How wooden buildings create value?

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Catch the carbon
CLIMATE SOLUTIONS IN THE LAND USE SECTOR

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UKKE052 UrWood

Content

- Towards carbon neutral buildings
- Environmental value
- Economic value

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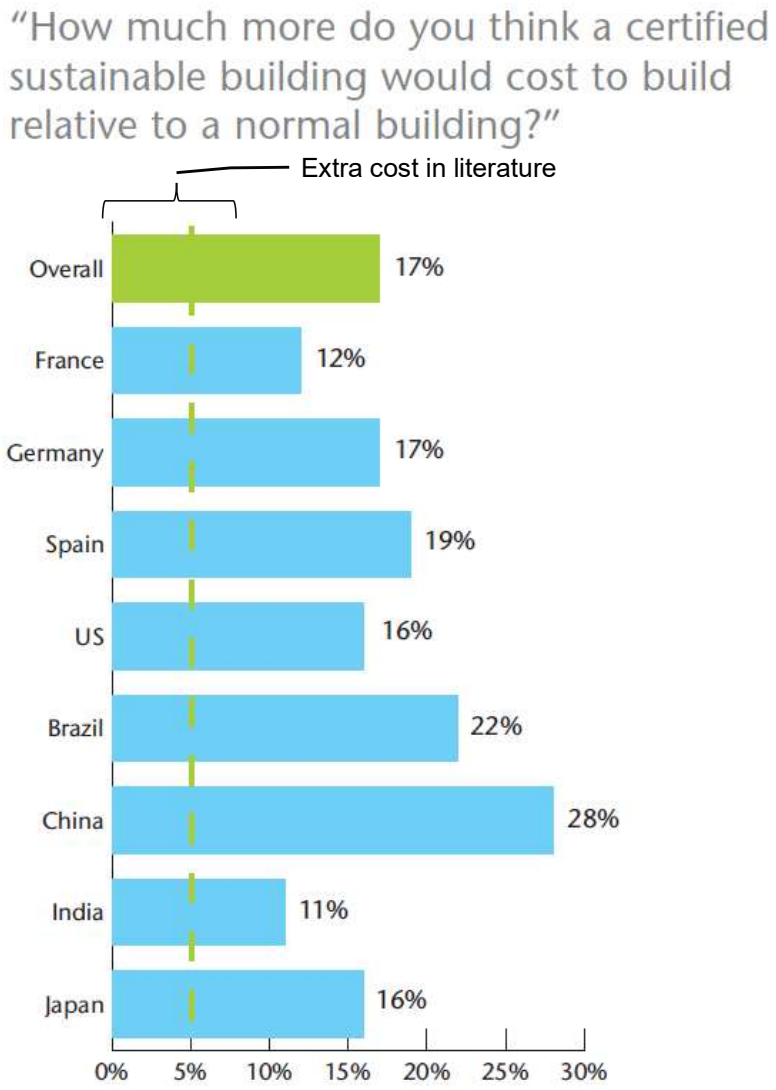
Green construction costs

- **How much extra does it cost to build green buildings (LEED Gold or better)?**
  - 10%
  - 20%
  - 30%
  - 40%



- L. Zhang et al. / Journal of Cleaner Production 172 (2018)

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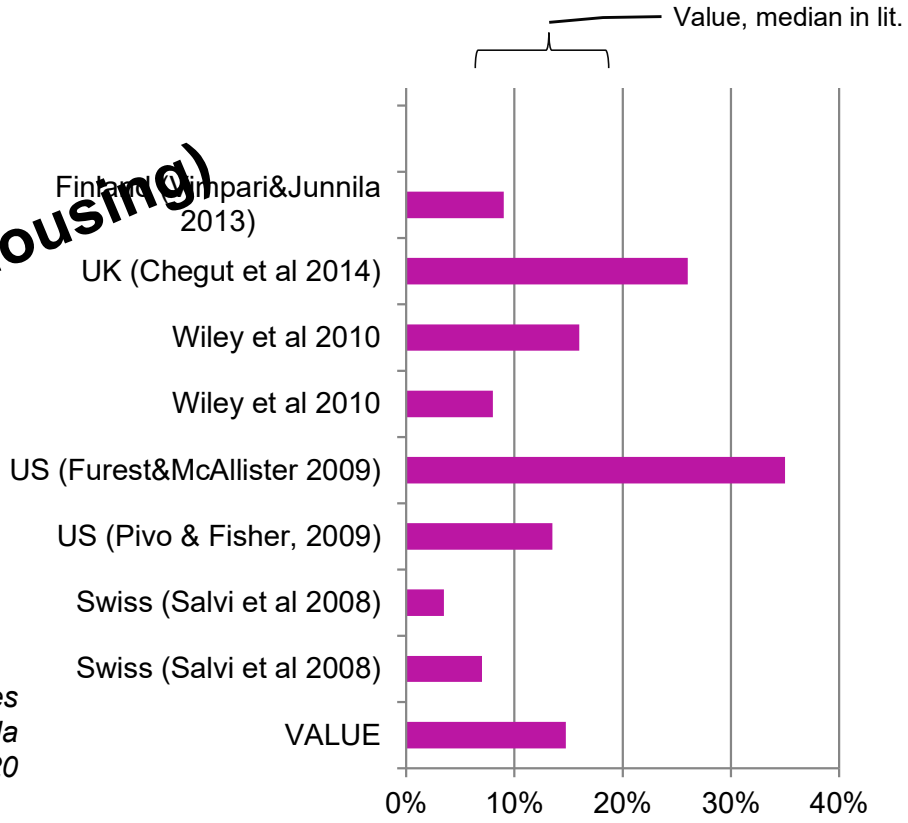
Value of green buildings

- **What is the value of green buildings?**
  - 0%
  - 5 %
  - 10%
  - 15 %

17% premium (6% housing)

vs.

5 % extra cost



A Review of the Financial Performance of Certified Properties
*Niina Leskinen * Jussi Vimpari, Seppo Junnila*
Sustainability journal, 2020

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Towards carbon neutral buildings

- Life cycle understanding
- Wood buildings

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Climate mitigation ≠ Carbon neutrality

=> Paradigm shift

- **Timing is essential**
- **Carbon neutral operation is not the solution**

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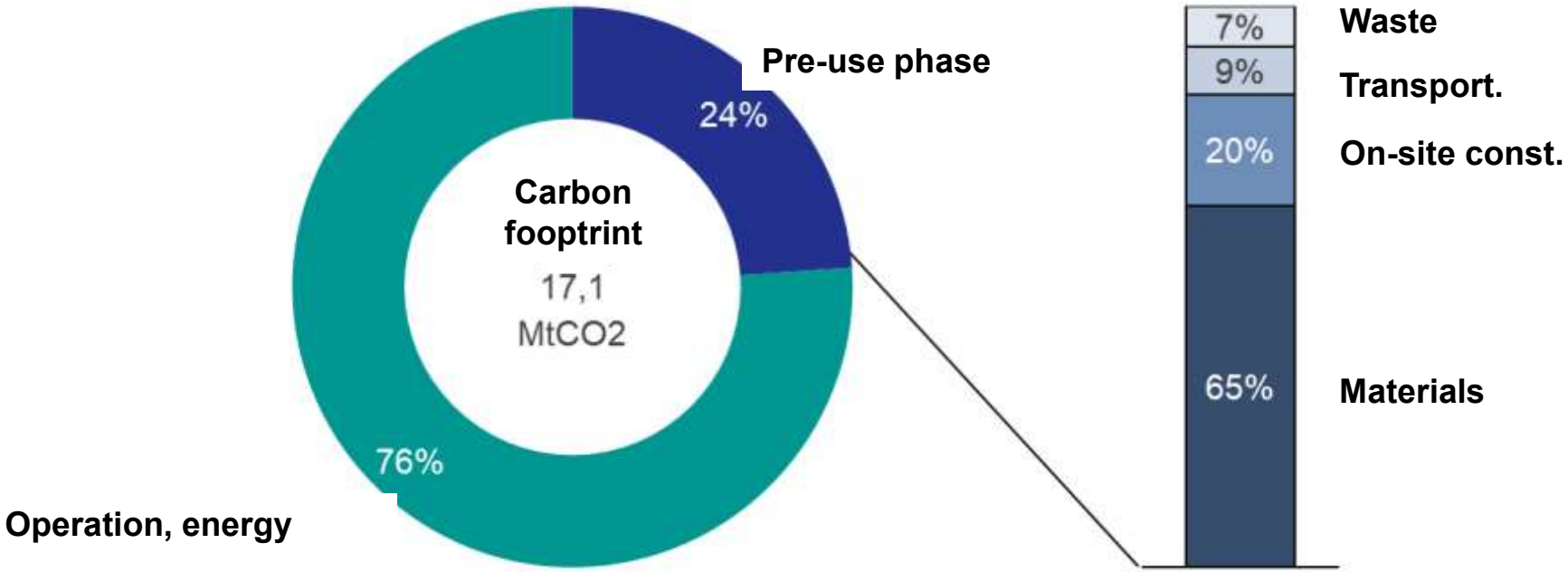
Building life cycle emissions (traditional approach)



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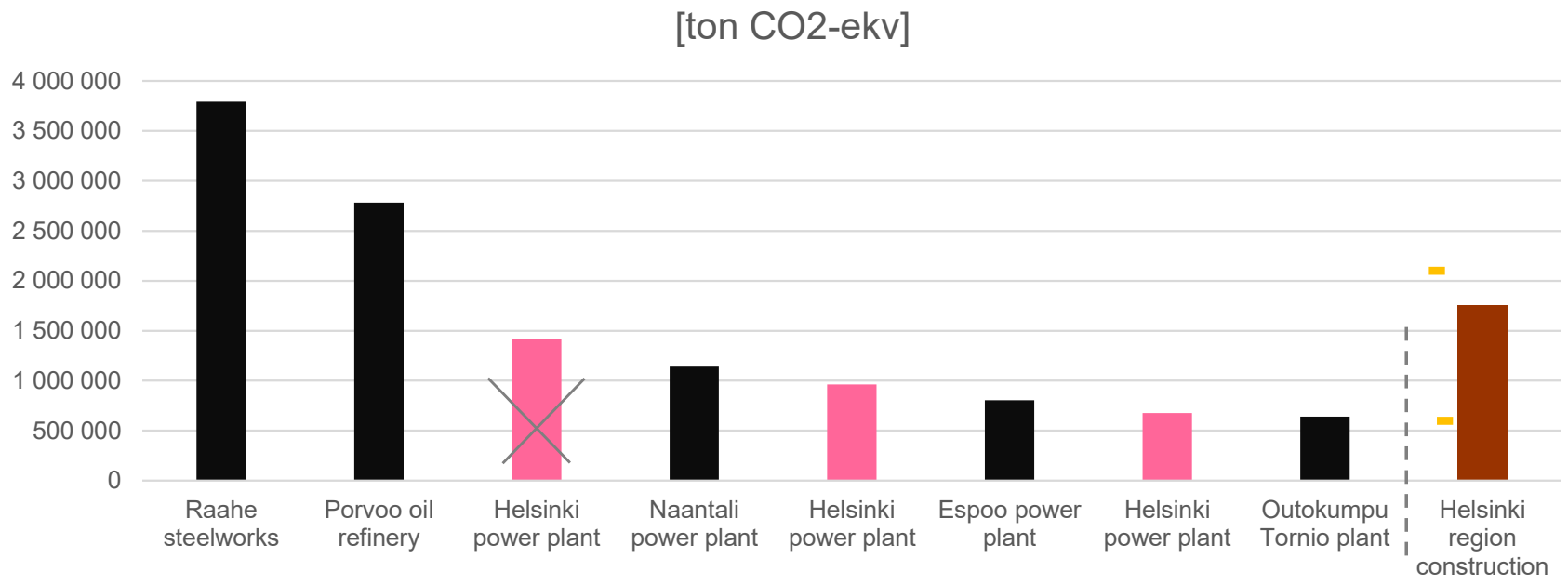
Vähähiilinen rakennusteollisuus 2035, Gaia Consulting Oy, 2020

Top carbon emiters in Finland 2018



*https://www.energiavirasto.fi/

Can life-cycle assessment produce reliable policy guidelines in the building sector?
A Säynäjoki, J Heinonen, S Junnila, A Horvath - Environmental Research Letters, 2017

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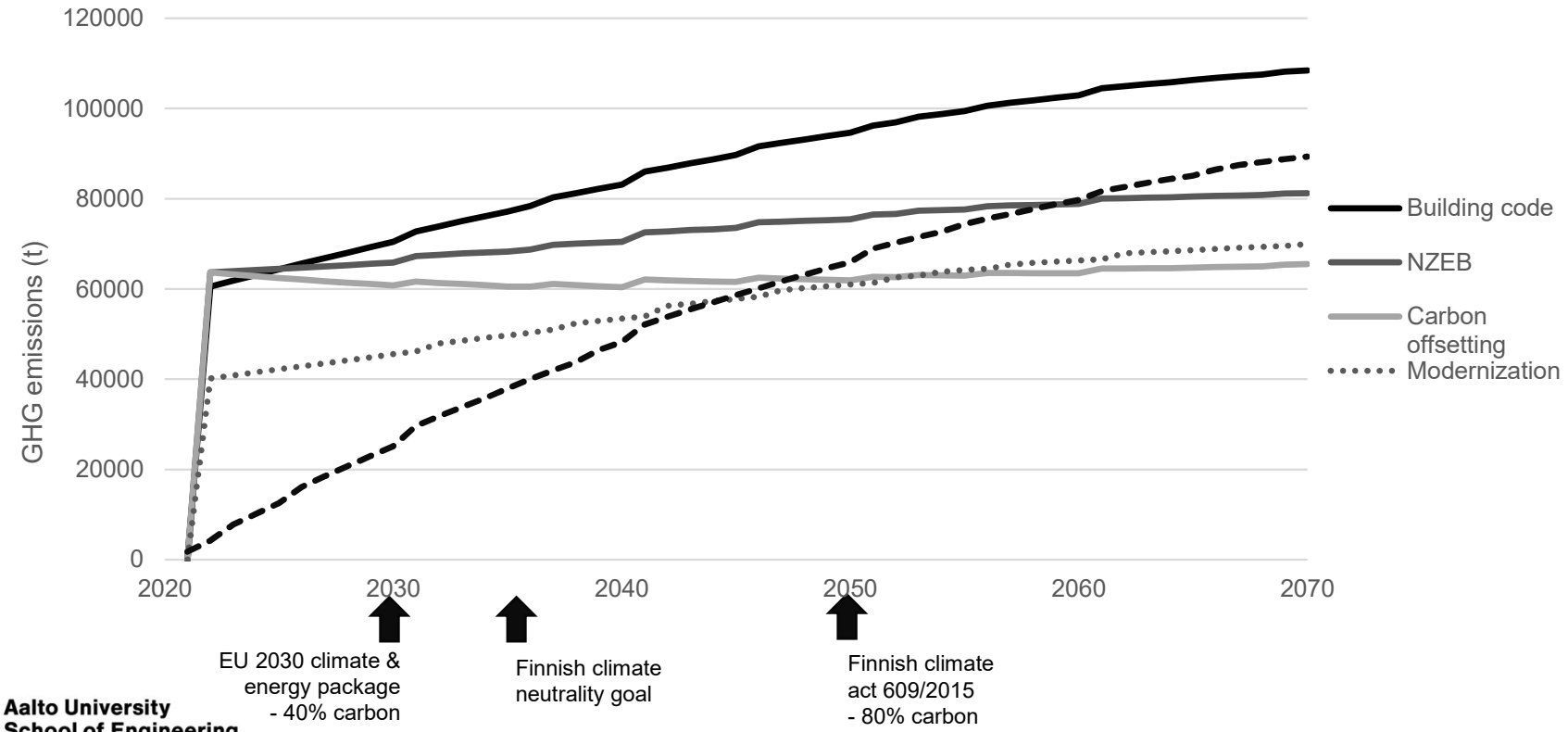
Construction carbon spike and operation, new residential development



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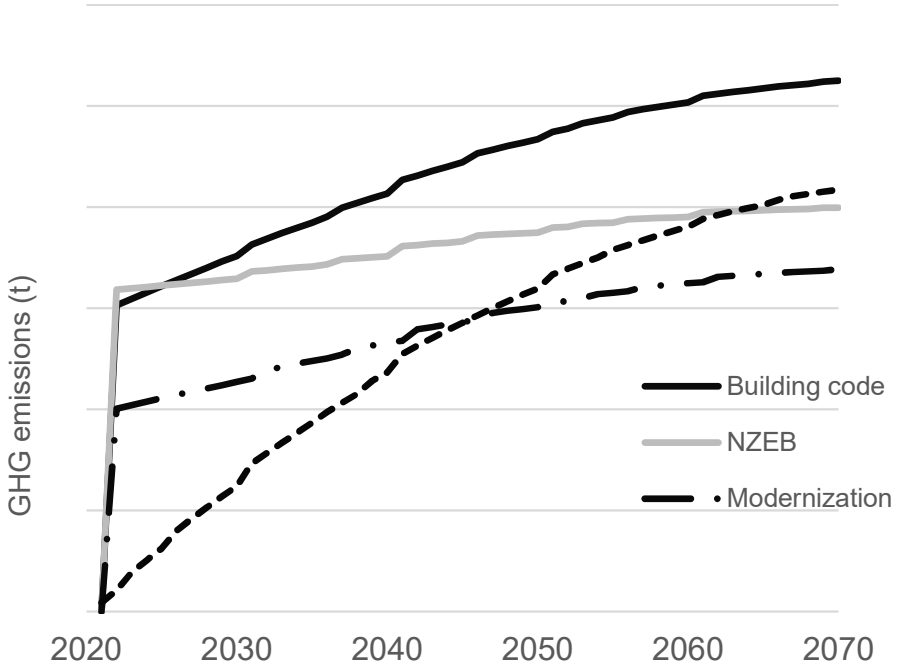
**A scenario analysis of the life cycle greenhouse gas emissions of a new residential area*
A Säynäjoki, J Heinonen, S Junnila 2012
Environmental Research Letters 7 (3), 034037

Construction carbon spike mitigation

- Circular economy
  1) Sharing spaces
  2) Reuse of buildings
  3) Reuse of building parts
  4) Reuse of building materials
- Materials with Carbon sink
  - Timber
  - New innovative materials to come…
- Low-carbon manufacturing
  - New manufacturing processes, renewable energy, etc.
  - Carbon offsetting



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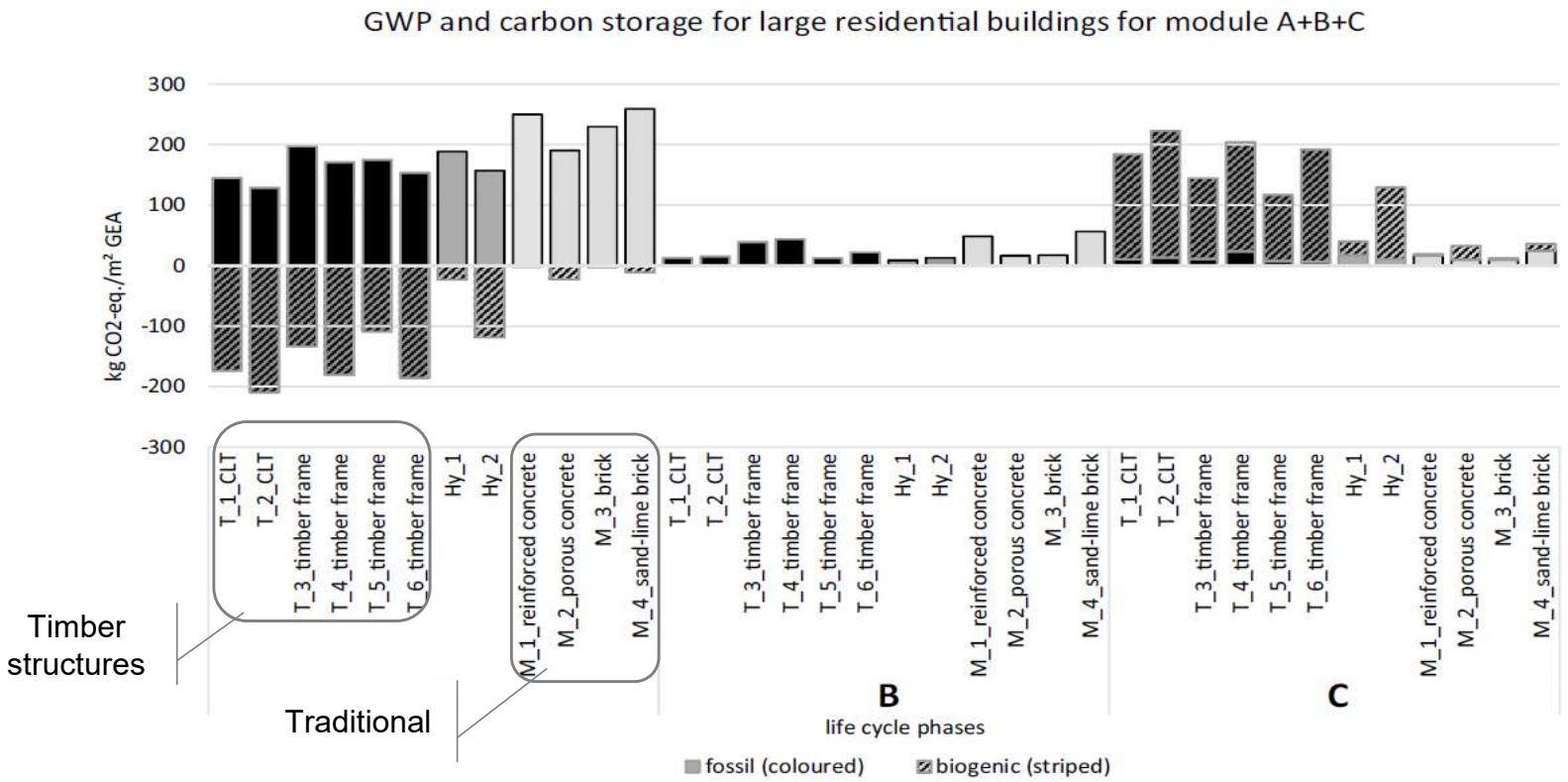
Wood vs. traditional structures



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*"Environmental aspects of material efficiency versus carbon storage in timber buildings", Hafner, A. & Schäfer, S. Eur. J. Wood Prod. (2018) 76: 1045"

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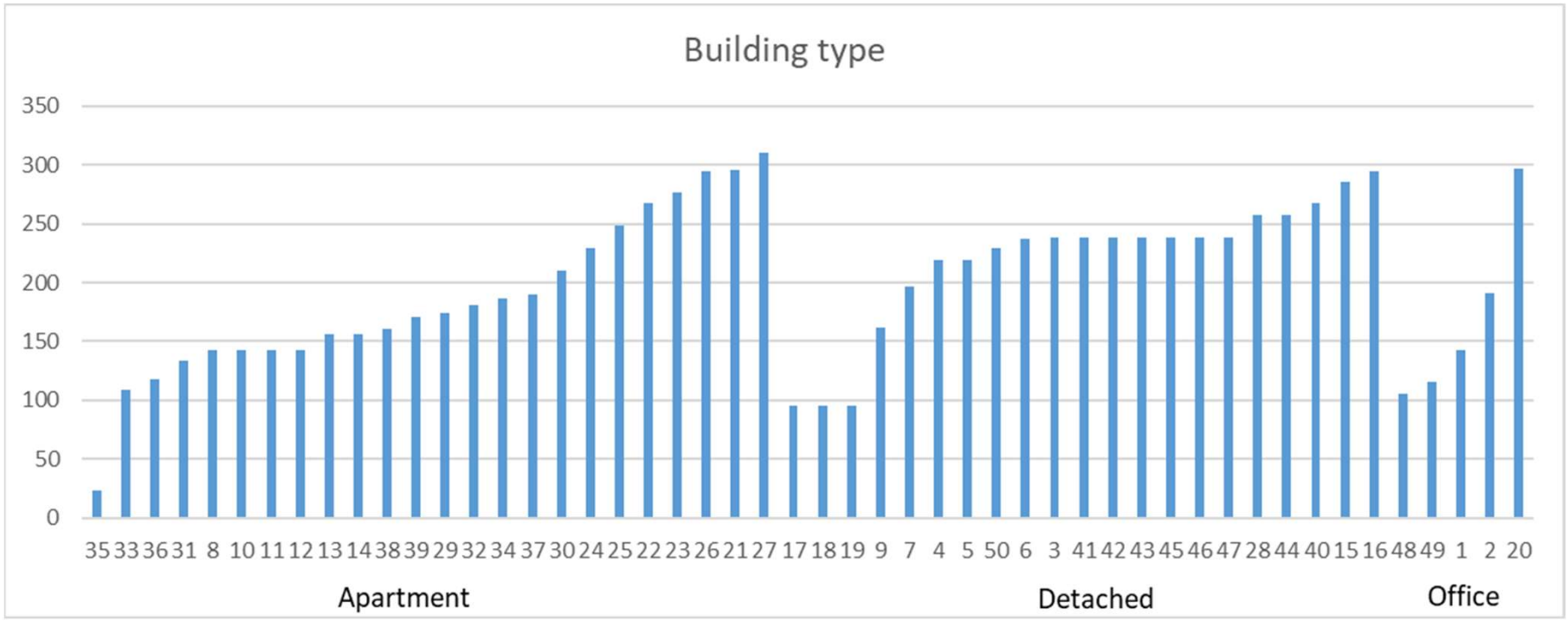
Carbon storage in wooden buildings



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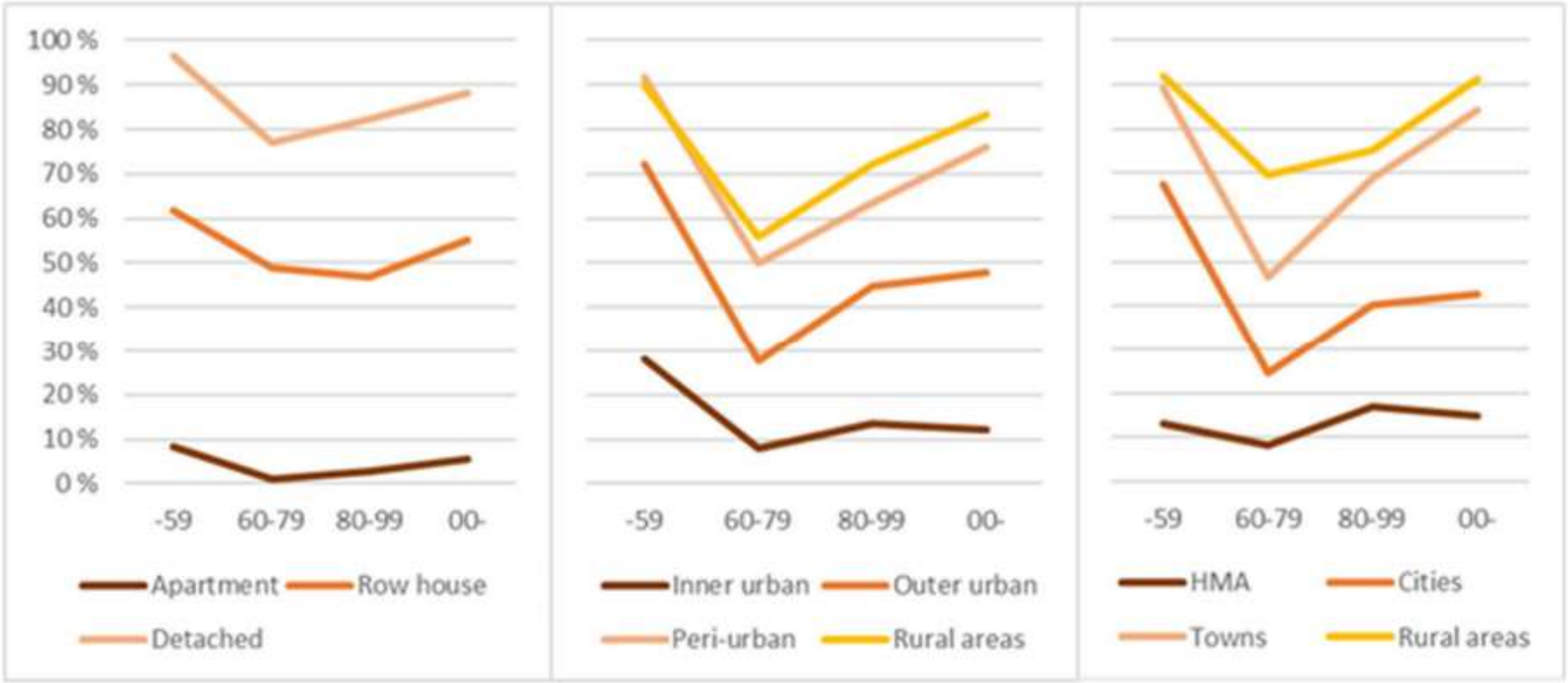
Cities as carbon sinks—classification of wooden buildings,
Amiri *et al* 2020 *Environ. Res. Lett.* **15** 094076

Wooden housing in Finland



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Ottelin et al 2021, “Comparative carbon footprint analysis of residents of wooden and non-wooden houses"

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Economic viability of wooden buildings

- Construction costs
- Market value

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Construction costs of wooden multistory buildings

	Authors	Country/Region	Concepts			
			Wood is cheaper	Wood is **not** cheaper	Wood has faster construction time	Believes wood can be cheaper in future
1	Cazemier (2017)	Australia		x	x	x
2	Hossaini et al. (2015)	Canada	x		N/A	
3	Jones et al. (2016)	United Kingdom		x	x	x
4	Kopzcynski (2018)	United States		x	N/A	x
5	Koppelhuber et al. (2017)	Germany	/	/	x	x
6	Kramer and Richie (2018)	Australia	x		x	
7	Nykänen et al. (2017)	Europe		x	x	x
8	Richie and Stephan (2018)	Australia	x		x	
9	Svaljenka et al. (2017)	Slovakia	x		x	
10	Thomas and Ding (2018)	Australia	x		x	
11	Mäkimattila (2019)	Finland		x	x	
12	Mäkimattila (2019)	Sweden	x		x	

N/A indicates that no information regarding the topic was found.

/ indicates that the costs may be lower/higher depending on the case and construction technique

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"Economic feasibility of wood-based structures – improving urban carbon neutrality strategies. Talvitie, Vimpari, Junnila- Environmental Research: Infrastructure and Sustainability, 2021"

Market price of wood buildings

Alternative regression estimates for log of transaction price

	(1) Helsinki	*(2) Helsinki*	*(3) Helsinki*	*(4) Helsinki*	*(5) Helsinki*
Wood	*-0,259***	*-0,167**	*0,043*	*0,041**	*0,085****
Std. err.	*[0,079]*	*[0,07]*	*[0,024]*	*[0,020]*	*[0,020]*
R-squared	*0,003*	*0,574*	*0,85*	*0,894*	*0,91*
Adj R-squared	*0,003*	*0,574*	*0,85*	*0,894*	*0,909*
N	*14888*	*14888*	*14888*	*14867*	*14867*
(a) Age & Size		*yes*	*yes*	*yes*	*yes*
(b) Housing characteristics			*yes*	*yes*	*yes*
(c) CBD Euclidean Distance			*yes*	*yes*	*yes*
(d) Neighbourhood characteristics				*yes*	*yes*
(e) Postal codes					*yes [79]*

"Economic feasibility of wood-based structures – improving urban carbon neutrality strategies. Talvitie, Vimpari, Junnila- Environmental Research: Infrastructure and Sustainability, 2021"

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Market price: cities, building types

- Market premiums in Helsinki for apartment buildings
- No price effect for apartment buildings in other major cities
- Detached buildings seem to have lower prices (and construction costs)

Statistically significant positive effect

No statistically significant difference

Statistically significant negative effect

$* p < 0,05$, $** p < 0,01$, $*** p < 0,001$

"Price premium for wooden dwellings? Wood-based structures as a tool to enable carbon neutrality for cities. Talvitie, Vimpari, Junnila, 2021

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Wood on Certified buildings?

Concrete vs. wooden designs

Table 6. Case building's total LEED points and LEED certification level.

Scenario	Con	OptCon	ConWood	Wood
Material selection points	5	5	8	14
Other points	32	32	32	32
Total points	37	37	40	46
LEED level	–	–	Certified	Certified

"Embodied emissions of buildings - A forgotten factor in green building certificates, Ali Amiri, Nargessadat Emami, Juudit Ottelin, Jaana Sorvari, Björn Marteinsson, Jukka Heinonen, Seppo Junnila,, Energy and Buildings, Volume 241, 2021"

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Conclusion

- **Cost of green building is less than anticipated**
- **Market premiums are typically higher than extra costs**
- **Carbon footprint of buildings today**
  - 50% construction + 50% use
- **Wooden urban building premiums are starting to show on markets**

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