Introduction

The construction process demands high amounts of energy for these activities: temporary lighting; transportation; generator, equipment, and machinery use; welding; heating and cooling.

Global Energy Consumption by Sector, 2015

However, regulations on energy efficiency for the construction phase are limited.  

Country, State, and Province building energy codes, 2016

Methods

This research has shown that more data is needed to ascertain individual construction activities and equipment energy use, in order to determine how to manage it and attain sustainable construction. PM emission data sourcing is needed in standards and codes to ensure it is considered.

The EPA provides an equation based on level of construction activity and emission factor, using either a “top down” or “bottom up” methodology.

1. Reviewed four green building codes, and fourteen voluntary building standards – texts.

2. Investigated construction site energy consumption to determine factors influencing inefficient site energy management.

Results and Discussion

There is a gap in the codes and standards for the construction phase of development, i.e. ground breaking to substantial completion. Normalized Percent “hits” of key terms per grouping from total standards

Standards Alphas

Applicable Sections

WELL Building Standard (v2), U.S 7
BREEAM (2016), International 16
EBE (2012) 14
ENFG (2018), Special Emphasis, U.S 1
EPS (2011) Special Emphasis, U.S 7
Green Star, South Africa 1
Green Building Initiative (2015), U.S 5
ICF/ASHRAE (2015), U.S 6
Zero Carbon Building Standard, Canada 4
ASHPMX Standard (0.5.1), International 5
ASHRAE Standard 189.1, International 3
ASHRAE Standard 55, International 5
National Carbon Offset Standard, Australia 1

codes were reviewed for key terms related to energy efficiency and/or sustainable construction. Context was grouped into:

• Manufacturing: Resource sourcing to supply  
• Construction: Ground breaking to substantial completion  
• Building: Substantial Completion to end of file

Sustainable building standards and codes are focused mainly on improving Indoor Environmental Quality (IEQ), the health of occupants, and limiting the environmental impacts of buildings. There is a gap on the full lifecycle of the building production which includes manufacturing of materials, and construction of the building.

Lastly, two key terms, temporary lighting and energy star portfolio show a way for improvement.

• Energy STAR portfolio, is required by majority of standards for calculating GHG emissions consistently across the building sector. Changes towards construction inclusion may rely upon changes in the tools such as ENERGY STAR, as much as the standards and codes themselves.

• Temporary lighting is relevant for the frequency of night construction, working in spaces void of fenestration, or requiring task specific lighting. Reduced nighttime work was at the foregound of reduced carbon footprints of construction sites in Malaysia (Eismaeilifar et al, 2015)

Further Work

• Determine the connection between inefficient lighting and health implications on construction workers  
• Corrobore results through a survey sent out to construction firms in residential, commercial, and civil sectors  
• Estimate reductions in environmental emissions from energy efficiency standards  
• Predict emission reductions over 20 year period for construction processes with the increase in energy efficient standards

References


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Conclusion

Energy use, environmental emissions and health impacts are linked, reaffirming the importance of energy efficiency standards towards the support of the ‘healthy Infra’.  

Environmental Emissions:

Energy Impacts

Normalized Percent “hits” of key terms per grouping from total standards

None

Health Impacts

0%
20%
40%
60%
80%
100%
0%
20%
40%
60%
80%
100%
Meaningful reductions in construction energy use are needed to support the ‘healthy Infra’.