Power Shift
Multiple Impacts Report

Webinar

December 2017

ENERGY CONSUMERS AUSTRALIA

Power Shift – Helping consumers manage their energy usage

Power Shift Objectives

- Improve our evidence-based understanding of what really works in supporting vulnerable consumers to manage their energy bills (the *research* outcome).
- Identify opportunities for market-led solutions and other initiatives to support vulnerable consumers to manage their energy bills (the *empowering consumers* outcome).

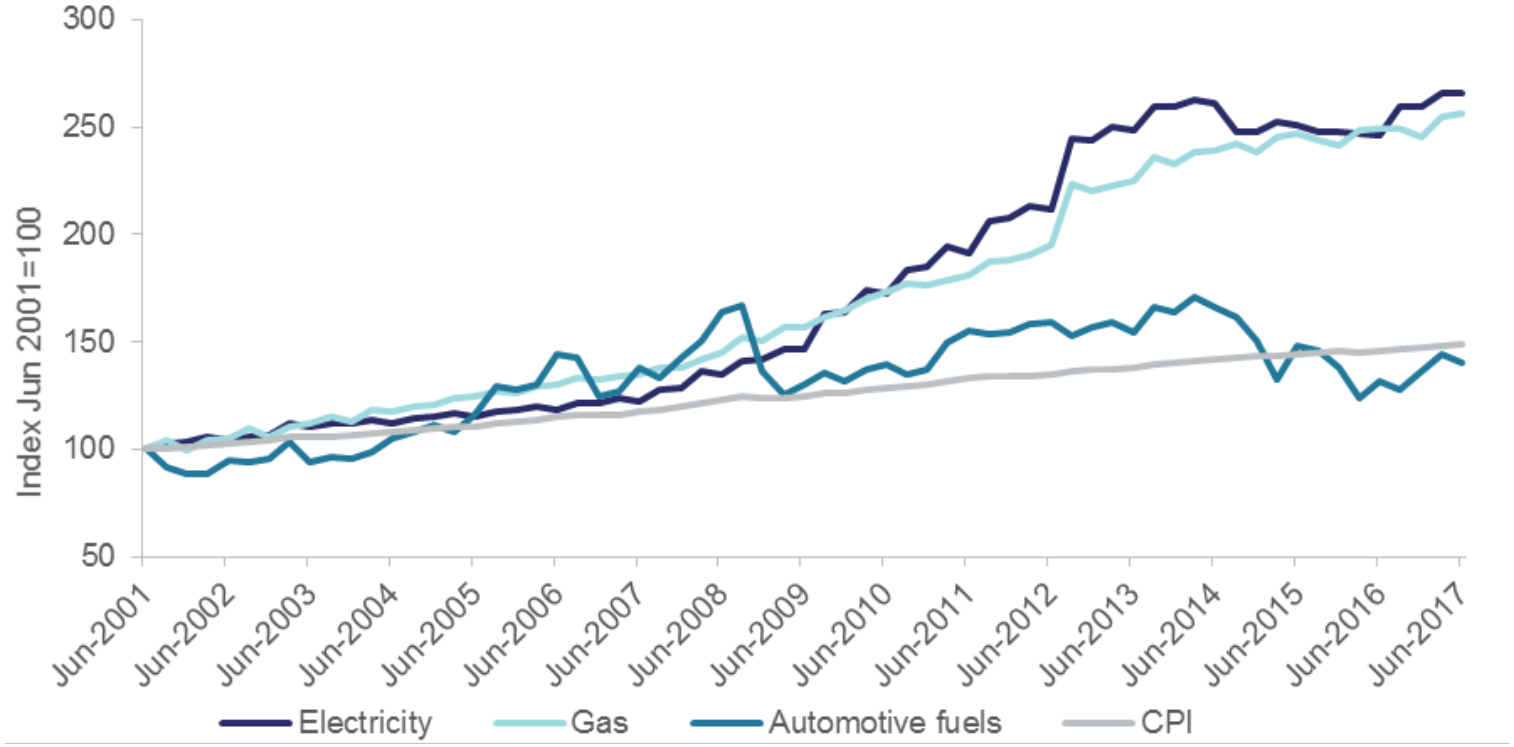
Energy Consumers Australia

To **promote the long term interests of consumers of energy with respect to the price, quality, safety, reliability and security of supply** of energy services by providing and enabling strong, coordinated, collegiate evidence-based consumer advocacy on National Market matters of strategic importance or material consequence for Energy Consumers, in particular Residential Customers and Small Business Customers.

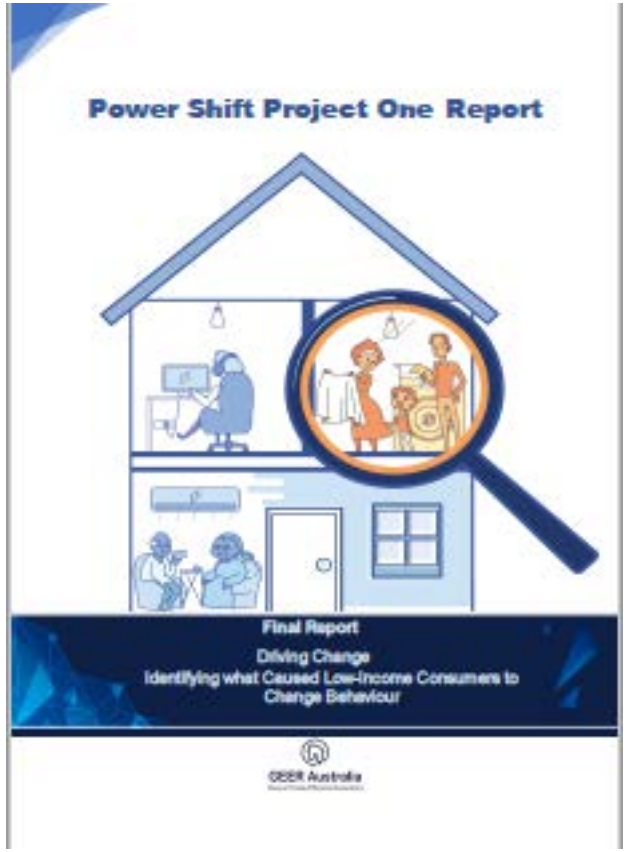
…affordability continues to be critical

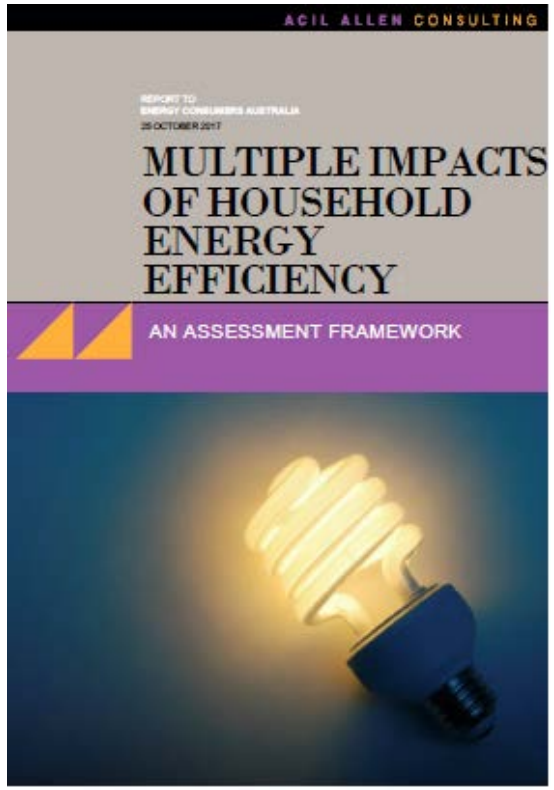
Australian Energy Update, Figure 3.6

http://www.environment.gov.au/energy/publications/australian-energy-update-2017



2016/17 Research





Power Shift 2017/18 work program

- Research:
  - Retail market barriers to energy management goods/services
  - Mapping customer decision-making
- Digital platform to share consumer resources
- Housing – how best to inform policy development
- Health – communicating LIEEP learnings to health sector.

PRESENTATION TO:
ENERGY CONSUMERS AUSTRALIA

18 OCTOBER 2017

MULTIPLE IMPACTS OF HOUSEHOLD ENERGY EFFICIENCY

AN ASSESSMENT FRAMEWORK

C O N T E N T S

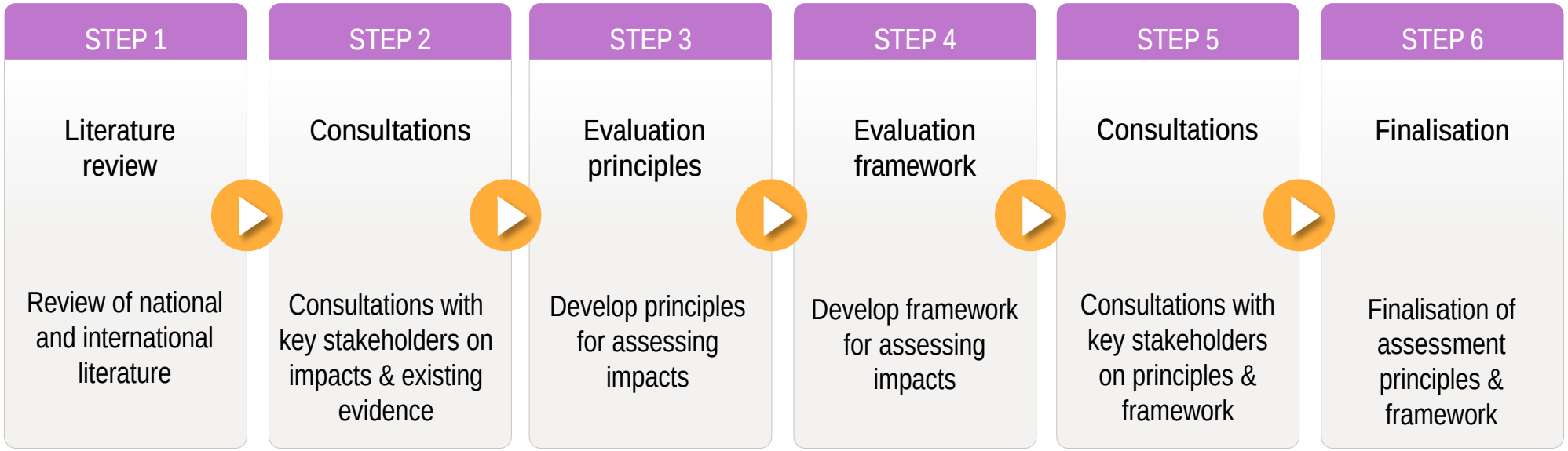
PROJECT BACKGROUND

1

PROJECT OBJECTIVE AND SCOPE

- Traditionally household energy efficiency programs assessed on basis of reductions in energy usage and thereby reduction in energy costs
- There is now a considerable body of evidence of multiple impacts (both costs and benefits) associated with energy efficiency—both private and public
- Absence of a holistic framework for applying existing international research on these multiple impacts to the Australian context makes consideration of these impacts contentious
- ECA commissioned ACIL Allen to develop a policy framework to help identify and measure the multiple impacts of improved household energy efficiency. Framework developed by drawing on LIEEP projects and Australian and international research to:
  - develop principles and procedures to assist industry and policy-makers in the design and implementation of programs to promote energy efficiency
  - where possible, make recommendations to inform Australian policy-makers on how best to define and quantify these impacts
- Developing new methodologies/estimates to measure individual impacts was outside the scope of this project

METHODOLOGY



THE MULTIPLE IMPACTS OF ENERGY EFFICIENCY

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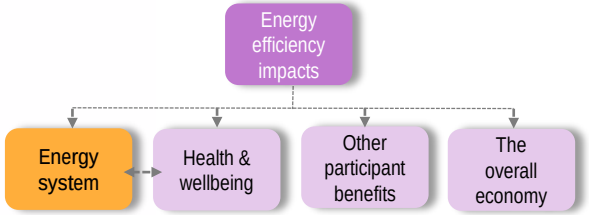
THE MULTIPLE IMPACTS OF ENERGY EFFICIENCY

ENERGY SYSTEM IMPACTS



Energy system

Health & wellbeing

Reduced household energy consumption & bill savings

Utility costs from reduced energy consumption

Lower retailer costs from reduced arrears & disconnections

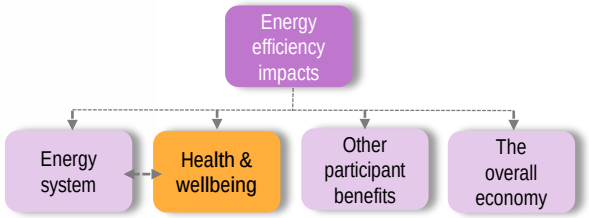
Reduced CO2 emissions from energy generation

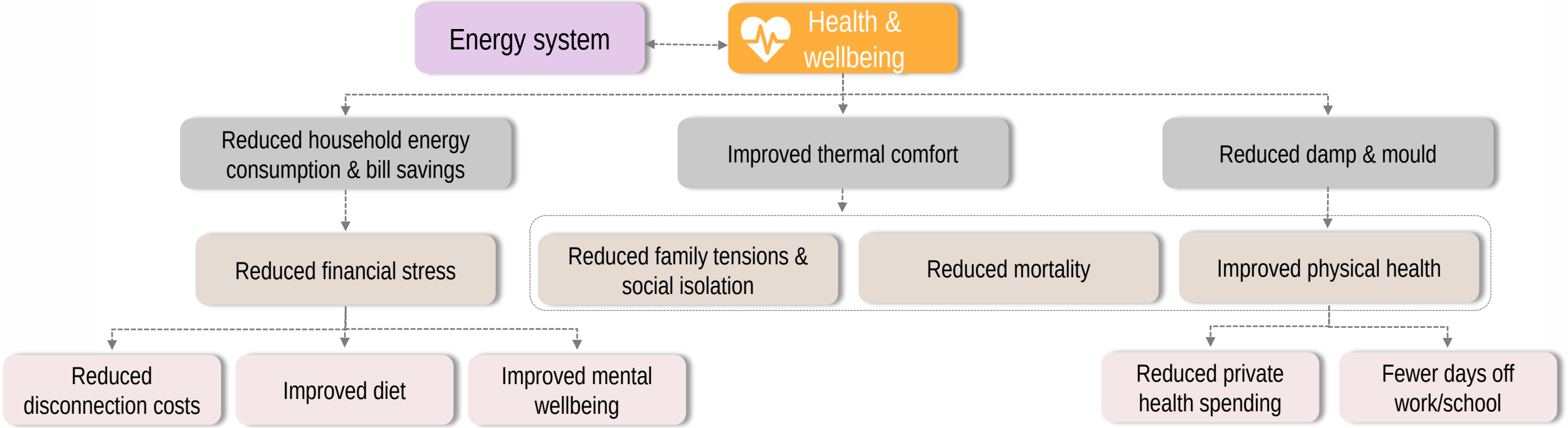
Avoided health costs related to air pollution from electricity generation

Avoided generation costs

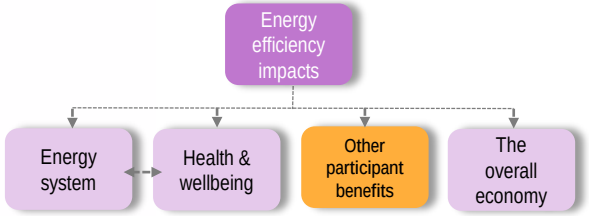
Deferred network investment

HEALTH AND WELLBEING IMPACTS





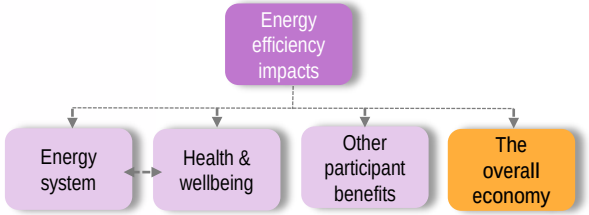
OTHER PARTICIPANT IMPACTS

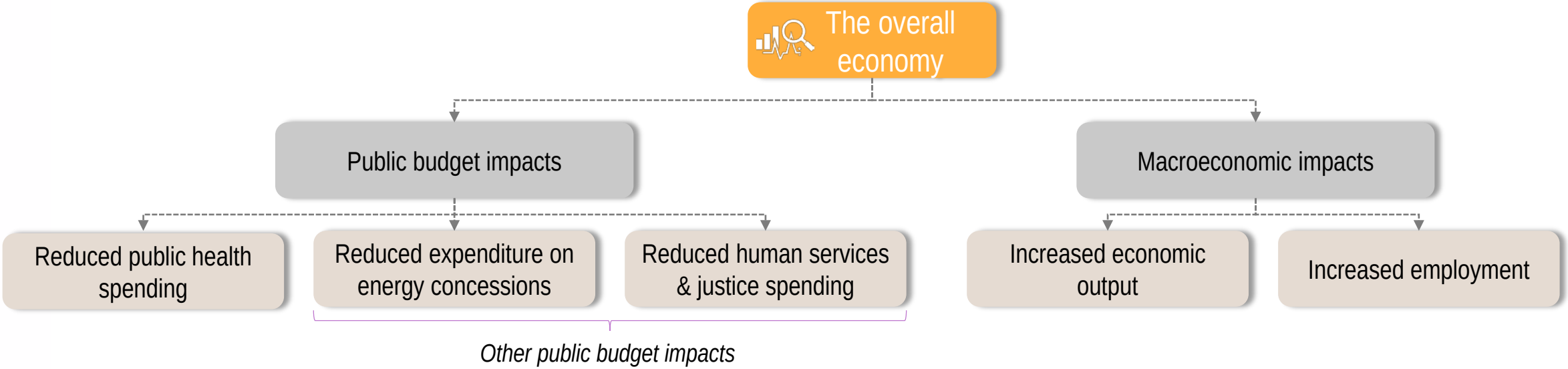


Other participant benefits

- Improved knowledge of energy efficiency behaviours & strategies
- Increased empowerment & self-efficacy
- Improved positive attitude towards energy efficiency
- Increased property values

IMPACTS ON THE OVERALL ECONOMY





PRINCIPLES FOR ASSESSING THE MULTIPLE IMPACTS OF ENERGY EFFICIENCY

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PRINCIPLES FOR ASSESSING THE MULTIPLE IMPACTS OF ENERGY EFFICIENCY

Best practice assessment principles
Evidence of causal link
Materiality of impact
Consistency with public and corporate objectives
Comprehensiveness
Consistency with existing framework
Quantification

Principles for quantification of impacts
Robust methodology • Individual treatment • Fit for purpose • Transparency
Robust estimates • Symmetry • Avoid double counting • Consider the rebound effect • Measure marginal, not average, impacts • Consider the incidence of impacts
Transferability of estimates

FRAMEWORK FOR ASSESSING THE MULTIPLE IMPACTS OF HOUSEHOLD ENERGY EFFICIENCY

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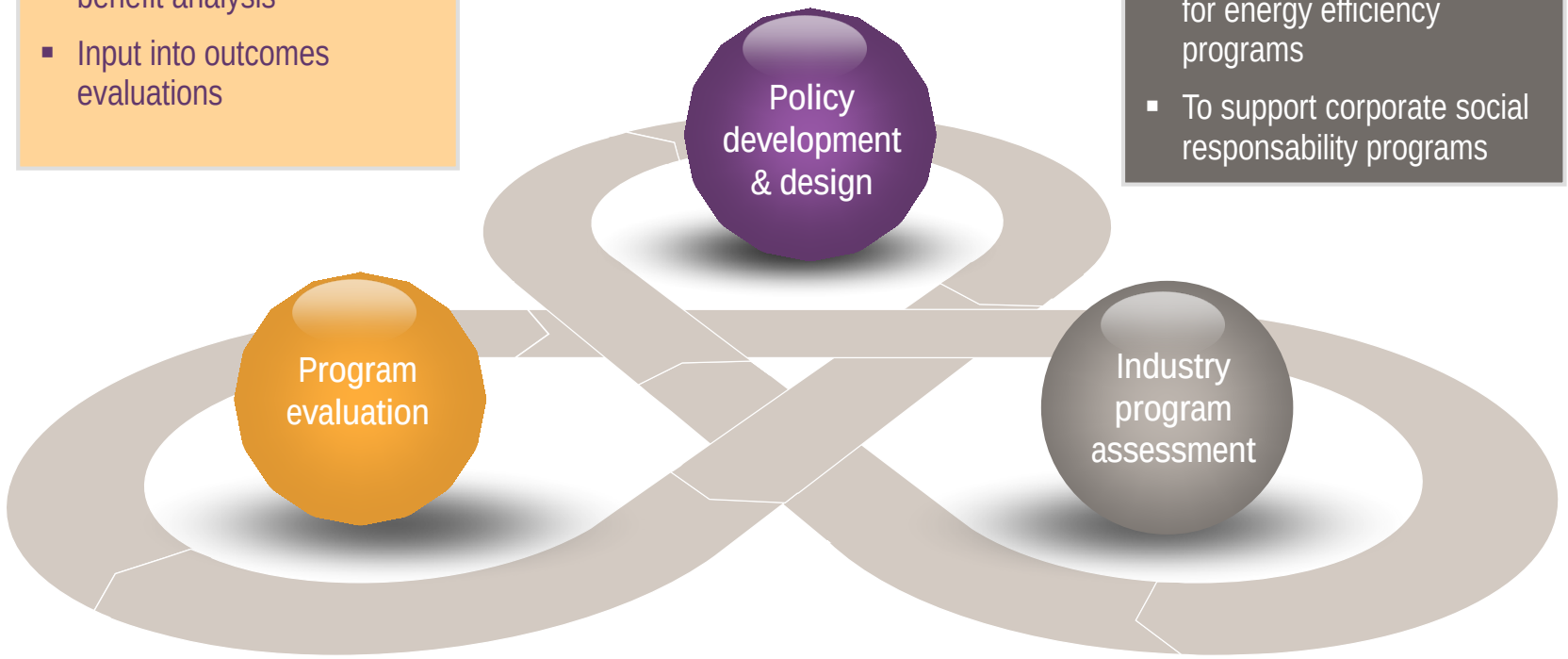
USE OF MULTIPLE IMPACTS ASSESSMENTS

- Input into ex-ante or ex-post cost-benefit analysis
- To guide policy development and design

- Input into ex-post cost-benefit analysis
- Input into outcomes evaluations

- Input into business cases for energy efficiency programs
- To support corporate social responsability programs



CROSS-CUTTING METHODOLOGICAL CONSIDERATIONS

SOCIAL RESEARCH PROTOCOLS & METHODS

- Consider & document contextual factors that can affect prevalence and magnitude of energy efficiency impacts (e.g. climate zone & geographical factors)
- Only use estimates from comparable programs
- Best practice social research protocols should be followed.

VALUING INTANGIBLE BENEFITS

- Use standard approaches when valuing impacts:
  - ✓ Revealed preference
  - ✓ Stated preference
  - ✓ Benefit transfer
  - ✓ Life satisfaction approach

DISCOUNT RATES

- Extensive debate around the basis and selection of an appropriate discount rate
- In Australia, preferred approach is to base discount rate on market-based interest rates, rather than government long-term bond rates
- Most commonly used central discount rate is 7%, with sensitivity testing typically at 10% and 3 or 4%

STOCKTAKE OF CURRENT KNOWLEDGE

- Impact description
- Likely materiality of impact
- Approaches for quantifying impact
- Indicators & data requirements
- Dependencies & trade-offs with other impacts
- Contextual factors & considerations
- Key studies assessing the impact
- Transferability of existing impact estimates
- Next steps

SUMMARY OF IMPACT FRAMEWORK COMPONENTS

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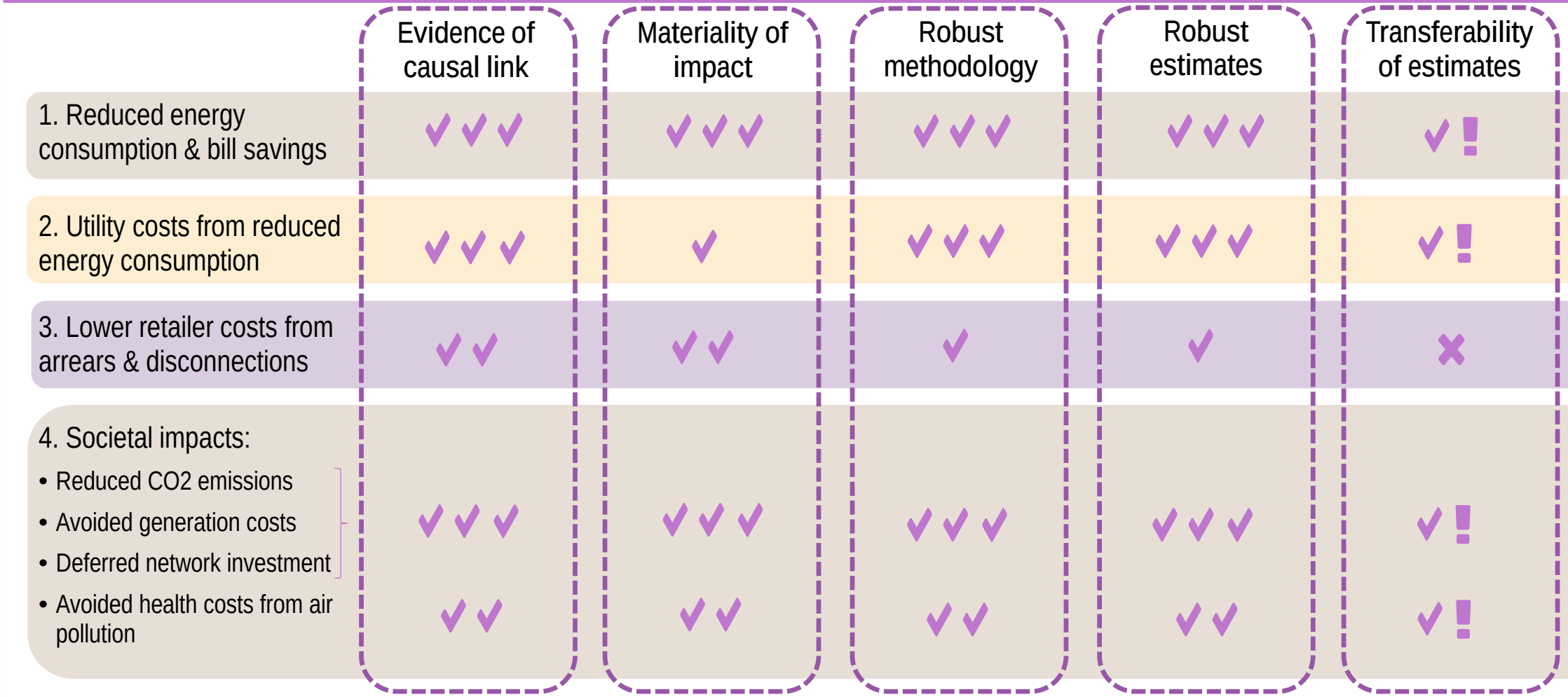
SUMMARY OF IMPACT FRAMEWORK COMPONENTS

Evidence of causal link	• The theoretical foundation for the impact and the strength of the supporting empirical evidence
Materiality of impact	• Relative magnitude of the impact (in programs where impact is expected to occur)
Robust methodology	• Degree to which well established research protocols exist
Robust estimates	• The number of robust studies from which to draw estimates
Transferability of estimates	• Whether existing estimates are transferable to an Australian context

ENERGY SYSTEM IMPACTS



Caution: refer to the report before applying this information

Care should be taken to only transfer estimates from comparable programs/contexts.

HEALTH AND WELLBEING IMPACTS (1)

	Evidence of causal link	Materiality of impact	Robust methodology	Robust estimates	Transferability of estimates
5. Reduced financial stress	✓✓	✓✓✓	✓	✓	✗
6. Reduced disconnection costs	✓✓	✓	✓	✓	✗
7. Improved diet	✓	✓	✗	✗	✗
8. Improved mental wellbeing	✓✓	✓✓✓	✓✓	✓✓	✓!

Caution: refer to the report before applying this information

! Care should be taken to only transfer estimates from comparable programs/contexts.

HEALTH AND WELLBEING IMPACTS (2)

	Evidence of causal link	Materiality of impact	Robust methodology	Robust estimates	Transferability of estimates
9. Improved thermal comfort	✓✓✓	✓✓✓	✓	✓	✗
10. Reduced damp & mould	✓✓✓	✓✓	✓	✓	✗
11. Reduced family tensions & social isolation	✓	✓	✗	✗	✗
12. Reduced mortality	✓✓✓	✓✓✓	✓✓✓	✓✓	✓!
13. Improved physical health	✓✓✓	✓✓	✓✓✓	✓✓	✓!
14. Fewer days off school or work	✓✓	✓✓	✓✓✓	✓✓	✓!

Caution: refer to the report before applying this information

! Care should be taken to only transfer estimates from comparable programs/contexts.

OTHER PARTICIPANT IMPACTS

	Evidence of causal link	Materiality of impact	Robust methodology	Robust estimates	Transferability of estimates
15. Householder knowledge, attitudes & behaviour	✓✓	i	✓	✓	✗
16. Increased property values	✓✓✓	✓✓	✓✓✓	✓✓✓	✗

i Caution: refer to the report before applying this information

! Care should be taken to only transfer estimates from comparable programs/contexts.

PUBLIC BUDGET AND MACROECONOMIC IMPACTS

	Evidence of causal link	Materiality of impact	Robust methodology	Robust estimates	Transferability of estimates
17. Reduced public and private health spending	✓✓	✓✓	✓✓✓	✓✓	✓!
18. Other public budget impacts of energy efficiency	✓	✓	✗	✗	✗
19. Macroeconomic impacts	✓✓	✓✓	✓✓	✓✓	✗

Caution: refer to the report before applying this information

! Care should be taken to only transfer estimates from comparable programs/contexts.

KEY FINDINGS AND NEXT STEPS

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KEY FINDINGS

- Energy efficiency initiatives traditionally assessed based on energy savings alone
- More benefits that could be of greater value, such as:
  - Improved physical health (reduced morbidity and mortality)
  - Improved mental wellbeing
  - Reduced financial stress, family tensions and social isolation
- Research has created a useful framework and stocktake of current knowledge of these impacts
- Significant work required to quantify impacts for specific Australian circumstances that take into consideration, for instance:
  - Socioeconomic factors
  - Climate zones
  - Current characteristics of the building stock and penetration of energy efficient fixtures and appliances

NEXT STEPS

- Further research in Australian context required to close gaps in our knowledge to improve the efficiency and effectiveness of energy efficiency programs
  - Developing harmonised indicators to measure impacts
  - Developing instruments to collect robust data for these indicators

ADDITIONAL AREAS OF RESEARCH

Householder knowledge, attitudes & behaviour	• Establish common framework & survey instrument to measure change • Explore linkages to other impacts
Improved thermal comfort	• Develop harmonised indicators & validated survey instruments to measure change • Investigate nature & extent of problem in Australia (both warmer & colder climate zones)
Reduced damp & mould	• Develop harmonised indicators & validated survey instruments to measure presence & severity of damp & mould and impact of energy efficiency interventions • Investigate nature & extent of problem in Australia
Increased property values	• Further research in Australian context using existing methodologies

ADDITIONAL AREAS OF RESEARCH

Reduced financial stress	• Define harmonised metrics for measuring financial stress • Develop validated survey instruments to measure household experience of financial stress
Improved physical health	• Assess health conditions that may be improved through energy efficiency in warmer climates • Implement established research protocols to assess impact of energy efficiency in Australia (both colder & warmer climate zones)
Reduced mortality	• Assess extent to which mortality may be reduced through energy efficiency (both warmer & colder climate zones) • Implement established research protocols to assess impact of energy efficiency in Australia (both colder & warmer climate zones)
Reduced family tensions & social isolation	• Define harmonised metrics to measure change • Develop validated survey instruments to measure household experience of family tensions & social isolation

ADDITIONAL AREAS OF RESEARCH

Reduced disconnection costs	• Define harmonised metrics to measure change • Develop validated survey instruments to measure impact of reduced disconnection costs for program participants
Improved diet	• Assess nature & extent of problem in Australia • Develop methodologies (indicators & survey instruments) for assessing impact of interventions on improved diet
Improved mental wellbeing	• Assess nature & extent of problem in Australia • Implement established research protocols to assess impact of initiatives on mental wellbeing across Australia
Reduced public & private health costs	• Assess extent to which health costs may be reduced through energy efficiency in all climates • Implement established research protocols to assess impact of energy efficiency on public health spending across Australia

ADDITIONAL AREAS OF RESEARCH

Fewer days off school or work	• Implement established research protocols to assess impact of energy efficiency on days off school or work across Australia
Lower energy retailer costs & reduced disconnections	• Assess nature & extent of problem in Australia • Develop methodologies (indicators & survey instruments) for assessing impact of interventions on retailer costs
Other public budget impacts	• Assess nature & extent of problem in Australia • Develop methodologies (indicators & survey instruments) for assessing impact of interventions on concessions & reduced human services and justice spending
Macroeconomic impacts	• Continue to explore approaches to assess macroeconomic impacts where net impact is thought to be material

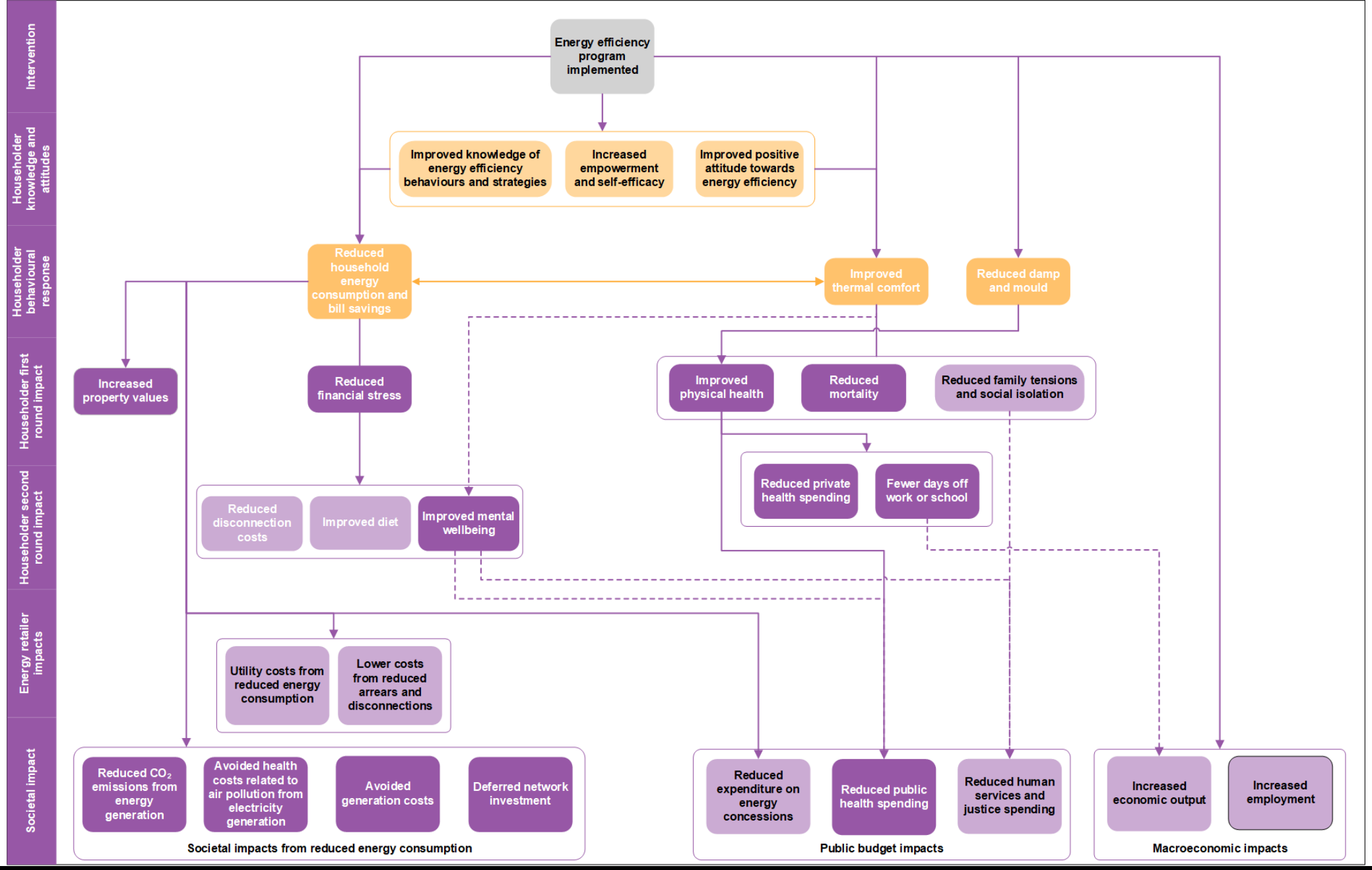
APPENDIX

A

ENERGY EFFICIENCY IMPACTS LOGIC MAP

- Divided into 7 separate levels and 26 individual impacts.
- Impacts presented in a darker shade are, to date, underpinned by a more substantial evidence base than those in a lighter shade
- Interrelationships between the impacts are indicated by connecting arrows. A solid line indicates that a stronger causal link has been established in the existing literature, while a dashed line symbolises a weaker causal link.
- The logic map can be interpreted, from top to bottom, as follows:

1. The **first layer** is the implementation of an energy efficiency policy or program and the associated energy efficiency measures
2. The **second layer** represents changes in householders' attitudes towards, and knowledge of, energy efficiency
3. The **third layer** represents household behaviour change as a result of the energy efficiency intervention
4. The **fourth & fifth layers** represent the first & second round impacts arising from changes in energy consumption & thermal comfort
5. The **sixth layer** describes the impacts for industry participants
6. The **final layer** depicts the societal impacts from residential energy efficiency.


Intervention
Householder knowledge and attitudes
Householder behavioural response
Householder first round impact
Householder second round impact
Energy retailer impacts
Societal impact
Energy efficiency program implemented
Improved knowledge of energy efficiency behaviours and strategies
Increased empowerment and self-efficacy
Improved positive attitude towards energy efficiency
Reduced household energy consumption and bill savings
Improved thermal comfort
Reduced damp and mould
Increased property values
Reduced financial stress
Improved physical health
Reduced mortality
Reduced family tensions and social isolation
Reduced private health spending
Fewer days off work or school
Reduced disconnection costs
Improved diet
Improved mental wellbeing
Utility costs from reduced energy consumption
Lower costs from reduced arrears and disconnections
Reduced CO_2 emissions from energy generation
Avoided health costs related to air pollution from electricity generation
Avoided generation costs
Deferred network investment
Societal impacts from reduced energy consumption
Reduced expenditure on energy concessions
Reduced public health spending
Reduced human services and justice spending
Public budget impacts
Increased economic output
Increased employment
Macroeconomic impacts

EXAMPLES OF STOCKTAKE OF CURRENT KNOWLEDGE

- Improved physical health
- Householder knowledge, attitudes and behaviour

IMPROVED PHYSICAL HEALTH (1)

Criteria	Findings
Description	Energy efficiency programs that result in improved thermal comfort in a dwelling (as described above) can lead to improved physical health, including in symptoms for a range of diseases such as respiratory and cardiovascular diseases, allergies, arthritis and rheumatism.
Likely materiality of the impact	Overall, evidence to date indicates that improved physical health, alongside improved mental wellbeing, can be one of the most important non-energy impacts of energy efficiency. A number of randomised controlled trials have reported a statistically significant relationship between energy efficiency and improved physical health. However, some studies have found no significant link between physical health and energy efficiency. It is not yet clear whether this is due to program specific considerations or some other factors. Further, the magnitude of the impact will depend on contextual factors described below. To date, no robust studies have been undertaken in Australia.
Approaches for quantifying the impact	The most robust evidence for assessing the impact of energy efficiency on physical health use methodologies set out in epidemiological health studies. These typically include a rigorous study set up including a control or comparison group to establish a causal link between the energy efficiency intervention and observed outcomes.
Indicators and data requirements	Possible indicators for improved physical health are: – number of visits to the hospital or doctor, obtained through health records or household surveys – number and type of prescription medicines, obtained through health records or household surveys – participant reports of health status, obtained through household surveys using validated instruments. Using health records to assess differences in outcomes for participant and control/comparison groups is the most robust source of evidence. However, accessing health records, even in the context of a rigorous, academic study, may be difficult due to data privacy constraints. When accessing health records proves impracticable, participant reports of healthcare visits, prescription medication usage and health status can provide information on the prevalence and magnitude of health impacts. Ideally, existing, validated survey instruments such as the SF-36 Short Form Health Survey and GHQ-12 General Health Questionnaire should be used. Improved physical health may be monetised through converting improved health outcomes to quality adjusted life-years (QALYs), a standardised measure which can be monetised. Improved physical health can also be monetised through reduced public and private health spending. When relying on household self-reports, monetisation of impacts should be done conservatively.
Dependencies and trade-offs with other impacts	Improved physical health is dependent on the extent to which the energy efficiency intervention leads to an improvement in thermal comfort, the key exposure factor linking energy efficiency to improved health and well-being outcomes, or to a reduction in damp or mould. To the extent that households experience financial pressure and make the choice to prioritise bill savings over improving the thermal comfort of the dwelling, there is a trade-off between the two. Linked to the take-back effect, this trade-off is more likely to be present in so-called easy retrofits than for deep, systematic energy efficiency interventions where evidence of a take-back effect has not been found. A reduction in damp and mould is likely to be most significant in the context of a well-designed, systematic retrofit rather than a non-systematic intervention.

IMPROVED PHYSICAL HEALTH (2)

Criteria	Findings
Contextual factors and considerations	Improved physical health is dependent on an improvement in thermal comfort or a reduction in damp or mould being realised as a result of the energy efficiency intervention. Therefore, the same contextual and program specific factors apply to improved physical health as to improved thermal comfort and to reduced damp or mould. These are: – the nature of the intervention – climate zone – level of humidity – targeting of vulnerable populations – extent to which the intervention requires co-contribution from program participants.
Key studies assessing the impact	Grimes, A., Denne, T., Howden-Chapman, P., Arnold, R., Telfar-Barnard, L., Preval, N., & Young, C. (2012). Cost benefit analysis of the warm up New Zealand: heat smart programme. Wellington: University of Wellington. Chapman, R., Howden-Chapman, P., Viggers, H., O'dea, D., & Kennedy, M. (2009). Retrofitting houses with insulation: a cost–benefit analysis of a randomised community trial. Journal of Epidemiology & Community Health, 63(4), 271-277.
Transferability of existing estimates	The estimates of improved physical health from improved thermal comfort are from the New Zealand housing stock, which has been characterised as 'old and cold'. The Warm Up New Zealand: Heat Smart Programme, provided subsidies for measures such as insulation, draught proofing and clean heating devices in at houses built before 2000. A preceding clinical study assessed the impact of insulation among low income households where at least one person had symptoms of respiratory disease. The reduction in the number of medical and hospital visits may be conservatively applied if the initiative: – is located in a cold climate zone comparable (to a reasonable degree) with New Zeeland – provides insulation to uninsulated dwellings where lack of adequate warmth during cold periods is a substantial issue. In addition, the estimates from the community trial are only applicable in the context of low income households where at least one family member has a pre-existing respiratory health condition.
Next steps	Further research on the impact of energy efficiency on physical health should be conducted in an Australian context. Key actions include: – assessing the range of health conditions that may be improved through energy efficiency in warmer climates – implementing established research protocols to assess the impact of energy efficiency across Australia, including in both colder and warmer climate zones.

HOUSEHOLDER KNOWLEDGE, ATTITUDES AND BEHAVIOUR (1)

Criteria	Findings
Description	The implementation of an energy efficiency program may lead to changes in participants' knowledge, attitudes and self-efficacy. These can be defined as follows: – knowledge relates to an understanding of energy efficiency behaviours and strategies – attitudes measures the extent to which householders regard energy efficiency behaviours and practices positively – self-efficacy (also known as empowerment) reflects householders' ability to control the use of energy in the home through a greater understanding of how energy works.
Likely materiality of the impact	The materiality and relevance of this impact depends on the extent to which knowledge, attitudes and behaviours have been incorporated in the program design. If it is a key part of the intervention logic, it should be measured. Research undertaken in Australia provides some evidence that this impact has been achieved among low income households. However, the usefulness of existing studies is limited by methodological constraints such as lack of baseline information and consistency in the measurement framework. Finally, it is unlikely that interventions that do not explicitly include improvement in knowledge, attitudes and self-efficacy will achieve this outcome.
Approaches for quantifying the impact	Changes in knowledge, attitudes and self-efficacy are measured using a household survey. Ideally, this would include before-and-after measurements for both participants and an equivalent control or comparison group. It is not appropriate to monetise this impact.
Indicators and data requirements	The research undertaken for this report has not identified a validated survey instrument for measuring improvements in knowledge, attitudes and self-efficacy. In the absence of a common framework, studies investigating the issue have developed their own indicators, covering issues such as: – understanding of energy use in the home – interest in, and attitudes towards, energy efficiency – confidence in using heating/cooling controls to manage temperature.
Dependencies and trade-offs with other impacts	Improvements in knowledge, attitudes and self-efficacy may amplify the effect of the energy efficiency intervention, resulting in greater energy savings and/or enabling householders to better manage the trade-off between bill savings and thermal comfort. This impact, when present, may therefore contribute to greater downstream impacts such as improved health, reduced bill pressure and improved mental wellbeing.
Contextual factors and considerations	As discussed above, the presence of this impact is highly dependent on program design and implementation. However, in principle it should be available to all household types, regardless of socioeconomic and geographical considerations.

HOUSEHOLDER KNOWLEDGE, ATTITUDES AND BEHAVIOUR (2)

Criteria	Findings
Key studies assessing the impact	Databuild (2014). Evaluation of Non-Energy Benefits for the NSW Home Power Savings Program. Final report to the NSW Office of Environment and Heritage. GEER Australia (2017). Power Shift Project Two Deliverable 1: Overview of Energy Efficiency Co-Benefits. Report to Energy Consumers Australia. James, M., & Ambrose, M. (2017). Retrofit or Behaviour Change? Which has the Greater Impact on Energy Consumption in Low Income Households? Procedia Engineering, 180, 1558-1567.
Transferability of existing estimates	Given that this impact is highly dependent on program design and implementation, estimates are not transferable to other interventions.
Next steps	To advance the understanding of how energy efficiency interventions may contribute to improved knowledge, attitudes and self-efficacy, it is important to establish a common framework and survey instrument for measuring change. Linkages to other impacts should be explored further, particularly considering the role program design incorporating knowledge, attitudes and self-efficacy considerations may have on amplifying the impact of any physical energy efficiency measures.