GREEN BUILDING

SLOT-3

EMBOIDED ENERGY BASED PROJECT

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The embodied energy and environmental emissions of construction projects in China: An economic input–output LCA model

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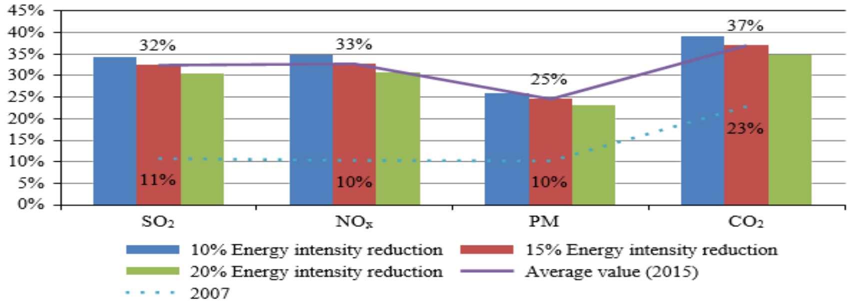
ABSTRACT:

Due to a lack of comprehensive national statistics, a detailed knowledge of resource consumption, embodied energy, and environmental emissions of civil projects in China is challenging. This study created a 24 sector environmental input–output life-cycle assessment model based on 2002 Chinese national economic and environmental data to quantitatively examine the energy and environmental consequences of civil construction at a macro level. The model creates a national inventory of energy consumption and emissions. Estimates are established based on the amount of economic activity in 2015 for projected future civil works. According to the findings, construction projects account for about one-sixth of the overall economy's energy use in 2007, and may account for roughly one-fifth of total energy consumption by 2015. Coal and oil usage account for the majority of this energy consumption. The primary pollutants of the country's atmosphere and environment are energy-related emissions. If industry's energy use and manufacturing practises continue unchanged from 2002, China's total energy consumption goals will face hurdles in the coming decade. As a result, meeting China's energy and environmental quality targets will need the effective application of efficient energy technology and laws.

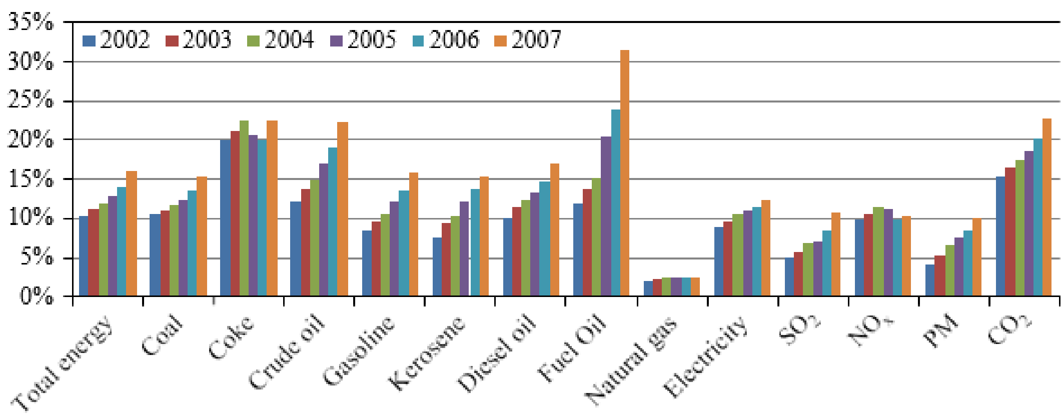
INTRODUCTION:

The environmental and energy issues that come with moving society toward a more sustainable path are enormous and pressing. Building and infrastructure building has become a significant energy consumer in China as a result of changes in industry and transportation. As a result, there has been a rise in environmental stress. Building energy usage accounted for 47 percent of overall energy consumption in China in 2007. (Wang, 2005). Given the rapid pace of urbanisation and infrastructural development, this percentage is expected to continue to rise in the next decades. In terms of building life cycle energy consumption, operational energy accounts for roughly 80% of overall energy consumption (BEERC, 2009). Recent research has focused on this topic. An examination of the operating energy of commercial and residential buildings in China discovered that the present National Bureau of Data of China's commercial building energy consumption statistics understate energy use by 44 percent, and the fuel mix is misleading.



ENERGY AND ENVIRONMENTAL EMISSION INTENSITY:

The energy and environmental emission intensities per unit economic activity are employed in the I–O LCA model to compute the energy consumption and mass of pollutants emitted by each sector's unit output. The intensities must be calculated using the value of a sector's entire economic production, energy consumption, and emissions. Energy and emissions data for China cannot be gathered directly from a national statistics system. The available data was handled in the following ways to address this:
The challenges with energy consumption are primarily due to discrepancies in data collecting. The Chinese economy's energy consumption data is accessible in 48 sectors from the China statistics yearbook, which must then be spread throughout the 122 economic sectors. The 122 sectors were mapped to the 48 sectors in this model. It was anticipated that each sub-energy sector's consumption is related to the higher-level sector's economic production.



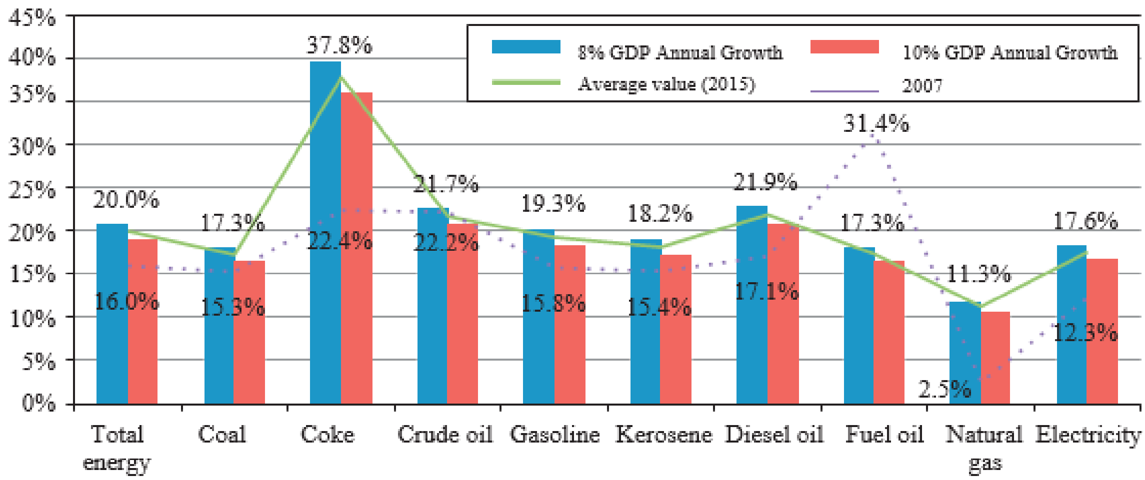
Because China lacks meaningful statistics, a more complicated scenario in terms of environmental emissions emerges. To evaluate the emission intensity of the sectors' energy use, the US EPA's AP-42 uncontrolled emission factors were utilised. Empirical data on pollutant generation and emission control technology in China's industrial sectors were used to adapt the data from the United States to Chinese practises (National Pollution Investigation Office, 2008).

RESULT AND ANALYSIS:

In 2007, the embodied energy of construction projects in China was 436 million mtce, accounting for 16 percent of the country's total energy consumption. According to the Ministry of Housing and Urban–Rural Development (MHURD), building operation energy accounts for 25% of total national energy consumption in PR China. As a result, building construction and operating energy consumption account for 40% of China's total yearly energy consumption. However, this graph only shows the embodied energy from the top 23 construction-related industries. If all 122 sectors are included in the model, embodied energy will account for around 20–25 percent of annual energy consumption, implying that buildings and infrastructure will account for roughly half of China's yearly energy consumption.

CO2 emission control methods are uncommon in China. Because CO2 is mostly produced by the combustion of coal, the total economy's CO2 emission pattern is comparable to that of SO2.

Construction industry CO_2 emissions amounted for 25% of national CO_2 emissions in 2007, hence construction and its connected industries play a significant role in decreasing the carbon intensity of the Chinese economy.



In 2015, both energy consumption and pollutant emissions will rise in tandem with anticipated growth in construction demand. In terms of energy consumption, coke is on the rise and is expected to account for more than a third of national coke consumption in 2015. Because coke is used in the production of steel, the rise in construction-related coke use is logical, given the predicted increase in construction volume. The use of fuel oil in building has decreased significantly. This is consistent with a ten-year trend in China's use of fuel oil. The intensity of fuel oil has been declining at a faster rate than that of other types of energy.

CONCLUSIONS:

The embodied energy and environmental emissions of the building sector account for a large portion of China's total energy consumption and environmental load, according to this study. Because structures and infrastructure have such a long lifespan, operational energy accounts for the majority of a building's life cycle energy use, and hence embodied energy study in China is uncommon. This is also attributable to the present national statistics system's absence of vital data. Embodied energy encompasses more economic sectors (particularly industrial sectors) than operational energy, and its potential for energy reduction is easier to attain from the standpoint of available techniques, therefore it merits the attention and efforts of government, businesses, and researchers. Effective measures could also be taken to reduce the construction sector's growing output, such as upgrading energy infrastructure so that embodied energy contains a higher percentage of clean and renewable energy, optimising transportation and avoiding uneconomic transportation of building materials and equipment, and developing energy-efficient and environmentally friendly manufacturing techniques.
The government could adopt rules and regulations to address energy efficiency and emissions in the construction sector, such as restricting diesel emissions from non-road construction equipment or promoting energy efficiency in steel and cement industries. This tool might be used to predict how such measures will affect embodied energy and emissions. In China, embodied energy and

the environmental implications of the building sector will grow in importance over the next five years, having a significant impact on the country's long-term sustainability.

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