Environmental Effects of Wood Substitution in Commercial Construction

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Background

• Wood in Residential vs. Commercial
• Oregon Wood Production
• Research Gap on Literature

http://freshspace.co/blog/the-future-of-office-buildings/
Scope

• Cradle-to-Gate LCA
• Athena IE4B
• Structural System
• Six Commercial Bldgs.

http://www.coldstreamconsulting.com/building-and-infrastructure-lca
Methodology

Case Study Selection

- Location, type, area, loads
- Steel, concrete, masonry
Methodology

- Include: floors, roofs, walls, foundations & LFRS
- Non: doors, windows, partitions, stairs, entrances

Case Study Selection ➔ Assumptions

Methodology

Athena IE4B Modeling
Methodology

Case Study Selection → Assumptions → Athena IE4B Modeling → Results → Conclusions
Results

• Global Warming Potential—GWP [kg CO2 eq]
• Fossil Fuel Consumption—FFC [MJ]
• Other Impact Categories
  • Non-Renewable Energy (NRE)
  • Acidification Potential (AP)
  • Smog Potential (SP)
  • HH Particulates (HHP)
  • Ozone Depletion Potential (ODP)
  • Eutrophication Potential (EP)

• Construction Effects
Results

Global Warming Potential

Global Warming Potential [Per ft²]
Results

Fossil Fuel Consumption

Fossil Fuel Consumption [Per ft²]
Results

Impact Change - Materials

- NRE [MJ]
- GWP [kg CO2 eq]
- FFC [MJ]
- AP [kg SO2 eq]
- SP [kg O3 eq]
- HHP [kg PM2.5 eq]
- ODP [kg CFC-11 eq]
- EP [kg N eq]
Results

Materials & Construction

<table>
<thead>
<tr>
<th>SC</th>
<th>GWP [kg CO2 eq]</th>
</tr>
</thead>
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<td>0</td>
</tr>
<tr>
<td>SC2</td>
<td>1e+5</td>
</tr>
<tr>
<td>SC3</td>
<td>2e+5</td>
</tr>
<tr>
<td>SC4</td>
<td>3e+5</td>
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<tr>
<td>SC7</td>
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</tbody>
</table>
Results

Impact Change - Construction

- HHP [kg PM2.5 eq]
- ODP [kg CFC-11 eq]
- GWP [kg CO2 eq]
- AP [kg SO2 eq]
- FFC [MJ]
- NRE [MJ]
- EP [kg N eq]
- SP [kg O3 eq]

[Graph showing changes in different environmental impact categories]
Preliminary Conclusions

• Materials:
  • **GWP~28%** Less CO2 Emission!
  • FFC~28% Less FF Consumption!

• Construction:
  • GWP~17% Less CO2 Emission!
  • FFC~30% Less FF Consumption!

• Future:
  • More case studies (≠ materials, ↑ buildings)
  • Compare results & analyze the EI4B software
  • Detailed design & LCA of 1 wood building
Thank You!

Questions 😊