

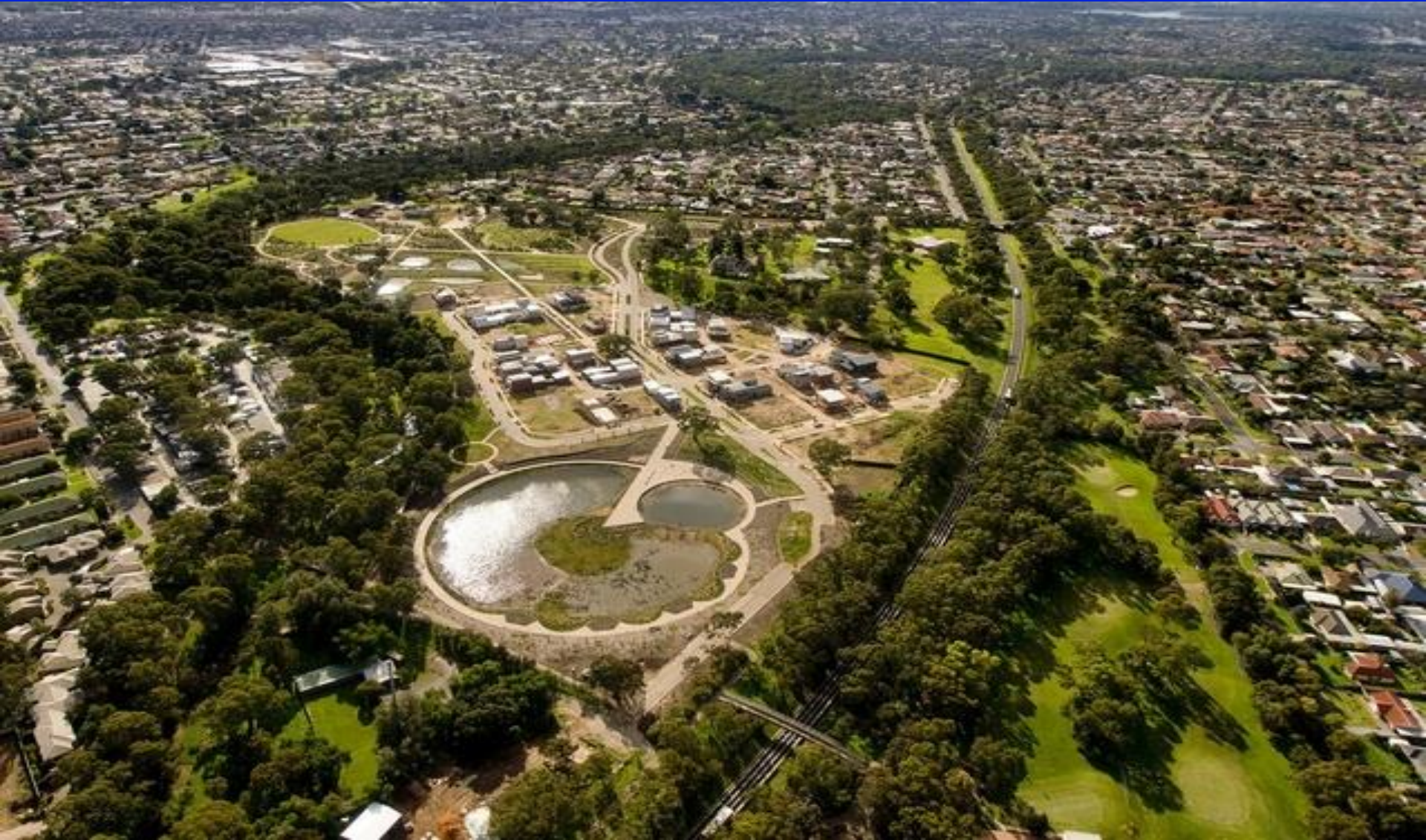
# Do zero energy homes make economic sense?

## Lessons from Lochiel Park Green Village

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PhD, MSc, GCert Policy Studies, B Business, B App Sc  
Presentation to the Sustainable Places  
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# The research site





# Lochiel Park Green Village



# Deeper Understanding

## Comprehensive analysis

- Households
  - Who are they, what do they think, why do they live there, are they comfortable with energy technologies, ....
- Industry
  - Are NZC homes hard to design, hard to build, can the supply chain deliver, is the standard too high, ....
- Government
  - How is the policy delivered, what are the societal impacts, does it make economic sense ....

# Sustainability Standards

## Minimum requirements:

- Thermal comfort 7.5 NatHERS Stars
- Solar water heater, gas boosted
- 1kWp PV for each 100m<sup>2</sup> floor area
- High rated appliances
- Low energy lighting (CFLs & LEDs)
- Ceiling fans



# Lochiel Park Residents

## Family characteristics

- Average no. persons = 2.7
- 28% households have kids
- 15% households include seniors

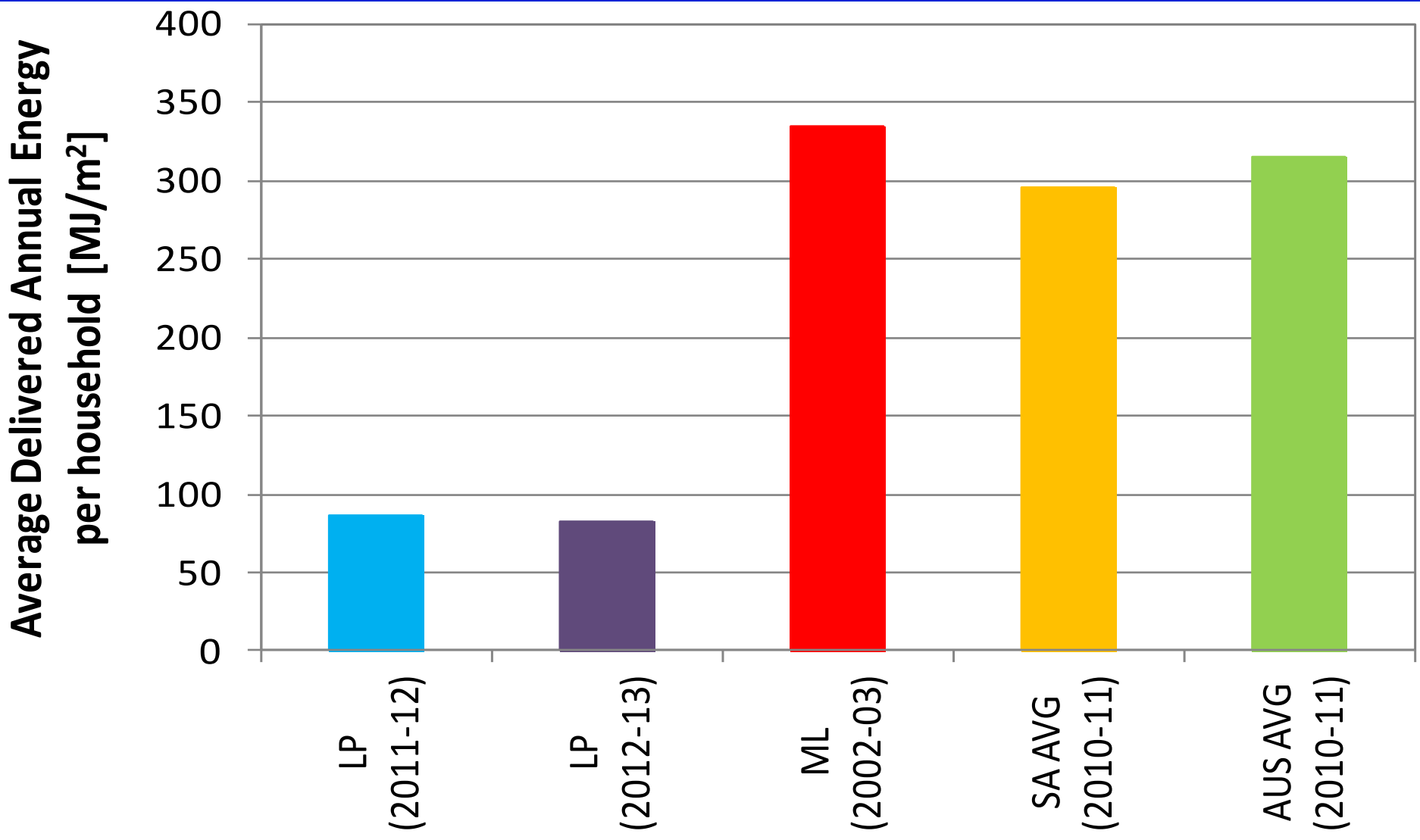
## Ownership characteristics

- Owners, renters, public housing

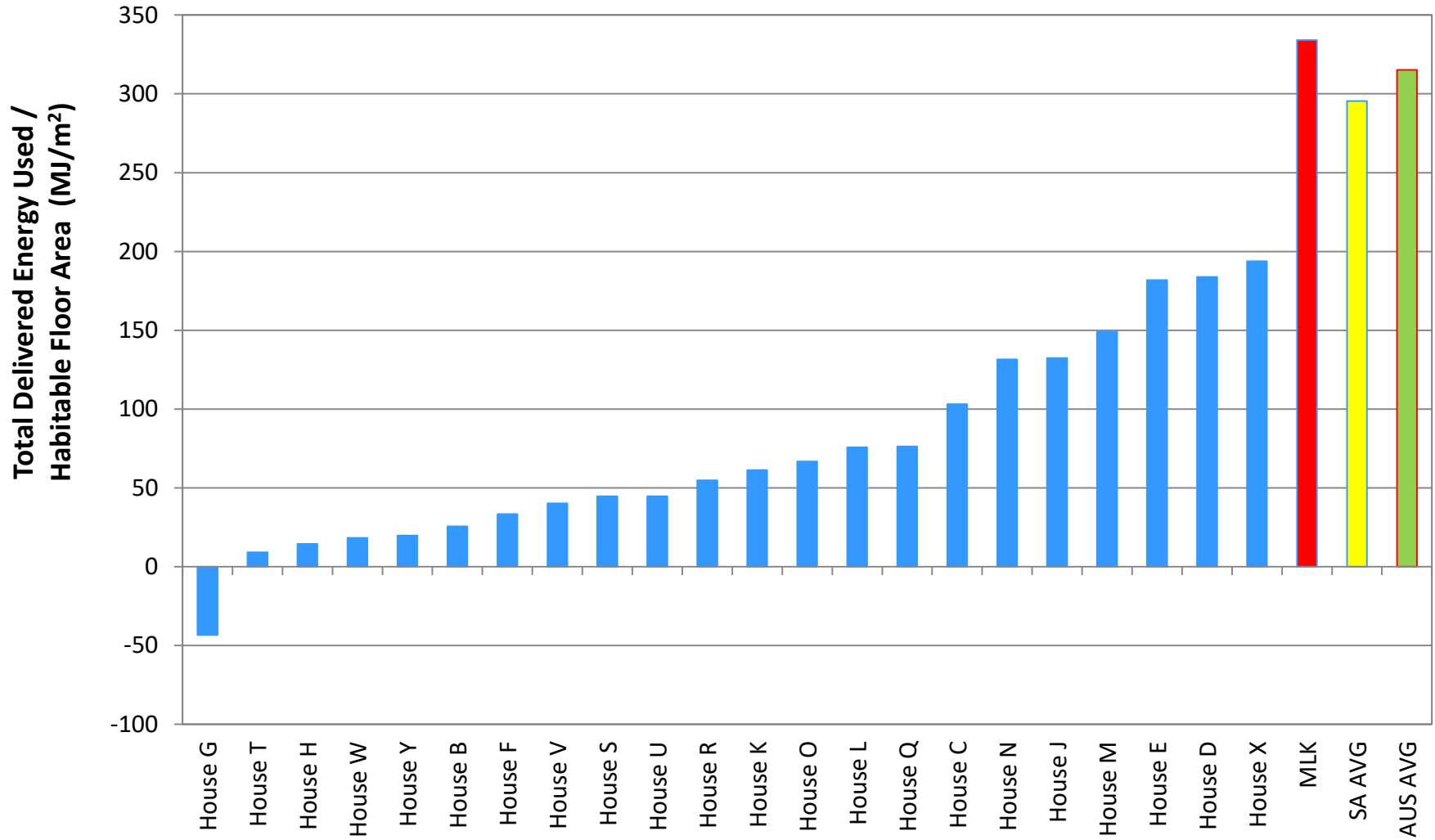
## House characteristics

- Average no. Bedrooms = 3 (range 1~4)
- 80% have a home office
- Average floor area = 203m<sup>2</sup>

# Lochiel Park Results



# Delivered Energy Use







# Lochiel Park Technologies

## Electrical Equipment per Household

- Ave no. TVs = 2.2 (420w)
- Ave no. Computers = 2.2
- Ave no. Refrigerators = 1.6 (664 litres)
- Ave no. Lights
  - fixed indoor lights = 41
  - portable lights = 6
  - outdoor lights = 10
- Ave fixed indoor lighting = 748w (3.75w/m<sup>2</sup>)
- Ave no. stuff = 103 electrical items

## Photovoltaics

- Array size ranges from 1.5 kWp to 4.2 kWp (ave 2.49 kWp)

# Thermal Comfort

	90% Monitored Temperature Range (°C)					ASHRAE 90% Comfort Range
	House CC	House AA	House J	House W	House Y	(Adaptive Comfort Model)
Heating	17.4 – 21.8	16.2 – 23.2	16.6 – 22.5	16.5 – 22.9	15.1 – 21.5	19.0 – 24.0
Cooling	23.9 – 28.7	22.6 – 28.1	24.2 – 29.5	23.0 – 31.2	21.4 – 31.1	22.3 - 27.3

# What do users think?

Household U:

*'... the thermal comfort is fantastic. Particularly the even nature of thermal comfort throughout the year. The performance in the cooler months is particularly good, ....'*

# Magic Formula to NZE

Average Net Zero Energy Impact =

- NatHERS 7.5 Stars (<58 MJ/m<sup>2</sup>)
- Solar water heater 40 STCs
- Lighting density 3 W/m<sup>2</sup>
- PV 2.75kWp plus 1.0kWp per each 100m<sup>2</sup>



# Economic Analysis

- Start at national building code level
- Change technologies to NZE level
- Utilise actual use data to incorporate rebound
- Apply GDP inflation
- Apply discounts rates used for Aust Govt policy decisions
- Apply measured learning rates for technologies
- Apply policy for 10 year period
- Monetise only those benefits and costs with high confidence (eliminate many real benefits)



# Costs & Benefits

## Key costs

- Additional construction costs
- Mostly technology purchase
- Supply chain responds quickly

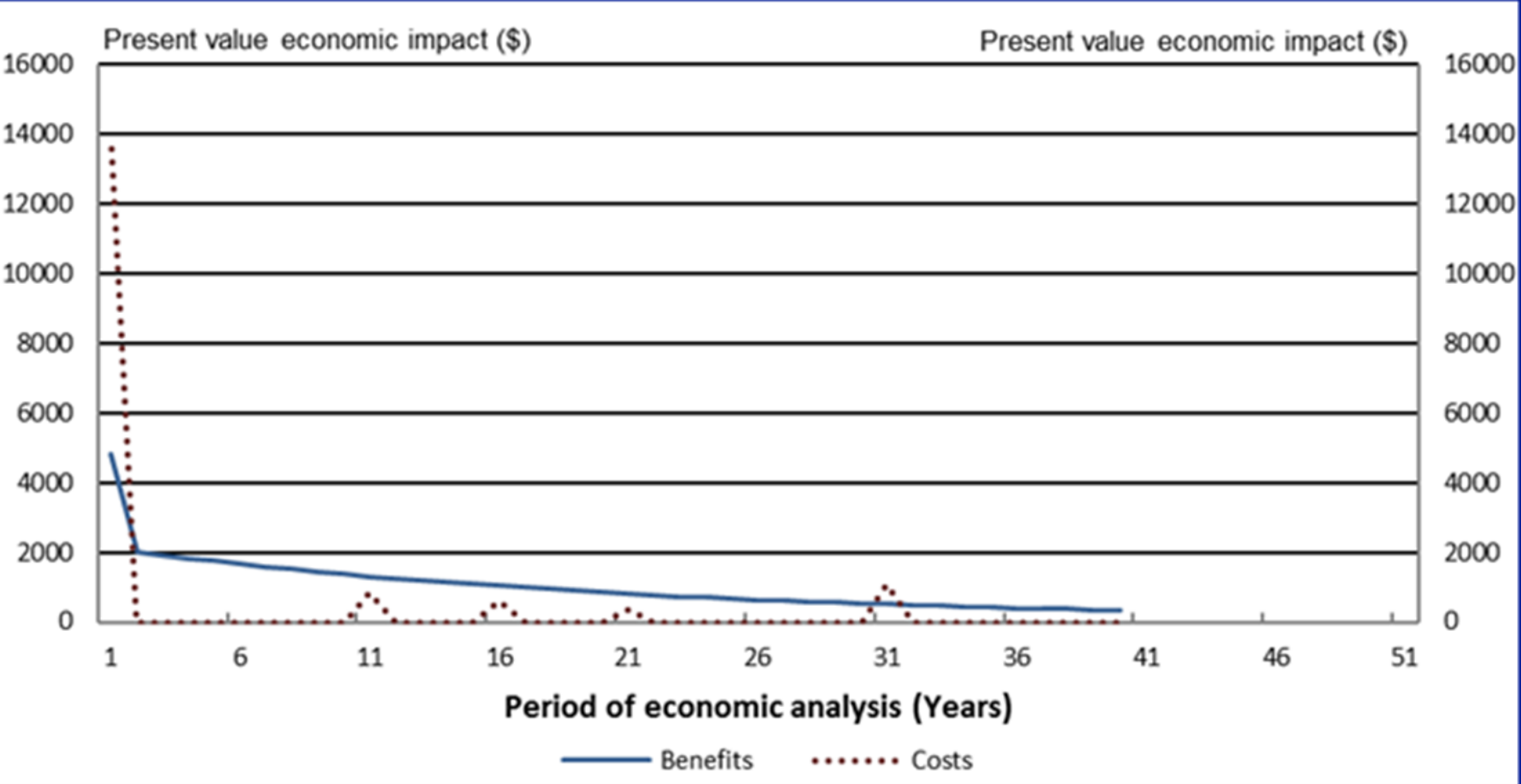
## Key benefits

- Large energy savings
- Sale of 50% electricity generated
- Health, comfort, asset & intrinsic value

# Economic impact to Owner

<b>Benefit</b>	\$41,355
<b>Cost</b>	\$16,420
<b>Net Present Value</b>	\$24,935
<b>Benefit/Cost Ratio</b>	2.52

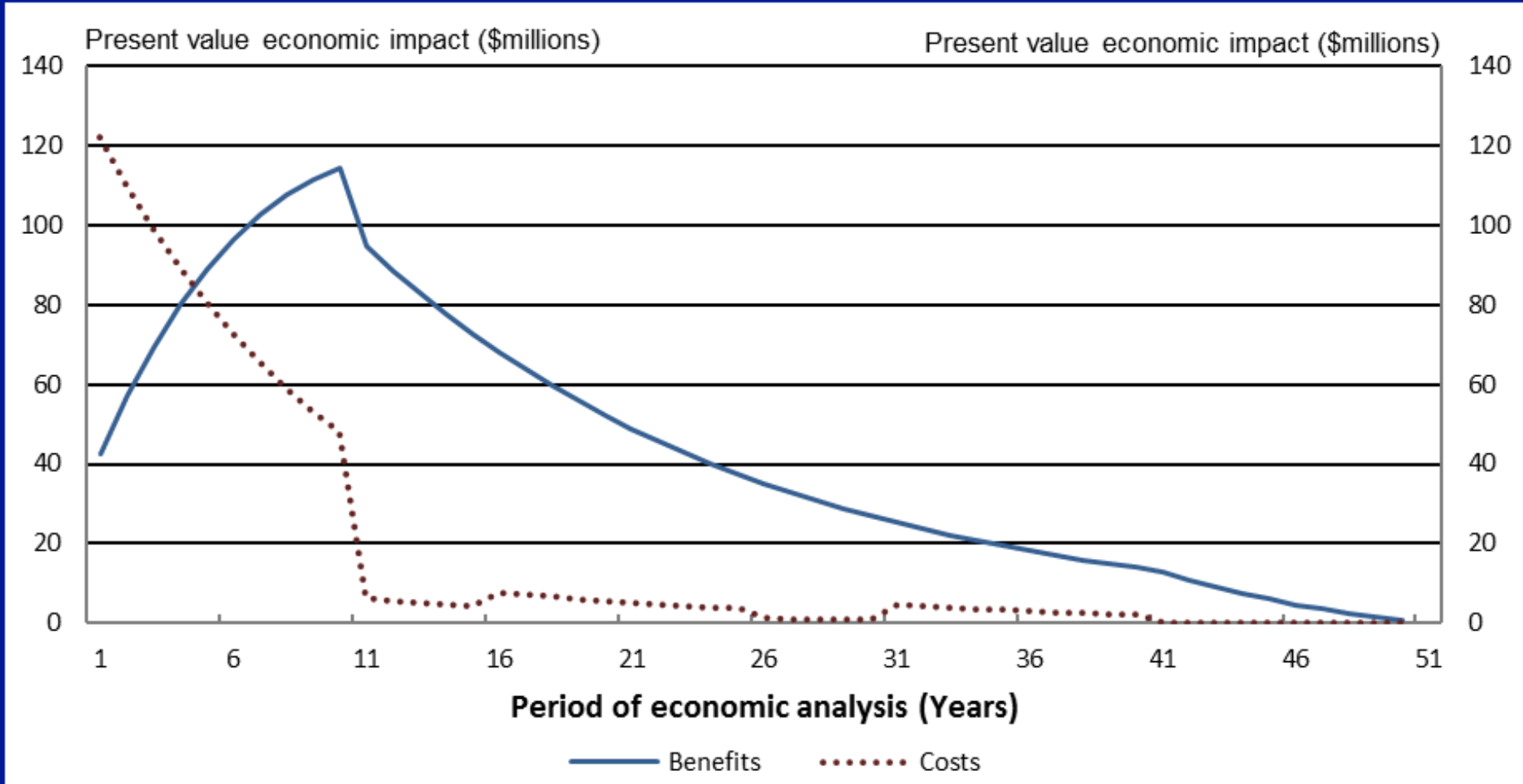
# Home Owner Economics



# Economic impact to Region

<b>Benefit</b>	\$2,206m
<b>Cost</b>	\$919m
<b>Net Present Value</b>	\$1,288m
<b>Benefit/Cost Ratio</b>	2.40

# Societal Economics







# Summary

- Lochiel Park is demonstrating low carbon living
- Industry has the ability to deliver now
- The economics stack up
- The people love low carbon living
- All we need is political will

# Thank you

