Information paper: Carbon benefits of town centre living

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Whakarāpopototanga matua | Executive summary

1. Eke Panuku delivers urban regeneration within town centre neighbourhoods that have a range of amenities and are well served by public transport. We presume that our developments enable Aucklanders to live a low carbon lifestyle through delivery of sustainable buildings in locations that allow them to travel less and use sustainable modes.

2. Arup was engaged to undertake carbon modelling to test this assumption and compare the carbon impacts between two household typologies - a generic Eke Panuku town centre development and a typical suburban household.

3. The modelling found that the carbon emissions from the operational use and associated household travel activities of a typical Eke Panuku household are lower when compared to a typical Auckland household by approximately 14%, saving 1.2 t CO2/year/household. This was comprised of approximately an 11% reduction in travel related emissions and 34% reduction in household energy related emissions.

4. This data, together with other relevant information, will be used to further develop a narrative around low carbon living and town centre urban regeneration to complement our thriving town centres guidance. There are many benefits to living in our town centre neighbourhoods; carbon reduction is just one of these. We are leading by example, designing neighbourhoods that enable low carbon living.

5. While a reduction of 14% may not sound significant, it is important to note that it represents a conservative, realistic number. It is based on an average household within each location. The modelling shows that further reductions could be achieved.

6. It is acknowledged that some households within town centre locations could have significantly lower emissions and conversely some households in suburbia would have much higher transport-related emissions. Further, it is noted that an energy efficient home could be built anywhere, not just a town centre. However, a house built in a suburban location is likely to have higher transport emissions associated. The results also exclude the emissions associated with infrastructure which for a new greenfield development would be significant.

7. The report considered opportunities to further decrease household emissions and showed potential for a 45% reduction from the baseline. Recommendations have been provided for interventions to further reduce transport and operational energy emissions as well as embodied construction emissions.

Matapaki | Discussion

Background

8. Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan sets a goal for the region to reduce greenhouse gas emissions by 50% by 2030 and reach net zero emissions by 2050. As Auckland Council's urban regeneration agency, Eke Panuku is working to deliver on these targets through facilitating low carbon transit-oriented developments in existing town centres, bringing housing and people closer to transport networks.

9. The objectives of the modelling were:

    - Demonstrate the performance of low carbon households such as those developed by Eke Panuku in the operational life cycle stage using carbon modelling.

    - The modelling tested the following hypothesis:

      Households in high performance dwellings with access to low carbon transport options and reduced travel distances have a measurable carbon benefit compared to a typical Auckland household typology.

10. Region-wide carbon modelling was undertaken by Arup to inform the actions in Te Tāruke-ā-Tāwhiri. This project used this modelling as a basis. It drilled down to the individual development level to enable comparisons to be made against different typologies.

Results

11. A typical Auckland household for this study is defined as a standalone 3-bedroom existing suburban household with 2 to 3 people which was based on 2018 census data.

12. The scope of the assessment was operational energy household emissions and emissions associated with household passenger travel. Embodied construction emissions were excluded for this assessment. The baseline emissions shown in Figure 1 are broken down into two components: emissions from operational energy use and emissions from associated passenger travel.

13. The emissions from a typical Auckland household are 8.7t Co2 e/year/household with the vast majority attributed to transport.

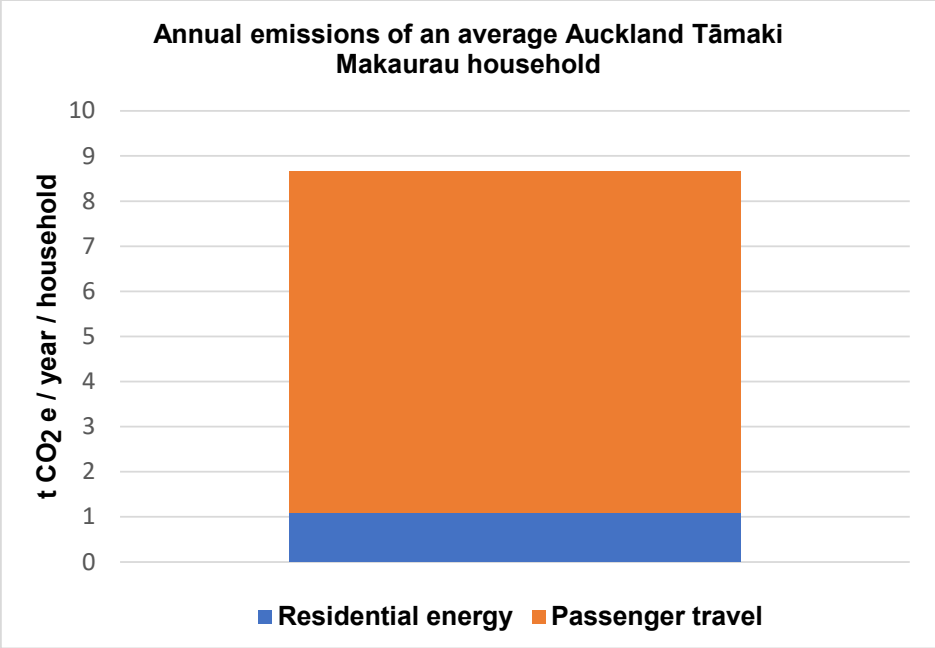

Figure 1. Annual emissions of average Auckland household

14. The comparison of emissions of an Eke Panuku development against the average Auckland household is shown in Table 1.

Table 1. Comparison of household emissions of typical Auckland household versus Eke Panuku household

Category	Typical Auckland household emissions	Eke Panuku household emissions	% reduction in Eke Panuku households
Travel related household emissions	7.56 t CO_2 e / year / household	6.76 t CO_2 e / year / household	11%
Operational household energy emissions	1.09 t CO_2 e / year household	0.71 t CO_2 e / year / household	34%
Total carbon emissions / year per household type	8.65 t CO_2 e / year / household	7.47 t CO_2 e / year / household	14%

In comparison with an average Auckland household, an 11% reduction in travel-related emissions is possible. New housing within a town centre transit-oriented development enables reduced travel distance for certain trips, encourages mode switch from car to public transport/walking and cycling, and a switch from petrol to electric vehicles. Figure 2 shows the individual travel-related components that contribute to the reduced carbon emissions of Eke Panuku developments.

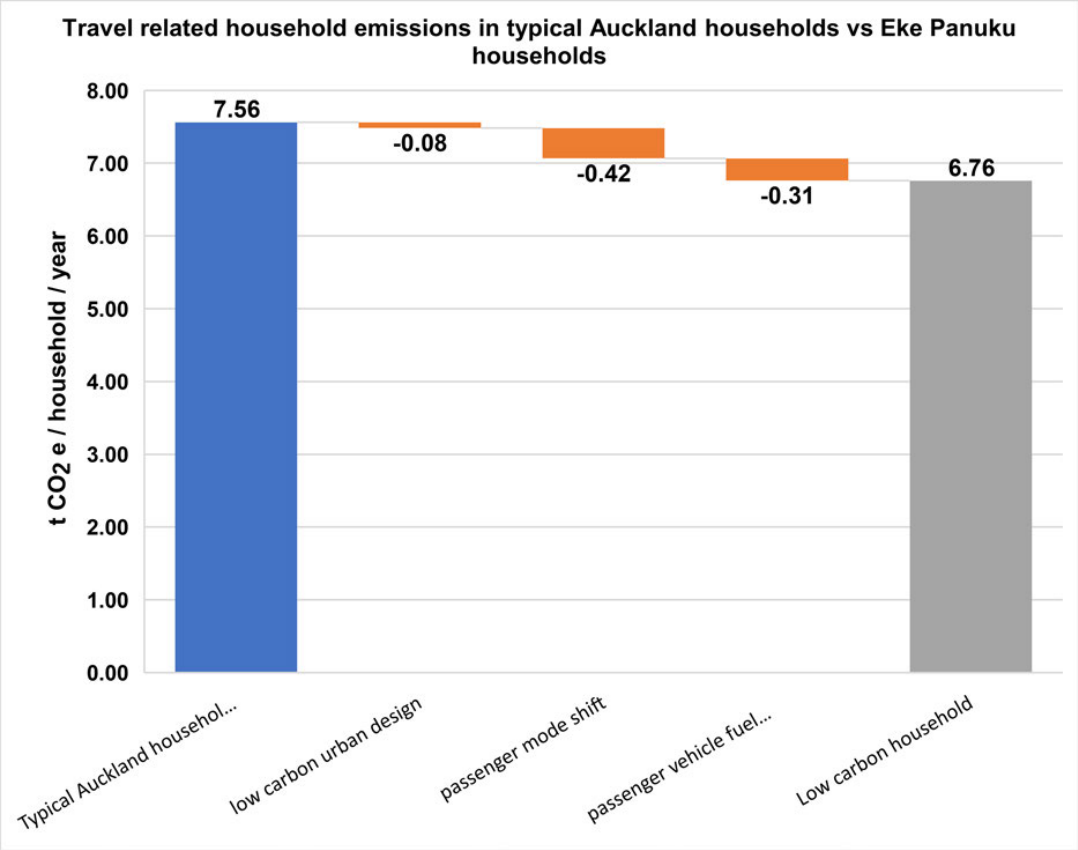

Figure 2. Travel related household emissions for Eke Panuku and a typical Auckland household

15. In comparison with an average Auckland household, a 34% reduction in household operational emissions is possible. This is due to energy efficient lighting, water efficient appliances, improved building insulation practices, energy efficient space heating and cooling and water heating standards adopted for the build. These improvements are associated with the Eke Panuku requirement for homes to meet a Homestar 6 rating.

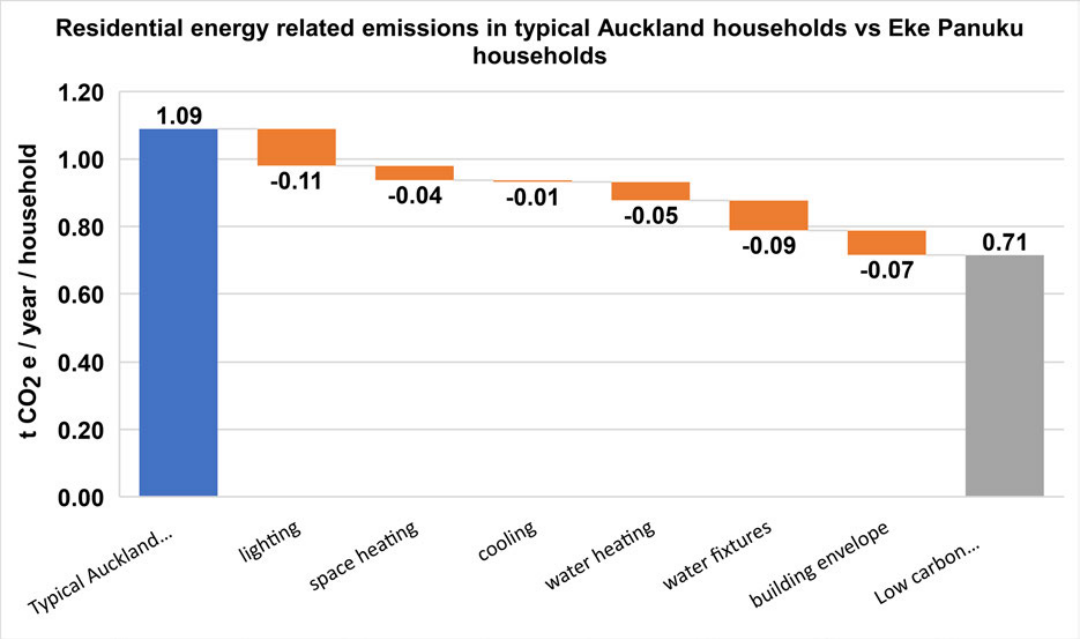

Figure 3. Residential energy and water-related emissions in typical Auckland households

16. Modelling was undertaken to look at how emissions could be further reduced. Reduction of emissions through vehicle fuel switch measures is likely to have by far the most influence in reducing household passenger travel emissions, followed by low carbon urban design measures. The future potential reduction is indicative and is shown in Figure 4 with a dotted line. This represents a potential further carbon reduction of 45% from the baseline.

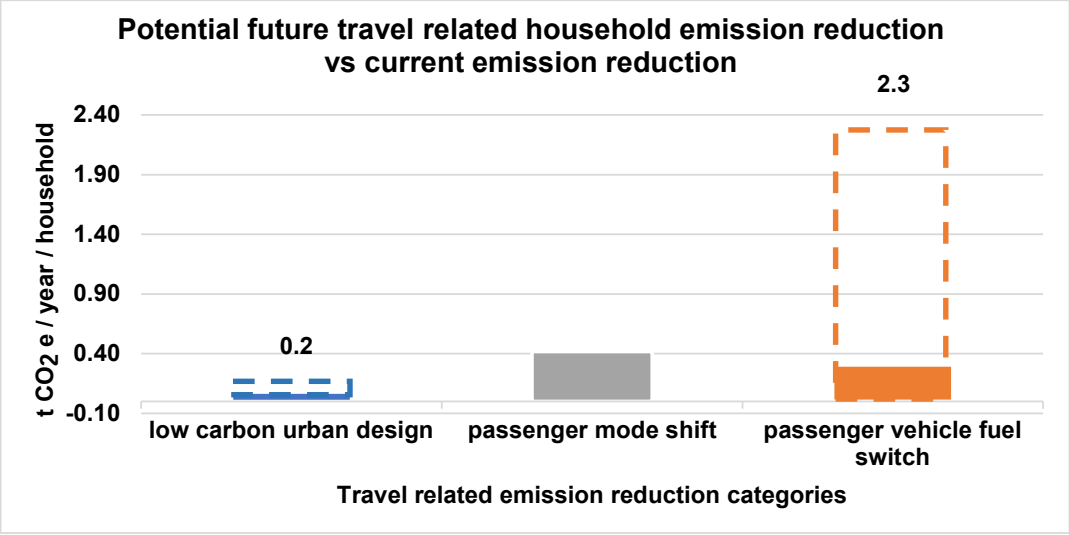

Figure 4. Potential future travel related household emission reduction vs current emissions reduction

17. Figure 5 shows the modelled emissions for each category of operational household emissions as a function of energy use. A reduction in emissions is most likely to be

achieved through improved insulation measures. This future potential reduction is shown in the graph with the dotted line and is indicative.

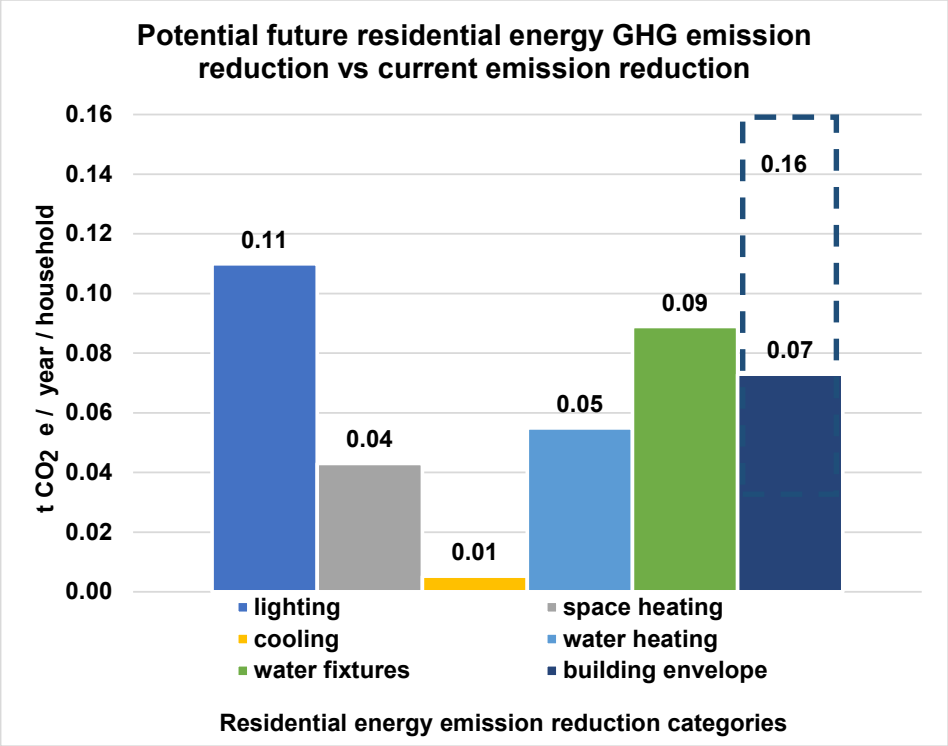

Figure 5. Potential future residential energy GHG reduction opportunities

Additional considerations

18. There is emerging analysis of the embodied carbon of public infrastructure such as roads and utilities. The latest research shows that when housing is built in new greenfield development, the embodied carbon of infrastructure e.g., roads required to establish the development, can be significant. Therefore there is additional benefit to the Eke Panuku approach of facilitating and delivering brownfield development.

19. This modelling looked at operational emissions and did not measure construction related emissions and embodied carbon. It is acknowledged that is important for construction related and embodied carbon emissions to be minimised. However, it is important to note that reducing operational emissions is likely to have the most benefit in reducing emissions overall. A case study by BRANZ in 2018 found that the carbon footprint of a typical house is comprised of 91% operational emissions and 8% construction and embodied emissions.

20. This work further illustrates the benefits of investments in transport that will promote mode shift such as investments across our programmes in walking and cycling connections and amenity upgrades.

Next steps

21. There are several next steps following this work. We will explore how Eke Panuku could further influence fuel switching and reduced travel movements in line with the future potential reductions identified by the modelling. Options include promoting the inclusion of shared workspaces within apartment developments to reduce commuting emissions and introducing requirements around electric vehicle charging provision within residential developments.

22. While transport emissions are the largest contributor to operational emissions, we will also look at further opportunities to reduce emissions from energy and embodied emissions through use of materials. We will look at the potential to shift to higher minimum Homestar ratings and the extent that this could contribute to further emissions reductions.

23. We will use this work to help develop a narrative around the benefits of our development model to tell a more compelling story. This may involve the use of visuals to illustrate the carbon benefit in a more meaningful way, together with additional data.

Ngā tāpirihanga | Attachments

Attachment A - Household Carbon Modelling Study

Attachment A

Household Carbon Modelling Study

Eke Panuku Development Auckland | Shaping spaces for Aucklanders to love

A comparison of carbon impacts between two household typologies using quantitative carbon modelling

Image source: Eke Panuku Development Auckland Statement of Intent 2021-24

Version 2.1 Final report

7 September 2022

Document Verification

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		Description			
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		Name			

Table of contents

1. Purpose

Background

Climate response is at the heart of the work by Eke Panuku. They do this by delivering urban regeneration and quality housing in town centres that are well served by public transport. In this way, Eke Panuku aims to enable Aucklanders to live a 'low carbon lifestyle'. The buildings energy usage and the associated transport activities are significant contributors to Auckland's greenhouse gas emissions.

The work by Eke Panuku is a critical to reducing emissions and transitioning to a low carbon resilient Auckland city. This work includes delivering well designed, intensive mixed-use developments, by integrating land use and transport, and incorporating sustainable building approaches. By encouraging a change in the way homes are built in town centres, designing for improved access to travel options, enabling reduced vehicle kilometres travelled, and designing to cater for lower carbon modes, Eke Panuku can help reduce emissions from housing and transport.

To quantify the carbon benefit, we account for the dwelling construction features as well as the changes associated with travel related behaviour. This provides a clearer definition used to compare Eke Panuku households to typical households in Auckland.

Alignment with Eke Panuku strategy

One of Eke Panuku's key roles is to facilitate urban redevelopment through sustainable housing and community facilities in Auckland Tāmaki Makaurau. As a facilitator, Eke Panuku has a responsibility to champion the Auckland Plan carbon reduction outcomes and support the other parallel sustainability activities by various groups. They do this through partnership and embedding sustainability at all life cycle stages of the development. These key partners include Auckland Council and development partners. Eke Panuku aims to share and help drive the vision of 'low carbon thriving town centre lifestyle'. To bring this to life, Eke Panuku has put together a compelling story using carbon household data to communicate the carbon benefits of Eke Panuku developments. This can help enhance climate change decision making frameworks, inform sustainability performance reporting and quantify the increased value of such household typologies.

Objectives for the report

1. Demonstrate the performance of low carbon households such as those developed by Eke Panuku in the operations life cycle stage using carbon modelling.
2. The modelling will test the following hypothesis:
    - Households in high performance dwellings with access to low carbon transport options and reduced travel distance have a measurable carbon benefit compared to a typical Auckland household.

2. Context

Policy and legislation

Action is required to reduce emissions and build resilience to the already changing climate. Te Tāruke-ā-Tāwhiri: Auckland's Climate Plan, sets out a plan for the region to reduce greenhouse gas emissions by 50 per cent by 2030, reach net zero emissions by 2050 and create a pathway to prepare for the impacts of climate change. Eke Panuku's role is to support Auckland Council's climate change strategies outlined in the Climate Plan.

Eke Panuku has committed in the Statement of Intent 21/24 to help Auckland Council facilitate low carbon transit-oriented development by bringing housing and people closer to transport networks, to leverage the existing investment and provide increased transport choices.

The end uses of this work could help demonstrate the realisation of these policy legislative outcomes outlined in the SOI 21/24.

Stakeholder key questions

Below is a summary of the stakeholder interests regarding this carbon modelling assessment:

- Eke Panuku Board – Does the way we deliver urban regeneration have a positive benefit on reducing carbon emissions?
- Eke Panuku Management and Corporate Responsibility Team – Which elements contribute to carbon reduction the most and therefore where should Eke Panuku concentrate their efforts to decrease carbon in the future?
- Auckland Council – To what extent do Eke Panuku developments help reduce carbon emissions? What is the potential contribution to Auckland's emissions reduction targets from sustainable housing in town centres that are well served by public transport?

3. Approach

Collaborative approach

Arup worked with Eke Panuku's Kristen Webster (Head of Corporate Responsibility) and Brenna Waghorn (GM of Strategy and Planning) who provided insight on the Eke Panuku and Auckland Council strategic drivers, risks, and provided information about Eke Panuku developments.

Methodology

A summary of our five-step approach is outlined in the table below.

Step 1	• Held an inception meeting with Eke Panuku on 6 May 2022 to understand the scope of work, strategic context and outlook, drivers and priorities of this study.
Step 2	• Used the CURB tool developed by C40 for this study • Defined the baseline (typical Auckland household) and conducted CURB modelling to create an emission profile. • Identified what CURB interventions give the highest range in carbon benefits. • Categorised interventions by CURB sectors (stationary energy residential and travel related emissions).
Step 3	• Hosted a workshop with Eke Panuku to confirm which interventions would be applied in an Eke Panuku household. Gathered evidence from example Eke Panuku developments as well as literature to justify the modelling assumptions for the current and potential future emission reduction.
Step 4	• Conducted the CURB modelling for the second typology to create an emissions profile of a household in a typical Eke Panuku development. This was used to demonstrate the current emissions reduction story. • Conducted CURB modelling to show the potential future emission reduction opportunities and identified practical actions for Eke Panuku to realise these benefits. • Used the CURB modelling outputs to demonstrate the difference in emissions at a household level and draw comparative insights between the two typologies.
Step 5	• Developed a report which summarises and visually illustrates the outcomes of the quantitative modelling and allows readers to quickly draw comparisons between household typologies to support the Eke Panuku Board meeting.

4. Findings

Summary of the modelled household typologies

Typical Auckland households create emissions higher than the 1.5-degree lifestyle.	Eke Panuku's current building approach has lower emissions when compared to the typical Auckland household, due to higher building energy performance and reduced travel emissions. This results in a 14% reduction from the baseline.	Eke Panuku has opportunities to maximise carbon reduction further by facilitating a switch to electric vehicles and further improving energy performance of the building envelope. This could result in a 45% reduction from the baseline.
The baseline household emits approximately **8.7 t CO_2e/year/household** (equivalent to 3.2 t CO_2e/year/person within the household*)	The current Eke Panuku household emits approximately **7.5 t CO_2e/year/household** (equivalent to 2.8 t CO_2e/year/person within the household)	The future potential Eke Panuku household emits approximately **4.8 t CO_2e/year/household** (equivalent to 1.8 t CO_2e/year/person within the household)

* Based on a typical Auckland household of 2.7 people as per the CURB modelling assumptions based in Stats NZ data from the report titled Housing in Aotearoa: 2020. Updated 2021. Stats NZ https://www.stats.govt.nz/reports/housing-in-aotearoa-2020

4. Findings

Comparison of emissions from modelled household typologies to a 1.5-degree lifestyle

A lifestyle carbon footprint target of 2.5 tCO_2e/person/year has been adopted by multiple individuals and organisations (such as 1five.org*). This is based on a global average carbon budget for 2030, and subtracting the portion of emissions that are associated with public services (leaving just those associated with personal consumption). Our study for Eke Panuku looked at only a fraction of those emissions associated with personal consumption i.e., those for housing. In both the current and future scenarios the emissions are in excess of the total allowance for personal consumptions.

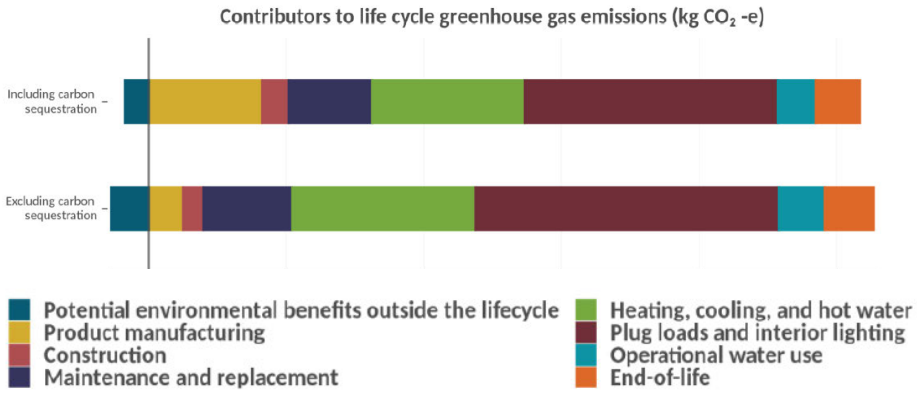
The 2.5 tCO_2e/person/year value has been derived from a study by IGES, Aalto University and others, that explore a number of pathways with different budget allowances. The typical Auckland and Eke Panuku scenarios are both in exceedance of all pathways presented in this study**.

Comparison of emissions from modelled household typologies to lifecycle emissions from a typical house

Data from BRANZ was published by Stats NZ***. BRANZ conducted an emissions lifecycle study on an Auckland house. It shows that operational energy contributes ~80-90% of life cycle emissions from a house, with the rest from embodied, construction related activities and end of life activities. This is true for both dwellings that include and exclude carbon sequestration, which in this instance is the storage of carbon in building materials.

This data shows that the biggest opportunity and priority is to reduce emissions from the household carbon lifecycle is in operational energy.

Further to this, household transport emissions (as shown on page 10) are seven times more significant than dwelling-based emissions, so there is the opportunity for Eke Panuku's developments to enable lower carbon transport choices through public transport, active travel and electric vehicles.



Source. Housing in Aotearoa: 2020. Updated 2021. Stats NZ https://www.stats.govt.nz/reports/housing-in-aotearoa-2020

* 1Five.The 1.5 Cº Life Pilot Project. 2021. https://1five.org/wp-content/uploads/2022/02/1Five_Pilot_Project-Report_Reading.pdf

** Institute for Global Environmental Strategies, Aalto University, and D-mat ltd, "1.5-Degree Lifestyles: Targets and Options for Reducing Lifestyle Carbon Footprints." Technical Report, 2019. https://hotorcool.org/wp-content/uploads/2021/01/15_Degree_Lifestyles_Main Report.pdf

*** Housing in Aotearoa: 2020. Updated 2021. Stats NZ https://www.stats.govt.nz/reports/housing-in-aotearoa-2020

4. Findings

The baseline household emissions story

Emissions from typical Auckland households

8.7 **t CO_2e/year/household**

Source: Wikimedia Commons

4. Findings

What is the operational carbon profile of a typical Auckland household?

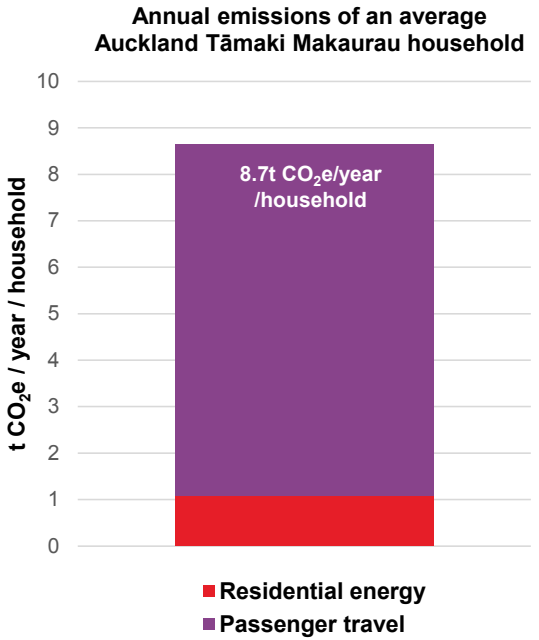
The operational emissions from a typical Auckland household were used to establish a baseline.

A typical Auckland household for this study is defined as standalone 3-bedroom existing suburban household with 2 to 3 people. This was based on the 2018 census data*.

This was done using the C40 CURB carbon modelling tool which was used for the Auckland Climate Plan. Since 2016, the Healthy Homes requirement was introduced in 2019. This increased the insulation and heating standard requirements. All new and existing homes are required to have ceiling and floor insulation. The heating requirement states that all homes are to have one built-in heater using any type/fuel type. These have been applied to the baseline assessment.

The scope of the assessment was operational energy household emissions and emissions associated with household passenger travel. Embodied construction emissions were excluded for this assessment. The baseline emissions shown in the graph are broken down into two components, emissions from operation energy use and emissions from associated passenger travel.

There is emerging analysis of the embodied carbon from public infrastructure like new roads and utilities. The latest research shows that houses in new greenfield developments create more embodied carbon due to the need to install new infrastructure e.g. new access roads. These additional emissions can be significant**.



*Housing in Aotearoa: 2020. Updated 2021. Stats NZ https://www.stats.govt.nz/reports/housing-in-aotearoa-2020
** Confidential project

4. Findings

The current Eke Panuku household emissions story

8.7 t CO_2e / year / household
for a typical Auckland household

14% reduction of total household emissions per year

7.5 t CO_2e / year / household
for a typical Eke Panuku household

Breakdown by category:

- 11% lower travel related emissions
- 34% lower household operational energy emissions

4. Findings

The current Eke Panuku household emissions story

The table below summarises the emissions of a typical Auckland Tāmaki Makaurau household compared to a typical Auckland Tāmaki Makaurau Eke Panuku household. The table shows that the low carbon Eke Panuku household results in a significant reduction of emissions in both household travel and operational household emission components.

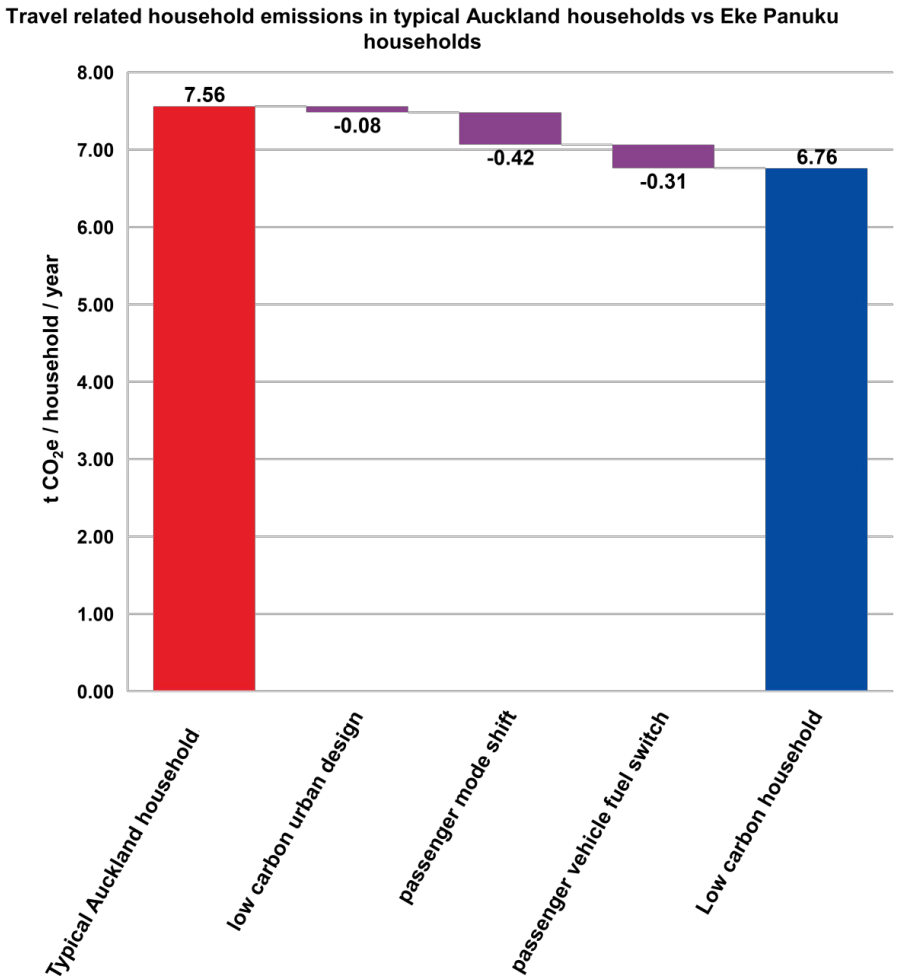
Category	Typical Auckland household emissions	Eke Panuku household emissions	% reduction in Eke Panuku households
Travel related household emissions	7.56 t CO_2e / year / household	6.76 t CO_2e / year / household	11%
Operational household energy emissions	1.09 t CO_2e / year / household	0.71 t CO_2e / year / household	34%
Total carbon emissions / year per household type	**8.65 t CO_2e / year / household**	**7.47 t CO_2e / year / household**	**14%**

4. Findings

The current Eke Panuku household emissions story – travel emissions

An 11% reduction in travel emissions from households in developments with low carbon transport options, as their location enables reduced travel distance for certain trips, encourages mode switch from car to public transport/walking and cycling, and switch from petrol to electric vehicles.

The relative contribution of each of these three elements to the reduction of travel related household emissions is outlined in the graph to the right.



4. Findings

The current Eke Panuku household emissions story – travel emissions

The following assumptions were made in modelling the current Eke Panuku household typology:

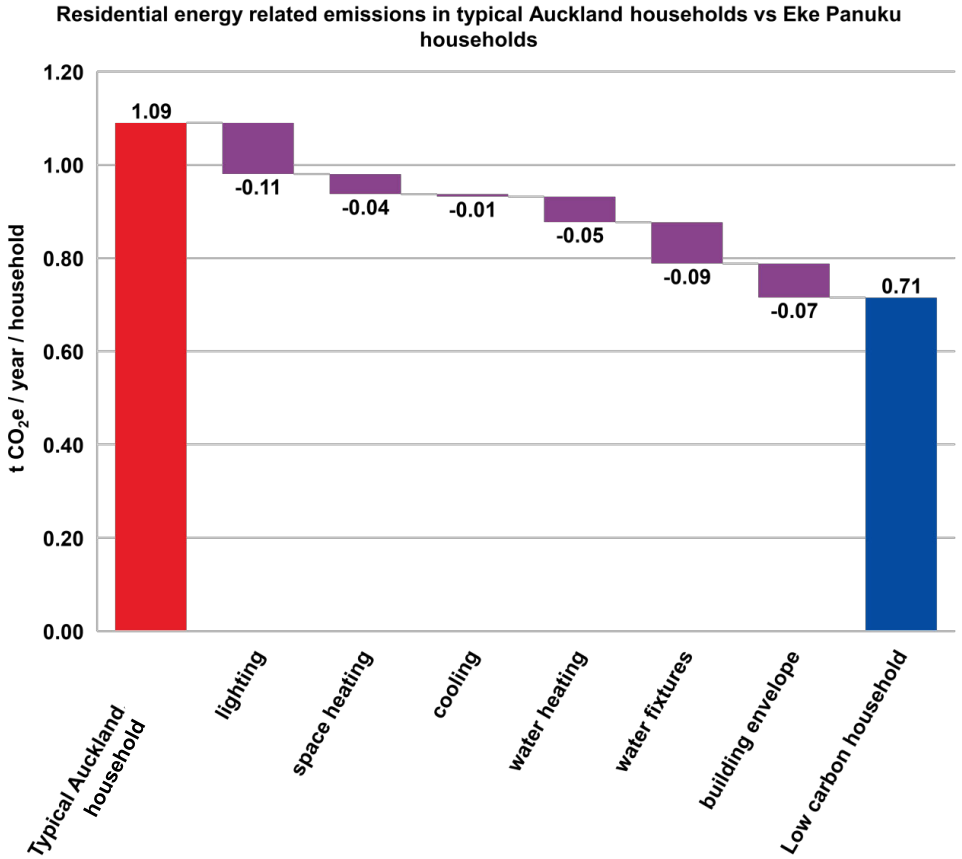
- Assumed that all low carbon households are in transit-oriented development neighbourhoods which creates approximately 10% trip reduction. This is based on the C40 studies used to build CURB and is supported by the research study* conducted by Waka Kotahi which found that in TOD with rail, ferry or bus stations within 800m catchment and services every 15 minutes recorded approximately 25-30% reduction in travel distance. The modelled 10% trip reduction assumes that 30% of low carbon households have public transport access every 15mins within an 800m catchment with a 30% TOD reduction rate based on research. The modelling takes a conservative approach to this as detailed information about each development was not available at the time of the study.
- Assumed a 15% shift from private car to public transport bus/rail/ferry due to capped i.e., reduced car parking provision/household through car share parking spots, and reduced/eliminated personal parking spaces e.g., Avondale Central 6 and 10 Racecourse Parade. And 132 Greenlane East, Greenlane Project 54. This is based on historical transport evidence in Auckland which have found a maximum mode shift of approximately 15%.
- The (Manaaki) development confirmed in their report that EV charging is provided, however the number of EV charging spaces was not stated. On average 10% of parking spaces in the Wynyard Quarter developments are EV charging parking spaces. Based on this information, the assumption made for the carbon modelling was a 10% uptake in electric vehicles in typical Eke Panuku households.

* Evaluating the greenhouse gas emission reduction benefits from land transport mode shift programmes and projects, March 2021, L Thorwaldson, F Thomas, A Carran-Fletcher MRCagney, https://www.nzta.govt.nz/assets/resources/research/research-notes/004/004-evaluating-ghg-emission-reduction-benefits.pdf

4. Findings

The current Eke Panuku household emissions story – energy emissions

A 34% reduction in household operational emissions in low carbon residential households is due to the appliances with low water flow, improved building insulation practices, more energy efficient heating and cooling energy standards adopted for the build.



4. Findings

The current Eke Panuku household emissions story – energy emissions

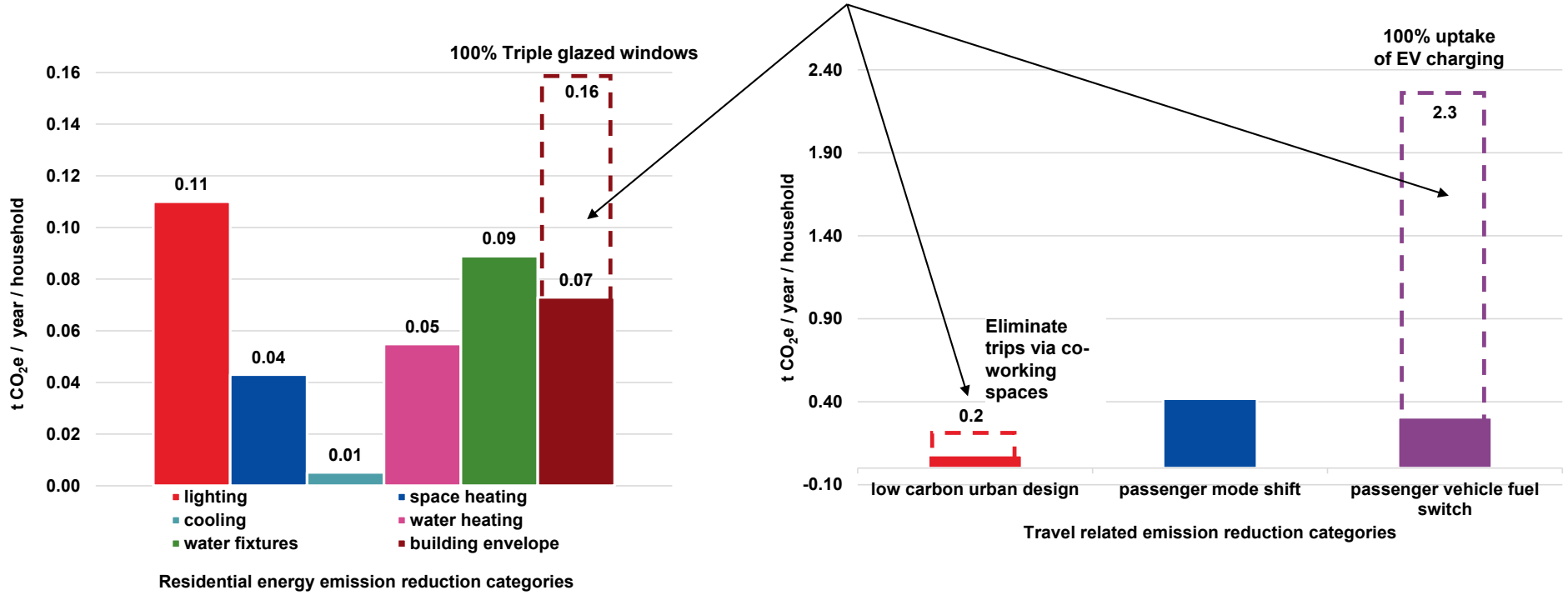
The following assumptions were made in modelling the current Eke Panuku household typology:

- 100% LED lighting for all low carbon households. E.g. in 2013 Wynyard Quarter development actioned 100% LED lighting for street lighting and public spaces, and combination of T5 fluorescent lighting for the households.
- 70% of space heating is though heat pumps running on electricity.
- 30% of cooling standards are high efficiency chillers. E.g. Wynyard Quarter development adopted improved electric chiller COP5.
- 50% of water heating done by an electric heat pump. E.g. Wynyard Quarter development used a combination of solar and electric and gas.
- 100% water fixtures are low flow. E.g. Wynyard Quarter development used 5 Star WELS taps
- 70% of households have improved building insulation quality and have single glazed windows

4. Findings

The future Eke Panuku household emissions story – energy emissions

Areas of opportunity to reduce emissions in the future. It shows the higher end of the range of potential emission reduction from specific activities resulting in a 55% reduction of emissions.

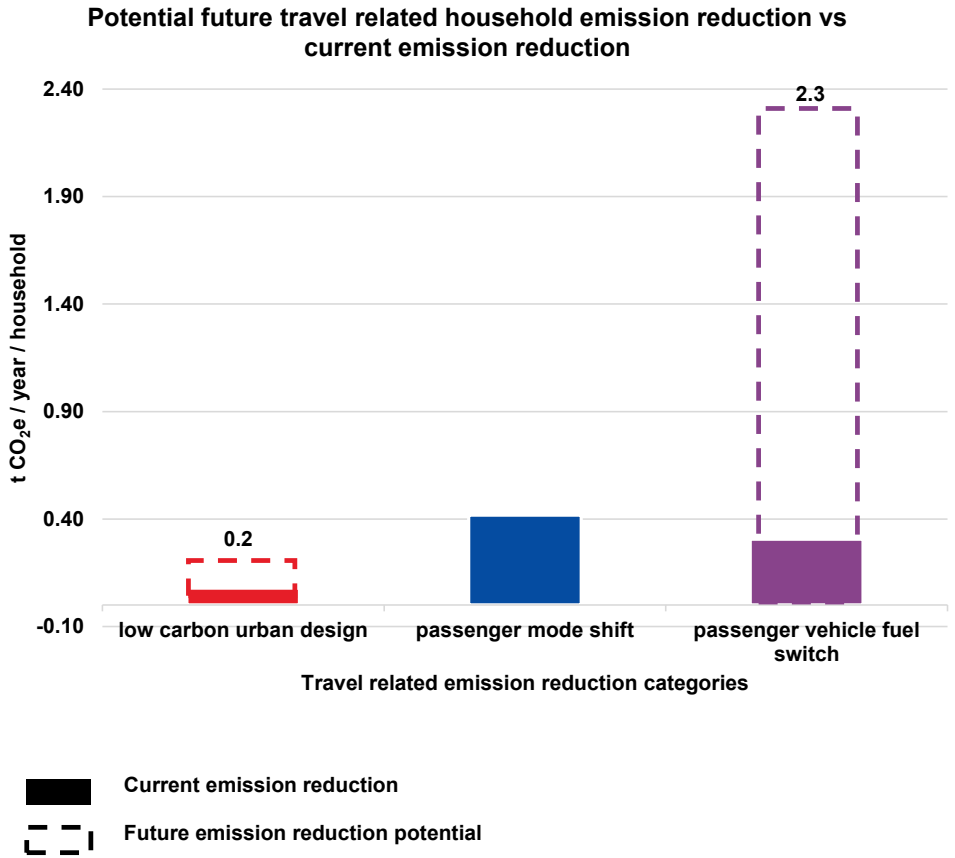


Note this modelled estimate excludes carbon reduction from construction activity which would reduce future emissions even more. See the summary chapter for suggested actions to reduce emissions.

4. Findings

The future Eke Panuku household emissions story – travel emissions

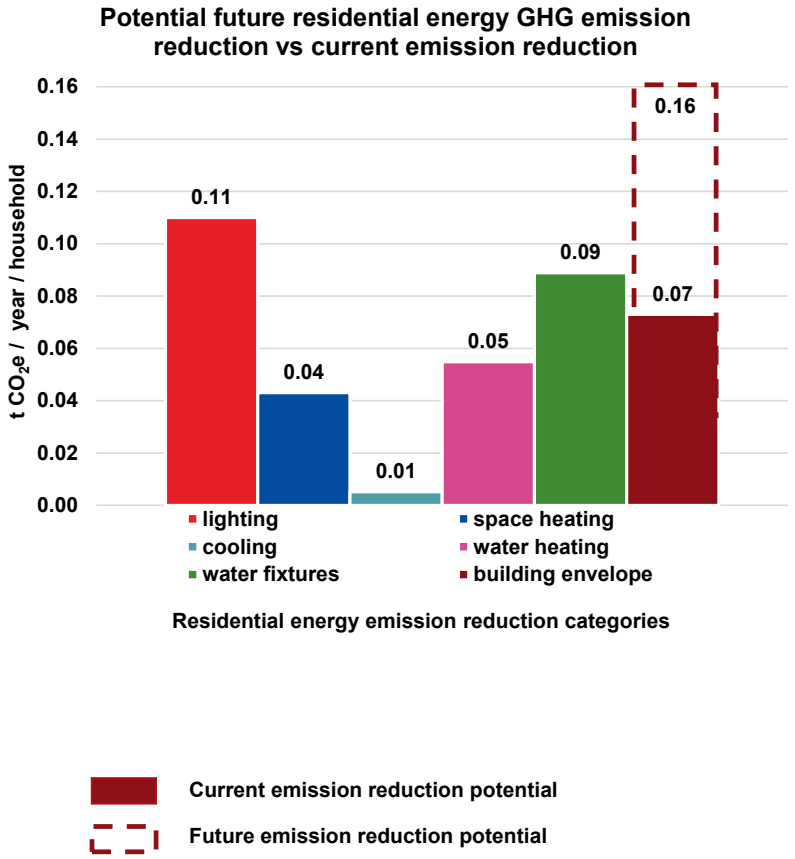
The graph shows the modelled emissions for each category of travel related household emissions. Reduction of emissions through vehicle fuel switch measures is likely to have the most influence in reduction household passenger travel emissions, followed by low carbon urban design measures. The future potential reduction is shown in the graph with the dotted line as a proportion of the current emission reduction potential and is indicative only.



4. Findings

The future Eke Panuku household emissions story – energy emissions

The graph shows the modelled emissions for each category of operational household emissions as a function of energy use. A reduction in emissions will likely come from improved insultation measures. This future potential reduction is shown in the graph with the dotted line as a proportion of the current emission reduction potential, and is indicative only.



5. Conclusions

Conclusions

The carbon emissions from the operational use and associated household travel activities of a typical Eke Panuku household are lower when compared to a typical Auckland household by approximately 14% saving 1.2 t CO2/year/household. This could be reduced more to a 55% reduction if the recommended actions on the next page are adopted. This provides evidence that Eke Panuku enables Aucklanders to live a *'low carbon lifestyle'* through low carbon development and building design features, as well as through the low carbon travel benefits due to the households location within a high-density town centre.

In relation to embodied carbon, typically, larger houses increases the carbon footprint of dwellings due to the amount of materials used, the type of construction, replacement and the number of people living in the dwelling. A case study by BRANZ in 2018 shows that the carbon footprint for a typical house (detached, single-storey, four bedrooms, 194 m2, double-glazed windows with aluminium frames, building code compliant wall and ceiling insulation, a sheet metal roof with a concrete slab foundation, and situated in Auckland region) is mostly from operational emissions (91%) and 8% from construction/embodied emissions*. This means focusing on reducing operational emissions is likely to have the highest impact in emission reduction.

The way Eke Panuku deliver urban regeneration has a positive benefit on reducing carbon emissions. The level of reduction is approximately 11% reduction in travel related emissions and 34% reduction for household energy related emissions. This means Eke Panuku housing in town centres well served by public transport contribute to the Auckland Climate Plan carbon reduction goals for Auckland. The findings of the assessment demonstrate the realisation of the Eke Panuku's policy legislative outcomes outlined in the SOI 21/24. These findings can be used to enhance climate change decision making frameworks, inform sustainability performance reporting and quantify the increased value of Eke Panuku households.

There are two areas of opportunity to decrease residential household emissions even further in the future.

1. There are potential additional carbon benefits that could be achieved through reducing embodied emissions associated with construction activities including carbon from materials (which were not included in this assessment through the use of higher energy saving products for building features.
2. Encourage reduction in passenger travel and switch to lower emission vehicles.
3. Encourage low carbon lifestyle choices e.g. food consumption to help reach the 1.5 degree lifestyle. This is based on a 2 adult 1 child household case study by Auckland Councils FutureFit calculator this could result in a reduction of 2.1 t co2 e/year reduction the household switched from red meat in most meals to vegan meals. Eke Panuku can support through raising awareness of lower carbon lifestyle choices e.g food consumption.

*Housing in Aotearoa: 2020. Updated 2021. Stats NZ https://www.stats.govt.nz/reports/housing-in-aotearoa-2020

6. Recommendations

Recommendations

In the table below is a summary of practical considerations that Eke Panuku could take to achieve a lower carbon future of approximately 55% carbon reduction when compared to the typical Auckland household.

Homestar 6 version 5 has no specific changes in requirements on insulation, window glazing or EV charging ports so it is unclear at this stage that achieving Homestar 6 version 5 will help reach the potential future 55% reduction. Therefore, it is recommended to implement these actions below in addition to compliance with Homestar 6 version 5.

Reduce embodied construction emissions	Actions to reduce transport emissions	Actions to reduce household energy emissions
• Introduce low carbon construction activities through material selection and low carbon energy use construction vehicles via procurement requirements e.g. timber construction can help reduce the impact of housing on climate change.	• Design all households to have dedicated EV charging spaces. • Reduce transport emissions by eliminating some commuter trips by designing work from home/co-working offices in a development. The can be further enabled by work from home policy changes e.g. the Wales Government has set a remote working policy to encourage remote working with a goal to have 30% of Welsh workers working at or near to home on a regular basis. Note that such a policy change is outside of the scope of Eke Panuku.	• Use of triple glazed windows through procurement requirements.

Recommendations to improve reporting

- Compile data on provision of facilities to reduce emissions (e.g. EV chargers) in Eke Panuku developments, to improve reporting on carbon emissions.

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