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重塑发展指标，迈向可持续未来
Change the way we count to reach a sustainable future

中德清洁空气对话论坛：挑战、机遇与解决方案
Sino-German Dialogue Forum on Clean Air: Challenges, Opportunities and Solutions
北京 Beijing |2016/09/19

Lailai Li China Country Director
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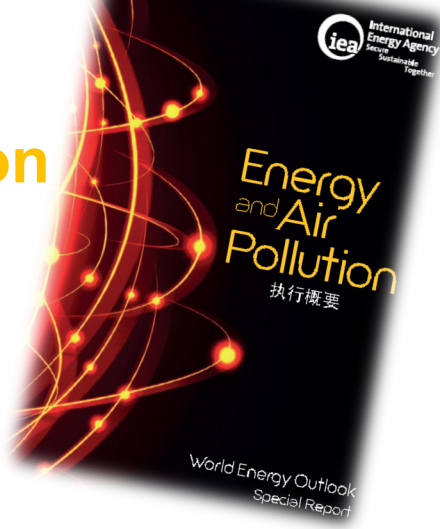
《世界能源展望》特别报告 – 能源与空气污染
WEO Special Report – energy and air pollution



空气污染是主要的公共健康危机之一

Air pollution is a major public health crisis

- 全球空气污染每年致使约**650万**人过早死亡

Globally ~**6.5 million** premature deaths each year are attributed to air pollution

- 是全人类健康面临的**第四**大风险，仅次于高血压、膳食风险和吸烟

the fourth greatest overall risk factor for human health worldwide, after high blood pressure, dietary risks and smoking.

- 如果不采取有效行动，由于空气污染致使的过早死亡人数将从当前的300万上升至2040年的450万人

Premature deaths attributable to outdoor air pollution will easily increase to **4.5 million in 2040** from around 3 million today if no action is taken forcefully.

《巴黎协定》挑战现状
Paris Agreement challenges status quo

把全球平均气温升幅控制在工业化前水平以上低于2°C之内，并努力将气温升幅限制在工业化前水平以上1.5°C之内 （巴黎协定）

Holding the increase in the global average temperature to below 2 ° C and pursuing efforts to limit the temperature increase to 1.5 ° C (Paris Agreement)

- 如果将1870年后全球二氧化碳累计量控制在1000GtC中，全球有**高于66%**的机会将温升控制在2度之内（政府间气候变化专门委员会《第五次评估报告》）

There is **>66%** of opportunity to achieve the goal of “2 degree” if cumulative total anthropogenic CO_2 from 1870 is controlled within 1000 GtC（IPCC AR5)

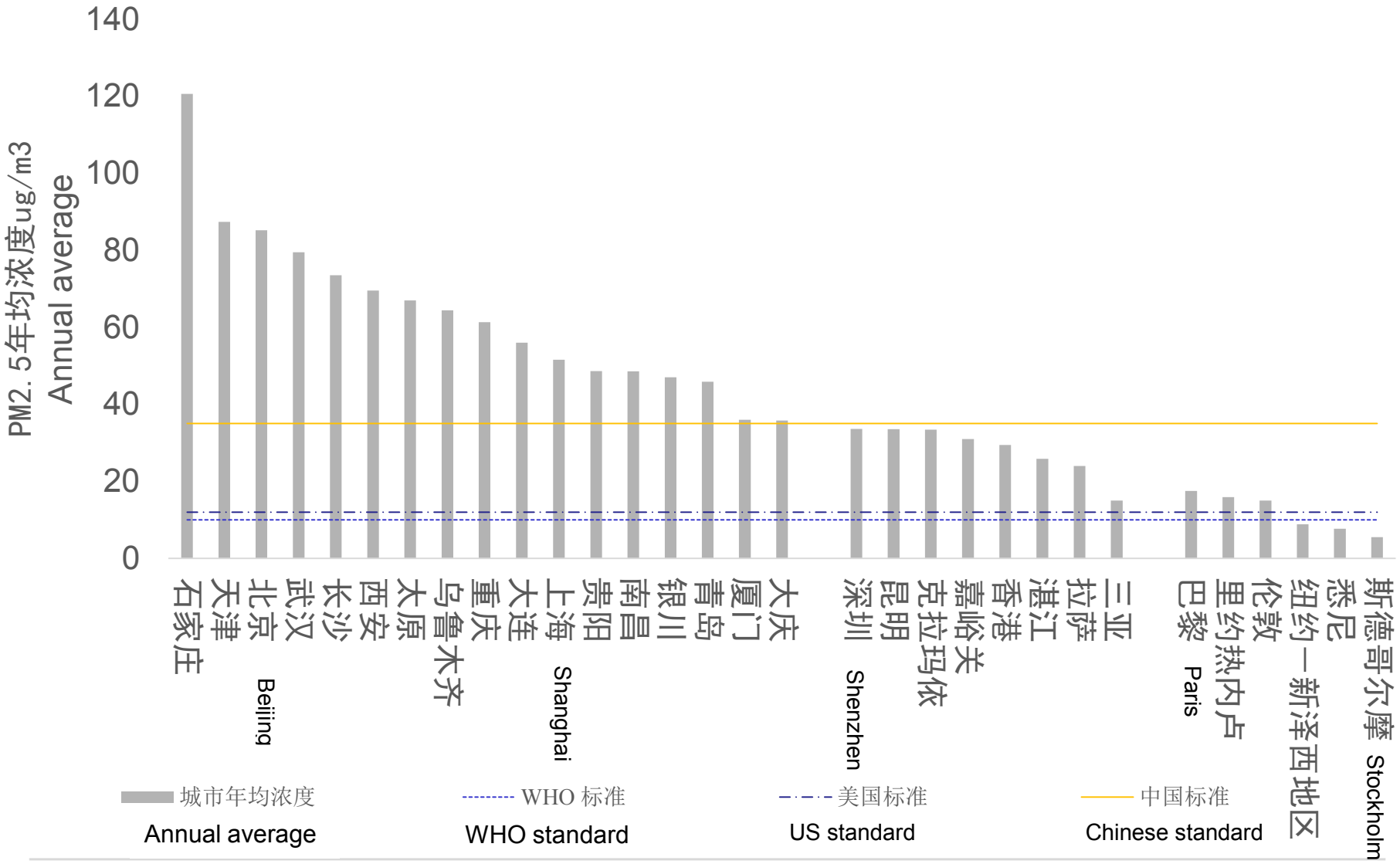
- 到2011年，全球累计排放已达**515**[445～585] GtC

By 2011, the cumulative anthropogenic emission had reached **515** [445～585] GtC

- 2009年斯特恩提出过全球温升2.5度情景：到2050年全球人均排放降低到2吨；而2014年世界人均排放为5.7吨，中国大约7吨。挑战严峻。

In the 2.5 degree scenario, emission has to be cut to 2tC per capita by 2050 (Stern 2009), while in 2014 the world average is 5.7 tC and China ~7tC

2014年PM2.5 排放水平和标准
2014 PM2.5 annual emission levels and standards



来源 Source : WHO, US EPA, MEP of GoC and GB3095-2012

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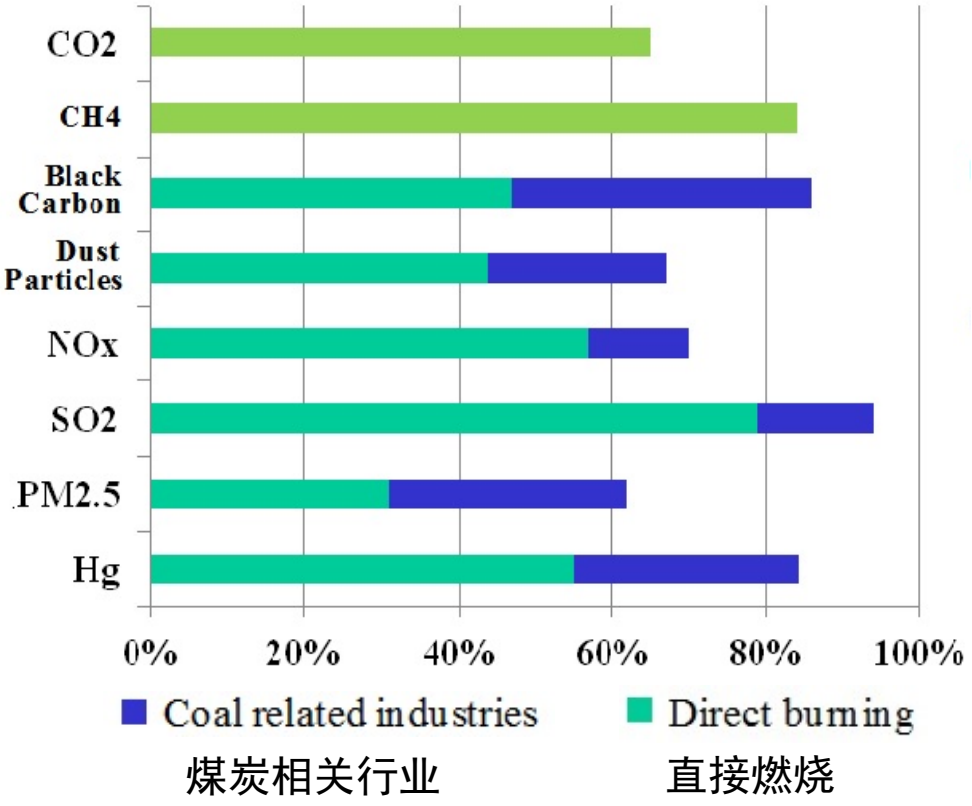
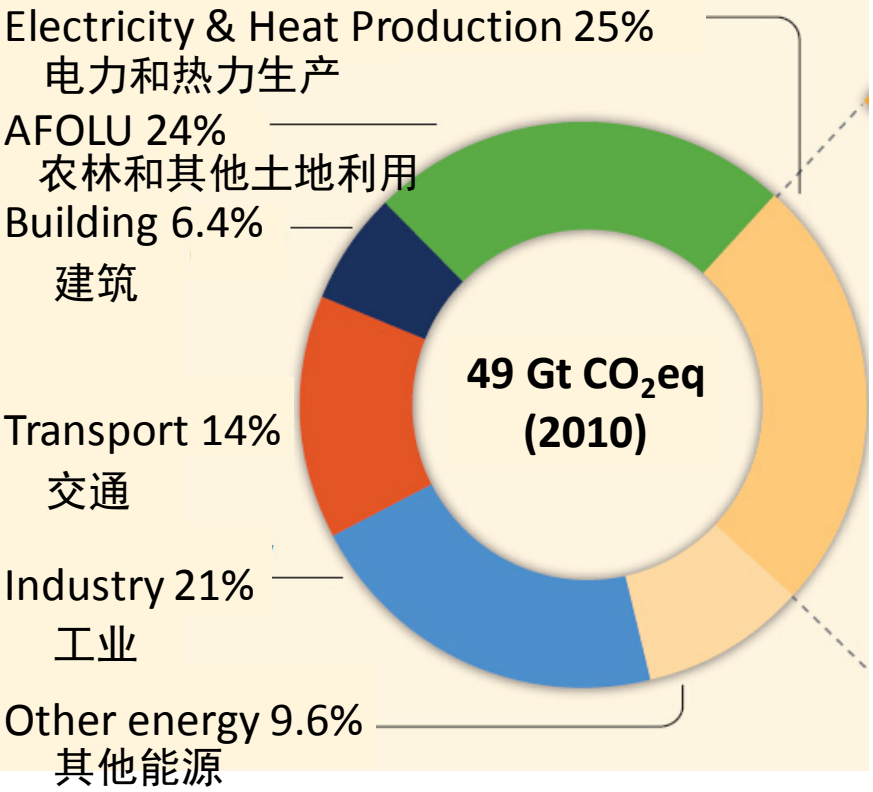
化石燃料 – 空气污染和气候变化最主要和共同的来源
Fossil fuel – a common, dominating source of air pollution and climate change

Source of air pollution:



Source of anthropogenic CO_2:



来源 Source: Yang F. 2016 / IPCC AR5，WG3), 2014

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重塑能源结构，最大的协同效应
Reshaping energy, the biggest co-benefits

已知 Known:

- 空气治理行动同时可贡献于二氧化碳碳排放的**提前达峰**

The clean air actions also provide for an **early peaking** in carbon dioxide emissions

- 聚焦能源行业：**替代化石燃料**和**提高能效**可以同时打赢两场战役 The energy sector is center of the focus: **replacing fossil fuels** and **improving energy efficiency** win the battle of both

- 聚焦城市：承载超过全球**50%**的人口，创造约**80%**的经济，消耗超过**2/3** 的化石燃料，排放约**70%**的C02

The city is the center of the “battle”, concentrating more than **50%** of people and **~80%** of economy, consuming over **2/3** of the fossil fuels, and emitting **70%** CO_2

- 治理空气的各项技术成熟，且尚未充分投入使用

Technologies to tackle air pollution are well known but not well deployed;

结论：

问题远未解决。

Conclusion：

the problem is far from solved.

我们的经济就像这艘远扬巨轮。
经济不转型，目的地不会改变。
我们如何转型？

Our economy is like this oceangoing Knock Nevis, moving toward a destiny. Unless it turns, destination won't change. **How do we make it turn?**

投资何处？一个经典的现代城市案例
Where to Invest？ – a case of a typical modern city

- 丰富的自然资本 Rich natural capitals
  - 数亿年地质变化的独特的丹霞地貌
  Unique landscapes reflecting the geological volatility of hundreds of millions years;
  - 茂密的森林及丰富且脆弱的生物多样性，蕴藏着大熊猫栖息地
  Vulnerable biodiversity in thick forests resided by giant panda
  - 拥有世界上还在运行良好的最古老水利设施
  The oldest water conservancy the world still operating well

- 一个现代娱乐城
  A “modern” entertaining empire, featured by
  - 室内滑雪、避暑地
  Indoor ski/summer resorts
  - 奢侈品消费商场
  Luxurious shopping malls
  - 游乐园
  Amusement park
  - 六星级酒店 6-star hotels
  - 高档住宅 Luxurious real estate

取决于衡量成功的指标如何设置
Depending on indicators set to measure success

- GDP长久以来一直是衡量发展水平或成功发展的指标

GDP has long been made to indicates the development or success of the development：

GDP = C 居民消费 total consumer spending
+ I 投资 total investment by businesses
+ G 政府消费 total government spending
+ (Ex - Im) 货物和服务的净出口 net export

就业和环境如何体现？

Where is employment or environment –imbedded somewhere?

- 如果GDP可以用来衡量成功，那么投资就会导向“现代”娱乐城，经济巨轮便面临着被“气候变化”和“污染”淹没的风险。

If GDP is to measure the success, then the investment is oriented to the “modern” entertaining empire, likely risking we reach the destination.

改变增长方式，实现可持续未来
Change the way we count to reach the sustainable future

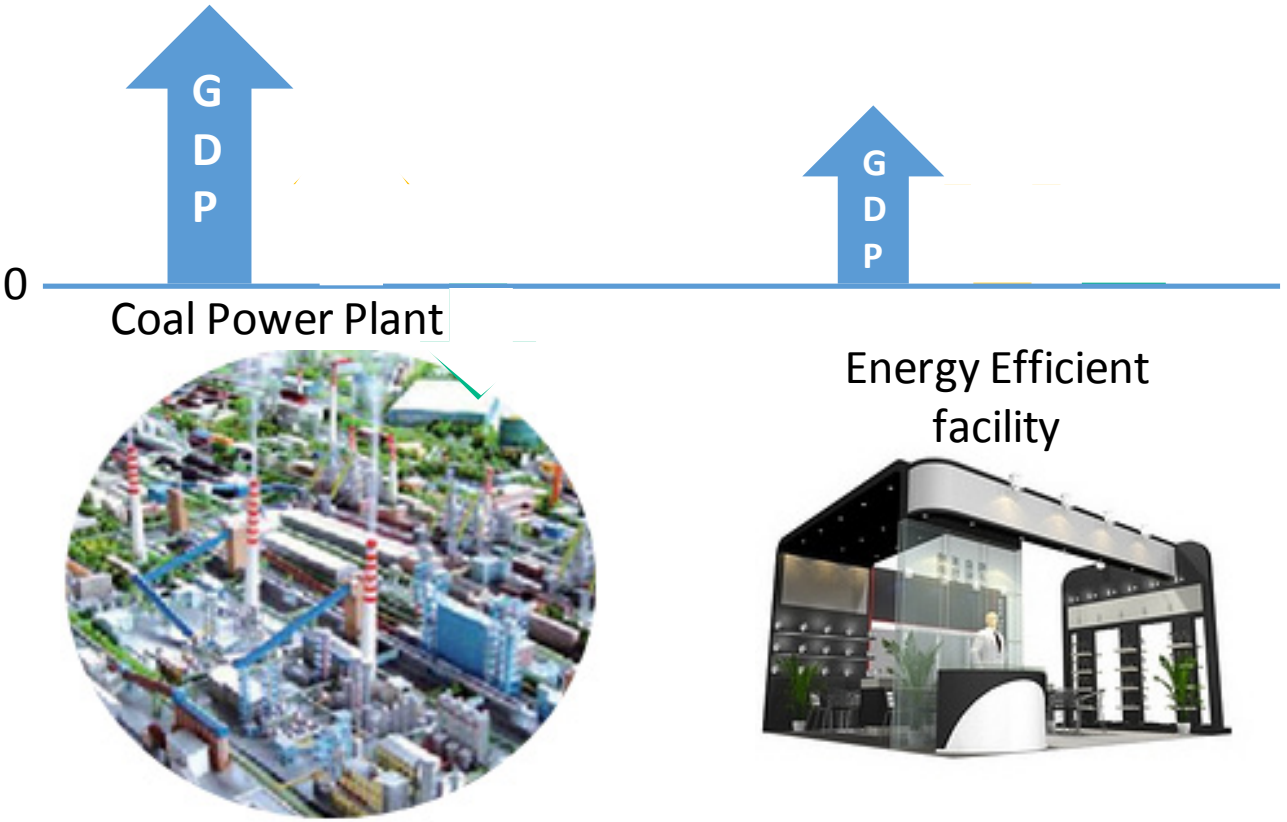
- 一项基本任务是重新评估我们用习惯了的发展指标

A primary task is to review the indicators used to measure the development.

- 指标位于决策的核心，因为它反映了目标的价值取向（例如：发展究竟是为了GDP 还是创造就业？）

Indicators sit in the center of decision as it reflects the value of the goal achievement (e.g. GDP or employment)

指标位于决策的核心，影投资决策
Indicators sit in the center of decision where to invest



低碳经济需要一些对GDP贡献不显著但对可持续发展意义深远的东西
A low carbon economy requires something that contribute little to GDP but more to sustainability

- 强化人力资本 Enhanced human capital able to
  - 合理计划以减少不必要的消费

  Plan properly to reduce the unnecessary consumption
  - 实现科技创新，提高效率，以满足多样且多变的需求，同时避免锁定效益和产能过剩

  Make technological innovations to improve efficiency to meet diversified and fast changing needs while avoiding the lock-in effects or overcapacity
- 可再生能源科技，利用无尽的太阳和风能代替化石能源生产

Renewable energy technologies that replace fossil fuel production with infinite sunlight & wind

- 提高管理效率，从而提高服务质量，同时降低资源消耗

Improved management efficiency that reduces consumption of materials for better quality of services

不以GDP为驱动力经济模式

最佳实践 1：

Encouraging best practice in
non-GDP driven economy

实现清洁能源和农业现代化双重效益
Economics of clean energy and agriculture

青岛光伏农业
Solar agriculture in Qingdao

- 光照 Sunshine: 2200~3000 hours/year

- 光伏大棚：屋顶铺设面积为26公顷，覆盖66公顷耕地，由1000位当地农民管理

Solar panel roofed greenhouse: 26 hectares to cover 66 hectares of land managed by ~ 1000 local farmers

- 高附加值农业产品：茶叶、菌类、蔬菜、花卉和苗木

High value agricultural products: tea, mushroom, vegetables, flowers and tree seedlings, etc.

收益与优势
Benefits and advantages

- 农民收入：提高30%

Farmers' income: 30% higher

- 改善农业管理：不仅提高产量，还保育土壤肥力

Refined agriculture management not only improve the yields but also the fertility of soil.

- 发现了稀缺土地资源的多种用途
  Multiple use of scarce land resource

- 用户使用了清洁能源并减少了电费
  Access to clean energy and lower electricity bills for end users

200万瓦光伏大棚的经济账
Benefits and advantages

占地面积 Land area	67 hectare	装机量 Installed capacity	20 MW
总投资 Total investment	￥301.55 million	年发电量 Annual electricity	21 million kWh
年营业额 Annual sales	￥76.13 million	总成本 Total cost	￥49.18 million
毛利 Gross profit	￥22.3 million	净利润 Net profit	￥20.11 million
投资收益率 Total investment yield	7.4%	内部收益率Internal rate of return	10.5%
偿还期 Payback period	7.2 year	创造就业 Job created	800

节能与二氧化碳减排
Energy saving & CO_2 reduction

装机量 Installed capacity	20MW
年发电量 Annual power generation	21 million kWh
年均替代化石燃料 Avoidance of fossil fuel/year	6430 tsce
年均减少二氧化碳排放 CO_2 reduced/year	18,400 t

推广潜力
Potential for scaling up

- 中国有1350万公顷耕地，包括200万公顷温室大棚，主要集中在东部和中部

China has a total 135 million hectares of farmland, including 2 million hectares greenhouse hectares greenhouse mostly located in the east and central China.

- 18个推广项目，总覆盖3300公顷的项目已规划，预计装机容量为800MW

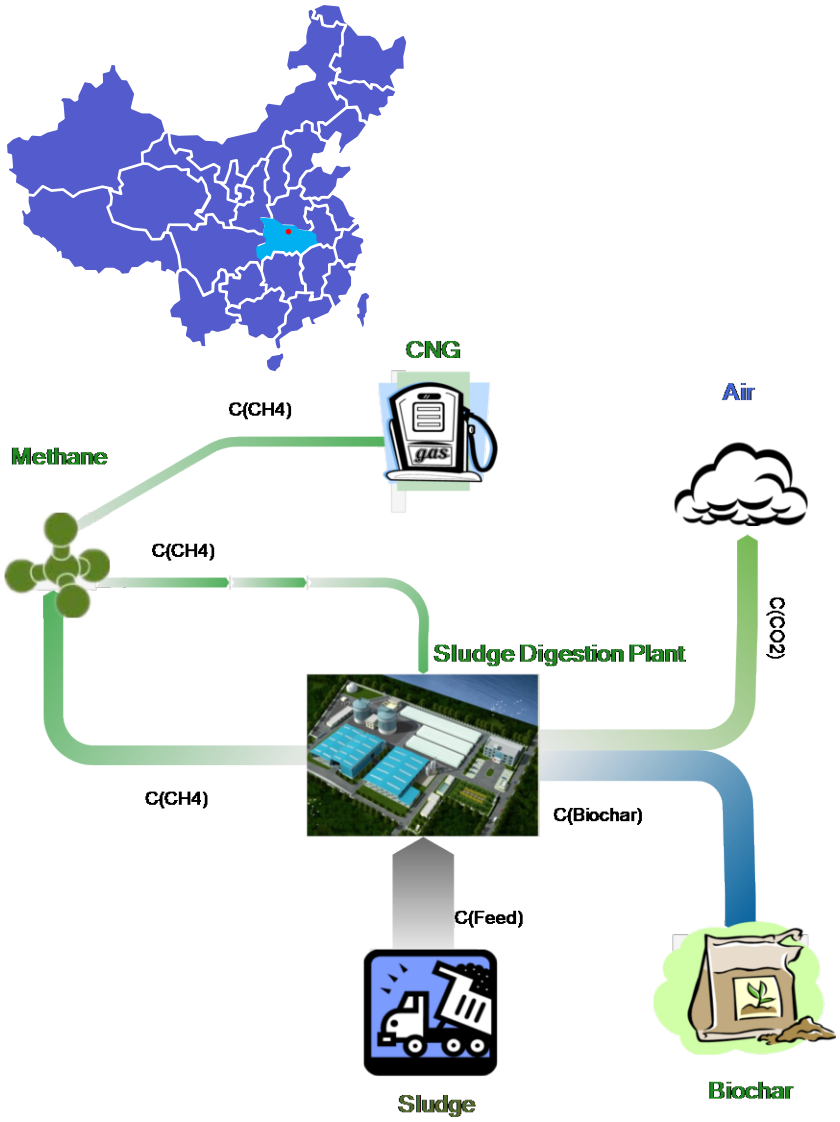
18 projects of such of 3300 hectare are being planned, with a total installed capacity of 800MW

最佳实践2
Encouraging best practice

转废为能 – 循环经济模式
Wastes to energy -- a model of circular economy

创新的污泥处置管理：湖北襄阳

Innovative sludge management: A good practice in Xiangyang Hubei Province



处理规模：300吨/日 （污泥和餐厨垃圾）

Capacity: 300 tons/day (sludge and kitchen waste co-digestion)

处理技术：高温热水解+ 中温厌氧消化

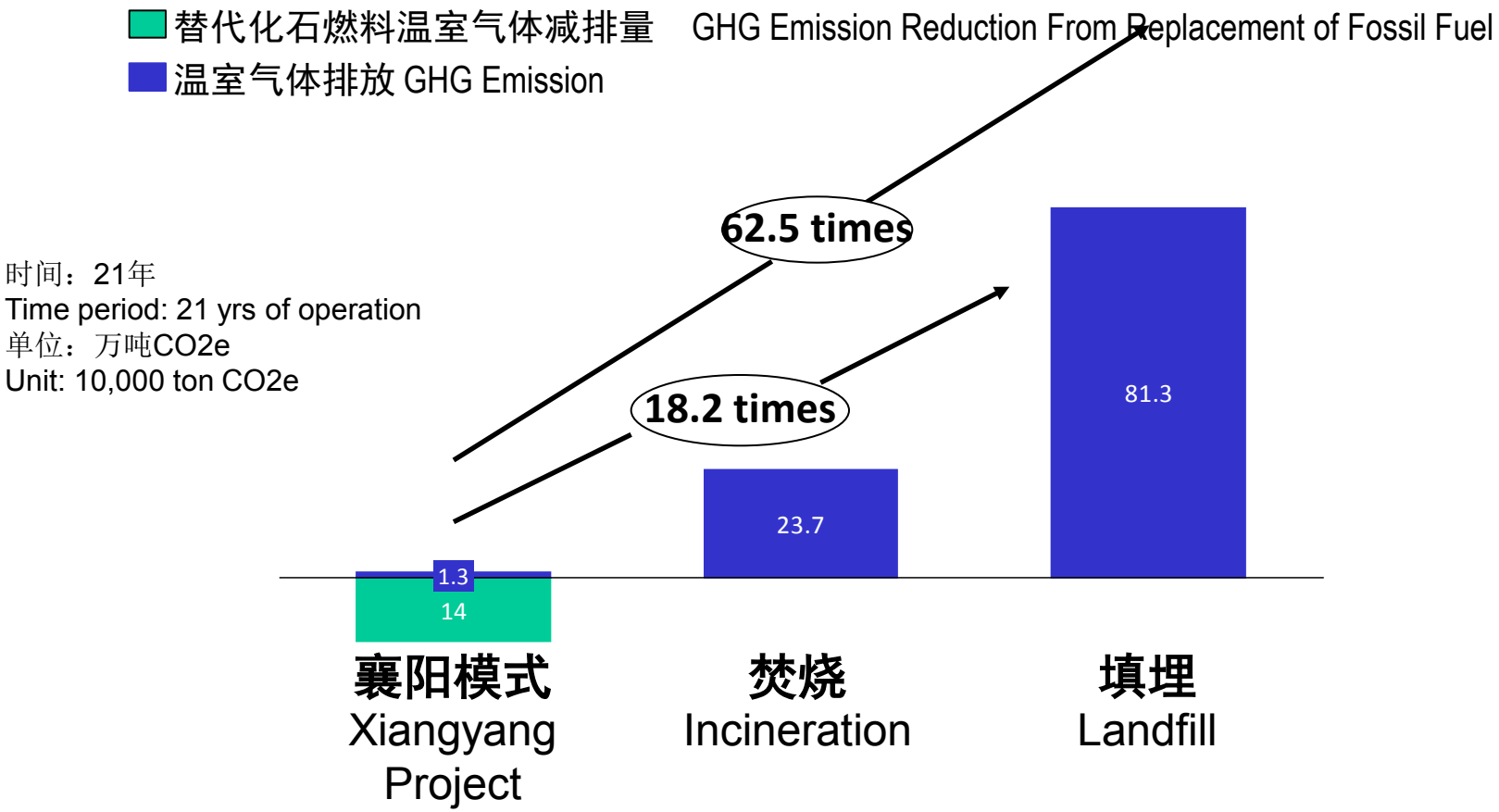
Method: thermal hydrolysis + anaerobic digestion

产品：车用压缩天然气（6000立方米/日，生物炭土（55-60 吨/ 日）

Product: CNG (6000m3/day), biochar (55-60 tons/day) for seedling cultivation

来源 Source: WRI

温室气体排放比较：襄阳项目、焚烧和填埋
Comparison on GHG Emission of Xiangyang Project, Incineration, and Landfill



推广
scaling up

更多城市在安装和计划建设类似的污泥能源化项目

More cities are installing or planning to construct the similar sludge-to-energy system

北京 Beijing

合肥 Hefei

长沙 Changsha

成都 Chengdu

每日5, 500 吨污泥/餐厨垃圾处理 = 每年减少706, 000吨CO_2e

5,500 tons sludge/kitchen waste treatment capacity per day = 706,000 tons CO_2e reduction per year

转废为能的经济账：年收支
Annual economy of wastes to energy project

生物炭土用于苗木种植

The biochar is used to grow tree seedlings

收入 Revenue (10,000 RMB)		成本 Cost (10,000 RMB)	
污泥处理补贴 Sludge Treatment Subsidy	1, 829	污泥处理成本 Sludge Treatment Cost	1, 584
餐厨垃圾处理补贴 Kitchen Waste Treatment Subsidy	259	餐厨垃圾处理成本 Kitchen Waste Treatment Cost	270
CNG 营收 Sales Revenue	972	税 Taxes	90
生物炭土营收 Biochar Sales Revenue	1, 300	财务费用 Financial Expense	245
苗木营收 Sales of tree seedlings	(tbd)	非直接指出 Indirect Expense	850
总计 Total	4, 360	总计 Total	3, 039

Note: Additional values include carbon captured and 120 jobs.

最佳实践3：
Encouraging best practice 3：

投资改善空气和温室气体减排的公共服务
Invest in improving public service to mitigate air pollution and GHG emission

将投资导向公交，有效减少污染和碳排放
Divert investment to public transport reduce pollution & CO_2 effectively

交通方式 Transport measure	温室气体减排 GHG reduction (%)	成本/ 吨CO_2 Cost per tCO_2 (US$)
快速公交分担率由0–5% BRT mode share increases from 0-5%	3.9	66
快速公交分担率由0–10% BRT mode share increases from 0-10%	8.6	59
步行分担分担率由20–25% Walking share increases from 20-25%	6.9	17
自行车分担率由0–5% Bike share increases from 0-5%	3.9	15
自行车分担率由1–10% Bike mode share increases from 1-10%	8.4	14
综合手段 Package (BRT, pedestrian upgrades, cycleways)	25.1	30

拥堵收费研究
Research on congestion charge

- 伦敦：拥堵收费实施一周年后，拥挤水平**下降30%**；收费时段进入中心区的巴士和长途客车同期**增长20%**。

London: traffic congestion **reduced 30%;** the share of public transit **increased 20%;** Particulate Matter (PM) reduced 2.46%~3.07% within London's low emission zone (WRI, 2016)

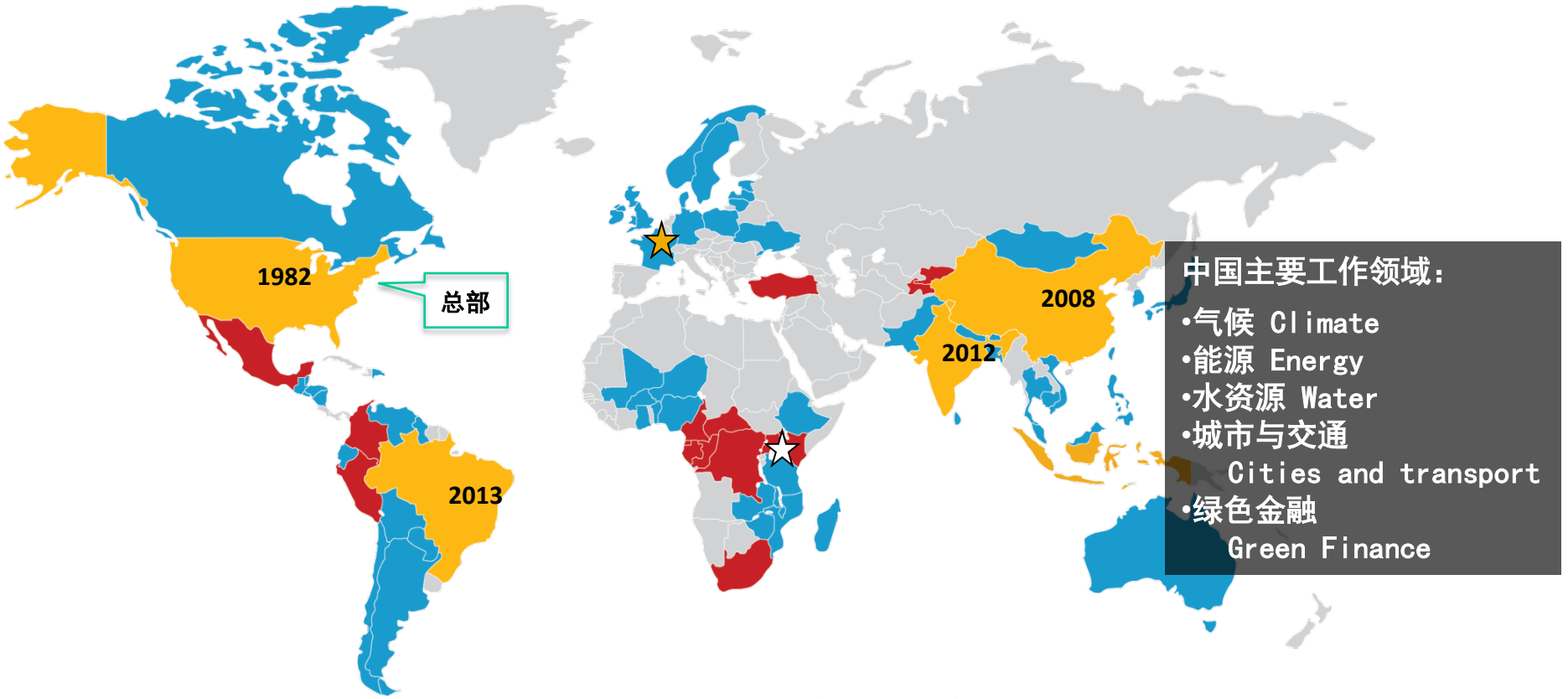
- 斯德哥尔摩：拥堵税使内城中汽车排放物**减少10% ～ 15%**，空气污染物**下降10% ～ 14%**；交通量**下降大约21%**；低排放区：政策实施后的第4 年，全市**PM排放下降了约38%**

Stockholm: pollutants by motor vehicles **reduced 10~15%** while traffic congestion **reduced 21%;** 4 years after the low emission zone implemented PM emission **reduced 38%** (WRI, 2016)

- 北京（估计）：低排放区拥堵收费后和2013比较PM2.5**下降6%**左右，NOx **下降7%**左右

Beijing: it is estimated congestion charge will reduce PM2.5 by **6%** and NOx by **7%**, compared to 2013（WRI 2016）.


JAHRE VIKING



中国主要工作领域：

- 气候 Climate
- 能源 Energy
- 水资源 Water
- 城市与交通
  Cities and transport
- 绿色金融
  Green Finance

常设办公室

项目办公室

已有长期合作

联络处

计划新设办公室

谢谢

Thank you!

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