



Technology Roadmaps

技术路线图

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Energy Technology Transitions in China
中国能源技术变迁
13 June 2009

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Background

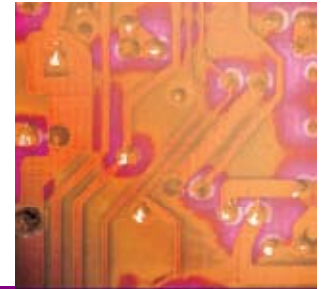
背景

- **Key technologies identified by ETP2008**
ETP2008确定了关键技术
- **Technological development requires co-operation**
技术发展必须有合作
- **Value of roadmaps recognised by MEM / MEF, G8+3 meetings etc**
路线图的重要性被MEM/MEF在G8+3会议证明了
- **IEA asked to play a leading role**
国际能源署作为主导

Roadmaps路线图

17 technology roadmaps provide 87% of CO₂ savings under the Blue scenario (从BLUE情景, 17个路线图可减少87的CO₂的排放。)

- **Potentials**可能性
- **Pathways to commercialization**商业化
- **Technology targets**技术目标
- **How to get there**怎么得到
- **Key actions needed**关键的举动
- **Key areas for international cooperation**关键领域必须有国际合作



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PERSPECTIVES
2008

Scenarios &
Strategies
to 2050

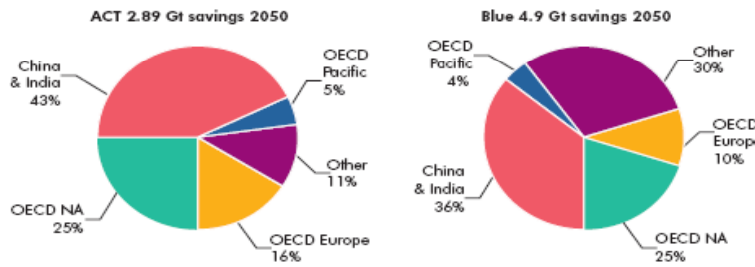
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Roadmaps 路线图 – Example CCS 例如 CCS

10% of CO₂ reduction potential needed for emissions halving

10%的CO₂ 减排潜力需要排放减半

CO₂ Capture and Storage - Fossil-Fuel Power Generation

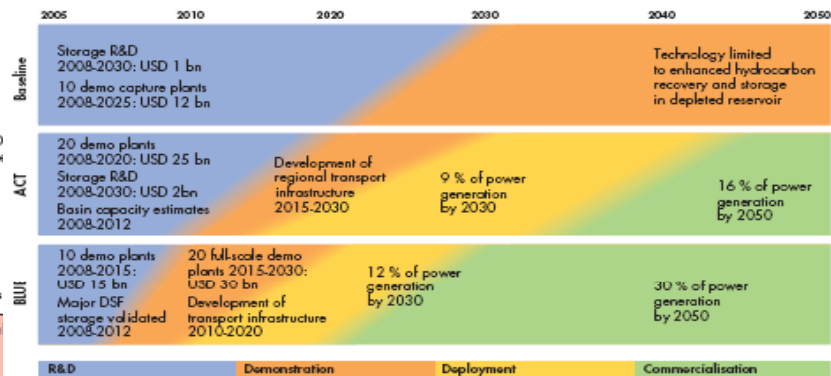


	Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost* USD bn 2030-2050		Global Deployment Share 2030	RDD&D Inv. Cost USD bn 2005-2030	Commercial Inv. Cost* USD bn 2030-2050
OECD NA	35%	25-30	160-180	OECD NA	35%	30-35	350-400
OECD Europe	35%	25-30	100-120	OECD Europe	35%	30-35	150-200
OECD Pacific	10%	7-8	30-40	OECD Pacific	10%	10-12	70-80
China & India	15%	10-12	280-300	China & India	15%	12-14	450-500
Other	5%	3-4	60-70	Other	5%	4-5	300-350

Technology Targets

	ACT: Emissions Stabilisation	BLUE: 50% Emissions reduction
RD&D		
Capture technologies for three main options (post-combustion, pre-combustion, and oxy-fuelling)	Technologies tested in small- and large-scale plants. Cost of CO ₂ avoided around 50 USD/t by 2020. Chemical looping tested	
Demonstration targets	20 large-scale demo plants with a range of CCS options, including fuel type (coal/gas/biomass) by 2020	30 large-scale demo plants with a range of CCS options, including fuel type (coal/gas/biomass) by 2020
New gas-separation technologies: membranes & solid adsorption	New capture concepts: next-generation processes, such as membranes, solid absorbers and new thermal processes	
Technology transfer	Technology transfer to China and India	Technology transfer to all transition and developing countries
Deployment		
Regional pipeline infrastructure for CO ₂ transport	Major transportation pipeline networks developed and CO ₂ maritime shipping	
Deployment targets	Early commercial large-scale plants by 2015 (ZEP, ZeroGen, GreenGen)	30% of electricity generated from CCS power plant

Technology Timeline



Key Actions Needed

- Develop and enable legal and regulatory frameworks for CCS at the national and international levels, including long-term liability regimes and classification of CO₂.
- Incorporate CCS into emission trading schemes and clean development mechanisms.
- RD&D to reduce capture cost and improve overall system efficiencies.
- RD&D for storage integrity and monitoring. Validation of major storage sites. Monitor and valuation methods for site review, injection & closure periods.
- Raise public awareness and education on CCS.
- Assessment of storage capacity using Carbon Sequestration Leadership Forum methodology at the national, basin and field levels.
- New power plants built after 2020 to have CCS.
- New power plants to be "capture-ready" after 2015.

Key Areas for International Collaboration

- Development and sharing of legal and regulatory frameworks.
- Develop international, regional and national instruments for CO₂ pricing, including CDM and ETS.
- Raise public awareness and education.
- Sharing best practices and lessons learnt from demonstration projects (pilot and large-scale).
- Joint funding of large-scale plants in developing countries by multi-lateral lending institutions, industry and governments.
- Development of standards for national and basin storage estimates and their application.
- Organizations: CSLF, IEA GHG, IEA CCC, IPCC.

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IEA Roadmap Definition

国际能源署路线图含义

- **A technology roadmap is a dynamic set of technical, policy, legal, financial, market & organizational requirements** 技术路线图是个动态设置的技术，政策，法律，金融，市场和组织的要求
- **Content will be agreed upon by stakeholders involved** 利益相关者参与将要确定和同意线图的内容
- **It will result in improved and enhanced sharing and collaboration of RDD&D information among participants** 将导致改进和加强交流与合作对于RDD&D信息在参与者之间
- **The goal is to accelerate the overall RDD&D process to allow for earlier market uptake** 目标是加快整体的RDD&D过程为了允许早一点的市场开放



Common Roadmap Elements

路线图的共性内容

- 1. Current status of technology and RDD&D activities**
目前的情况关于技术和RDD&D的活动
- 2. Future technology targets to be achieved and by when**
未来技术目标可不可以达到与在什么时候
- 3. Critical RDD&D activities and milestones needed to meet these targets**
主要的RDD&D活动和里程碑需要为了达到目标
- 4. Barriers to overcome (legal, regulatory, acceptance etc.)**
必须克服的问题（法律， 监管， 接受， 等等）
- 5. Policies required to support development and deployment**
需要的政策为了保持发展和部署
- 6. Identification of roles and responsibilities, including international co-operation**
确定任务和责任， 包括国际合作
- 7. Evaluation criteria for assessing progress**
评价标准为了评估进展



Common Roadmap Boundaries

路线图共同边界

- 1. timelines out to 2050;** 时间表到2050年
- 2. all phases of the RDD&D cycle;** 全部的研发和推广周期
- 3. address technical, legal, policy, regulatory, financial and organizational issues** 议论技术，法律，政策，监管，金融，和组织的问题



Approach for International Roadmaps 国际路线图方法学

- **Scoping paper reviewing existing work and identifying issues** 审查现有的文件和确定问题
- **1 or 2 “pressure cooker” workshops with 15-20 experts from industry, government, academia...** 1或者2 “压力锅” 作坊，以15-20个专家从工业，政府，和学术等等
- **Develop draft roadmap** 创造路线图的草案
- **Circulate draft of roadmap to wider stakeholder group** 宣布路线草案给更广泛的利益相关者集团
- **Carry out missing analysis and refine roadmap** 确定哪些分析被留掉和改善路线图
- **Re-circulate second draft for further comment** 在宣布第二个草案为了进一步的评论
- **Publish (ETP2010 and separately)** 出版（ETP2010和个别的）

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Current Status 目前的情况

● Supply side 供应的方面

- ◆ **CCS power generation** CCS发电
- ◆ **Coal – IGCC** 煤炭-IGCC
- ◆ **Coal – USCSC** 煤炭-USCSC
- ◆ **Nuclear III + IV** 核能 III + IV
- ◆ **Solar – PV** 太阳能 -PV
- ◆ **Solar – CSP** 太阳能-CSP
- ◆ **Wind** 风能
- ◆ **Biomass – IGCC & co-combustion**
生物质能-IGCC和共同燃烧
- ◆ **Electricity networks** 电力网络
- ◆ **2nd generation biofuels** 二代生物燃料

● Demand side 需求的方面

- ◆ **Energy efficiency in buildings** 能源效率在设施上
- ◆ **Energy efficient motor systems** 能源效率马达系统
- ◆ **Efficient ICEs** 效率的ICE
- ◆ **Heat pumps** 热泵
- ◆ **Plug-ins and electric vehicles** 即插电式电动车
- ◆ **Fuel cell vehicles** 燃料电池汽车
- ◆ **Industrial CCS** 工业的CCS
- ◆ **Solar heating** 太阳能供暖
- ◆ **Efficient industry processes (starting with Cement)** 高效率的工业流程（水泥开始）

Work has already begun on technologies shown in green, and these roadmaps will be launched later in 2009. 已经开始发展绿色技术，2009年底将发布这些路线图。

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Current Status 目前的情况

- **CCS – 2 workshops held; tech, policy and finance issues completed, draft roadmap summer 09** 举行了2次CCS研讨会；技术，政策，金融等问题已经完成，2009年夏天将完成路线图初稿
- **PV – 1 workshop on policy held, 2nd workshop July 09; draft roadmap – summer 09** 针对PV技术举行了第一个研讨会；第二个研讨会将在2009年7月；2009年夏天将完成路线图初稿
- **Electric Vehicles – 1 workshop held; tech & policy issues completed; draft roadmap – summer 09** 有关电动车举行了第一个研讨会；技术和政策的问题解决了，2009年夏天将完成路线图初稿
- **Cement – 3 workshops held; tech, policy and finance issues completed; final version of technology papers published July 09; draft roadmap – summer 09** 已经举行了3个水泥研讨会；技术，政策，和金融的问题解决了，2009年7月份将出版最后的技术草案，2009年夏天将完成路线图初稿。
- **Wind – 2 workshops held; tech, policy and finance issues completed; draft roadmap Summer 09** 举行了2个风能研讨会；技术，政策和金融的问题解决了；2009年夏天将完成路线图初稿。
- **Nuclear – 1st workshop scheduled for September 09** 举行了一个核能研讨会，2009年夏天将完成路线图初稿。

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Lessons Learned & Recommendations

经验教训和建议

- **Decide what is your goal** 确定什么是你的目标
- **Design a clear working definition** 设计一个明确的工作定义
- **Design clear study boundaries** 制定明确的限研究
- **Decide on what elements should be in a roadmap** 决定哪些要素应在路线图
- **Gather the data** 收集数据
- **Engage a wide audience of experts** 问广泛的专家小组
- **Give yourself time – the process is long** 给自己时间-过程特别长
- **Execute & monitor the plan and revise as necessary** 执行和监测计划，必要时修改。



Collaboration with China on roadmaps

与中国进行路线图合作

- **Chinese participation in international roadmaps** 关于中国参与国际路线图
- **Develop domestic roadmaps** 开发国内的路线图
 - ◆ **Which technologies? Coal, PV, Transport including fuel efficiency and electric vehicles** 哪些技术? 煤炭, PV, 运输, 包括燃料效率和电动车
 - ◆ **Which organisations?** 哪些组织?
 - ◆ **What process?** 哪个过程?
 - ◆ **How to disseminate?** 怎么宣布?



Thank you
谢谢大家

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