中国における低炭素型発展の概観

耿涌　教授
Yong Geng　　Professor

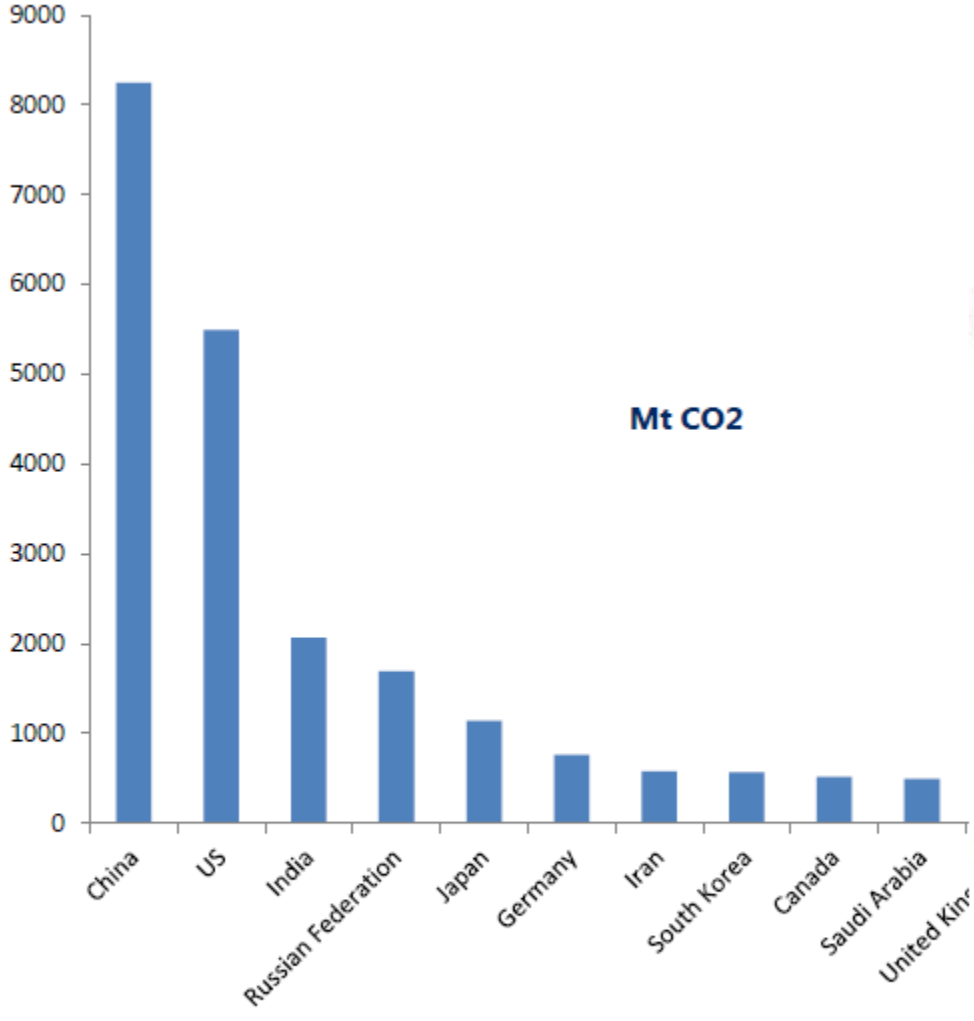
中国：大きな国に大きな問題が存在

世界一の CO_2 排出国：世界総排出量の**20% (World Bank, 2010)**

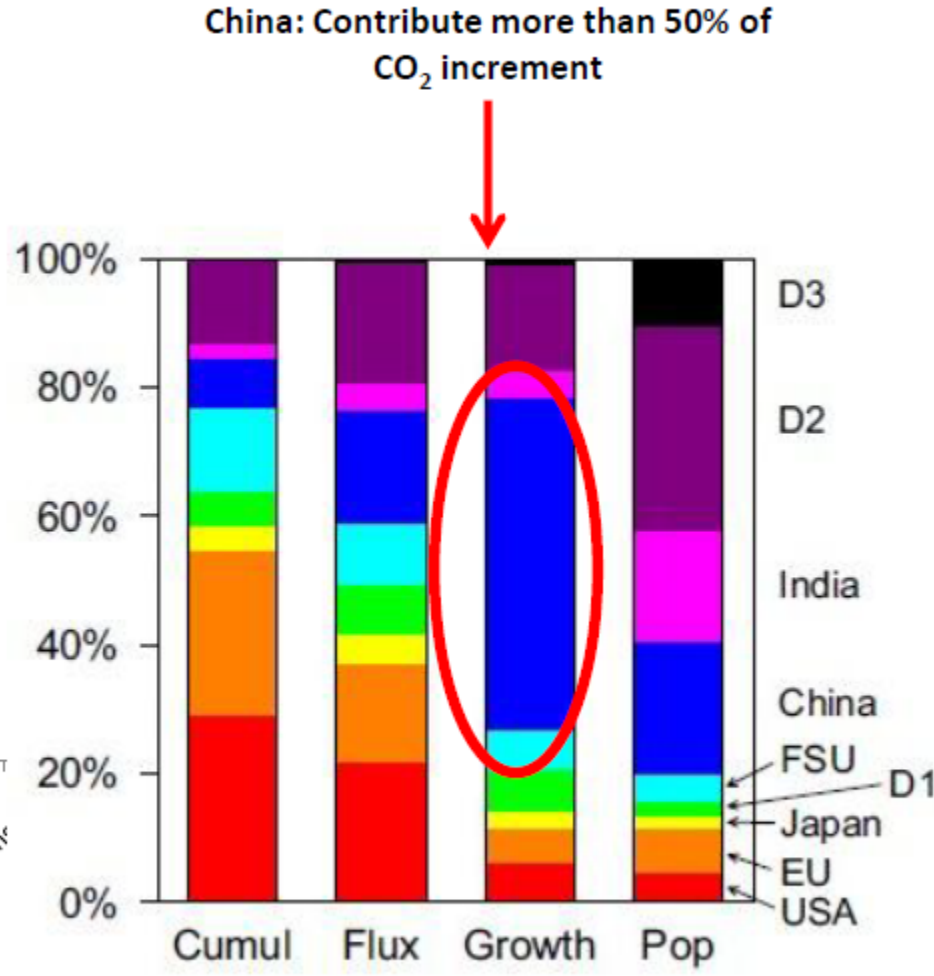
世界一の 一次エネルギ消費国**(BP, 2012)**：世界全体のエネルギ消費量の**18%**

世界全体の**GDP**の**6%**

背景



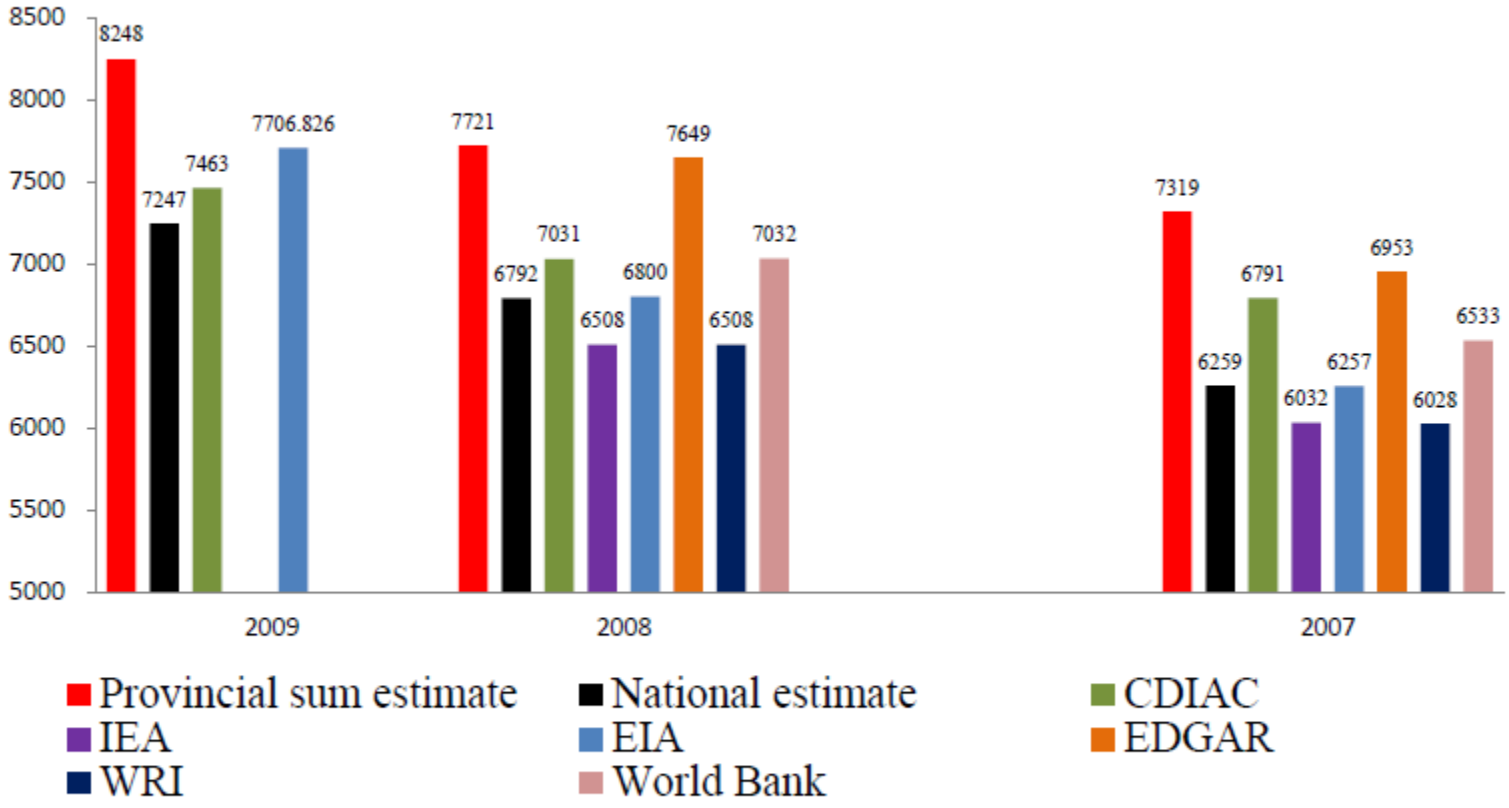
Source: CDIAC, 2011



Source: Raupach, et al., *PNAS*, 2007

背景

1．**1997年～2010年の中国全国および地域別のCO_2インベントリー**



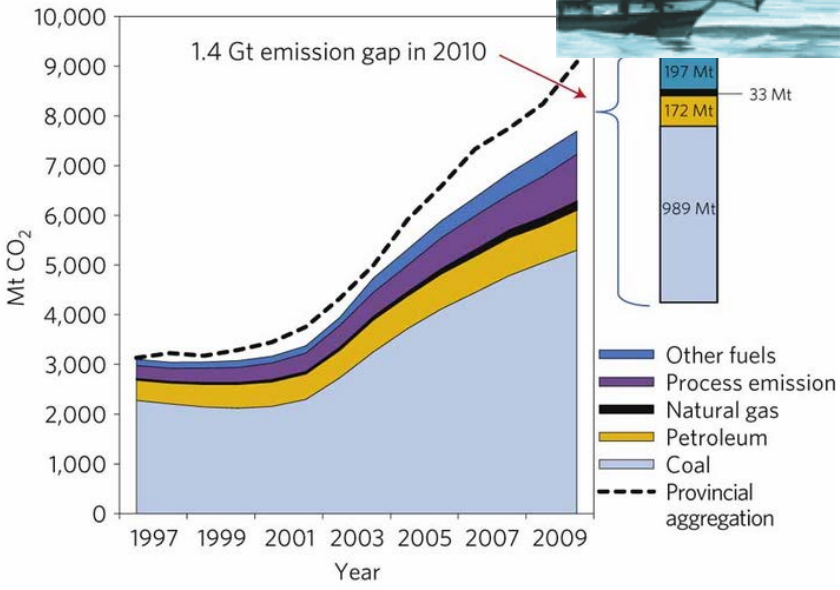
Dabo Guan, Zhu Liu, Yong Geng, Sören Lindner, Klaus Hubacek "The Gigatonne Gap in China's CO_2 Inventories", ***Nature Climate Change***.

中国における排出量の不確定性

CO_2排出量インベントリーの間にギガトン(GT) 級の差異が存在

Dabo Guan, Zhu Liu*, Yong Geng*, Sören Lindner and Klaus Hubacek

本論文ではデータ共有と検証のための新しいステップについて提示し、中国におけるより良いエネルギーと排出量データの計算手法を検討



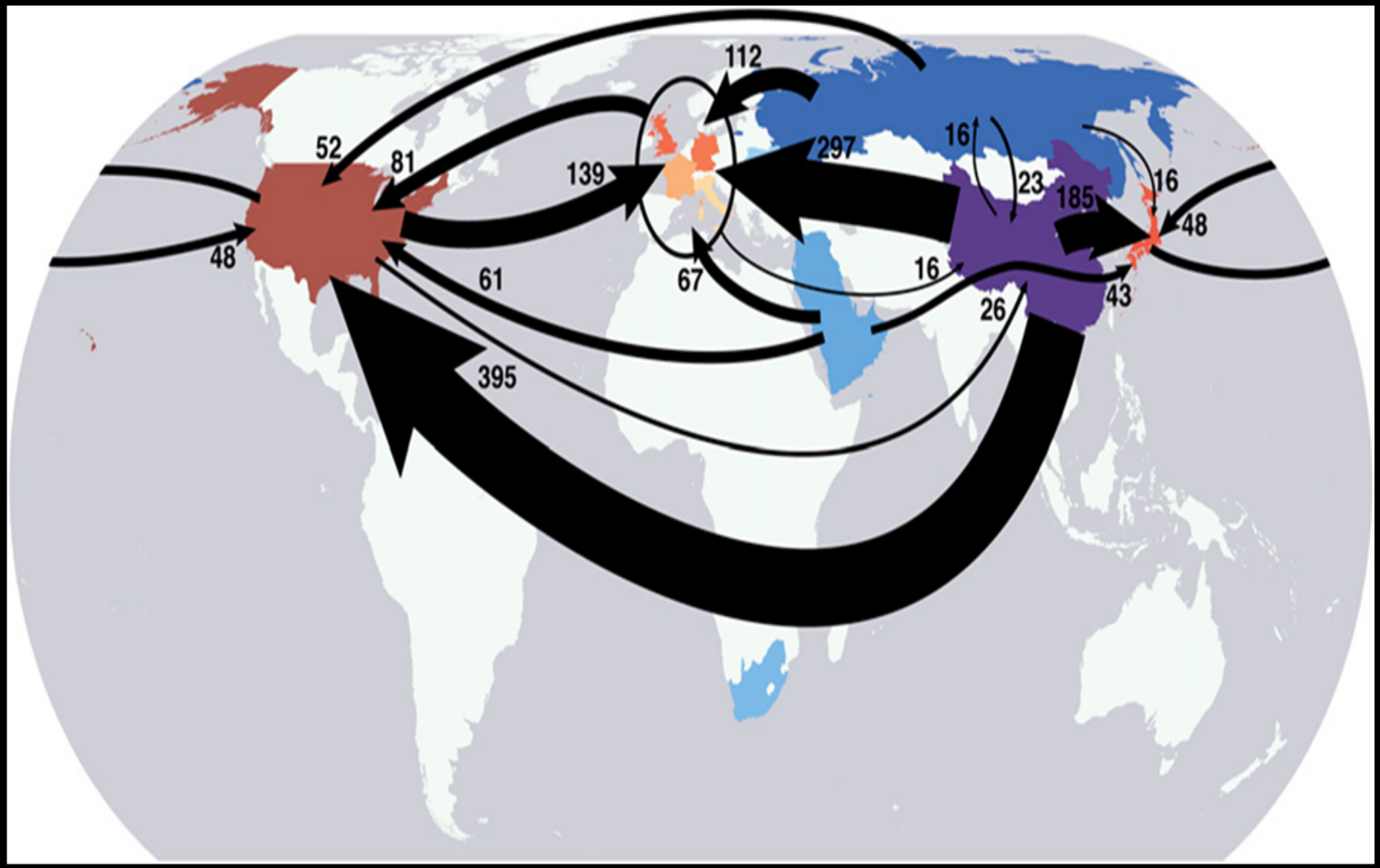
		2007	2008	2009	2010
CO_2 emission (Mt)	Provincial summation	7,334	7,731	8,240	9,084
	National total	6,359	6,848	7,266	7,693
	EIA	6,257	6,800	7,707	
	IEA	6,032	6,508		
	CDIAC	6,791	7,031	7,463	8,041
	World Bank	6,533	7,032		
	WRI	6,032	6,508		
	LBNL		6,666		
	EDGAR	6,953	7,649		
Raw coal (Mt)	Provincial summation	3,209	3,361	3,562	3,910
	National total	2,588	2,810	2,966	3,163
Crude oil (Mt)	Provincial summation	353	362	391	441
	National total	340	355	381	429
Natural gas (million m^3)	Provincial summation	71,484	82,833	96,823	111,612
	National total	69,523	81,293	89,520	94,167

Sectoral contributions to the 747 Mt discrepancy of raw coal use between national total and provincial summation in 2010

- Energy transformation and loss (56%)
  - Thermal power production (2%)
  - Heating supply (14%)
  - Coal washing (37%)
  - Coking and others (3%)
  - Energy loss (<1%)
- Final energy consumption (44%)
  - Agriculture (1%)
  - Manufacturing (37%)
  - Construction (<1%)
  - Transportation (1%)
  - Commercial sectors (2%)
  - Residential consumption (1%)
  - Other final consumption (2%)

排出量の30%：輸出品生産のためのエネルギ消費より

30% of China's domestic emission are caused by energy use for export production.



Source: Davis & Caldeira (2009) PNAS

背景

Eco-indicators: Improve China's sustainability targets

Geng Yong

Nature **477**, 162 (08 September 2011) | doi:10.1038/477162b
Published online 07 September 2011

Autonomy and lack of standardization allow local government officials to cherry-pick their achievements to collect political credits and encourage them to select indicators that cast them in a positive light.

Data collection on eco-indicators is complicated when it involves different agencies. Officials need to secure cooperation from other relevant government agencies to guarantee the validity and accuracy of such data.

Most eco-indicators are voluntary and can be pursued with different intentions. The relatively rich regions of genuine interest in improving resource efficiency and environmental performance. The ns are more likely simply to want to gain access to national financial subsidies.

NATURE CLIMATE CHANGE | NEWS AND VIEWS

Policy: China's regional emissions

Yongfu Huang & Jingjing He

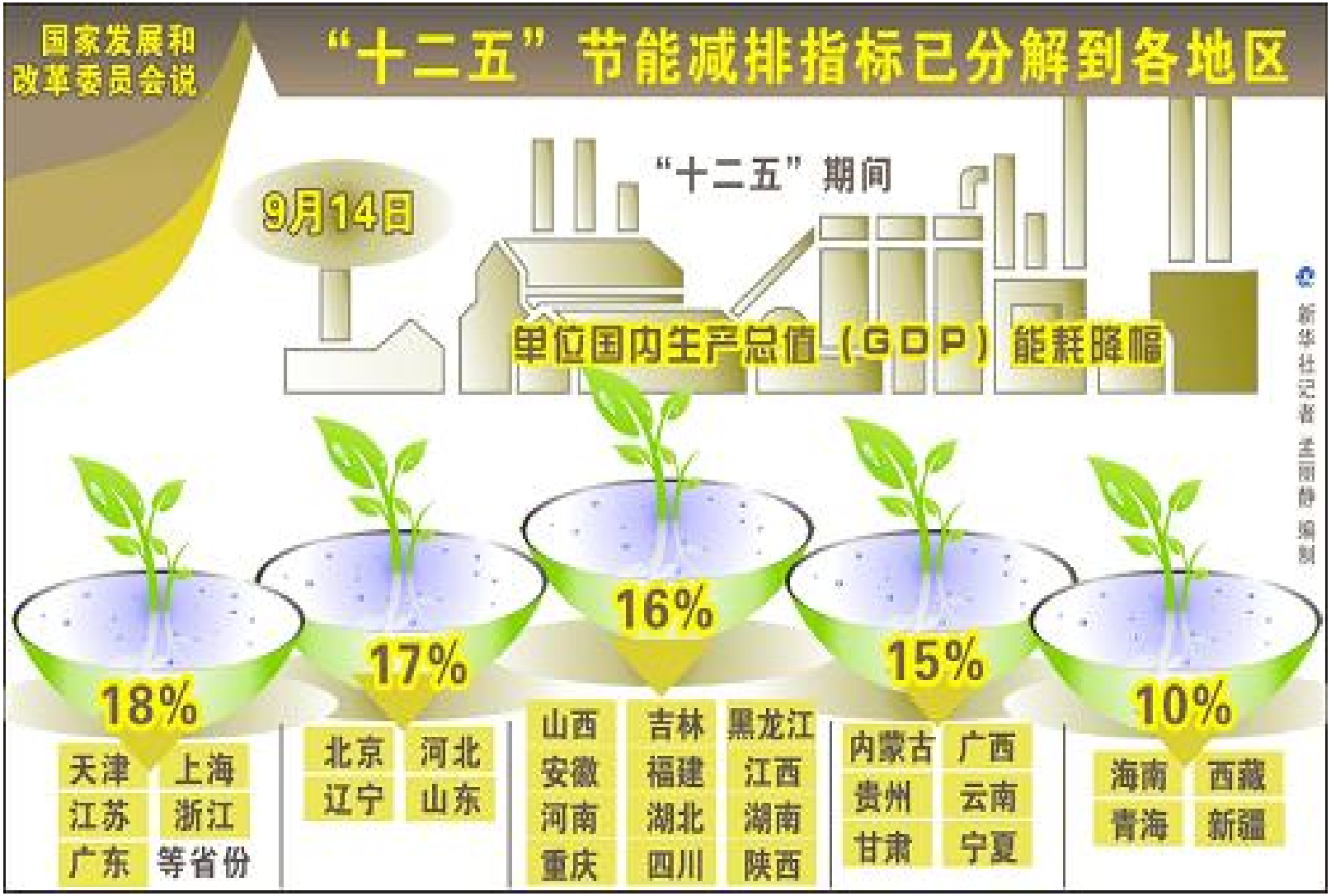
Affiliations | **Corresponding authors**

中国の地域別および産業別の排出パタンを提示

Nature Climate Change **1**, 347–349 (2011) | doi:10.1038/nclimate1238
Published online 28 September 2011

The reduction of carbon dioxide emissions is a pressing challenge for China. Now research demonstrates that China's local energy-related emission patterns are important for setting effective greenhouse-gas abatement policies.

GDPに基づく省エネと排出削減目標



CO_2排出削減目標についての問題点

ENVIRONMENTAL Science & Technology

Viewpoint

pubs.acs.org/es

Achieving National Emission Reduction Target—China's New Challenge and Opportunity

Yong Geng[†,*] and Joseph Sarkis[†]

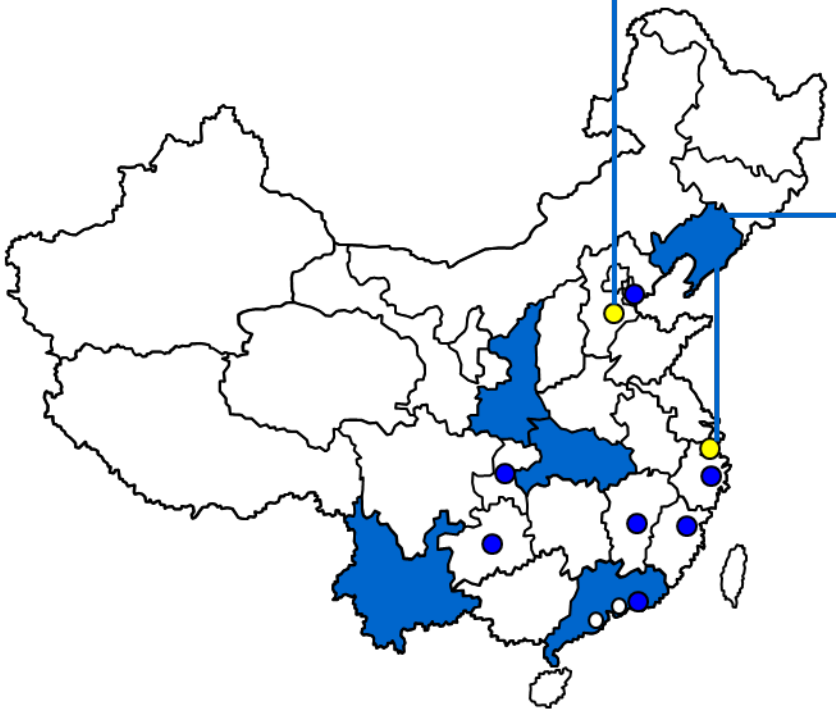
- Given China's rapid economic development, the use of ratio-based indicators (i.e. indicators per unit of output, per unit of energy, per capita, per hectare) still results in greater absolute emissions and consumption of materials or energy ;
- A universally accepted and regionally normalized measurable criteria and process do not exist.
- Barriers to implementation, such as indicators' lack of theoretical foundation and standardization, a transparent monitoring and auditing mechanism, data validity and accuracy, also exist.

IAE

国家低炭素プロジェクト

13 more provinces and cities are set by NDRC$_2$ as Low-carbon Pilot, besides Shanghai and Baoding of WWF

- **WWF low-carbon projects**: Shanghai, Baoding
- **NDRC pilot (Aug. 9, 2010)**: Low-carbon pilot in 5 provinces and 8 cities



1 WWF: World Wildlife Foundation
2 NDRC: National Development and Reform Committee

Baoding, Hebei (WWF)

- **Date of pledge:** Oct 10, 2009
- **WWF Object (2010 – 2015):**
  - Encouraging the investment and export of sustainable energy product
  - Capacity building in city planning and industrial park: solar energy demonstration city and Industrial park of wind and solar technology

Shanghai (WWF)

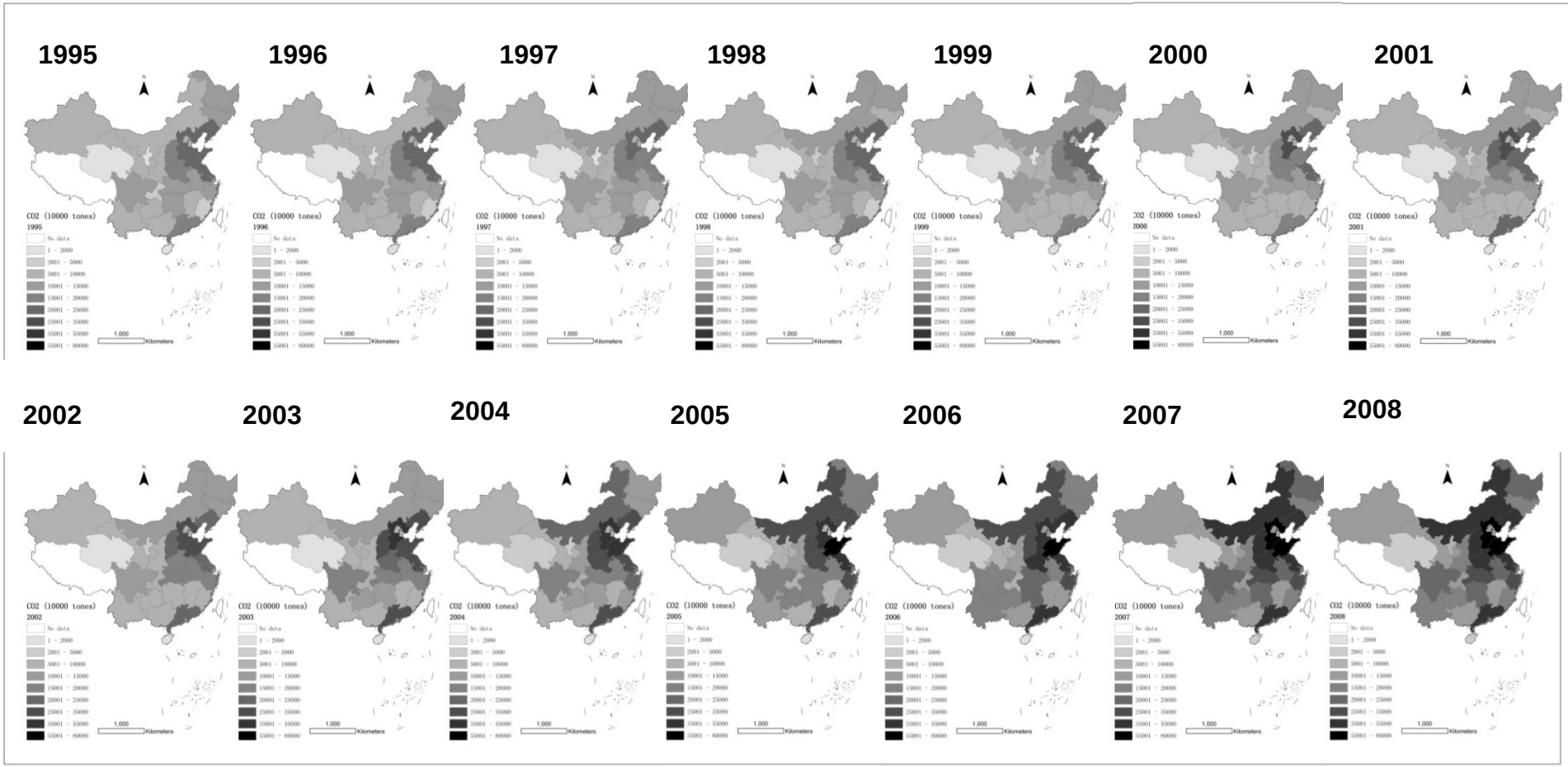
- **Date of pledge:** Oct 10, 2009
- **WWF Object (2010 – 2015):**
  - Energy Efficiency improvement in Building Sector
  - Renovation and management demonstrations in office buildings and hotels
  - Newly Build Eco-Building

Low-carbon Pilot (NDRC$_2$)

- **Coverage:**
  - **Provinces:** Liaoning, Guangdong, Yunnan, Hubei, Shaanxi
  - **Cities:** Tianjin, Chongqing, Shenzhen, Xiamen, Hangzhou, Nanchang, Guiyang, Baoding
- **Actions (2011-2016):**
  - Provincial / municipal carbon emission cap
  - Domestic carbon emission trading programs

SOURCE: WWF, local government portal, National Development and Reform Commission, China Daily

中国における地域ごとのCO_2排出量の変遷（1995-2008）

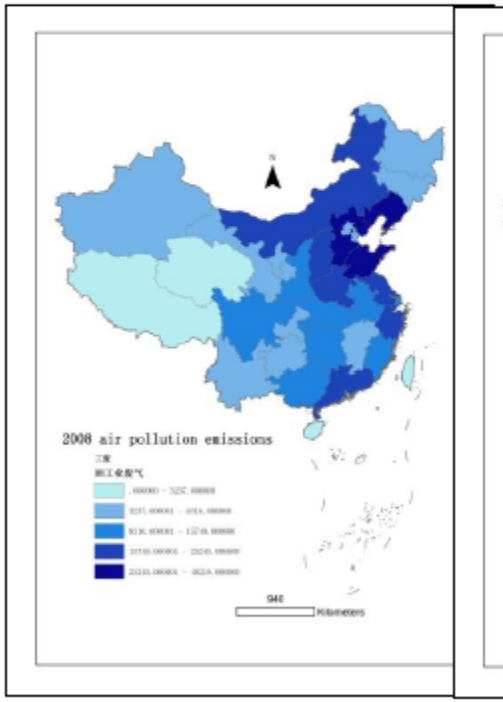


Disparity and cluster of China's provincial GHG emission

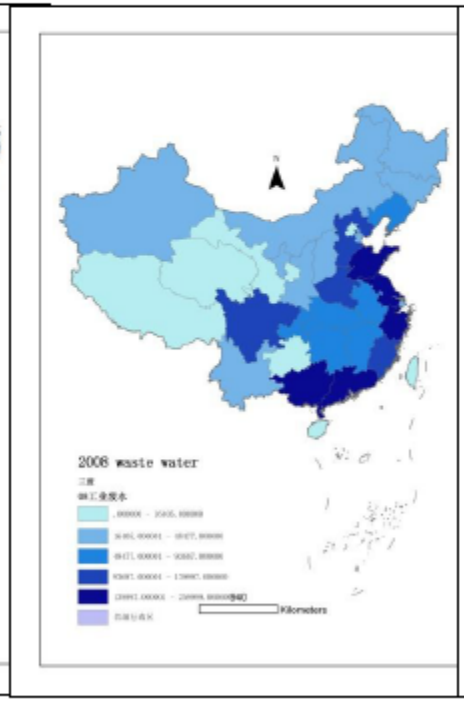
汚染物質ごとの排出量の比較

Co-benefit of energy saving effort in China

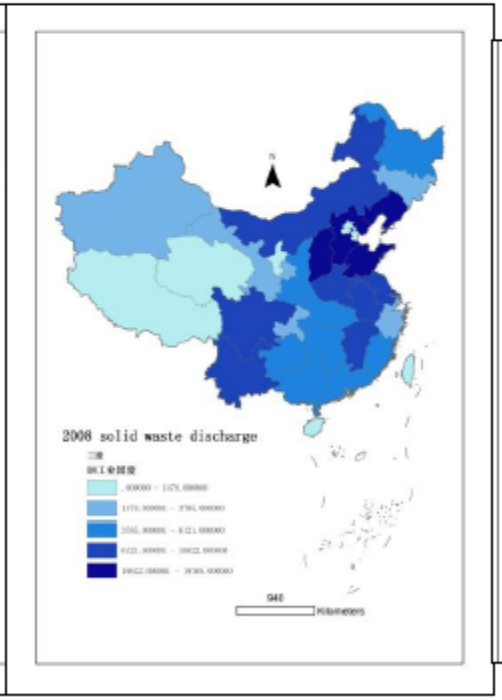
- Nexus of pollutant emission and waste discharge
- Co-benefit of energy saving and emission reduction



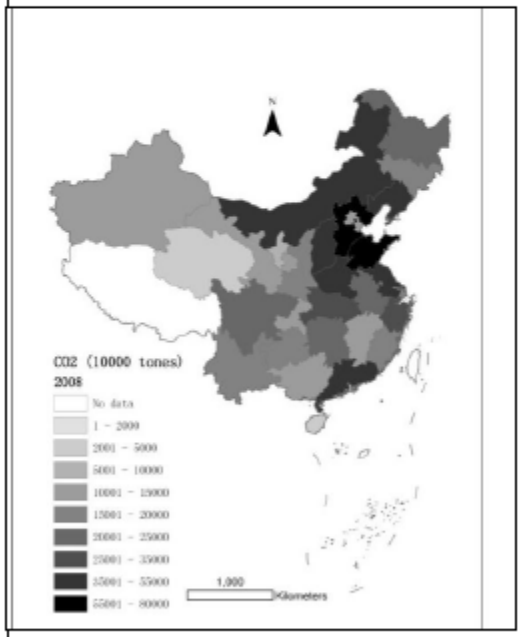
Air pollution emission in 2008



Waste water discharge in 2008



Industry solid waste discharge in 2008



CO_2 emission in 2008

低炭素型発展―地域の視点から

Contents lists available at SciVerse ScienceDirect

Energy

journal homepage: www.elsevier.com/locate/energy

Uncovering China's greenhouse gas emission from regional and sectoral perspectives

Zhu Liu [a,b], Yong Geng [a,*], Soeren Lindner [a,c], Dabo Guan [a,d]

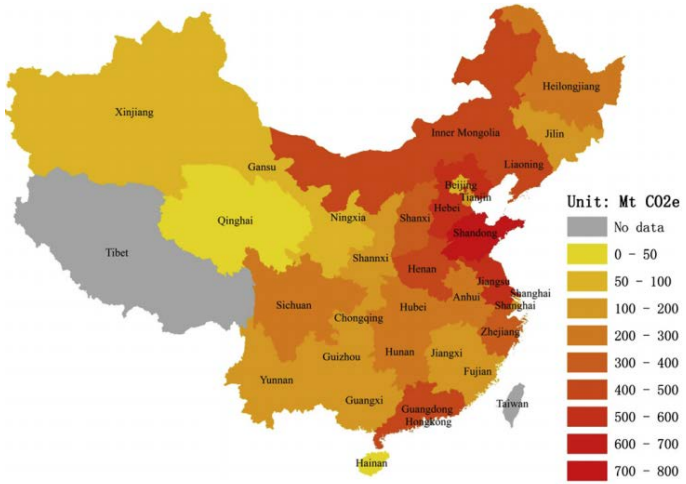


Fig. 1. China's provincial GHG Emission in 2009.

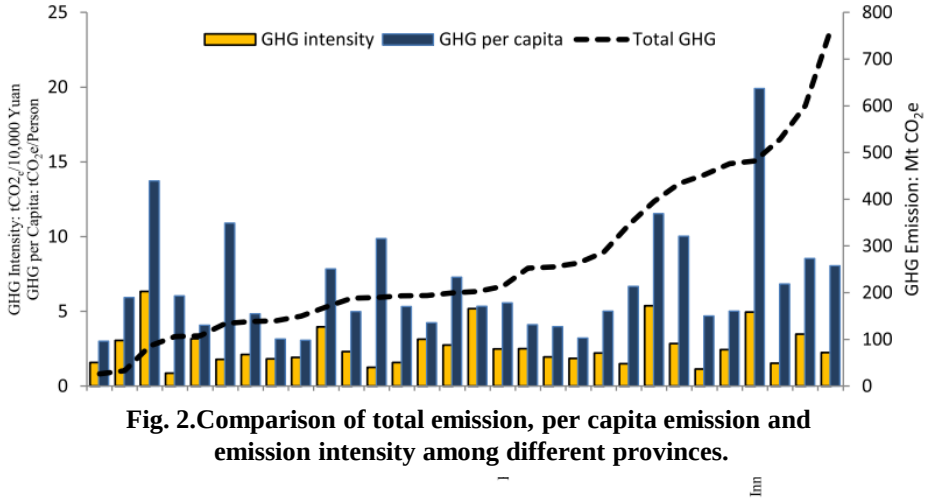
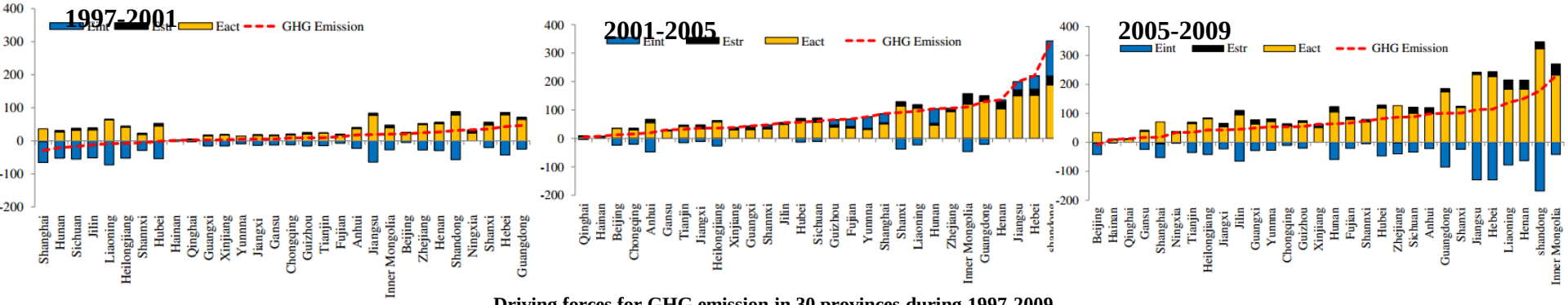


Fig. 2.Comparison of total emission, per capita emission and emission intensity among different provinces.

Fig. 2. Comparison of total emission, per capita emission and emission intensity among different provinces.



Driving forces for GHG emission in 30 provinces during 1997-2009

不均衡の技術発展が中国のCO2削減に主な障害となる。

Energy Policy 49 (2012) 751–758

Contents lists available at SciVerse ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Embodied energy use in China's industrial sectors

Zhu Liu [a,b], Yong Geng [a,*], Soeren Lindner [c], Hongyan Zhao [a,b], Tsuyoshi Fujita [d], Dabo Guan [a,e]

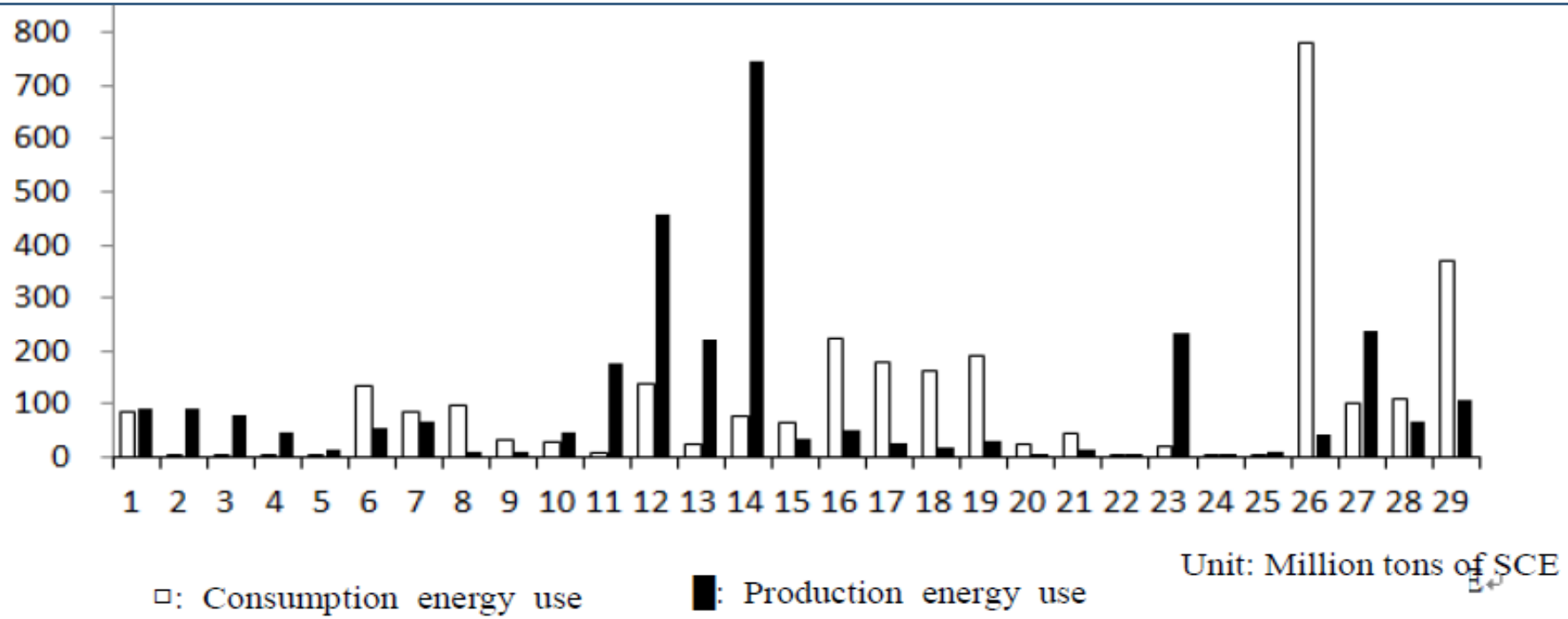


Figure. 2 Production-based energy use and consumption-based energy use for 29 economic sectors

Energy 36 (2011) 4799–4808

Contents lists available at ScienceDirect

Energy

journal homepage: www.elsevier.com/locate/energy

Regional societal and ecosystem metabolism analysis in China: A multi-scale integrated analysis of societal metabolism(MSIASM) approach

Yong Geng [a], Ye Liu [a,*], Dan Liu [b], Hengxin Zhao [a,c], Bing Xue [a]

[a] Key Laboratory of Pollution Ecology and Environmental Engineering & International Research Center for Circular Economy and Industrial Ecology, Institute of Applied Ecology, Chinese Academy of Sciences, P.O.Box417, No.72 Wenhua Road, Shenyang 110016, China
[b] Economic Crime Investigation Department, China Criminal Police University, Shenyang 110854, China
[c] Graduate University of Chinese Academy of Sciences, Beijing 100039, China

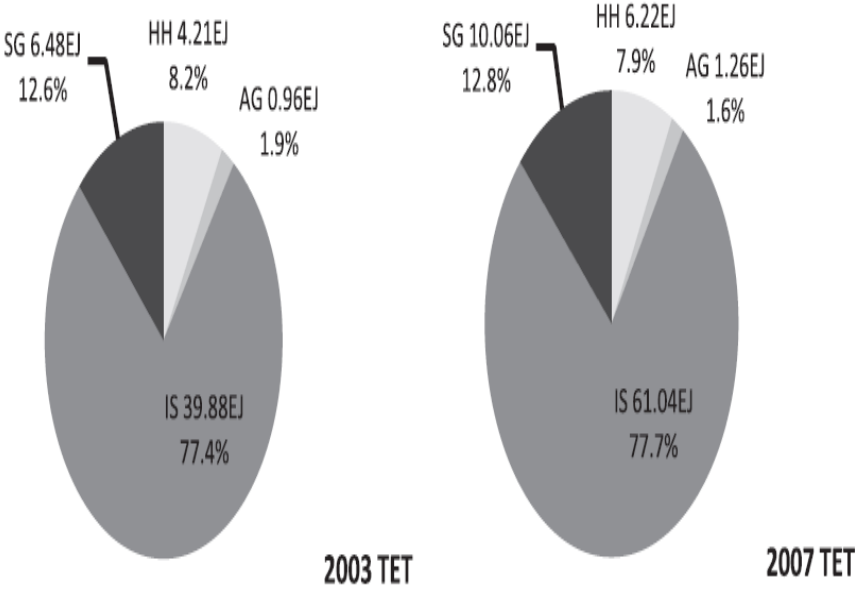


Fig. 2. Exosomatic energy throughput in different sectors in the whole selected Chinese regions for 2003 and 2007.

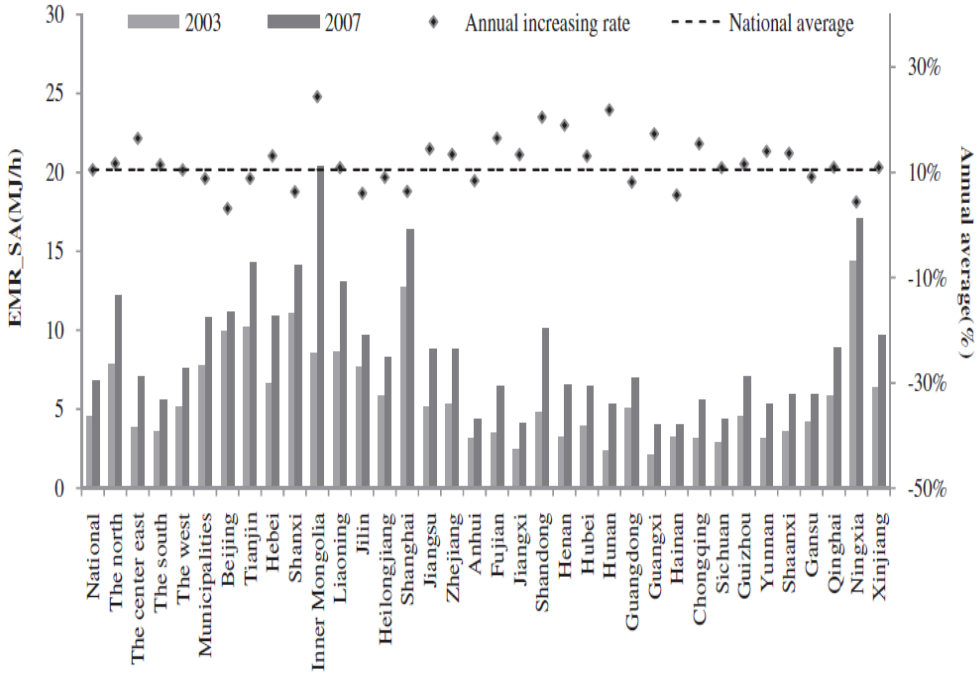


Fig. 4. *EMR* in the selected Chinese regions for 2003 and 2007.

都市レベルの低炭素型発展

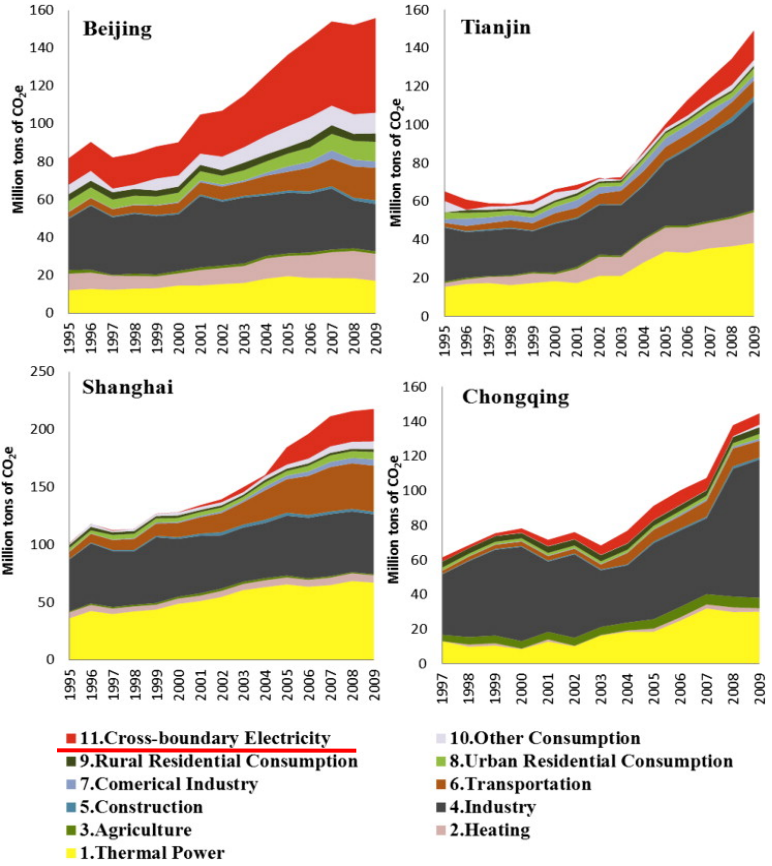
Contents lists available at SciVerse ScienceDirect

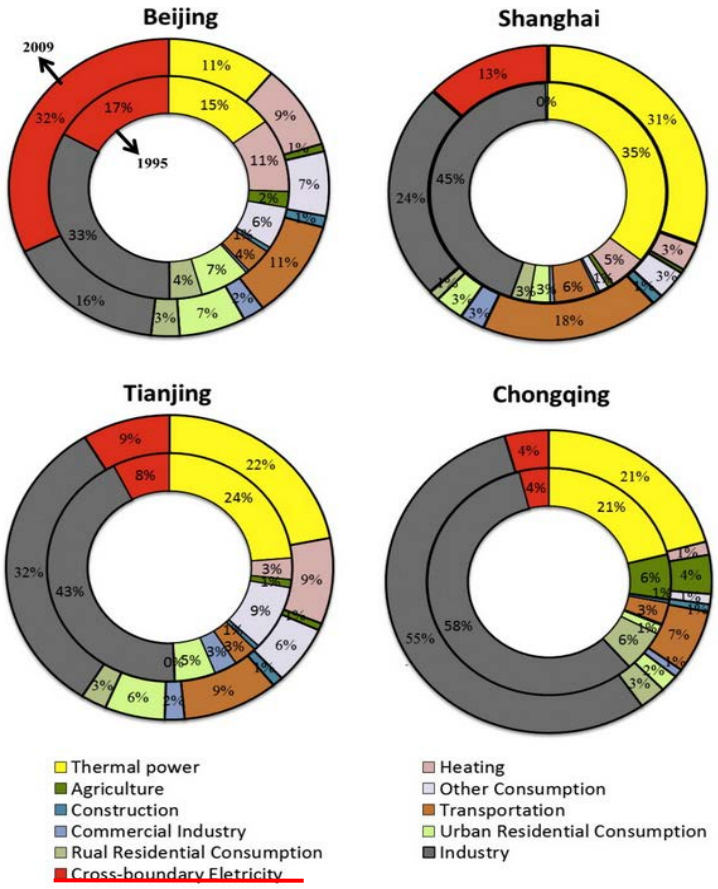
Energy

journal homepage: www.elsevier.com/locate/energy

Features, trajectories and driving forces for energy-related GHG emissions from Chinese mega cites: The case of Beijing, Tianjin, Shanghai and Chongqing

Zhu Liu [a,b], Sai Liang [c], Yong Geng [a,*], Bing Xue [a], Fengming Xi [a], Ying Pan [d], Tianzhu Zhang [c], Tsuyoshi Fujita [e]





Contents lists available at ScienceDirect

Energy Policy

journal homepage: www.elsevier.com/locate/enpol

Contributing to local policy making on GHG emission reduction through inventorying and attribution: A case study of Shenyang, China

Fengming Xi [a], Yong Geng [a,*], Xudong Chen [b,c], Yunsong Zhang [d], Xinbei Wang [a], Bing Xue [a], Huijuan Dong [a], Zhu Liu [a], Wanxia Ren [a], Tsuyoshi Fujita [b], Qinghua Zhu [d]

[a] Institute of Applied Ecology, Chinese Academy of Sciences, No. 72 Wenhua Road, Shenyang 110016, PR China
[b] National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan
[c] Graduate School of Environmental Studies, Nagoya University, Furo-cho, Chikusa-ku, Nagoya 464-8601, Japan
[d] School of Management, Dalian University of Technology, No. 2 Linggong Road, Dalian 116024, PR China

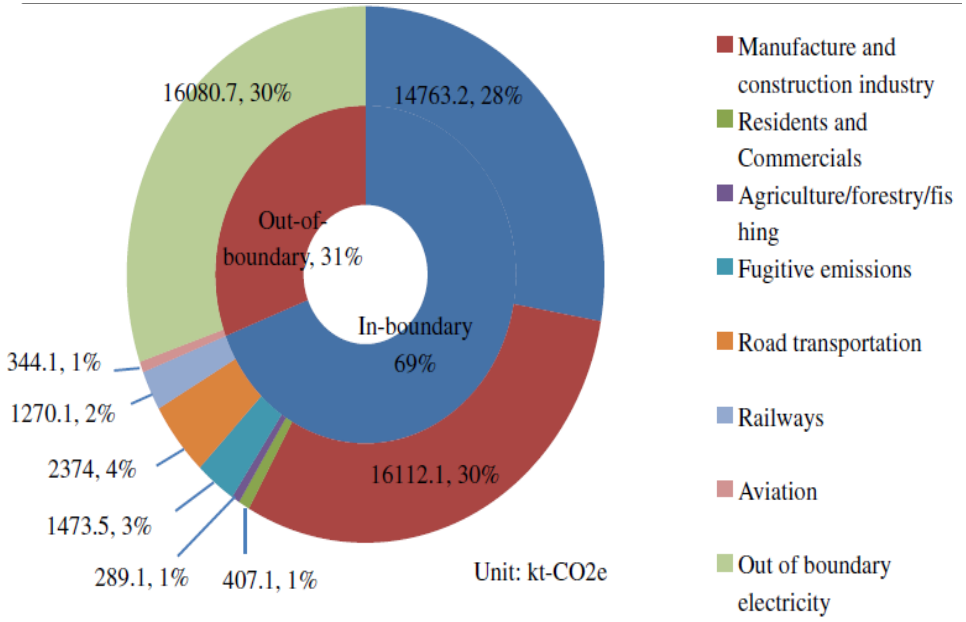


Fig. 3. GHG inventory of the energy sector in Shenyang.

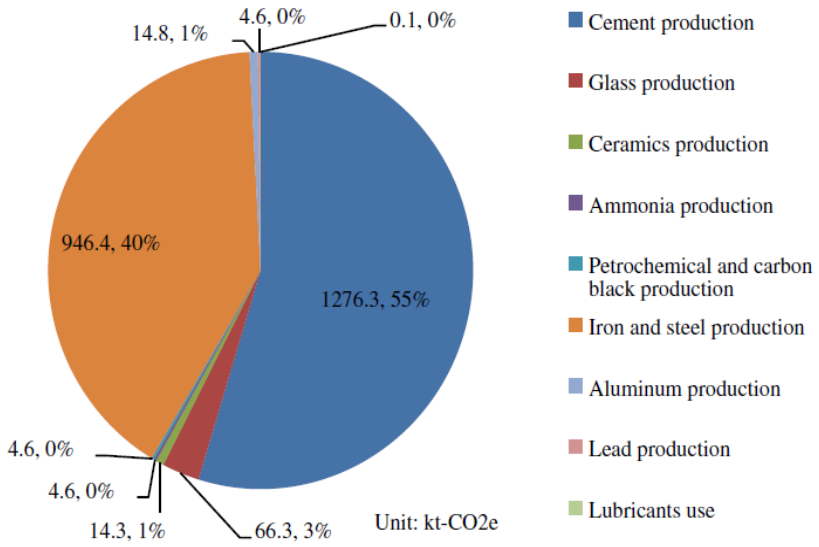


Fig. 4. GHG inventory of industrial processes and product use in Shenyang.

Enteric fermentation

主要産業レベルの低炭素型発展

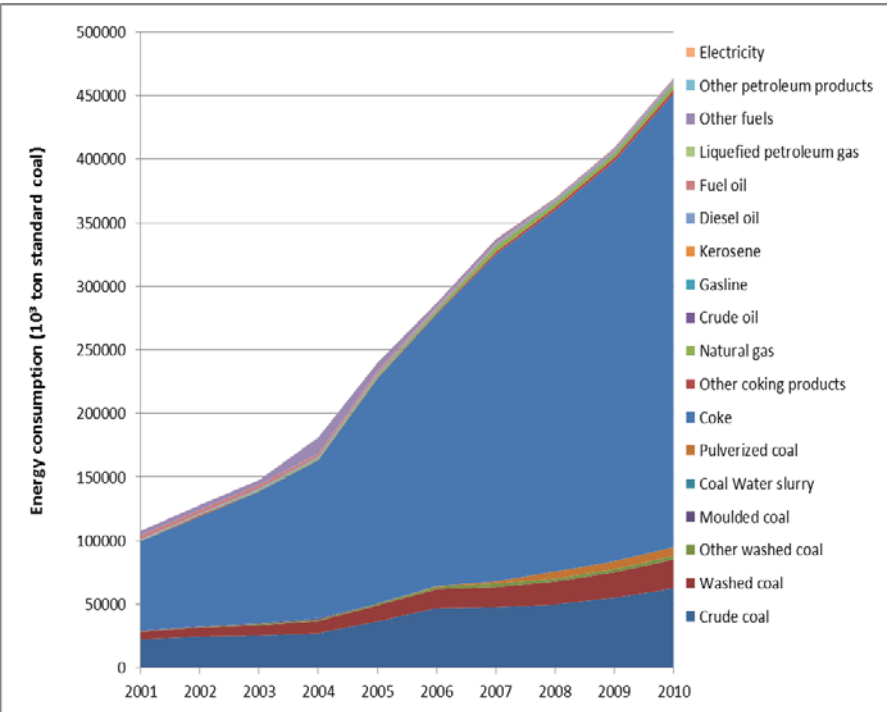
Contents lists available at SciVerse ScienceDirect

Energy Policy

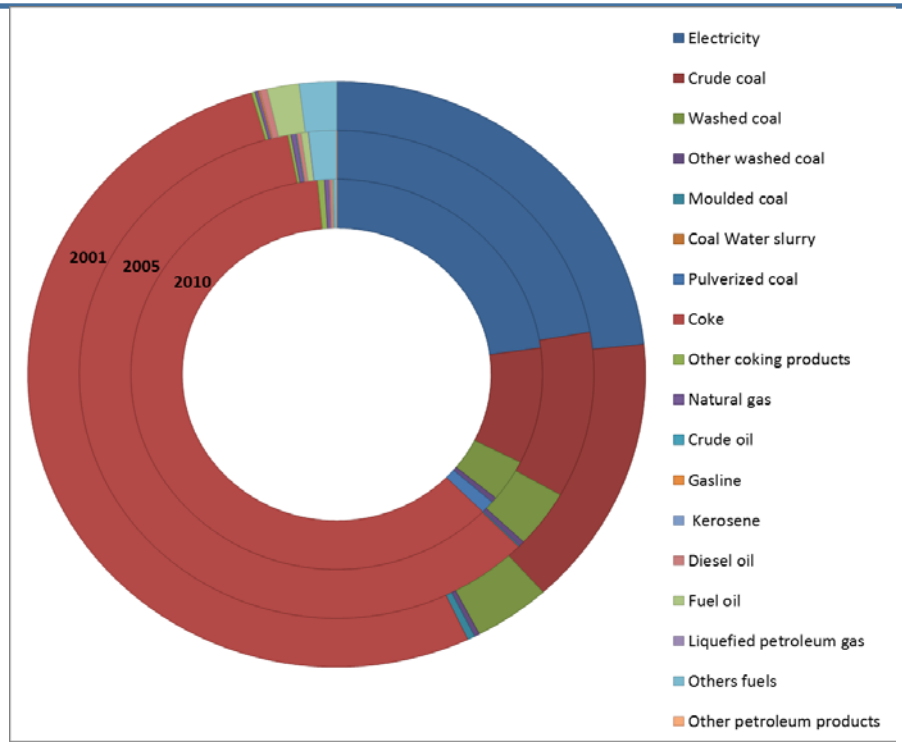
journal homepage: www.elsevier.com/locate/enpol

A Comprehensive Analysis of GHG emission in Chinese Iron and Steel Industry

YihuiTian[a], QinghuaZhu[a], Yong Geng[b*]

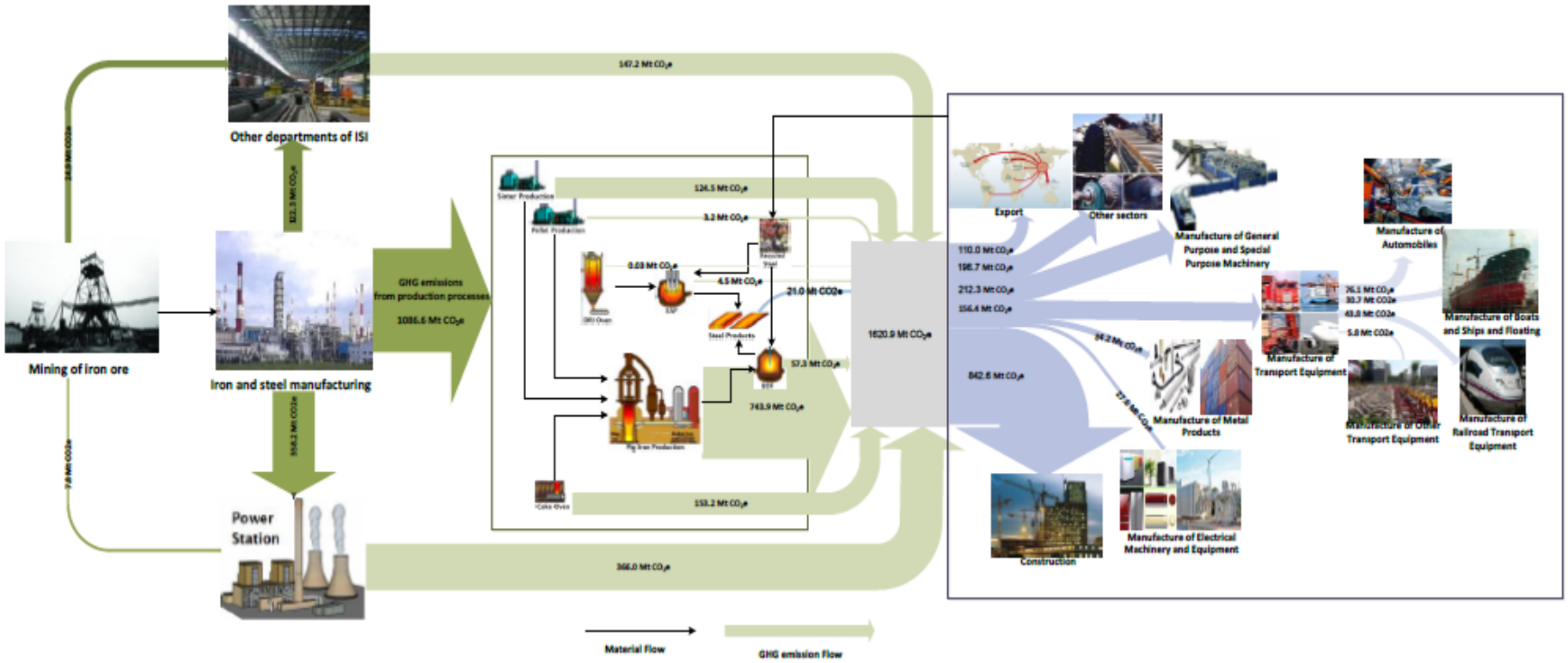


Energy consumption in Chinese iron and steel industry (2001-2010)



GHG emissions from different energy sources

中国鉄鋼産業におけるエネルギー起源のGHGフロー（2009年）



セメント産業の低炭素型発展

Journal of Cleaner Production xxx (2012) 1–7

Contents lists available at SciVerse ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Trajectory and Driving Factors for GHG Emissions in the Chinese Cement Industry

Yilei Wang[a], QinghuaZhu[a], Yong Geng[b*]

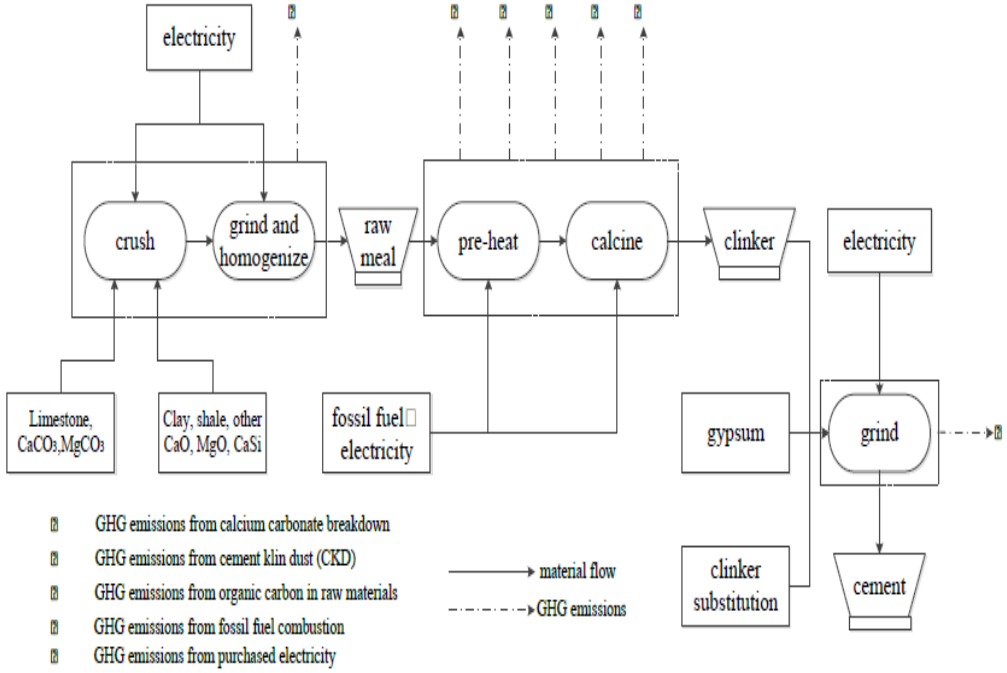


Figure 2 The overall flowchart of process for cement production

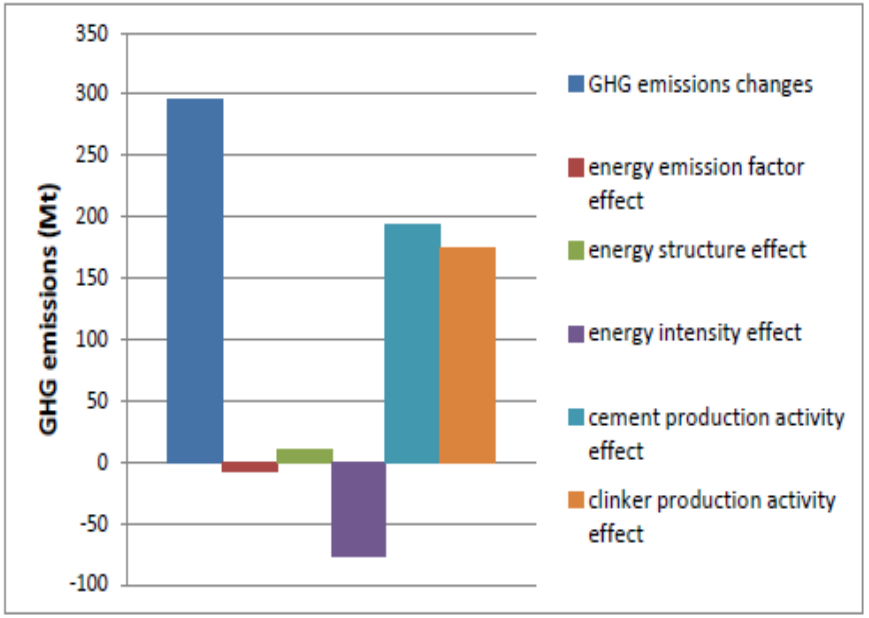


Figure 7 Contribution of different driving factors on GHG emissions for Chinese cement industry (2005-2009)

主要産業の低炭素型発展

Contents lists available at SciVerse ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: www.elsevier.com/locate/rser

CO_2 emissions from China's power sector at the provincial level: Consumption versus production perspectives

Soeren Lindner [a,b], Zhu Liu [a,c], Dabo Guan [d,e], Yong Geng [a,*], Xin Li [d]

Figure 1 Domestic emissions from the electricity sector in all Chinese provinces in 2008

Table 2: Provinces grouped in three categories according to comparison of emissions embodied in production and consumption

Region	Provinces with higher emissions embodied in production	Provinces with balanced emissions	Provinces with higher emissions embodied in consumption
Central China	Hubei	Sichuan	Henan, Hunan, Jiangxi Chongqing
Eastern China	Anhui	Fujian	Shanghai, Jiangsu, Zhejiang
North East	Jilin, Heilongjiang		Lianoning
North West	Ningxia, Shaanxi	Gansu, Qinghai, Xinjiang	
South China	Yunnan, Guizhou	Hainan	Guangdong, Guangxi
North China Grid	Shanxi Inner Mongolia	Shandong	Beijing, Tianjing, Hebei

ご清聴、ありがとうございました