

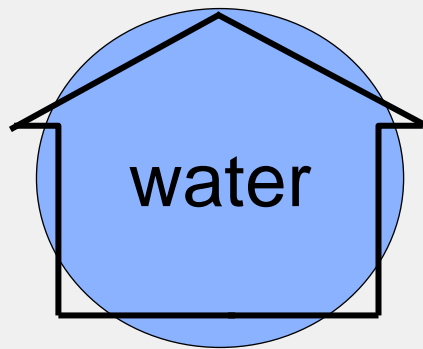
Modelling GHG savings achieved by cogen within the **BASIX** engine.

Dr. Kevin Yee
NSW Department of Planning

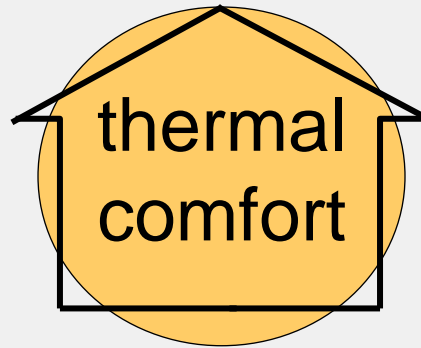
Sustainable Housing in NSW

Building Sustainability Index - BASIX

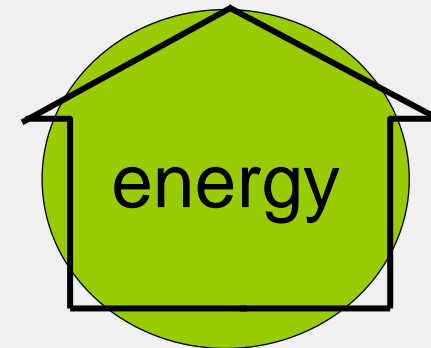
A scheme including online assessment tool to implement **minimum sustainability targets** for all new homes and renovations¹.



Up to **40%**



pass



Up to **40%**

¹ over \$50,000

Why BASIX?

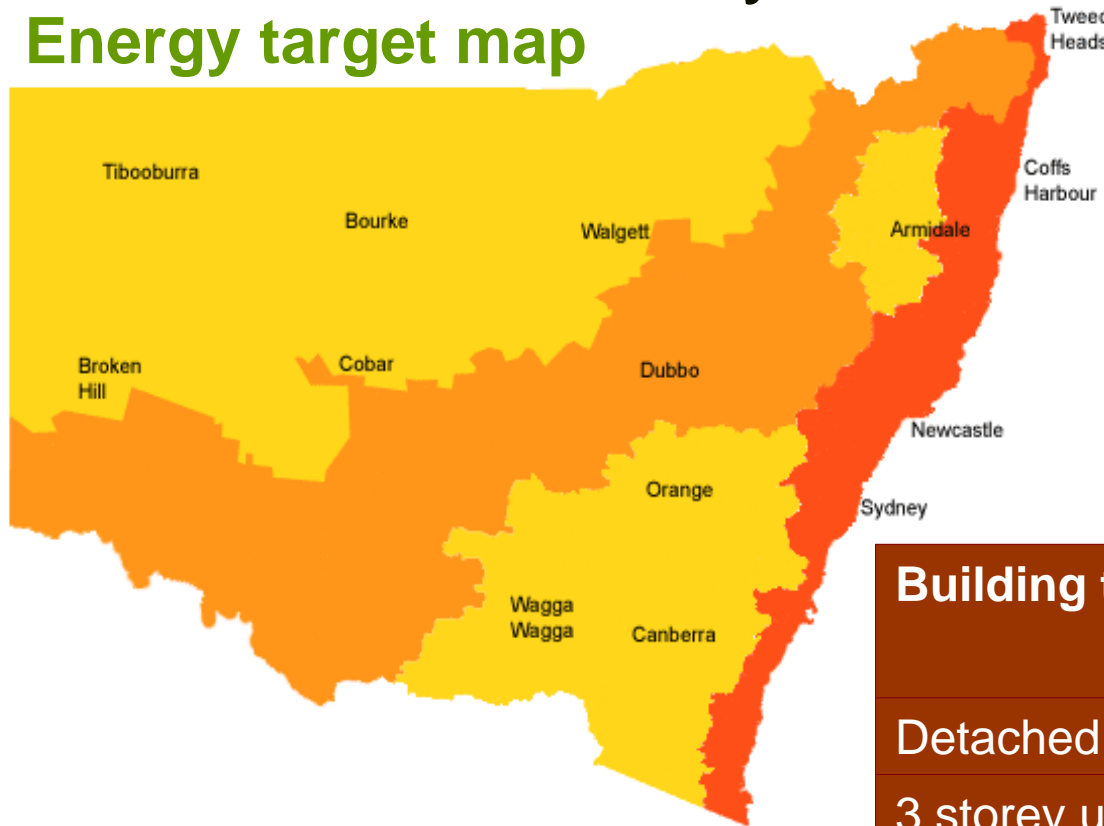
Measurable outcomes

- Based on real energy and water consumption patterns (benchmarks)
 - For energy:
3,292 kg CO₂ emissions per person per year
- Score = % GHG savings from the benchmark
- Energy score vs. Kyoto Protocol

Energy Saving Targets

40% for single dwellings in coastal areas,
5% for multi storey units in Western NSW

Energy target map



ENERGY TARGETS

- Zone 1
- Zone 2
- Zone 3

Building type	Zone		
	1	2	3
Detached + semi-detached	40	35	25
3 storey units	35	30	20
4 and 5 storey units	30	25	15
6 storey units and higher	20	15	5

Residential Sector

NSW Greenhouse Gas Emissions 2002

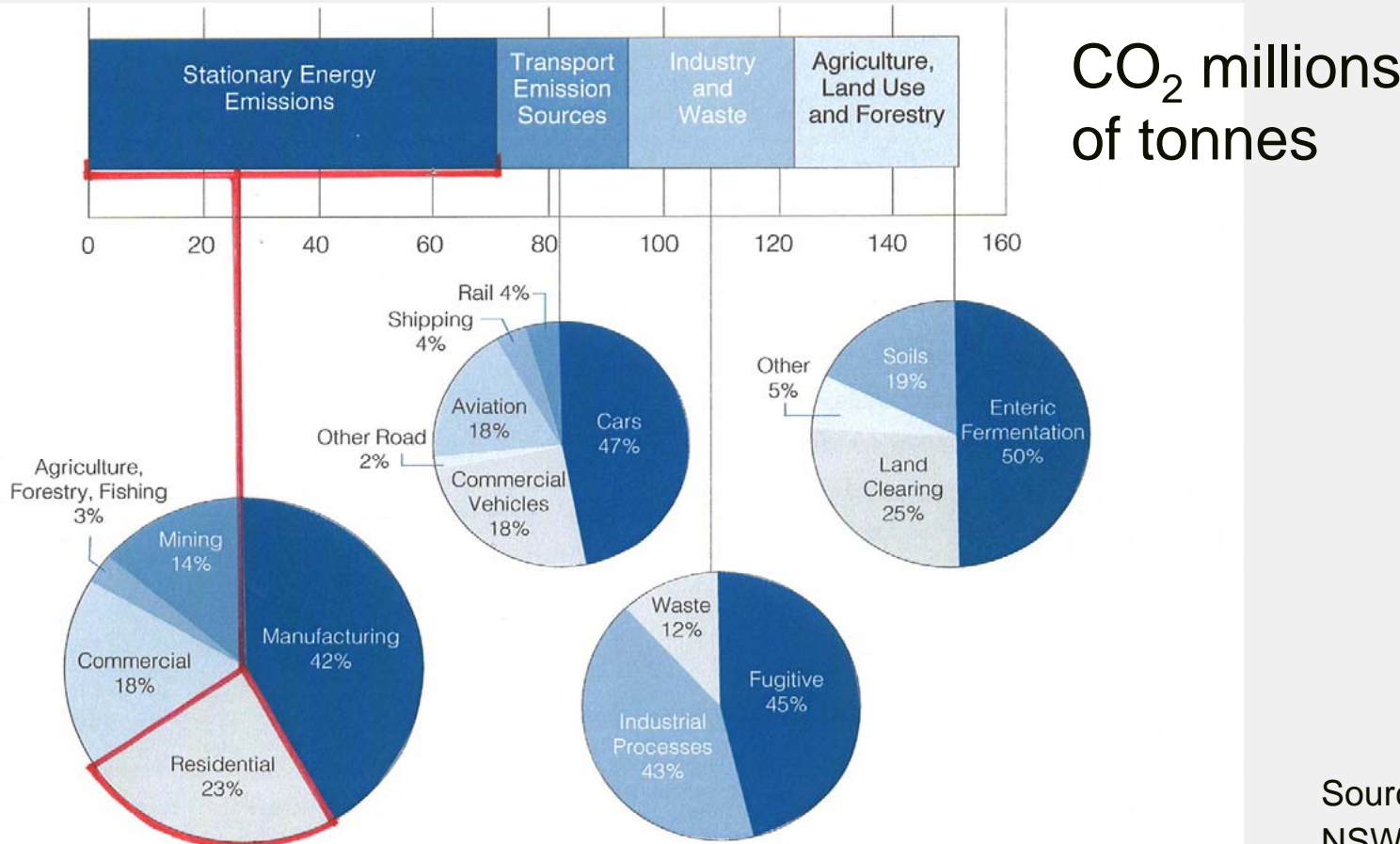


Figure 4: NSW Greenhouse gas emissions sources by sector⁶
 Note: Breakdown of stationary energy emissions is based on 1999 national figures, as a breakdown for NSW is not available

Source:
 NSW Greenhouse
 Office 2005



NSW – Residential Energy Use

GHG emissions of the average NSW house [BASIX Benchmark]

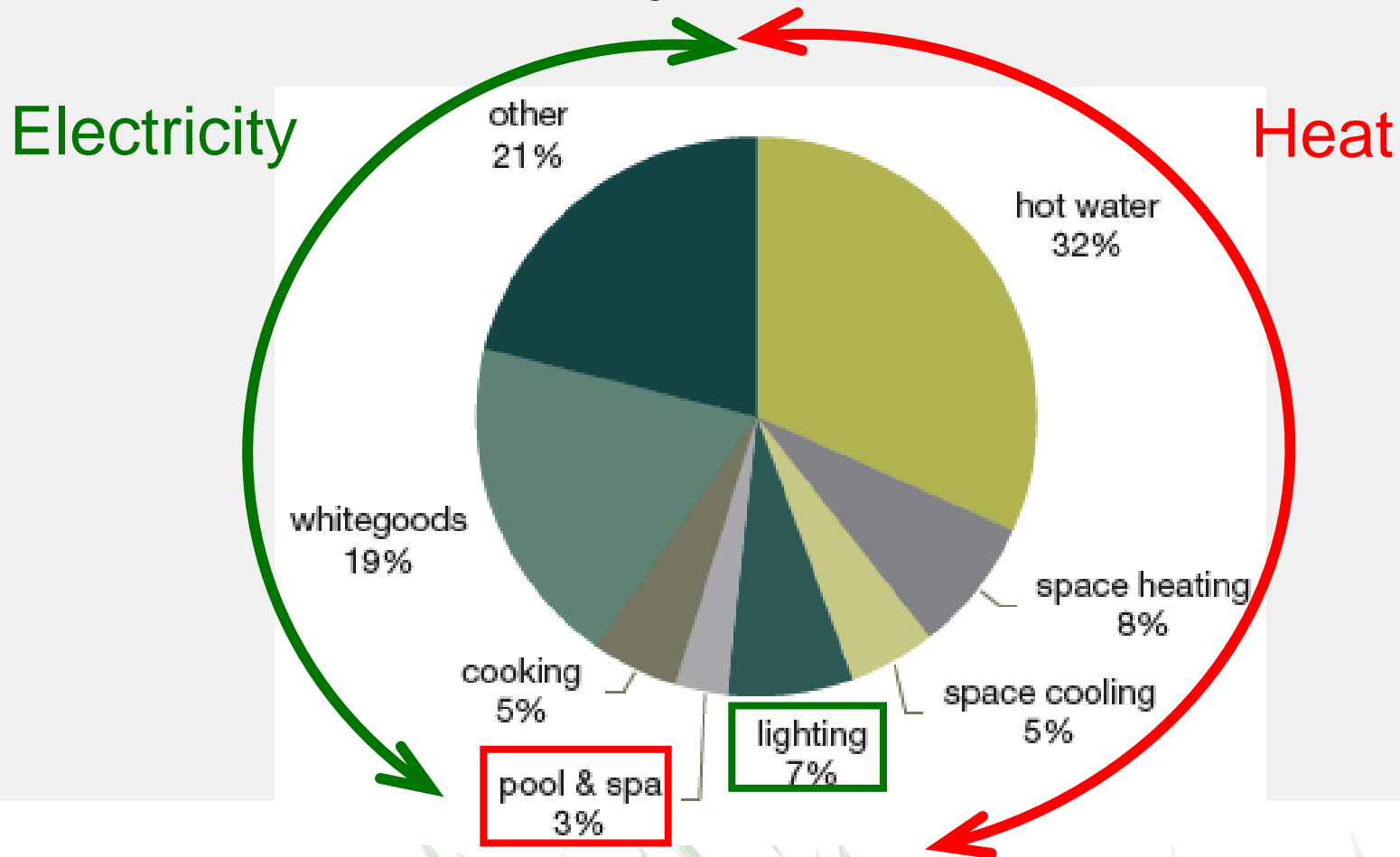


Chart compiled by BASIX from ABS data and Commonwealth of Australia 2008: *Energy Use in the Australian Residential Sector 1986-2020*, Department of the Environment, Water, Heritage and the Arts, Canberra.

Aim

- The role of cogen to increase GHG savings in multi-unit high-rises:
 - Modelling (BASIX)
 - Case study
 - Implications on energy saving targets

Using cogen in BASIX

BASIX is 'cogen ready'.

The multi-unit tool allows cogen/trigen as a central system for hot water, space heating, space cooling and as an alternative energy source for electricity.

Central hot water system	Details
Central hot water system (No. 1)	System type * <input type="text" value="cogeneration svstem"/>
	Solar collector area (solar only) * <input type="text"/> m ²
	Piping insulation (ring main and supply riser) * :

Application areas of cogen in BASIX

Thermal load of dwelling

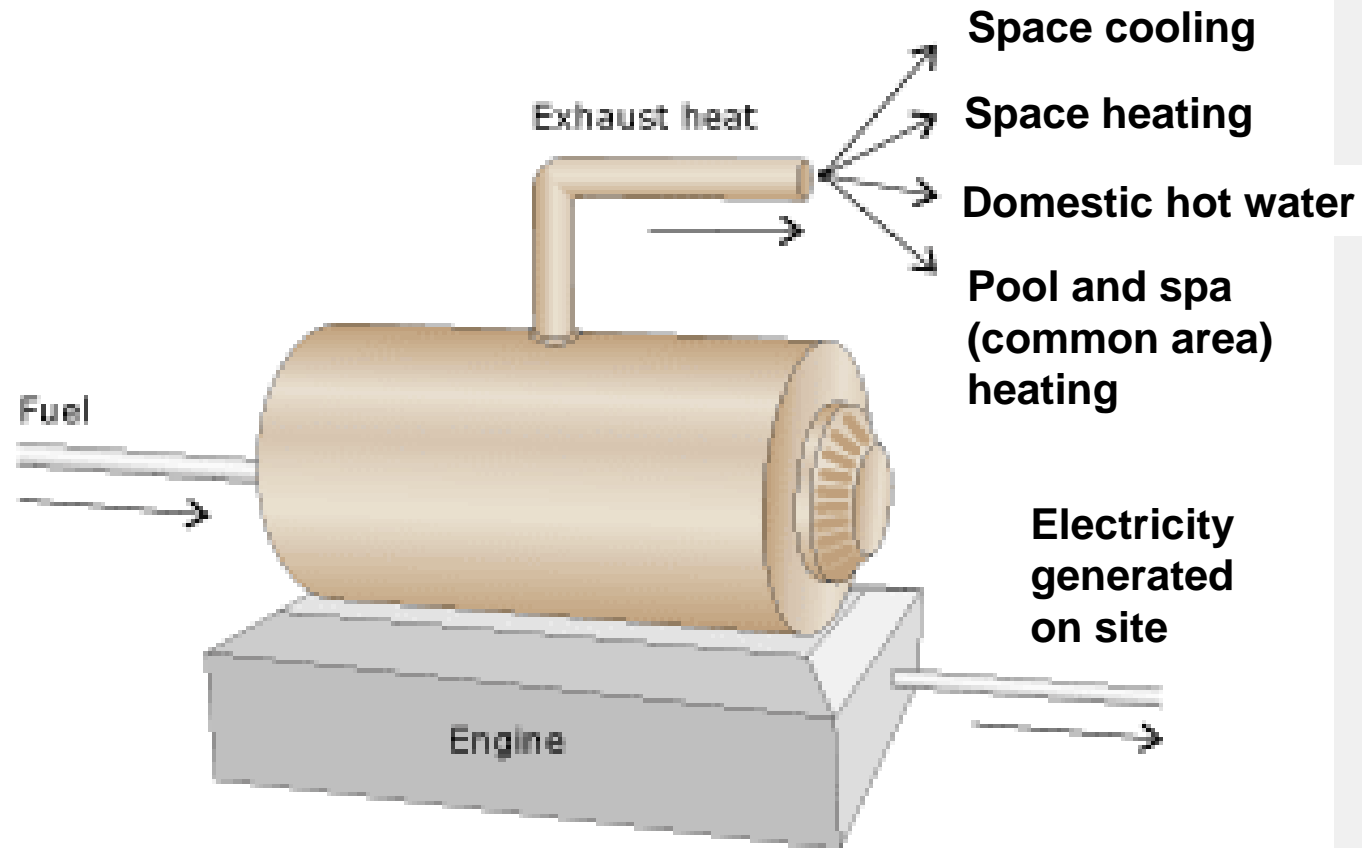


Diagram Not To Scale

Model inputs

Fuel type:

- Diesel
- Biodiesel
- Gas

Output (kW)

Efficiency (%)

Energy ▸ Central systems

Hot water * Cooling * Heating * **Alternative Energy Supply *** Lifts * Pool and Spa * Sauna * Other

Enter the following details **if you intend to install** a central alternative energy system(s).

Alternative energy supply	Details
Cogeneration system ?	Fuel type ? <input type="text" value="biodiesel"/>
	Electrical output * ? <input type="text"/> kW
	Efficiency of fuel to electricity conversion * ? <input type="text"/> %

How BASIX models energy use by cogen?

- Energy use:
 - Minimum of the proposed capacity and thermal load
 - Proportion of thermal load being satisfied
 - Efficiency of heat harvest
- Remainder of thermal requirements?
- Electricity generated

How BASIX models CO₂e savings?

- Annual energy use
 - Annual fuel usage
 - Annual CO₂ emission (GHG intensity)
- Annual CO₂ emission
 - % CO₂ emission savings from the NSW benchmark (3,292 kg-CO₂/(person.year))
- BASIX scores (c.f. the Kyoto protocol)

Features of the model

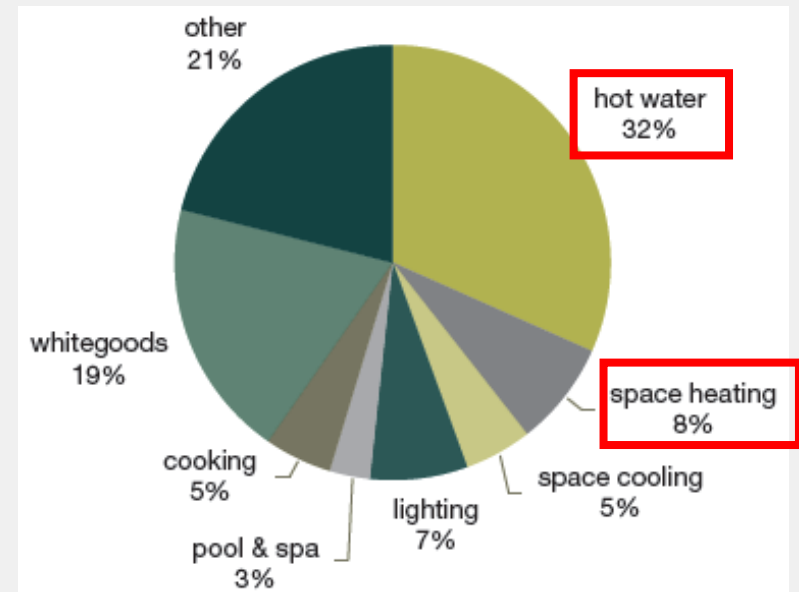
Net CO₂e

- Minus CO₂ from the generated electricity
- Average GHG intensity for electricity in NSW
- Why?
 - Internal use
(business + light industry)
 - Export to the grid (in theory)
 - Stimulating implementation

Features of the model

Thermal priority mode

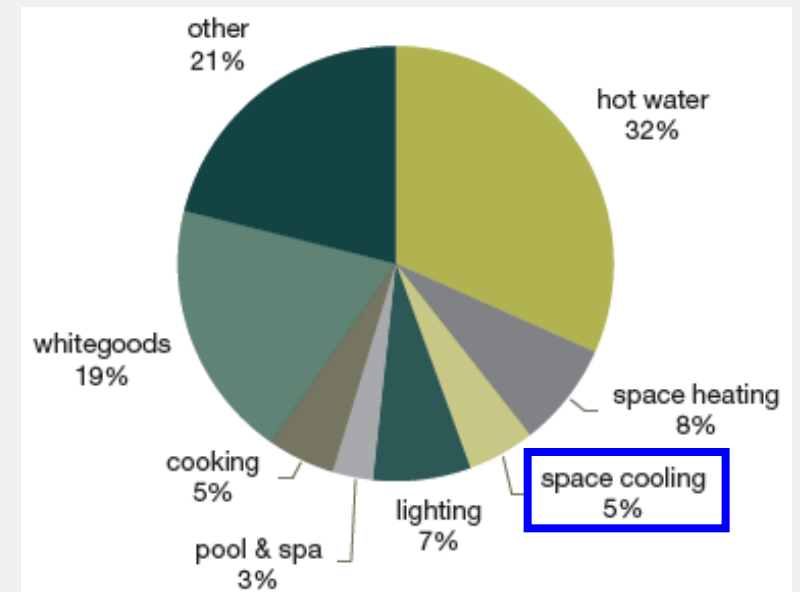
- Trying to meet thermal demand
- Alternatives...
- Why?
 - Reducing operating costs:
fuel price outweigh value of electricity
 - Excess heat?
 - Potential shortcomings – large cogen units



Features of the model

Flexible Delivery

- Trigen
- Non-prescriptive:
 - Offering choices
 - Alternative assessments
- Ongoing monitoring and review...



Case study

Cambridge Apartments, Chatswood

- Unit installed and monitored by MPI from Dec 2007



Tedom F25AP Cogen unit

Electrical output = 25kW
avg. electrical eff. = 26%



Hot water storage of
cogen unit



Raypak gas boilers

Gas unit ratio (LHV) =
35.83 MJ/m³

Why the case study?

Objectives

- Model verification
- Impact of cogen on the BASIX energy score
- Implications
 - Achieving score > 20 after cogen?

Model verification

Current approach

- Period: 13 Dec 2007 – 8 Dec 2008
- Thermal and electricity outputs from the unit

Pilot results (MPI) vs. BASIX simulations

Results compared...

13 Dec 2007 – 8 Dec 2008

	Pilot results	BASIX simulations
Thermal output (GJ)	1300	1350
Electricity output (kWh)	~ 131,000	~134,000

Implications

- Net savings in CO₂e during the period: 210 tonnes
- Improvements in BASIX energy score = 24
- Significance:
 - Possible to achieve an energy score of > 20
 - > 40 with efficient lightings etc.
 - Viable option to achieve targets of the Kyoto Protocol

Summary

Cogen in BASIX

- Satisfying thermal requirements
- Verified from actual high-rises
- Significant increase in energy scores →
implication on the savings target

Where can we go from here?

- Effects of consumption pattern (peak vs. off-peak) on cogeneration output
- Non-residential application of cogen heat and electricity

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