

*Cost benefit pathways to zero emission
housing: Implications for household
cash-flows in Melbourne*

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Lifetime Affordable Housing

- Australian Research Council funded linkage project

- Key research themes:
 - I. Lifecycle costs
 - II. Metropolitan location
 - III. Affordability
 - IV. Policy implications

Project partners

- RMIT University
- UniSA
- Building Commission
- VicUrban
- Land Management Corporations (LMC) SA

Context - Increasing energy use

- Energy consumption by households is an important contributor to greenhouse gas emissions
- Increase of nearly 20% 1996 -2006
- Costs of operation set to increase
- Sustainability debates presented as opposed to affordability problem

The case for higher standards

- UK, EU, parts of USA – zero emission new housing by 2020
- Not on agenda in Australian policy
- Debate over energy efficiency – affordability Vs. sustainability
- Lack of consensus on theory, practice & policy
- Lack of clear evidence in Australia about low emission housing
- What does it mean for households?

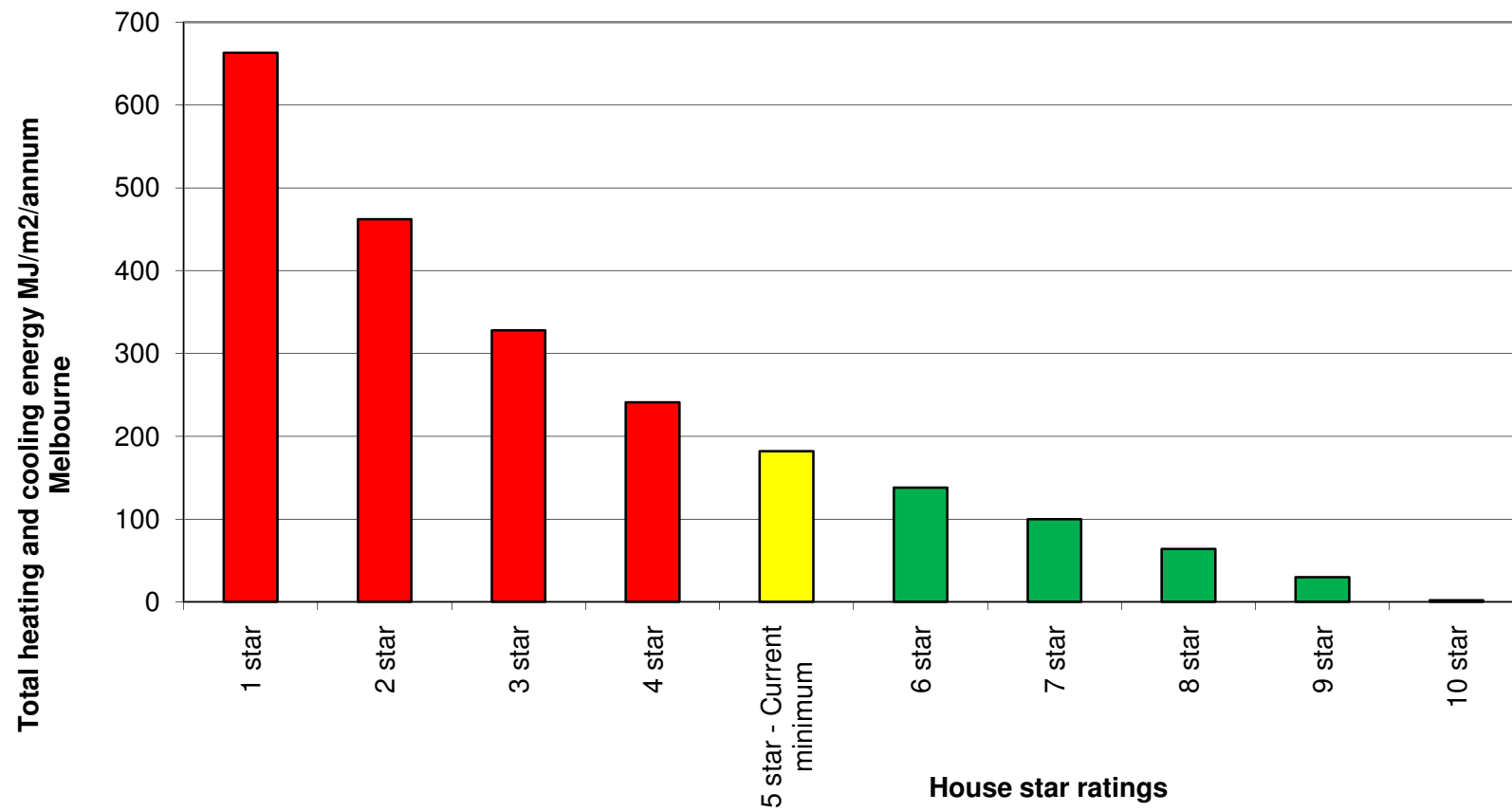
Four critical factors in household energy use:

1. Energy source
2. Efficiency of equipment used
3. Size of space being heated
4. Efficiency of building shell

NatHERS rating system:

- Unique starbands are set for each climate zone in Australia, taking into account the extremes of the local weather conditions.
- The Nationwide House Energy Rating Scheme (NatHERS) approved software *AccuRate*, is used in order to estimate the total space conditioning energy requirement

National House Energy Rating Scheme



THEME 1: Housing life cycle costs & benefits

- Research questions

- What are the through-life costs & benefits of predominant housing forms in Australia's major cities?
- How might infrastructural investments affect the ongoing costs associated with housing?
- What are the through-life costs & benefits of improved building envelope thermal performance & incorporation of RE technology?

This paper: Aims

- I. Empirical analysis of the through-life costs & benefits of improved building envelope thermal performance & renewable energy options for new housing in Victorian climate conditions?
- II. Assessment of the cash flow implications of low emission housing for households?

Through life costing approach

- 5 scenarios of increasing energy efficiency and renewable energy levels
- Cost Benefit Analysis
- 40 year time-horizon
- Supply & demand factors
 - thermal efficiency & onsite solar photovoltaic, solar hot water
- Analysis:
 - Accumulated costs
 - Net Present Values
 - Cash flows
 - Payback periods
 - Resale value
 - With/without rebates & feed-in tariffs

Sample:

- 80 house plans
- Modelled in Accurate simulation software
- Energy efficiency upgrade scenarios
(insulation, glazing, shading)
 - 6 stars
 - 7 stars
 - 8 stars





Baseline Case

additional investment \$



Improved thermal performance



Renewable Energy Technology

energy saving

energy generation

Time-horizon



energy price scenario



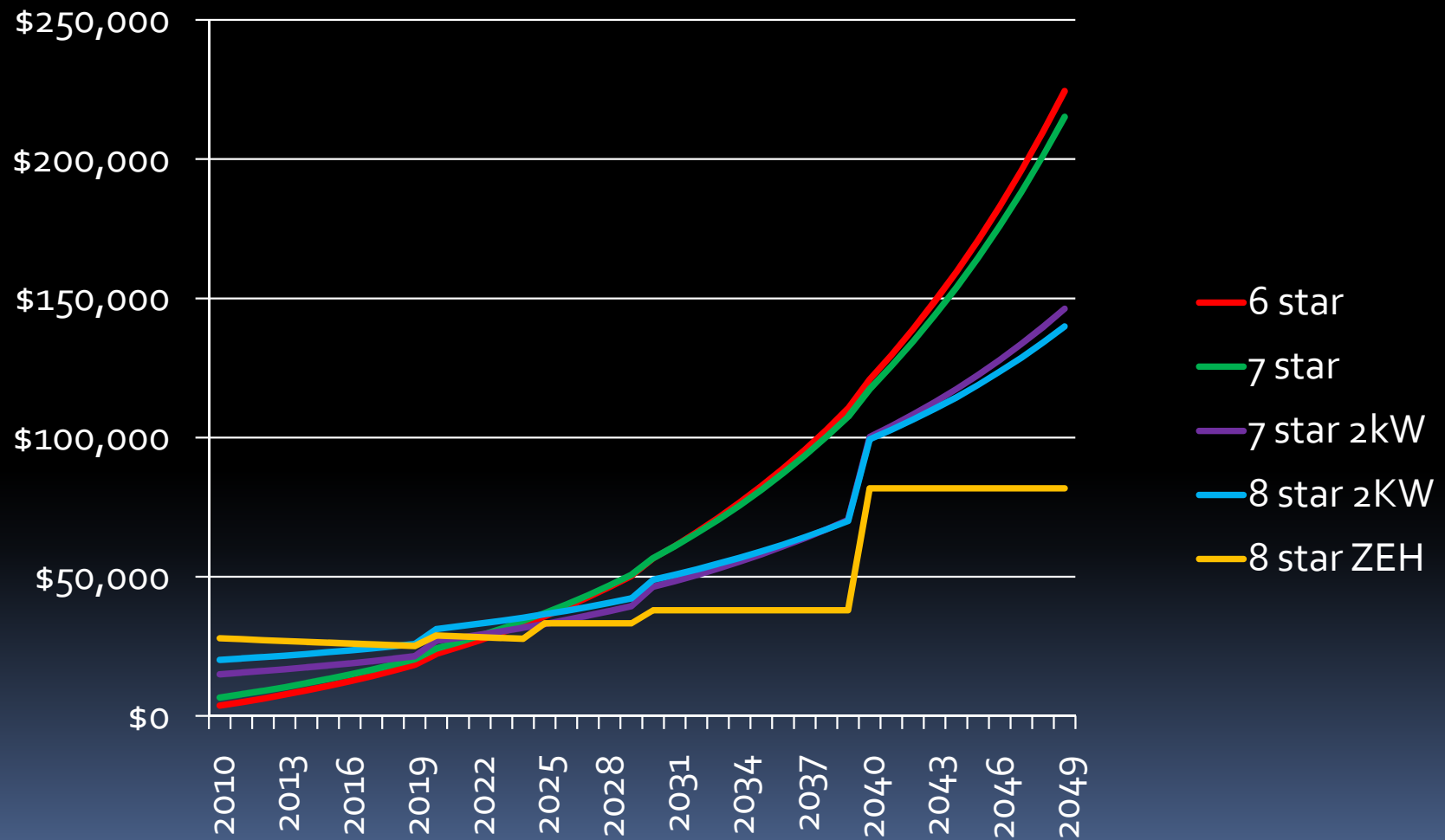
Cost savings \$



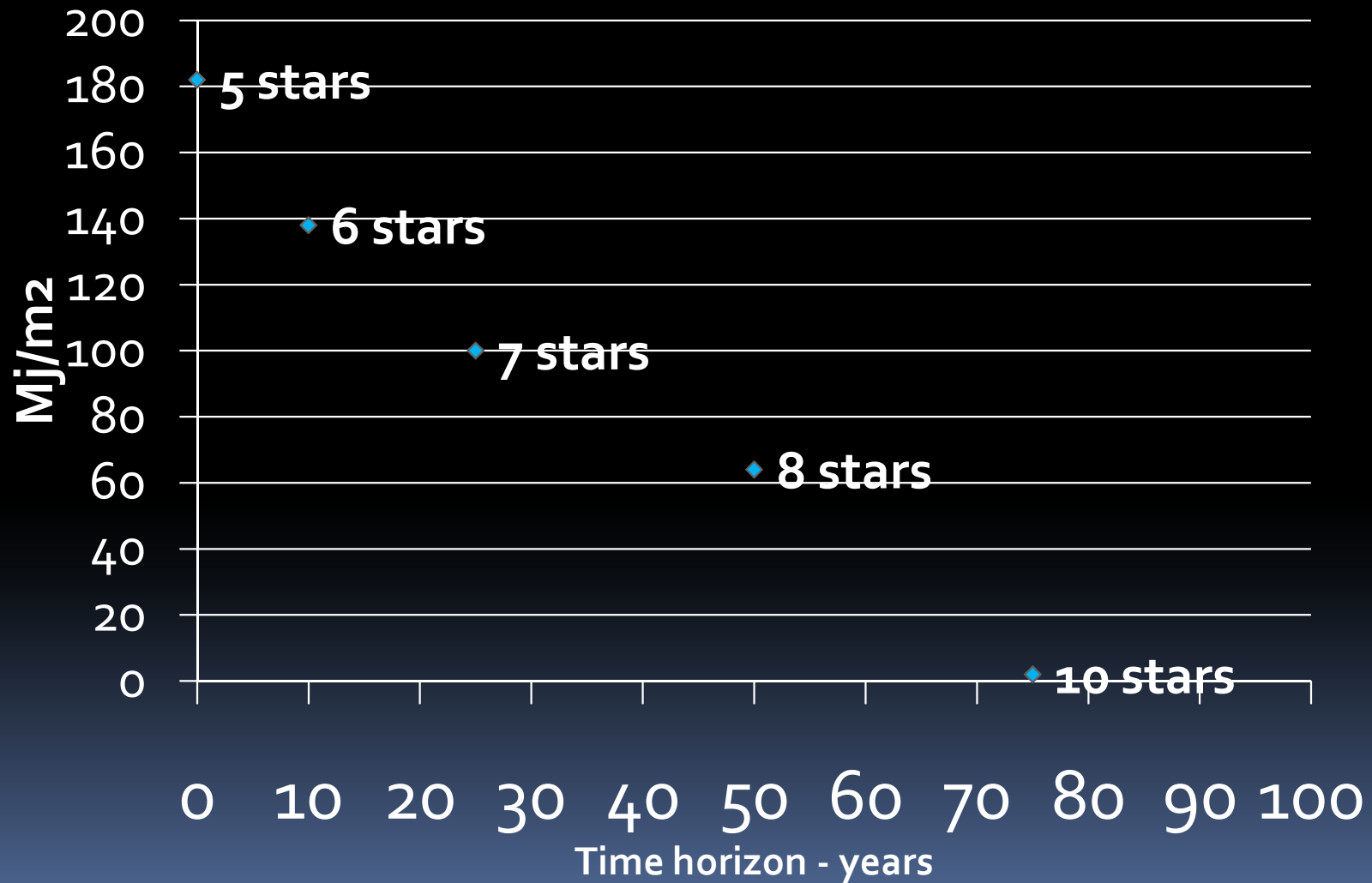
Scenarios

Scenario	MJ/m ² /an num	RE options	Emissions reduction compared to 6 stars
6 stars	138	None	NA
7 stars	100	None	5.70%
7 stars 2kW	100	2kW SPV	55.50%
8 stars 2kW	64	2kW SPV	60.90%
8 stars ZEH	64	3kW SHW SPV,	100.00%

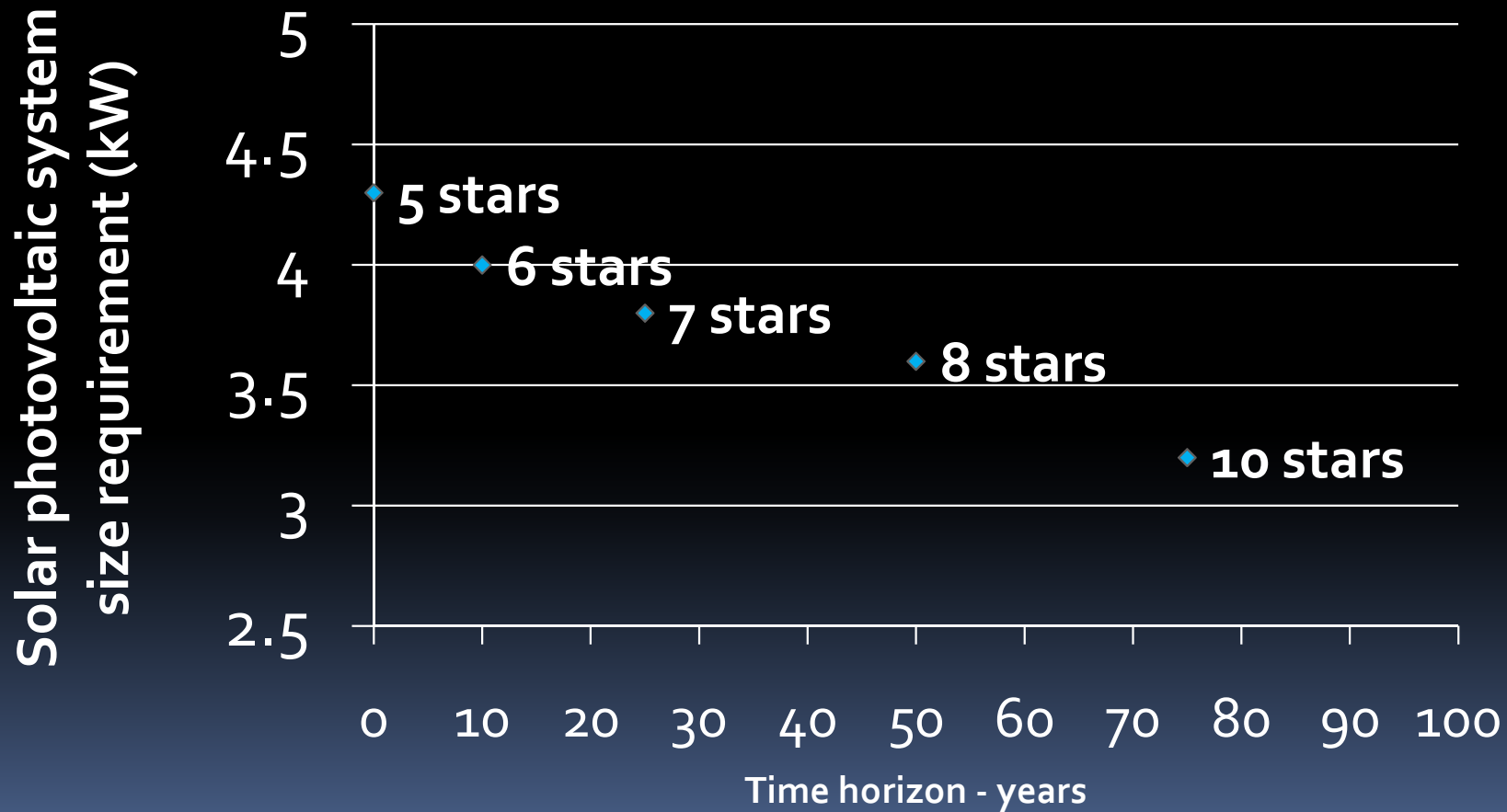
Results - Accumulated costs across time



Results - Cost optimal performance



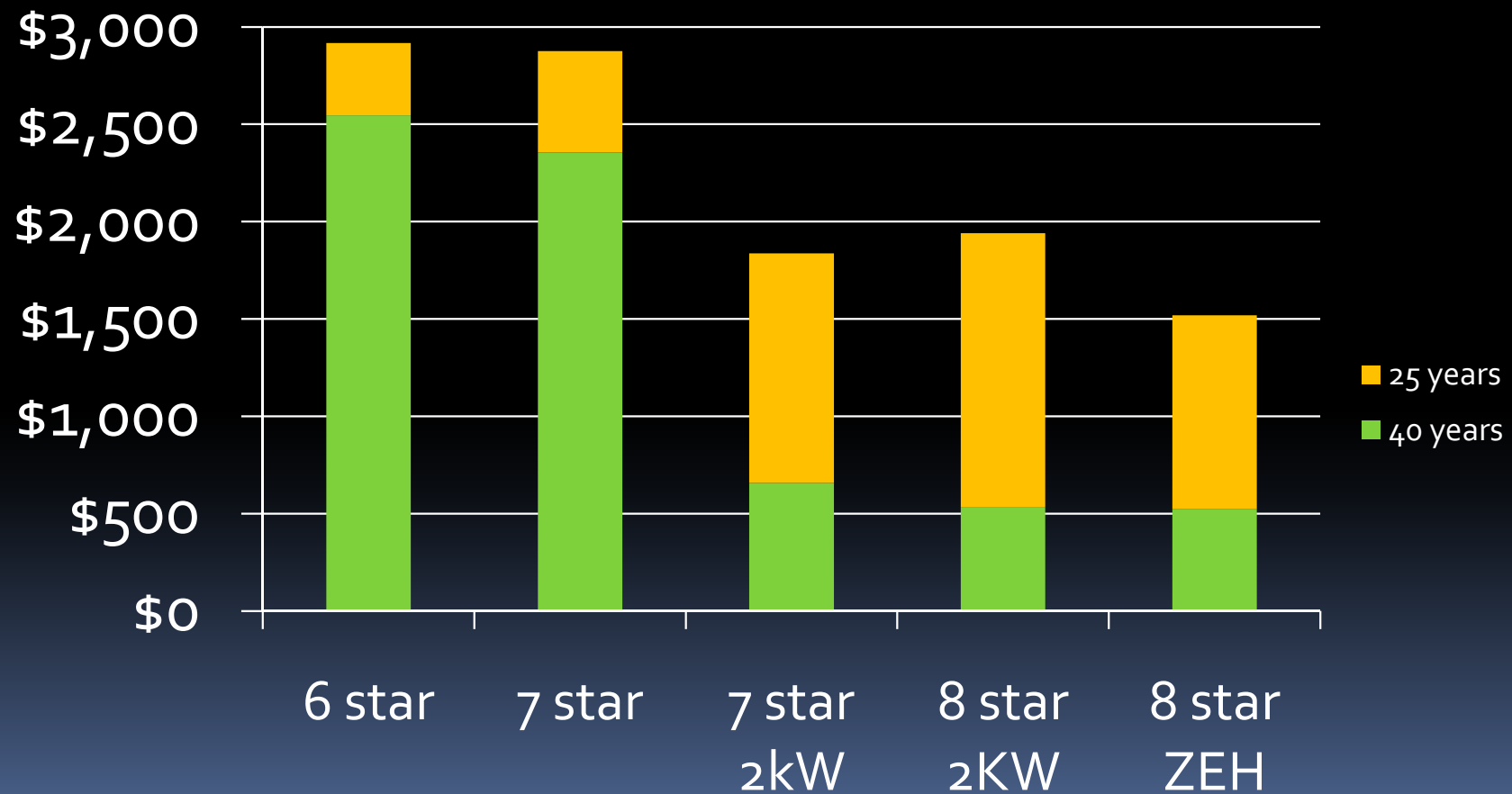
Results - SPV size requirements for cost optimal scenarios across time



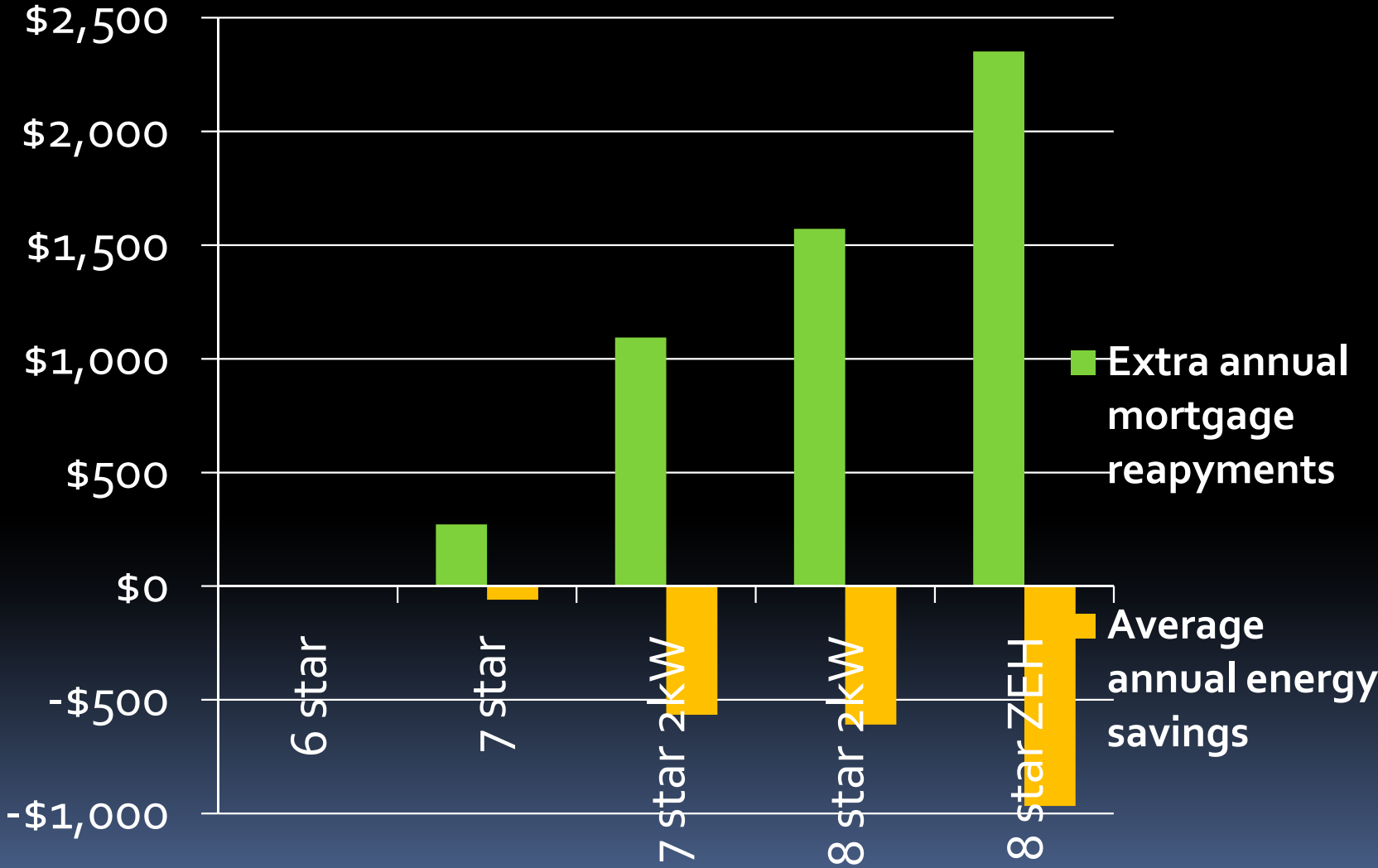
Results summary

- 8 star ZEH with 3kW SPV and SHW cost optimal across 50 years
- Environmental savings/yr
 - 6,250 kWh of fossil fuel energy
 - 8,375 kg of GHG emissions equivalent
- If all 39,000 new detached housing; save/yr
 - 243,750,000 kWh
 - 326,625 tonnes GHG emissions equivalent
- Over 50 years this would save:
 - 6,331,250 tonnes of GHG emissions equivalent for houses built in 2010

Results - Averaged annualised costs



Results - Mortgage costs vs. energy savings



Results summary

- For an extra upfront cost of 7%, savings of 64% across 40 years could be achieved by 8 stars ZEH
- Including extra mortgage repayments this reduces to a saving of 52% across 40 years
- Accumulated savings are significantly greater when energy efficiency is combined with renewable energy technologies
- Based on home loan assumptions would add approx \$115/month or \$3.78/day

Implications:

- Housing - a long lasting infrastructure that is far more expensive to retro fit for low energy performance than to construct to minimum standards.
- Significant energy & emissions savings can be made through better energy efficiency and renewable energy

Implications (2) emissions reduction

- Three key components to reduce emissions:
 - heat demand reduction (orientation, house size)
 - increased energy efficiency (heating / cooling equipment efficiency)
 - conversion from fossil fuels (renewable technologies)
- These can't be addressed in isolation – e.g. focus on star ratings alone

Conclusions:

- Analysis suggests it is economically beneficial to construct ZEH
- Significant accumulated savings from improved energy efficiency and renewable energies
- However, will add to mortgage repayments
- Next steps
 - What are the pathways to achieve ZEH?
 - How can we ensure that it is affordable to consumers?

Comments / Questions?

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