



Global Experience with Financial Incentives to Promote Building and Equipment Energy Efficiency 建筑节能财税激励的国际建议

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12 May 2005, Beijing, China
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2005年5月12日, 北京

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Content of presentation 主要内容

- International energy efficiency trends
- 国际能源效率发展趋势
- Rationale for energy efficiency policy measures in the building sector
- 在建筑节能领域的节能政策合理性
- Factors to consider for financial and fiscal incentives
- 财税激励影响的因素考虑
- Some European case studies
- 欧洲案例
- Summary and conclusions
- 总结与结论

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What has energy efficiency done for us?

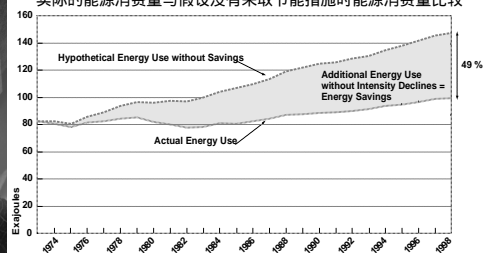
能源效率为我们做了什么？

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Actual Energy use and Hypothetical Energy Use without Intensity Reductions, IEA-11

实际的能源消费量与假设没有采取节能措施时能源消费量比较



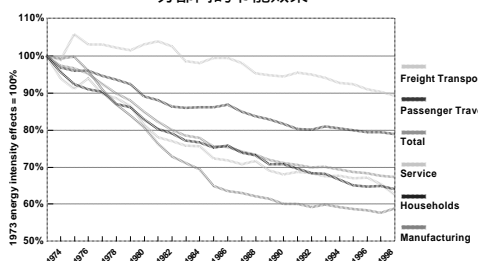
Without 25 years of energy savings, energy consumption would have been almost 50% higher

25年间, 若没有采取节能措施, 可能会多消耗一半以上的能源



Sector Intensities and Total Economy Effect, IEA-11

分部门的节能效果



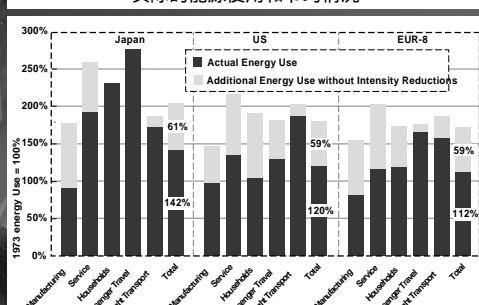
Energy intensity declines have slowed in all sectors since the late 1980s

从80年代末期, 所有部门的能源强度都呈现下降趋势



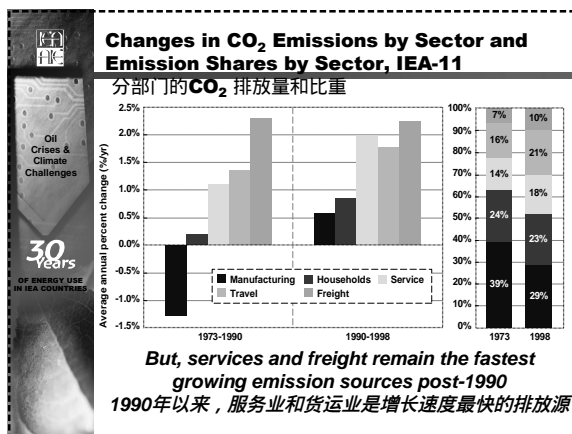
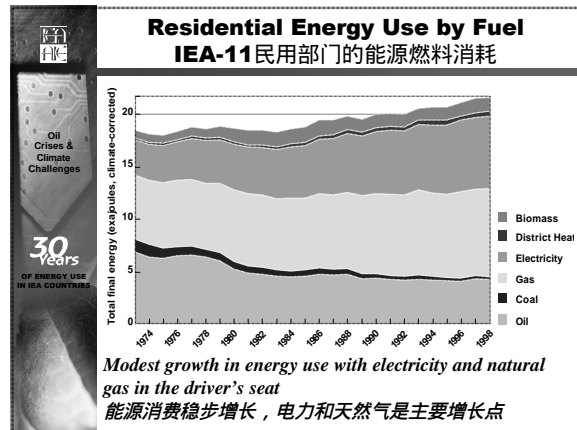
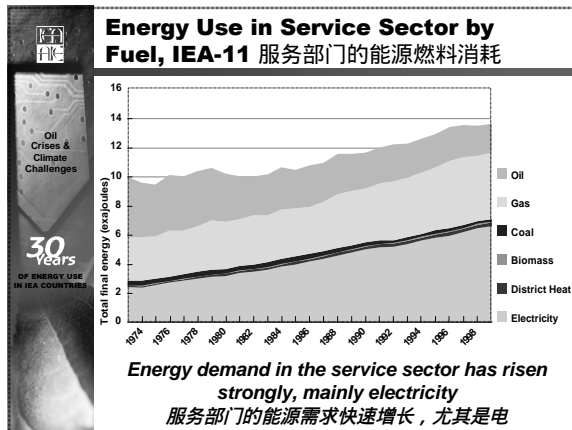
Actual Energy Use and Energy Savings

实际的能源使用和节约情况



Total energy savings across the three regions are similar, but there are important differences by sector

3个地区的总体节能情况相似, 但分部门的情况不同



What have we been doing for energy efficiency?

在能源效率方面我们在做什么？

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Building energy codes – since 1974 建筑能源标准法规 - 1974年以来

- European and North American countries introduced prescriptive (component-based) standards for new buildings
- 欧洲和北美洲为新建建筑引入了说明性标准（基于构件）
 - Mainly addressed thermal transmission losses
 - 主要针对降低传热损失
 - Mainly defined limits in terms of final energy per unit area
 - 主要规定了单位建筑面积的最大终端能耗
- Mostly mandatory, but US regulations are set on a state basis and vary widely & Japan applies voluntary guidelines
- 大部分是强制性的，美国主要是基于各州来实施，并且情况差异很大，日本采取了自愿性的指导

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Building energy codes – since 1980's 建筑能源标准法规 - 1980年以来

- Other countries followed suit (Australia, Brazil, China, ex-USSR, HK, Japan, Jamaica, NZ, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam)
- 其它国家也在采取措施（澳大利亚，巴西，中国，前苏联，香港，日本，牙买加，新西兰，菲律宾，新加坡，斯里兰卡，泰国，越南）
- Some European and North American countries/states extended requirements to include:
 - 一些欧洲和北美洲国家/州扩展了要求的范围，包括
 - Major renovations 主要的改造
 - All building types (not just residential) 所有的建筑（不仅仅是住宅）
 - Performance-based limits applying to whole building 基于整座建筑物的性能
 - Multiple compliance routes 多种路线
 - Primary as opposed to final energy limits 一次能源要求

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International leadership in building codes 建筑标准的国际领先水平

- California, EU, Russia and now China for lighting
- 加州、欧盟、俄罗斯和当前中国的照明领域
- Codes are far more stringent than before
- 当前的标准比原来严格得多
- Codes will now also cover:
 - Heating and cooling 供热和空调
 - Winter and summer thermal comfort 冬季和夏季的热舒适性
 - Internal and solar gains 太阳能利用
 - Ventilation and IAQ 通风和室内空气品质
 - Lighting loads 照明负荷
- Renewable and less conventional energy sources 可再生能源和非常规能源
- California applies codes to existing buildings whenever they change tenancy or ownership
- 加州对既有建筑也采取了标准，不管业主是谁

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Stringency of EU codes: transmission losses 欧盟更加严格的标准 - 传热损失方面

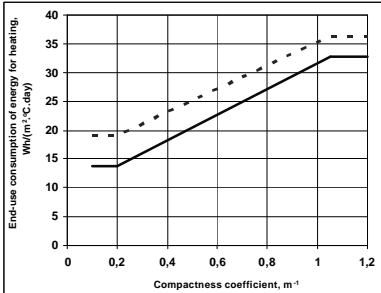
	Roofs					Outer walls					ground floor					windows				
	1.15	0.25	0.35	0.45	0.55	1.15	0.25	0.35	0.45	0.55	1.15	0.25	0.35	0.45	0.55	1.75	2.25	2.75	3.25	3.75
Sweden																				
Norway																				
Finland																				
Denmark																				
Lithuania																				
Ireland																				
Russian Federation																				
UK																				
Netherlands																				
Austria																				
Germany																				
Switzerland																				
France																				
Belgium																				
Italy																				
Portugal																				
Spain																				

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Comparison of Required Energy-Performance Levels of Russian Federal and Regional Codes (dotted line) and Germany's EnEV-2002

俄罗斯联邦和地区标准（点滑线）和德国EnEV-2002标准所要求的节能性能比较



Source:
Y. Matrosov

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Classes of Energy Efficiency for Buildings 建筑节能性能分级

Letter grade and graphical representation	Name of the class	Deviation of design or normalized measures specific energy consumption from code-stipulated level, %	Recommended measures
<i>For new and renovated buildings</i>			
A	Very high	Less than - 51	Economic incentives
B	High	From - 10 to - 50	As above
C	Normal	From + 5 to - 9	-
<i>For existing buildings</i>			
D	Low	From + 6 to + 75	Renovation desirable
E	Very high	Greater than 76	Upgrades urgently required

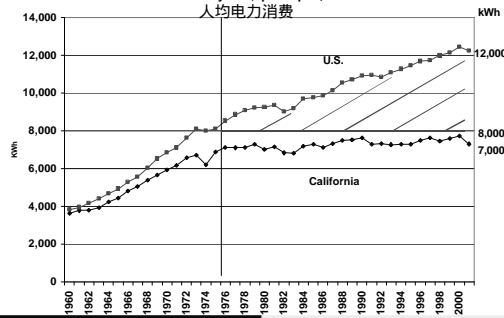
Source: Y. Matrosov

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Impacts: US vs. CA electricity use 影响：美国和加州电力消费

Total Electricity Use, per capita, 1960 - 2001
人均电力消费



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What could energy efficiency
do for us?

能效效率能够为我们做什么？

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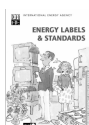


IEA publications on equipment energy efficiency IEA关于设备能源效率的出版物

INTERNATIONAL ENERGY AGENCY
COOL APPLIANCES
Policy Strategies for Energy Efficient Homes



THINGS THAT GO BLIP IN THE NIGHT
Energy Efficient Homes

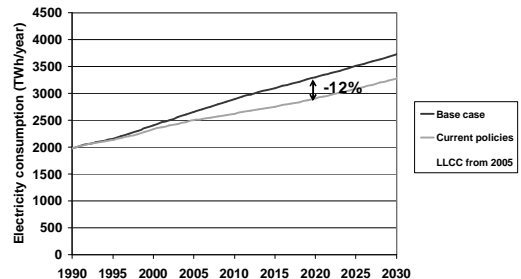


ENERGY LABELS & STANDARDS
Energy Efficient Homes

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Residential electrical appliance electricity consumption scenarios in IEA countries 1990-2030 IEA国家居民用电情景分析



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Cool Appliances: 高效电器 Cost and CO₂ impacts of Current Policies 当前政策对CO₂排放的影响及成本分析

- Current policies across the OECD are on course to:
- OECD国家当前的政策
 - reduce electricity demand by 9.9% in 2010
 - 到2010年降低电力需求9.9%
 - reduce electricity demand by 12.5% in 2020
 - 到2020年降低电力需求12.5%
 - avoid 146 Mt-CO₂ emissions in 2010
 - 到2010年降低CO₂排放量1.46亿吨
 - avoid 209 Mt-CO₂ emissions in 2020
 - 到2020年降低CO₂排放量2.09亿吨



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Cool Appliances: 高效电器 Cost and CO₂ impacts of Current Policies 当前政策对CO₂排放的影响及成本分析

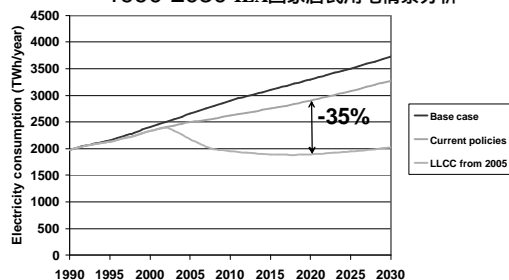
- The cost of avoided CO₂ in 2010 is projected to be:
- 到2010年降低CO₂排放量的预期成本
 - \$78/Tonne-CO₂ in OECD-North America
 - OECD的北美洲国家: -\$78/Tonne-CO₂
 - 241 Euro/Tonne-CO₂ in OECD-Europe
 - OECD的欧洲国家: -241 Euro/Tonne-CO₂



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Residential electrical electricity consumption scenarios in IEA countries 1990-2030 IEA国家居民用电情景分析



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Cost and CO₂ impacts of LLCC from 2005 scenario compared with Current Policies LLCC和当前政策比较: 对CO₂排放的影响及成本分析

- Compared with Current Policies implementing the LLCC from 2005 scenario across the OECD would:
- 与当前政策比较, 从2005年实施LLCC的OECD国家将:
 - reduce electricity demand by 26% in 2010
 - 到2010年降低电力需求26%
 - reduce electricity demand by 35% in 2020
 - 到2020年降低电力需求35%
 - avoid 344 Mt-CO₂ emissions in 2010
 - 到2010年减排CO₂ 3.44亿吨
 - avoid 524 Mt-CO₂ emissions in 2020
 - 到2020年减排CO₂ 5.24亿吨



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Cost and CO₂ impacts of LLCC from 2005 scenario compared with Current Policies LLCC和当前政策比较：对CO₂排放的影响及成本分析

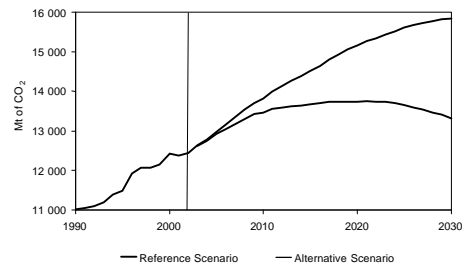
- The cost of avoided CO₂ in 2020 is projected to be:
 - -\$66/Tonne-CO₂ in OECD-North America
 - OECD的北美洲国家：-\$66/Tonne-CO₂
 - -169 Euro/Tonne-CO₂ in OECD-Europe
 - OECD的欧洲国家：-169 Euro/Tonne-CO₂



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OECD CO₂ emissions in the World Energy Outlook Reference and Alternative Scenarios 在《世界能源展望》中，OECD国家的CO₂排放情景

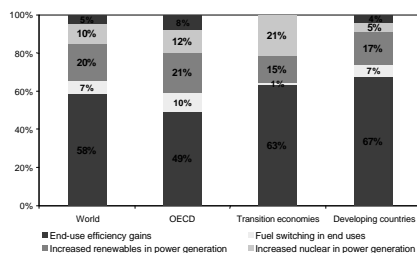


OECD CO₂ emissions peak around 2020 – 25% higher than in 1990
2020年CO₂排放高峰比1990年高25%

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Contributory factors in CO₂ reduction 2002-2030 CO₂减排的贡献因素

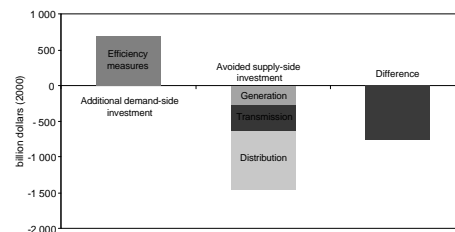


Improvements in end-use efficiency contribute for more than half of decrease in emissions, and renewables use for 20%
提高能源效率占50%以上，利用可再生能源占20%

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Difference in global electricity investment in the Alternative vs. Reference Scenario 2003-2030 全球电力投资情景分析



Additional investments on the demand side are more than offset by lower investment on the supply side
需求侧的投资将远小于供应侧可避免的投资

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What could (should) we do for energy efficiency?

在能源效率方面我们应该做什么？

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Overview 概要

Globally buildings are the largest energy using sector

- 建筑部门是最大的能源消费部门
- It is particularly subject to market failures
- 主要是因为市场失败
 - Split incentives: developer/owner/manager/tenant
 - 分散激励：发展商/业主/管理者/租户
 - Time horizons and discounting 时间因素
 - Location the key determinant of rental demand 地点因素
- It is therefore remarkable how little we know about:
- 所以，我们对以下因素了解很少
 - How efficiently energy is used in this sector? 如何利用能源效率
 - How "tough" is policy in this sector? 实施政策的难度
- Overall impression is that policy is relatively weak
- 总体印象是政策相对比较弱
 - But we need more transparency, data and policy analysis
 - 但是我们需要更多的透明度，数据和政策分析

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Non-financial/fiscal policy instruments in the OECD OECD国家的非财税激励措施

- Planning and zoning laws 规划和分区的法律、法规
- Building codes 建筑标准
 - New, retrofits, existing 新建、改造、既有
- Rating, accreditation schemes 分级
 - Labeling, disclosure 标识
- Equipment standards 产品标准
 - Lighting, motors, standby, etc 照明, 电机、待机能耗等
- R&D, demonstration 研发, 示范
- Market transformation initiatives 市场转换
- Voluntary initiatives 自愿性活动

OECD国家的例子很多, 但是没有一个国家采用了全部措施

There are great examples of each from around the OECD, but no one country 'has it all'

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Planning, zoning 规划, 分区

- Urban form is a key determinant of tertiary sector energy use – rarely integrated into policy thinking
- 城市是第三产业的主要对象 - 很少被政策考虑
- Issues include: 议题包括
 - Mixed-use or performance-based zoning? 混合使用或者基于性能分区
 - Implied travel demand and infrastructure 旅行需求和基础设施
 - Incentives for building re-use, refurbishment vs. demolition 对建筑再利用、改造的激励vs. 破坏
 - District heating and cooling infrastructure? 区域供热、供冷的基础设施
 - Urban heat island effect 城市热岛效应

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Planning, zoning 规划, 分区

- With rising (urban) populations, we need to evolve high-quality, high-density, multi-functional urban environments
- 随着城市人口增加, 我们需要发展高质量、高密度、多功能的城市社区
 - High energy (resource) efficiency is matched by people-friendliness; architectural excellence; green/cultural space
 - 应该采取能源(资源)效率措施: 市民友好、建筑设计合理、绿地和文化氛围

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Building Codes 建筑节能标准法规

- Performance-based codes becoming more common
- 基于性能成为一种趋势
 - But deemed-to-comply solutions, derogations abound
- Key issue: how hard are we trying?
- 主要问题: 有多大难度
 - Benchmarked performance requirements?
 - 诊断性能要求
 - Compliance? 执行率
 - (reported as <20% in Belgium)
 - 据说比利时还不到20%

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Building Codes 建筑节能标准法规

- Key issue: how hard are we trying?
 - Existing buildings? 既有建筑
 - In EU, restricted to buildings >1000 sq. m, or 10% of stock
 - 在欧盟, 大于1000平方米的建筑物, 或者10%的市场
 - Performance over time? 随时间的性能
 - Where to retain prescriptive provisions? 在哪里保留说明性条款
- Priorities: review governance and transparency of the code-making process, and the stringency of outcomes
- 优先: 对标准制定过程进行严格、透明的监管, 提出严格要求

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Labelling can also be used for buildings

(e.g. EU Directive on Energy Performance of Buildings) 可以使用建筑能效标识(例如, 欧盟建筑能源性能的规定)



In Upper-Austria private homes are labelled under the A to G format

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The new building Energy Passport in Germany
德国的新建建筑能源护照



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Rating, Accreditation Schemes
分级，鉴定计划

- Major focus of activity in the last decade
- 主要针对过去10多年的活动
 - Many tools available: LEED, BREEAM, GBC
 - 许多工具：LEED, BREEAM, GBC
- But...what share of buildings are rated? Are they transforming markets?
- 但是，经过分级认证的建筑有多少？已经市场转化了吗？
- Reasonable weightings of energy performance and other (e.g. environmental) impacts?
- 合理节能（环保）性能的影响

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Rating, Accreditation Schemes
分级，鉴定计划

- How many countries require disclosure of building energy performance?
- 多少国家要求标识建筑能耗？
 - This is a key step to overcome tenant/landlord and developer/owner/manager market failures
 - 这是克服市场障碍的第一步
 - Create a market-based premium for efficient/green buildings
 - 对高效/绿色建筑提供奖励

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Equipment/Component Standards
设备/构件标准

- With intensification of office space the plug load is rising rapidly 办公楼能耗发展快速
- Lighting: need whole-of-luminaire requirements (lamp, ballast, fixture), and increasingly, sensors and controls 照明：需要整体要求（灯具、镇流器、固定装置），传感器，控制
- Serious efforts needed on IT & office equipment, including standby (coverage in test procedures, standards, labels) 应用IT技术，包括待机能耗（测试过程，标准，标识）
- Many energy-using building components (chillers, fan coil units, pumps, motors, etc) not covered by equipment standards
- 许多用能构件（制冷机，风机盘管，水泵、电机等）尚未包含在设备标准中

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Market Transformation Initiatives
市场转换

- E.g. 'buy-down' schemes for new technologies
- 对新技术
 - Leveraging government-purchasing or collectives
 - 发挥政府采购和大宗采购的杠杆作用
 - Best known in US, Sweden (NUTEK)
 - 美国，瑞典的情况
 - E.g. super-windows, CFLs, low standby office-equipment
 - 例如，超级保温节能窗，紧凑型荧光灯，办公设备待机能耗

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Market Transformation Initiatives
市场转换

- Issues: 议题
 - Unheard of in many countries 在许多国家没听说过
 - wide disparities in EE equipment/ component availability – and skills in installing them
 - 节能设备及安装技术存在不同的情况
 - Additional equipment types would benefit
 - 其它设备形式可能有益
 - Eg. Heat exchangers, ground-sourced heat pumps, storage devices
 - 例如，换热器，地源热泵，能量储存设备
 - Innovation investments may be 'stranded' if overall performance requirements are weak
 - 如果对性能要求不高，那么改造投资将成为问题

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R&D & Demonstration 研发和示范

- Many countries offer good support for R&D, e.g. through national institutes
- 许多国家通过国家机构对节能技术研发提供支持
 - Whereas industry R&D is typically very low
 - 但是，对工业技术的研发支持非常少
- Demonstration programs also common
- 示范项目也很普遍
 - E.g. Canada's Commercial Building Incentive Program
 - 例如，加拿大商业建筑激励项目
- Demonstration is necessary, in a conservative industry
- 对于保守的企业，示范非常必要
 - But mass-deployment is the real prize 大规模推广是真正的奖励
 - Are voluntary initiatives enough? 仅靠自愿，够吗？

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Voluntary Initiatives 自愿性活动

- Two varieties: 两类
 - Overall corporate performance (often CO2) 整体性能（一般是CO2）
 - Specific products (e.g. Green Lights, Energy Star, Green Buildings) 特定产品（例如，节能灯，能源之星，绿色建筑）
- Major benefit is flexibility 良好的收益
 - But accountability and transparency of results? 结果的透明度
 - Compliance costs low but administrative costs may be high
 - 执行成本低，但是管理成本有可能较高
 - Degree of free-riding? “搭便车”的程度
 - Do they lead or follow the market? 他们是引导还是跟随了市场
 - Major question-mark over their performance over time
 - 其性能随时间的变化
 - How and when are they updated? Is performance benchmarked?
 - 什么时候，如何更新？性能是否基于基准？

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So why fiscal/financial incentives for energy efficiency? 为什么实施能源效率激励措施？

- Most jurisdictions (National or State level Governments) have introduced these incentives in recognition that:
- 大部分地方（国家或者州政府）已经引入了激励措施
 - the environmental externalities of energy usage are not reflected in energy prices
 - 能源利用的环境成本没有在能源价格中得到体现
 - resource based taxation is progressive in that it encourages economic and environmental efficiency
 - 财税激励有利于提高经济和环境效率
 - market failures and imperfections constrain the ability of economic actors to implement energy efficiency measures that are in their own economic self-interest
 - 市场的失败受限于经济因素采取的能效措施，其实对其自身是有利的

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Market failures in the building sector 建筑部门的市场失败

- The person who pays the energy bill is often not the person who owns the property – the landlord/tenant problem
- 支付能源费用的人往往不是资产的主人 - 房东/佃户问题
- In the tertiary/industrial sector the equipment procurement budget (capital expenses budget) is usually managed in isolation of the operations and maintenance budget – thus the incentives of the respective budget managers are not aligned to minimise equipment life-cycle costs
- 在第三产业中，设备的采购预算通常和运行管理预算是独立的。这种分别管理的方法不利于使设备成本最小化

AGENCE INTERNATIONALE DE L'ENERGIE



Market imperfections in the building sector 建筑部门的市场不完整性

- Lack of knowledge about energy savings opportunities linked to a lack of information and awareness of specific energy operational creates a major “transaction cost”
- 因为对节能机会的认识不足导致缺乏对特定能源管理信息和意识，引起“交易”成本
- Energy performance is “bundled” with so many other more important factors (e.g. building location and size, character and feel of the building, functionality and services, etc.) and hence is unlikely to be a determining factor for a rental or purchase decision
- 能源性能与其它许多因素有关（例如，建筑位置和规模，建筑特点，功能和服务等），所以在租赁和购买行为中，这不是决定性因素

AGENCE INTERNATIONALE DE L'ENERGIE



Market imperfections in the building sector 建筑部门的市场不完整性

- Constructors aim to complete construction to a minimum building quality specification and are strongly motivated to economise on capital costs
- 因为初投资问题，建筑人员目标是尽可能降低某些性能
- This is especially true when the long-term consequences of such practice (in the form of higher future energy costs) are invisible to the commissioner of the project
- 当实际情况（一般是未来的能源成本较高）的长期效果对项目实施很明显时，上述问题的确可能发生

AGENCE INTERNATIONALE DE L'ENERGIE



Market imperfections in the building sector 建筑部门的市场不完整性

- Purchasers or renters are often strongly time constrained when they select a new building (e.g. when a private citizen changes employment and they need an apartment in time to start a new job)
- 购买者和租赁者在选择新建筑时（例如，私人由于被解雇，需要一个公寓开始新工作），他们经常受时间的限制
- this results in lower market pressure on building quality issues such as energy performance
- 这种情况下导致他们对建筑性能（包括节能性能）不关心

AGENCE INTERNATIONALE DE L'ENERGIE



Specific barriers to energy efficiency in the building sector 在建筑部门的一些特殊节能障碍

- A very fragmented construction industry that is usually highly risk averse and very slow to innovate
- 分散的建筑企业通常面临高风险，改造很慢
- A general lack of knowledge of the tools and techniques to construct efficient buildings
- 对建造高效节能建筑的工具和技术缺乏认识
- A general lack of skilled labour caused by inadequate training and low qualification requirements
- 由于缺乏足够的培训和严格的要求，缺少有技术的劳动力
- Constrained or inadequate supply of efficient building materials and components
- 缺乏高效节能建筑材料及构件的供应
- Constrained access to capital
- 缺乏资金

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Factors to consider – I 考虑因素 - 1

- Which of these failures/imperfections/barriers are not fully addressed by existing Government support for domestic energy efficiency?
- 政府部门支持的能效政策和技术还没有完全解决哪些障碍？
- Are there any other locally specific market failures that may constrain investment in this area?
- 本地区有限投资的市场障碍吗？
- The relative merits of the portfolio of economic instruments used to improve household energy efficiency in other countries
- 在其它国家，通过经济手段提高家庭能源效率的优点

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Factors to consider – II 考虑因素 - 2

- How would the proposed economic instrument relate to existing policy measures?
- 提议的经济手段和既有政策的关系
- Are there any synergies or overlaps?
- 形成互补还是有重叠
- Would the instrument be consistent with the aims of existing measures or would they involve potential conflicts?
- 这些手段和既有措施的目标是否一致，还是存在潜在的冲突
- If there are conflicts, how might these be addressed?
- 如果有冲突，如何解决？

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Factors to consider – III 考虑因素 - 3

- What would be the likely impact of the proposed instrument in changing behaviour? Would it act as a reward or a penalty and what are the merits of this approach?
- 提议措施对改变行为有什么影响？是作为奖励还是惩罚手段？其优点是什么？
- What would be the likely costs – whether financial, social or environmental – to (a) business and (b) consumers?
- 财物、社会和环境成本怎么样 - 对商业部门和消费者来说？
- What would be the distributional impact of the proposed instrument? Would there be an effect on prices of products, dwellings or fuel?
- 提议的手段有什么分散性影响？对产品、住房和燃料的价格有何影响？
- Are there any other features of the proposed instrument that should be taken into account - e.g. administrative costs, international state aid issues, consistency with other legislation?
- 对提议的措施，还有什么其它特点需要考虑？例如，管理成本，国际援助，与其它法规的一致性。

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Denmark: Energy/CO₂ taxes case study 丹麦：能源/CO₂税案例

- In 1990 a decision was made to move general taxation away from income and corporate profits towards taxes on resources such as energy and specifically CO₂
- 1990年，政府决定把一般性税收改为能源/CO₂税
- Such taxes were first imposed in 1992 and were strengthened again in 1998
- 这种税在1992年实施，在1998年得到进一步加强
- Between 1998 and 2002, energy taxes increased by approximately 20 %, corresponding to approximately Euro 1.34 per GJ
- 1998-2002年，能源税增长了20%，为Euro 1.34 /GJ
- These energy/CO₂ taxes are set to be tax neutral thus they were designed to avoid any increase in the net level of taxation
- 这些能源/CO₂税为中性税，不会导致总体税收增加
- Income tax and corporation taxes were cut accordingly
- 所得税和财产税相应地降低

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Denmark: Energy/CO₂ taxes case study 丹麦：能源/ CO₂税案例

- The taxes are cross cutting and apply to all end-use sectors except transport
- 支持所有的（除交通）的终端能源利用部门
- They are further used as a strong negative incentive to encourage large energy users to engage with government on implementing energy efficiency measures
- 还将鼓励政府部门的大能源用户采取节能措施
- Major users are allowed to negotiate significant tax exemptions providing they agree to implement certain energy efficiency measures
- 如果同意采取某种节能措施，经过协商，主要用户可以得到明显的减免税优惠
- These include an initial energy efficiency audit which is used to set efficiency implementation objectives
- 包括能源效率审计，原来确定能效水平目标

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Denmark: Energy/CO₂ taxes case study 丹麦：能源/ CO₂税案例

- When these measures are promptly implemented the company becomes eligible for the exemption
- 这些节能措施一旦实施，该公司就得到了减免税资格
- However, there are no such exemptions for households and small users
- 但是，对家用电器和小用户没有实施减免税
- A key component is the vigorous verification process which has led to some companies having their tax exemptions removed
- 一个关键的部分是认证过程，可能导致一些公司得不到减免税资格

AGENCE INTERNATIONALE DE L'ENERGIE



Denmark: DSM commitments 丹麦：能源需求侧管理（DSM）项目

- Through electricity sector legislation electricity supply companies are obliged to plan and to carry out electricity saving activities for households and the tertiary sector
- 通过电力部门立法，供电公司规划和开展民用和商用领域的节电活动
- The activities are public service obligations and expenses can be covered through the electricity tariff
- 这些活动是公益性的，相关费用可以由电力税支持
- The means applied are threefold:
 - Economic/financial 经济的/财政的
 - Planning obligation 规划
 - Advising/Information/awareness 广告/信息传播/提高意识

AGENCE INTERNATIONALE DE L'ENERGIE



Denmark: Heating audits 丹麦：供热系统能源审计

- Every house-owner is eligible for a free heating-audit of their building, which results in recommendations for possible energy saving measures in building shell and heating equipment
- 每个住宅用户可以得到对其住宅的免费供热节能审计，从而可以得到对建筑围护结构和供热系统的节能改造措施建议
- If the recommendations are followed the house owner obtains an Energy Certificate
- 如果这些建议被采纳，业主可以得到一个“能源认证”证书
- The investments necessary to obtain an Energy Certificate will have a simple payback time of 8-10 years but these are further supported through grants
- 节能投资回收期一般不超过8-10年，但是可以通过赠款支持
- Since 1985 an Energy Certificate is requested in real estate-deals, when buildings were built before 1979 and is always requested when a house owner wants a grant for energy saving measures
- 1985年以来，对1979年前建的建筑物在房地产交易中或者住房业主申请节能投资赠款时，要求有“能源认证”证书。

AGENCE INTERNATIONALE DE L'ENERGIE



Denmark: Heating audits 丹麦：供热系统能源审计

- In the period from 1981 to mid 1989, 850.000 dwellings (40% of all dwellings) have obtained an Energy Certificate (396.690 individual and 462.709 collective dwellings)
- 1981 - 1989年，850.000座住宅（约全部的40%）已经得到了“能源认证”证书（其中，个人396.690，集体462.709）
- 91% of the heating audits were conducted pre 1985. Today, only 8-10,000 heating audits are conducted p.a.
- 91%的供热系统能源审计是1985年前完成的。今天，每年实施的供热审计仅为8-10,000
- In 1988, 40% of all house-deals had an Energy Certificate
- 在1988年，40%的所有住宅交易都对“能源认证”证书提出要求

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Denmark: other measures 丹麦：其它措施

In addition to stringent building codes applying to new build and retrofits Denmark has implemented:

除了对新建和改造建筑实施严格的节能标准外，丹麦还实施了：

- two building energy labelling schemes
- 两个建筑能源标识项目
- special energy efficiency rules for public buildings as well as rules for maintenance schemes for HVAC systems
- 对公共建筑和暖通空调系统制定了节能法规
- window energy labelling linked to new requirements on window retrofits
- 结合对窗户改造的新要求出台了窗户的能源标识
- And is implementing the provisions of the EU energy performance in buildings Directive
- 同时，按照欧盟建筑能源性能法令条款要求开展工作

AGENCE INTERNATIONALE DE L'ENERGIE



Denmark: policy impacts 丹麦：政策影响

- By 2001 enterprises accounting for 60% of industrial energy use had entered LTAs with Government to benefit from reduced energy/CO₂ taxes
- 到2001年60%的企业加入了LTAs，从减免能源/CO₂税中获益
- From 2000 onwards DKK175m p.a. is given to building efficiency subsidies
- 从2000年，提供建筑节能补贴（DKK175m p.a.）
- Evaluation of the tax measures found they had cut national CO₂ emissions by 3.9% in 4 years
- 对减免税措施的评估表明，4年中，国家CO₂排放量降低了3.9%
- Market share for very high EE windows reached 60% in 2002

AGENCE INTERNATIONALE DE L'ENERGIE



Denmark: policy impacts 丹麦：政策影响

- Market share for very high EE windows reached 60% in 2002
- 到2002年，超高效节能窗市场占有率达到60%
- A subsidy of DKK 2500 from 1999 to 2001 for household gas boilers with efficiency of >95% results in their market share growing from 10% to 50% in 2 years
- 1999~2001年，对能效水平在95%以上天然气锅炉的补贴（DKK 2500）在两年中使其市场占有率从10%提高到50%
- Subsidies for connection to the district heating network resulted in 50% of eligible houses being connected by 1997
- 到1997年，通过补贴措施，鼓励用户使用区域热网供热，50%的住宅已经连到热网上

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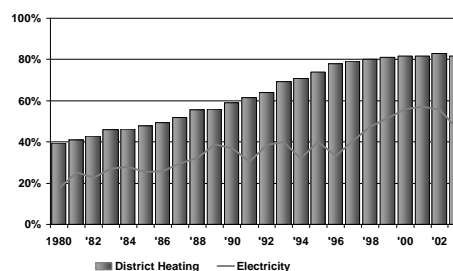
Denmark: policy impacts 丹麦：政策影响

- Seen over a longer period, there has only been a slight change in national energy consumption
- 从长期看，全国的能源消费量变化很小
- From 1990 to 2004, adjusted national energy consumption increased by a mere 2.6 percent
- 1990~2004年，能源消费量仅增长2.6%
- In the same period, GDP grew by 32 percent, which means that every unit of GDP in 2004 required 22 percent less energy compared to 1990
- 同期，GDP增长了32%，意味着2004年GDP能耗比1990年降低了22%

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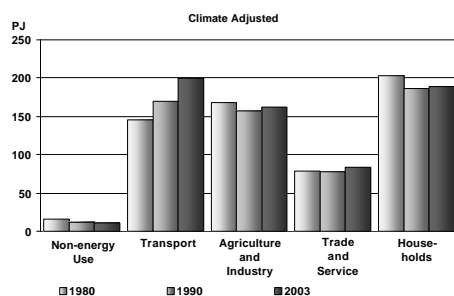
CHP Shares in Electricity and District Heating Production 热电联产在电力和区域供热中的比重



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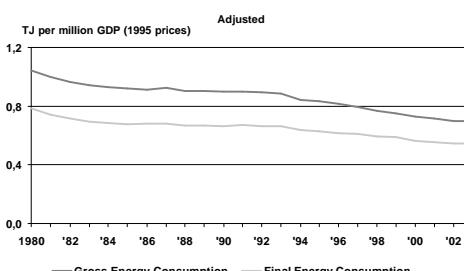
Final Energy Consumption by Use 分品种的终端能源消费



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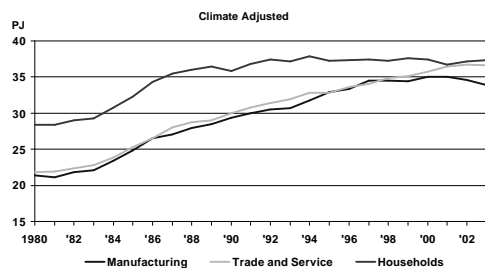
Gross Energy Consumption and Final Energy Consumption per Million GDP 单位GDP的能源消费总量和终端能源消费量



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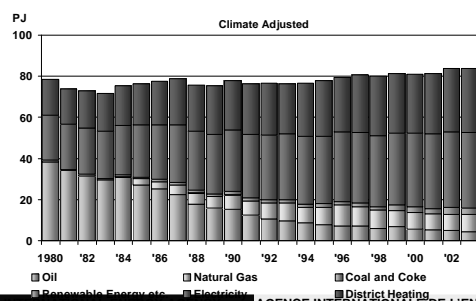
Final Electricity Consumption by Sector 分部门的终端电力消费



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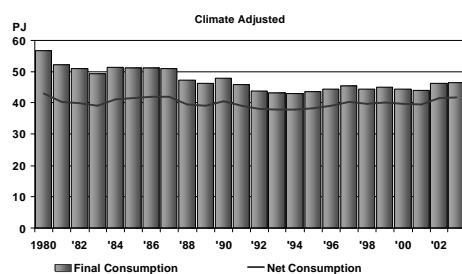
Energy Consumption in the Trade and Service Sector by Energy Product 在商贸部门的分品种能源消费



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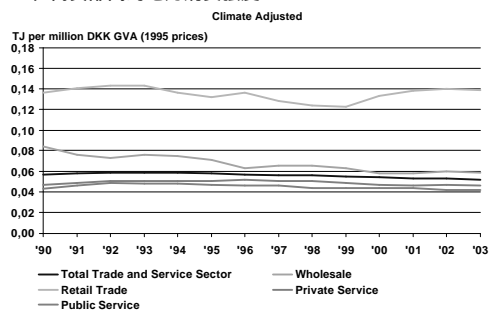
Energy Consumption for Space Heating in the Trade and Service Sector 在商贸部门的采暖能源消费



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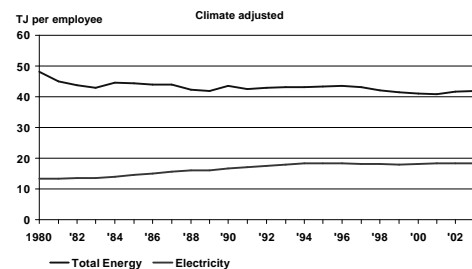
Electricity Intensities in the Trade and Service Sector 在商贸部门的电力消费强度



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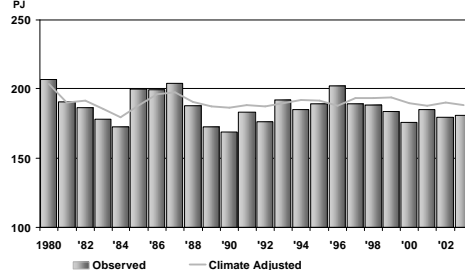
Energy Consumption per Employee in the Trade and Service Sector 在商贸部门的人均能源消费量



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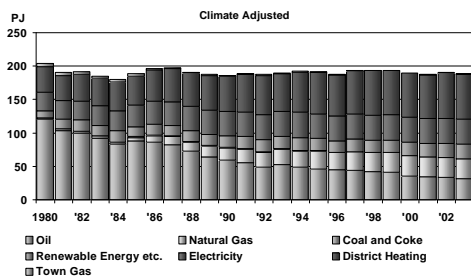
Energy Consumption in Households 住宅的能源消费



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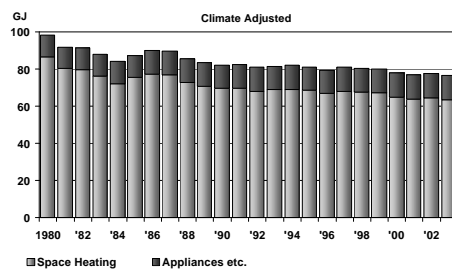
Energy Consumption in Households by Energy Product 分品种的住宅能源消费



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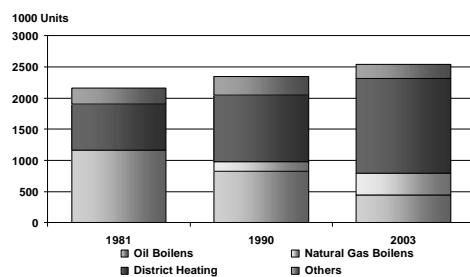
Energy Consumption per Household 每个家庭的能源消费



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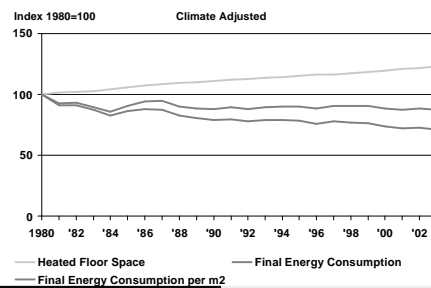
Heating Installations in Danish Dwellings 丹麦住宅的供热方式



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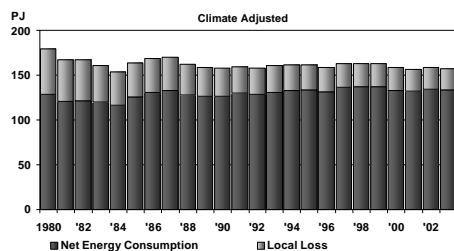
Energy Consumption for Space Heating in Households 住宅的采暖能耗



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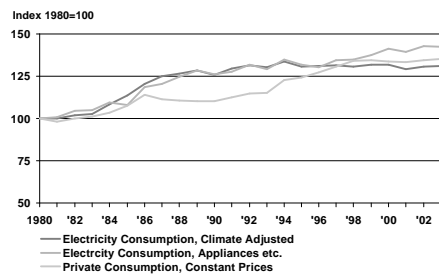
Net Energy Consumption and Space Heating Loss in Dwellings 住宅的净能耗和采暖损失



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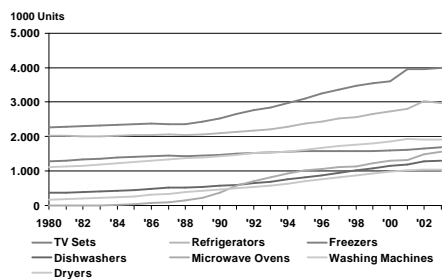
Electricity Consumption in Households versus Private Consumption 家用电器电力消费和个人消费



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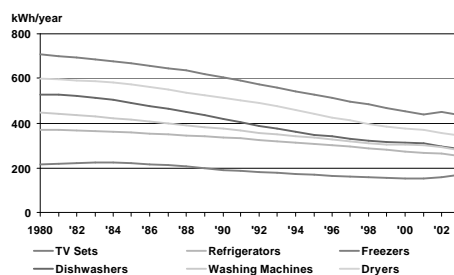
Stock of Electrical Appliances in Households 家用电器拥有量



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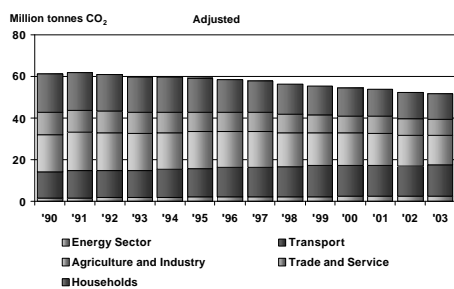
Specific Electrical Consumption of Households Appliances 家用电器的年耗电量



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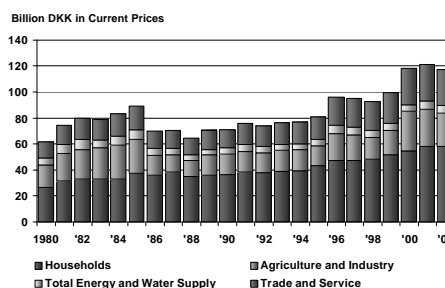
CO2 Emissions in Final Energy Consumption incl. Energy Sector 包括能源部门的终端能源消费引起的CO2排放量



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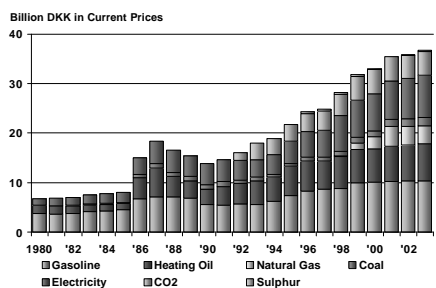
Energy Expenditures by Sector 分部门的能源费用支出



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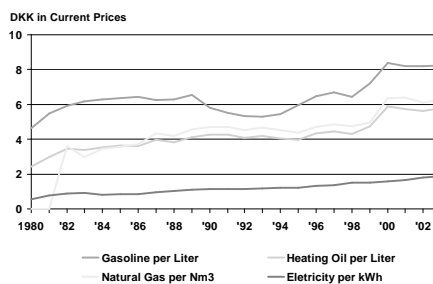
Revenues from Energy, CO2 and Sulphur Taxes 能源、CO2和硫的税收



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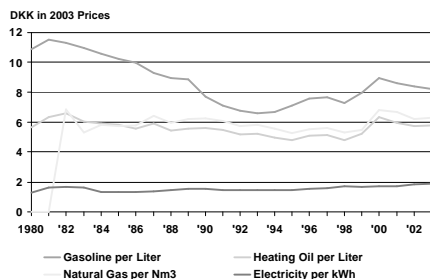
Energy Prices for Households 家庭用能价格



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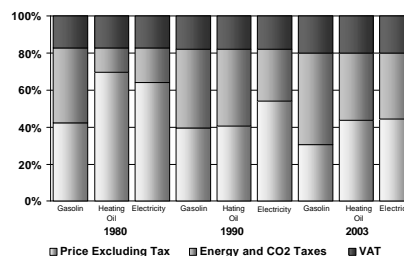
Energy Prices for Households 家庭用能价格



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Composition of Prices for Households 家庭用能价格构成



AGENCE INTERNATIONALE DE L'ENERGIE



Germany: tough codes and soft loans 德国：严格的标准和软贷款

- At the federal level Germany combines strong building energy performance regulations with very soft loans for building efficiency improvements
- 在联邦水平，德国采取严格的建筑节能性能和软贷款来推动建筑节能
- The loans are financed through the Marshall fund and all home renovators, whether private owners or property renters are entitled to apply for the loans
- 贷款由Marshall基金支持，所有进行节能改造家庭都可以申请，不管是房东还是租房的人
- The eligibility requirement is that the proposed renovations must meet the current building codes at least at the level of the prescriptive performance levels set for the components to be renovated
- 资格要求是改造建议应该最低满足当前建筑标准中对要改造构件的性能要求

AGENCE INTERNATIONALE DE L'ENERGIE



Germany: tough codes and soft loans – II 德国：严格的标准和软贷款 - II

- For example, if only the windows are to be renovated then an applicant is entitled to receive a loan providing that the new windows meet the current prescriptive requirements
- 例如，如果仅对窗户进行改造，那么就要满足新窗户性能的要求，才能够申请贷款
- If a whole building or apartment is to be renovated then the entire system must meet the general building code requirements
- 如果对整座建筑进行改造，那么整座建筑的性能应该得到要求
- As the codes are regularly strengthened the energy performance requirements for the renovation to be eligible to receive the loans are also regularly raised
- 因为标准中加强了对节能性能的要求，所以贷款也在增长
- This minimises the risk of free-ridership
- 这降低了“搭便车”的风险

AGENCE INTERNATIONALE DE L'ENERGIE



Germany: other measures 德国：其它措施

- Eco-tax with CHP exemptions (2.05c/kWh, €0.45/1000-litres heating oil, 19.03/toe natural gas in 2003)
- 热电联产的生态税减免(2003年，2.05c/kWh, €0.45/1000-litres 采暖燃油, 19.03/toe 天然气)
- Soft finance for energy conservation contracting companies – In 1999 some 480 companies ran 39000 projects with a total investment of €6.6 billion
- 为节能服务公司提供软贷款。在1999年，有480家公司实施了39000个项目，总投资达66亿欧元
- The 'eco-bonus' scheme gives an allowance of 2% of purchase costs for installation of heat pumps, solar units and heat recovery units
- “生态奖励”计划为安装热泵、太阳能设备和热回收设备行为提供2%购买成本的补贴
- Grants are available for new buildings conforming to low-energy standards
- 为满足超低能耗建筑标准的新建建筑提供赠款

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Germany: impacts 德国：影响

- Final energy consumption in the residential and commercial sectors was 1.2% lower in 2000 than in 1990
- 在2000年，住宅和商业建筑终端能耗比1990年降低1.2%
- Climate-corrected residential heating demand was 6.5% lower per m2 in 1999 than 1995
- 1999年，与气候相关的单位面积的采暖能耗比1995年降低了6.5%
- Climate-corrected energy intensity in the service sector was 17% lower per unit of GDP in 2000 than 1995
- 2000年，与气候相关的单位GDP商业建筑能耗比1995年降低了17%

AGENCE INTERNATIONALE DE L'ENERGIE



Netherlands: household incentives

荷兰：家庭激励

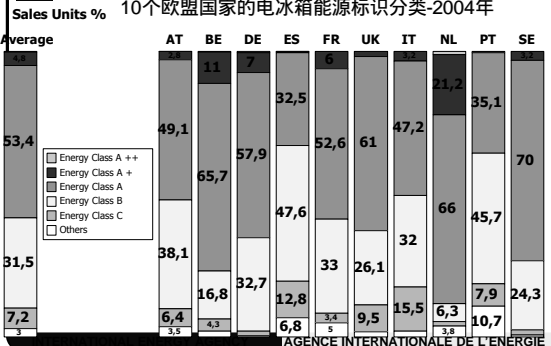
- voluntary scheme of energy audits – householders implementing the recommendations of the audit are eligible for a 25% capital subsidy (up to €158)
- 能源审计的自愿性项目 - 实施推荐的能源审计的家庭可以得到25%的成本补贴（不超过158欧元）
- Energy Premium Regulation annual subsidies of €54m for class A and A+ appliances financed through energy tax revenues. (Note: implementation cost = 24% of subsidies)
- 由能源税资助的“能源基金管理”项目每年为达到A和A+级的设备提供€54m的补贴
- Resulted in the Dutch appliance market being the most energy efficient in Europe
- 结果是荷兰的家电市场是欧洲最高效的

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Refrigerator sales by energy label class in ten EU countries – year 2004

10个欧盟国家的电冰箱能源标识分类-2004年



The UK: a raft of measures

英国：大量措施

In the last 10 years the UK has introduced:
过去10年间，英国引入了

- The Energy Efficiency Commitment 能源效率承诺
- The Enhanced Capital Allowance scheme 强化的津贴计划
- CO2 taxes on businesses (Climate Change Levy = $0.43\text{p/kWh}_{\text{elec}}$, $0.15\text{p/kWh}_{\text{gas}}$, $1.17\text{p/kg}_{\text{coal}}$, $0.96\text{p/kg}_{\text{LPG}}$). The taxes are net neutral through reduced employee national insurance contributions
- 商业部门的CO2税（气候变化杠杆 = $0.43\text{p/kWh}_{\text{elec}}$, $0.15\text{p/kWh}_{\text{gas}}$, $1.17\text{p/kg}_{\text{coal}}$, $0.96\text{p/kg}_{\text{LPG}}$ ）。属于中性税，将降低雇员的保险费
- Climate Change Agreements – 80% reduction in CCL for businesses that agree to meet stringent efficiency and CO2 emissions targets
- 气候变化协议 - 商业部门CCL降低80%，满足严格的能效要求和CO2排放目标
- Reduced VAT on efficient goods and products 对节能设备减免增值税
- Home Energy Conservation Act 家庭节能法令

AGENCE INTERNATIONALE DE L'ÉNERGIE



The UK: Energy Efficiency Commitment

英国：能源效率承诺

- The EEC programme requires gas and electricity suppliers to encourage and help their domestic customers to reduce energy consumption and to meet targets for quantified energy savings (expressed as an average saving per customer). Suppliers can decide which technologies to promote, within the full range of: insulation, efficient boilers, lighting, appliances, etc. subject to scheme approval by Ofgem (the regulatory agency).
- EEC项目要求天然气和电力供应商鼓励和帮助国内用户降低能源消费，达到节能目标（以每个用户的平均节能量计算）。供应商能够决定要推动哪项技术，包括：保温隔热，高效锅炉，照明，家用电器等。由Ofgem（管理机构）来批准计划。

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The UK: Energy Efficiency Commitment

英国：能源效率承诺

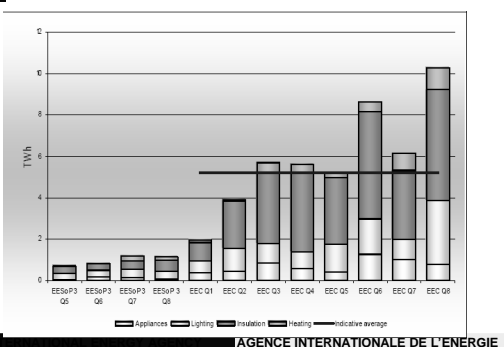
- It is a combined social and environmental programme, with at least half of the energy cost savings going to households in receipt of benefits (low income households). The first phase of the scheme ran from 2002-2005, and is funded via a charge of up to £3.60 per customer bill, with a programme expenditure of around £150 million p/a.
- 这是个社会与环境方面的综合性项目，可以通过补贴使用户节约最少一半的能源成本。项目的第一阶段为2002~2005年，由每个用户提供的3.6英镑费用建立基金，每年项目支出大约£150 million p/a。
- Savings of more than 62TWh have been achieved and the scheme has just been renewed with a more ambitious target
- 已经实现了62TWh以上的节能效果，并且项目已经制定了更高的节能目标。

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EEC energy savings over 2 years

两年间EEC项目的节能量





The UK: Home Energy Efficiency Scheme 英国：家庭能源效率项目

- Home Energy Efficiency Scheme: grant funding for qualifying households that helps to overcome financial constraints to improving energy efficiency. Now operating under the name 'Warm Front', it is targeted at vulnerable households in the private rented and owner-occupied sectors, with special provision for over-60s households in receipt of an income-based benefit, and includes installation of central heating systems as well as insulation, etc.
- 为达到要求的家庭提供资金，帮助他们克服提高能源效率的财政障碍。目前，以'Warm Front'的名义在实施，目标群体是个人承租的和业主居住的住房，对60多个家庭提供基于收入利益的特殊优惠，并且包括按照集中供热系统和保温隔热措施等。

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The UK: Home Energy Efficiency Scheme 英国：家庭能源效率项目

- Government expenditure of about £600 million was allocated for the four year period 2000-2004. In Scotland, grant support for energy efficiency measures is provided by the comparable 'Warm Deal' scheme, and the Central Heating Programme provides free efficient central heating systems to elderly householders in the private sector and to tenants of social landlords
- 在2000~2004年间，政府支出了约6亿英镑。在苏格兰，通过'Warm Deal'项目提供节能措施的资金，并且集中供热项目提供免费的高效集中供热系统给私人部门、佃户和房东的陈旧建筑

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The UK: Affordable Warmth Programme 英国：可以承受的Warmth项目

- Affordable Warmth Programme: lease finance to encourage the installation of high-efficiency gas central heating and energy efficiency measures
- 比较少的财政支持高效燃气供热和节能措施
- This allows programmes run by DEFRA, the Devolved Administrations, and social housing landlords to take advantage of enhanced capital allowances on heating systems via a seven-year leasing arrangement
- 允许由DEFRA、Devolved Administrations和房东实施项目，通过7年的租赁安排利用强化的资金奖励支持供热系统节能措施
- Transco are underwriting the residual value of the equipment at the end of the lease period. Authorisation currently exists for a limit of one million homes by 2007 (about 5% of the UK stock)
- 在租赁期内，Transco 对设备的剩余价值进行保值。到2007年，Authorisation 将支持100万个家庭（英国的5%）

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The UK: Reduced VAT 英国：降低增值税

- Reduced rate of VAT: for installation of insulation materials, draught stripping, hot water and central heating system controls by contractors
- 为安装和采取保温材料，热水和集中供热系统控制措施的承包商降低增值税
- The 5% reduced rate also applies to the grant-funded installation of central heating systems, heating appliances, factory-insulated hot water tanks, micro CHP and renewable energy heating systems
- 同时，降低5%的税率提供给赠款资助的集中供热系统保温隔热措施，热水器安装，微型热电联产和利用可再生能源的供热系统

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Belgium 比利时

- Belgium: "premium" paid to purchasers of A-rated fridges and freezers between 1996 and 1998, similar incentive for installation of solar collectors and compact fluorescent lights
- 在1996到1998年间，给A级的电冰箱和冰柜提供补贴，并且为安装太阳能集热器和紧凑型荧光灯措施提供类似的补贴
- A range of incentives are available for the retro-fitting of buildings, including a tax deduction of 15-40% of the cost of replacing boilers, installing solar boilers and photovoltaic systems, installing double glazing and installing roof insulation
- 部分激励用于建筑节能改造，包括锅炉替代成本15%~40%的减免税，安装太阳能锅炉和光伏电池系统，安装双层玻璃窗，和屋顶保温措施
- The maximum amount that can be claimed is limited to €500 each year per household
- 每年每个用户最大的金额不能超过500英镑。

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France 法国

- France: a tax reduction worth 15% of expenditure (up to €8,000 per household) for the sale of insulation materials, heating control equipment and insulated windows was introduced in the 2002 budget
- 在2002年的预算中，为销售保温材料、热量控制设备和节能窗的支出提供15%的减免税（每个家庭不超过8000欧元）
- Tax reductions for heating insulation improvements, heating controls, replacement of boilers or installation of a wood stove in houses built before 1982
- 为在1982年之前建造的住宅中供热保温隔热措施、供热系统节能控制、锅炉替代和安装燃烧木材的取暖炉提供减免税优惠
- This reduction is valid for work carried out by professional contractors
- 这种措施可以由专业的承包商实施

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Japan 日本

- Tax incentives and low interest loans for efficient new construction
- 为新的节能建筑提供减免税和低息贷款
- Experimental subsidies for Building Energy Management systems
- 为楼宇能源管理系统提供实验性的补贴
- Tax reductions to 7% of acquisition costs for efficient equipment for commercial entities
- 为高效设备和商业建筑提供成本7%以内的减免税
- Accelerated corporate capital depreciation for efficient equipment acquisitions to a maximum of 30% of the acquired value
- 为高效设备实施加速折旧，不超过30%

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Energy & CO2 taxes 能源和CO2税

- Denmark & Sweden (Energy & CO2 taxes, VAT and Emissions Trading)
- 丹麦和瑞典（能源和CO2税，增值税和排放贸易）
- Netherlands: Regulatory Energy Tax (80% recycled, 20% RUE & RE subsidies – degressivetax i.e. lower rate for larger users, from €0.0654/kWh_e to €0.0005/kWh_e in 2004), Eco-tax, VAT and Emissions Trading. In total taxes are 50% of the household energy bill
- 荷兰：调整的能源税（2004年，80%循环利用，20%补贴 - 递减的税，例如为大用户采取低利率，从€0.0654/kWh_e到€0.0054/kWh_e），生态税，增值税和排放贸易。总税相当于50%的家庭能源支出。

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Energy & CO2 taxes 能源和CO2税

- UK (Climate Change Levy (Energy tax), but doesn't apply to domestic sector, low VAT + Emissions Trading)
- 英国（气候变化杠杆（能源税），但不应用在国内部门，低增值税+排放贸易）
- Germany (Eco-tax, VAT and Emissions Trading)
- 德国（生态税，增值税和排放贸易）
- Finland (CO2 tax)
- 芬兰（CO2税）
- Italy (Electricity tax)
- 意大利（电力税）

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Energy/CO2 taxes tied with long-term agreements 和长期协议结合的能源/CO2税

- Denmark, Sweden, NL (applies to tertiary sector and small businesses) and UK (not households) give reduced taxes to companies that sign-up to long-term energy efficiency agreements
- 丹麦，瑞典，NL（应用在第三产业和小商业用户）和英国（不包括家庭）为签订长期能源效率协议的公司提供减免税

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Market instruments: efficiency obligations and trading schemes – “white certificates” 市场手段：效率义务和贸易计划 - “白色认证”

- White certificate schemes are implemented in the UK (EEC from 2001) & Italy (2001) (France: later in year)
- 实施白色认证的国家有英国（从2001年的EEC项目）和意大利（2001年）（今后法国也将实施）
- Set mandatory energy-savings (efficiency) obligations for energy suppliers
- 为能源供应商设定强制性的节能义务目标

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Market instruments: efficiency obligations and trading schemes – “white certificates” 市场手段：效率义务和贸易计划 - “白色认证”

- Compliance can be by: savings internal to the suppliers operations, savings the supplier implements among their customers, or by purchase of white certificates achieved by other suppliers
- 达到要求的标志：供应商内部的节能，供应商提供给用户的节能，由其它供应商得到的白色认证购买行为
- Typically the savings mechanisms are prescribed (e.g. insulation, high efficiency boilers, CFLs etc.) and costs are transferred to the end-user via the tariff
- 通常，对节能机制进行了规划（例如保温隔热，高效锅炉，节能灯等），并且通过税收将成本转移到了终端用户

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Efficiency obligations and trading schemes: white certificates and emissions trading 效率义务和贸易计划：白色认证和排放贸易

Many practical issues are uncertain about both e.g:

许多实际问题值得讨论

- Which operators should have reduction obligations?
- 哪个环节应该有降低的义务？
- What process should be followed to set the reduction levels?
- 应该采用什么过程来设定降低的水平？
- What baseline should be set against which savings are to be measured?
- 为量化节能量，应该设定什么样的基准？

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Efficiency obligations and trading schemes: white certificates and emissions trading 效率义务和贸易计划：白色认证和排放贸易

- What cap price should be set for the certificates?
- 认证的价格
- How frequently should allocation plans be revised?
- 分配计划更新的频率
- What is the interaction between emissions trading and white certificates?
- 排放贸易和白色认证直接的相互作用

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Innovative instruments 革新手段

- “Feebates” A tax on undesired practice which pays for a rebate for desired practice
- “Feebates”补贴措施
- Feebates have been recently introduced for vehicles (France 2005 imposed a €3500 tax on highest CO₂ emitting SUVs and a €700 rebate on lowest emitting vehicles, California has been considering this approach)
- 在机动车方面引入了“Feebates”（法国在2005年对高排放的多功能运动车征收3500欧元的税，为对排放车提供700欧元的补贴，加州已经在考虑采用这种措施）
- Nobody has tried this for buildings (to my knowledge)
- 对建筑节能还没有尝试（据我所知）

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Energy efficiency agencies or trusts 能源效率机构和信托基金

- Denmark (Electricity Savings Trust from 1997 funded by a levy of DKK 0.006/kWh_e)
- 丹麦（节电信托基金，1997年建立，征税DKK 0.006/kWh）
- UK (Energy Savings Trust, Carbon Trust funded through Climate Change Levy)
- 英国（节能信托基金，通过征收气候变化税建立的碳信托基金）
- Sweden (STEM)
- 瑞典(STEM)
- NL (Novem)
- 新西兰(Novem)

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Energy efficiency agencies or trusts 能源效率机构和信托基金

- France (ADEME – direct grant plus airport noise tax)
- 法国（ADEME）
- Germany (DENA)
- 德国(DENA)
- Italy (ENEA)
- 意大利(ENEA)
- Motiva (Finland)
- Motiva（芬兰）
- ENOVA (Norway)
- ENOVA（挪威）
- EVA (Austria)
- EVA（澳大利亚）

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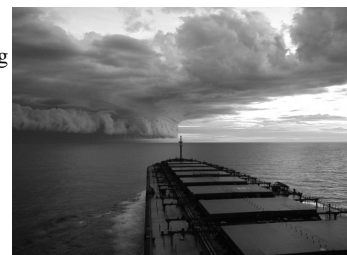


Contacts and more information 联系方式和更多信息

www.iea.org (例如，关于IEA在能源效率方面的出版物)

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