Østfoldforskning

SUSTAINABLEINNOVATION

Refurbishment or Replacement of Buildings – What is Best for the Climate?

Presented by Guro Nereng

Ostfold Research

Anne Rønning, Mie Vold and Guro Nereng

Aim of the study

1. To document the GHG emissions from the two alternative solutions
2. To gain experiences from using LCA methodology as a basis for decision making in a feasibility phase

Cases

New construction:

- Existing building is demolished completely and new building is constructed
- New building has good adaptability

Refurbished construction:

- Demolishment of all interiors excluding primary building components and building envelope
- Rebuilding interior
- Medium adaptability

Life cycle phases

- Demolishing and preparation for construction
- Building construction (cradle to gate for building materials and components)
- Operation
- Maintenance and Development

during 60 years service life

End of Life – was not included in the comparison due to lack of data

Challenges for use of P-LCA

1. The construction sector in Norway does not have a tradition to evaluate their projects on mass basis, only in economical terms. Thus, one does not have key figures or experienced based calculations to lean on.
2. In a feasibility phase one doesn’t know which materials will be chosen.
3. There are not environmental data available for all building materials and components.

Data

- NAMEA statistics (National Account Matrix including Environmental Accounts)
  - Given as tonne GHG emissions per NOK
- Product specific emissions in those cases where the materials were given
  - EPDs for steel and concrete

Assumptions operation

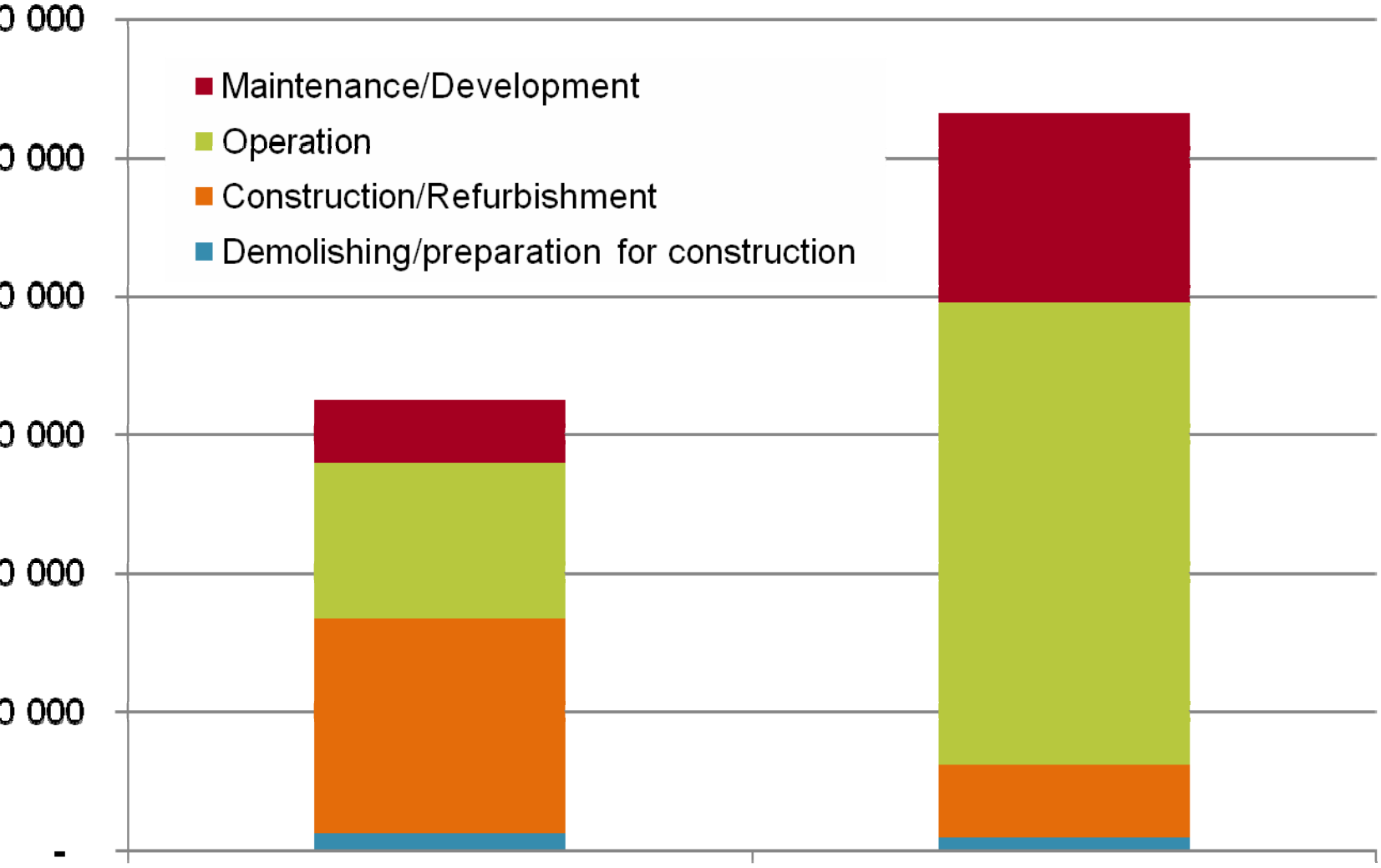
		New Construction	Refurbished Construction
Energy use	**Net energy demand**	100 kWh/m^2 and year	300 kWh/m^2 and year
	Purchased electricity[1)]	85 kWh/m^2 and year	174 kWh/m^2 and year
	District heating[2)]		126 kWh/m^2 and year
Inspection of technical equipments	**Building conditions**	Good performance, good routines	Medium performance, medium routines
	Cost	NOK 60,-/m^2 per year	NOK 90,-/m^2 per year
Cleaning	**Building conditions**	Good performance, good routines	Good performance, good routines
	Cost	NOK 70,-/m^2 per year	NOK 70,-/m^2 per year

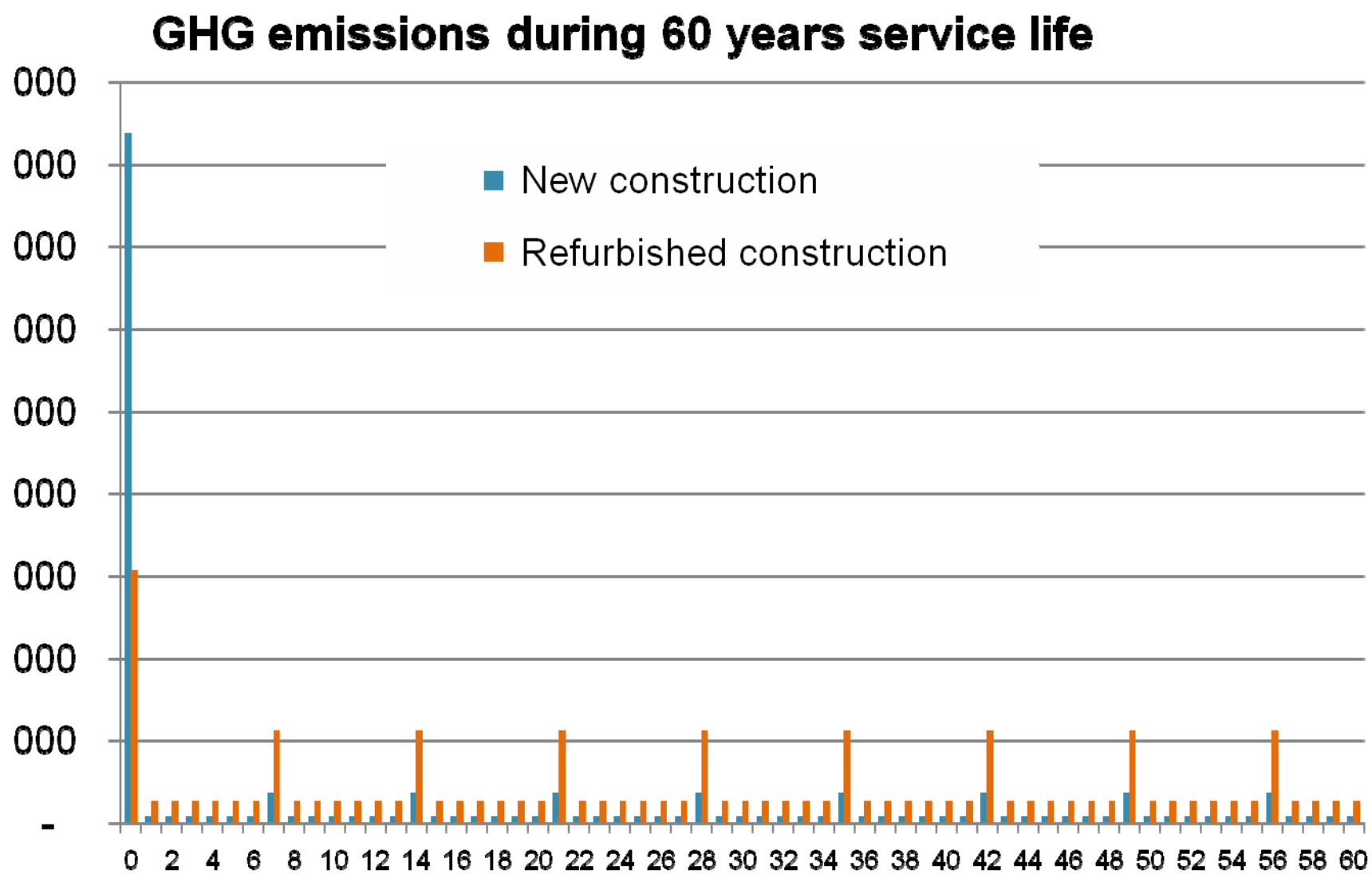
[1] Nord-el mix (Nordic el production, loss included)
[2] FREVAR: Emissions per kWh produced + 10% loss

ssumption Maintenance/Development

	New Construction	Refurbished Construction
ng condition	Good adaptability	Medium adaptability
	NOK 1.500,-/m^2 floor area	NOK 4.500,-/m^2 floor area
	Every 7th year	Every 7th year

Total GHG-emissions during the life span of the constructions




GHG emissions during 60 years service life
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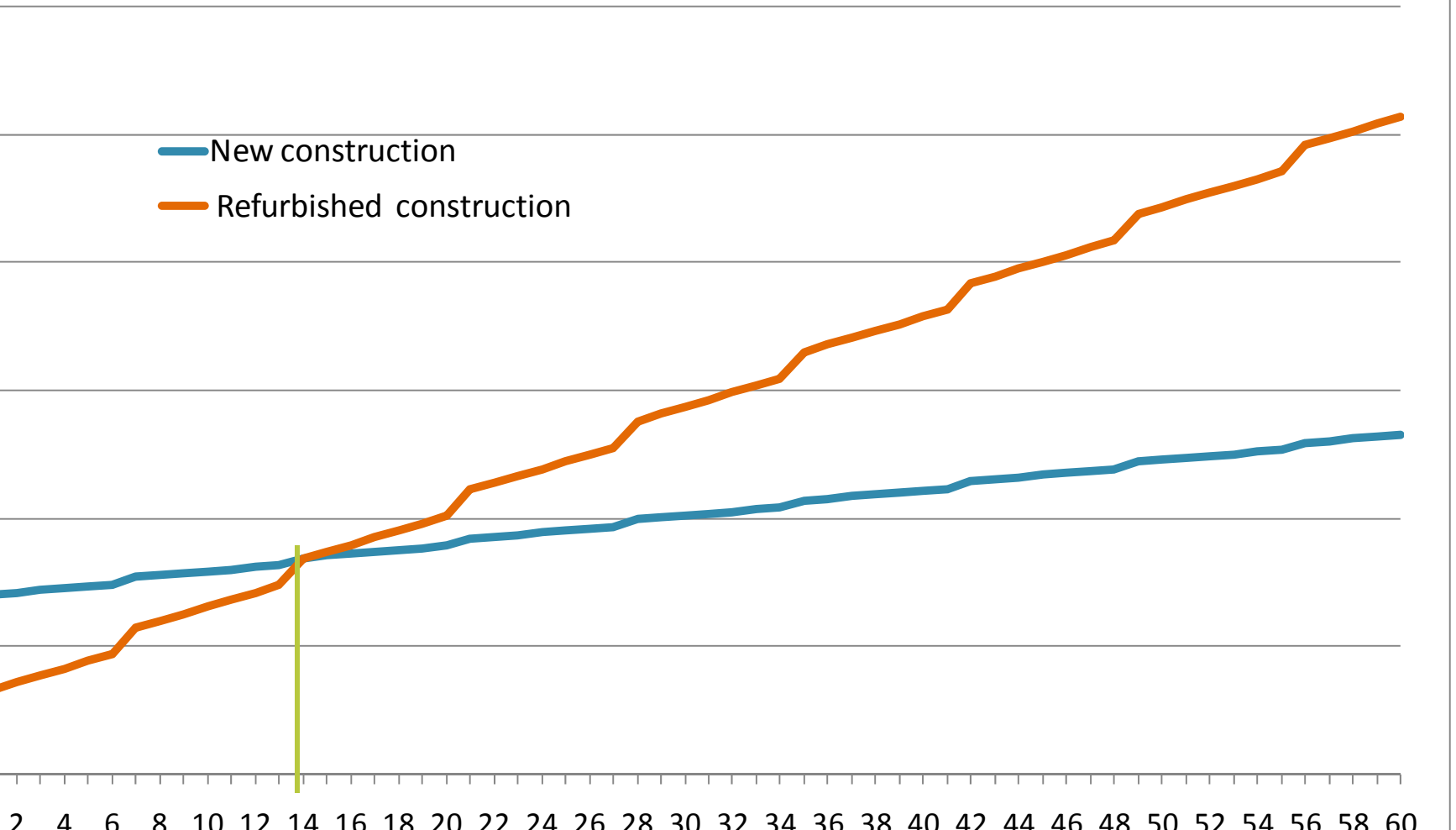
-
New construction
Refurbished construction
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60

Accumulated GHG-emissions per work place for new vs. refurbished construction



onclusion

From a climate point of view the most favourable strategy was to replace the existing construction and build a new one.

One can accept higher environmental load in the construction phase **if** the way the combination of building materials and solutions are affecting each other **increase the adaptability** of the construction and therefore **reduce the emissions** during the life time of the building

The results contributed to increased knowledge of the different choices in a feasibility phase may have on the life cycle activities in a buildings life span

When it comes to actual choices of material and technical solutions the service lives of different building products and components, and their effect on a building and its service life need to be analyzed

he existing building is emolished

Construction of the new building has started