Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

中国生活垃圾的低碳发展

Low-carbon Waste Management in China

中国城市生活垃圾处理领域国家适当减缓行动项目

China Integrated Waste Management NAMA Project

中华人民共和国住房和城乡建设部
Ministry of Housing and Urban-Rural Development (MoHURD)

NAMA Facility

On behalf of

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Department for Business, Energy & Industrial Strategy

Danish Ministry of Energy, Utilities and Climate

Implemented by

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

中国城市环境卫生协会
China Association of Urban Environmental Sanitation

China Integrated Waste Management NAMA

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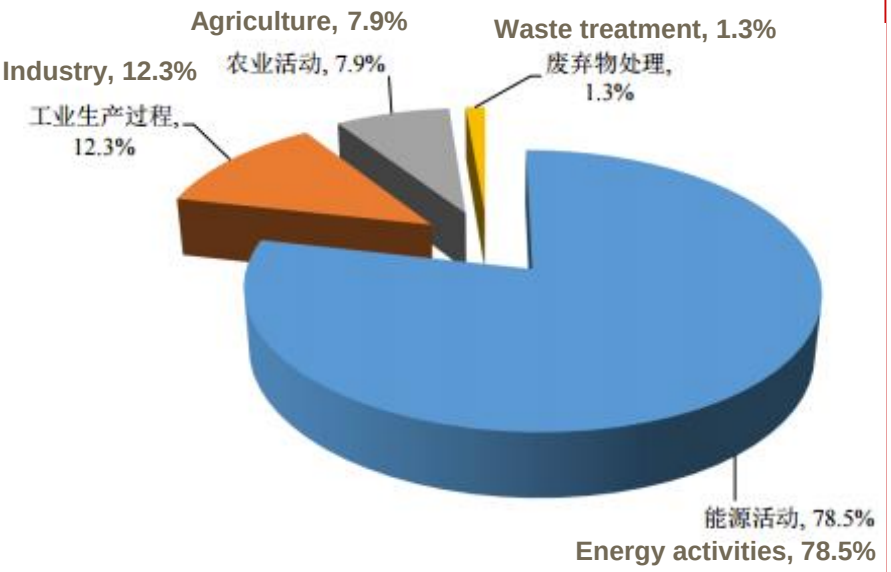
  NAMA 基金会支持项目 – 中国城市生活垃圾领域国家适当减缓行动项目介绍

GHG reduction potential in the waste sector
中国垃圾领域的减排潜力

GHG emissions from the Chinese waste sector
中国垃圾领域的温室气体排放



Source: The first two year update of climate change in People's Republic of China 2016

来源：《中华人民共和国气候变化第一次两年更新报告》（2016年12月）

158 million t CO_2eq from waste sector

废弃物行业CO_2 排放量1.58亿吨

Waste water 91 million t

废水0.91亿吨

Incineration 14 million t

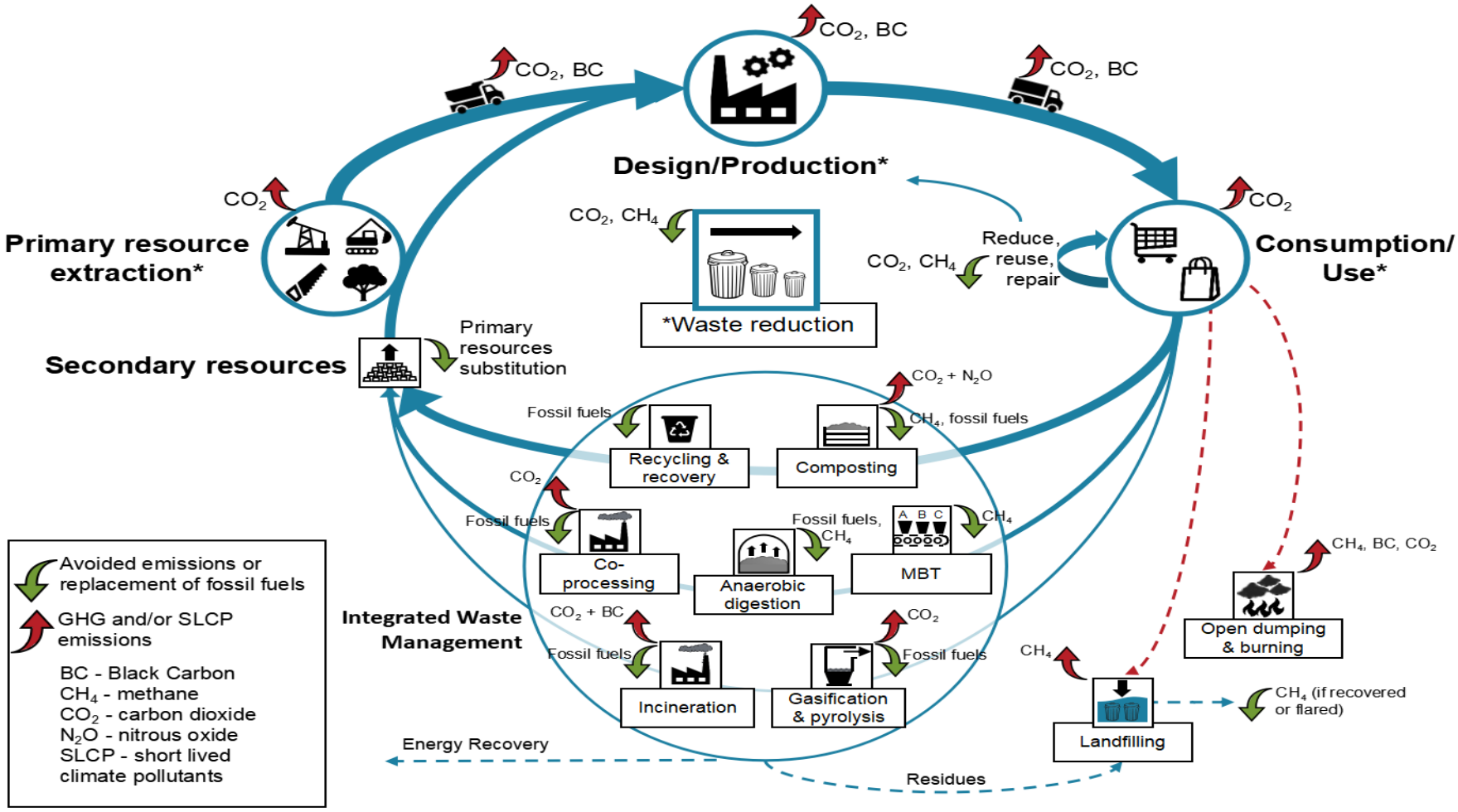
垃圾焚烧0.14亿吨

landfill 54 million t

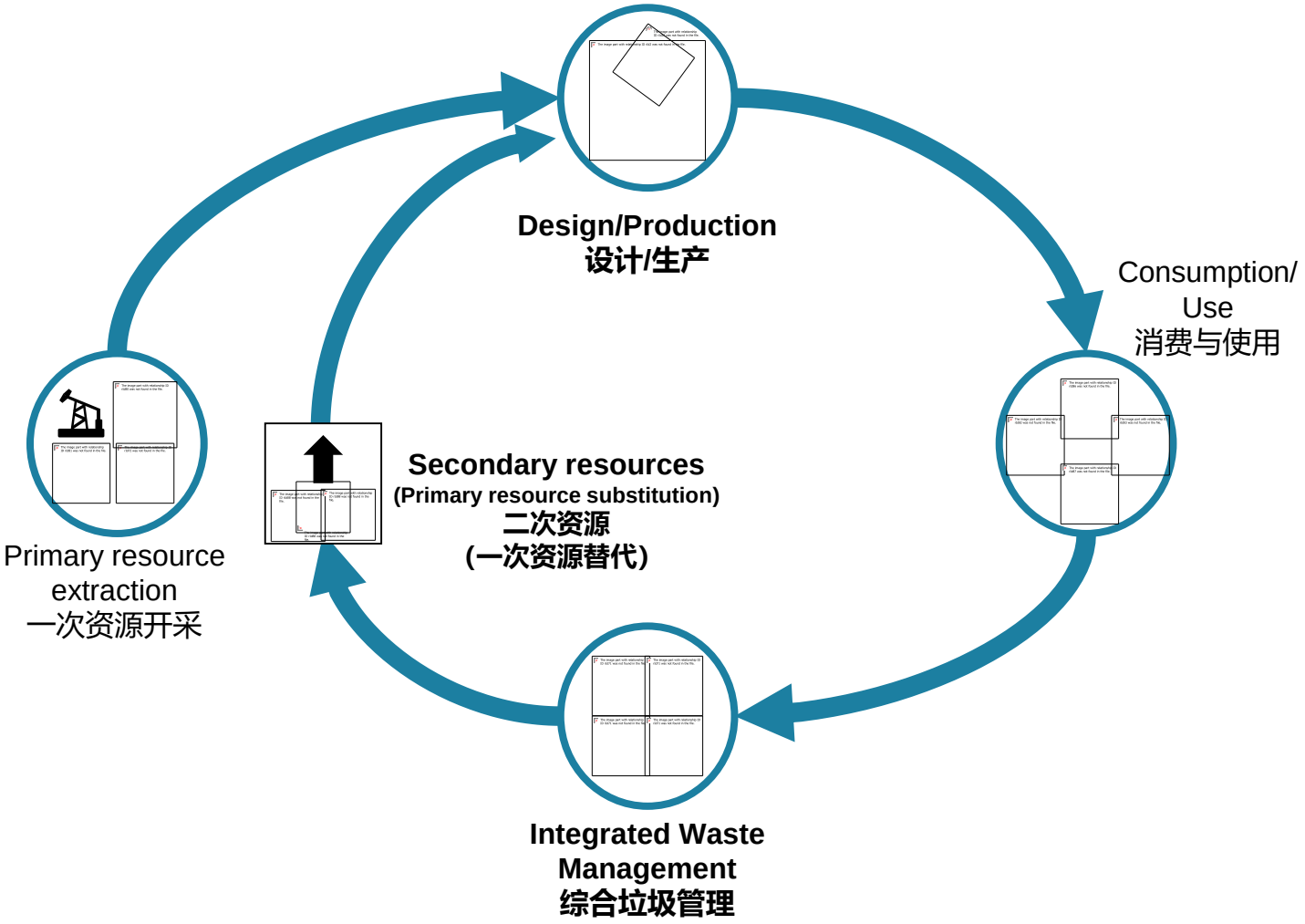
垃圾填埋0.54亿吨

(2012)

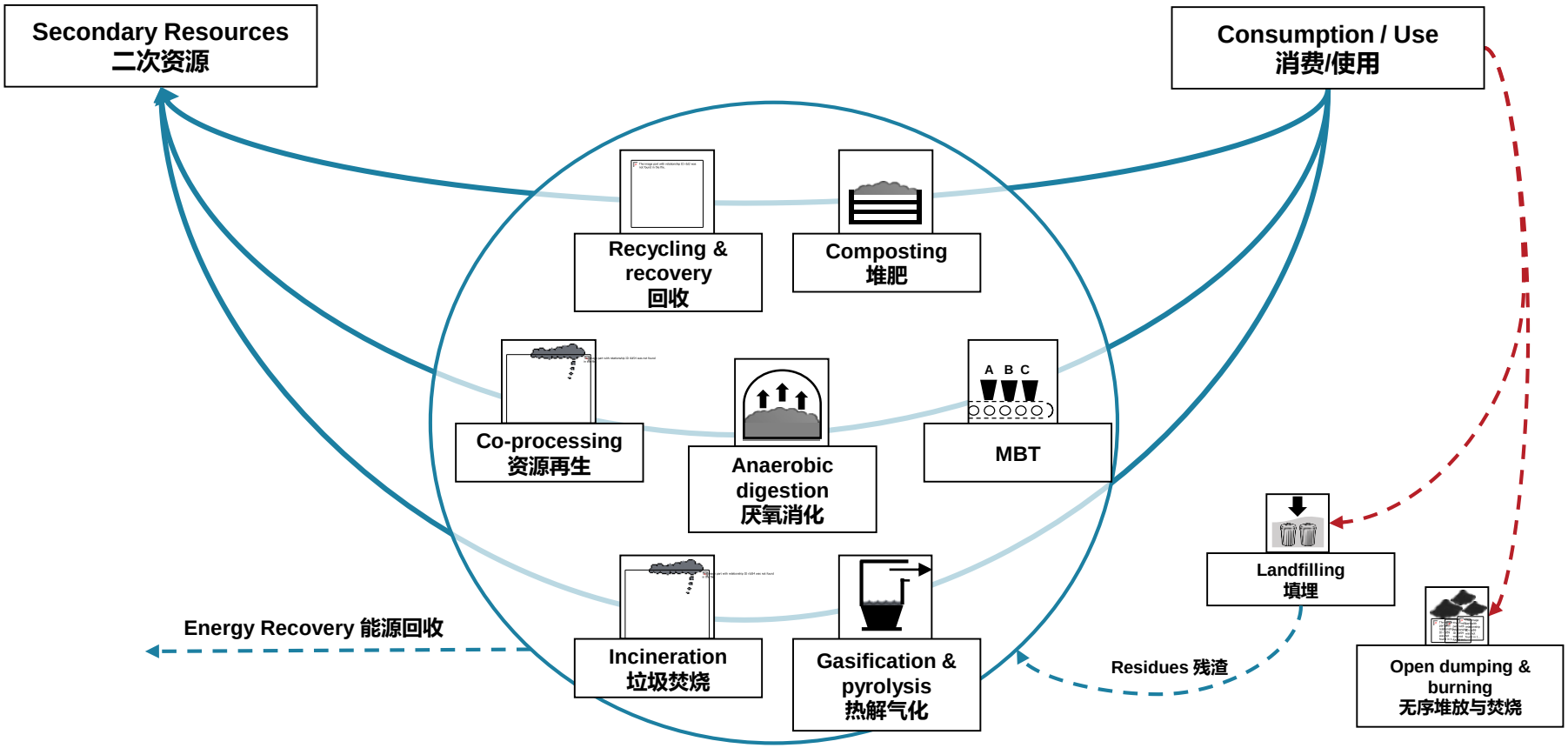
GHG emissions from solid waste treatment
垃圾处理过程中的温室气体排放



The Circular Economy
循环经济



Integrated Waste Management
综合垃圾管理



Closing the loop
闭环

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Design/Production
设计/生产

Primary resource extraction
一次资源开发

Secondary resources
(Primary resource substitution)
二次资源（替代一次资源）

Fossil fuel substitution with alternative resources
化石能源替代

Integrated Waste Management
综合垃圾管理

Production of co-products
生产副产品

Use of altern. solvents
使用替代溶剂

Reduced energy consumption
降低能源消耗

Renewable plant resources
可再生资源

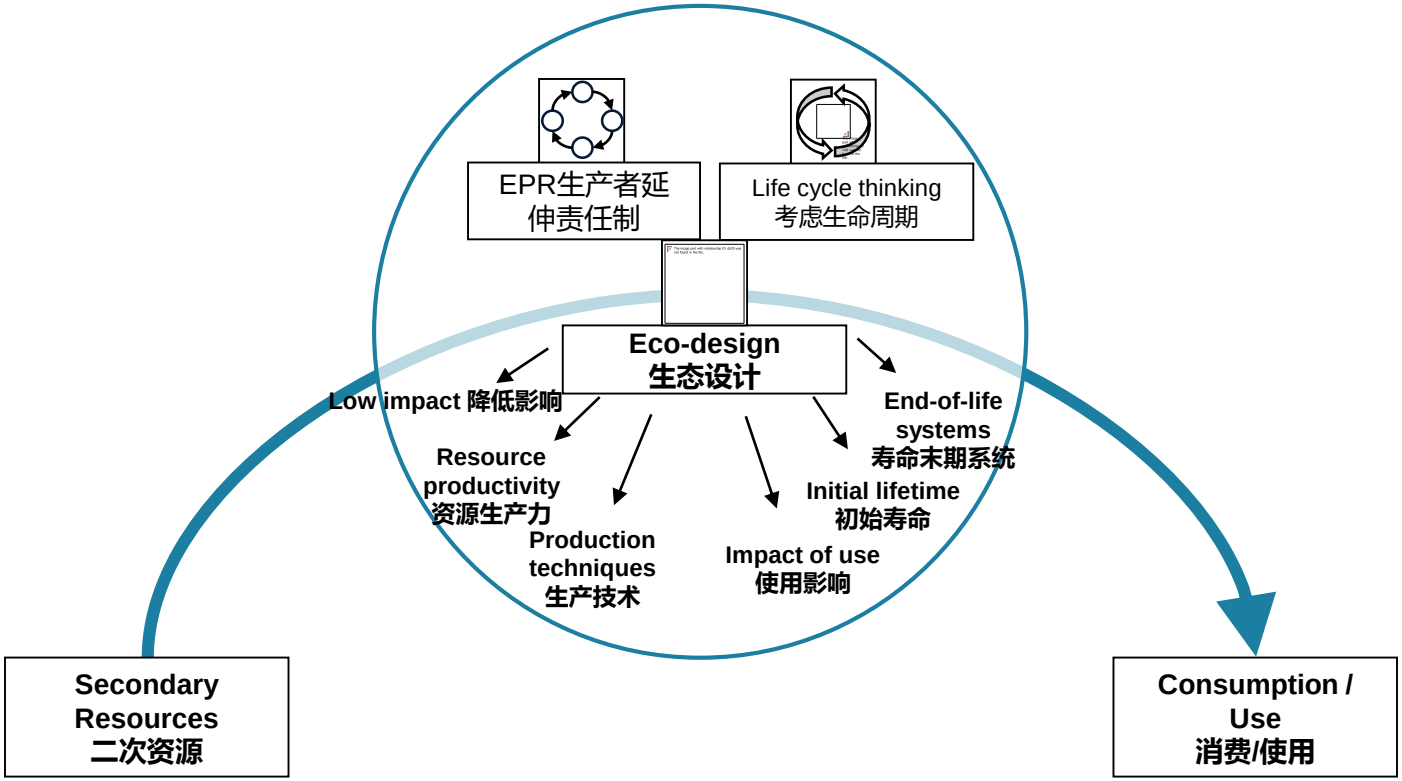
Biodegradable extract
可生物降解

Process optimisation
工艺优化

Example *(UBA, 2016)*

- **Production of 1 kg new copy paper requires ~50 l water and ~5 kWh of energy.**
- **生产1公斤新纸需要消耗50L谁和5度能源**
- **Production of 1 kg recycling paper requires ~50% less energy, ~30% less water and saves ~2,2 kg wood. Requires use of 1,2 kg waste paper**
- **生产1公斤再生纸，可以降低50%能源，30%谁和2.2公斤木材。需要使用1.2公斤废纸**

Sustainable design and production
可持续设计和生产



Conscious Consumption
自觉消费

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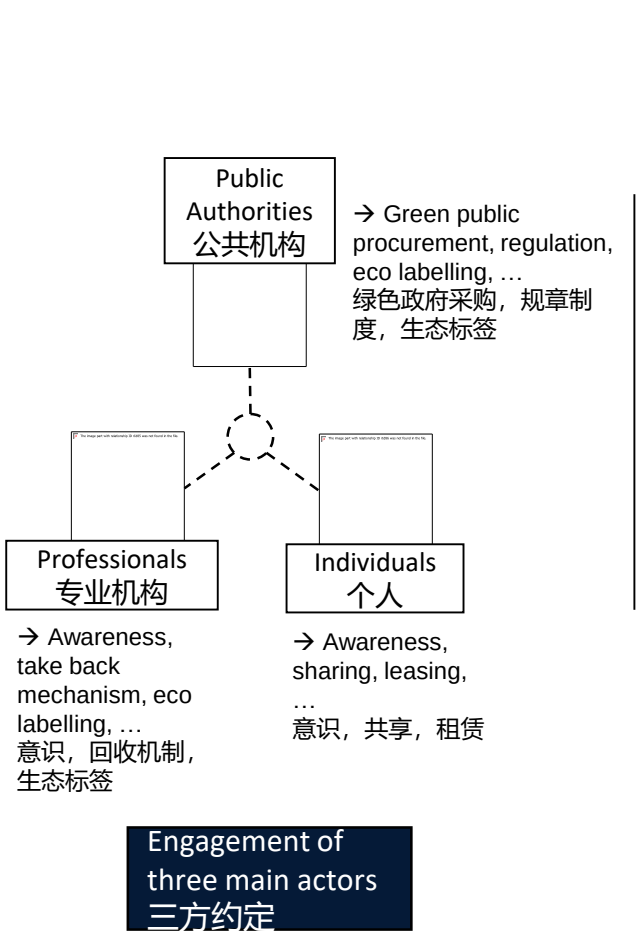
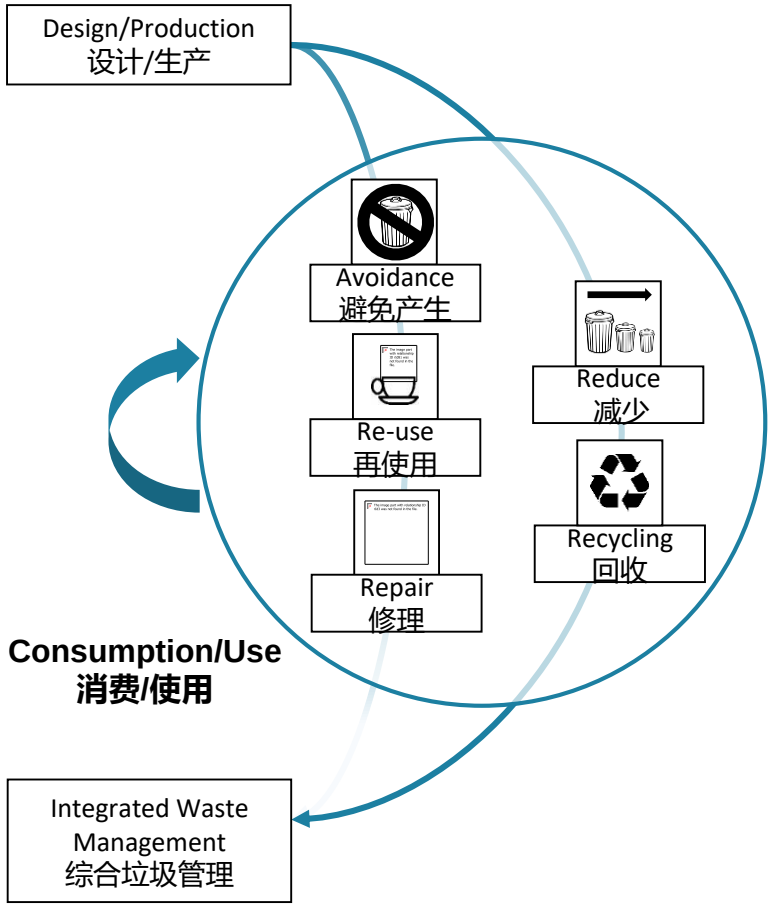
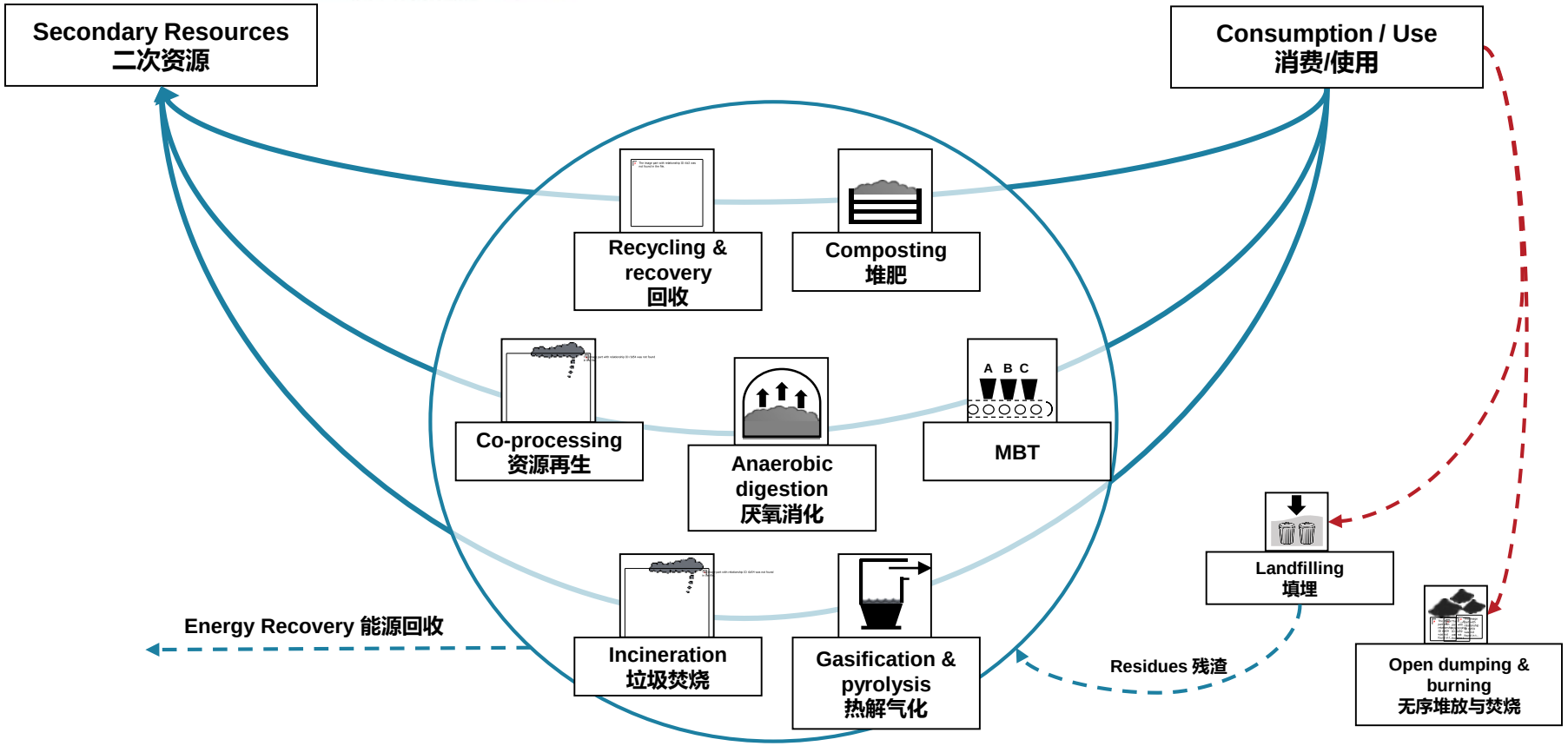




Integrated Waste Management
综合垃圾管理



one ton of MSW
1吨生活垃圾

- Sanitation landfill 卫生填埋：1.22 tCO_2 eq
- Passive landfill 简易填埋：1.02 tCO_2 eq
- incineration焚烧：0.47 tCO_2 eq
- Composting 堆肥：0.14 tCO_2 eq
- AD 厌氧消化：-0.13 tCO_2 eq

* Calculated by IWM NAMA Project based on the IPCC methodology and considering Chinese conditions

How to reduce the GHG emissions from solid waste treatment
垃圾处理过程中的减排

- 以100万人口城市为例，生活垃圾收集处理量为1000吨/日，餐厨垃圾100吨/日；1 million citizens, MSW 1000 tons of per day, restaurant waste 100 tons per day
- 假设现状为60%填埋，39%焚烧，1%其它处理，60% landfilled, 39% incinerated, 1% by other ways
- 排放量**34万**吨二氧化碳当量/年, emissions of 340,000 tons CO_2eq per year

实现40%有机垃圾分离

(400吨/日)

40% bio-waste separated

总排放量：**4万**吨/年

40,000 tons CO_2eq per year

垃圾分类20%有机垃圾用于沼气(200吨/日)
20% bio-waste separated for AD
总排放量：**26万**吨/年
260,000 tons CO_2eq per year

→

70%填埋气甲烷收集利用
Utilization of 70% of landfill gas
总排放量：19万吨/年
190,000 tons CO_2eq per year

→

焚烧厂渗滤液优化，余热利用
Optimization of leachate treatment, heat utilization
总排放量：14万吨/年
140,000 tons CO_2eq per year

→

餐厨垃圾处理；管理体系优化
Restaurant waste treatment
总排放量：12万吨/年
120,000 tons CO_2eq per year

The potential of GHG reduction by waste treatment in China
中国城市生活垃圾处理的减排潜力

428 million tons of MSW collection in 2030

2030年垃圾清运量4.28亿吨

17.6%

Potential GHG reduction **352** million tons

减排潜力3.52亿吨

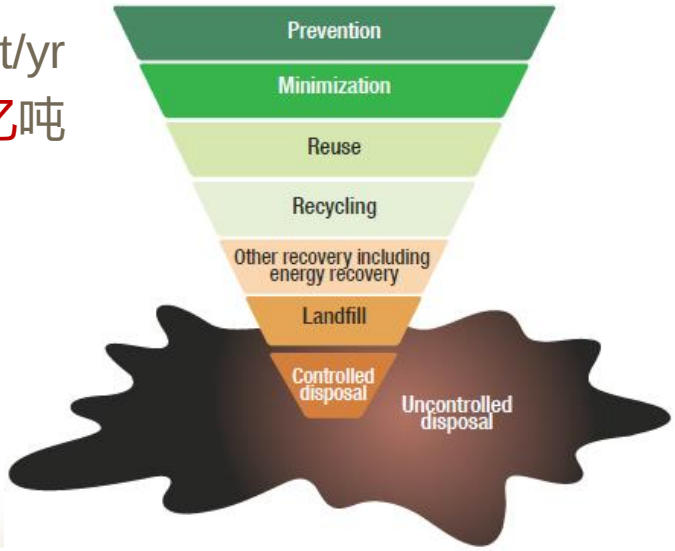
11.1%

According to Chinese NDC

根据中国的NDC目标

GHG emissions reduction **2** billion t/yr

Source: China Policy Review 中国经济报告 年减排20亿吨



270 million tons of MSW treated in 2016

2016年城市垃圾无害化处理量2.7亿吨

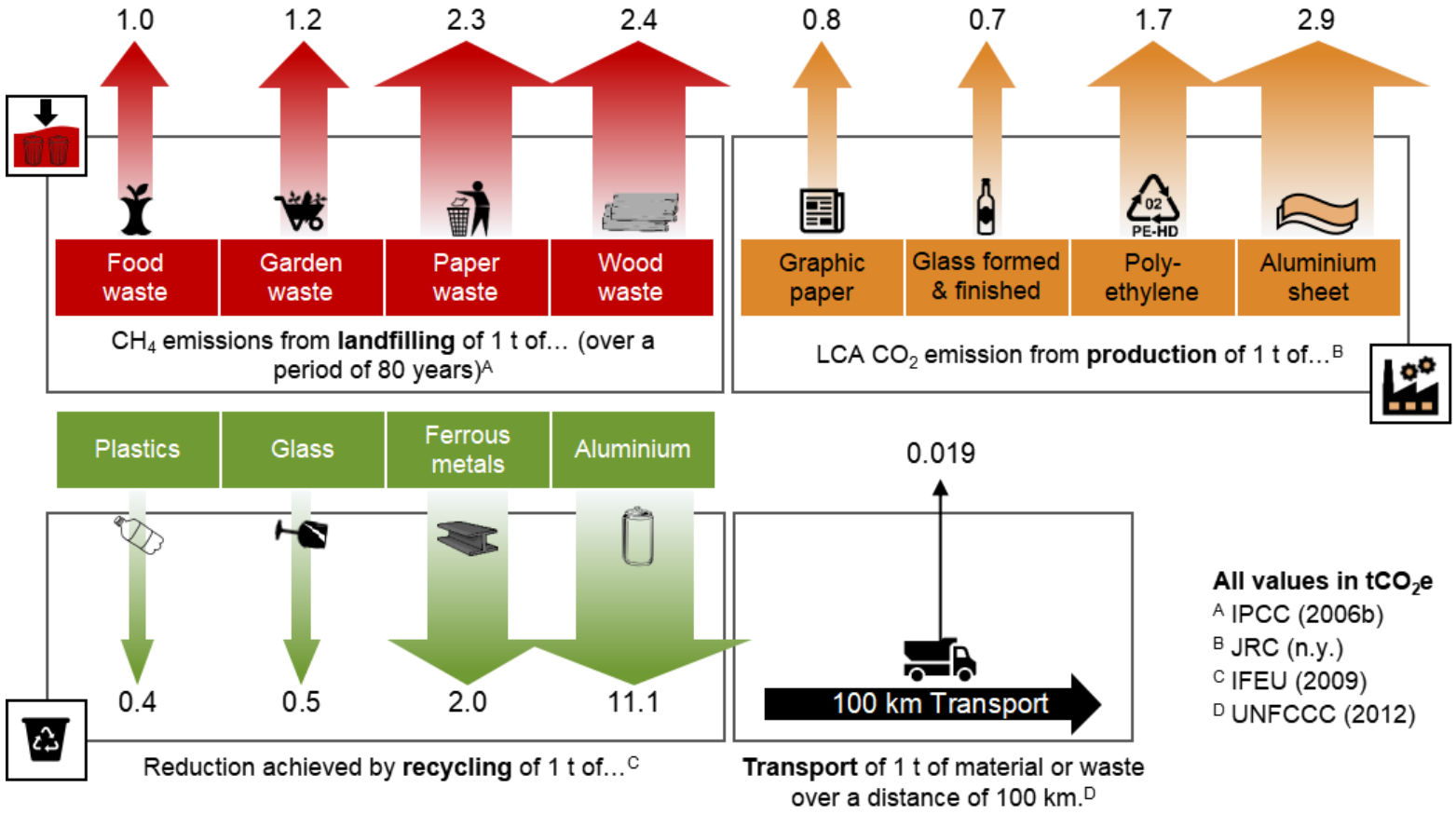
Potential GHG reduction **222** million tons

减排潜力2.22亿吨

Source: the China municipal waste industry development report

中国生活垃圾处理行业发展报告

Emissions from different material
不同物质碳排放数据



Source: Own elaboration / GIZ.

Data of recycling resource
再生资源回收数据

序号No.	名　称 Name	单位 Unit	2015年	2016年	同比增长%
1	废钢铁waste steel	万吨	14380	15130	5.2
2	废有色金属 waste nonferrous metal	万吨	876	937	7.0
3	废塑料 waste plastics	万吨	1800	1878	4.3
4	废纸 waste paper	万吨	4832	4963	2.7
5	废旧纺织品 waste textiles	万吨	260	270	3.8
6	废玻璃 waste glass	万吨	850	860	1.2
注：本表未包含废轮胎、废弃电子产品、报废汽车及废电池等数据。					

Source: The report of recycling resource industry development in China 2017(summary)

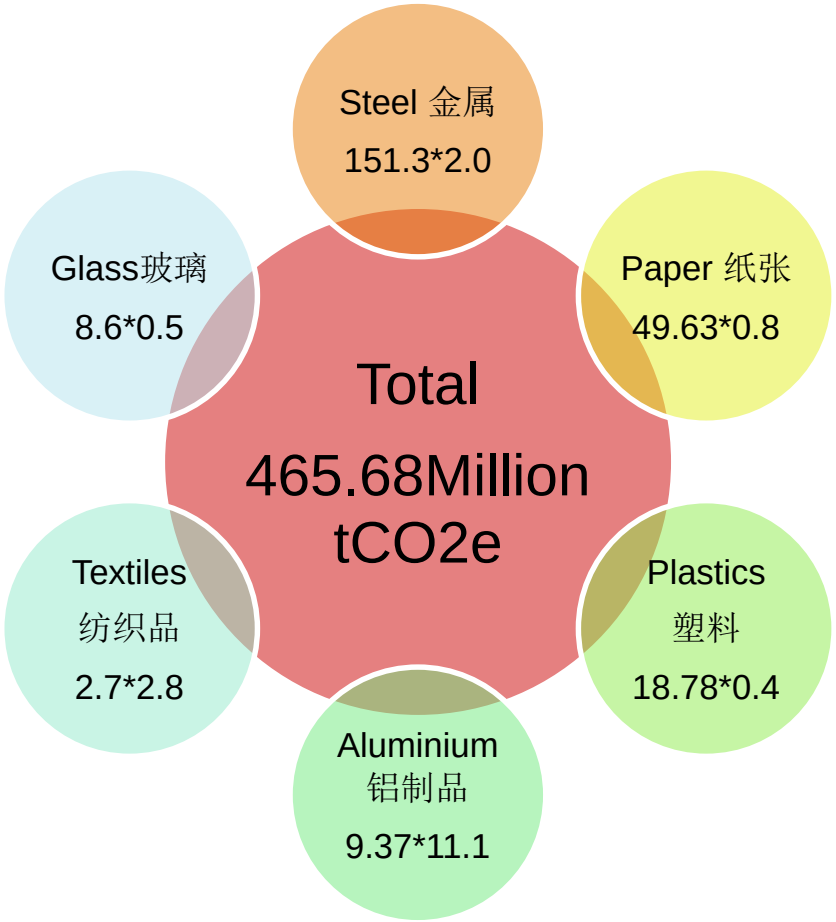
Emission factors for recycling

	Rounded values according to (Prognos, IFEU, INFU 2008); metals estimation IFEU							
kg CO2-eq/t waste	Organic waste	Organic waste	Paper	Glass	Metals (steel)	Aluminium	Plastics	Textiles
	Digestion	Composting	Deincing	Melting	IFEU estimate	IFEU estimate		
Emissions	57	87	180	20	22	700	1023	32
Avoided emissions	160	95	1000	500	2047	11800	1437	2850
Net result	**-103**	**-8**	**-820**	**-480**	**-2025**	**-11100**	**-414**	**-2818**

Credit anaerobic digestion	Average gas yield	100	Nm^3/t biowaste
	Average methane content	60%	Vol%
	Net electric efficiency CHP	30%	%
	Average electricity production	180	kWh/t biowaste

Source: IFEU,2009. Tool for Calculating Greenhouse Gases in Solid Waste Management.

Emissions reduction from waste recycling
垃圾回收减排量



After the calculation the GHG emissions reduction amount is 465.68 Million tCO2e in 2016, and the increaing rate is about 4% per year.
经计算，2016年我国可回收垃圾减排量为4.65亿吨二氧化碳当量，而且该数据增速为每年4%左右。

GHG emission reduction from the solid waste in Germany
德国垃圾领域的温室气体减排

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

GHG emissions from the waste sector
3-5%
德国垃圾行业温室气体排放占比3-5%

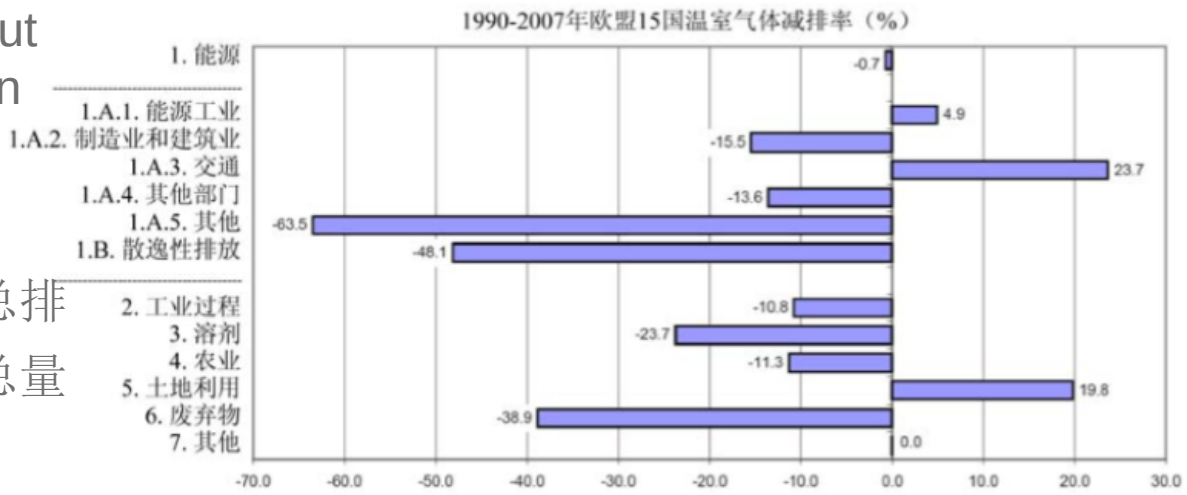
GHG emissions reduction from the waste sector
24%
德国垃圾行业温室气体减排占比24%

- Germany: from (38) to (-18) = (56) million t CO_2 eq, 1990-2006, 24% of total emission

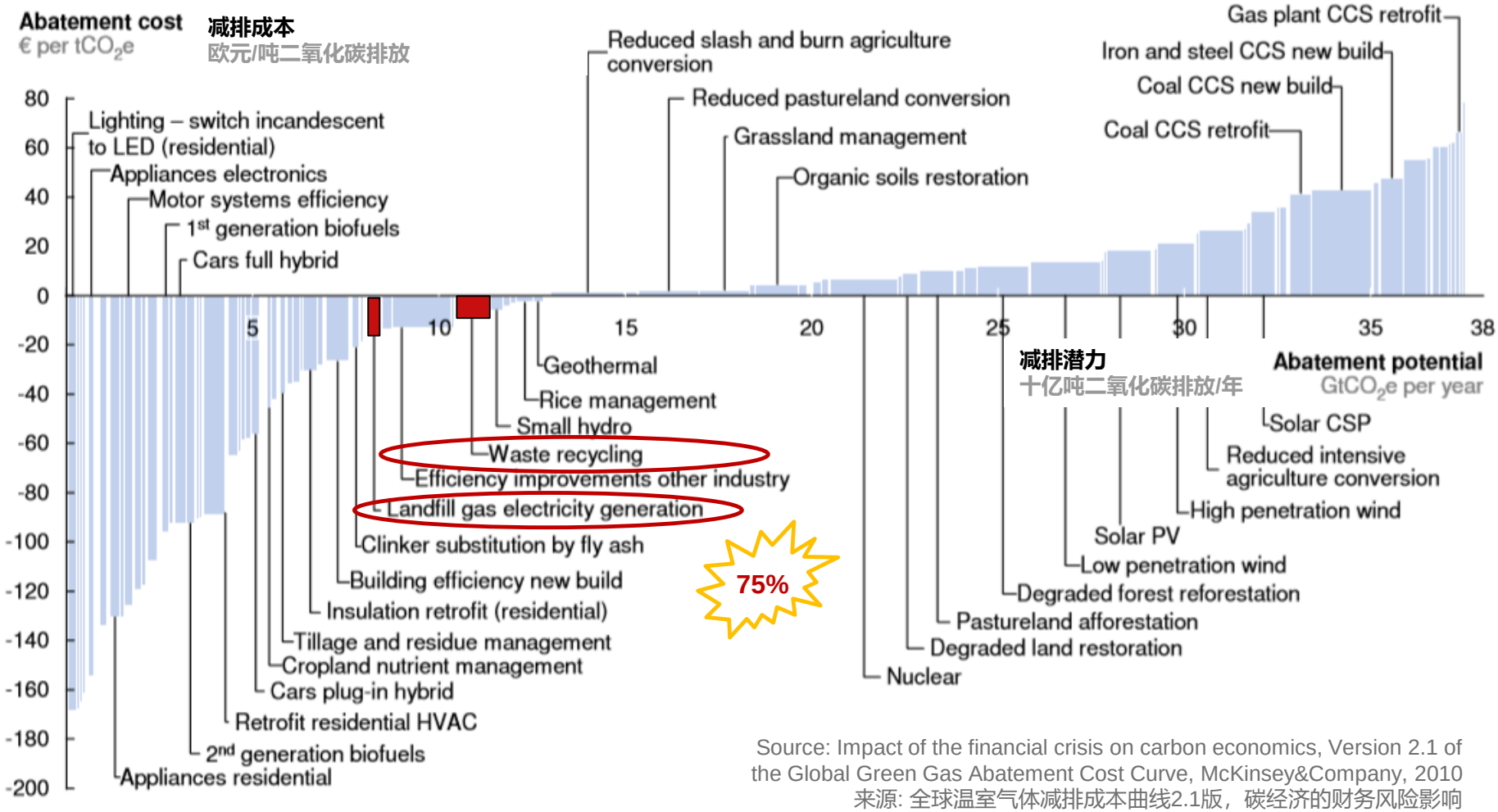
  德国：1990-2006年，从年排放3800万吨变为-1800万吨，实现年减排量5600万吨，占排放总量的24%

GHG emission reduction from the solid waste in Germany
德国垃圾领域的温室气体减排

- EU15: 1990-2007, GHG emissions reduced 4.3%,
- 1990-2007 年，欧盟15 国的温室气体减排总量下降了4.3%
- Mainly because of reduced methane emissions from the solid waste sector of in total 66.5 Mt CO_2 eq (-38.9%).
- 主要源于垃圾行业甲烷排放持续稳定减少，减排38.9 %，共计6650万吨。
- GHG emissions from the waste sector was 2.76% in 2007, but the GHG emissions reduction from the waste sector was 29.7%.
- 虽然废弃物领域仅占2007年总排放量的2.76%， 但是其减排总量却别占到同年度减排总量的29.7%



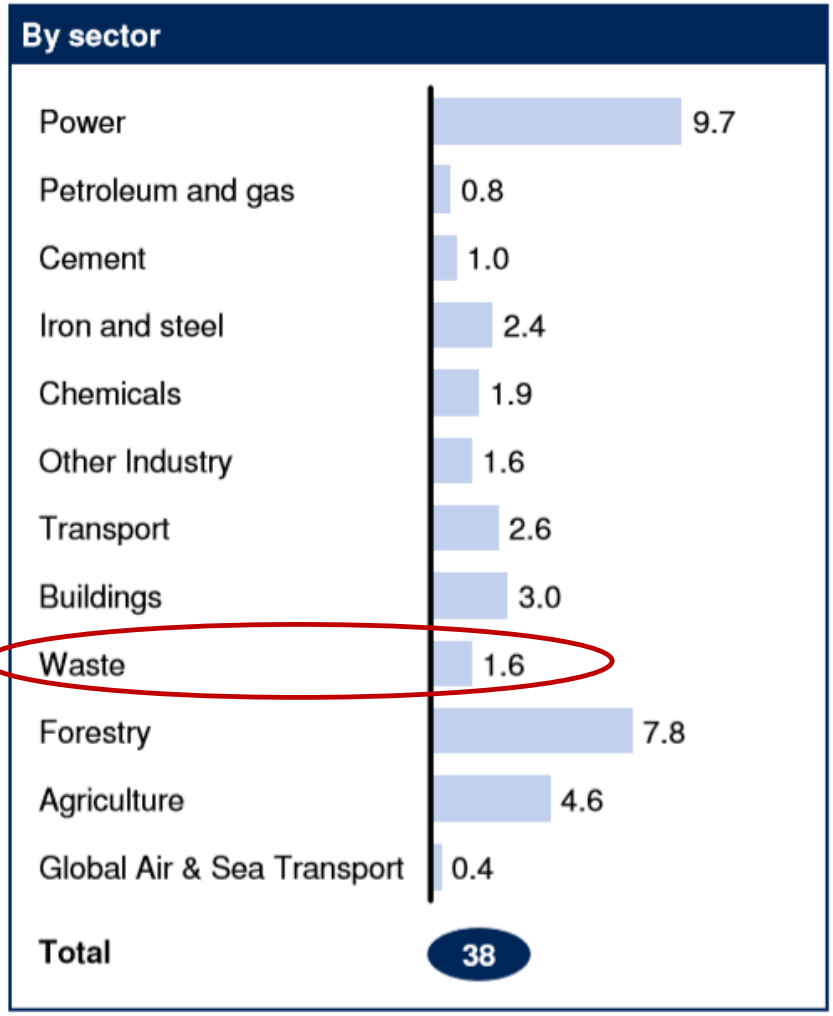
Global GHG Abatement Cost Curve beyond BAU - 2030
2030全球减排成本曲线



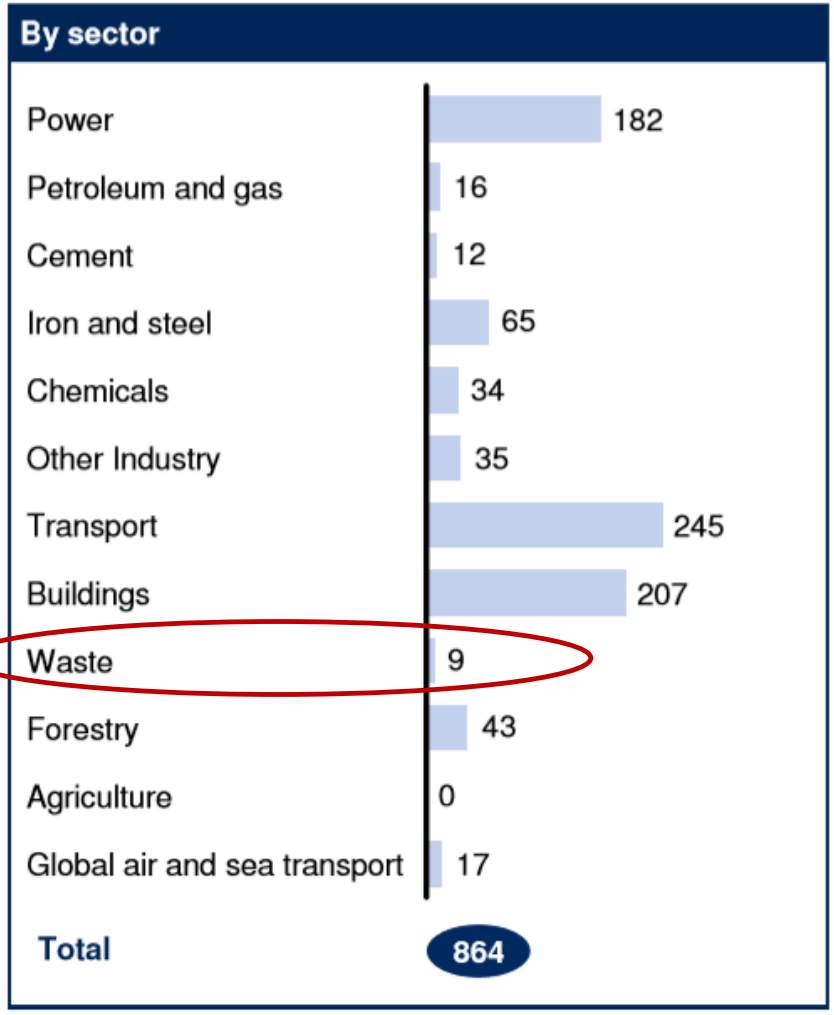
Source: Impact of the financial crisis on carbon economics, Version 2.1 of the Global Green Gas Abatement Cost Curve, McKinsey&Company, 2010
来源: 全球温室气体减排成本曲线2.1版，碳经济的财务风险影响 麦肯锡, 2010

Abatement potential by sector & Investment requirements to achieve 2030
行业减排潜力以及投资需求2030

GtCO$_2$e per year 十亿吨二氧化碳当量/年



€ billion per year, in addition to current projected BAU investments
十亿欧元/年，额外于目前已经规划的BAU投资额



Source: Impact of the financial crisis on carbon economics, Version 2.1 of the Global Green Gas Abatement Cost Curve, McKinsey&Company, 2010

Capital intensity and abatement cost
资本密度以及减排成本

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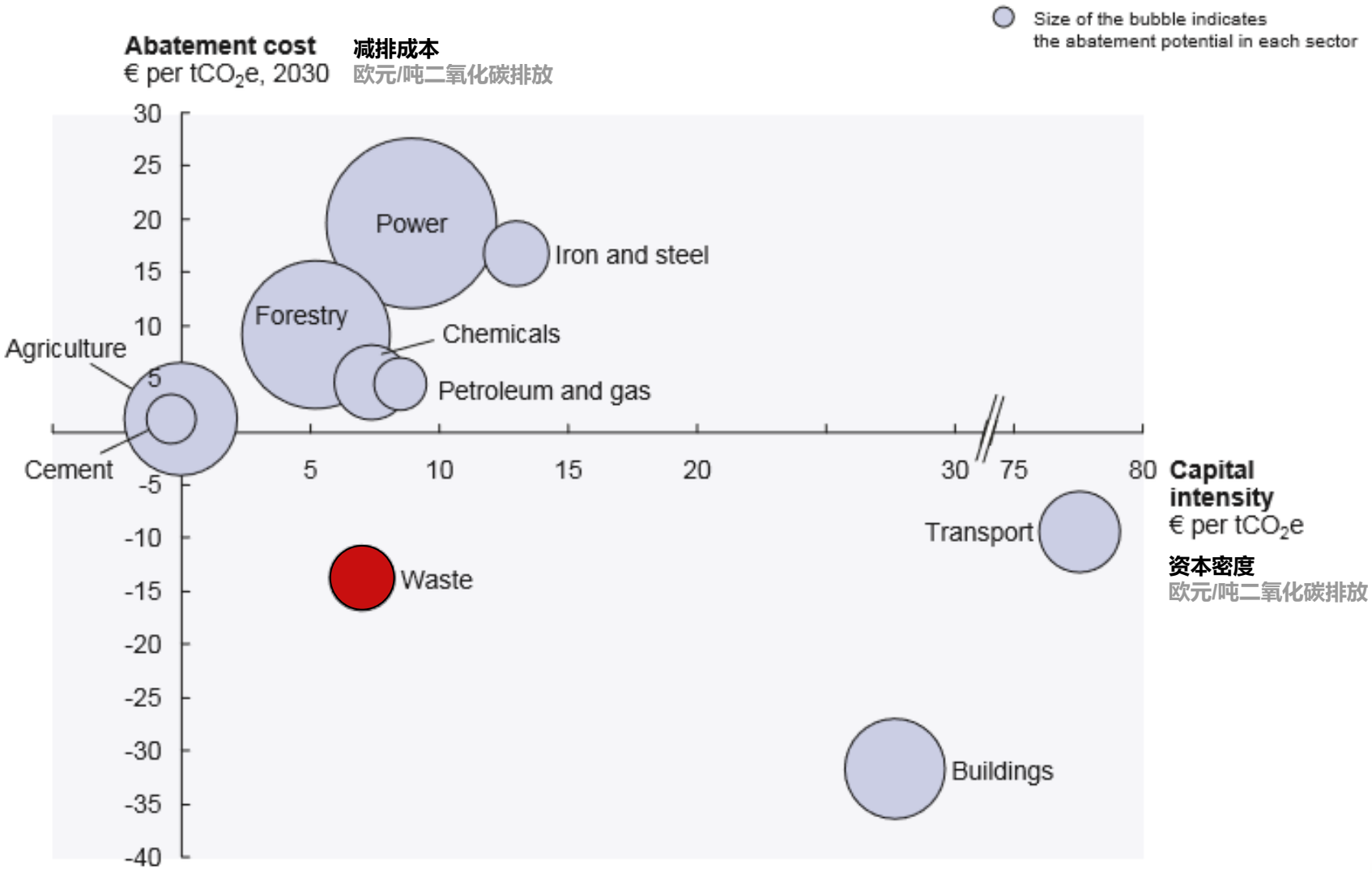


NAMA Support Project – IWM NAMA
IWM NAMA 项目介绍

Nationally Appropriate Mitigation Actions (NAMAs)
国家适当减缓行动

First defined in COP13 in 2007 as “nationally appropriate mitigation actions **by developing country Parties** in the context of sustainable development, **supported and enabled by technology, financing and capacity-building**, in a measurable, reportable and verifiable （MRV）manner” (1/CP.13:1.b.ii)

NAMAs在2007年的COP13中首次被定义为“发展中国家缔约方在可持续发展的背景下，接受资金、技术与能力建设援助，以可测量、可报告、可核查的方式出台的国家适当的减缓行动”。（1/CP.13:1.b.ii)

China‘s Nationally Appropriate Mitigation Actions (NAMAs)
中国的国家适当减缓行动

中国国家发展和改革委员会应对气候变化司

DEPARTMENT OF CLIMATE CHANGE, NATIONAL DEVELOPMENT & REFORM COMMISSION OF CHINA

No. 38, Yue Tan Nan Jie, Beijing, 100824, China, Tel: +86-10-68505862, Fax: +86-10-68505881

28 January 2010

Executive Secretary
UNFCCC Secretariat
Bonn, Germany
Fax: +49-228-8151997

Dear Mr. Yvo de Boer,

I have the honor to communicate to you the information on China's autonomous domestic mitigation actions as announced, for information to the UNFCCC Parties, as follows:

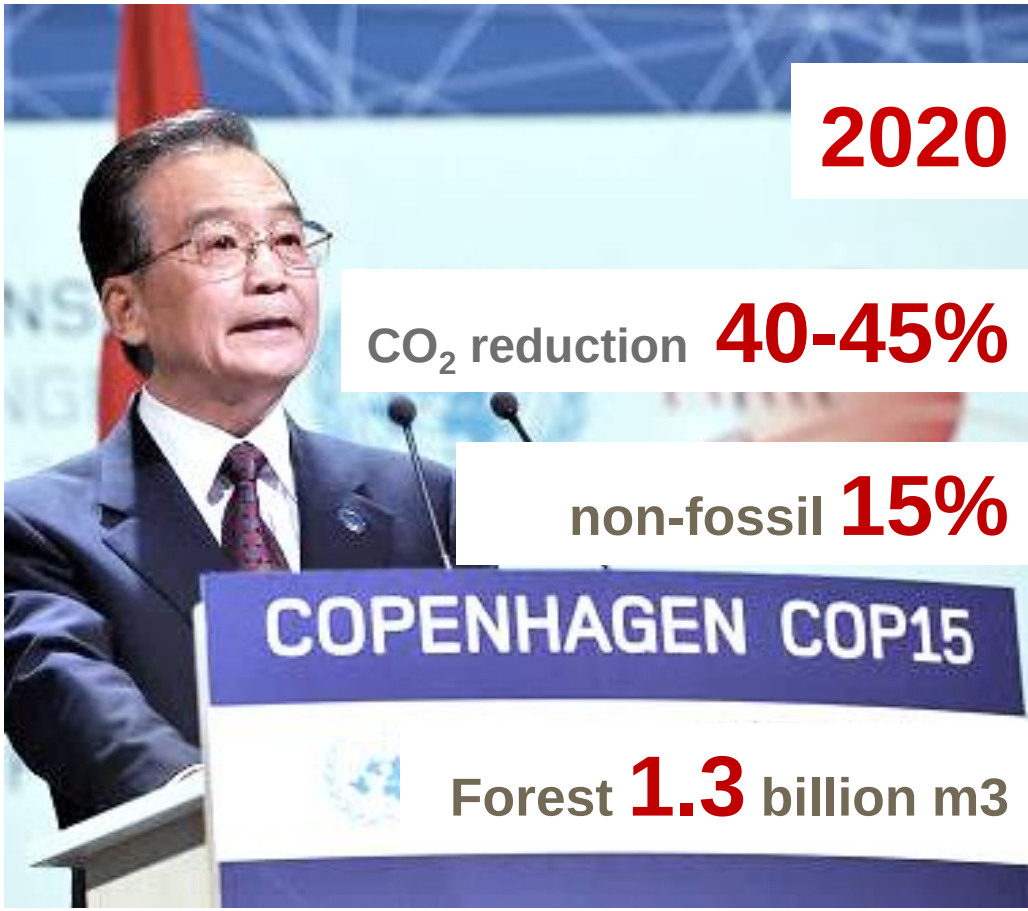
China will endeavor to lower its carbon dioxide emissions per unit of GDP by 40-45% by 2020 compared to the 2005 level, increase the share of non-fossil fuels in primary energy consumption to around 15% by 2020 and increase forest coverage by 40 million hectares and forest stock volume by 1.3 billion cubic meters by 2020 from the 2005 levels.

Please note that the above-mentioned autonomous domestic mitigation actions are voluntary in nature and will be implemented in accordance with the principles and provisions of the UNFCCC, in particular Article 4, paragraph 7.

This Communication is made in accordance with the provisions of Articles 12, paragraph 1(b), Article 12, paragraph 4 and Article 10, paragraph 2(a).

Sincerely yours,

SU Wei
Director-General
Department of Climate Change
National Development and Reform Commission of China
(National Focal Point)



Nationally Determined Contributions (NDCs)
中国国家自主贡献

中华人民共和国国家发展和改革委员会

尊敬的克里斯蒂娜·菲格里斯女士：

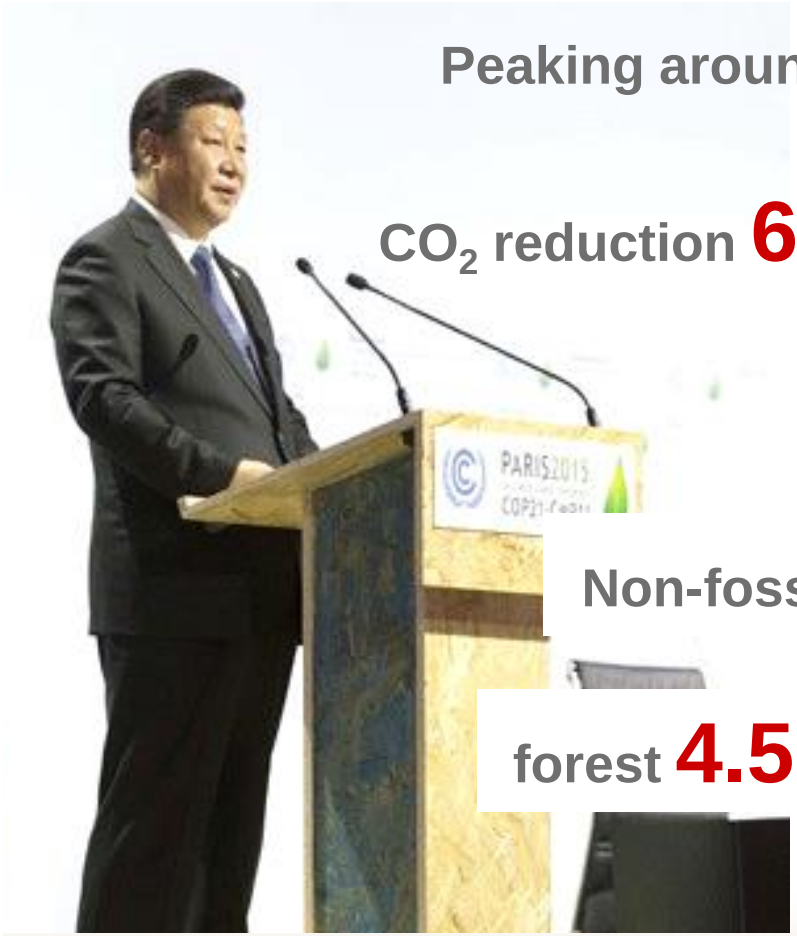
作为联合国气候变化框架公约中方国家联络人，我谨此转交后附《强化应对气候变化行动——中国国家自主贡献》。

顺致最崇高的敬意。

中国国家发展改革委应对气候变化司司长

联合国气候变化框架公约中方国家联络人

2015 年 6 月 30 日于北京



Peaking around **2030**

CO_2 reduction **60-65%**

Non-fossil **20%**

forest **4.5** billion m^3

NAMA Facility
NAMA 基金会

Accelerate low carbon development, shift challenging sectors in a country towards a sustainable, irreversible, low carbon pathway 加速低碳发展，促进行业变革，引领国家迈向可持续的、不可逆转的低碳发展之路

德国
Germany (BMUB) & UK (BEIS)
英国

2013

丹麦
Denmark (EFKM, MFA) & European Commission
欧盟

2015

2.6亿欧元
262 million €
21 projects
21个项目

2017

NAMA Facility

On behalf of
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
Department for Business, Energy & Industrial Strategy
Danish Ministry of Energy, Utilities and Climate

China Integrated Waste Management NAMA - glance

Duration:
- September 2017 – August 2022

Budget:
- 8,000,000 €

Political Partner:
- Ministry of Housing and Urban-Rural Development (MoHURD)

Implementation Partner:
- China Association of Urban Environmental Sanitation (CAUES)

Client:
- NAMA Facility

中国城市生活垃圾领域国家适当减缓行动项目

执行期:
- 2017年9月 –2022年8月

预算:
- 8,000,000 €

政府支持单位:
- 中国住房和城乡建设部

执行合作单位:
- 中国城市环境卫生协会

委托方:
- NAMA基金会

Objective:

The NSP will reduce GHG emissions of China's waste sector and induce a transformational change in the sector which will increase the attractiveness of integrated waste management and waste-to-energy systems as a financially sustainable low-carbon investment field.

Outcome

Public and private up-scaling throughout China's waste management sector is triggered by replicable flagship cases of integrated waste management systems and waste-to-energy technologies according to BAT and BEP that have been proven to operate in a financially sustainable way in at least three demonstration municipalities.

Components:

- **PC 1:** TA to the Demonstration Municipalities
- **PC 2:** Policy Advice
- **PC 3:** Analysis of GHG mitigation effects
- **PC 4:** Capacity Development
- **PC 5:** Private Sector Mobilisation

目标:

通过NAMA项目的执行，减少中国城市生活垃圾行业的温室气体排放；促进中国城市生活垃圾管理行业的变革，建立经济可持续的垃圾低碳综合管理和垃圾能源化利用体系。

成果

通过最佳可行技术（BAT）和最佳环境实践（BEP）的应用，在至少三个示范城市建立财务可持续的垃圾低碳综合管理以及垃圾能源化利用系统，并以此为案例进行复制推广，提升垃圾行业低碳综合管理能力。

构成:

- **构成 1:** 示范城市技术支持
- **构成 2:** 政策建议
- **构成 3:** 温室气体减缓效果分析
- **构成 4:** 能力建设
- **构成 5:** 促进私人部门参与

How to reduce the GHG emissions from solid waste - conclusion
固废领域温室气体减排之道 – 结论

- Waste prevention and reuse – awareness raising 垃圾减量与再利用 - 提升意识
- Waste recycling - combination between informal or formal sector 垃圾回收，官方&非官方
- Increase the utilization of landfill gas – from 20% to 70% 加大填埋气利用率 – 20%到70%
- Optimize the waste collection and transportation

  优化垃圾收运
- Promote the utilization of green waste to organic fertilizer

  推动绿化垃圾生产有机肥
- Waste segregation – biological way, not only incineration

  垃圾分类，促进易腐垃圾处理，避免粗暴焚烧

integrated waste management
垃圾综合管理

low-carbon development
低碳发展

Thank you for your attention !

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项目主任 Project Director

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Integrated Waste Management
NAMA Project