Climate change, energy and housing - what's possible in NZ?

The changing role of households in a carbon-constrained future

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UNIVERSITY of OTAGO

SAPERE AUDE

Te Whare Wānanga o Otāgo

NEW ZEALAND

Why do we need to do things differently?

- Legacy of poor quality housing
- Health & wellbeing impacts
- Energy poverty
- Housing shortage and affordability
- Inefficient use of energy
- Impacts of climate change on housing
- Impacts of housing on the climate

What I'll cover

1. Climate change - the big picture
2. Taking action now
3. Climate change impacts on housing
4. GHG emissions from housing
5. A changing energy future
6. What's possible?

1972 Apollo 17

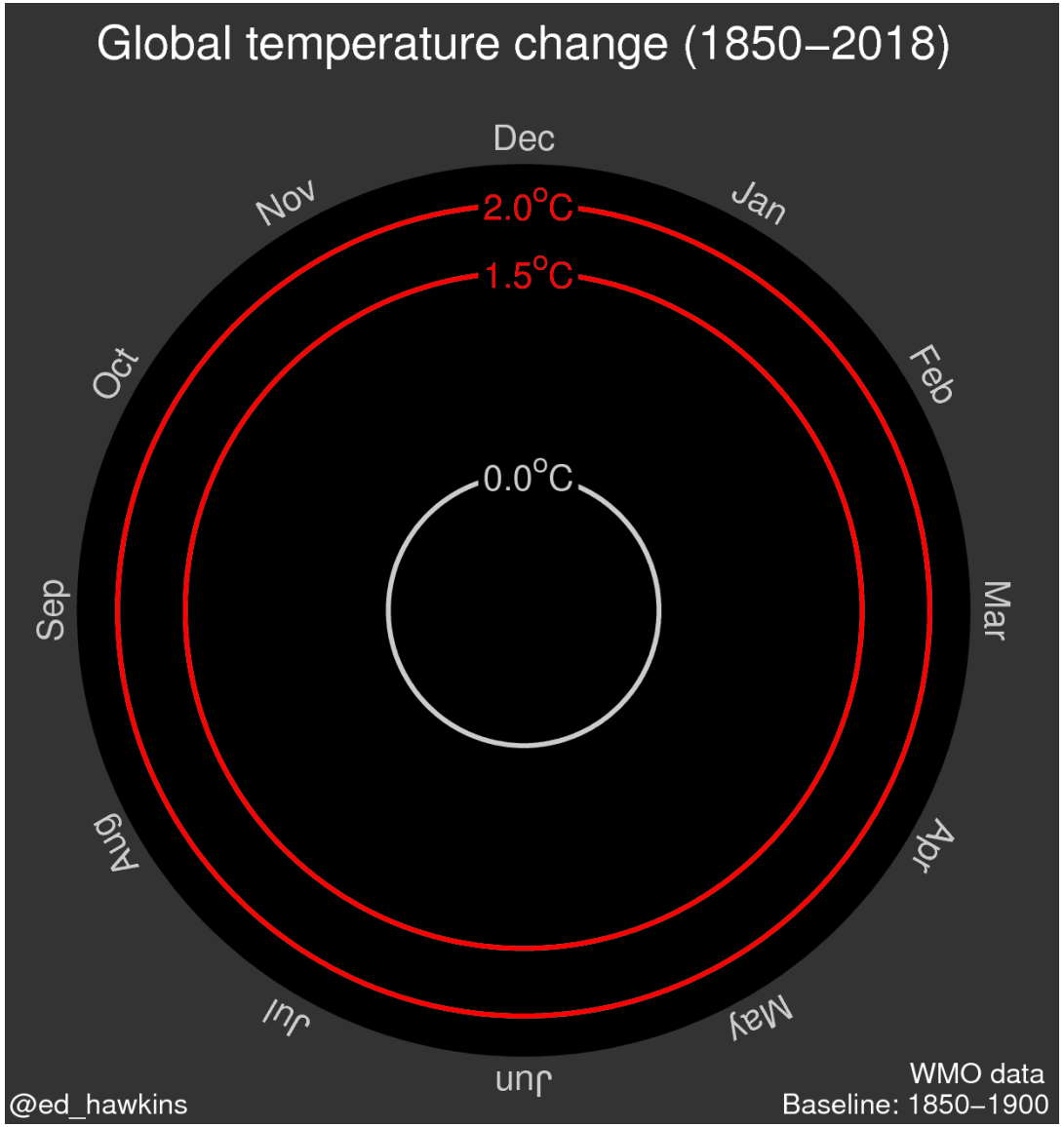
Earth’s decreasing capacity to support life

- Waste build-up
- Water pollution and scarcity
- Resource depletion
- Species extinctions
- Extreme weather events
- Ocean acidification & warming
- Sea level rise

Origins = industrial revolution, powered by fossil fuels

Bountiful energy created expectations of ever-increasing wealth and consumption

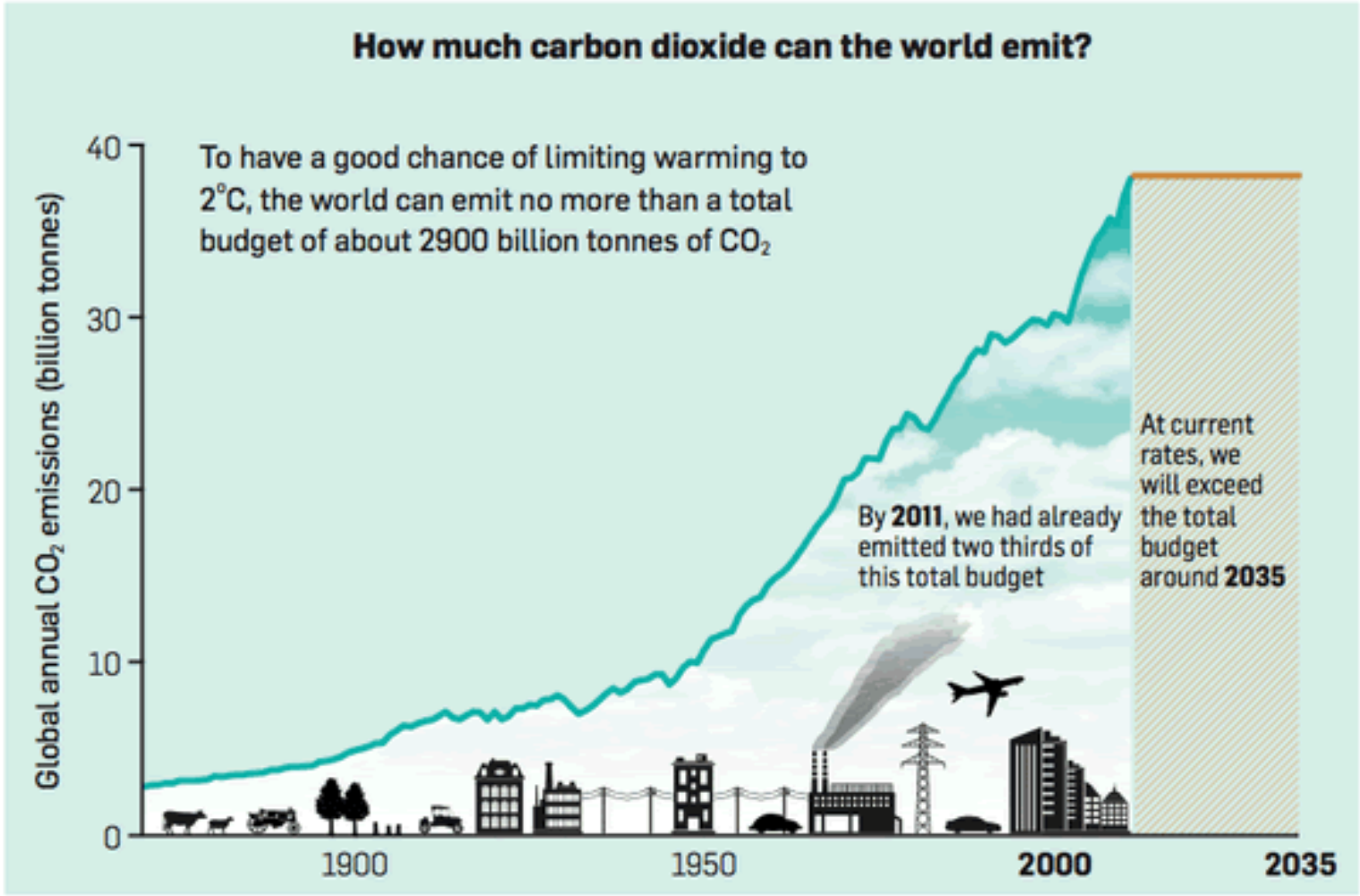
Global temperature increase



World Meteorological Organisation
https://public.wmo.int/en/files/spiral2018wmolargegif

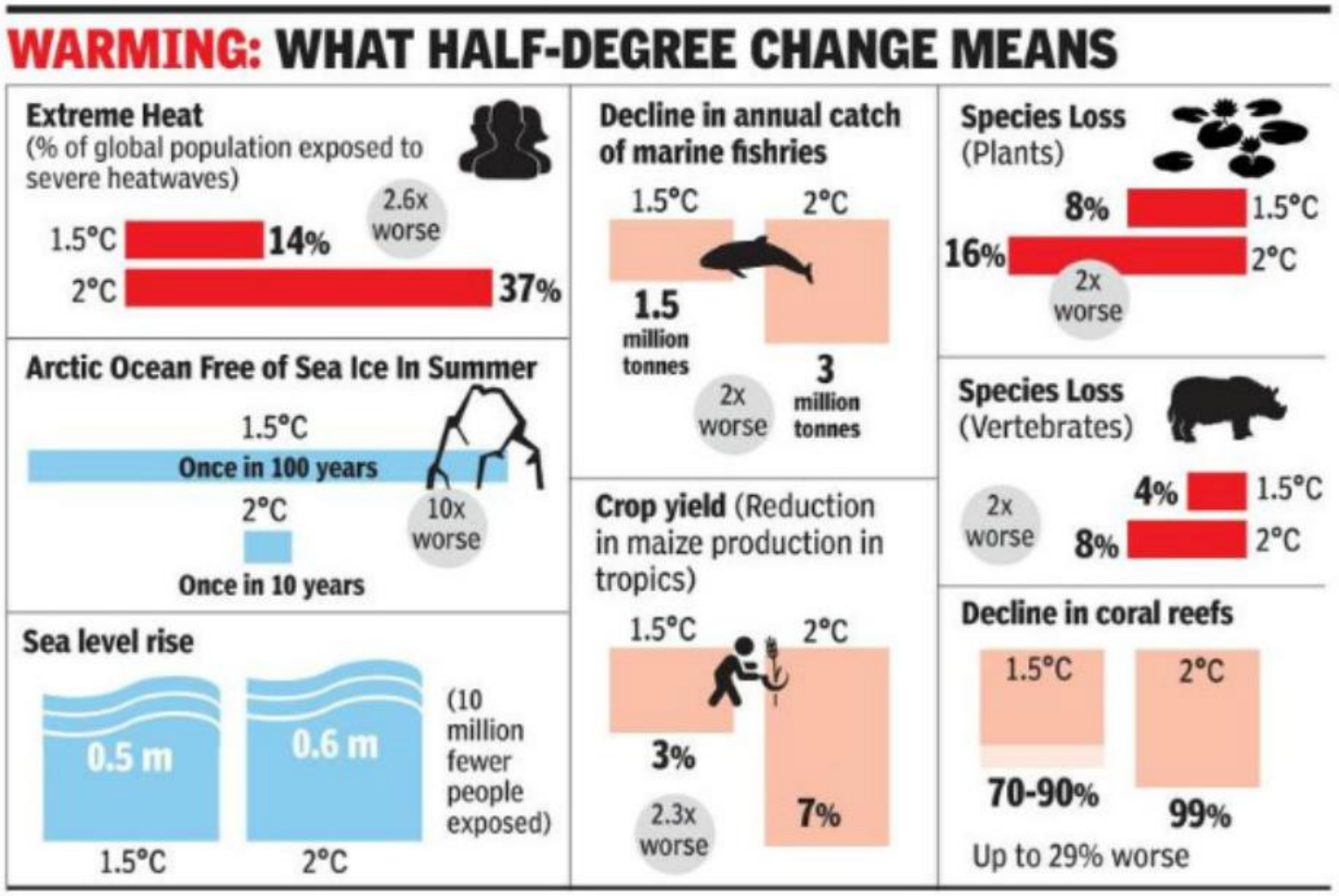
IPCC 2014: Fifth Assessment Report

FIGURE 1



Source: Information is sourced from the IPCC's Fifth Assessment Report, Working Group 1 (emissions data, Figure 6.8; carbon budget, SPM E.8)

IPCC 2018: need to limit to 1.5°C



IPCC 2018
Special Report on Global Warming of 1.5 °C

Global climate 2019: Climate change accelerates (synthesis report for IPCC)

Emissions not reducing

Already at 1.1°C

Impacts ‘harder and sooner’

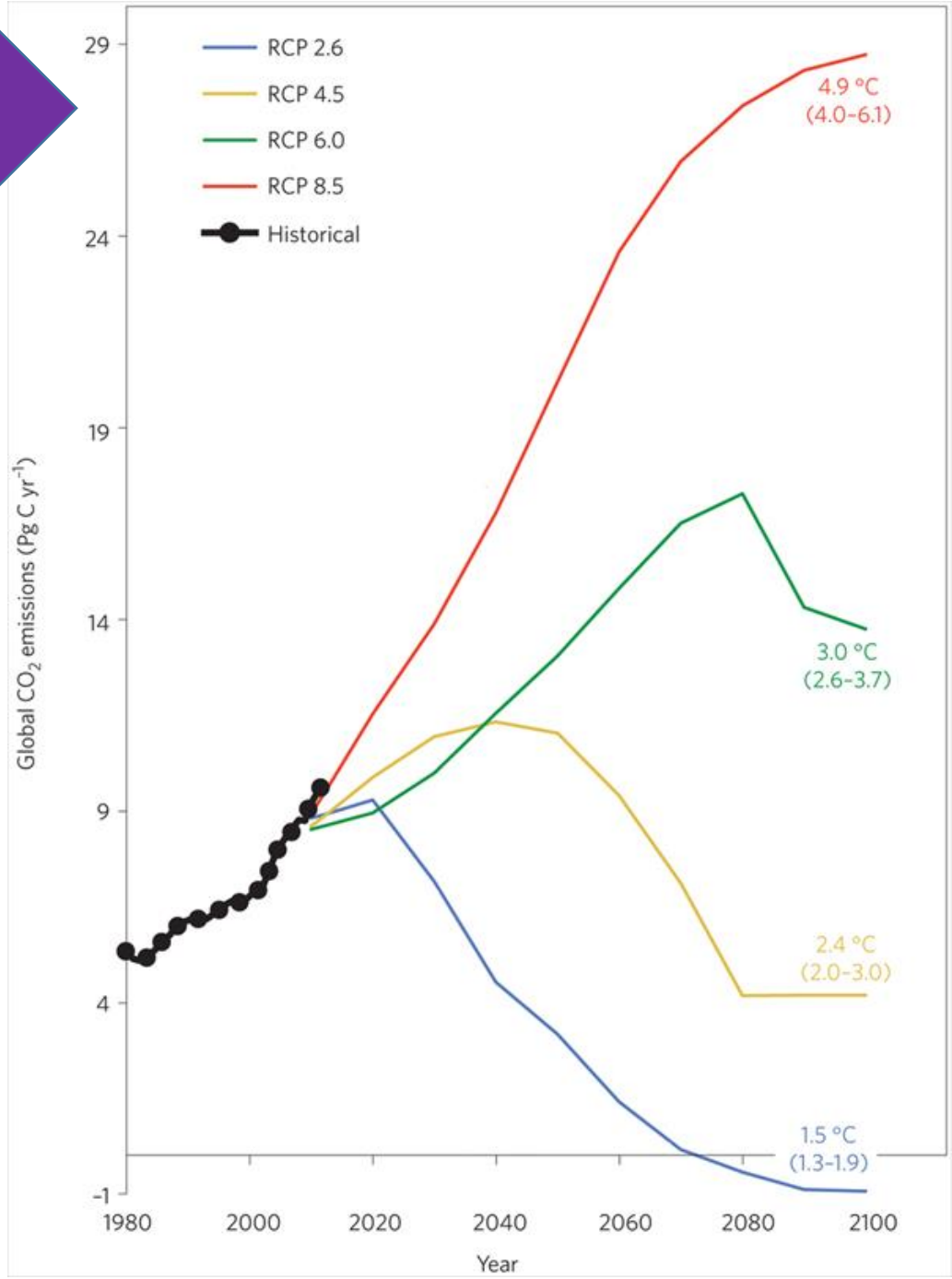
United in Science (2019) https://www.ipcc.ch/2019/09/22/united-in-science-report-climate-summit/

Pathways to the future

4-6 °C – Major impacts on humans and other species

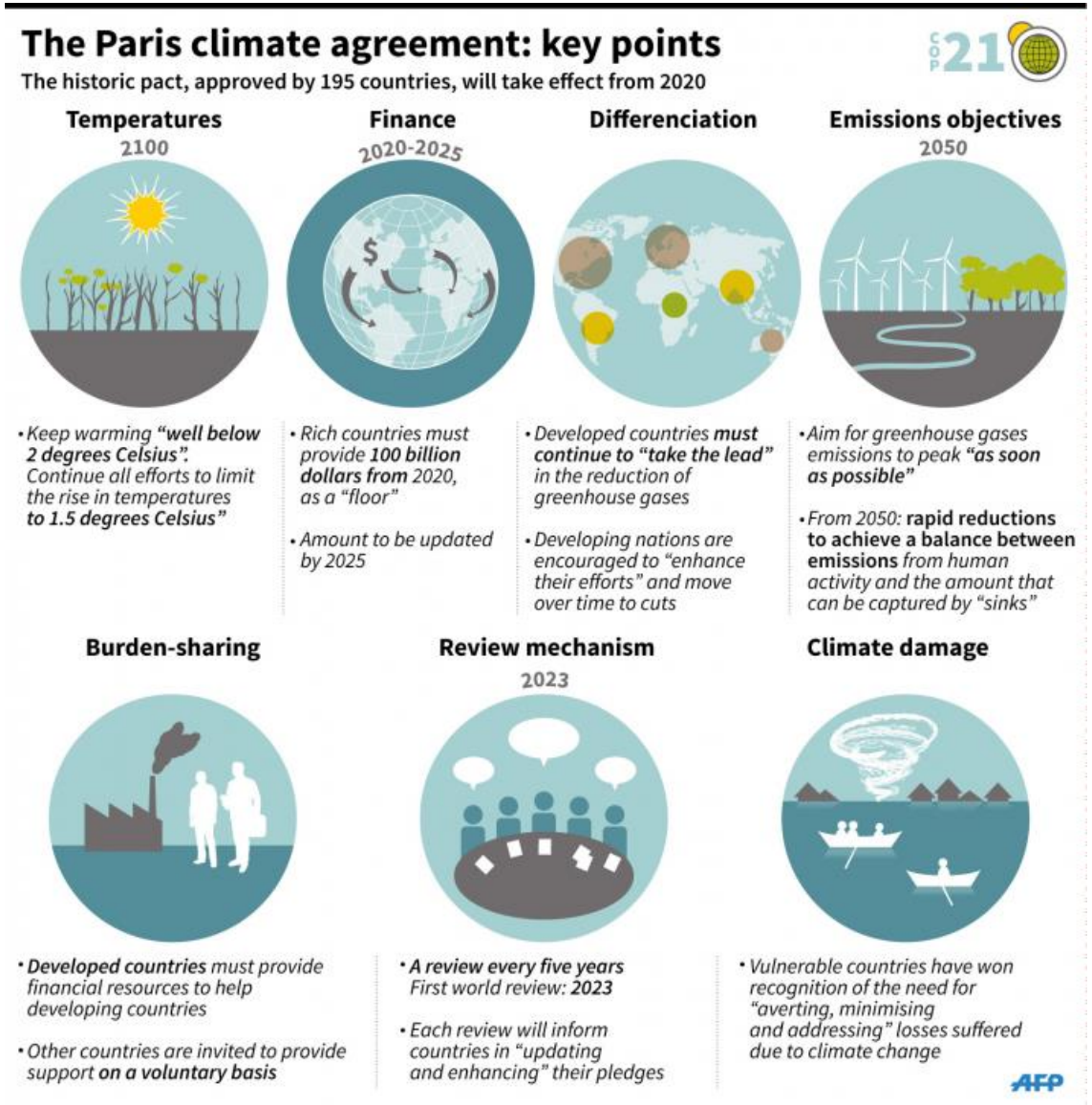
2-3 °C - Tipping points, irreversible change, some regions unliveable

1.5 °C - Significant climate impacts but a liveable planet



2. Action needed at all scales and sectors

Global action

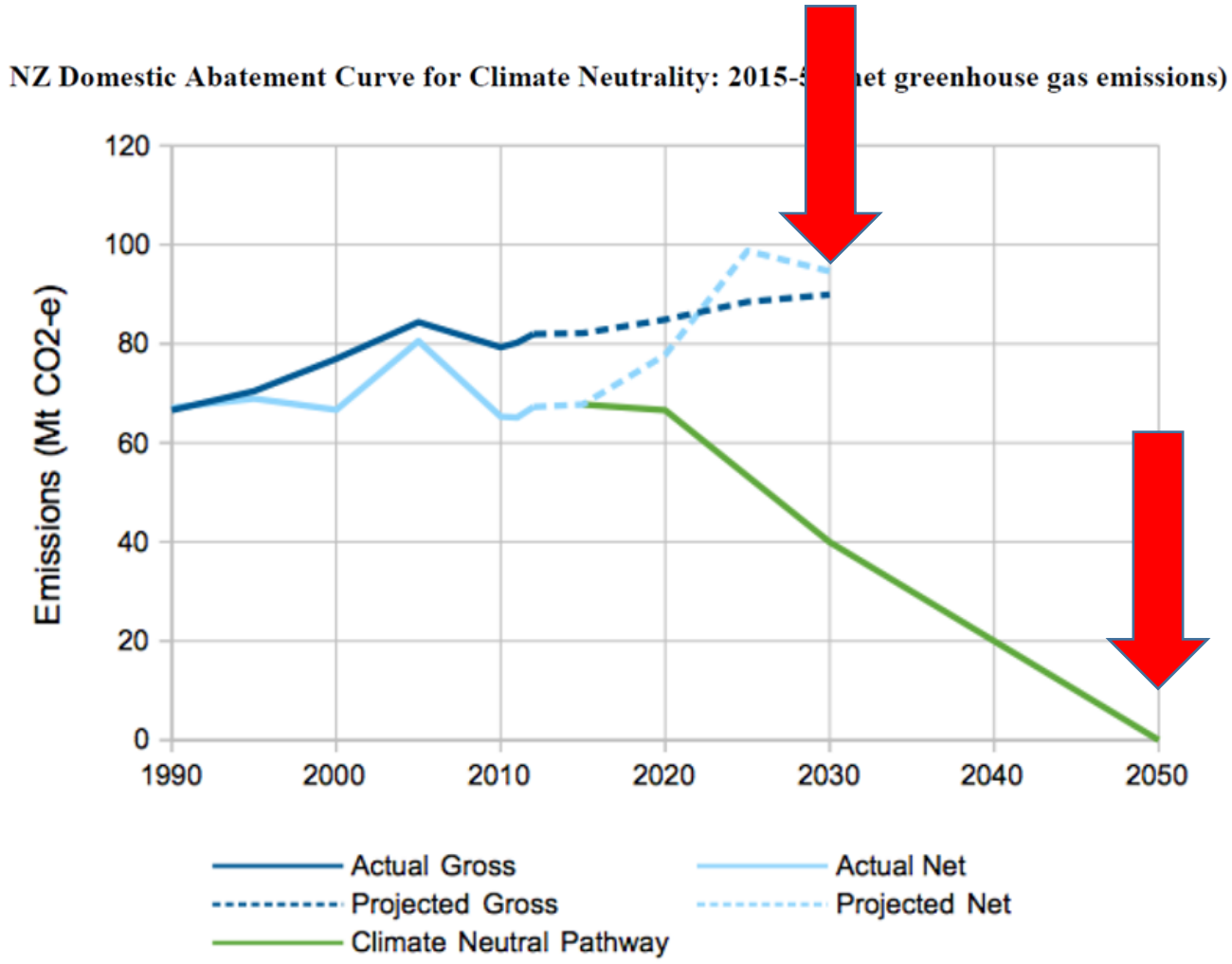


United Nations Framework Convention on **Climate Change** (UNFCCC)

New Zealand action

- **Reduce our emissions to net zero by 2050**
- **3-5% pa reduction**

- Zero Carbon Act 2019
- Climate Commission
- ‘Carbon budgets’



Councils increasingly concerned

Auckland Council declared a climate emergency – now what?

Published: 17 July 2019

"Our climate is changing and the time for action is now," says Mayor Phil Goff.

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NEW ZEALAND / ENVIRONMENT

Dunedin city council declares climate emergency

6:55 pm on 25 June 2019 Share this

Dunedin is the latest council to declare a climate emergency, setting i ambitious new target to reach net zero carbon two decades earlier tha planned.

Otago Daily Times

Dunedin 12 | 7 Tuesday, 23 July 2019 Send us news & photo

News Sport Life & Style Entertainment Business Regions

Thursday, 27 June 2019

QLDC declares climate emergency

Regions > Queenstown

Queenstown Lakes District Council passed a motion to declare a climate emergency by i 7-4. Photo: Paul Taylor

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NEW ZEALAND / ENVIRONMENT

Wellington declares climate emergency

4:42 pm on 20 June 2019 Share this

Charlotte Cook, Journalist
charlotte.cook@rnz.co.nz

HOME nzherald.co.nz Mobility

NEW ZEALAND

Hawke's Bay Regional Council declares a climate emergency

26 Jun, 2019 9:01am 3 minutes to read

HOME Bay of Plenty Times Tauranga trainer hea

BAY OF PLENTY TIMES

Climate emergency declared by Bay of Plenty Regional Council

28 Jun, 2019 10:33am 2 minutes to read

RNZ Home News Radio Podcasts & Series Topics Pacific

New Zealand World Politics Pacific Te Ao Māori Sport Business Country Co

NEW ZEALAND / ENVIRONMENT

Canterbury and Nelson councils declare climate emergencies

5:01 pm on 16 May 2019 Share this

Canterbury Regional Council earlier today voted to declare a climate emergency, becoming the first council in the country to do so.

Where does housing come in?

Anticipating climate change impacts

- Developing climate-resilient housing (adaptation)

Reducing greenhouse gas emissions

- Transition to net zero housing (mitigation)

Government, councils, iwi, communities, businesses, service sectors, NGOs, households ….

All involved in some way.

3. Climate change impacts on housing

Coastal erosion

Stuff: 8 Sept 2019. Residents can't go back after beachfront homes at Port Waikato deemed unsafe

More extreme storms

Ex-tropical cyclone batters New Zealand, sparking state of emergency in southern towns (Mapua, Nelson). Sydney Morning Herald, 1 Feb 2018.

Loss of infrastructure

Stuff: 28 May 2016. Eating the shore (Oamaru).

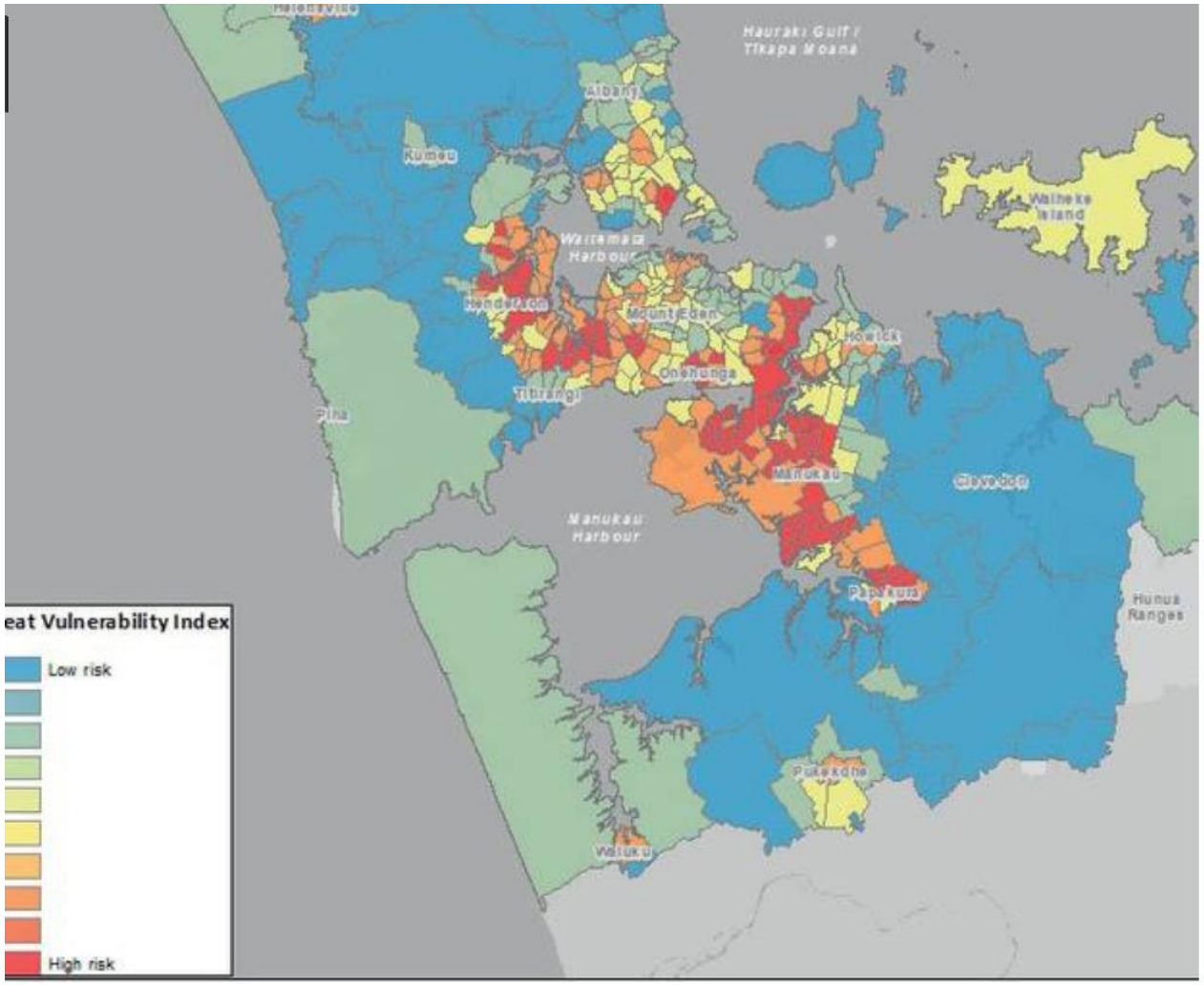
Fires

Stuff: 6 Feb 2019. Nelson bush fire: Pigeon Valley and Rabbit Island wildfires.

Water scarcity

Stuff: 7 May 2019. Tasman District Council estimates summer drought costs.

More extreme heat



NZ Herald: 20 March 2019. Extreme heat, disease and rising seas: how climate change threatens Auckland

At-risk urban areas

South Dunedin flood, June 2015

Photo: Stephen Jaquiery, Otago Daily Times, 16 Dec 2015

Future urban relocations?

Stuff: 13 April 2019. Sea level rise will cause $7b worth of damage to Wellington unless emissions are drastically cut.

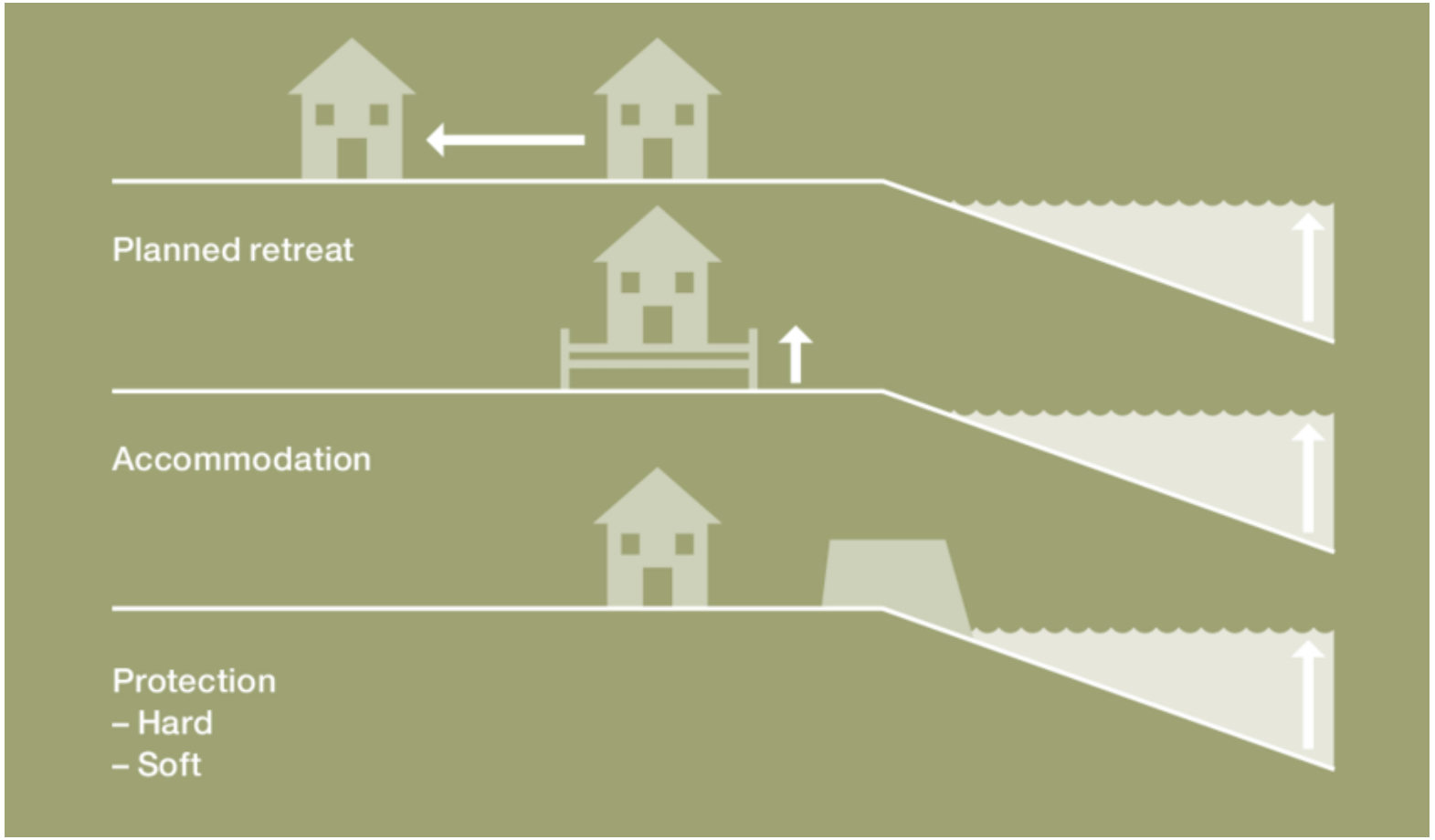
Issues for housing sector

- General exposure – heat, water scarcity, extreme storms
- Pockets of extreme exposure – floods, erosion, fire
- Forced abandonment of individual homes
- Planned retreat
- Health and wellbeing impacts

Impacts incrementally worsening PLUS extreme events

- Likelihood of inequitable impacts
- Fairness of solutions

e.g. Designing for sea level rise



Parry, M., Arnell, N., Berry, P., Dodman, D., Fankhauser, S., Hope, C., ... & Wheeler, T. Adaptation to climate change: assessing the costs. *Environment*, (2009) *51*(6), 29-36.

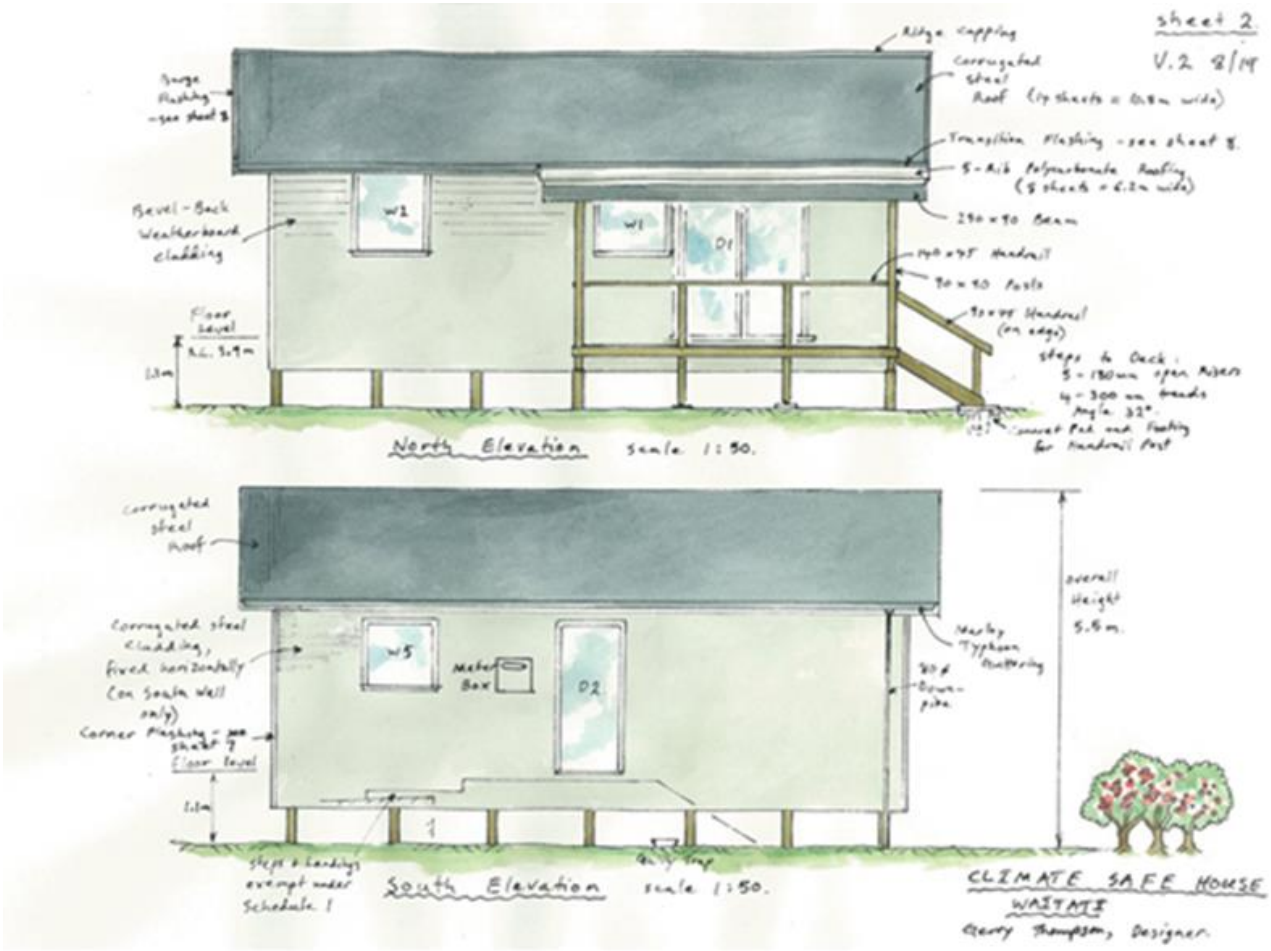
Climate safe housing

BRCT

Blueskin Resilient Communities Trust

NZ's First Climate Safe House

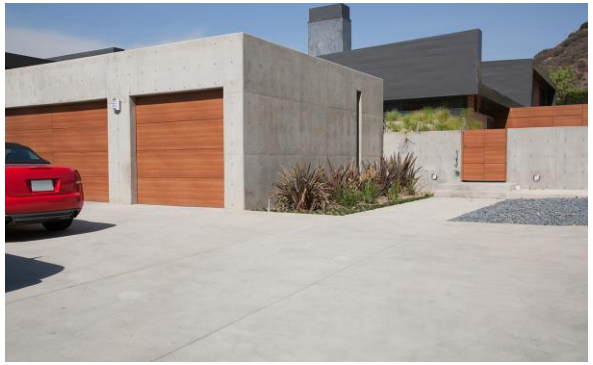
Pledge Me



4. Greenhouse gas emissions from housing

Life cycle approach

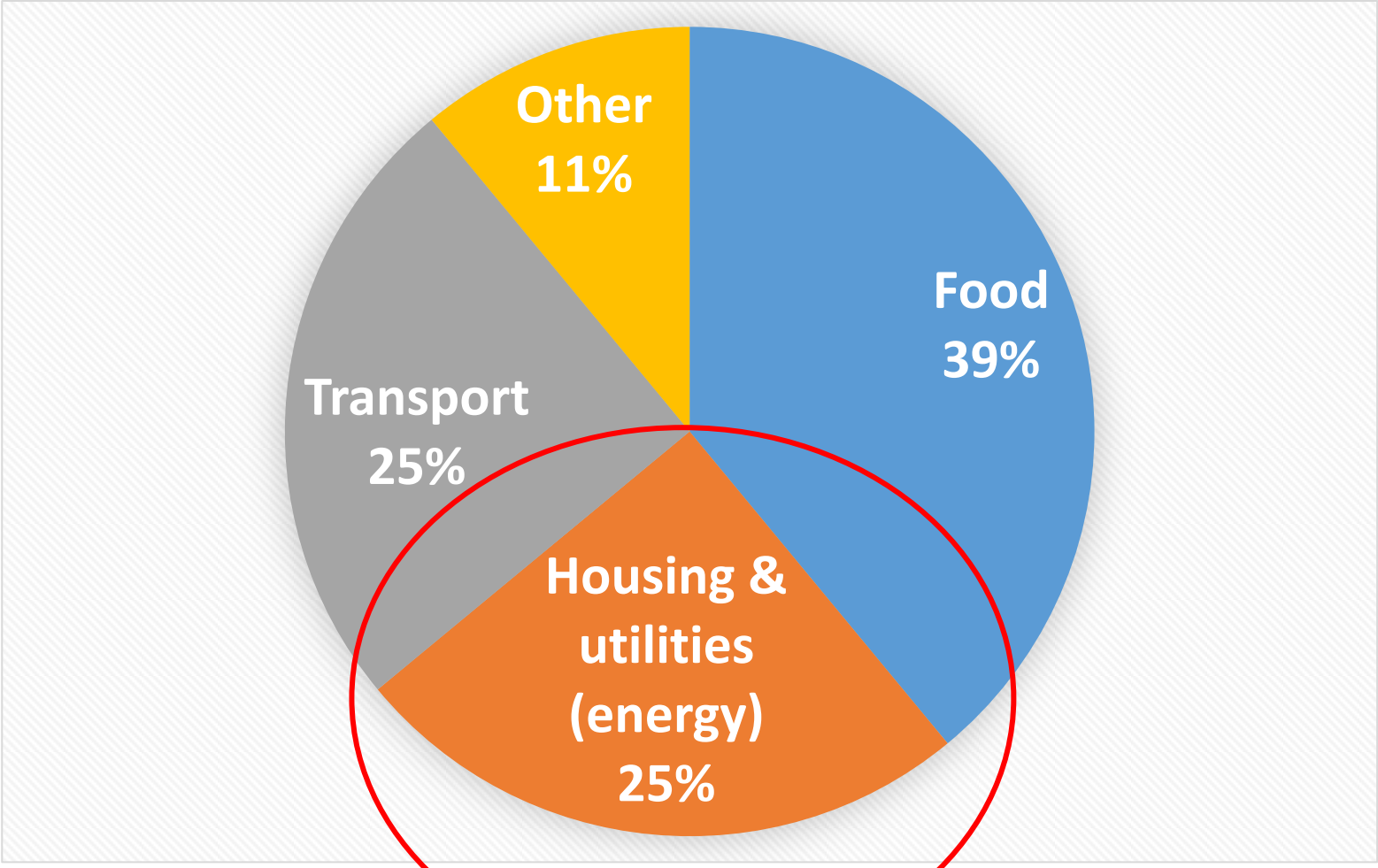
Emissions embedded in building materials & construction



Direct emissions from living in the house

Emissions from demolitions, waste

Direct GHG emissions (average household)



Motu 2016

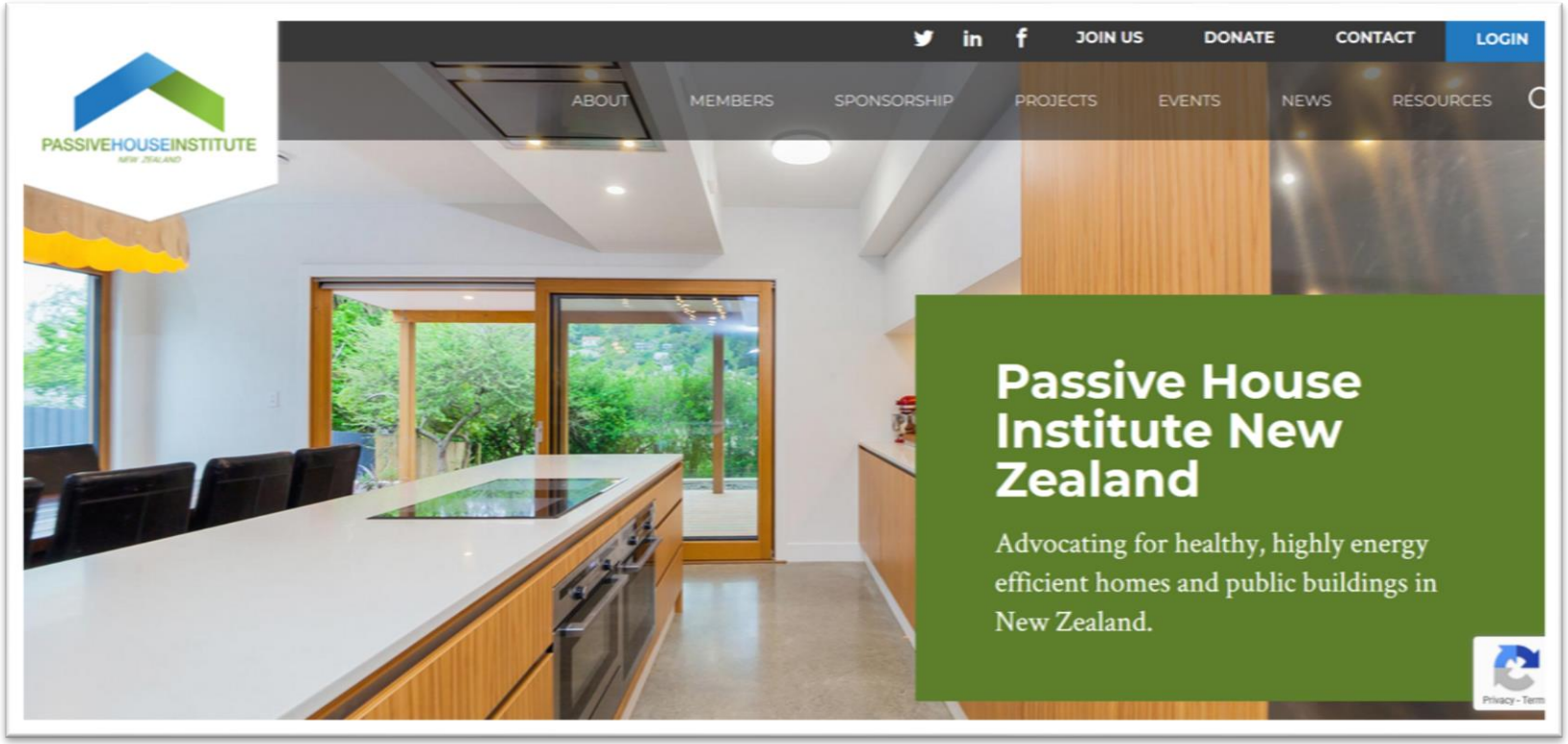
Role of households in a low-carbon world

- Minimising energy consumption?
- Renewable consumers?
- Prosumers?
- Energy independent?

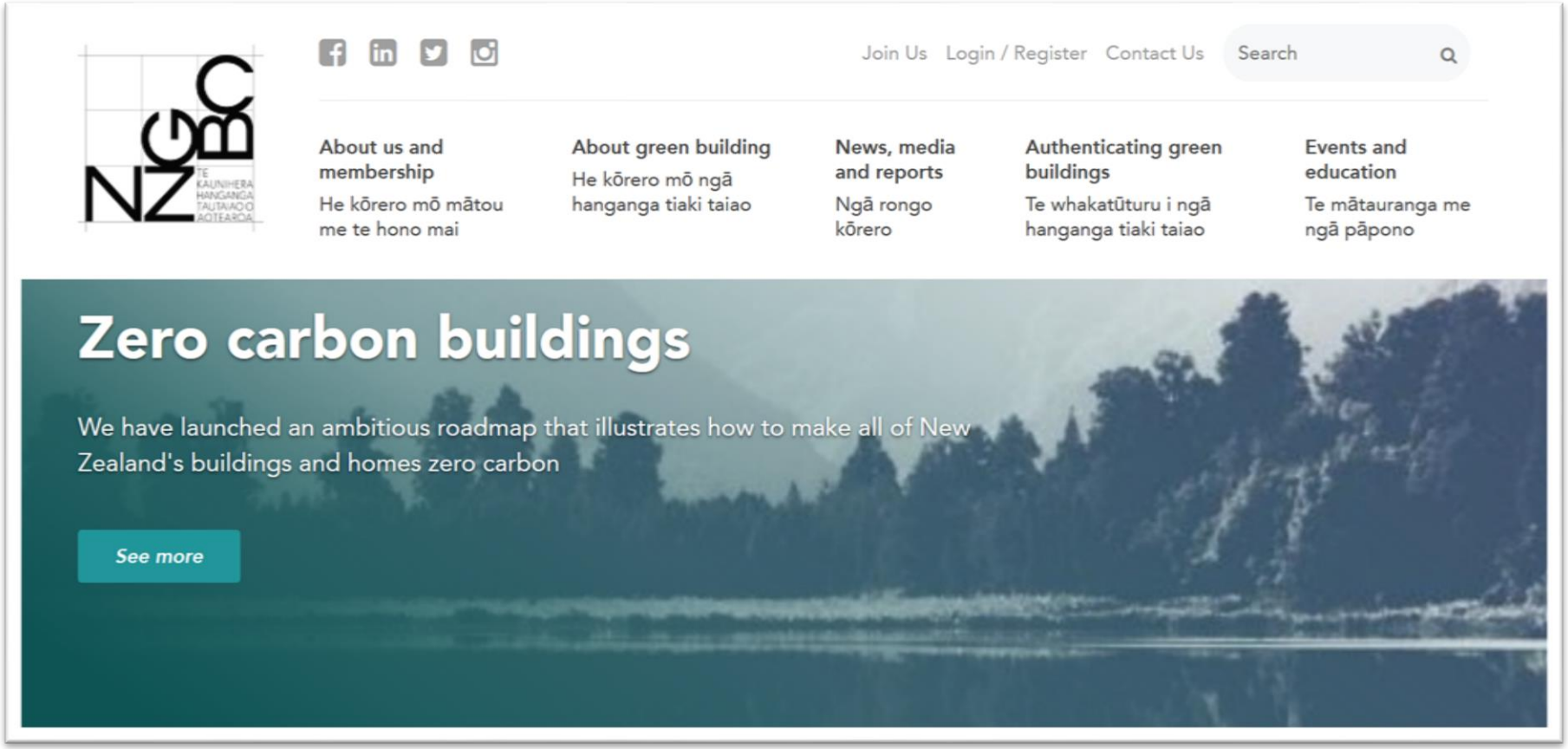
- Active participants in a broader net-zero energy system?

Pt Chevalier zero energy house
https://ourauckland.aucklandcouncil.govt.nz/articles/news/2015/12/adm-case-study-pt-chev/

Passive heating and cooling



Zero carbon buildings



NZ Green Building Council https://www.nzgbc.org.nz/

EU – decarbonisation of building stock by 2050

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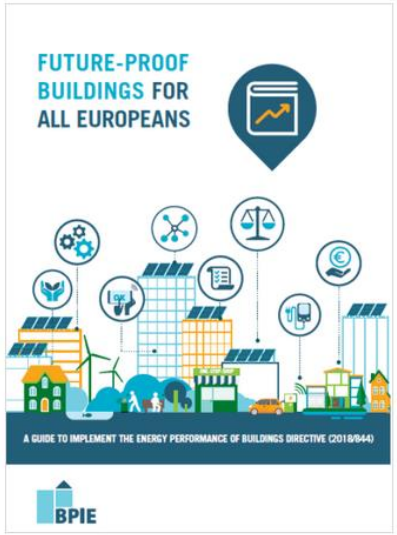
Home › Publications › **Future-proof buildings for all...**

Future-proof buildings for all Europeans – a guide to implement the Energy Performance of Buildings Directive

Two-thirds (65%) of the European building stock was built before 1980: about 97% of the EU's buildings must be upgraded to achieve the 2050 decarbonisation goal, but only 0.4-1.2% are renovated each year.



A more efficient, technically equipped and smarter building stock could be the cornerstone of a decarbonised energy system.

Buildings have the potential to be at the forefront of providing flexibility to the energy system, through energy production, control, storage and demand response, as well as green charging stations for electric vehicles. This can only happen if a systemic upgrade of the building stock is achieved.

The recent amendments [2018/844] to the Energy Performance of Buildings Directive (EPBD) [2010/31/EU] set a clear direction for the full decarbonisation of the European building stock by 2050. It provides a clear goal for Member States and the tools to achieve it.

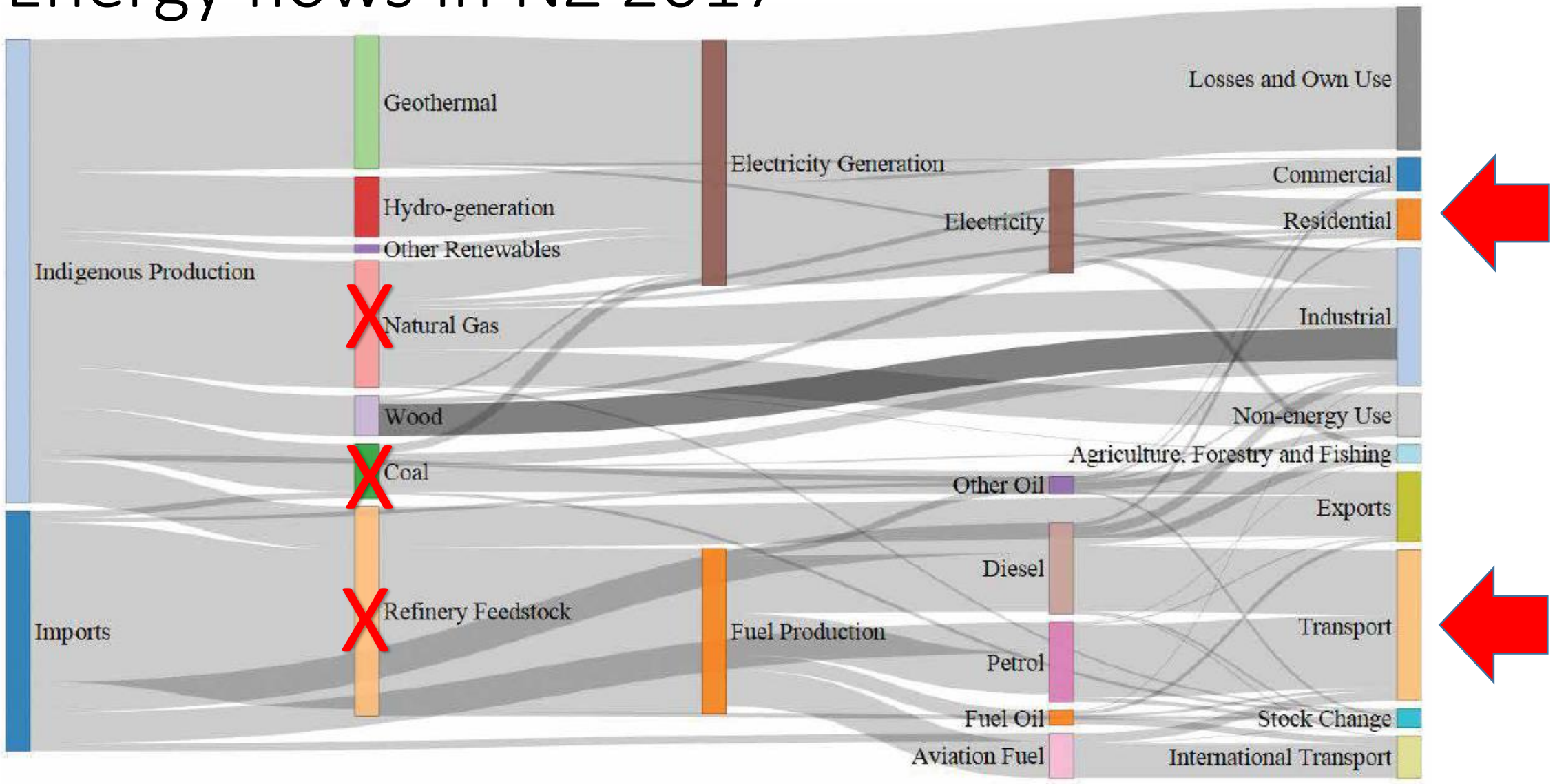
However, implementation is rarely a straightforward task: this comprehensive toolkit provides guidance, tips, case studies and templates to support and inspire EU Member States to meet this challenge.

Long-term renovation strategies, financing of renovation, EPCs and building renovation passports, smart readiness indicator and how to calculate energy performance: the publication focuses on articles were requirements evolved or were added.

http://bpie.eu/publication/a-guide-to-implementing-the-energy-performance-of-buildings-directive/

5. A changing energy future

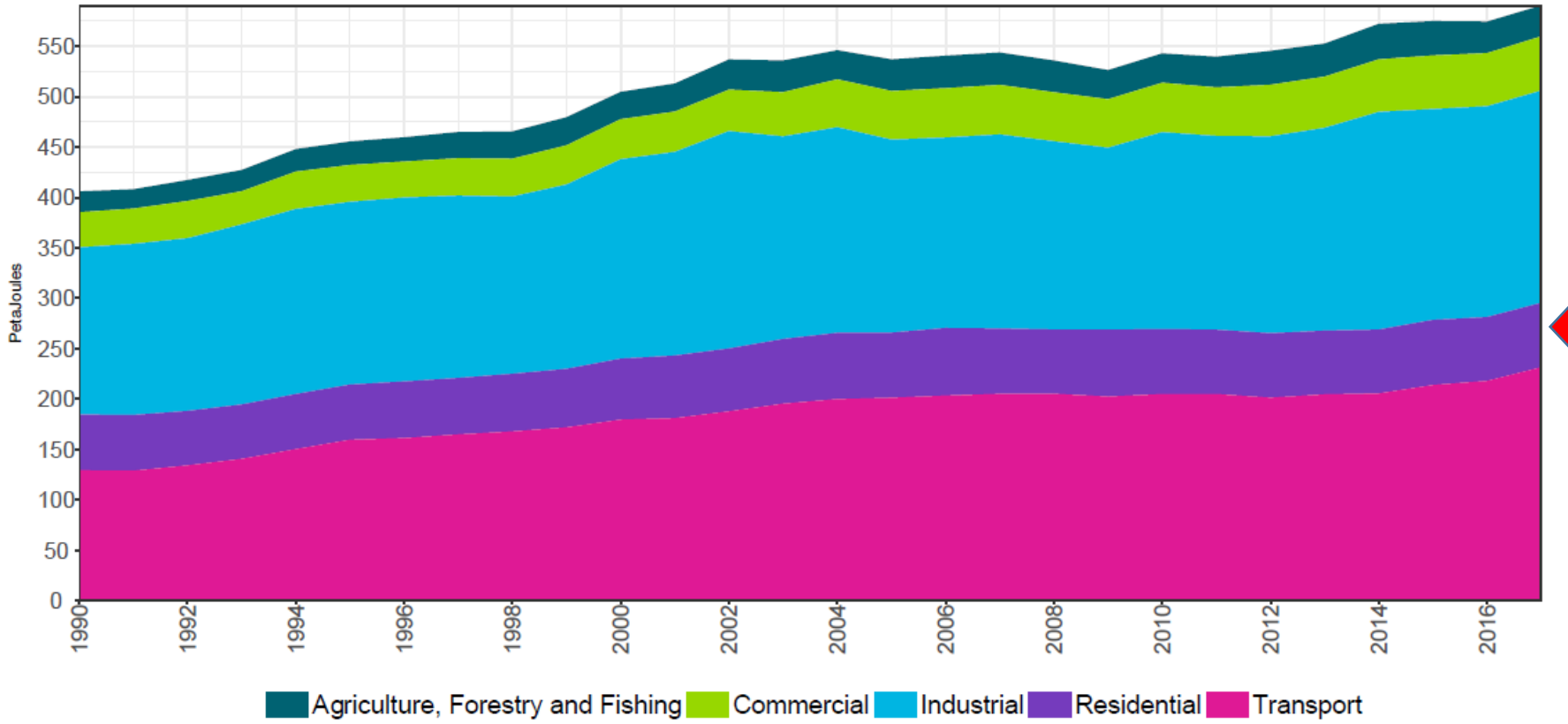
Energy flows in NZ 2017



MBIE 2018 Energy in New Zealand

Households as a proportion of total energy demand

Figure 1: Energy Demand

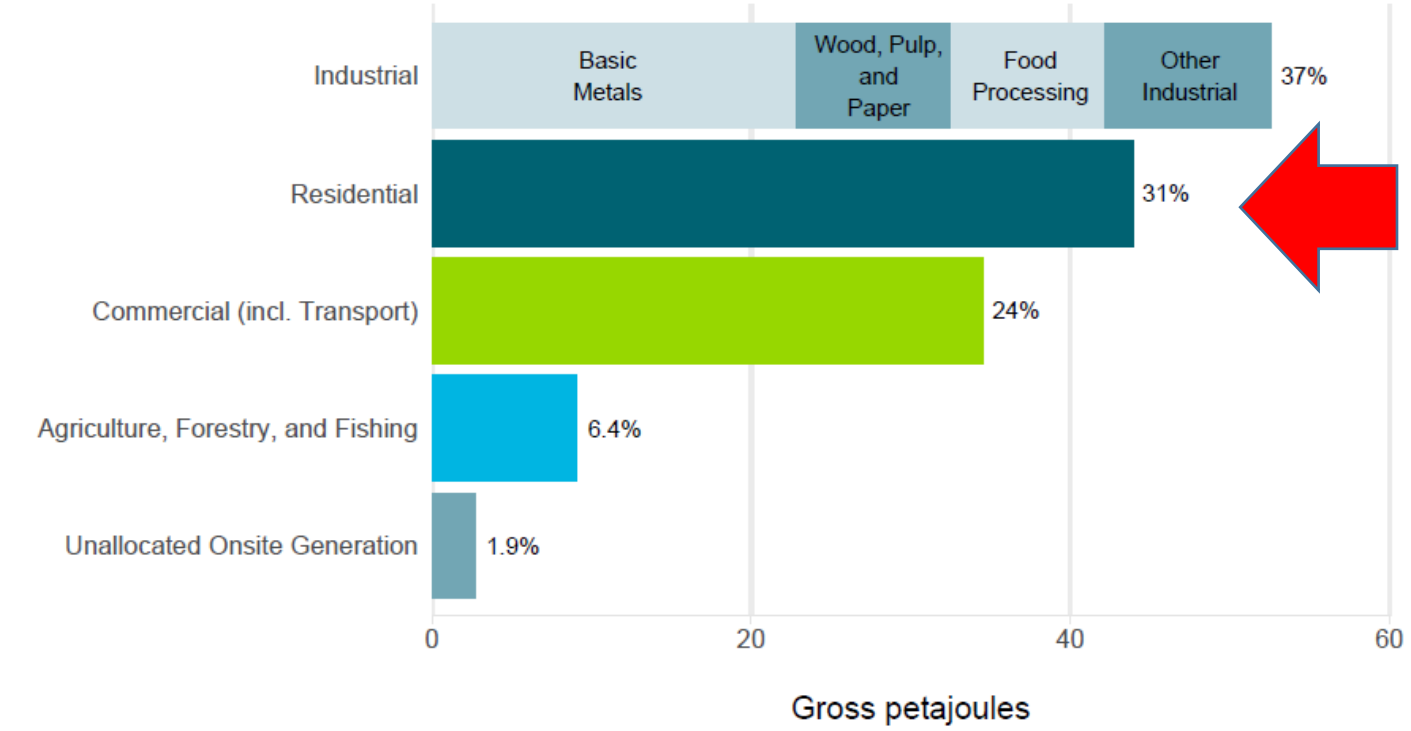


~10%

MBIE 2018 Energy in New Zealand

Households as a proportion of electricity demand

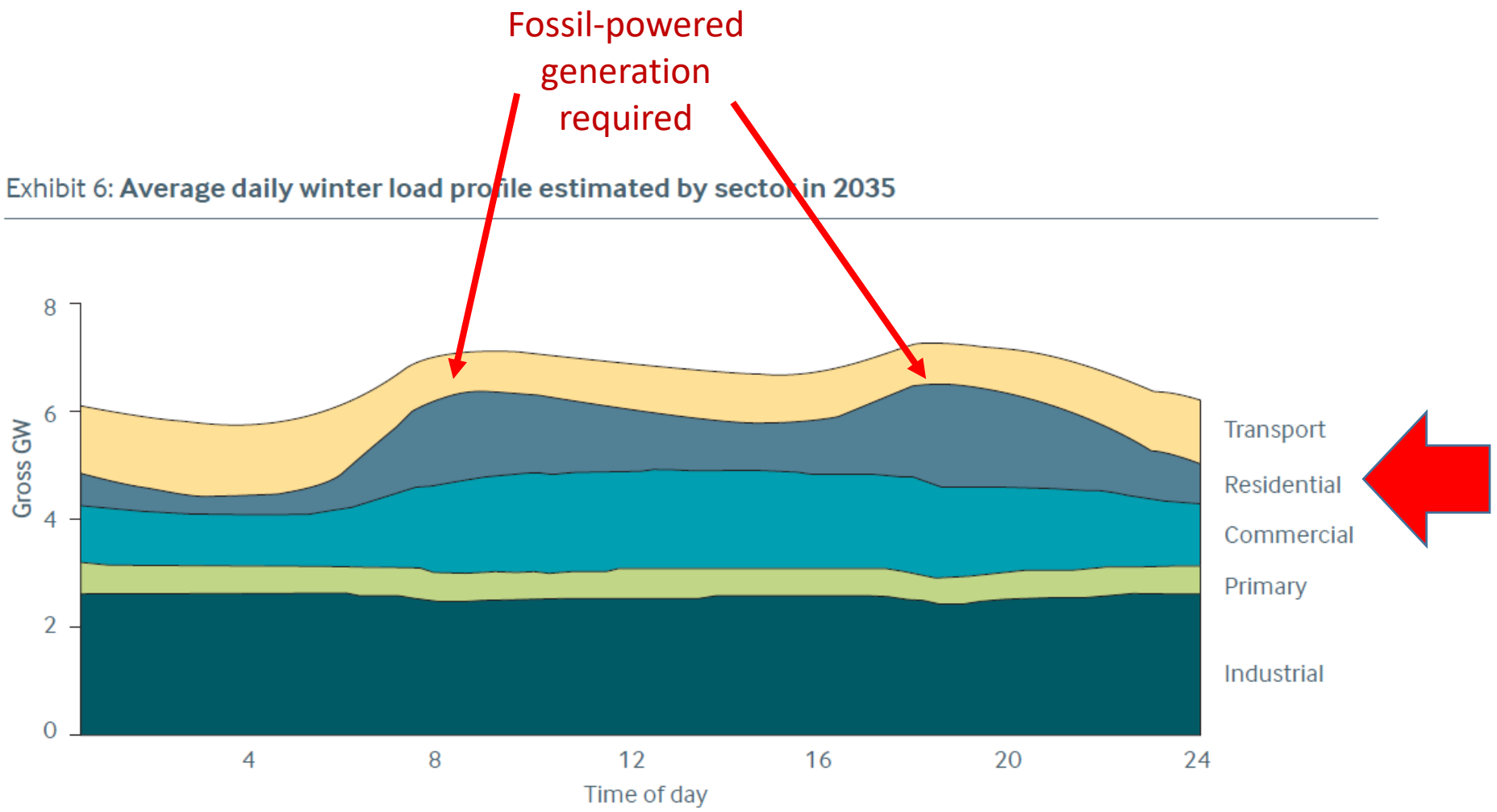
Figure 34: Electricity Consumption by Sector in 2017



~30%

MBIE 2018 Energy in New Zealand

Annual peak demand driven by households



Transpower 2018
Te Mauri Hiko

The future is (largely) electric

For a net zero economy by 2050: (Productivity Commission 2018)

- Electrification of transport, industrial processes
- At least 2x electricity supply
- ~100% renewable

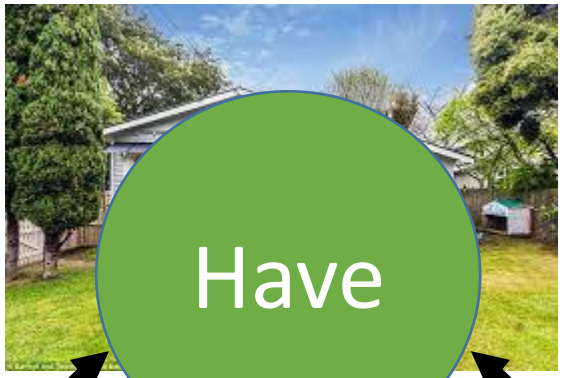
Households could be active contributors to NZ's low-carbon energy system

Reducing peaks in demand

Generating power

Storing and releasing power

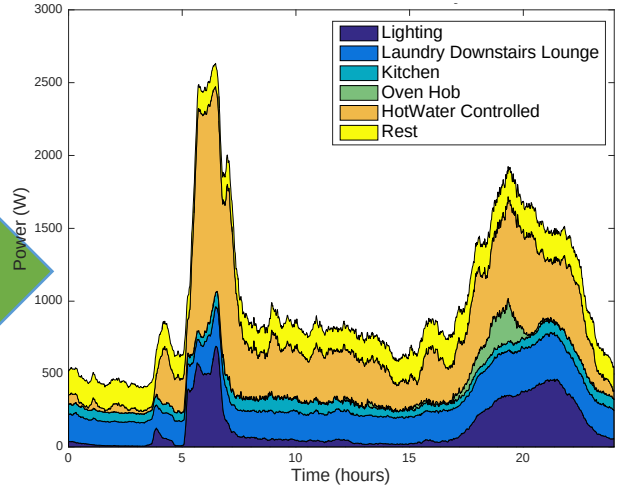
Houses don’t use energy, people do!



Have

Think

Do



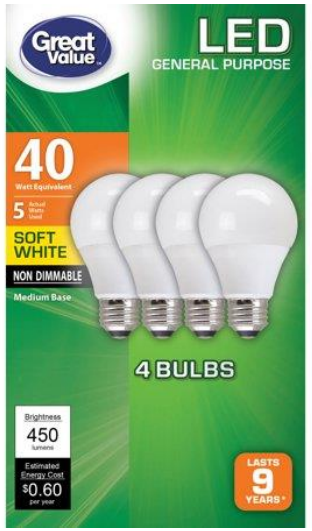
energy cultures

Changing household aspirations

- Climate concern
- Independence
- Resilience
- Digital competence
- Dematerialisation
- Electricity as a vegetable
- Local/community focus

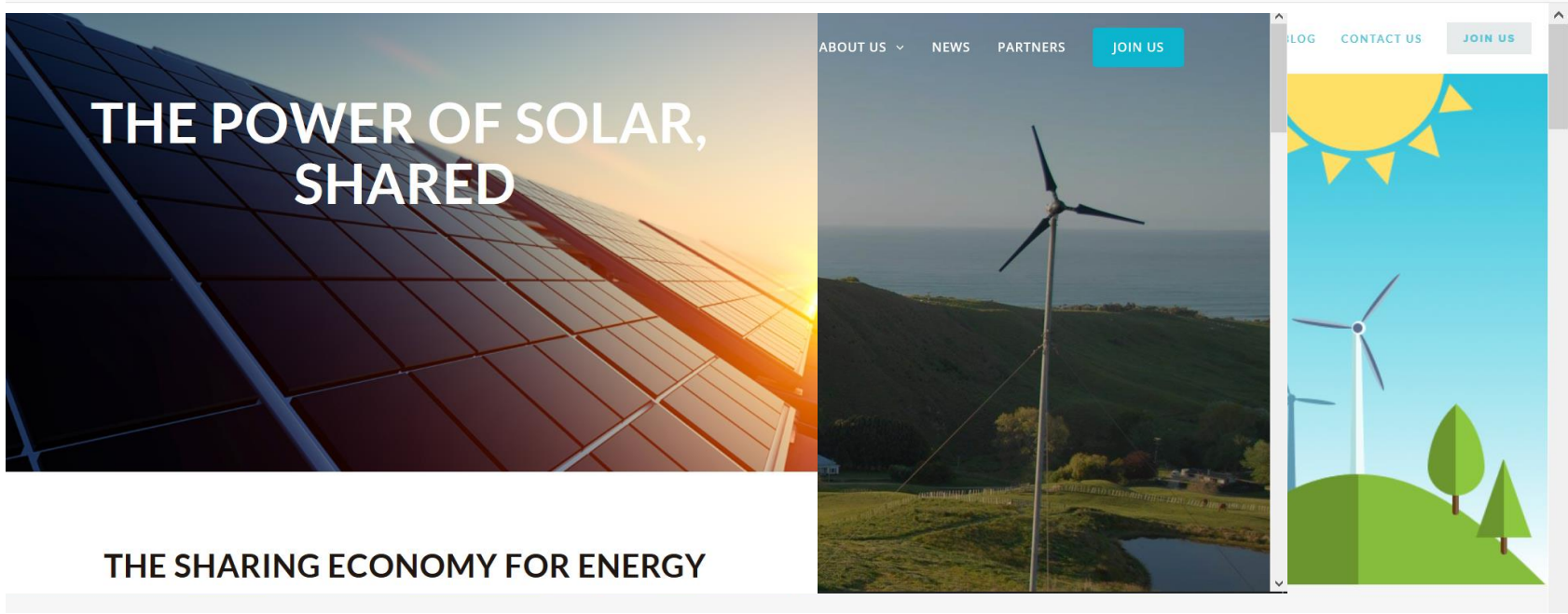
National Library NZ

New household technologies

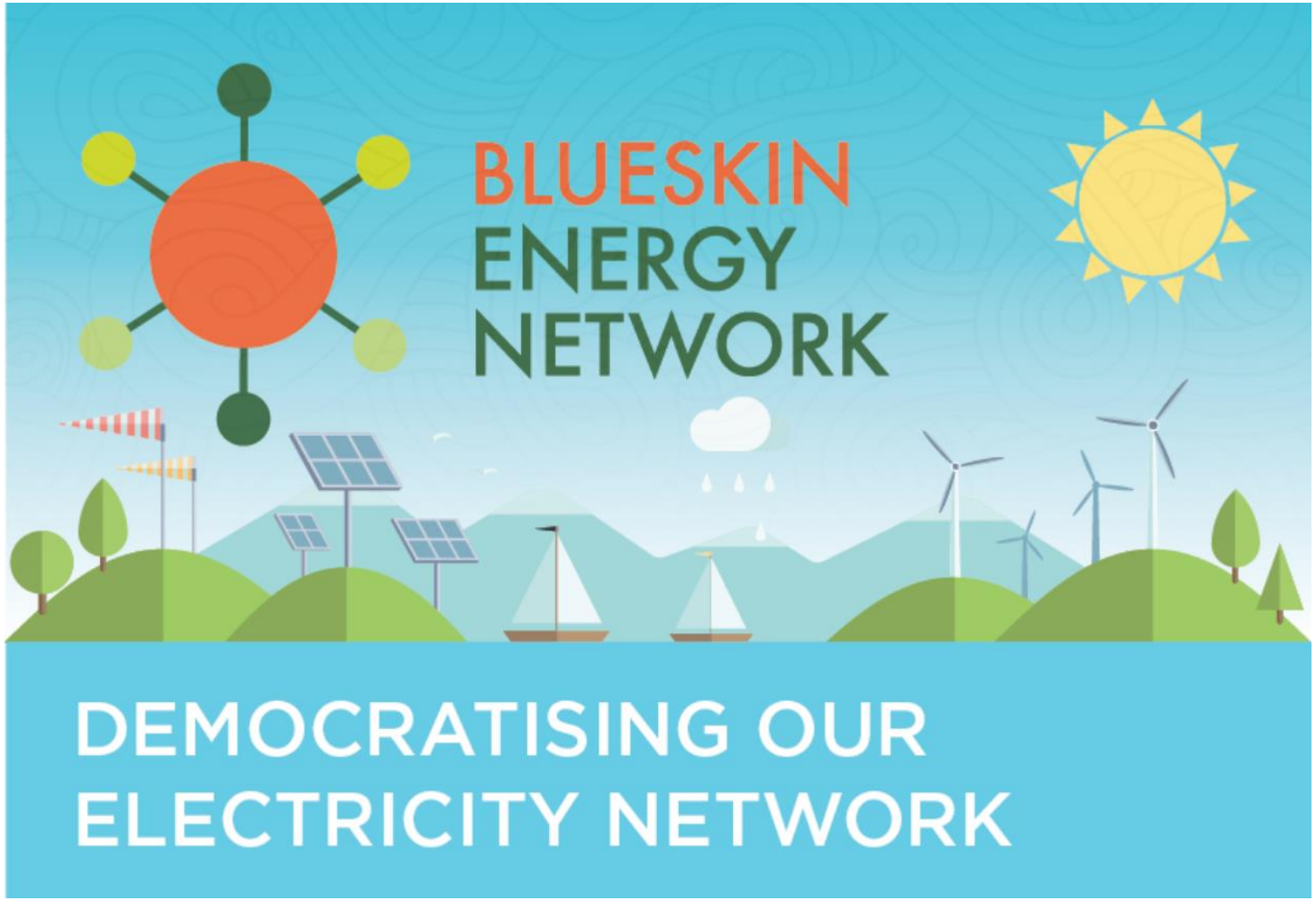


New business models

- Selling and gifting of solar surplus
- Buying local
- Digital underpinning

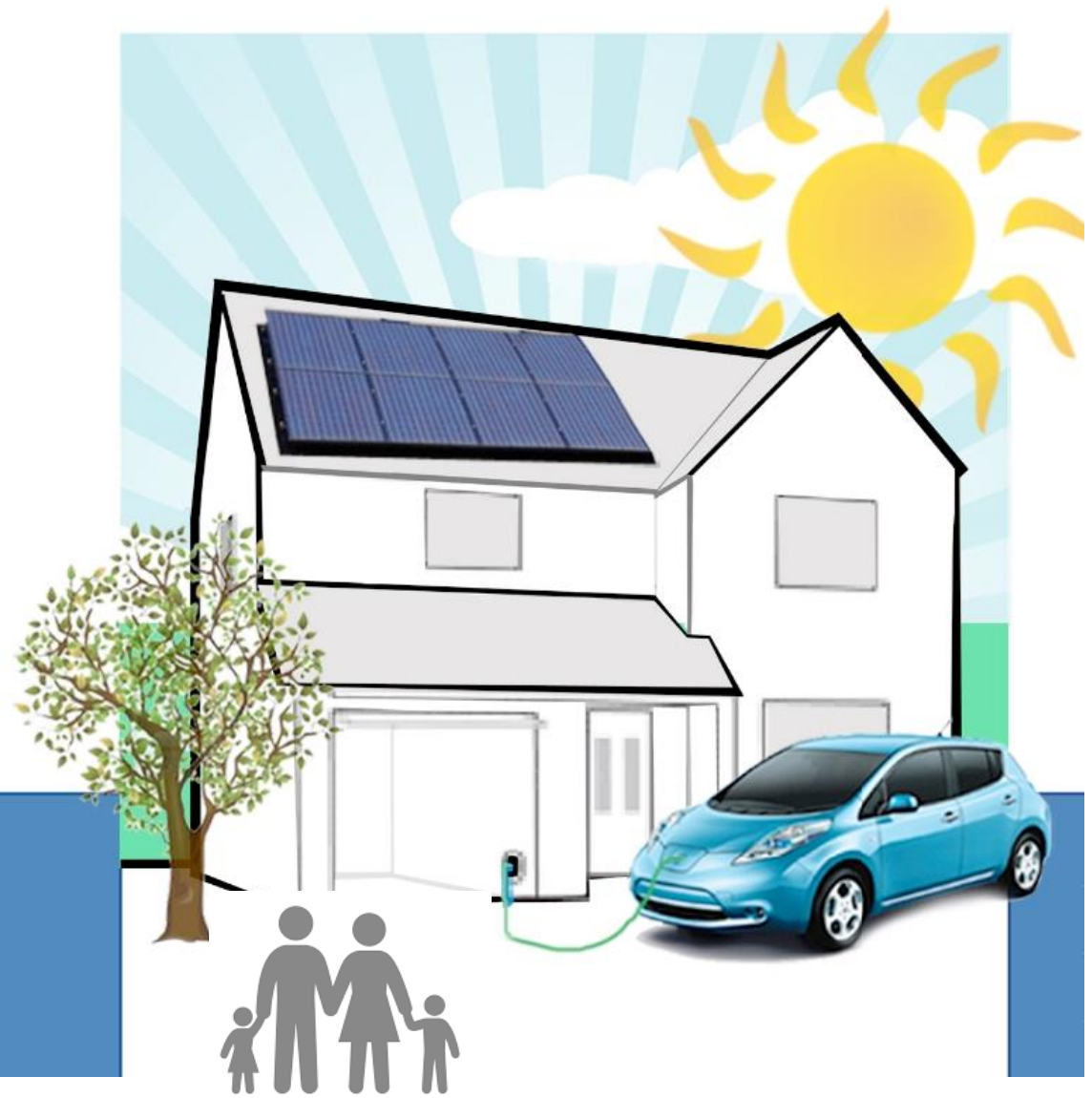


Peer-to-peer trading; local energy markets



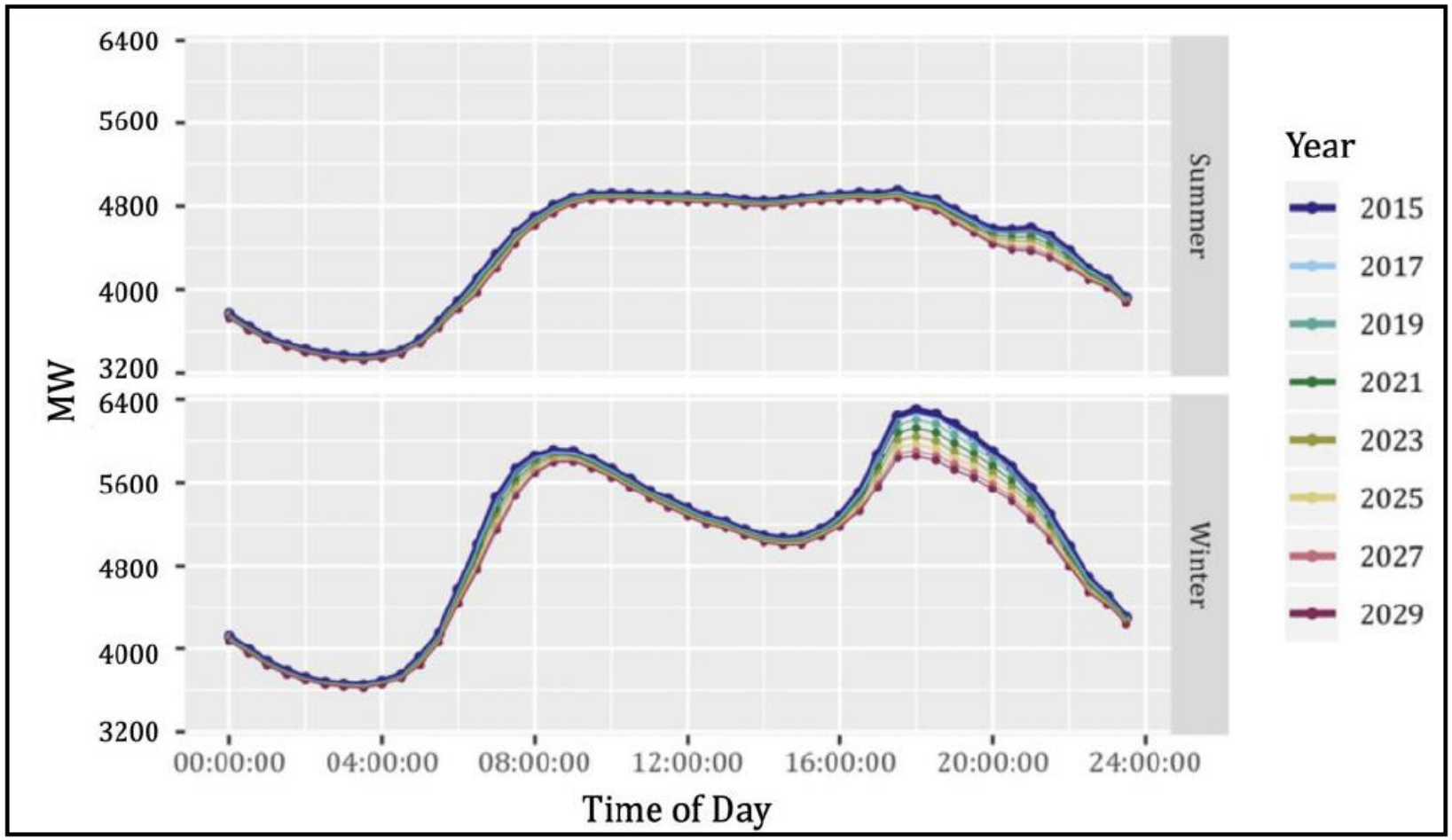
Everyday behaviours are starting to link sectors that were separate

- Housing sector
- Electricity sector
- Transport sector



Changing energy cultures

Efficient lighting alone could achieve a 9% reduction in NZ's peak demand (winter evening)



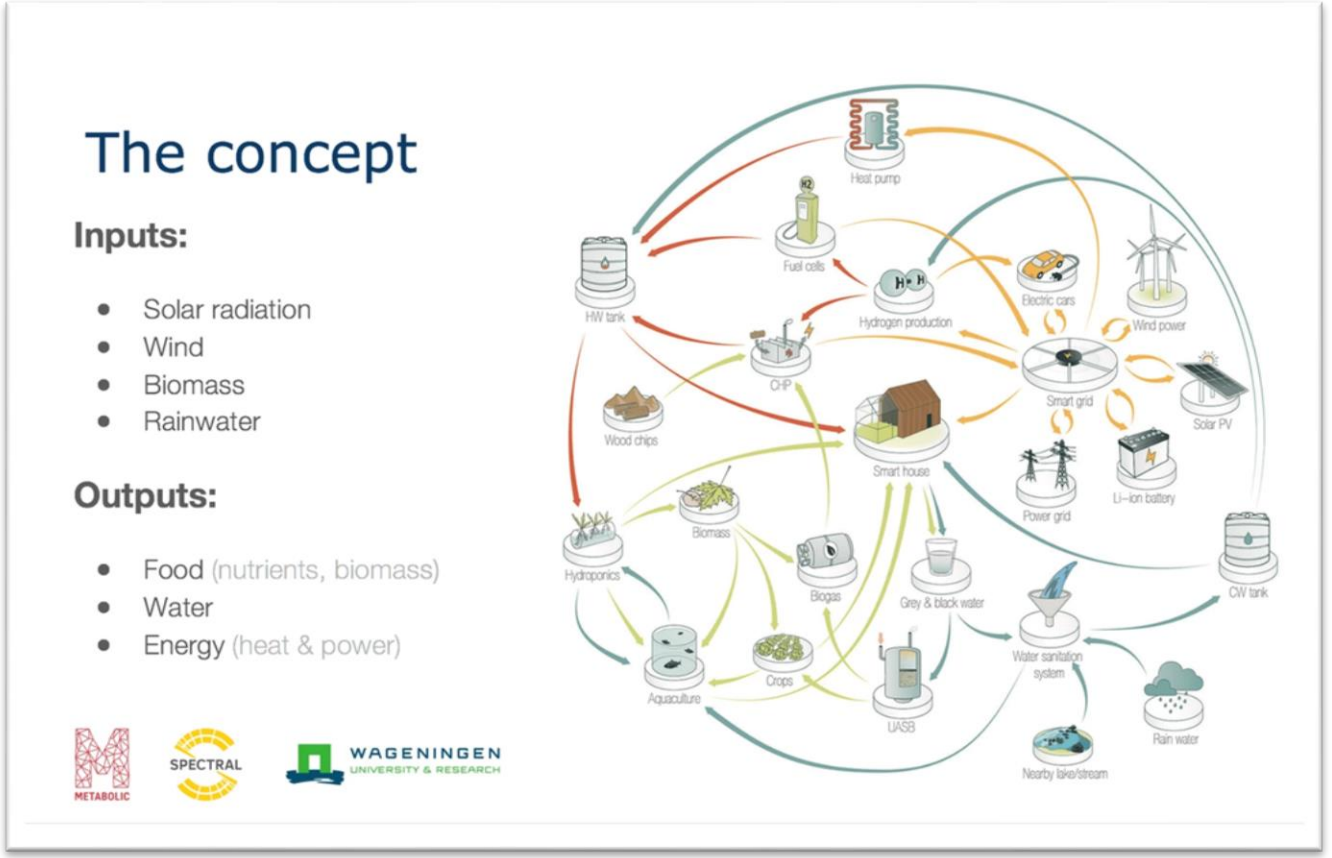
Potential total peak reduction by 2029 compared to 2015

Winter morning 300 MW
Winter evening 500 MW

Dortans, C., Anderson, B., Stephenson, J., & Jack M**.,** (forthcoming) The impact of lighting efficiency on peak demand in New Zelaand.

Emerging …

- Demand response – being paid to smooth the peaks
- Virtual power plants
- Households as decentralised microgrids



https://www.vice.com/en_us/article/vbngmd/decentralized-microgridding-can-provide-90-of-a-neighborhoods-energy-needs-study-finds

6. Bringing it together

What we don’t want

What we need for a liveable future

Climate-resilient housing

- Resistant to and responsive to climate impacts
- Inviting/enabling low-carbon living
- Enhancing wellbeing

Zero-carbon housing

- Net zero construction
- Net zero living in individual homes

and/or

- Homes actively contributing to NZ's net zero electricity system

}

Climate-responsive housing that supports zero-carbon lifestyles

New and retrofitted

It’s possible. It’s essential. How to get there?

1. Build a vision

All NZ housing supports net-zero climate-resilient living by 2050

2. Get there in 30 years

- Partnerships (multi-sector)
- Policies (supportive environment)
- Practices (knowing and doing)

- Entrepreneurship (social, business)
- Enthusiasm (co-benefits, opportunities)
- Equity (just transition)


Questions welcome