Chinese Building Materials Survey and Life-Cycle Data

Review – ELITH

Ali Cheshmehzangi
The University of Nottingham Ningbo China

Introduction

The lifecycle thinking includes consideration of environmental impacts, a) along multiple staged; and b) along multiple indicators. This is part of the process towards energy efficient buildings and cities. Energy, being central to the current technological development in architecture and urban design, will remain a key aspect to Greenhouse Gas (GHG) reduction and sustainable building material and building design.

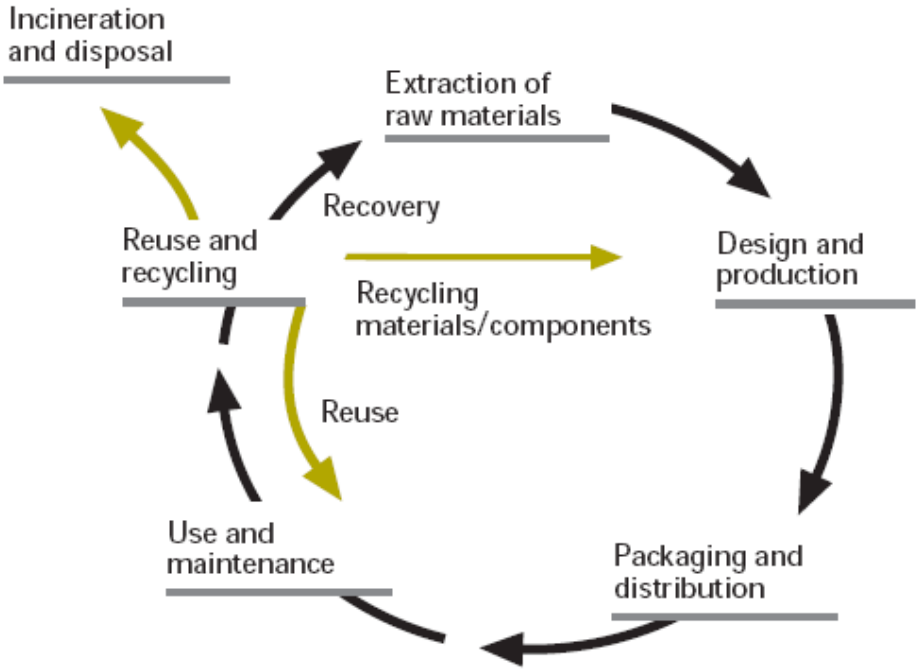

Figure 1 – lifecycle thinking

In the context of China, current methodologies in research include the followings:

Life Cycle Assessment (LCA)

- Quantifying environmental impacts of products
- Standards: ISO 14040s → GB 24040 (China)

Type III environmental declaration

- Also, Environmental Production Declaration (EPD)
- Verified LCA reports of products;
- Standards: ISO 14025 → GB 24025 (China), ISO 21930s, …

Carbon footprint (CF)

- Verified life cycle greenhouse gas emissions of products
- Standards: PAS2050, WRI GHG protocols, ISO 14067 and etc.

The idea of the carbon footprint (CF) is an indicator of the environmental effects of energy use, which recently has become a widely used term and concept in the public debate on appropriate responses to mitigate the threat of global climate change (Wiedmann and Minx 2008). Currently, there is no consensus on how to measure or quantify a carbon footprint (Wiedmann and Minx 2008, Matthews et al. 2008).

Chinese LCA Database (also known as CLCA)

The International Energy Agency (IEA 2007:307) projects that 800 million m2 of new urban residential floor space will be built in China annually through to 2030. This is largely attributable to the steady urbanization, growth of household income, growth of the service sector (Taylor et al 2001) and decreasing average household size (IEA 2007:306).

In 2009, LCA award was given to China by UNEP/SETAC.

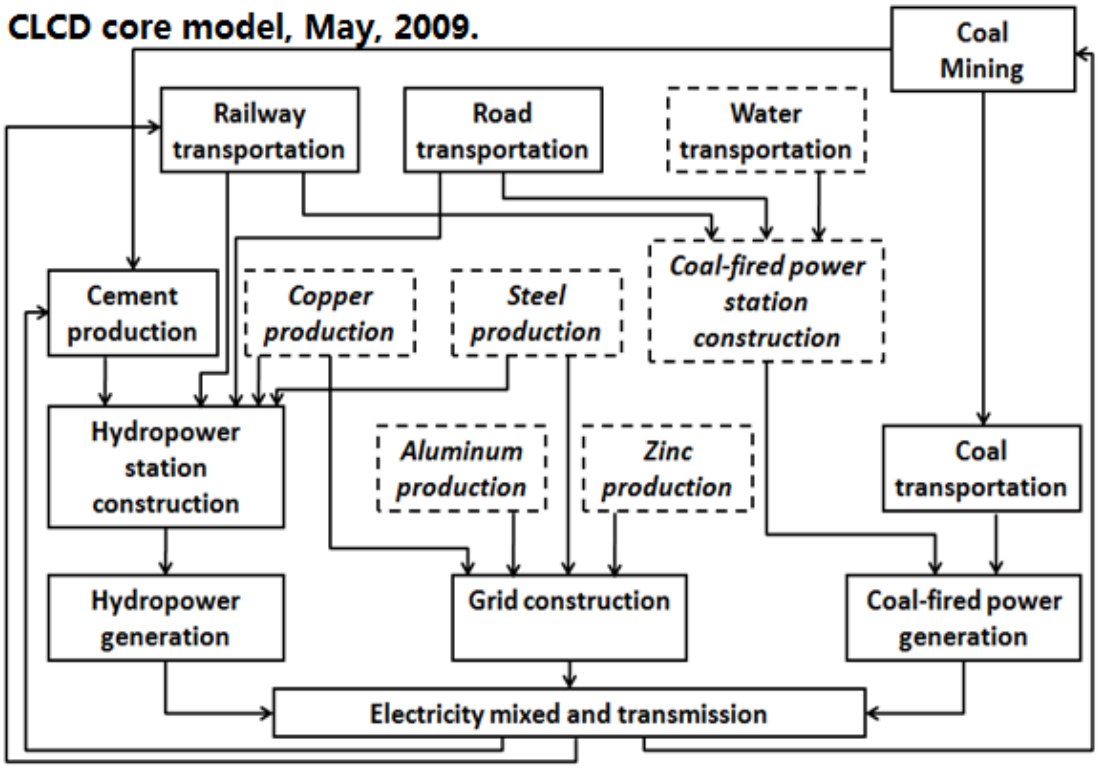

Figure 2 – Chinese LCA core model; initial model in 2009.

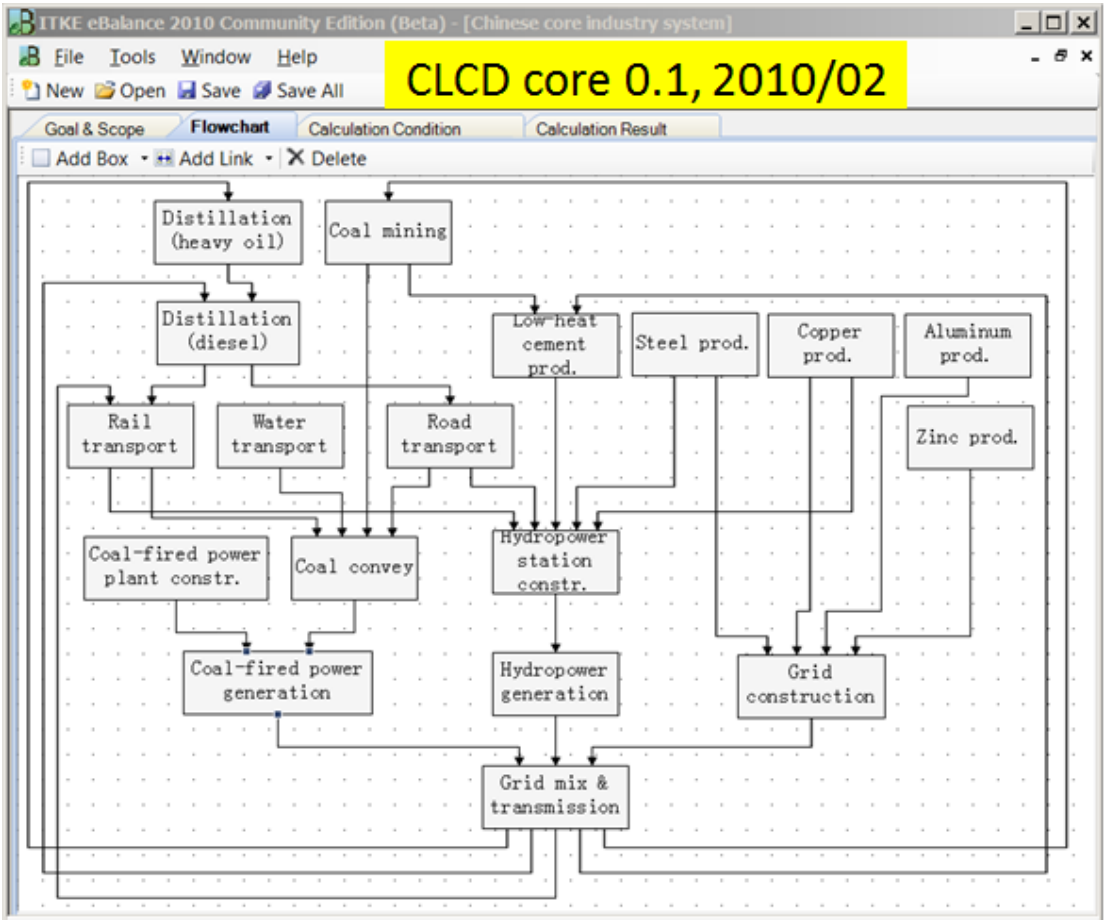

Figure 3 – CLCA core model; developed model in 2010.

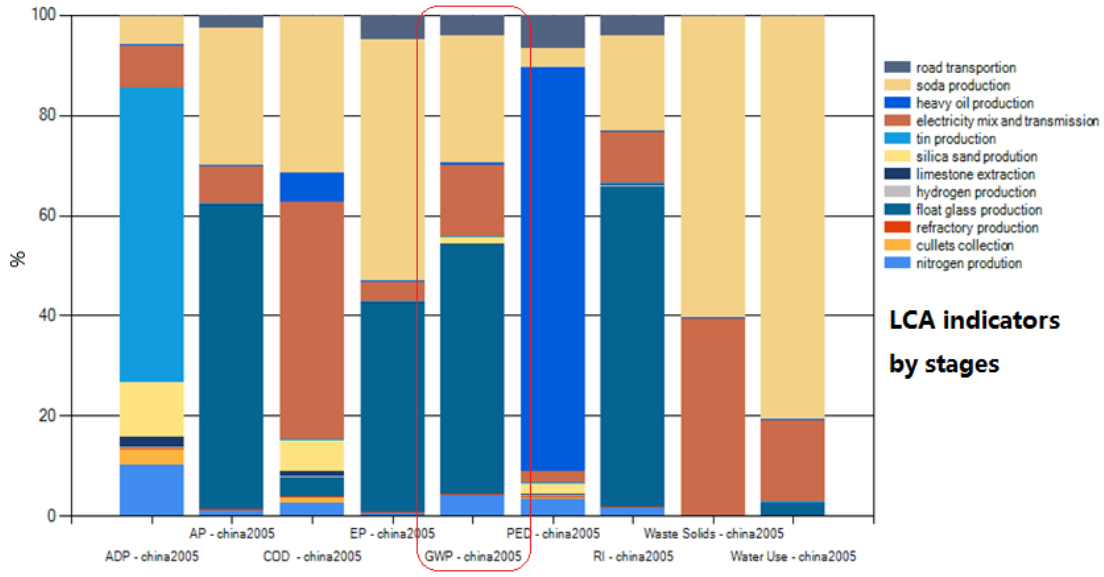

Figure 4 – China's LCA indicators by stages.

China's Database in eBalance

China's database in eBalance, conveyed with CLCD, ELCD and Ecoinvent, was first released on Sept. 19, 2010. This database includes the followings:

- Energy carriers: electricity, fossil fuels;
- Transport: road, railway, river canals;
- Metals: iron and steel, aluminum, copper, lead, zinc;
- Chemicals: H2SO4, NaCO3;
- Building materials: cement, glass, aluminum-plastic board, ceramics.

National Standards for Verification

As part of China's national standards for verification, we can witness significant progress from appliances standard verification to verification processes for lifecycle of buildings and low-carbon design.

A set of national standard documents are already in place as part of China's framework and principles.

中华人民共和国国家标准

GB/T 24025—2009/ISO 14025:2006

环境标志和声明
Ⅲ型环境声明 原则和程序

Environmental labels and declarations—
Type Ⅲ environmental declarations—Principles and procedures

(ISO 14025:2006,IDT)

2009-07-10 发布 2009-12-01 实施

中华人民共和国国家质量监督检验检疫总局
中国国家标准化管理委员会 发布

Figure 5 - GB24025 – framework and principles (EPD)

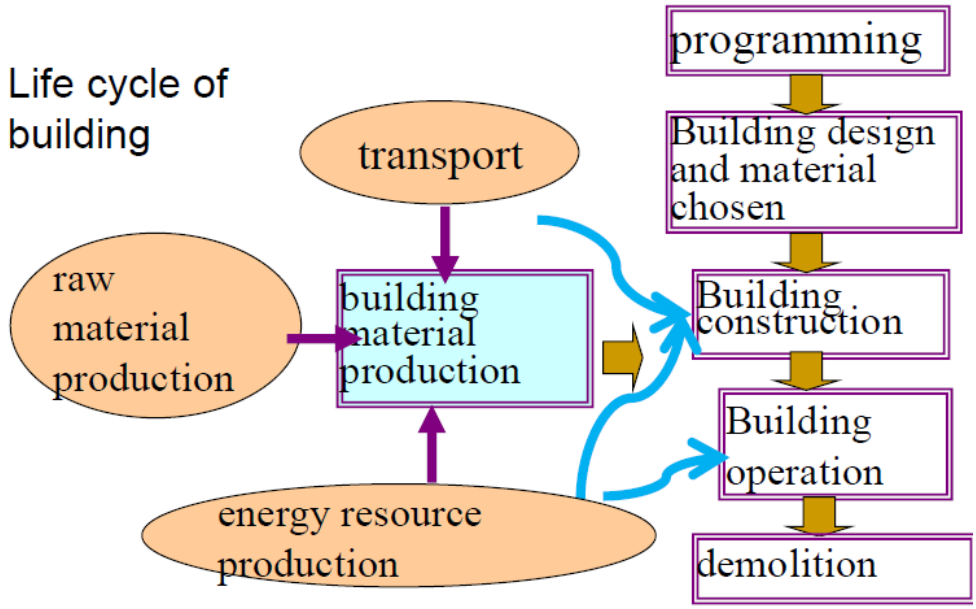

Figure 6 – proposed plan for China's life cycle of building

For residential areas, two aspects of 'low carbon for operation' and 'low carbon for construction' are considered as part of the overall strategy for emission reductions.

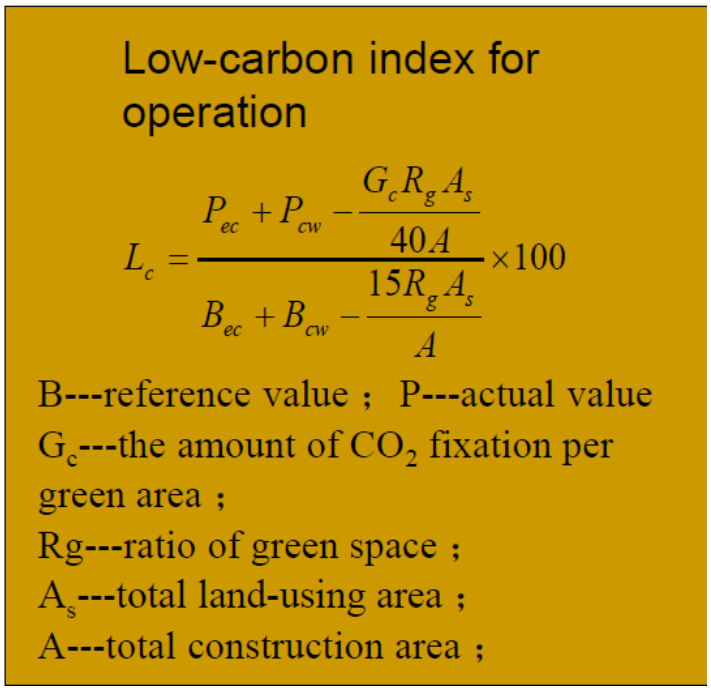

Figure 7 – China's low-carbon index for operation (for residential areas)

What is the current stage of LCA in China?

So far, core Chinese Life Cycle Assessment database (CLCD) and tools (eBalance) have been developed. Currently EPD & CF standards and verification program for building materials is under development. This is expected to extend to building level.

Current Policy Scenario

So far the current LCA studies in China have considered three main dimensions/issues of:

1) Greenhouse Gas (GHG) emissions and related mitigation potentials;
2) Vulnerability to Climate Change;
3) Material and resource uses.

The Current Policy Scenario (CPS) has already included future development of energy demand and related CO2 emissions in 2030. The current phase of development plan until 2020 is made as part of national agenda for low carbon plan. The national scenarios between 2020 and 2050 will then be reordered onto a local CO2 intensity reduction path. Therefore, it is essential to have building level developed in the coming few year (before 2020).

References

Deng, W., Prasad, D., Osmond, P. and Li, F. T. (2010) Quantifying Life Cycle Energy and Carbon Footprints of China's Residential Small District, Journal of Green Building. Vol. 6 (4), pp. 96-111.

Gu, D.J., Zhu Y.X. and Gu, L.J. (2006), Life cycle assessment for China building environment impacts. Journal of Tsinghua University (Science and Technology) 46(12), pp. 1953-1956 (in Chinese).

IEA (2007), World Energy Outlook 2007, International Energy Agency.

Quan, J. and Hongtao, W. (2010) Type III environmental declaration (EPD) and Carbon Footprint (CF) verification program for building materials and buildings in China, UNEP-SBCI, Shanghai.

Wiedmann, T. and Minx, J. (2008), A definition of 'carbon footprint', In: Pertsova C.C., Ecological economics research trends: Chapter 1, pp. 1-11, Nova Science Publishers, Hauppauge NY, USA.

Yang W. and Kohler N. (2008), Simulation of the evolution of the Chinese building and infrastructure stock, Building Research & Information, 36(1), pp. 1-19.

Yang J.X., Xu C, and Wang R.S., (2002), Methodology and application of life cycle assessment. Beijing: China Meteorological Press (in Chinese).

Yang X.M. (2003), Quantitative assessment of environmental impact on construction during planning and designing phases. Master thesis, Department of Construction Management, School of Civil Engineering, Tsinghua University, (in Chinese).

Zhang, Z., Wu, X., Yang, X., and Zhu, Y. (2006), BEPAS: A life cycle building environmental performance assessment model. Building and Environment, 41 (5), pp. 669-675.