



Current Status and Reduction on Potential for Materials Use in Buildings Construction in China

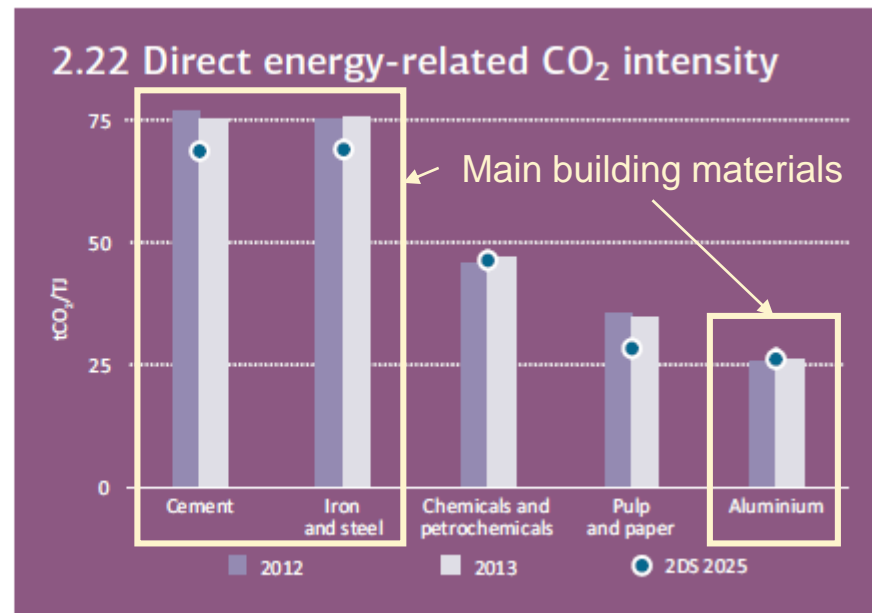
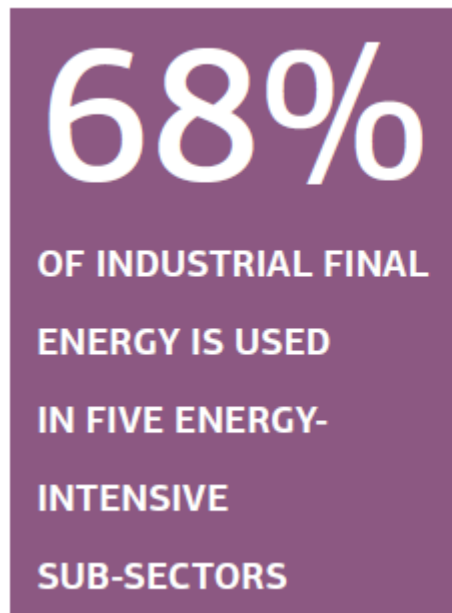
Da Yan

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Background

- ② The energy used to produce building materials such as cement, steel, aluminum, glass, et., plays an important role in energy system and is worthy to be focused on.
- ② In order to get a better understanding, some researches on the material use situation and trends are needed.



Methodology



Increase of
building floor area



Increase demand of
building materials



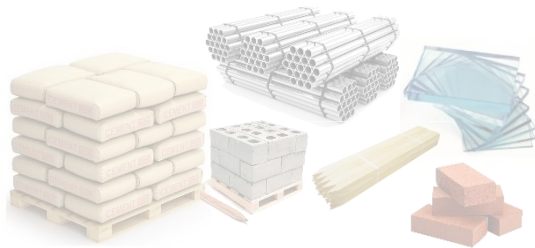
Increase of
energy consumption



Methodology



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Increase demand of
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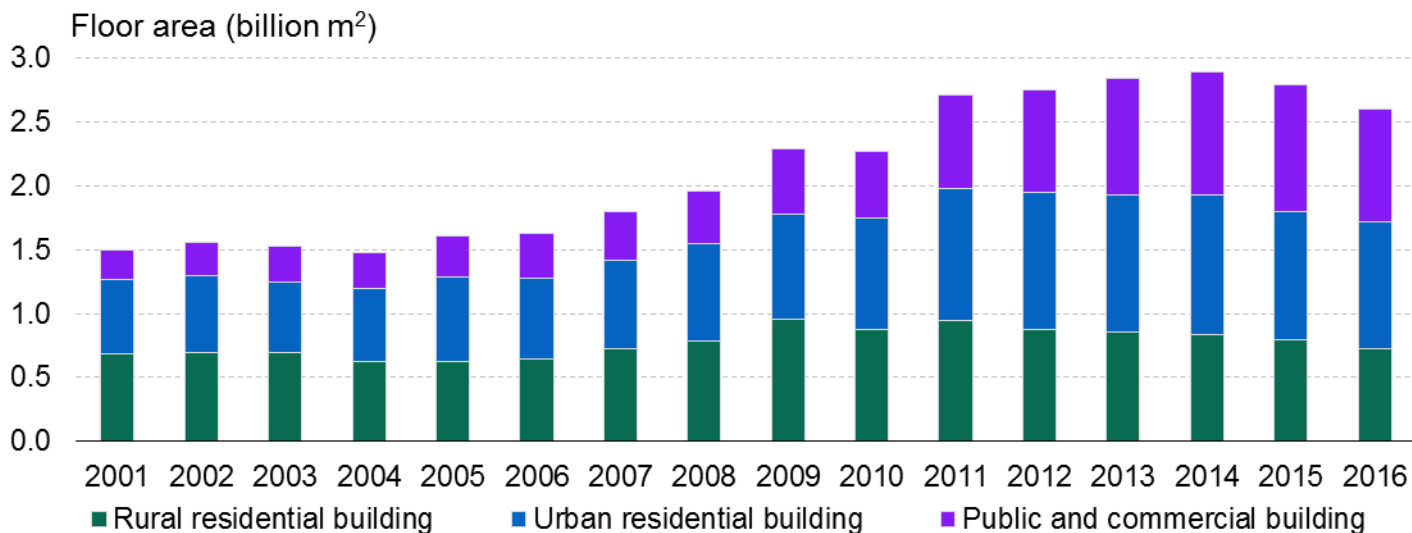


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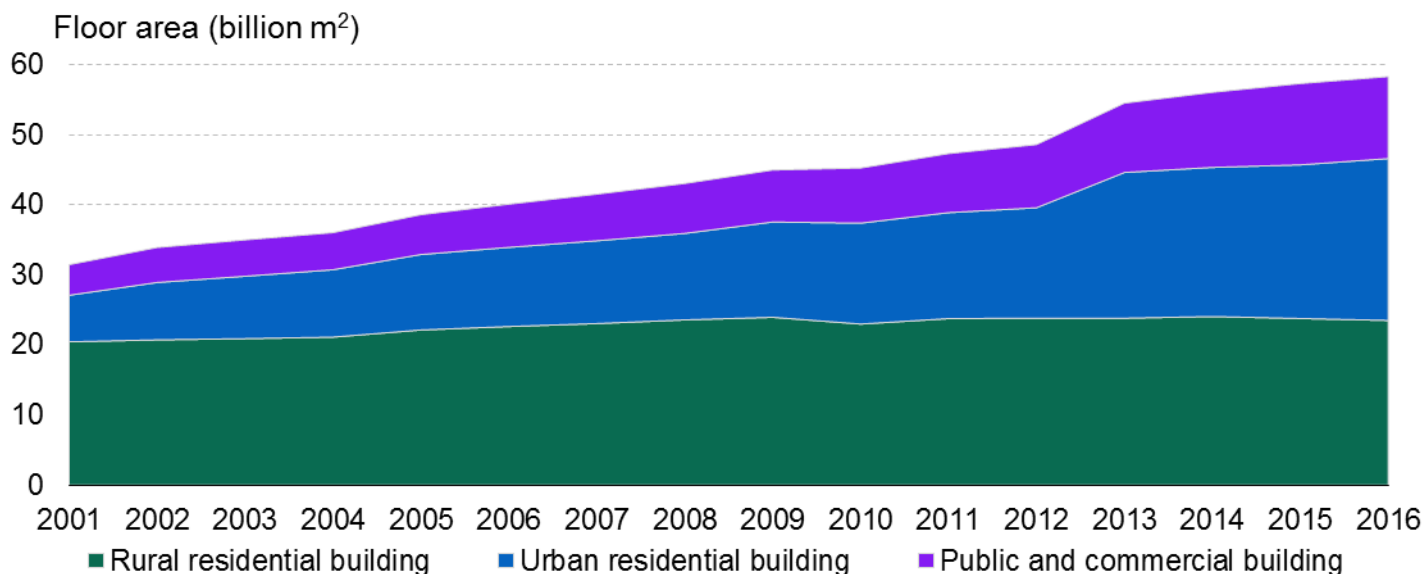
Current Status for China's Buildings Construction

- With economic development and increasing living standards, China's building construction industry has maintained a steady growth.
- China's new annually completed buildings were around 1.5 billion m² in 2001, and 2.6 billion m² in 2016.
- Among the new buildings built in 2016, about 66% are residential buildings.



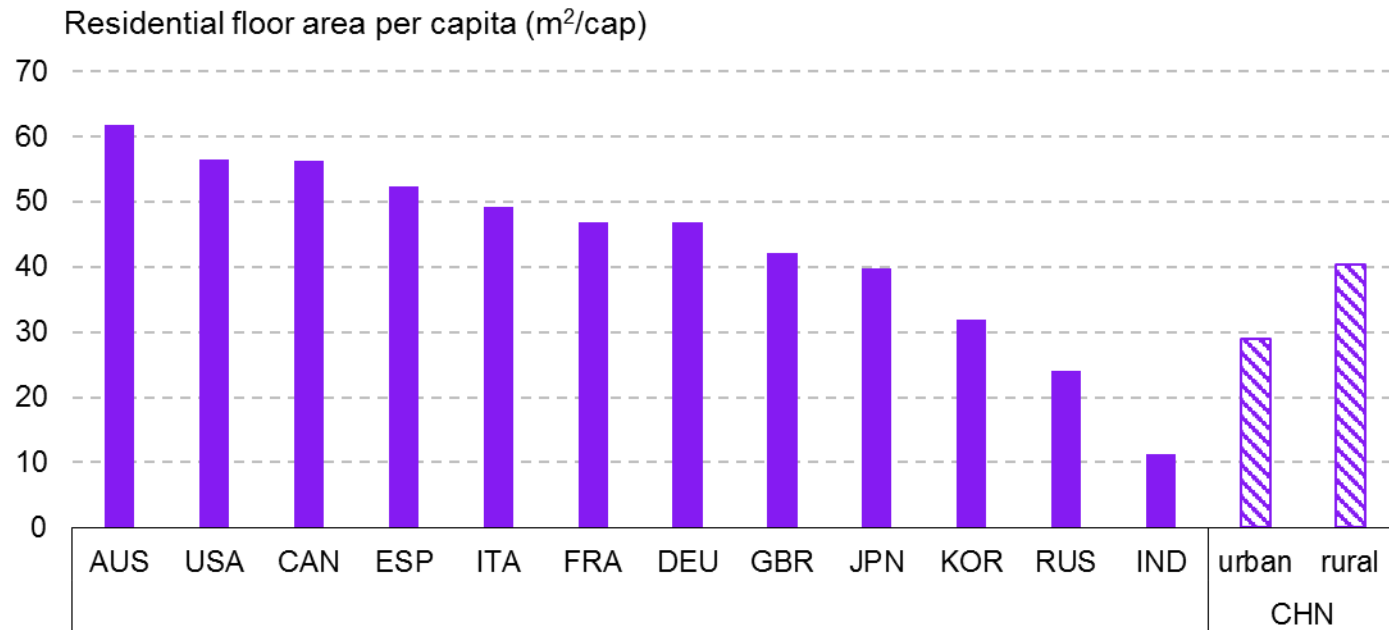
Current Status for China's Buildings Construction

- ④ The growing floor space has led to the rapid growth of China's buildings stock.
- ④ In 2016, China's total floor area was approximately 58.3 billion m², in which urban residential floor area was 23.1 billion m², rural residential floor area was 23.5 billion m² and public and commercial floor area was 11.7 billion m².



Current Status for China's Buildings Construction

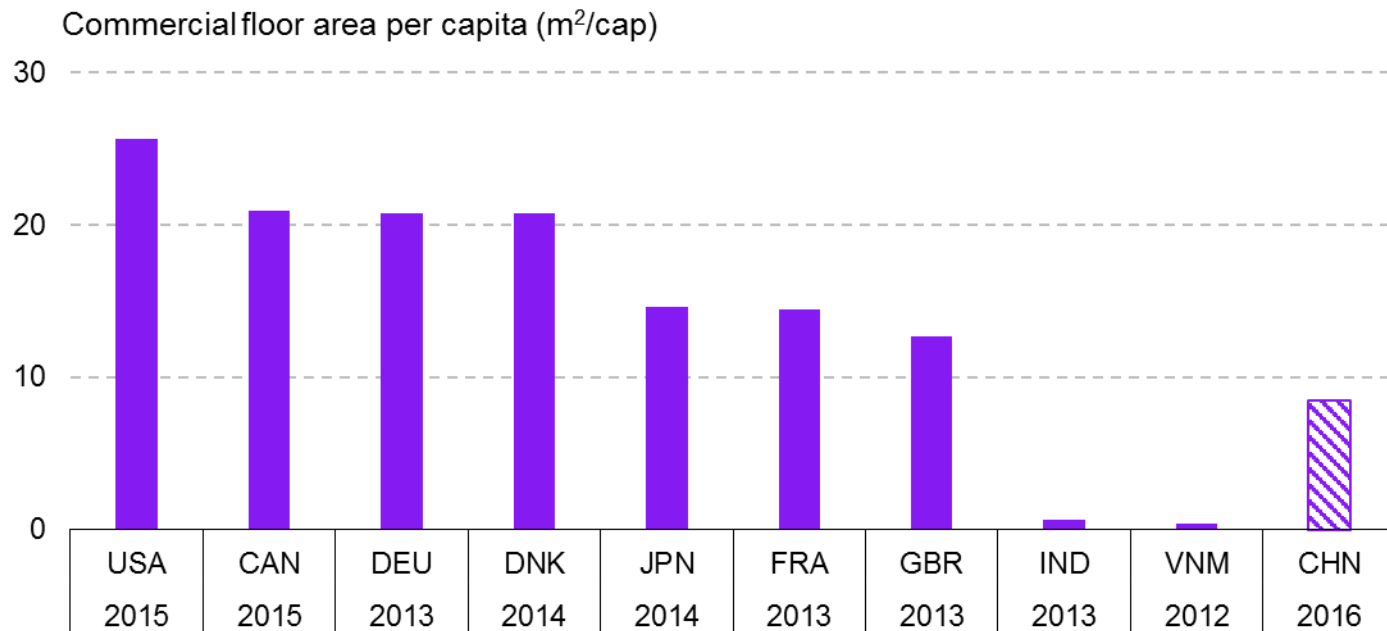
- For residential buildings, China's floor area per capita (FAPC) is 28.9 m² in urban areas and 40.4 m² in rural areas. (2016)
- The FAPC in the US, Canada and Australia are all above 50 m² while that of most other OECD member countries is around 40 m².



Data source: BERC (2017), China Building Energy 2017. Beijing: China Building Industry Press.
Data for China is in 2016 while others in 2014.

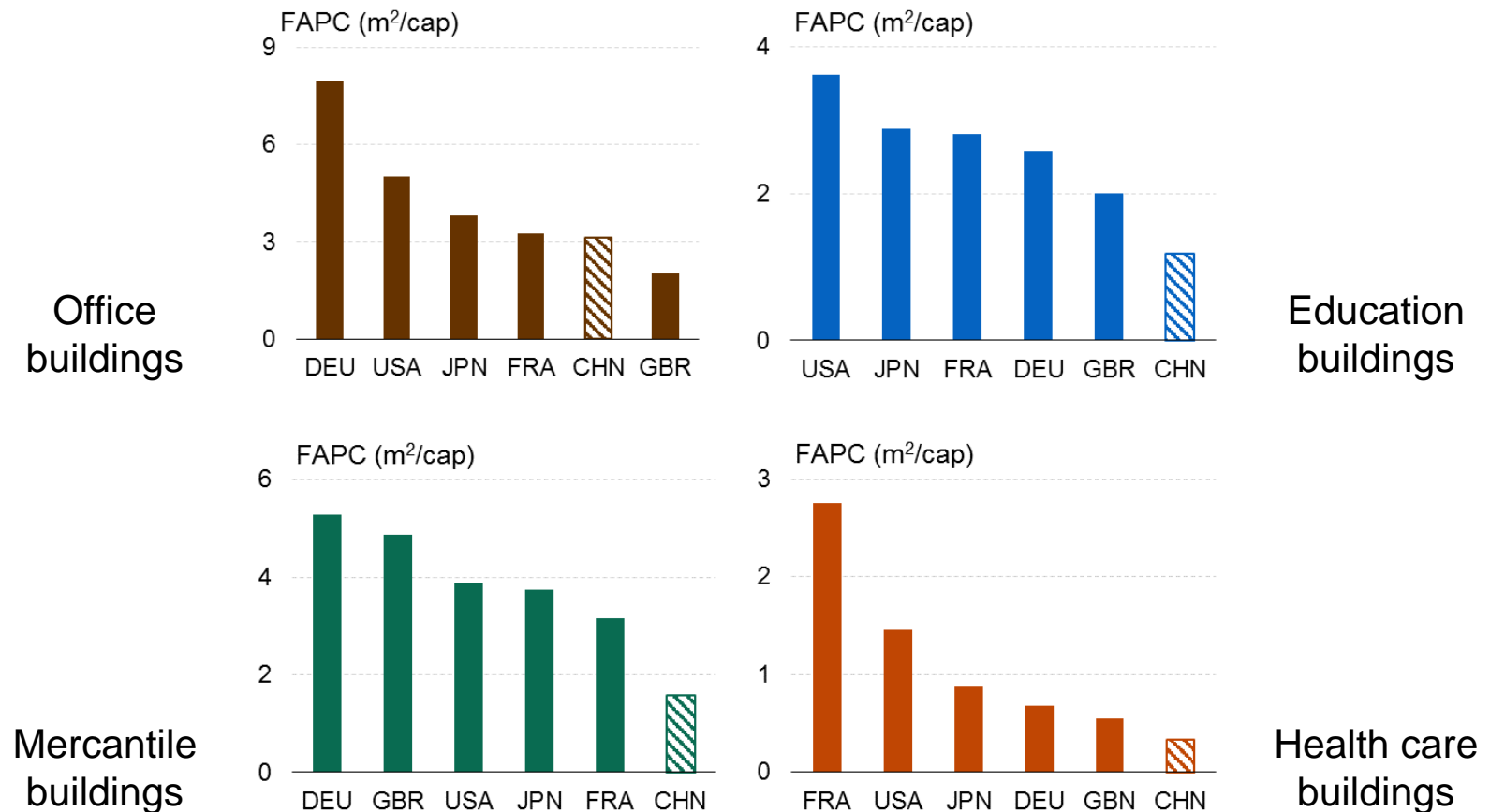
Current Status for China's Buildings Construction

- ④ Average commercial floor area per capita in China is 8.5 m², while that in US above 25 m² and in most developed economics above 15 m².
- ④ There is still a big potential for public and commercial building stock growth, therefore related energy efficiency policy still has to focus on new-constructed buildings.



Current Status for China's Buildings Construction

For different building types, the situation of floor area per capita (FAPC) is also different.



Methodology



Increase of
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Increase demand of
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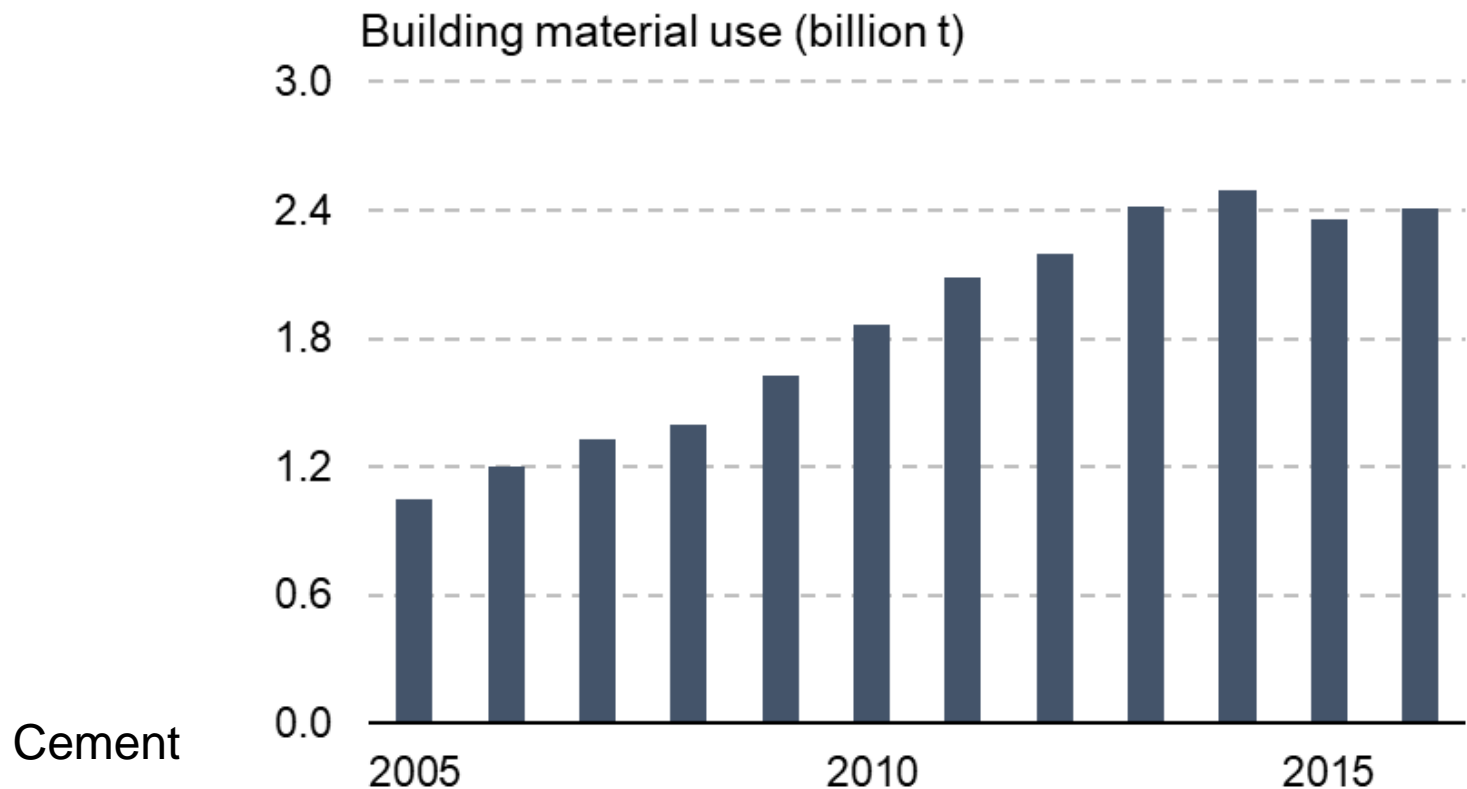


Increase of
energy consumption



Current Status for China's Buildings Material Use

With the increasing building floor area, the use of building material also increased in the past years.

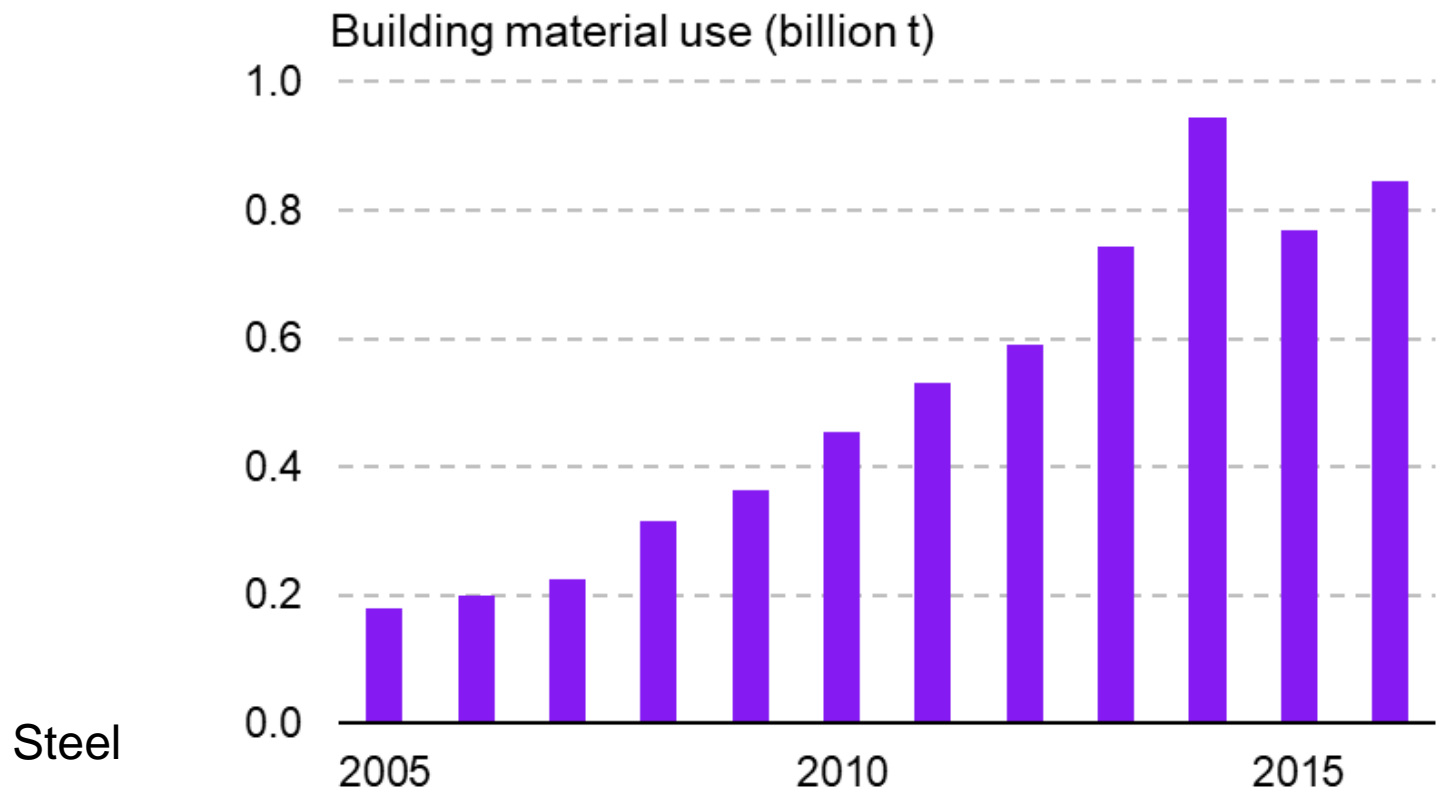


* In this part, the materials include both buildings and infrastructures.

Data source: NBS (2017), China Statistical Yearbook on Construction 2017, Beijing: China Statistics Press.

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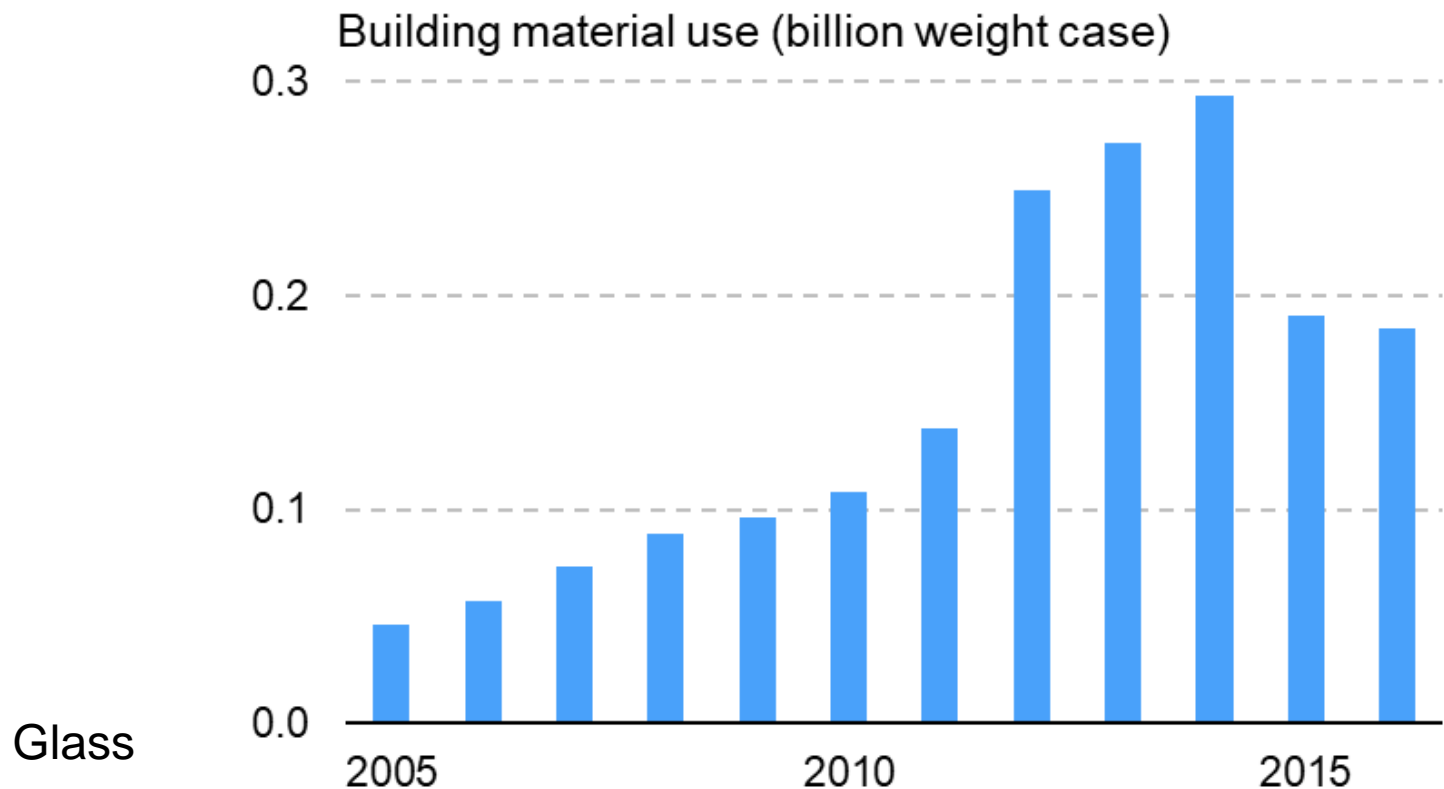


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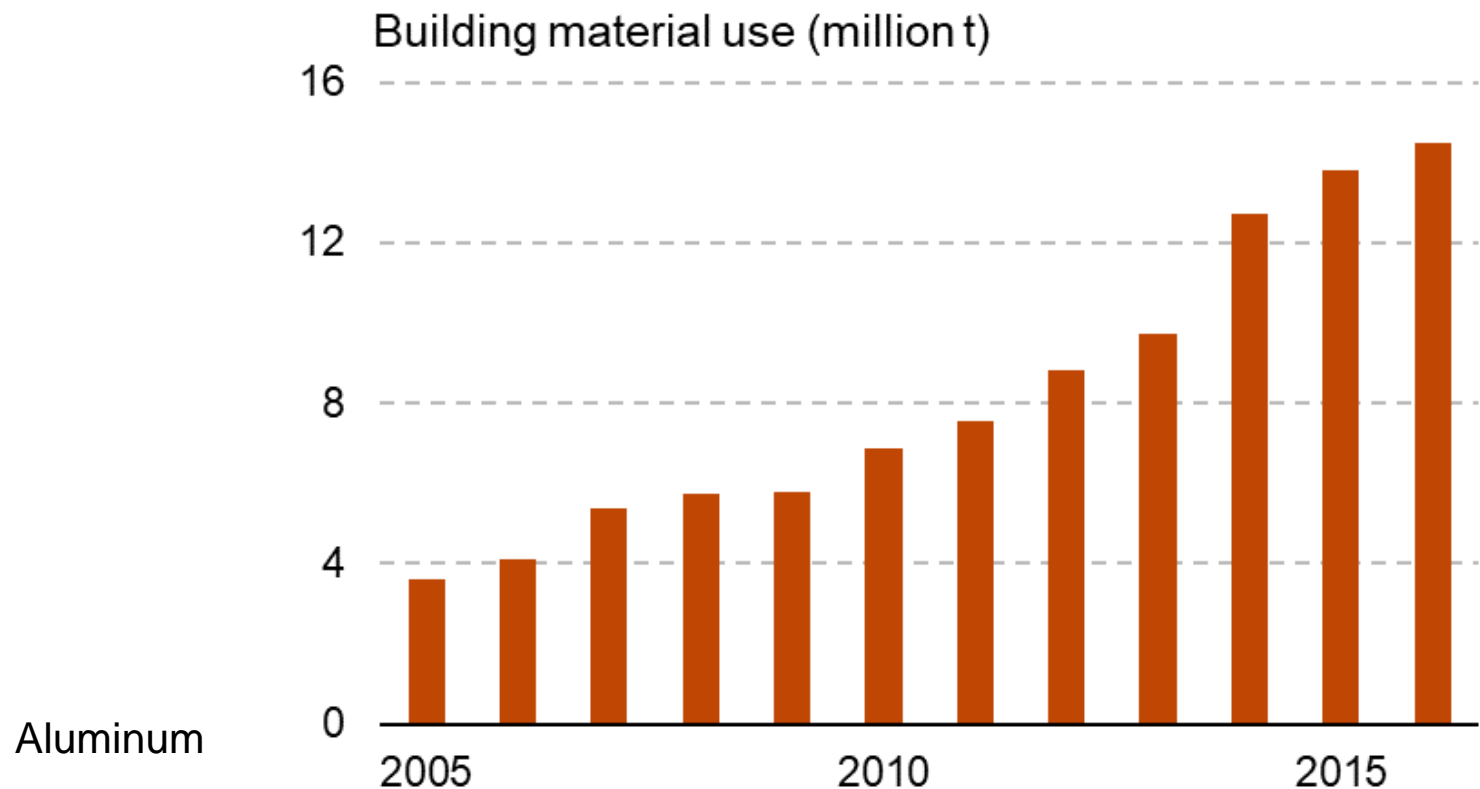


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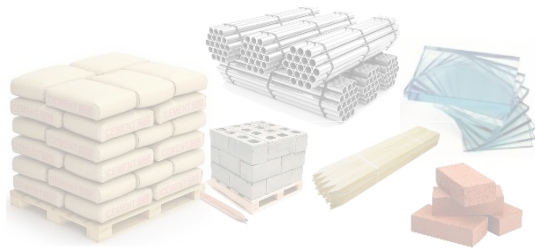
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Methodology



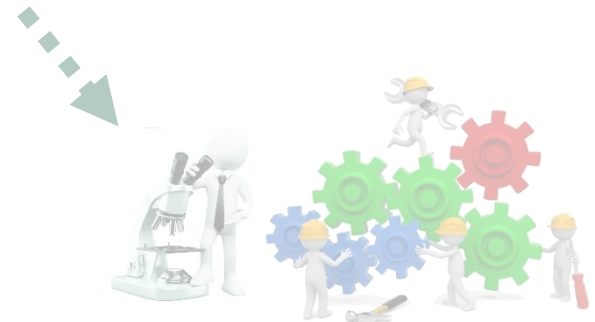
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Increase demand of
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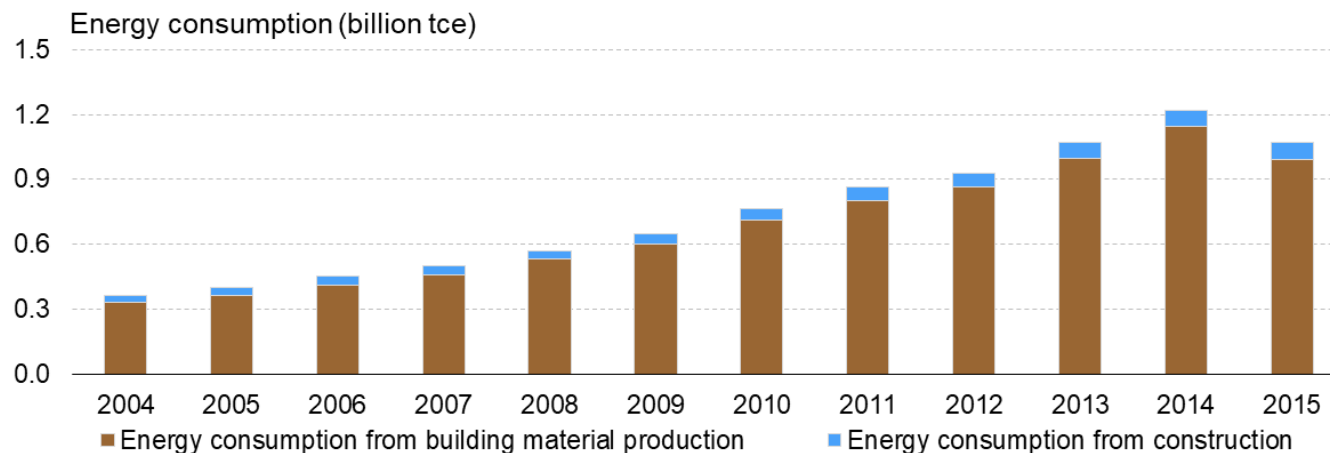
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Current Status for China's Buildings Material Use

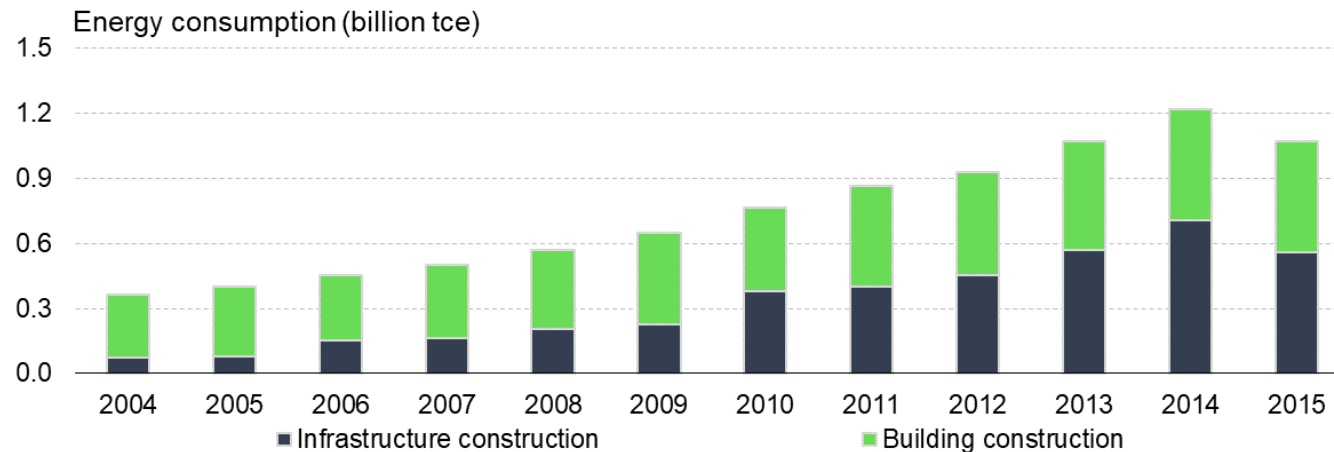
④ The total embodied energy consumption for the construction of buildings and infrastructure, including building materials production and construction, was 1.07 billion tce in 2015, accounting for 25% of China's total primary energy consumption.

④ 93% of the energy consumption was for the production of materials (buildings and infrastructure).

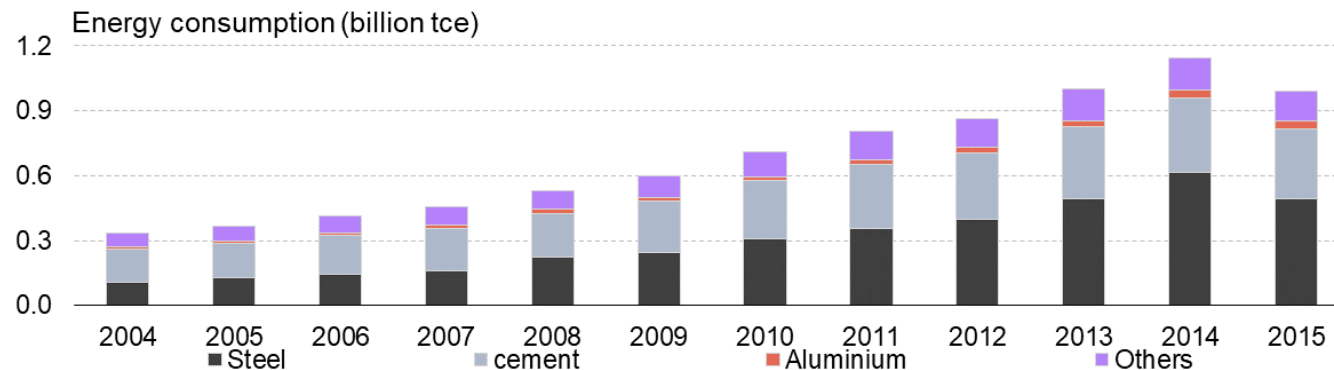


Current Status for China's Buildings Material Use

🌀 In 2015, the energy consumption for buildings construction was 0.45 billion tce, while that of infrastructure construction 0.77 billion tce.



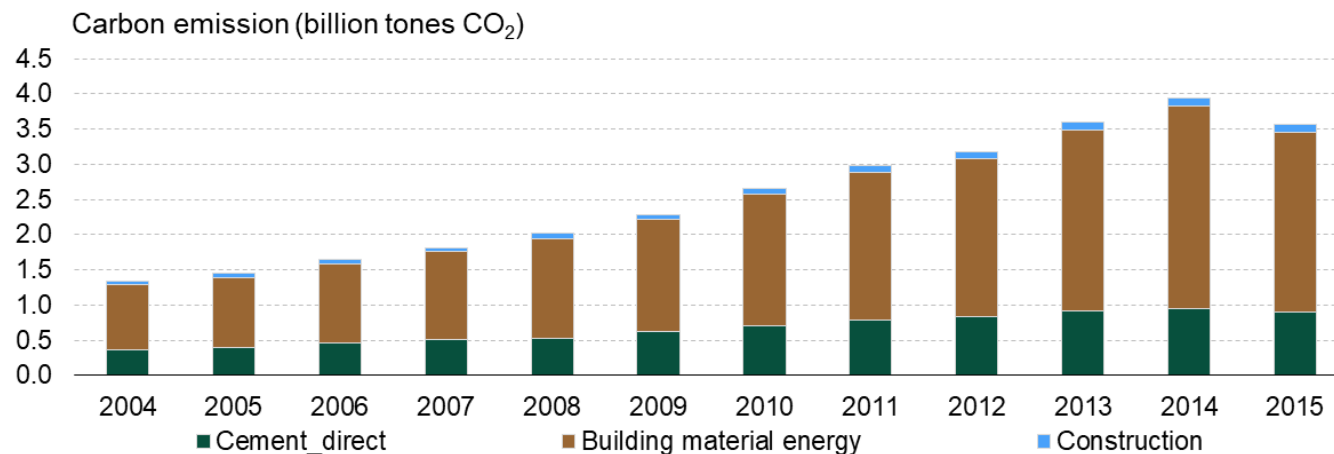
🌀 The steel and cement are the materials consuming most energy.



Current Status for China's Buildings Material Use

④ The production of these materials was responsible for a lot of CO₂ emission. Besides, CO₂ is also a by-product during the production of cement.

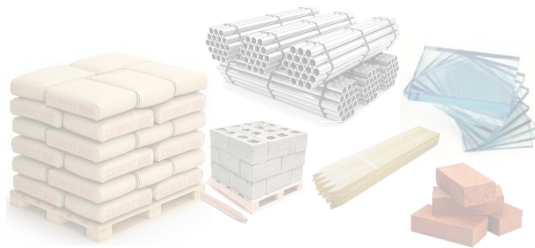
④ In 2015, about 2 billion tones GHG emission was from building construction sector (including direct and indirect emission).



Methodology



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Limit on new construction

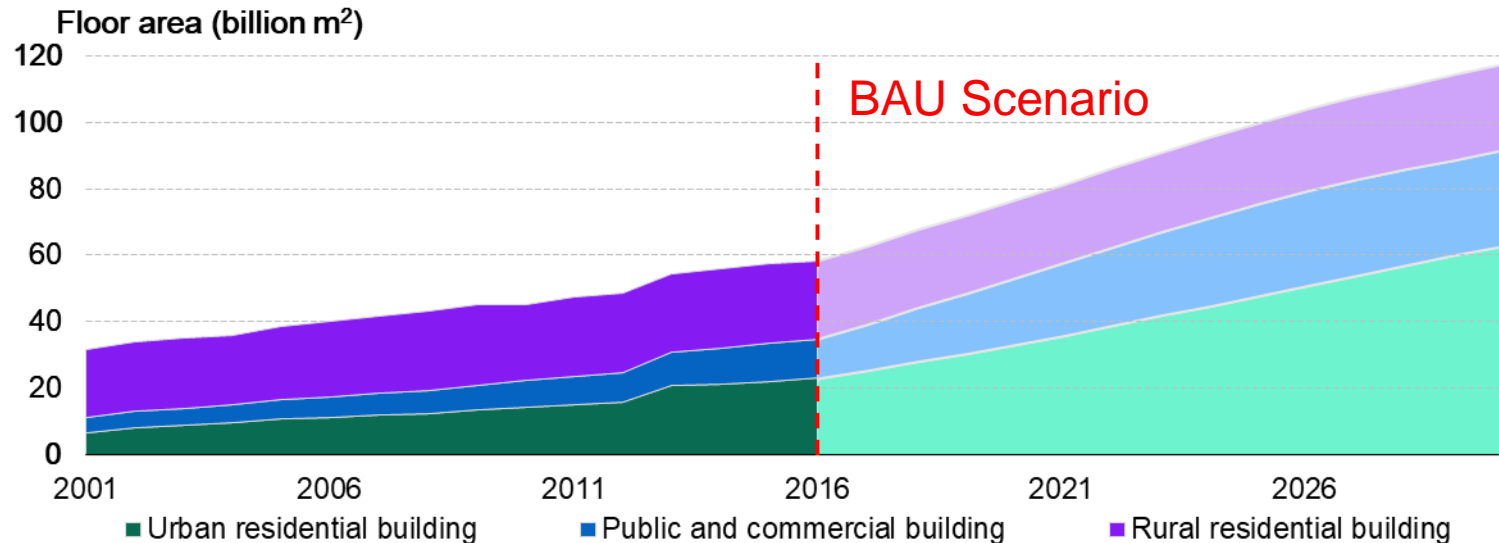


Improve efficiency

Potential on Building Floor Area

How many buildings are needed in China?

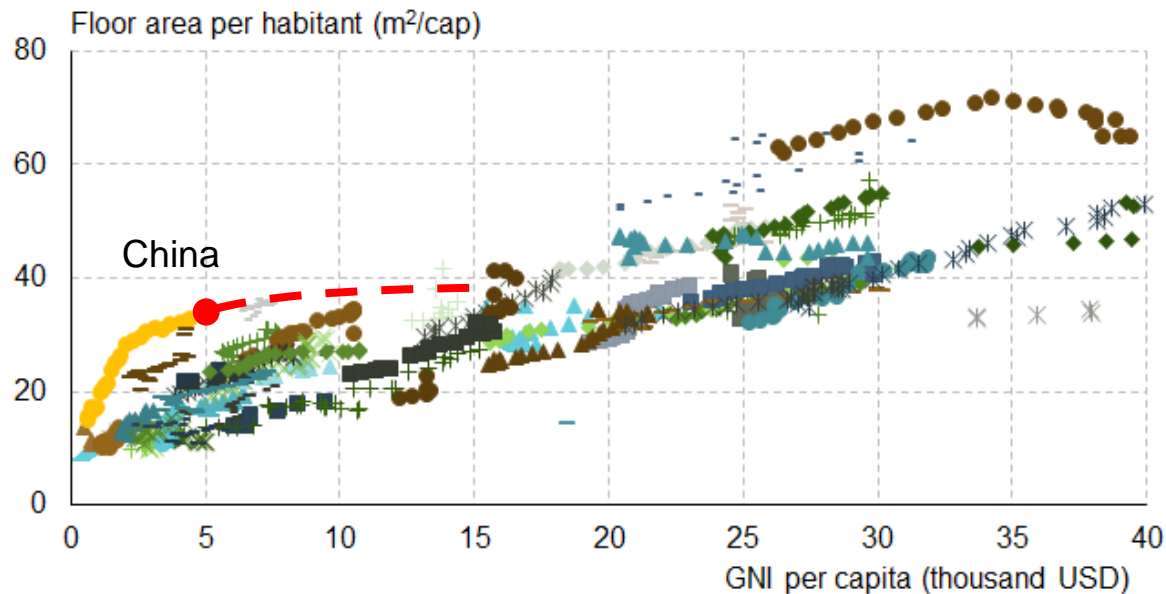
If the floor area keeps increasing in the next 15 years, the total building floor area in China may be more than 100 billion, which is not affordable in energy and environment.



Potential on Building Floor Area

Residential Buildings:

- The FAPC in urban area around 35 m²/cap while in rural area around 40 m²/cap may be suitable.
- With this scenario, the residential floor area in urban area would be around 35 billion m² while in rural area 19 billion m².



Relationship of RFA and gross national income

Potential on Building Floor Area

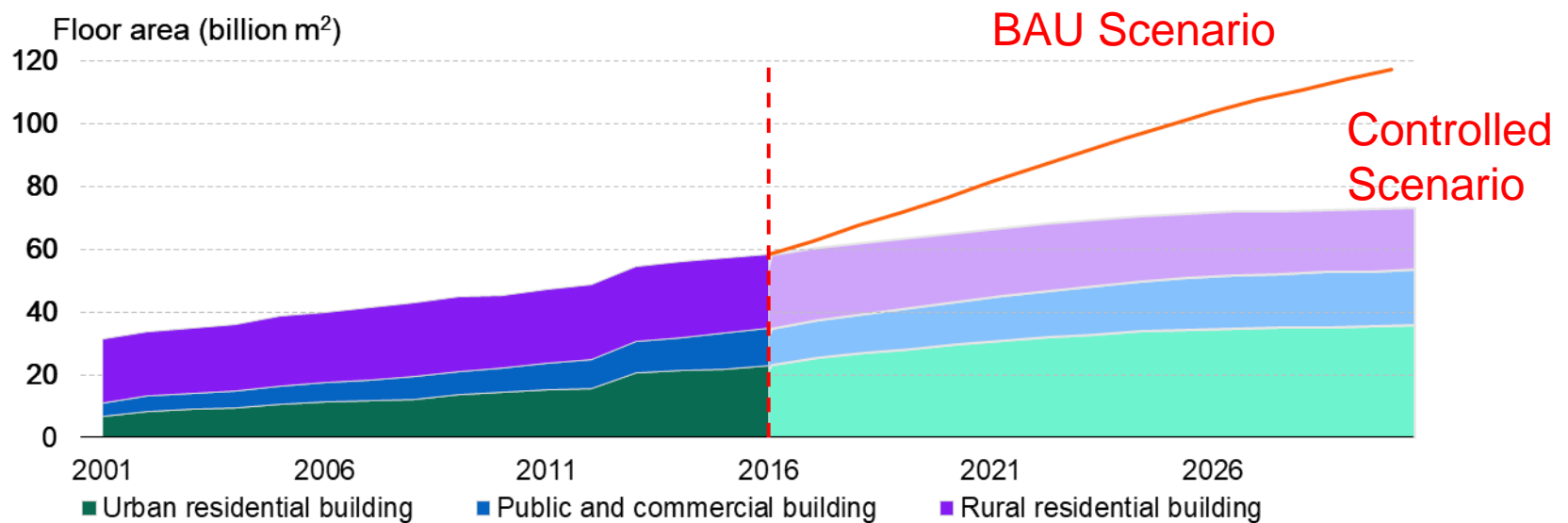
Commercial Buildings:

- For office buildings, the floor area is relatively enough;
- For public service buildings such as education and health care, more buildings are still needed;
- The FAPC around 10 to 15 m²/cap may be suitable.

	2016		Plan	
	Building stock (billion m ²)	FAPC (m ² /cap)	Building stock (billion m ²)	FAPC (m ² /cap)
Office buildings	4.31	3.1	5.00	3.4
Lodgings	0.49	0.4	0.88	0.6
Mercantile buildings	2.17	1.6	2.79	1.9
Education buildings	1.63	1.2	3.53	2.4
Health care buildings	0.46	0.3	1.18	0.8
Others	2.68	1.9	4.56	3.1
Total	11.7	8.5	18.0	12.2

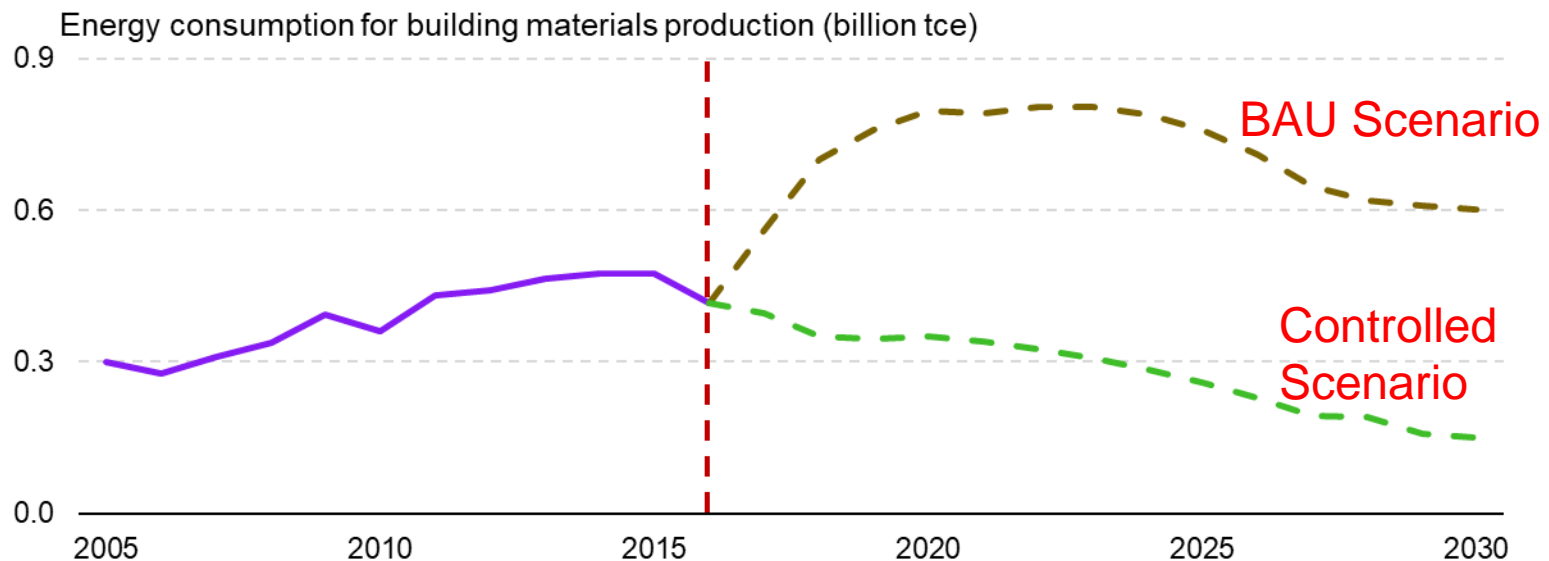
Potential on Building Floor Area

- With suitable policy measures, the total floor area could be controlled under 80 billion m².
- Comparing with the BAU scenario, this scenario is affordable for energy and environment, and possible to support living standard improvement and economic development.



Potential on Building Floor Area

- ④ The control of floor area may reduce about 75% of energy use for materials used in building construction.



* The energy use in this figure excludes the materials for infrastructures.

Reduce on Potential for Material Use Intensity

- ④ In the 13th five-year plan for promoting green buildings, the reduce of building material is also included.
- ④ In 2020, the buildings using green material should be more than 20% of total buildings, and more than 15% of newly-built buildings should be prefabricated building.



China's
Green building

Energy saving

Material saving

Water saving

Land saving

Environmental protection



Prefabricated building

Potential on Material Production Efficiency

② Improve the energy efficiency of building materials

② In the past years, the energy use intensity of building materials has decreased a lot, but still has room for the most efficient case.

	Unit	2000	2016	Global advanced level
Comparable steel-sector	kgce/t	784	640	576
Primary aluminum smelting	kWh/t	15418	13599	12900
Cement	kgce/t	172	135	97
Building ceramics	kgce/m ²	8.6	6.9	3.4
Flat glass	kgce/weight case	25.0	14.4	13.0

Conclusion

- ④ The newly completed buildings lead the increase of building material use.
- ④ The total embodied energy consumption for the construction was 1.07 billion tce in 2015, accounting for 25% of China's total primary energy consumption.
- ④ In next 30 years, controlling floor area, promote green materials and prefabricated buildings, as well as improve the efficiency of material production can all contribute to the reduce of material.

Thanks for your attention!

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