

Whole of House Verification – Stage 2

Department of the Environment and Energy
AECOM

Introduction

The objective of this project is to assist the Department of the Environment and Energy in gathering evidence for analysis with a purpose of progressing Measure 31.2 of the National Energy Productivity Plan (NEPP) by considering a 'whole of house' approach to achieving net zero energy buildings for new and existing dwellings.

The research will be undertaken to answer the following key questions:

1. What are the current residential building typologies in each jurisdiction (built form, appliances and energy use)?
2. In consideration of whole of building energy consumption and low cost design, what could the future residential building stock in each jurisdiction look like?
3. How can a residential building policy support holistic energy performance? And what should be considered in the scope of existing and new dwellings?
4. What are the opportunities and risks associated with the above?

Project Stages

The project is broken down into two stages:

Stage 1: Establishing a baseline for housing across Australia in consideration of construction types, jurisdictional requirements and climate variances.

Stage 2: Quantitative and qualitative analysis of each baseline. This will include the assessment and optimisation of the thermal shell, inclusion and optimisation of baseline appliances (whole of house energy) and potential inclusion of generation (solar). Stage 2 works will also consider the ease of implementation and the risks, challenges and opportunities for the proposed initiatives.

This paper provides an outline of the draft Stage 2 works for comment.

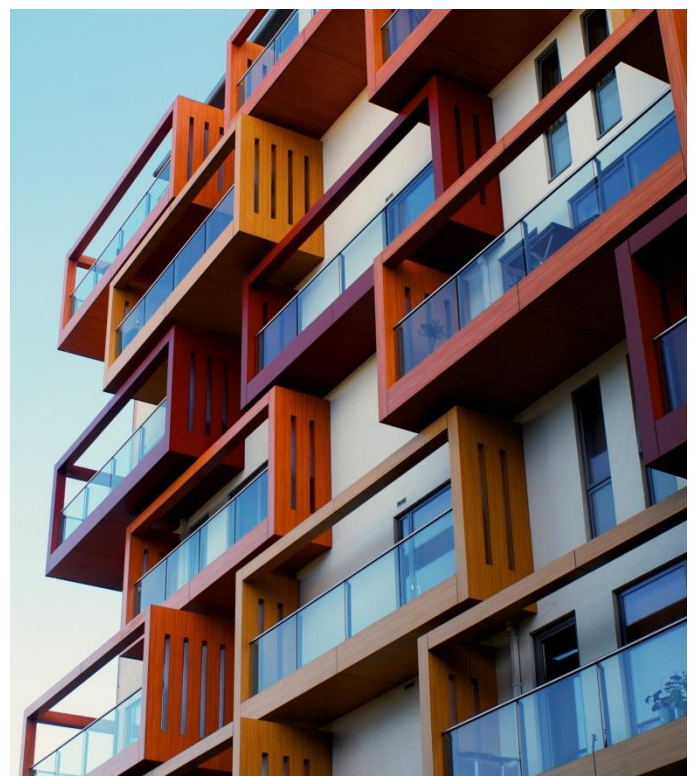
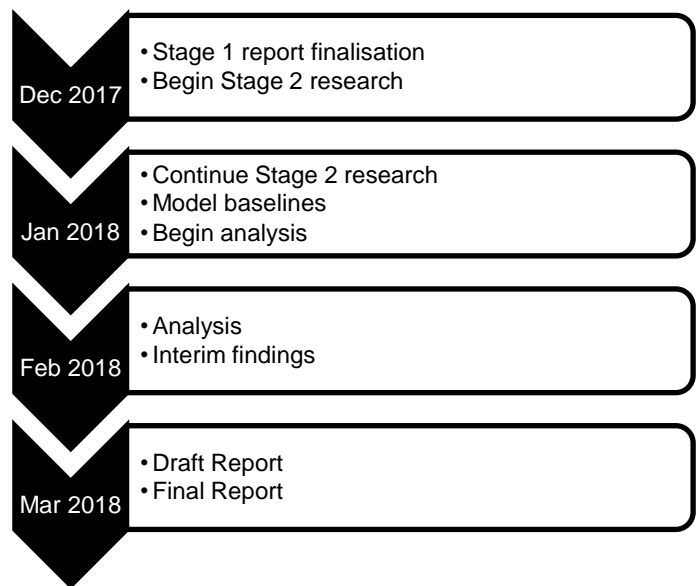
Stage 2

Stage 2 will focus on the pathways that could be taken for each of the base case dwellings to achieve net zero energy; through improvements in thermal shell, appliances and offsets through on-site generation.

Modelling will be undertaken using the CSIRO developed AusZEH software in order to determine thermal performance, subsequent heating and cooling requirements and appliance use.

Timeline

Note that these works fit within the broader trajectory work being completed by the Department of the Environment and Energy on low energy homes.



Class 1: Typical 2018

Appliances and efficiencies are based on 2018 projected values from the Residential Energy Baseline Study: Australia (Energy Consult, 2015).

		Heating	Cooling	Hot Water	Lighting	Cooktop	Oven
ACT	Canberra	Gas Ducted 75% efficiency	Reverse Cycle AC 4.62 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
NSW	Richmond, Wagga Wagga, Nowra, Sydney East	Reverse Cycle AC 4.15 COP	Reverse Cycle AC 4.39 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
	Moree	Reverse Cycle AC 4.15 COP	Reverse Cycle AC 4.39 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
NT	Alice Springs, Darwin	Reverse Cycle AC 4.77 COP	Reverse Cycle AC 4.78 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
QLD	Charleville, Cairns , Weipa, Longreach	Reverse Cycle AC 4.66 COP	Reverse Cycle AC 4.66 EER	Electric Storage 642.4kWh/year heat loss	LED	Gas	Electric
	Brisbane	Reverse Cycle AC 4.66 COP	Reverse Cycle AC 4.66 EER	Electric Storage 642.4kWh/year heat loss	LED	Gas	Electric
	Oakey	Reverse Cycle AC 4.66 COP	Reverse Cycle AC 4.66 EER	Electric Storage 642.4kWh/year heat loss	LED	Gas	Electric
SA	Adelaide	Reverse Cycle AC 4.22 COP	Reverse Cycle AC 4.35 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
	Mt Lofty, Mt Gambier, Woomera	Reverse Cycle AC 4.22 COP	Reverse Cycle AC 4.35 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
TAS	Hobart	Reverse Cycle AC 3.78 COP	Reverse Cycle AC 4.43 EER	Electric Storage 642.4kWh/year heat loss	LED	Gas	Electric
VIC	Melbourne, Ballarat, Mildura	Gas Ducted 75% efficiency	Reverse Cycle AC 4.35 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
WA	Katanning, Perth, Swanbourne	Reverse Cycle AC 4.11 COP	Reverse Cycle AC 4.50 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
	Newman, Carnarvon, Broome, Halls Creek	Reverse Cycle AC 4.22 COP	Reverse Cycle AC 4.48 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric
	Manjimup, Albany	Reverse Cycle AC 4.22 COP	Reverse Cycle AC 4.48 EER	Gas Instantaneous 80% efficiency	LED	Gas	Electric

Class 1: Typical 1990's

Appliances and efficiencies are based on the "half-life" efficiency of each appliance based on the projected values from the Residential Energy Baseline Study: Australia (EnergyConsult, 2015). I.e. if an the lifetime of a hot water system is deemed to be 16 years, then the efficiency for the hot water system is taken to be 8 years ago (2010 value for efficiency).

		Heating	Cooling	Hot Water	Lighting	Cooktop	Oven
ACT	Canberra	Gas Ducted 75% efficiency	Reverse Cycle AC 4.32 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
	Richmond, Wagga Wagga, Nowra, Moree, Sydney East	Non ducted Gas (unflued) 90% efficiency	Reverse Cycle AC 4.11 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
NT	Alice Springs, Darwin	Non ducted Gas (unflued) (LPG) 90% efficiency	Reverse Cycle AC 4.43 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
QLD	Charleville, Cairns , Weipa, Brisbane, Oakey, Longreach	Reverse Cycle AC 4.43 COP	Reverse Cycle AC 4.39 EER	Electric Storage 642.4kWh/year heat loss	CFL	Gas	Electric
SA	Adelaide, Mt Lofty, Mt Gambier, Woomera	Non ducted Gas (unflued) 90% efficiency	Reverse Cycle AC 4.17 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
TAS	Hobart	Electric Resistance 100% efficiency	Reverse Cycle AC 4.21 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
VIC	Melbourne, Ballarat,	Gas Ducted 75% efficiency	Reverse Cycle AC 4.11 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
	Mildura	Gas Ducted 75% efficiency	Reverse Cycle AC 4.11 EER	Electric Storage 642.4kWh/year heat loss	CFL	Gas	Electric
WA	Katanning, Manjimup, Albany, Perth,	Non ducted Gas (unflued) 90% efficiency	Reverse Cycle AC 4.22 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
	Newman, Carnarvon, Broome, Swanbourne, Halls Creek	Non ducted Gas (unflued) 90% efficiency	Reverse Cycle AC 4.22 EER	Electric Storage 642.4kWh/year heat loss	CFL	Gas	Electric

Class 2: Typical 2018

		Heating	Cooling	Hot Water	Lighting	Cooktop	Oven
ACT	Canberra	Reverse Cycle AC 3.91 COP	Reverse Cycle AC 4.62 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
NSW	Wagga Wagga, Nowra, Sydney East, Sydney	Reverse Cycle AC 4.15 COP	Reverse Cycle AC 4.39 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
NT	Darwin	Reverse Cycle AC 4.77 COP	Reverse Cycle AC 4.78 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
QLD	Brisbane	Reverse Cycle AC 4.66 COP	Reverse Cycle AC 4.66 EER	Electric Storage 427.05 kWh/year heat loss	LED	Gas	Electric
	Cairns	Reverse Cycle AC 4.66 COP	Reverse Cycle AC 4.66 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
SA	Adelaide	Reverse Cycle AC 4.19 COP	Reverse Cycle AC 4.66 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
TAS	Hobart	Reverse Cycle AC 3.78 COP	Reverse Cycle AC 4.43 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
VIC	Melbourne	Reverse Cycle AC 4.12 COP	Reverse Cycle AC 4.35 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric
WA	Perth, Swanbourne, Broome, Albany	Reverse Cycle AC 4.22 COP	Reverse Cycle AC 4.48 EER	Gas Instantaneous, 80% efficiency	LED	Gas	Electric

Class 2: Typical 1990's

		Heating	Cooling	Hot Water	Lighting	Cooktop	Oven
ACT	Canberra	Reverse Cycle AC 3.72 COP	Reverse Cycle 4.32 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
NSW	Wagga Wagga, Nowra, Sydney East	Reverse Cycle AC 3.93 COP	Reverse Cycle 4.11 EER	Electric storage 427.05 kWh/year heat loss	CFL	Gas	Electric
NT	Darwin	Reverse Cycle AC 4.46 COP	Reverse Cycle 4.43 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
QLD	Brisbane, Cairns	Reverse Cycle AC 4.43 COP	Reverse Cycle 4.39 EER	Electric Storage 427.05 kWh/year heat loss	CFL	Gas	Electric
SA	Adelaide	Reverse Cycle AC 3.98 COP	Reverse Cycle 4.17 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
TAS	Hobart	Reverse Cycle AC 3.65 COP	Reverse Cycle 4.21 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
VIC	Melbourne	Reverse Cycle AC 3.93 COP	Reverse Cycle 4.11 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric
WA	Broome, Albany, Perth, Swanbourne	Reverse Cycle AC 4.02 COP	Reverse Cycle 4.22 EER	Gas Instantaneous 80% efficiency	CFL	Gas	Electric