process analysis, which is used for Environmental Product Declarations (EPDs), is a bottom-up approach where the product system is broken down into a series of processes representing the life cycle of a product. It is precise in its distinction of different products but can ‘truncate’ some parts of the supply chain (such as the extraction of a particular raw material at the very start of the supply chain) and excludes supporting functions that are not directly part of the production process (such as services used by the business).

Environmentally extended input-output analysis (EEIOA) is a top-down approach that factors in the direct impacts of an entire economic sector and the indirect impacts of other sectors it draws goods and services from. It provides complete coverage of the supply chain and supporting processes, so that embodied emissions of different construction material options can be compared.

Hybrid analysis takes process analysis data and uses EEIOA data to fill the complete coverage of the supply chain and supporting processes so that different options can be compared. The EPiC data base is a hybrid database that contains data for the embodied emissions of over 280 construction materials used in a dwelling’s structure, shell and internal walls. The data represents the industry average for a category of building product rather than a particular brand.

The NSW Government continues to follow the evolution of life cycle analysis and inventory datasets in Australia and will consider improvements in embodied emission inventory datasets as part of future BASIX reviews.

Why do the EPiC embodied emission values differ from the process data?

EPiC embodied emission values are different from process data values because EPiC is a hybrid database, which includes not only embodied emissions from cradle to factory gate, but also services associated with the production processes such as insurance, finance, marketing and retailing.

On the other hand, process data does not include embodied emissions associated with minor raw material inputs to production, or processes high up in the supply chain in which the manufacturer has little knowledge or control. Emissions associated with transport and machinery during the manufacturing processes are often excluded or underestimated in process data. These emissions can account for 50% on average and up to 90% of the total emissions from cradle to factory gate.

Being a hybrid database, EpiC is able to address the above limitations of process data so that embodied emissions of different construction material can be compared with each other.

Would Environmental Product Declarations (EPDs) be considered in the materials index?

EPDs which uses process data analysis approach are popular in the building industry for lifecycle assessments. EPDs are based on the [European Standard EN 15804:2012+A1:2013](#). This standard provides the product category rules (PCR) for environmental declarations for construction products and services. The PCR defines the parameters to be declared, the life cycle stages to be considered and processes to be included, as well as rules for calculation and reporting.

The Department is exploring options to incorporate EPDs in the materials index and will provide updates on this issue as part of future BASIX reviews.

What building types will be included in the BASIX materials index and why?

The BASIX materials index will only be introduced for new dwellings at this initial stage because the scope of this BASIX review was limited to new dwellings. The department will consider options for applying the materials index for alterations and additions in future BASIX updates.

The BASIX material index focuses on the materials and products used in a dwelling's structure, shell and internal walls, based on details available in the development application or complying development certificate application. BASIX assesses the embodied emissions of construction materials from their production processes, including the extraction of raw materials, manufacture and transport – from cradle (A1) to factory gate (A3) (as per life cycle stages defined by the European Standard EN 15804).

What may be considered in the BASIX materials index in future?

The BASIX Materials index calculates the embodied emissions (Greenhouse gas emissions - kilograms of carbon dioxide equivalent) of materials at the product stage (from cradle to factory gate), including raw material supply, transport and manufacturing. Product stage is only part of the life cycle, but the most significant, particularly to BASIX which assesses at development application (DA) stage. This NSW Government initiative is a response to the global urgency to meet net zero emissions.

The initial version of the material index does not account for the full life cycle impact of building materials because these impacts are not as well understood yet. Life cycle analysis of buildings is continually evolving. Other factors such as the durability, maintenance and transport of building materials may be considered for future revisions.

The department recognises the positive effect that the reuse, recovery and recycling of building materials can have on a home's embodied emissions at the end of its life. This is being investigated by areas of government and industry to understand the 'end of life' issues in more detail and whether future updates to the BASIX material index should account for 'end of life'.

There is also potential to expand the materials index to cover broader sustainability impacts beyond reducing greenhouse gas emissions, that would support the principles of a circular economy. The NSW Government will explore through future reviews whether the expansion of the scope of

material index is feasible and beneficial. This includes examining how reuse of materials may be considered in a future standard.

What if my chosen construction material is not listed in the BASIX material index?

If your chosen or preferred construction material is not included in the BASIX material index, you can use the BASIX [alternative assessment process](#) to submit information to verify the emissions factor of your material. The department will review the alternative assessment documentation and, if approved, will substitute the emissions factor into the calculation.

A key objective for the department is to encourage and accelerate innovation in lower emission building products and processes. To support this, if we identify new construction materials that are being widely used, we will consider including them in the materials index in future BASIX updates.

What is the interaction between the material and thermal performance indices?

Some materials with high thermal mass may be associated with high embodied emissions. Architects or designers may select materials with high thermal mass to satisfy the thermal performance standard. These materials may also contribute to high embodied emissions.

For example, a waffle pod slab is often installed to achieve a high NatHERS star rating for thermal comfort reasons. However, this material type can also increase embodied carbon emissions substantially. High performance glazing, such as double glazing, can improve thermal performance by helping to reduce heating and cooling loads, but can also contribute to high embodied carbon emissions.

Architects or designers can either select high thermal mass materials with low embodied emissions or consider optimising thermal mass for thermal comfort in response to orientation and passive solar design principles.

How will the selected materials be checked?

The materials selected by the designer in the BASIX assessment will form part of the commitments in the BASIX certificate. The certifying authority will check the materials with other commitments on a BASIX certificate. This happens at the construction certificate and/or occupation certificate stage. The BASIX certificate will need to be revised to capture any changes in material selections between development approval and construction. Changes in material selections will impact on thermal performance. In other words, inputs to thermal performance modelling with NatHERS approved software, for example, need to be consistent with those in the BASIX materials section.

When will a materials target be set?

The Sustainable Buildings SEPP including the BASIX standards will be reviewed every 3 years, with the first review in 2025. These regular reviews provide an opportunity for BASIX to review the scope of the material index and set a materials target in the future.

By measuring and calculating embodied emissions from 1 October 2023, the new material index raises industry and household awareness of embodied emissions of different construction materials. It also signals to the market that low embodied emissions materials will be required in the future, so they can prepare for it.

The construction material industry is encouraged to increase its use of low emission products. Established supply chains of low emission construction materials will support wider uptake of low emission products.

How does the BASIX building material embodied emissions policy align with other developments in this field?

NABERS is preparing a national framework for the measurement of embodied emissions. The framework is expected to be launched in early 2024. Data collected by BASIX about building materials will provide the evidence base to inform the national framework. It will also help BASIX to align with the national framework in the future.

MECLA (Materials & Embodied Carbon Leaders' Alliance) is a collaboration of organisations working together to drive reductions in embodied carbon in the building and construction industry. BASIX participates in relevant MECLA working groups and has an ongoing collaborative relationship with MECLA.