KINESIS

PARRAMATTA CBD

HIGH PERFORMANCE BUILDING STUDY REVIEW

PREPARED BY KINESIS FOR CITY OF PARRAMATTA

FINAL REPORT – 6 DECEMBER 2023

Note: This report is provided subject to some important assumptions and qualifications:

The results presented in this report are modelled estimates using mathematical calculations. The data, information and scenarios presented in this report have not been separately confirmed or verified. Accordingly, the results should be considered to be estimates only and subject to such confirmation and verification.

Energy, water and greenhouse consumption estimates are based on local climate and utility data available to the consultant at the time of the report. These consumption demands are, where necessary, quantified in terms of primary energy and water consumptions using manufacturer's data and scientific principles.

Generic precinct-level cost estimates provided in this report are indicative only based on Kinesis's project experience and available data from published economic assessments. These have not been informed by specific building design or construction plans and should not be used for design and construct cost estimates.

The Kinesis software tool and results generated by it are not intended to be used as the sole or primary basis for making investment or financial decisions (including carbon credit trading decisions). Accordingly, the results set out in this report should not be relied on as the sole or primary source of information applicable to such decisions.

Prepared by Kinesis
P.O. Box Q164
Queen Victoria Building
NSW 1230
admin@kinesis.org

Document Version
Draft

Cover Image Credits
Google Maps, Photo Sphere (2011)

Document version	Date submitted	Approved by
1	15/6/2023	Harish Moro, Senior Consultant
2	23/6/2023	Harish Moro, Senior Consultant
3	3/8/2023	Harish Moro, Senior Consultant
4	7/11/2023	Harish Moro, Senior Consultant
5 (Final)	7/12/2023	Harish Moro, Senior Consultant

CONTENTS

CONTEXT FOR THIS ADDENDUM 4

REVISED PATHWAYS 4

APPENDIX 18

CONTEXT FOR THIS ADDENDUM

The City of Parramatta's LEP incentivises higher sustainability in new residential and mixed-use developments through a floorspace bonus scheme. The incentive structure requires a set of BASIX targets linked to the height of the proposed building and FSR.

The BASIX system is undergoing an overhaul through the introduction of Sustainable Buildings SEPP. This includes revised compliance targets as well as BASIX calculator updates that incorporate policy, technology and industry trends.

The City has engaged Kinesis to understand the impact of these updates to the BASIX system and recommend updated targets for the LEP controls to continue to incentivise high performance buildings in Parramatta CBD.

This is an addendum report that details the modelling and evidence base for updated BASIX targets. It should be read alongside the original report that provides further context.

REVISED PATHWAYS

Kinesis has modelled two sustainability pathways across various building heights and FSRs to understand 2 things:

- **Achievability - What BASIX scores are achievable across different building heights**
- **Feasibility - Which pathways are cost-effective across different FSRs**

The three pathways modelled are described in Table 1.

- Pathway 1 configured to simulate an all electric development that just complies with the new BASIX targets. Note there are many pathways to achieve compliance and this represents one such pathway.
- Pathway 2 incorporates building efficiency sustainability interventions that are readily available in the market. No solar PV is assumed to consider challenges including limited roof space given green roof requirements, overshadowing, etc.
- Pathway 3 incorporates the building efficiency interventions from pathway 2 + rooftop solar PV

It should be noted that a connection to a recycled water system or a rainwater reuse system is considered under all three pathways.

PATHWAY TECHNOLOGY ASSUMPTIONS

	Compliance pathway	Pathway 2	Pathway 3
Dwellings			
NatHERS	7-star average	8-star average	8-star average
Hot Water	Electric instantaneous hot water with internal piping insulated (R-value of 0.6)	Individual electric heat pump hot water systems with 41-45 STCs	Individual electric heat pump hot water systems with 41-45 STCs
Space Heating & Cooling	2.5-star average zone A/C (living & bedroom areas)	5-star average zone A/C (living & bedroom areas)	5-star average zone A/C (living & bedroom areas)
Lighting	LED lighting	LED lighting	LED lighting
Solar			Typically 0.02 kW per sqm site area (BASIX data of residential mixed use apartment buildings in Parramatta).
Appliances	Not mentioned	5-star energy & water dishwasher, 9-star clothes dryer, electric oven and induction cooktop, indoor (or under-cover) clothes drying line	5-star energy & water dishwasher, 9-star clothes dryer, electric oven and induction cooktop, indoor (or under-cover) clothes drying line
Water Fixtures	4-star WELS toilet, 5-star WELS taps, 4-star WELS showerhead	4-star WELS toilet, 5-star WELS taps, 4-star WELS showerhead	4-star WELS toilet, 5-star WELS taps, 4-star WELS showerhead
Ventilation	Individual fans in laundry, kitchen & bathroom with ducted to façade or roof and manual switch	Individual fans in laundry, kitchen & bathroom with ducted to façade or roof and manual switch	Individual fans in laundry, kitchen & bathroom with ducted to façade or roof and manual switch
Common area + Central Systems			
Underground carpark	LED lighting with time clock and motion sensors for carpark. Supply and exhaust ventilation with CO sensor and VSD fan installed	LED lighting with time clock and motion sensors for carpark. Supply and exhaust ventilation with CO sensor and VSD fan installed	LED lighting with time clock and motion sensors for carpark. Supply and exhaust ventilation with CO sensor and VSD fan installed
Lift	Gearless traction with VVVF motor	Gearless traction with VVVF motor & regenerative drive	Gearless traction with VVVF motor & regenerative drive
Parking	0.6 spaces/dwelling + EV charging	0.6 spaces/dwelling + EV charging	0.6 spaces/dwelling + EV charging
Water reuse (Recycled Water or Rainwater 50L per dwelling tank)		Connected for irrigation, toilet and laundry	Connected for irrigation, toilet and laundry
Parking	LED lighting with time clock and motion sensors for carpark. Supply and exhaust ventilation with CO sensor and VSD fan installed	LED lighting with time clock and motion sensors for carpark. Supply and exhaust ventilation with CO sensor and VSD fan installed	LED lighting with time clock and motion sensors for carpark. Supply and exhaust ventilation with CO sensor and VSD fan installed

Table 1: Pathway technology assumptions

BASIX COMPLIANCE TARGETS BY BUILDING HEIGHT

Table 2 below shows the translation between BASIX Energy targets under the old governance system and the updated BASIX Energy targets under the Sustainable Buildings SEPP that take effect from 1 October 2023. The old BASIX Energy targets did not differentiate by height above 6 storeys. The new ones do. BASIX Water targets remain unchanged.

	Old BASIX Energy Targets	New BASIX Energy Targets from Sustainable Buildings SEPP (from 1 October 2023)
Low rise (3 storeys)	45	67
Mid rise (4-5 storeys)	35	61
High rise (6 – 20 storeys)	25	60
High rise (20 storeys & higher)	25	63

Table 2: Old and New BASIX targets under the Sustainable Buildings SEPP

The two pathways were modelled across different building heights ranging from 5 storeys to over 40 storeys. The modelling was undertaken using the BASIX Sandbox calculator and validated through Kinesis' own precinct modelling software to manage for any bugs and issues with the BASIX sandbox calculator. Through the modelling, Kinesis identified four height bands between which the BASIX scores achievable from the pathways varied significantly. They can be summarised as:

- **5-15 storey**
  Can achieve high BASIX overcompliance
- **16-30 storey**
  A step change in common area and centralised energy loads. E.g., increased lifts, common area lighting, etc.
- **31-40 storeys**
  Limited roof space reduces the impact of on-site renewables on higher BASIX scores. Increased non-residential floorspace and associated centralised energy demand further decreases BASIX scores achievable through efficiency measures.
- **Beyond 40 storeys**
  Difficult to achieve BASIX overcompliance without best practice efficiency measures and appropriate lift efficiency settings including regenerative lifts and optimised/ efficient servicing of floors.

*Note**:** As buildings get taller common area energy loads increase from more lifts, lighting, ventilation, etc. Typically buildings over 40 storeys have 4-5 lifts. These lifts need to be regenerative and configured to efficiently service the various floors of the building to achieve BASIX overcompliance. Solar PV also has a smaller impact as buildings get taller. This is because the energy generated from the solar PV remains constant but the energy demands increase as height increases. The specific BASIX scores achievable under the three pathways for each of the 4 building height bands are outlined in Table 3. Pathway 1 simulates compliance. Pathway 2 and 3 can exceed BASIX compliance by the number of points indicated by "+X".

Note: BASIX Energy compliance scores are 63 for high rises over 21 storeys and 60 for high rises between 6-20 storeys. The overcompliance scores in the table below incorporates this higher compliance score. That is, for example if pathway 2 is implemented for a building 16-30 storeys tall, it would BASIX Energy 70 for buildings between 16-20 storeys and BASIX Energy 73 for buildings between 21-30 storeys.

BASIX PERFORMANCE UNDER THE THREE PATHWAYS BY BUILDING HEIGHT BAND

	Pathway 1	Pathway 2	Pathway 3
5-15 storeys	Compliance	BASIX Energy +12 BASIX Water +15	BASIX Energy +25 BASIX Water +15
16-30 storeys	Compliance	BASIX Energy +10 BASIX Water +15	BASIX Energy +20 BASIX Water +15
31-40 storeys	Compliance	BASIX Energy +10 BASIX Water +15	BASIX Energy +15 BASIX Water +15
Greater than 40 storeys*	Compliance	BASIX Energy +10 BASIX Water +15	BASIX Energy +15 BASIX Water +15

Table 3: BASIX performance under the three pathways by building height band

Note on achieving 8 star NatHERS

- The maximum energy load thermal for 7 star NatHERS is 30 MJ per sqm per annum
- The maximum energy load thermal for 8 star NatHERS is 22 MJ per sqm per annum

8 star NatHERS can be achieved through well considered materials, façade design, dwelling layout/ orientation and sizing, shading elements, glass performance, and acoustic treatment. Two example apartment buildings that have achieved 8 star NatHERS are provided below.
Omega Apartments with 8 star natHERS ESD rating - Cottee Parker
Australia's greenest apartments set to take shape in Clar... (urban.com.au)

Note on recycled water

- Recycled Water is the recommended mechanism under Pathway 2 and 3 to achieve higher BASIX Water scores.
- At the scale of development expected for the CBD, the implementation of a precinct wide recycled water system would be most effective.
- The performance standards above incorporate a recommendation that dual reticulation is incorporated into residential buildings for both internal and external uses to enable recycled water in the future (see *Performance Standards for Future Proofing in original report*).

TESTING THE FEASIBILITY OF THE PATHWAYS BY FSR

A floor space bonus is proposed for new residential development that meets higher BASIX targets. In order to determine whether the costs associated with improved development outcomes are of a magnitude that ensures the floorspace bonus is taken up, the value of the floor space bonus must be determined. This can be done from two lenses.

1. A land value uplift lens which considers how Council can leverage the financial benefit from increased land value to incentivise higher sustainability performance. This is limited in its consideration of incentives and costs associated with the floorspace bonus scheme.
2. A more holistic approach which considers the additional revenue and costs associated with delivering additional dwellings from the floorspace incentive scheme.

LENS 1 - LAND LIFT VALUE = THE VALUE OF INCREASED LAND AREA

In Lens 1, the value the floorspace bonus has been calculated based on a land lift calculation. Land lift calculates the additional value added to the land which is attributable to the increased floor space. The increased floor space can be compared to creating new land and the value of this land can be calculated based on current land values. The lift in value is determined by multiplying the additional floor space by the "buildable rate". The buildable rate is the current land value divided by the floor area allowed by the current FSR.

Land Lift = ((Land Area x Land Value) / Base Floor Area) x New Additional Floor Area
This simplifies to:
Land Lift = Land value x Land area x 0.05

Example:

- Land Area = 5,000 m2
- Base floor area under current FSR = 30,000 m2
- Current land value = $12,000 per m2 of land
- Additional floor space under FSR Bonus = 1,500 m2
- Land lift = $3,000,000

Under this approach the additional financial benefit attributed to increased land value is attributed to Council and can be used to deliver improved performance outcomes while the additional financial benefit derived from the additional development (e.g. sale of apartments) flows through to the developer. Typically, cities around the world capture between 50% and 100% of this land lift for use in the delivery of improved development, environmental or social outcomes. An example of a floorspace incentive introduced by the NSW state government can be seen here: Social and affordable housing reform – Frequently asked questions (nsw.gov.au)). This example shows that the structure of Parramatta's floorspace incentive scheme is similar to NSW Government's scheme.

To maximise the utilisation of the floor space bonus scheme, it is important to ensure the benefits of the floor space bonus are of a magnitude that provides adequate incentive for developers to meet this enhanced standard. This was determined by comparing the land lift value to the expected marginal capital cost incurred under Pathways 2 and 3 that would deliver BASIX overcompliance. For the purposes of this analysis, feasibility is defined as instances where the land lift value exceeds the cost of implementing these higher BASIX pathways. FSRs up to 16:1 have been included in the modelling in the case of clause 4.6 variations and as an evidence base for planning proposals.

COST BENEFIT ANALYSIS - LAND LIFT VALUE VS COST OF HIGHER BASIX

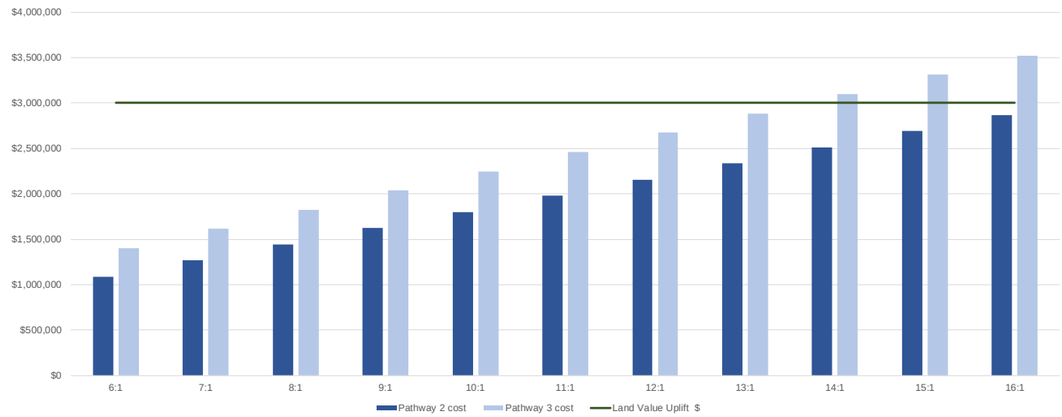

Figure 1: Land Lift Value compared to marginal cost of implementing the two sustainability pathways Land Lift Value is higher that the marginal cost of higher building performance under both pathways.

For a given site area, as the FSR increases:

- The 5% floorspace bonus results in the same land lift value (assuming land value is the same across all lots)
- The cost of implementing the pathways increases with number of dwellings or residential floorspace

Kinesis has considered a standard lot area and estimated the costs and the benefit under each of the pathways for all viable FSRs ranging from 6:1 to 16:1. Noting that the Council team has informed Kinesis that there is a FSR incentive cap of 16:1 in the Parramatta CBD. The cost of implementing the pathways is however sensitive to:

- Delivery costs for various sustainability interventions*
- Number of dwellings

Lens 2 aims to consider these incentives and costs more holistically from the perspective of the market as shown in the next page.

LENS 2 – ADDITIONAL REVENUE = THE VALUE OF ADDITIONAL FLOORSPACE & DWELLINGS AND THE COSTS ASSOCIATED WITH ITS DELIVERY

Number of dwellings

This approach considers the potential financial benefit from additional development (through the sale of additional apartments) that can be realised by the market through the floorspace bonus scheme. The analysis shown here is indicative of the incentive available. Developers will need to do a feasibility analysis on a case-by-case basis.

The revenue, costs and margins that developers can realise through the floorspace bonus scheme under pathways 2 and 3 are shown in the charts to the right.

- The cost of delivering higher BASIX to become eligible for the floorspace bonus is indicated in blue bars.
- The revenue from selling additional apartments built using the floorspace bonus is shown by the purple line.
- The various cost associated with delivering the additional dwellings is shown in shades of orange. They include construction costs, finance costs and infrastructure costs associated with delivering the dwellings.
- The margin that developers can realise from the additional dwellings delivered through the floorspace bonus scheme is shown in green.

As such, developers can make a margin under pathways 2 and 3. Through this lens, pathway 3 is feasible for all FSRs from 6:1 to 16:1.

Other costs of building out such as land costs, professional fees, marketing and sales are regarded as fixed costs that would have been incurred irrespective of the additional dwellings that can be delivered through the Floorspace bonus scheme. As such, they are not included in this comparison.

COST BENEFIT ANALYSIS OF PATHWAY 2 – REVENUE VS COSTS

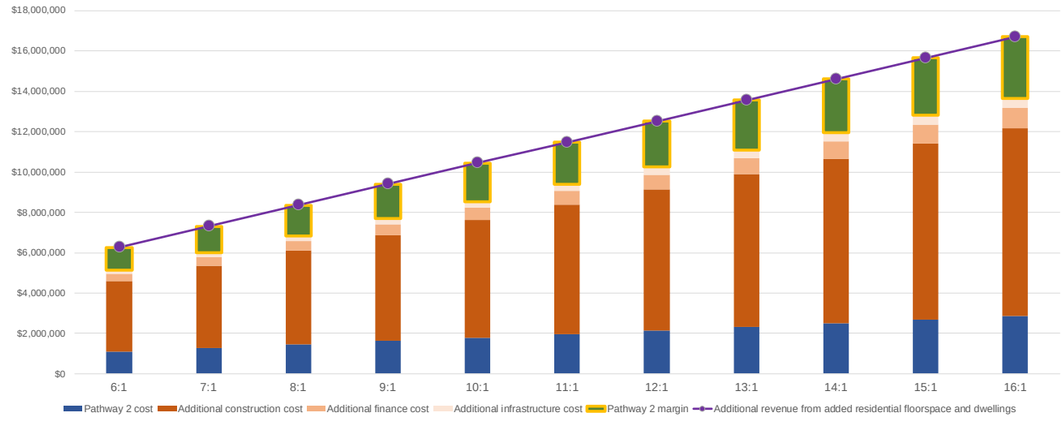

Figure 2: Revenue and costs of floorspace bonus under pathway 2

COST BENEFIT ANALYSIS OF PATHWAY 3 – REVENUE VS COSTS

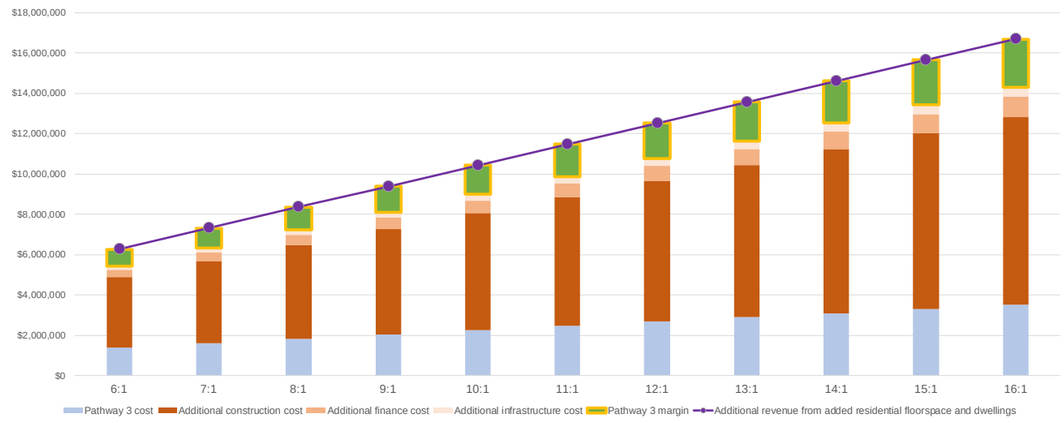

Figure 3: Revenue and costs of floorspace bonus under pathway 3

Feasibility modelling notes:
Given that the cost of the pathways vary based on delivery costs and number of dwellings, the feasibility of the pathways would need to be tested on a case by case basis by developers. This analysis simply provides a rule of thumb as to which pathways are feasible across different FSRs. As a minimum, Pathway 2 is feasible under all FSRs and the targets have been set accordingly. Key assumptions used in this analysis are outlined below.

1. Land area and land value

- Standard lot area of 5,000 sqm across each FSR from 6:1 to 16:1
- Land value of $12,000 per sqm of land (land value estimate based on data from realcommercial.com.au, Valuer General NSW and domain.com.au). Land value will likely vary based on FSR zoning but there is insufficient data to determine this appropriately. As such, consistent land value of $12,000 per sqm has been applied across the board.

2. Marginal capital cost of delivering Pathways 2 and 3 relative to compliance Pathway 1

	Pathway 1 – compliance	Pathway 2	Pathway 3
Marginal Capital Cost	$0 / dwelling	$5,000/ dwelling + $20k extra for regenerative lifts	$7,000/ dwelling + $20k extra for regenerative lifts + 100k for 100 kW (0.02 kW per sqm site x 5000 sqm)

Table 4: Marginal capital cost for pathways 2 and 3

Kinesis has undertaken market research and provided an estimate of the marginal capital cost of delivering Pathways 2 and 3 relative to Pathway 1 (simulating compliance). These costs however can vary significantly as for example, with appliance costs. We have obtained appliance costs from a range of retailers. Appliances with the same rated performance come in a range of prices depending on the brand and the retailer. Sometimes, the prices can deviate from the median price by over 20%. For example, a 9 star heap pump dryer can be priced anywhere between $1,500 to $2,500. Kinesis has collated the range of capital costs under all three pathways in Table 4. Our analysis has assumed the lower end of capital costs. This is reasonable as developers can negotiate large purchase agreements and realise cost efficiencies while implementing the pathways.

3. Number of dwellings

The cost of implementing the pathways scale with the number of dwellings whereas the land lift value from the FSR benefit does not. In this analysis, the typical number of dwellings has been estimated for each FSR. Through analysis of the BASIX certificates, we have estimated the average proportion of residential floorspace to total GFA in a building as 50% and average apartment sizes as 72-73 sqm. Therefore, for a 5,000 sqm site, Table 5 provides the yield metrics that are relevant to the calculations

FSR	6	7	8	9	10	11	12	13	14	15	16
Baseline GFA (sqm)	30k	35k	40k	45k	50k	55k	60k	65k	70k	75k	80k
Bonus GFA	1.5k	1.75k	2k	2.25k	2.5k	2.75k	3k	3.25k	3.5k	3.75k	4k
Total dwellings	205	240	274	308	342	376	411	445	479	513	548
Additional dwellings	10	12	14	15	17	19	21	22	24	26	27

Table 5: Estimate of number of dwellings by FSR

4. Additional revenue and cost assumptions

The median price of an apartment dwellings in Parramatta CBD is $610,000 as at October 2023. Source: https://www.realestate.com.au/nsw/parramatta-2150/

The RBA has provided indicative cost of building out in Sydney. The three cost items relevant for this analysis is shown below.
The Cost of Building Out | RDP 2020-04: The Apartment Shortage | RBA

Cost of Building out (Sydney average)	$ per apartment dwelling
Construction cost	340,000
Finance	36,000
Infrastructure charges	18,000

RECOMMENDED TARGETS BY FSR & HEIGHT BANDS

City of Parramatta have noted that the floor space bonus is available to residential and mixed-use developments in the CBD for various height brackets.

The findings in this report have outlined that:

1. Achievability of higher BASIX depends on building height and
2. Both sustainability pathways are feasible for the range of FSRs

Based on the modelled BASIX performance by building height band (Table 3) and the cost benefit analysis in Figure 3.

- Table 6 highlights the BASIX performance standards that are achievable for new residential and mixed-use development across the Parramatta CBD over and above the BASIX compliance standards proposed in the Sustainable Buildings SEPP to take effect from October 2023.

- Developers can achieve these targets by pursuing Pathway 3 for FSR ranging from 6:1 to 16:1

Building height	BASIX overcompliance requirements
5-15 storeys	BASIX Energy +25, BASIX Water +15
16-30 storeys	BASIX Energy +20, BASIX Water +15
31-40 storeys	BASIX Energy +15, BASIX Water +15
41+storeys	BASIX Energy +15, BASIX Water +15

Table 6: BASIX performance targets by building height band for full range of FSRs

The prescribed targets by discrete building height bands have been developed by observing consistent sustainability performance across building heights within each of the height bands – 5-15 storeys, 16-30 storeys, 31-40 storeys and 40+ storeys.

Two examples,

1. A developer intending to build a 20-storey residential development with a 14:1 FSR in Parramatta CBD would need to achieve BASIX Energy +20 and BASIX Water +15 over proposed BASIX compliance requirements through the Sustainable Buildings SEPP of BASIX Energy 60 and BASIX Water 40.

2. A developer intending to build a 55-storey residential development with a 11:1 FSR in Parramatta CBD would need to achieve BASIX Energy +15 and BASIX Water +15 over current BASIX compliance requirements of BASIX Energy 63 and BASIX Water 40.

IMPACTS TO DEVELOPERS FROM PROPOSED CHANGES TO FSR BONUS SCHEME TARGETS

The Sustainable Buildings SEPP has made significant changes to the BASIX system. In summary:

- Homes built to the current BASIX standard range between 5.5 and 6 star NatHERS on average. The new thermal performance standards will increase to 7 stars. This is the same thermal performance as that proposed for the National Construction Code in 2022.
- BASIX energy standards have increased as described in Table 2.
- The greenhouse gas emission factor is the amount of emissions (expressed as kilograms of carbon dioxide equivalent (kg CO2-e)) generated and transmitted from each unit of grid electricity to households. BASIX currently uses an emission factor of 1.062 kg CO2-e for each kilowatt-hour (kWh) of electricity. Under the new system, a 10-year average from 2022 to 2031 (or 0.67 kg CO2-e/kWh) will be adopted for calculating BASIX energy scores from 2022.
- Current industry practice such as LED lighting and appliance efficiency is assumed as default in the BASIX calculator.

These changes do make it slightly harder to achieve higher BASIX targets but as outlined in the modelling, there are feasible, practical pathways to achieve this.

Consider the following two development examples of differing site area and typology:

Address	14-20 Parkes Street	180 George Street
Site Area (sqm)	2,829.7	7979
Base FSR (ratio)	10	10
Design Excellence Bonus FSR (ratio)	1.4 (+15%)	1.5 (+15%)
Total FSR (ratio)	11.4	11.5
Total GFA (sqm)	32280	91753
Total Apartments (dwellings)	331	767
Bonus GFA (sqm)	1415	3989
Additional dwellings (dwellings)	14	33

Cost-benefit through lens 1

Address	14-20 Parkes Street	180 George Street
Land value uplift	$1.4m	$4.1m
Cost of higher BASIX pathway 3	-$1.7m	-$4m
Total construction cost	$69m	$228m
Cost of higher BASIX as % of total construction cost	3%	2%

Sources for development value:
14-20 Parkes Street; 180 George Street

Cost-benefit through lens 2

Address	14-20 Parkes Street	180 George Street
Additional revenue from additional dwellings	$8.8m	$20.3m
Cost of higher BASIX pathway 3	-$1.7m	-$4.0m
Construction cost of additional dwellings	-$4.9m	-$11.3m
Finance cost of additional dwellings	-$0.5m	-$1.2m
Infrastructure charges of additional dwellings	-$0.25m	-$0.6m
Developer margin	+$3.1m	+$7.2m

FUTURE PROOFING FOR FURTHER UPDATES TO BASIX POLICY

After its introduction in 2004, there were only two changes to BASIX targets. Once in 2017 and in October 2023 through the Sustainable Buildings SEPP.

Despite these changes, the benchmark or baseline remains 3,292 kilograms of carbon dioxide per person per year, which was the average for pre-BASIX homes. The two changes in 2017 and 2023 have been to the minimum compliance targets and the levers in the BASIX calculator.

Based on this history, we could assume that the BASIX benchmark may remain the same but the compliance requirements (required performance relative to this benchmark) can change.

Substantial additional work is required to provide pathways that avoid frequent future reviews with minor changes to the BASIX. Such work can be undertaken only when there are significant changes in BASIX requirements, such as a certain percentage increase in compliance scores, rather than every minor change.

Notwithstanding, we have provided two recommendations to manage for updates to the BASIX policy.

1. Council may consider replacing the current BASIX +X targets with the equivalent percentage improvement over BASIX compliance targets. See the last column.

Building height	New BASIX compliance targets from Sustainable Buildings SEPP (from 1 October 2023)	BASIX overcompliance requirements (incremental BASIX points)	BASIX overcompliance requirements (actual targets)	BASIX overcompliance requirements (% increase over compliance targets)
5-15 storeys	BASIX Energy 60, BASIX Water 40	BASIX Energy +25, BASIX Water +15	BASIX Energy 85, BASIX Water 55	BASIX Energy – 42% BASIX Water – 38%
16-20 storeys	BASIX Energy 60, BASIX Water 40	BASIX Energy +20, BASIX Water +15	BASIX Energy 80, BASIX Water 55	BASIX Energy – 33% BASIX Water – 38%
20-30 storeys	BASIX Energy 63, BASIX Water 40	BASIX Energy +20, BASIX Water +15	BASIX Energy 83, BASIX Water 55	BASIX Energy – 32% BASIX Water – 38%
31-40 storeys	BASIX Energy 63, BASIX Water 40	BASIX Energy +15, BASIX Water +15	BASIX Energy 78, BASIX Water 55	BASIX Energy – 24% BASIX Water – 38%
41+storeys	BASIX Energy 63, BASIX Water 40	BASIX Energy +15, BASIX Water +15	BASIX Energy 78, BASIX Water 55	BASIX Energy – 24% BASIX Water – 38%

2. Over the long term, it is expected that the industry moves towards net zero buildings or BASIX 100. As this approaches, it is unclear how the BASIX policy will maintain its relevance in this setting. BASIX Energy compliance targets are already above 60 points and the overcompliance requirements under the floorspace bonus scheme puts it at 78-85 points. In the next upgrade of BASIX, council can consider proactive adjusting the floorspace bonus scheme incentive to completely move away from BASIX target and simply require delivery of net zero buildings.

KEY DATA SOURCES

- BASIX Standards Calculator (Increase to BASIX Standards | Planning Portal - Department of Planning and Environment (nsw.gov.au)
- Land value data from Valuer General NSW, realcommercial.com.au, domain.com.au.
- BASIX sandbox tool
- Historical BASIX data, BASIX_Dwelling_Certificates_2011-2020 | Dataset | NSW Planning Portal
- Cost assumptions from
  - online appliance retailers including Appliances Online, Harvey Norman, Bing Lee, The Good Guys,
  - Kingspan water tanks
  - Solar choice - solar PV
- ACADS-BSG Australian Climatic Data (Reference Meteorological Year, RMY) for hourly temperature, insulation and humidity.
- Bureau of Meteorology local rainfall and evaporation data
  - Data is from the representative weather station for the local climate zone
  - The RMY (Representative Meteorological Year) is synthesized from a composite of 12 typical meteorological months that best represent the historic average of the specified location using post-1986 data in addition to the earlier weather data for each of the 69 climate zones in Australia.
- Sydney Water (2009) Rouse Hill 15 minute and daily demand profiles (Kinesis request, unpublished)
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
- Kinesis 2014, Additional water end use breakdowns derived from first principle analysis of residential and non-residential building types.
- National Water Commission, 2011, National performance report 2009-2010: urban water utilities, National Water Commission, Canberra
- NSW Department of Planning, BASIX Residential Water Consumption Data (2010)
- Sydney Water Best Practice Guidelines for water conservation in commercial office buildings and shopping centres (2007), http://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdu0/~edisp/dd_054580.pdf
- Sydney Water Best Practice Guidelines for holistic open space turf management (2011), www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq1/~edisp/dd_045253.pdf
- Water Corporation. (2014). Mapping water use at school. from https://www.watercorporation.com.au/home/teachers/lesson-plans-and-teaching-resources/lesson-plan-search/lesson-plan/?id=%7BD9516524-4A2C-4B98-A113-3891D59F1AAA%7D
- Department of Resources, Energy and Tourism, 2010, Energy in Australia – 2010, ABARE, Canberra
- Department of Infrastructure and Transport, 2011, Road vehicle kilometres travelled: estimations from state and territory fuel sales, Australian Government, Canberra
- Department of the Environment, 2014, National Greenhouse Accounts Factors, http://www.environment.gov.au/system/files/resources/b24f8db4-e55a-4deb-a0b3-32cf763a5dab/files/national-greenhouse-accounts-factors-2014.pdf
- Energy Use in the Australian Residential Sector, 1986 – 2020, Australian Government Department of the Environment, Water, Heritage and the Arts (DEHWA), 2008.
- Energy Efficient Strategies (2009), Appliance Energy Consumption in Australia: Equations for Appliance Star Ratings
- Building Code of Australia (2007) Energy Efficiency Requirements in Commercial Buildings
- Transport Data Centre (2006) The Development of a Sydney VKT Regression Model
- ABS (2010) 'Household Expenditure Survey, Australia: Summary of Results', catalogue number 65300DO001_200910, Australian Bureau of Statistics, Canberra.