



# Roofing Materials Analysis

Garret DeNolf, Kevin Henderson, Jim Fakonas, Jess Hoffman

May 8, 2008

# Introduction

- Roofs of homes alone take up  $1.2 \times 10^{10} \text{ m}^2$  in the US
- Small savings in energy can save much overall energy
- Six materials analyzed: Ceramic, cedar, steel, stone, PVC, asphalt
- All values were for 100 years



# Transport Costs



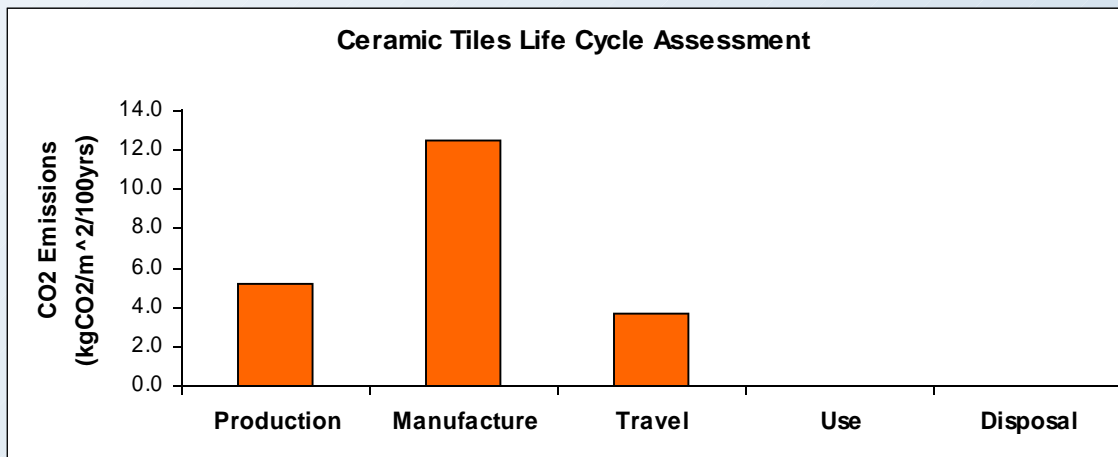
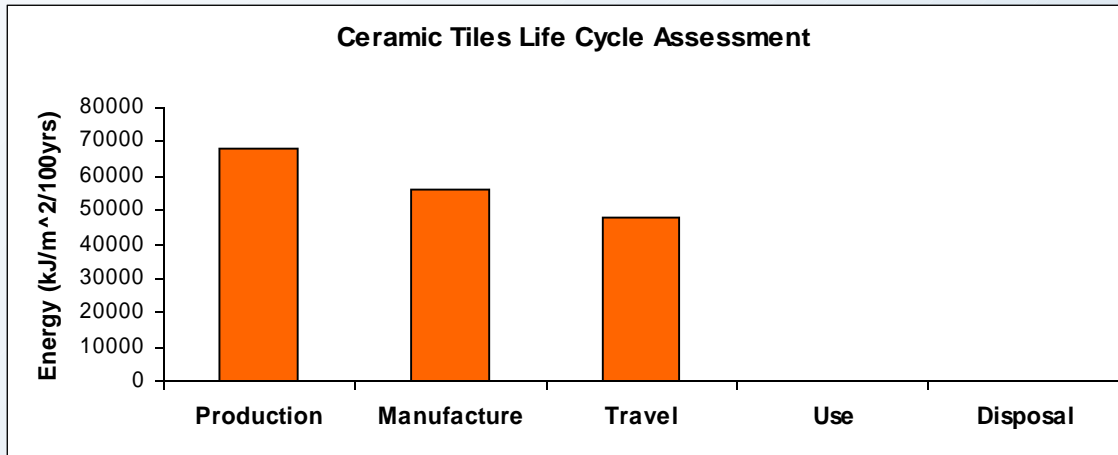
# Transport Costs

- 1.42 MJ/kg
  - Assumes 2000 miles travel, 40' truck, 26,580 kg/load, 7 miles/gallon, 132 MJ/gallon

<u>Material</u>	<u>Weight</u> (kg/m <sup>2</sup> )	<u>Transport Cost</u> (MJ/m <sup>2</sup> /100yrs)
Ceramic	25	47
Cedar	20	142
Steel	5.5	46
Stone	59	83
PVC	22	127
Asphalt	15	138

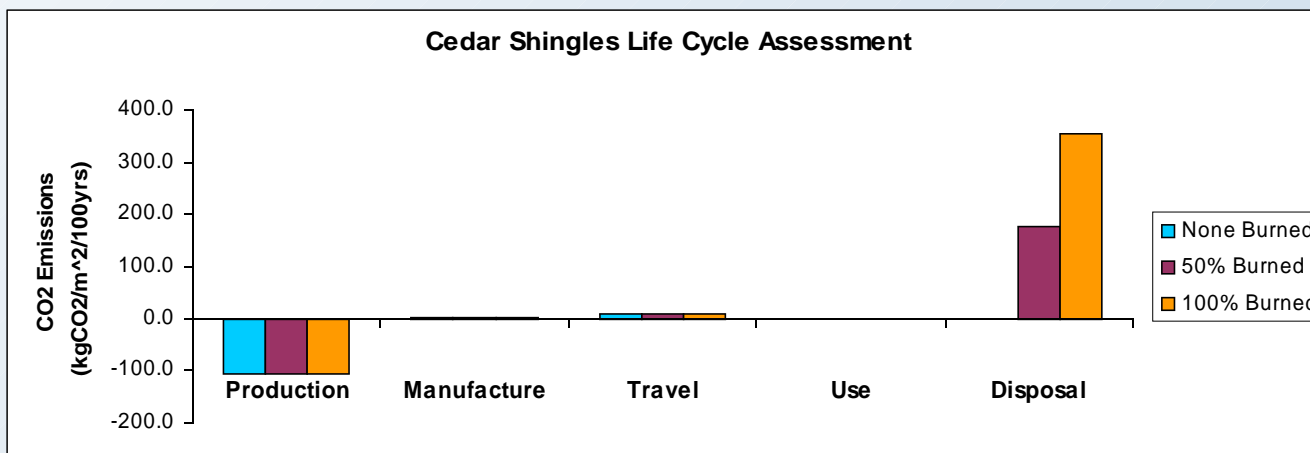
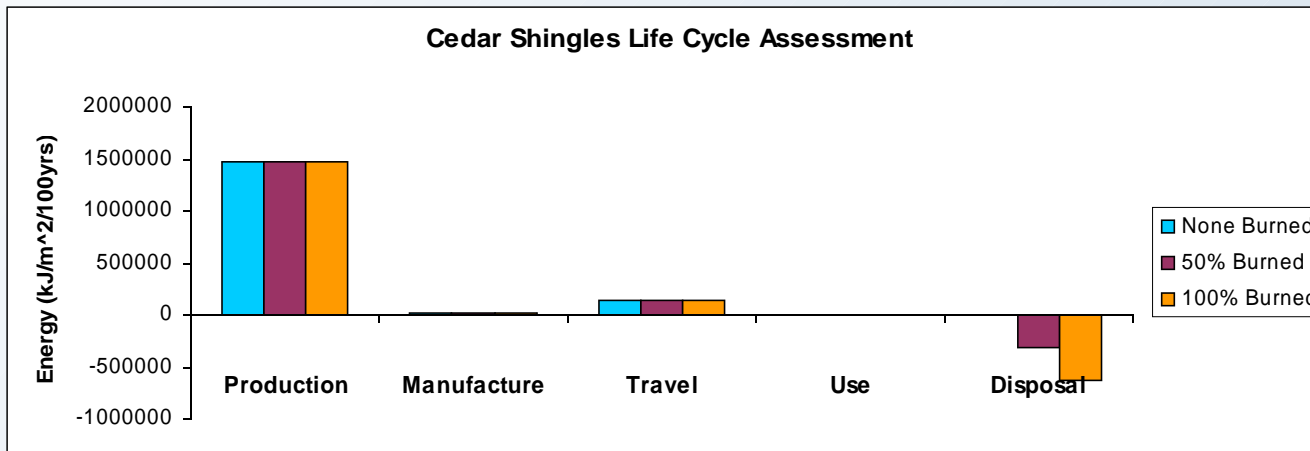
# Ceramic Roofing

- Replaced every 75 years
- 25 kg/m<sup>2</sup> on roof



# Cedar Roofing

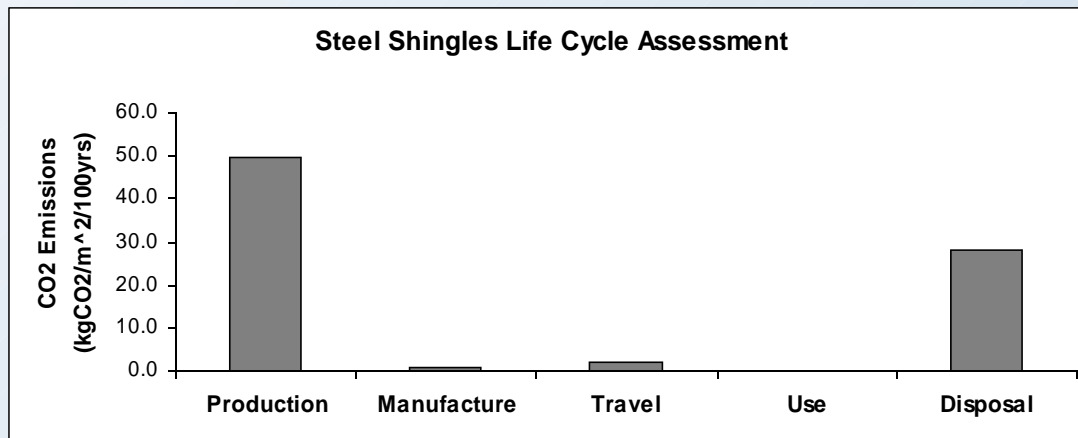
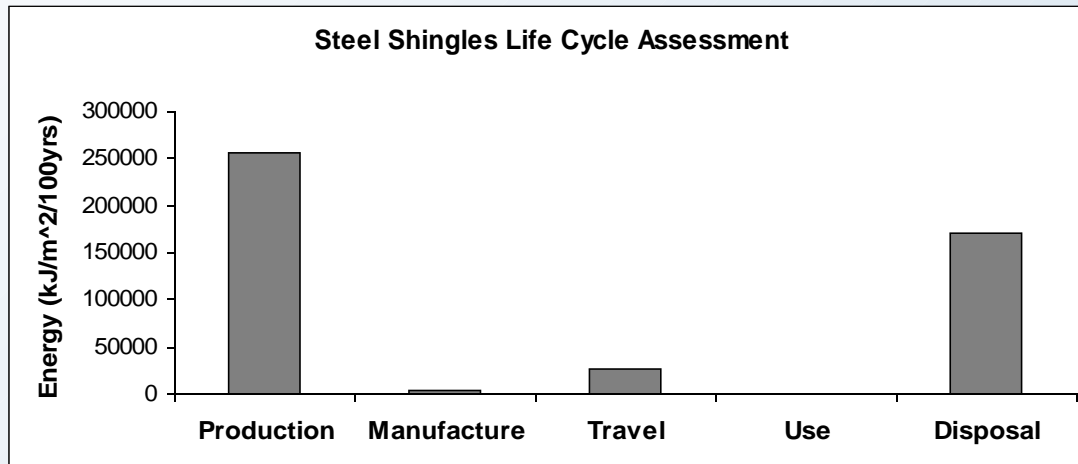
- Replaced every 20 years
- 20 kg/m<sup>2</sup> on roof





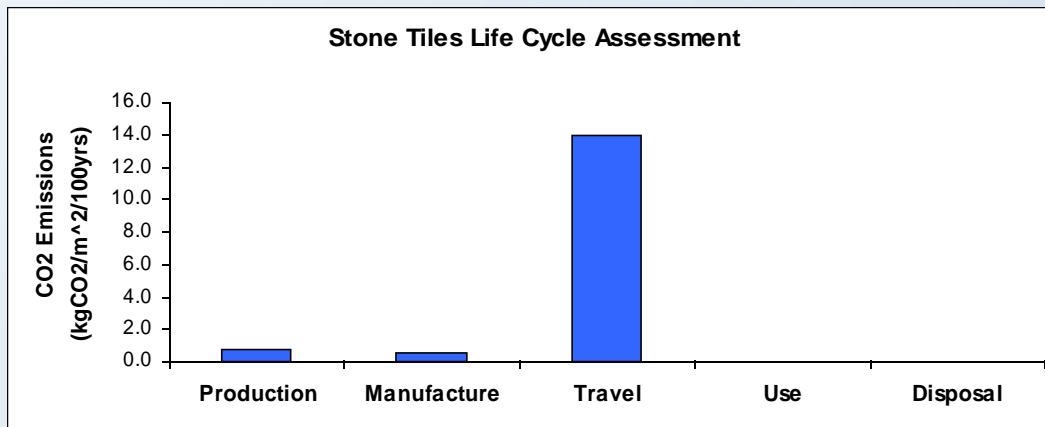
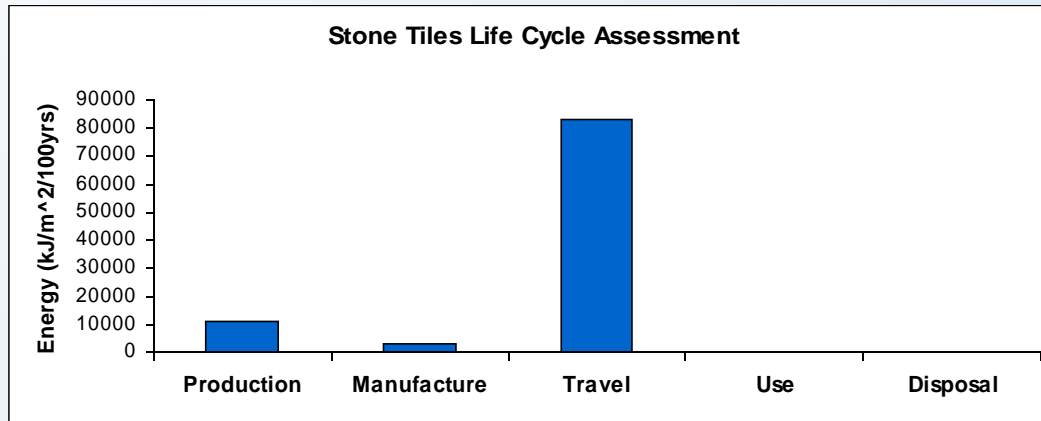
# Steel Roofing

- Replaced every 30 years
- 5.5 kg/m<sup>2</sup> on roof



# Stone Roofing

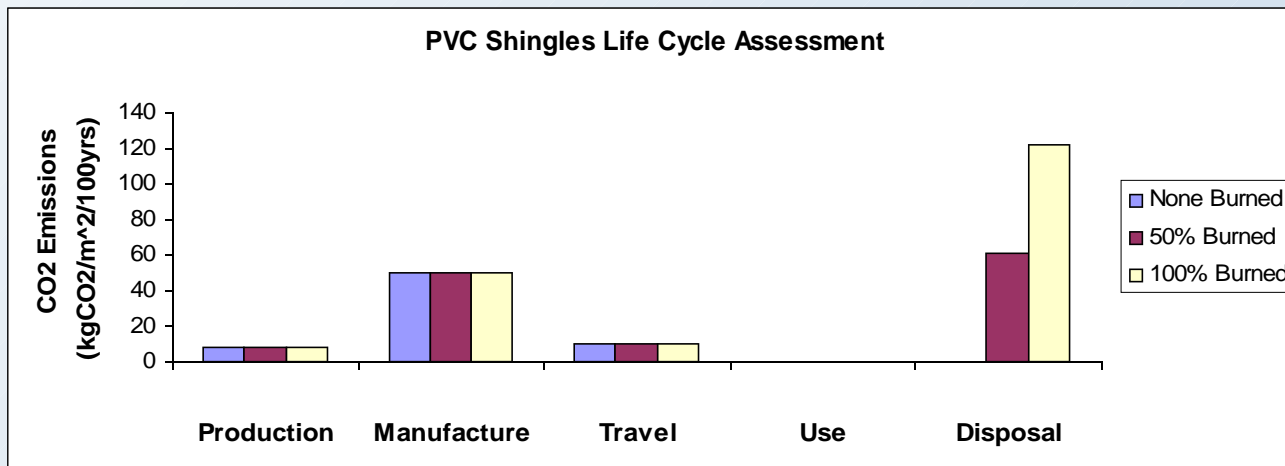
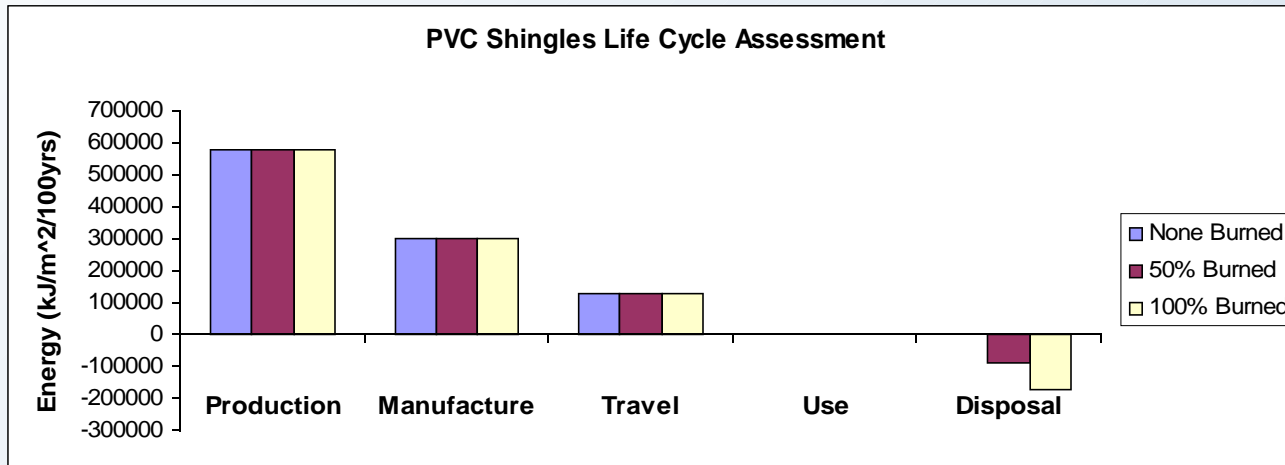
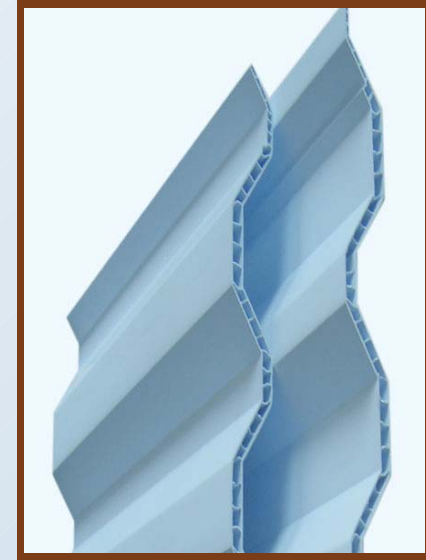
- Replaced every 100 years
- 59 kg/m<sup>2</sup> on roof





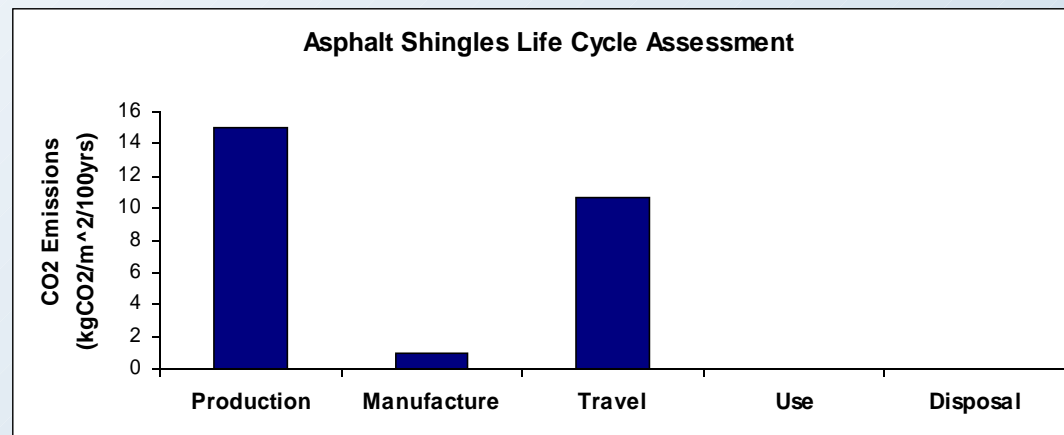
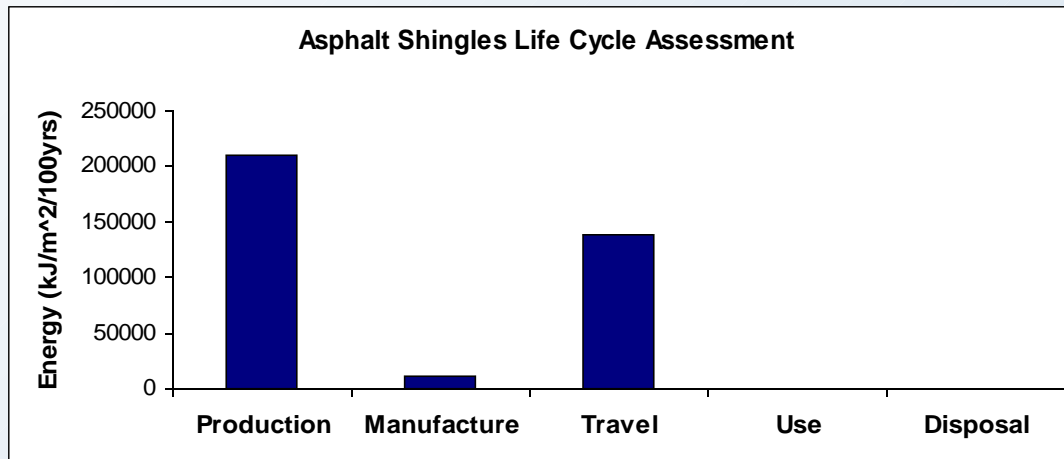
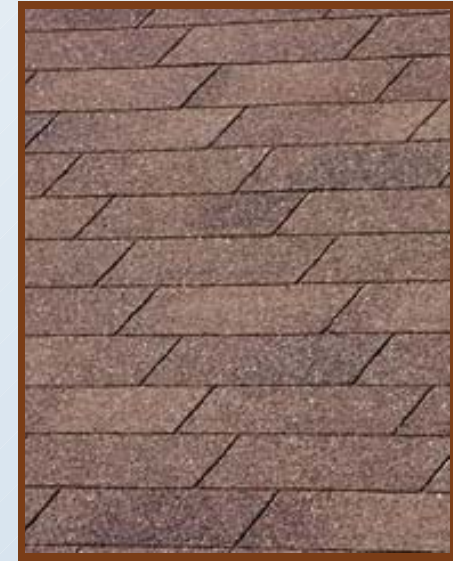
# PVC Roofing

- Replaced every 25 years
- 22 kg/m<sup>2</sup> on roof



# Asphalt Roofing

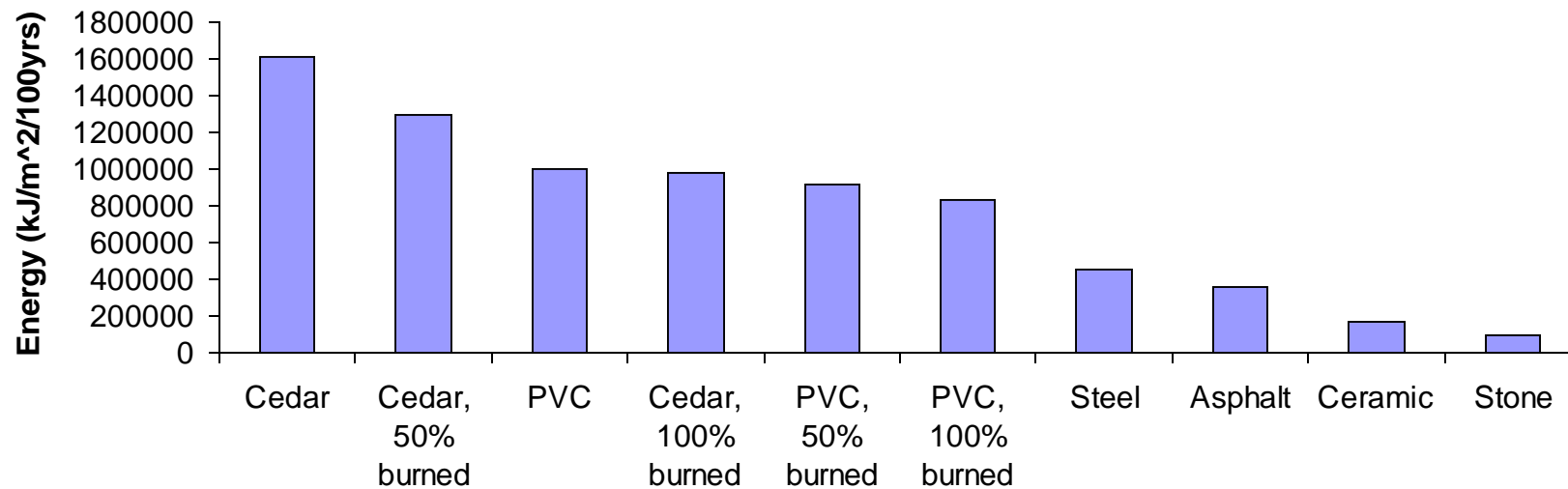
- Replaced every 15 years
- 14.6 kg/m<sup>2</sup> on roof



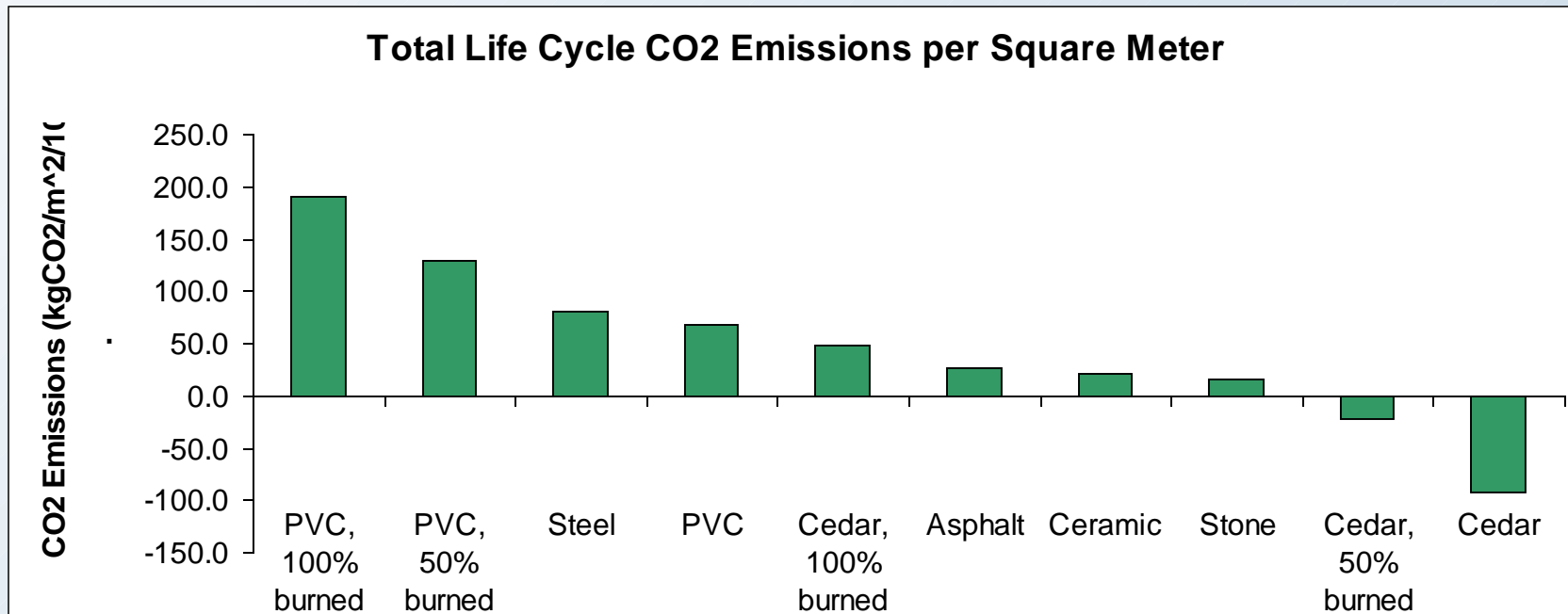
# Overall Energy Comparison



Total Life Cycle Energy per Square Meter of Roofing



# CO<sub>2</sub> Emissions



# Conclusions

- Energy Life Cycle for 100 years
  - Highest for cedar with none burned, 50% burned, and PVC
  - Lowest for stone, followed by ceramic
- CO<sub>2</sub> Life Cycle for 100 years
  - Highest for PVC with 100% burned, 50% burned, and steel
  - Lowest for cedar with none burned, 50% burned, and stone
- Best overall materials
  - The materials that combined low energy and CO<sub>2</sub> emissions were stone and ceramic, followed by asphalt
  - Stone – need a roof that can support the large weight
  - Ceramic – only good for warm weather climates
  - Asphalt – best overall option for less supported roof and moderate or cold climate

**Questions?**