



促进中美省州清洁能源发展合作

——广东省和加利福尼亚州节能与可再生能源政策研究

Promoting China-US Sub-national Cooperation on Clean Energy Development

——Study of Policies on Energy Saving and Renewable Energy
in Guangdong Province and California

2009-11

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本研究由全球环境研究所能效与气候变化项目组完成，众多专家给予了宝贵建议；本文的结论和观点不代表广东省政府和加州政府的立场。

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前 言

全球气候变暖问题日趋严重，中美两国作为温室气体排放和能源消费的大国，如何应对气候变化、共同发展清洁能源，具有特别重要的意义。全球环境研究所于 2007 年 12 月启动了“中美气候变化合作非正式对话项目”，相继促成了两国气候变化高级顾问的两次非正式对话、中国政府代表团参加美国加利福尼亚州（简称“加州”）举办的应对气候变化州长峰会、中美政府间正式对话和《中美关于加强气候变化、能源和环境合作的谅解备忘录》的发布，将能源节约、可再生能源等列为首要的合作领域，并鼓励省州间的政策对话和合作。全球环境研究所基于“广东省能源与环境问题研究”项目以及和广东省政府、加州政府的良好关系，开始探索广东省和加州在清洁能源技术与投资方面合作的可能性，以及适合中美省州合作的模式与领域。

众多学者都认为，有效的政策能够加速技术进步、促进投资。美国卡内基国际和平基金会能源与气候项目主任威廉·钱德勒曾建议，中美两国应以市场为平台，联合采取措施，为低碳能源提供各种经济性的激励政策¹。我们开展本研究，旨在对广东省和加州促进企业投资节能与可再生能源领域的政策进行研究，分析政策面临的挑战并提出改进建议，识别省州企业的合作领域和需要的激励措施。我们真诚感谢加利福尼亚大学的Tristan Mecham和Erica Jue对政策分析提出了诸多建议；同时特别感谢王彦佳教授、许文研究员和Julian L. Wong博士对本报告的贡献。

中国在联合国气候变化峰会上提出，争取 2020 年非化石能源占一次能源消费量比重达到 15%左右。美国《2009 清洁能源安全法案》（草案）也提出了可再生能源发展的中长期目标。省（州）政府需要落实国家的清洁能源战略，并量体裁衣的制定能源政策。我们希望本研究能促使中美省州相互借鉴经验、完善政策，并为今后的技术和投资合作提供基础性的支持。



全球环境研究所执行主任

¹ William Chandler. Breaking the Suicide Pact: US-China Cooperation on Climate Change, Carnegie Endowment for International Peace, Policy Brief No.57, May 2008

Preface

As the two largest emitters of greenhouse gases and two largest energy consumers in the world, joint action by China and the United States can make a tremendous contribution to addressing climate change and developing clean energy. Towards this end, the Global Environmental Institute (GEI) launched a “US-China Track II Dialogue on Climate Change.” project in December 2007. GEI facilitated two informal dialogues between senior advisors to climate issues of the two countries, and subsequently organized the Chinese government delegation to the “Governor’s Global Climate Summit 1” hosted in California. Following the summit, GEI encouraged high-level officials to carry out the diplomatic dialogue and sign the Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and Environment (MOU).

The MOU proposed cooperation on low-carbon energy and establishment of a new mechanism for climate policy dialogue between Chinese provinces and the U.S. states. Based on our previous project of “Research on Energy and Environment in Guangdong Province”, GEI will explore the feasibility of collaboration on technology and investment in energy saving and renewable energy between Guangdong and California where we have established the good relationship with governmental officials and business associations. This experience is valuable to creating appropriate models for future cooperation at the sub-national levels.

William Chandler, the director of energy and climate program of Carnegie Endowment for International Peace, suggested that policy intervention such as fiscal and financial incentives can help elevate energy saving industry². Policy is considered an effective tool to accelerate technology progress and attract private investment. The objective of this report is to give an overview of current policies of Guangdong and California on promoting business engagement in energy conservation and renewable energy. Recommendations for policy improvements are respectively proposed according to different challenges faced

² William Chandler. Breaking the Suicide Pact: US-China Cooperation on Climate Change, Carnegie Endowment for International Peace, Policy Brief No.57, May 2008

by the two countries. It also suggests some potential areas for business cooperation.

The government of China has put forth a general target of increasing the share of non-fossil fuels in primary energy consumption to around 15 percent by 2020. The United States also proposed medium and long-term goals for renewable energy development. In either case, provincial or state energy policy should be tailored to the national strategy. We trust this report will assist the sub-national governments in improving policies and providing the basic information for business.

We sincerely express our gratitude to Wang Yanjia of Tsinghua University, Xu Wen of Research Institute for Fiscal Science of China's Ministry of Finance, Julian L. Wong of Center for American Progress as well as Tristan Mecham and Erica Jue of University of California, San Diego, who dedicated their time and expertise to this report.

A handwritten signature in dark ink, reading "Jim Tjamen".

Executive Director
Global Environmental Institute

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摘 要

2009 年 7 月，中美两国政府签署了《关于加强气候变化、能源和环境合作的谅解备忘录》，欲加强节能与清洁能源技术的联合研发和应用，并推动省州之间开展应对气候变化的务实合作¹。众多学者认为，有效的政策能够刺激投资，加速技术研发与示范推广，增加可再生能源的消费比例。本报告以广东省和加州为例，研究了中美两国及省州政府促进企业投资节能与可再生能源的政策，分析其不足之处和完善方式；并就省州企业的合作领域及需要的激励措施提出了建议²。本报告旨在通过政策研究，促进广东省和加州共同研发清洁能源技术、利用各种可再生能源，以减少温室气体的排放。

首先，从中央和广东省两个层面总结了关于节能与可再生能源的法律法规、规划、能效标准和针对企业的财税激励手段。分析得出，广东省早在 2003 年就颁布了加强节能工作的地方法规，并将可再生能源发电纳入省级“十一五”规划；中央和广东省两级财政提供了可再生能源上网电价补贴、低息贷款、节能专项资金等激励，并对清洁能源领域中的企业给予企业所得税、关税、以及进口环节增值税等方面的税收优惠。

其次，采用案例研究法分析了美国“能源之星”标识、《2005 能源政策法案》和《2007 能源独立与安全法案》，以及加州政府促进太阳能发电、可再生能源分布式利用等项目。研究表明，加州通过可再生能源配额管理、电力价格调控、税款返还和财政补贴等措施吸引私营部门投资，整合公共部门、企业、科研机构等各方资源，促进可再生能源的发展。

再次，比较了中美之间（广东省和加州）政策的特点，分析各自面临的挑战并提出了完善建议。目前，中央及广东省可按照可再生能源的种类出台更具针对性的激励政策；部分财政专项资金的申请程序、补贴方式等需进一步明确；加强对政策的定量化评估，从而避免某些领域的投资集中和产能过剩；增加对清洁能

¹ 《美利坚合众国政府与中华人民共和国政府关于加强气候变化、能源和环境的谅解备忘录》，2009-07

² 本研究由全球环境研究所能效与气候变化项目组完成，众多专家给予了宝贵建议；本文的结论和观点不代表广东省政府和加州政府的立场。

源技术研发的资金支持。美国联邦层面最好出台一个全面、系统的能源发展战略；各州政府（以加州政府为例）尽量避免法规和激励方案的频繁变动，有助于降低企业在新技术和示范工程中的投资风险；增强对跨州基础设施的公共投资和对私营部门的激励。

本研究认为，广东省和加州可以在可再生能源发电，尤其是现代电网建设，以及建筑节能方面加强合作。中外企业如果联合投资于技术研发或工程项目，将有助于分担风险与成本、共享研究成果和经济效益。中美两国及省州政府可通过政策交流，逐步实现能源价格市场化、鼓励多元化的融资模式，共同引导和促进可再生能源市场的发展。

第 1 章 引言

1.1 研究背景

近年来，中美两国都面临着经济发展和温室气体减排的双重压力，能源消费成为核心问题，提高能源利用效率、发展清洁能源以减少化石能源的消耗量，不仅能带来巨大的经济效益，而且对于环境保护意义重大。2009 年 7 月，中美两国政府签署了《关于加强气候变化、能源和环境合作的谅解备忘录》，提出，双方应积极开展政策对话，加强在节能与能效、清洁能源技术的联合研发及应用等领域的合作，并尽可能提供激励措施寻求各级地方政府、企业界、学术界和非政府组织的参与；同时，中美决定建立有效的合作机制，推动省州之间开展应对气候变化的务实合作。

全球环境研究所在洛克菲勒兄弟基金会的资助下，于 2007 年 9 月启动了“广东省能源与环境问题研究”项目。研究得出，广东省是中国经济最发达的省份之一，2007 年，全省生产总值占国民生产总值（GDP）的 12.5%。同时，广东省也是中国能源消费的大省，2007 年的能源消费量占到全国能源消费总量的 8.69%，煤炭和原油分别占一次能源消费的 52.0%和 24.2%³。为实现“十一五”期间全省单位GDP能耗下降 16%和低碳经济发展的目标，广东省亟需提高能效、开发和利用可再生能源，调整能源消费结构。

2008 年 11 月，全球环境研究所和中国政府代表团共同参加了第一届美国州长气候变化峰会（加州峰会），了解到美国众多州都在致力于发展太阳能、生物质能等可再生能源，尤其是加州在清洁能源技术、绿色融资等方面位于美国各州的前列，其政策特点可概括为“胡萝卜加大棒”的方式。2009 年 10 月，广东省深圳市 LED（Light-Emitting Diode）行业代表团在第二届州长气候变化峰会上展示了自己的低碳节能产品与技术。广东省和加州已建立起的良好关系将有助于推动省州在能效技术、绿色投资等方面的深入合作。

在共同应对气候变化问题上，节能与能效技术的创新、可再生能源的开发利用日益受到重视。然而，初始资金需求量大、投资收益不确定等诸多因素很大程度上制约着私营部门在上述领域的研发投入与市场推广。Grubb (2004)^[1]的研究表

³ 广东统计年鉴 2008 (电子版); 国家统计年鉴 2008 (电子版)

明，有效的政策能够推动新技术从实验室走向商业化运用的过程，如图 1 所示。政策干预可分为技术推进和市场拉动两部分：前者是增加新技术的供给，如利用财政资金支持技术研发和示范；后者是为促进市场对新技术的需求，如实施税收优惠和价格补贴等，两种类型的政策往往是相辅相成的。Lüthi, Wüstenhagen (2008)^[2]和 Langniss (1999)^[3]的研究都认为，激励政策能够刺激投资，从而有效地增加可再生能源的市场份额，其主要原因是该类政策能降低投资者的风险。可以看出，政府需要制订有效的政策，结合市场力量，共同推动能源技术革命，促进清洁能源的发展。

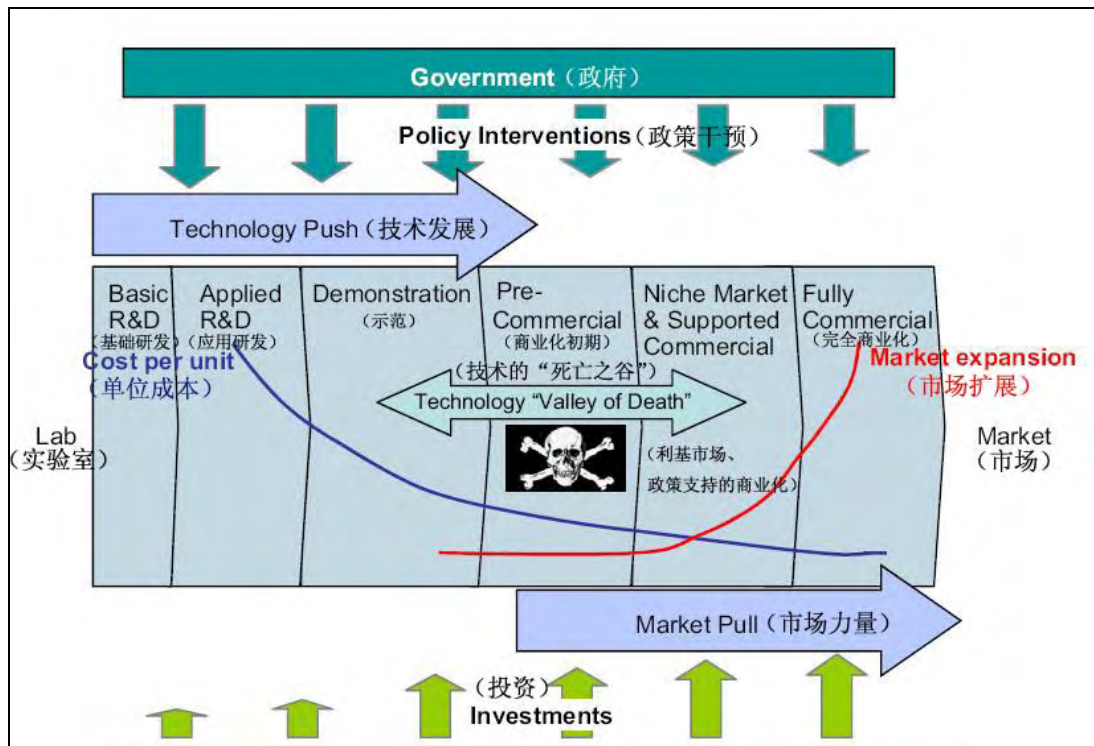


图 1 技术创新链与政策干预 (Grubb, 2004)

1.2 研究目标与思路

(1) 研究目标

本报告旨在系统总结中国中央和广东省、以及美国联邦和加州在促进企业投资节能与可再生能源技术研发和应用的政策；分析政策的不足并提出改进建议；研究企业在节能与可再生能源领域的投资机会和促进合作的政策措施。

（2）研究思路

第 1 章 引言，介绍研究背景、目标与思路，界定研究范围；

第 2 章 中国中央和广东省节能与可再生能源政策，总结国家层面和广东省的法律、规章、发展规划、能效标准以及财税激励措施；

第 3 章 美国联邦和加州节能与可再生能源政策，采用案例研究的方法着重分析美国“能源之星”标识、《2005 能源政策法案》和《2007 能源独立与安全法案》，以及加州促进可再生能源利用的激励计划；

第 4 章 节能与可再生能源政策分析，总结和评述中央及广东省、联邦及加州政策的特点与不足，并提出了改进建议；

第 5 章 节能与可再生能源领域的合作前景，结合省州在节能与可再生能源领域的发展规划，分析中外企业在现代电网发展、建筑节能中的投资机会与适宜的激励政策。

1.3 研究说明

本报告主要分析针对企业的节能与可再生能源政策，包含两方面：一是强制或规范性政策，包括法律、规章、地方法规、发展规划以及能效标准等；二是经济激励性政策，即财政、税收激励措施，包括专项资金、低息贷款和各种税收优惠等。鉴于中美能源管理体制等方面的差异，第 2、3 章将根据中美两国以及省州的特点展开论述。

中国的法律着重于提出节能与可再生能源发展的总体要求和将采用的激励办法，相关部委得到授权后制定配套的实施细则或管理条例，省级人大依据法律和管理需求再制定地方法规。因此，第 2.1 节将从中央和广东省两个层面概述有关的法律法规和标准。第 2.2 节将介绍中国财政和税收两类激励政策，举例说明针对从事节能与可再生能源企业的优惠。

美国的能源法案条款众多、规定详细，涉及的投资预算中包含每个财政年度政府需要拨付的资金。第 3.1 节将对《2005 能源政策法案》和《2007 能源独立与安全法案》中的节能与可再生能源部分进行详细解读。加州通常是先确定可再生能源的发展目标，再逐步制定激励政策，第 3.2 节将着重分析加州政府促进可再生能源发展的激励方案。

第 2 章 中国中央和广东省节能与可再生能源政策

2.1 法规、规划和标准

2.1.1 国家级的规定

(1) 法律、行政法规与部门规章

为促进节能技术研发和工程建设，规范和引导可再生能源市场，中国已颁布了 10 余项法律；最为重要的两项是《中华人民共和国节约能源法》与《中华人民共和国可再生能源法》。

《中华人民共和国节约能源法》（修订版）自 2008 年 4 月 1 日起施行，新的节能法将节约资源、能源确定为我国的基本国策，“国家实行节约资源的基本国策，实施节约与开发并举、把节约放在首位的能源发展战略。”《节约能源法》第 61 条规定，国家通过财政补贴支持节能照明器具等节能产品的推广和使用，发挥财政补贴的作用。

《中华人民共和国可再生能源法》⁴第六章特别制定了经济激励条款，支持可再生能源中的技术研究、标准制定和示范工程等活动；国家对列入可再生能源产业发展指导目录的项目给予税收优惠。正在审议的修订案(2009)草案强调了可再生能源总量目标；建立一个保障性的可再生能源发电收购制度；设立可再生能源发展基金，部分用于附加电价补贴和科技研发。

从 1980 年至今国务院陆续颁布了近 30 条节能行政法规；中央各部门出台的有关节能与可再生能源的部门规章 150 余个，出台规章最多的 3 个部门是国家发展与改革委员会、住房与城乡建设部（前建设部）和交通运输部⁵。

(2) 规划与节能减排方案

国家“十一五”经济与社会发展规划将节能服务产业和环保产业作为未来的发展目标之一。国家发改委根据该规划颁布了《节能减排综合性工作方案》，具体规定了有关节能减排的激励政策。

- 1) 税收政策：要求实行有利于节约能源资源的税收政策，制定节能和资源综合利用（设备、技术）目录及相应税收优惠政策。实行节能项目减免企业

⁴ http://www.mep.gov.cn/law/law/200802/t20080202_117982.htm

⁵ 马中等. 中国节能管理体制报告, 2008-12

所得税及节能专用设备投资抵免企业所得税政策。

- 2) 财政政策：要求安排节能专项资金，用以支持节能技术研究开发、节能技术和产品的示范与推广、重点节能工程的实施、节能宣传培训、信息服务和表彰奖励；
- 3) 金融服务：要求政府鼓励和引导金融机构加大对节能技术改造项目的信贷支持；国有金融机构优先为符合条件的节能项目提供直接融资服务。

《可再生能源发展“十一五”规划》提出，制定可再生能源发电配额制度，完善可再生能源发电电价优惠政策，施行有利于生产和使用可再生能源的税收政策。不符合国家能源规划的建设项目，金融机构不予贷款。

《节能中长期专项规划》提出，国家对一些重大节能工程项目和重大节能技术开发、示范项目给予投资和资金补助或贷款贴息支持。对生产《节能设备（产品）目录》所列节能产品实行鼓励政策。

（3）能源利用效率标准

能源利用效率标准（简称“能效标准”）是国家推进节能建设的重要参考指标和保证。目前，中国已经颁布实施了20余项用能产品的能效标准，涉及家用电器、照明器具和交通工具等，表1列示了部分标准。中国能效标准主要规定的是能效限定值（测试条件下所允许的用能产品的最大耗电量或最低能效值），是强制性标准，未达到能效限定值的产品不允许生产和销售。

表1 中国颁布的一些能效标准

颁布时间	标准名称
2007年	轻型商用车燃料消耗量限值标准（GB 20997）
2005年	公共建筑节能设计标准（GB 50189）
2004年	乘用车燃料消耗量限值标准（GB 19578）
1996年	电焊设备节能监测方法（GB/T 16667）
1995年	热力输送系统节能监测方法（GB/T 15910）
1994年	工业锅炉节能监测方法（GB/T 15317）
1994年	节能监测技术通则（GB 15316）

2.1.2 广东省的规定

(1) 地方法规

《广东省节约能源条例》是广东省于 2003 年颁布的地方法规，鼓励政府部门、企业和终端用户采取各项措施节约用能，并促进太阳能、风能、生物质能等可再生能源的发展。该条例第 22、23 条明确提出，开展节能技术改造以及研制开发节能新技术、新产品的企业享受国家和省的有关优惠政策。

(2) 节能与清洁能源的规划

规划是实施节能管理、发展清洁能源的基础和前提，广东省对能源领域的规划可分为经济与社会发展总体规划和重点专项规划，如表 2 所示。

广东省政府提出了“十一五”期间全省单位GDP能耗下降 16%的目标。2006 年至 2008 年，单位GDP能耗分别比上年下降了 2.93%、3.15%和 4.32%，累计降低了 10.4%，已完成计划的 65%⁶。依据规划目标，广东省积极发展以核电、风电、太阳能为代表的新能源，截至 2008 年底，广东水电、核电、风电发电量分别达到 255.8 亿千瓦时、313.25 亿千瓦时和 6.03 亿千瓦时⁷，清洁能源约占全省总装机容量的 32.5%⁸。

⁶ 广东统计年鉴 2009, <http://www.gdstats.gov.cn>

⁷ <http://energy.people.com.cn/GB/9823476.html>

⁸ 2009 广东低碳经济高峰论坛报告，世界自然基金会和中科院广州能源研究所, 2009-10

表 2 广东省促进节能与清洁能源发展的规划

广东省的规划	对清洁能源发展的要求与激励导向
广东省国民经济与社会发展“十一五”规划 ⁹	<p>加快发展核电，优化发展煤电，适度发展天然气发电和抽水蓄能发电；</p> <p>积极开发利用水能、风能、太阳能等可再生能源，2010 年，清洁能源占全省电力装机容量的 53%；</p> <p>加强省内电网和西电东送电网的建设，形成便于接受外区送电和省内电力交换；</p> <p>能源保障项目重点在核电站、大型风电场以及热电（冷）联产电厂项目等。</p>
广东省能源发展“十一五”规划	<p>一是建立健全能源安全机制，保障能源供应；二是加强节能工作，提高能源效率；三是加大能源污染控制力度，促进能源与环境的协调发展；四是制定激励政策，加快可再生能源发展；五是加强国际和省际能源合作，构建战略合作体系；六是促进能源与装备制造互动发展，形成大能源产业链。</p>
广东省科学和技术发展“十一五”规划	<p>优先发展风力发电技术、太阳能利用技术、节能技术（包括工业节能技术、建筑节能技术、交通系统节能技术、水煤浆技术）、天然气的开发与利用技术、分布式能源系统、生物质能的转化和利用技术、新型电池。</p>
广东省高技术产业发展“十一五”规划	<p>将新能源产业列为省重点发展的高技术产业；</p> <p>政策措施包括：加强产业政策指导；完善投融资政策、拓宽资金来源；加强国际合作，促进本土高技术企业快速发展；加强知识产权和技术标准工作等。</p>

（3）能效标准

广东省积极贯彻和执行各项国家标准，并结合省内经济与能源发展特点出台了一系列地方技术标准，如《〈公共建筑节能设计标准〉广东省实施细则》、《〈夏热冬暖地区居住建筑节能设计标准〉广东省实施细则》、《绿色建筑评价标准广东省实施细则》和《广东省建筑节能检测标准》等。

⁹ <http://www.gd.gov.cn/govpub/fzgh/sywg/0200607260010.htm>

2.2 财政税收的激励措施

2.2.1 财政激励

（一）中央财政的激励¹⁰

（1）对节能与可再生能源的补贴

第一、太阳能光电技术及示范

2009 年 7 月，财政部、科技部、国家能源局联合印发了《关于实施金太阳示范工程的通知》，重点支持用户侧并网光伏发电、独立光伏发电、大型并网光伏发电等示范项目建设，对并网光伏发电项目按光伏发电系统及其配套输配电工程总投资的 50% 给予补助；其中偏远无电地区的独立光伏发电系统按总投资的 70% 给予补助。

2009 年 3 月，财政部发布了《关于加快推进太阳能光电建筑应用的实施意见》，支持太阳能光电在城乡建筑领域应用的示范推广。补助资金支持的项目要求单项工程应用太阳能光电产品装机容量应不小于 50kWp，并优先支持并网式太阳能光电建筑应用项目¹¹。2009 年补助标准原则上为 20 元/Wp。

第二、高效照明产品

2007 年 12 月，财政部、国家发改委联合发布了《高效照明产品推广财政补贴资金管理暂行办法》¹²，对向大宗用户推广高效照明产品的企业，中央财政按中标协议供货价格的 30% 给予补贴；对向城乡居民用户出售高效照明产品企业，中央财政按中标协议供货价格的 50% 给予补贴。

第三、高新技术产品的研发

2007 年 7 月，财政部、商务部制定了《优化机电和高新技术产品进出口结构资金管理暂行办法》，专项资金用于资助机电和高新技术产品公共服务平台建设及共性技术研发项目，其中包括节能和新能源项目，实行按比例拨付资金的方式，但不超过项目实际投资的 50% 。

（2）低息（贴息）贷款

2008 年 10 月，财政部制定了《再生节能建筑材料财政补助资金管理暂行办法》。中央财政安排用于支持再生节能建筑材料生产与推广利用，主要包括：再生

¹⁰ 本小结根据财政部网站的部分资料整理而成，更多信息参见 <http://www.mof.gov.cn/mof/>

¹¹ 详见《关于加快推进太阳能光电建筑应用的实施意见》，财建[2009]128 号

¹² http://nmg.mof.gov.cn/jinjiqianshesi/zhengwuxinxi/zhengcefagui/200805/t20080523_34112.html

节能建筑材料企业扩大产能贷款贴息；再生节能建筑材料推广利用奖励；技术标准、规范研究与制定等。

（3）节能产品政府采购

为了扩大节能产品政府采购范围，确保节能认证产品的有效性和准确性，财政部、国家发改委不断调整《节能产品政府采购清单》，最近于 2009 年 6 月发布了《节能产品政府采购清单》第六期。目前的节能产品类包括空调机、照明产品、冰箱以及计算机、打印机等多办公设备。各级国家机关、事业单位等用财政性资金进行采购的应当优先采购节能产品。

（二）省级财政的激励

（1）“能效电厂”项目低息贷款

广东省于 2006 年申请使用亚行贷款开展“能效电厂”项目，历经 3 年多的探索，第一期能效电厂试点项目已于 2009 年初启动，目前与广州智光电气股份有限公司等 7 家子项目单位签约，贷款金额 3500 万美元，第二期的项目贷款规模将增至 6500 万美元。广东省财政厅承接亚行贷款后，转贷给对用电设备进行节电改造或采用节能新技术的项目单位，转贷利率在国内商业银行 6 个月贷款利率的基础上下浮 10%。

据测算，已签约的子项目全部实施完成后，年节电量将达 2.16 亿千瓦时，每年可节约 7.16 万吨标准煤；若将 1 亿美元贷款全部用于节能项目后，年节电量约为 6 亿千瓦时。

（2）节能专项资金

广东省财政厅与经贸委发布了《关于组织申报 2008 年省节能专项资金项目的通知》（第二批），安排节能专项资金支持节能重点工程和项目。此专项资金面对节能技术改造项目（项目实施后年可实现节能在 2000 吨标准煤以上、1 万吨标准煤以下）改造项目按节能量来实行奖励，奖励标准为 200 元/吨（\$29.4/吨）标准煤。此节能资金是中央政府对节能项目（年节能量 1 万吨标准煤以上）奖励很好的补充¹³。而且，为了支持能源服务公司的发展，《通知》明确提出：对采取合同能源管理模式实施的节能技术改造项目，由实施合同能源管理单位提出申请，奖

¹³ 国家节能技术改造财政奖励项目的范围：《“十一五”十大重点节能工程实施意见》（发改环资[2006]1457 号）中确定的燃煤工业锅炉（窑炉）改造、余热余压利用、电机系统节能和能量系统优化等

励资金的 70%奖励给实施合同能源管理单位，30%奖励给终端用户¹⁴。

节能奖励措施在实现环境效益的同时为企业带来了经济效益，促进企业实施节能项目。例如，对一条水泥生产线（2000 吨/天）实施纯低温余热发电的技术改造，设计该余热发电站装机容量为 4.5 兆瓦，需投资约 3000 万元。以建成后发电量 3.5 兆瓦、年平均发电 7000 小时、发电标准煤耗 332g/KWh¹⁵计算，企业每年可节省 8134 吨标准煤，约获奖金 162.68 万，相当于总投资的 5.42%，具有一定的激励作用。

（3）清洁生产联合行动

2007 年，广东省进一步加强了“清洁生产联合行动”，省级财政给予资金支持，鼓励开展清洁生产国际技术交流与合作，引进国外先进的清洁生产技术和设备；对符合条件的清洁生产项目优先推荐为国家节能重点项目，争取国债支持。政府采购和招标优先考虑清洁生产企业标志产品¹⁴。

2.2.2 税收激励¹⁶

（一）企业所得税

考虑市场竞争的公平性原则，中国自 2008 年 1 月 1 日起实行内外资企业所得税的统一；在此基础上，国家和广东省近年来颁布的促进节能和清洁能源发展的税收政策中，基本上不区分中资和外资企业，优惠条款的适用只在企业的生产和经营领域有所限定。

第一、《企业所得税》的优惠条款

- 1) 企业从事符合条件的环境保护、节能节水项目的所得，从项目取得第一笔生产经营收入所属纳税年度起，第一年至第三年免征企业所得税，第四年至第六年减半征收企业所得税。
- 2) 企业所得税法第三十四条所称税额抵免，是指企业购置并实际使用《环境保护专用设备企业所得税优惠目录》、《节能节水专用设备企业所得税优惠目录》和《安全生产专用设备企业所得税优惠目录》规定的环境保护、节

¹⁴ 广东省能源与环境问题研究项目报告书，全球环境研究所，2008-12

¹⁵ 中国电力统计年鉴 2007，2006 年广东省的发电标准煤耗为 332g/KWh

¹⁶ 本小结根据国家税务总局网站的部分资料整理而成，更多信息参见 <http://www.chinatax.gov.cn/n8136506/index.html>

能节水、安全生产等专用设备的，该专用设备的投资额的 10%可以从企业当年的应纳税额中抵免；当年不足抵免的，可以在以后 5 个纳税年度结转抵免。

- 3) 国家需要重点扶持的高新技术企业，减按 15%的税率征收企业所得税。其中，高新技术企业的认定依据《高新技术企业认定管理办法》和《国家重点支持的高新技术领域指引》¹⁷，《指引》第六章专门列出了各项“新能源及节能技术”，因此，针对高新技术企业的优惠政策一般适用于节能与新能源发展的企业。
- 4) 依据国务院《关于经济特区和上海浦东新区新设立高新技术企业实行过渡性税收优惠的通知》¹⁸规定，“5+1 地区”（深圳、珠海、汕头、厦门和海南五个经济特区和上海浦东新区）内新设立的高新技术企业，还可以享受“两免三减半”（自取得第一笔生产经营收入所属纳税年度起，第一年至第二年免征企业所得税，第三年至第五年按照 25%的法定税率减半征收企业所得税）的定期税收优惠。

第二、广东省的具体措施

关于税收政策的制定，广东省首先要遵循《企业所得税》的条款；在财政部与国家税务总局授权的范围内，制定符合省内经济特点的税收政策。例如¹⁹：

- 1) 在沿海经济开发区和经济技术开发区所在城市的老市区设立的从事技术密集、知识密集型项目以及能源、交通、港口建设项目的生产性投资企业，减按 15%税率征收企业所得税；
- 2) 设在国务院规定的“5+1”地区从事能源、交通、港口码头等基础设施项目的外商投资企业，经营期在 15 年以上的，可从获利年度起，5 年免征、5 年减半征收企业所得税；

（二）关税和进口环节增值税

根据《财政部 国家发展改革委 海关总署 国家税务总局关于落实国务院加快振兴装备制造业的若干意见有关进口税收政策的通知》，自 2008 年 1 月 1 日起，

¹⁷ http://www.most.gov.cn/zfwj/zfwj2008/200804/t20080428_61006.htm

¹⁸ http://www.gov.cn/zwgk/2007-12/29/content_847079.htm

¹⁹ <http://www.zhaoshangyinzi.com/zhengcefagui/2009/06/06/1305/>

对国内企业为开发、制造大功率风力发电机组而进口的关键零部件、原材料所缴纳的进口关税和进口环节增值税实行先征后退，所退税款作为国家投资处理，主要用于企业新产品的研制生产以及自主创新能力建设。

对符合《外商投资产业指导目录》²⁰鼓励类，并转让技术的外商投资项目，在投资总额内进口的自用设备及按照合同随设备进口的技术及配套件、备件，除《外商投资项目不予免税的进口商品目录》（共 20 种）所列商品外，免征关税和进口环节增值税²¹。

值得注意的是，外商投资企业采购国产设备增值税退税政策是在生产型增值税和对进口设备免税的背景下出台的。但从 2009 年 1 月 1 日，全国范围内实行了增值税转型，新购进设备所含的进项税额可以计算抵扣，即企业购买设备，不管是进口的还是国产的，其进项税额均可以抵扣。因此，增值税转型后，原有的这些政策正逐步取消。

²⁰ 国家发改委于 2007 年修订了《鼓励外商投资产业目录》，其中有关节能与新能源发展的产业涉及“煤洁净燃烧技术电站的建设、经营，新能源电站的建设、经营（包括太阳能、风能、磁能、地热能、潮汐能、生物质能等），节约能源开发技术、资源再生及综合利用技术等”。

²¹ 国家科学技术部、商务部联合发布了《鼓励外商投资高新技术产品目录》，该目录是在《外商投资产业指导目录》的基础上，为进一步突出国家鼓励外商投资高新技术产业而制定的。其中有一类专门设为“新能源与高效节能”产品。

第3章 美国联邦和加州节能与可再生能源政策

3.1 法律和标准

3.1.1 “能源之星”标识

“能源之星”标识项目（“ENERGY STAR” Program）²²是国际上关于节能的自愿性协议，最早由美国环境保护署于 1992 年颁布实施的。该能效标识项目经历了几个阶段，目前有 40,000 余种产品获得了“能源之星”标识，包括家用电器、电子产品、办公设备以及照明器具等。从 1995 年开始，节能的新建住宅和家庭供冷、供热系统也可获得“能源之星”标识。此外，一些金融机构还为购买“能源之星”认证的房屋的居民提供抵押贷款服务。在美国，该能效标识项目在节约能源方面取得了显著效果。根据美国环保署的统计，仅 2006 年就节省能源成本约 140 亿美元。

2007 年，加州能源委员会对能效标识中的部分条款做出了强制性规定，如加州根据自己的人口规模、经济发展状况制定了轿车的尾气排放标准，随后联邦政府也根据加州的标准出台了国家标准。而且，能效标识项目中的一些标准也成为了制定国际能效标准的基础。

3.1.2 2005 能源政策法案

《2005 能源政策法案》是一项有关能效和清洁能源发展的重要法案。该法案共包含六大部分，能效与可再生能源被列为第一、二部分，其它部分涉及石油、天然气、煤等传统能源。《2005 能源政策法案》中涉及能源效率的量化指标有 40 余项，包括联邦政府建筑节能指标、州节能指标、风能热效率指标等，配套了经济激励性或惩罚性的保障措施。

能效部分又分为联邦项目、能源资助与州项目、能效产品等章节，近 50 个条款，各种激励措施以具体项目的形式给出较为详细的规定。可再生能源部分则按照新能源的种类细分为生物质能、地热能、潮汐能、水能等，针对每一种能源的自然属性特点和国内的技术发展阶段制定强制定条款和激励措施。积极发展可再生能源的目的是减少对化石能源的消耗，一方面降低能源的对外依存度，另一方

²² <http://www.energystar.gov/>

面，减少化石能源燃烧产生的温室气体排放等环境影响。以下是部分具体的激励条款：

- 第 104 节-节能产品的政府采购，规定政府必须购买带有能效标识（“能源之星”）的产品；如果需采购的物品未列入能效认证范畴，政府应当购买同类产品中的节能产品。
- 第 140 节-能效示范项目，联邦政府应当为电力、天然气等示范项目提供财政资助，并列出了多种资助方式，如每个财政年度的预算额均按照相关条款中的详细规定予以拨付。
- 第 809 节-有关氢燃料的标准，能源部应当与科研机构、公共服务部门、相关政府机构联合制定发展氢能的安全标准。同时，能源部要努力促进各部门间的信息交流与共享。该小节还包含了联邦政府于 2020 年前的财政年度需要拨付的预算资金。
- 第 911 节-能效，能源部可直接参与建筑、交通和工业领域先进的、成本效益高的节能技术研发和示范工程，其目的是降低美国的能源需求，尤其是对国外能源的依赖。实施这些能效项目的另一目的是降低能源利用成本，保障能源安全，使经济更有竞争力，减少能源利用所产生的环境影响。同样，该小节中包含财政预算条款。例如，2007 年（财政年度）拨付 78.3 亿美元，2008 年（财政年度）拨付 86.5 亿美元，2009 年拨付 95.2 亿美元等。
- 第 912 节-先进照明技术，美国能源部应当促进先进照明技术的研发、示范和商业化应用，通过激励措施推动技术研究团队、企业、国家实验室以及高校的合作。

《2005 能源政策法案》制定了一系列有利于提供能效的经济激励性措施。例如，法案对高能效的电冰箱、洗衣机等产品制造商依据节能量给予税收返还或其它形式的优惠。例如，能耗低于联邦最低能效标准 25% 及以上的电冰箱生产商可得到 \$175/台的补贴，该金额约占电冰箱成本（\$800-\$1200）的 15%-20%。符合“能源之星” (2007) 标准的洗衣机制造商可获得 \$100/台的税款返还，该激励平均可抵消生产成本的 10%。

3.1.3 2007 能源独立与安全法案

《2007 能源独立与安全法案》²³是在《2005 能源政策法案》部分条款基础上发展而成的。该法案由提高机动车燃油经济性（制定燃油经济性标准、促进技术升级等）、增加生物燃料的供应（可再生能源比例、生物燃料的研发、生物燃料生产的基础设施等）、提高电器和照明系统能效、建筑与工业节能、政府与公共机构节能、加速技术研发（太阳能技术、地热能技术、能源存储等）、碳捕获与存储、完善能源政策、国际能源合作、交通节能、智能电网等十六部分组成；联邦与州政府所要实行的激励项目均有明确的规定。

以部分条款为例：

- 第二章中，增加生物燃料的供应量：不断提高能源消费结构中生物燃料的利用比例，规定由 2008 年的生物燃油为 90 亿加仑，并逐步提高，在 2036 年时达到 360 亿加仑。而且，从 2016 年起，不能再利用玉米淀粉等粮食作物生产生物燃油，而要以木素纤维等作为生产原料。生物燃料的整个生命周期必须降低 20% 的温室气体排放。
- 第四章中，国际能源合作：美国国际发展署将推动能效与清洁能源技术在其它国家的应用。第 912 节提到，向中国出口清洁能源与能效技术，以及加强发展中国家的能力建设以更好的应用这些技术。第 914 节提到，以提供更为灵活的融资、保险以及关于投资环境的信息等，鼓励拥有高效清洁能源技术的美国企业到海外投资。
- 第六章中，加速太阳能利用技术：第 602 节要求能源部设立有关热能储存的研发项目，以降低太阳热能储备技术的成本，实现根据用电需求进行发电负荷的转换和延长太阳能发电厂的运行时间。能源部在 2008 财政年度会专项拨付 500 万美元实施该项目，以后每财政年度会增加 200 万美元的预算，至 2012 年达到 1200 万美元（2011 财政年度为 1000 万美元）。
- 第十三章中，智能电网：国会必须认识到升级国内电网系统的必要性，以实现稳定、安全、高效的电力传输；规定了智能电网的联合运营方式，强调要整合政策、资金和技术共同推动智能电网的发展。

²³ http://en.wikisource.org/wiki/Energy_Independence_and_Security_Act_of_2007

3.2 加州的激励政策²⁴

加州的能源政策与规划由加州能源委员会负责制定。该委员会成立于1974年，总部设在加州首府——萨科拉曼多，主要职责为预测加州的能源需求，制定能效标准体系，并支持可再生能源技术。具体的措施如下：

(1) 太阳能上网电价

加州于2006年9月实施的上网电价政策²⁵旨在促进可再生能源的应用。上网电价政策适用于任何可再生能源，它以加州电力委员会推荐的市场价格为基础，在用电高峰期间（上午8点至下午6点）为太阳能发电提供更高的上网电价。上网电价政策允许小于1.5兆瓦的小型发电用户与电网公司签订10年、15年或20年的合同，将多余发电量卖给电网公司。实践表明，该激励政策促进了太阳能的利用。

(2) 太阳能利用的房产税豁免

加州对安装太阳能利用系统的用户将免除其增加的房产税²⁶，但对于游泳池和浴池的太阳能热利用不予以豁免。从1999年1月1日至2016年12月31日，凡是由具备资质的承包商安装在住宅、商业和工业建筑上的太阳能利用系统，均可全额免除附加房产税。

(3) 加州太阳能计划²⁷

加州太阳能计划由加州公共事业委员会监督实施。该计划在2007年至2016年期间，向负责安装太阳能系统的私营投资者提供激励，预算总额约21.67亿美元。太阳能计划的目标是2016年年底实现1,940兆瓦的太阳能装机容量，其中1,750兆瓦来自普通的市场需求，190兆瓦来自低收入家庭项目。另外，电网传输系统的不断完善将进一步促进加州对传统化石能源的依赖。

(4) 新建住宅太阳能发展计划²⁸

该计划仅针对新建筑，包括公寓和低收入住宅，资助金额依据建筑规模而定，从1千瓦的太阳能发电机组至覆盖整幢楼电力需求量的发电机组均可申请。自备发电设备（也称分布式发电装置，DG）必须经过管理机构的审核、认定才能纳入

²⁴ 根据加州能源委员会网站资料整理而成，更多信息参见 <http://www.energy.ca.gov/>

²⁵ <http://www.cpuc.ca.gov/PUC/energy/Renewables/feedintariffssum.htm>

²⁶ 加州的房产税按年度缴纳，税基为评估的房屋价值；一般而言，安装太阳能利用系统会提升房屋价值。

²⁷ California Solar Initiative, <http://www.cpuc.ca.gov/PUC/energy/solar>

²⁸ <http://www.gosolarcalifornia.ca.gov/nsdp/index.html>

该项目范畴。整个计划设计期限为 10 年，将提供总额 4 亿美元的专项资金，目标为在 2016 年实现新建住宅的 50%均采用太阳能发电。如果一户住宅包含六个或以上房间，所安装的太阳能发电设备要至少满足住宅总用电量的 50%。对单个建筑的资助额度与太阳能计划等同，对于低收入住房用户将提供额外的 3.50/W 补贴。

(5) 可再生能源发展项目²⁹

加州能源委员会实施可再生能源发展项目是为通过市场机制促进可再生能源分布式利用技术的推广，主要方式是对安装符合条件的可再生能源发电系统的用户提供一定比例的资助，以降低初始投资成本。

该项目包含太阳能光伏、风能和燃料电池发电系统。其中，对风能和燃料电池发电系统的激励始于 2007 年 1 月 1 日，符合资助条件的技术有两类：一是额定功率小于 50 千瓦的小型风轮机，二是氢气等燃料电池。太阳能发电项目则通过“加州太阳能计划”来具体实施。

(6) 自备发电设备激励项目³⁰

加州各部门采用风能、燃料电池以及先进储能技术且符合规定的发电设施都可以申请该笔专项资金。例如，风能发电可获得\$1.50/W 的补贴，如果使用的风机设备出自加州的制造商，可额外获得 20%的补贴（\$0.30/W）；相比风机的安装成本（约\$2.40/W），补贴所占的比例较高。燃料电池依据能源生产所采用的电池类型可获得\$2.50/W 至\$4.50/W 的补贴；应用于特定设备或系统的储能技术可得到\$2.00/W 的资助。

对某一项目的资助比例依据发电量规模，以风能发电为例，第 1 兆瓦将获得 100%的补贴资助，以后每一兆瓦获得的资助以 50%的速率递减，即 1 至 2 兆瓦之间的发电量获得\$1.50/W 补贴的 50%（即\$0.75/W），2 至 3 兆瓦之间获得 25%的资助（即\$0.375/W），依次类推，最高限定为 5 兆瓦的发电机组。如果要获得五年的合同担保，要求发电项目的年发电量不得低于最初设计水平的 90%，该担保要涵盖工资和零部件更换的成本。

(7) 能效建筑的低息贷款

该项目³¹的设计旨在提高加州的建筑能效。符合贷款条件的建设项目仅限于公

²⁹ http://www.energy.ca.gov/renewables/emerging_renewables/index.html

³⁰ <http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/index.htm>

³¹ <http://www.energy.ca.gov/efficiency/financing/index.html>

共部门，包括学校、地方政府的办公楼以及公共医院。项目的全部投资额均可申请这笔资金，但是单个建设项目的贷款额度最高为 **300 万美元**，能效融资项目的总贷款金额为 **2400 万美元**，部分节能收益用于偿还贷款。贷款利率固定为 **3%**，低于加州普通的商业贷款利率（现行长期贷款利率约为 **5.25%**）。

第4章 节能与可再生能源政策分析

4.1 政策的特点比较

4.1.1 中央和广东省的政策小结

法规标准上，广东省政府在《节约能源法》的指导下，早在2003年就颁布了《广东省节约能源条例》，是国内最早以立法形式重视节能工作的省份之一。广东省严格执行国家制定的各种产品、设备、系统的最低能源效率标准，并配套出台省内的管理细则。针对可再生能源，广东省的立法机关（广东省人大常委会）尚未制定地方法规予以规范。广东省政府制定了多项有关能源技术与市场应用的规划，这些政策性文件在短期能起到引导作用；但从长期来看，规划在权威性和强制性方面相对较弱，不能代替地方法规^[5]。

财政激励上，中央和广东省两级财政均对节能与可再生能源的投资提供了多项资金支持。主要概括为四方面：第一、财政补贴，主要针对新技术的示范性工程，如对用户侧并网光伏发电、大型并网光伏发电等示范项目按总投资额予以一定比例的补贴；第二、低息（贴息）贷款，如亚行贷款“能效电厂”项目，支持终端用能单位的节能设备改造与节能新技术的应用；第三、价格调控，对利用风能发电给予优惠的标杆上网电价，理论与实践均表明，价格政策有助于降低成本，效果显著；第四、政府采购，我国的政府采购清单主要针对节能产品，实际上，政府支持的技术研究和开发活动也可纳入采购范畴。

税收激励上，中央主要制定了节能和资源综合利用（设备、技术）目录及企业所得税减免、设备投资抵扣等优惠；根据《外商投资产业指导目录》，实行关税、进口环节增值税的减免，鼓励先进节能技术、设备及零配件的进口。广东省积极贯彻、执行各项税收政策，并结合省内的经济发展现状与目标，补充完善了相关优惠措施，例如，对符合产业政策的高新技术企业（含节能与可再生能源领域）给予更长期限的企业所得税减免等。

4.1.2 联邦和加州的政策小结

美国联邦层面的能源政策以法律手段结合经济激励等全方位措施吸引投资，整合公共部门、企业、科研机构等各方面的资源。以《2005能源政策法案》为例，

法案涉及能源的生产、储运、高效利用、新技术研发以及创新激励等各个环节，并注重完善税收减免、宣传教育等配套措施，对于各种能源形式统筹兼顾、规定详细，最大程度的考虑了法律的实施^[6]。

加州能源委员会也制定了符合本州特点的能源政策与规划，包括建筑能效标准等强制性规定，以及上网电价等激励性措施。

（1）可再生能源配额标准

根据加州的可再生能源配额标准，截至 2010 年，可再生能源的消费比例将提高至能源消费总量的 20%，并强制性要求发电厂有一定比例的发电量来自可再生能源，如风能，太阳能和地热能等。这些标准有助于能源供应企业掌握明确的信息，从而做出成本效益高的决策。此外，联邦政府对生物燃料的使用量也有类似的配额标准。

（2）电力价格调控

对于促进可再生能源发展的价格政策有两类：一是上网电价，即电网公司对于小规模企业或个人利用可再生能源产生的发电量支付高于平均价格的电价，由终端用户节能带来的利润或财政补贴等各种形式来弥补电网公司的损失；另一方面，加州政府对某些燃煤等低效运营的电厂按其发电量进行征附加税，以此将使用化石燃料产生的环境成本计入电价。

（3）降低成本政策

任何新技术的开发都需要投入较多的初始资金，现阶段生产和利用可再生能源的成本往往高于传统能源。因此，通过有效的政策来降低成本、增加企业利润是一项切实可行的措施。在加州，税款返还和补贴是较为常用的方式，例如，对用户用太阳能光伏发电设施的安装给予一定的补贴，使其成本可被普通的居民用户接受。为可再生能源项目提供政府担保贷款或低息贷款是另一种形式，一般对单个建设项目都设有贷款额度上限，以规避风险。

4.1.3 中美政策的特点比较

（1）强制性政策的比较

中国的节能与可再生能源法律着重论述重要性和必要性，对于激励条款的执行方式、优惠程度等内容需要由相关部门出台实施细则。各级政府制定的规划影

响着能源发展，政府会通过合理配置公共资源和有效运用行政权力，来实现规划提出的目标和战略。例如，广东省政府就将节能与可再生能源的发展纳入了省级能源发展“十一五”规划，归为能源战略的重要组成部分。

相比之下，美国的能源法案既有宏观性的论述，又有对政策实施方式的规定，每一项激励条款都有明确的界定，包括每年的财政预算，具有很强的可操作性。除了对产品和服务等实行最低能源效率标准外，法律还规定了惩罚性措施，以限制销售非节能的产品。

（2）经济激励性政策的比较

广东省政府启动了节能产品认证工作，并积极开展各种形式的节能技术改造项目，鼓励企业进入高于平均能效水平的行列。其次，广东省财政厅通过财税和金融政策，积极吸纳企业参与节能与可再生能源技术的研发与市场化应用。总体而言，广东省的节能与可再生能源政策日益重视指令性与经济激励性的结合，不再是单一的政府主导，逐步转向了“发挥市场的基础性作用，政府通过多种途径加以引导”的工作思路。

在加州，政府的角色是一个促进者，而非强制者，重点在于建立和完善促进节能与可再生能源发展的市场机制。政府利用公共财政制定基于市场的约束与激励性措施，以强制性的法规和财税优惠共同来规范和引导市场主体的投资。而且，加州注重财税政策的协调性和配套措施的完整性，通过各类激励计划的综合实施来达到能效目标。

据已有研究，两国的电价政策存在差别^[7]。首先，美国的电价政策依据清晰的能源种类划分，覆盖了各种可再生能源发电技术；而中国仅对风电、水电、生物质发电项目有较为明确的上网电价政策，覆盖面需要拓宽。其次，自2009年4月，美国11个州都在陆续立法将上网电价政策作为一项鼓励可再生能源发电的措施^[8]；而中国目前仍由国家发改委出台有关上网电价的规章，未形成法律条款（审议中的可再生能源法修订草案正在讨论是否纳入该项政策）。

4.2 政策存在的问题

4.2.1 中央和广东省政策面临的挑战

第一、政策的激励重点不够突出：各类规划的激励条款较为笼统，尚未按照能源种类出台针对性的措施。政策的制定一般滞后于市场的发展；在实践中，可再生能源产业属于新兴市场，其快速、多样化的发展客观上为政府制定有效的政策增加了难度。中国近年来在可再生能源领域发展迅速，尤其是风电场建设和太阳能光伏、光热设备制造的规模逐年扩大；而中央与地方的可再生能源产业政策和保障措施都相对滞后，尚未形成完整的体系。

第二、政策的可实施性不够强：支持节能与可再生能源发展的财政专项资金和补贴的种类繁多，部分专项资金的申请程序、补贴的标准和方式等内容模糊。一些企业由于缺乏对政策的敏感度和较为专业的解读、分析能力，往往延误申请时间或者遗漏必要的申请材料而不符合申请程序，以致无法享受各种优惠，中小企业在这方面的劣势更为明显。

第三、政策的配套措施不够完善：对于政策效果缺乏一些定量化的评估和预测，对必要的配套性措施考虑不足。以可再生能源发电产业为例，多项激励政策的实施使得大批企业因为追逐高利润而迅速进入该领域，在一段时期内突然增加新能源的发电量，而电网建设滞后，既造成能源浪费又带来企业亏损；事实上，电力供应涉及发电、输电、配电、供电等多个环节，激励政策不能只着眼于发电环节。又比如，风能发电的产业规划应当包含在风机设备、发电技术、标准制定以及风能服务等各领域投资；但目前，政策引导下的投资过度集中于风机制造，重视风电装机容量的扩大而忽略了发电量的实际利用效率，这种不平衡会阻碍风能产业的发展。

4.2.2 联邦和加州政策的不足之处

首先，尽管美国各州近年来纷纷强调可再生能源的发展，减少对化石能源的依赖；但在联邦层面，美国缺乏一个全面、系统的能源发展战略（《清洁能源安全法案》尚在审议中）。该战略的缺失往往导致了联邦政府的各部门支持不同的，甚至是截然相悖的能源技术及能源发展路线。企业由于难以判断未来的政策，很难对能源市场做投资决策。加州虽然制定了自己的能源发展规划，但其对市场的推

动作用和筹资力量远比不上联邦的战略。

其次，美国各州均制定了一系列有关能效与可再生能源发展的法规，种类繁多且无统一性。美国近30个州都出台了可再生能源配额标准（Energy Renewable Portfolio Standards），即要求可再生能源在本州的能源供应中达到一定比例，部分州对电力供应商也规定了可再生能源在其电源结构中的最低限，但各州的标准之间有较大差别。由于资源禀赋的区别，上述差异是难以避免的，但这种差别很可能阻碍了电力供应商的跨州贸易。

再次，联邦层面对于跨州基础设施建设的公共投资及对私营投资的激励不足，如各州的电网之间难以衔接，现有的输电网络无法使由可再生能源产生的发电量全部上网。跨州的电网等基础设施建设需要统筹协调各州不同的法律、标准以及经济、自然环境，投资成本相对很高，在缺乏有效激励的情况下，私营部门的资金难以进入该领域。

最后，联邦和加州促进能效提高与可再生能源发展的激励政策尚不能满足需求，有待进一步加强。清洁能源技术的研发和示范项目需要投入大量的资金，而技术的各发展阶段更需要不同的激励工具。目前，私营部门在申请公共资金时会遇到繁琐且风险较高的融资程序，这阻碍了技术从实验室到商业化应用的过程。相反，如果提供足够且适当的激励措施来降低新技术的成本，使其具有市场竞争力，会加速它的发展。

4.3 经验借鉴与政策建议

4.3.1 中央和广东省政策的完善建议

目前，发展可再生能源及节能的技术、产品和服务已经成为各国能源战略的重点。多数能源政策中都包含了针对上述领域的法律法规、战略规划以及投资激励，政策制定和实施的成功经验值得中国借鉴与学习。以美国为例，可再生能源政策的特点概括为“胡萝卜加大棒”：一是实施能效标准，并通过立法授权相关部门严格执行强制性的标准，联邦的法案条款详细、可操作性和针对性较强；二是在州层面，如加州能源委员会，制定和实施综合的财政激励方案，促进能源生产商、自备发电设备的用户、当地政府等各利益相关主体同时采取行动以实现可再生能源的发展目标。

建议广东省政府在借鉴美国加州经验的基础上，结合省内的经济发展现状和能源需求特点制定切实有效的激励政策，促进企业参与节能与可再生能源的技术创新与项目开发。具体措施为：

- 增强政策体系的针对性和完整性

按照可再生能源的属性和技术的发展阶段制定不同的激励政策，增强针对性。逐步健全能效标准体系，减少各项政策的执行成本。例如，对于燃油经济性标准、住宅能耗标准等，刚性基准和弹性条款要有机结合，为企业进行技术改造和生产线调整提供依据和时间表。能效标准是目前国际上普遍推崇的一种行之有效的政策，根据国际能源署的统计，截至 2006 年，全球已有 34 个国家采用了较为完备的能效标准体系。

- 提高法规和各种激励方案的可操作性

各单项政策之间，包括国家法律与广东省规章之间、省内不同政府部门颁布的激励政策之间要协调统一。明确企业申请优惠的条件、流程，制定合理、规范、简洁的审批程序。而且，政府制定政策时要尽量降低中小企业的执行成本，创造公平的市场竞争环境。通过政府网站等渠道及时公布各种新政策，对于无法执行或不符合发展现状的政策要予以修改。

- 加强政策的成本效益分析和量化评估

加州能源委员会根据 2002 年的条例，每两年会编制一份综合能源政策报告，对能源产业及能源需求、价格等各方面进行评估和预测³²。广东省政府可以借鉴这方面的经验，在政策制定过程中要有利益相关方的广泛参与，尤其要征询相关企业的意见，对各种备选方案进行成本效益分析，根据预测结果，及时出台配套的保障措施。政策的有效性需要用清晰的评价指标和方法加以衡量，以确定是否实现了预期的政策目标；而且，在实施环节也要有定期的信息反馈，以修订不符合发展现状的政策。在此问题上，中国风能协会副会长马学禄³³曾呼吁政府要系统的规划风能产业，而非仅重视风电设备制造，使投资能产生长远的经济和环境效益。

- 增加技术研发阶段的财政资金支持

技术周期包括研发、示范、推广、扩散、商业化应用五个过程³⁴。而绿色技术

³² The California Energy Commission, http://www.energy.ca.gov/2009_energypolicy/index.html

³³ <http://www.chinadaily.com.cn/bizchina/2009-09/11>

³⁴ UNFCCC, Expert Group on Technology Transfer, Recommendations on future financing options for

的投资特点是初始资金需求量大而投资回收期长^[9]，这往往限制了私营资本的介入，因此，财政资金的支持显得尤为重要。由上文分析可知，现有的激励政策集中技术的示范与市场推广阶段，很少涉及研发。中央和广东省政府都要适当增加针对可再生能源技术基础性研发的专项资金，增强国内企业在该领域的核心技术和关键设备的制造能力。

- 促进企业开展自愿节能与技术创新

鼓励企业自愿采取节约能源、提高能效、减排温室气体等方面的行动，如鼓励企业与政府签署节能自愿协议，由第三方进行定期的评估审计，对完成减排目标的企业给予表彰或某种形式的奖励。此外，加强对能效认证的宣传，使公众清楚了解各类产品的能耗水平，形成政府导向、市场驱动、公众参与的机制，促进生产模式和消费模式的转变。

4.3.2 联邦和加州政策的改进建议

- 建立联邦层面的、系统的能源发展战略

美国联邦政府需要颁布一项综合、全面、系统的清洁能源发展规划，指导各州制定和实施其能源战略。联邦层面的规划有助于协调各州不同的发展定位，避免重复性的开发、建设。在此基础上，加州可以根据自身的资源禀赋特点 and 经济发展需求，选择适宜的清洁能源产业，出台有针对性的激励政策，促进企业积极开展投资与贸易。

- 减少政策的不确定性，降低企业投资风险

加州已经出台了促进分布式可再生能源发电的税收优惠等多项激励方案，但其有效期大多仅为几年，较为频繁的政策变动将增加企业的投资风险。世界资源研究所提出，应对气候变化政策的设计要能够适应未来一段时期内可能发生的任何变化，包括一些不可预期的情况^[10]。因此，加州政府既要调整不适应经济、能源发展现状的公共政策，也要兼顾长效的激励作用 and 政策的连续性，促使企业形成稳定的投资回报预期，从而选择长期投资。

- 增加对基础设施建设和技术研发的激励

首先，联邦政府充分重视并支持跨州的基础设施建设，如有针对性的规定每

个财政年度的预算拨款。其次，加州要提供更多的激励以促进可再生能源的利用。这种激励一方面针对公共的研发机构，如科研院校；另一方面可以通过税款返还的形式给予企业，发挥财政资金的杠杆效应，刺激企业逐渐增加对能效项目、清洁能源利用技术的投资，吸引金融机构、工业企业、节能服务公司等相关部门进入新能源领域。

- 针对技术的不同发展阶段设计激励措施

根据已有研究³⁵，政府需要在技术生命周期中扮演不同的角色，有针对性地促进公营和私营金融机构、技术企业、学术界等各方参与到可再生能源领域中。因此，加州政府应当努力在技术生命周期的各个阶段发挥不同的重要作用，可采取的具体措施如表 3 所示。

表 3 不同技术发展阶段的激励政策需求

技术发展阶段 维度	发明研发阶段	工程示范阶段	扩散与应用阶段
利益相关方	科学家、研究机构、大学、政府	大公司（中外企业）、研究机构、大学、风险投资、政府	各类型公司、政府
资金来源	公共财政	公共财政、私营资本（风险投资）	公司投资、银行贷款、股票、基金、债券、公共财政
政策需求	补贴、发展规划等	财政补贴、规划、标准、许可等	税收优惠、价格调控、激励竞争、标准等

³⁵ 邹骥，王克等. 国际技术开发与转让创新合作机制研究报告, 2009-01

第 5 章 节能与可再生能源领域的合作前景

5.1 现代电网

广东省“十一五”规划中的能源基础设施建设重点在电力行业，积极促进太阳能、风能等可再生能源发电，2010 年要实现清洁能源占全省电力装机容量的 53% 的目标。加州政府也出台了一系列激励政策推动太阳能发电产业，尤其鼓励中小规模的家庭用户利用可再生能源发电。但是，风力大小、阳光强弱等自然界指标的波动无法保证这些清洁能源发电的稳定性，造成并网困难。近年来，现代电网尤其是智能电网迅速发展，逐步成为解决这一难题的有效途径。统计显示，2009 年，智能电网是清洁技术产业发展最为迅速的领域之一³⁶，它促进了可再生能源发电的并网与传输。中国工程院院士杜祥琬也指出，为适应可再生能源发展，需要构建智能电网和发展储能技术³⁷。

智能电网有诸多优势：首先，它能够实现不同能源发电之间的快速转换，当风力微弱或阳光不足时可及时转换为其它常规能源补充发电，促进了可再生能源的利用，而且可减少电网公司的运行费用，提高供电可靠性。其次，智能电网支持分布式发电装置，例如，水泥、钢铁等企业的余热发电系统、以及城郊小型高效的风轮机都可通过智能电网实现发电并网。再次，智能电网使得电力与用电信息在电网公司和用户之间进行双向传播；电网公司可以在夜间选用低成本的燃煤供电，而在用电高峰时增加天然气等清洁能源供电，普通用户则按不同时段的费率标准和耗电量缴纳电费，节省开支。

智能电网在中国尚处于起步阶段，国家电网公司表示，目前中国电网发展的重点在加快特高压电网和城乡配电网建设，于 2015 年形成智能电网运行控制和互动服务体系。广东省在规划中提出了加强省内电网和“西电东送”电网的建设，形成便于接受外区送电和省内电力交换。

加州于 2006 年启动了州内智能电网的规划与建设，由加州公共事业委员会和能源委员会联合管理，相关的立法工作正在进行中。为促进智能电网的发展，加州公共事业委员会出台了智能电网的规划前景与发展框架，并在制定相关标准以

³⁶ <http://www.deloitte.co.uk/TMTPredictions/technology/SmartGrid-electricity-grid-efficiency.cfm>

³⁷ 杜祥琬. 低碳能源战略报告，节能减排与应对全球气候变化高层论坛，2009-11

规范电网建设³⁸，同时提供信息及咨询服务以帮助企业申请美国能源部的经济激励基金。三家大型的私营电力公司（Pacific Gas & Electric, Southern California Edison和San Diego Gas & Electric）积极投资于智能电网及相关产业，计划未来几年在洛杉矶、旧金山等城市安装约 1200 万个智能电表。智能电网发展迅速，已逐步从人口集中的地区发展到普通的家庭用户，200 千瓦以上功率的发电设备基本实现了与电网连接。

广东省和加州可以在可再生能源发电系统和现代电网建设方面加强技术研发与应用的投资合作，例如太阳能及其它“间断性能源”发电并网技术，大容量、低损耗电力输送技术等。一方面，加州拥有先进技术与电网建设经验的企业可以选择来广东省或涉及广东省电力项目的地区投资，寻求与国内企业联合投资于技术创新或工程建设，推动可再生能源发电产业。实际上，广东省的快速发展与城市化进程为加州企业提供了极为广阔的市场空间。西门子与南方电网正在合建的云广特高压直流输电系统就是一个很好的案例。另一方面，广东省的企业对加州智能电网的发展也很重要。例如，有效地储存能源对可再生能源发电至关重要，广东省比亚迪集团公司的产品已大量投向美国市场，其中的蓄能电池将会应用于智能电网的建设。

5.2 建筑节能

2009 年 7 月，在美国能源部长朱棣文与商务部长骆家辉同时访华之际，中国住房和城乡建设部与美国能源部签署了美中建筑节能备忘录，希望利用可再生能源发展更多高能效建筑³⁹。

加州政府针对建筑节能提出了能效融资项目，该低息贷款提供给学校、政府部门等公共设施的节能工程，并以节能收益偿还贷款，鼓励各种节能措施。加州为降低能源消费，早在 1978 年就立法颁布了建筑能效标准(The Energy Efficiency Standards for Residential and Nonresidential Buildings)，而且，这些标准会定期地更新以促进能效技术的提高与运用。目前正在使用的《2005 建筑能效标准》(2005 Building Energy Efficiency Standards)是在 2001 标准基础上改进的，而该标准将在 2010 年 1 月被《2008 建筑能效标准》所取代。这项政策取得了显著效果，加

³⁸ Smart grid in California, California Public Utilities Commission, 2008-12

³⁹ http://qhs.ndrc.gov.cn/dtj/t20090824_297677.htm

州自实施该标准以来，节约电力和天然气成本超过 560 亿美元；预计到 2013 年，将再节约 230 亿美元⁴⁰。

广东省建设厅于 2007 年 12 月印发了《广东省建筑节能“十一五”规划》，要求新建建筑严格执行国家节能标准，对既有建筑实施节能改造，完善建筑一体化的太阳能光热、光电系统应用技术；保障措施要求完善激励和约束政策机制。而且，广东省建设厅于 2009 年 7 月进一步提出，未来几年要完善经济激励政策，各级政府在财政预算中安排一定资金，扶持重点节能工程、节能新机制的推广、节能管理能力建设等。

可以看出，建筑行业是广东省和加州共同关注的领域，双方都在鼓励各种形式的能效项目的开发与投资，合作前景广阔。

5.3 促进合作的建议

- 激励企业开展技术或工程项目的联合投资

科学技术是解决能源环境问题的根本途径，这一点已成为全球科学家、政治家的共识。有专家提出，中美两国建立联合能源实验室，即由政府出资建立共同研究基金，支持两国大学、研究机构开展合作研究项目⁴¹。但很多情况下，先进技术掌握在私营部门手中，将企业追求利润最大化和解决能源危机结合在一起来加快清洁能源技术的应用至关重要。本研究认为，企业间的联合投资可成为实现该双赢目标的有效方式。具体而言，中外企业可共同投资于高效清洁技术或工程项目，按照出资比例共担研发成本和风险，共享技术成果和经济收益，这种方式能够有效地保护知识产权，推动可再生能源的发展。同时，两国政府的联合激励政策可以降低任何一方侵占另一方效益的风险^[11]。

- 发挥市场机制的作用，实现能源价格市场化

世界自然基金会在《气候变化解决方案II》中提出，在能源价格较高的国家，可再生能源技术的单位产品成本会下降得更快，相对较早的低于矿石能源燃料的成本⁴²。王震等人提出，中国汽油和柴油的零售价格受到政府控制，过于保守的成品加油定价机制不利于能源节约^[12]。本研究认为，逐步取消对能源价格的管制，

⁴⁰ The California Energy Commission, <http://www.energy.ca.gov/title24/>

⁴¹ 中美清洁能源论坛, <http://www.cleanenergyforum.org/Initiatives.cfm>

⁴² 《气候变化解决方案 II》报告，世界自然基金会(WWF), 2009

完善“政府引导、市场为主”的定价机制，有助于境内外企业的投资与贸易合作。虽然多数价格管制或补贴是国家层面的政策，但是，广东省和加州也可以采取积极的行动。例如，加州取消对汽油的优惠税收；广东省在授权范围内，选择经济特区作为试点，逐步完善能源价格的形成机制。

- 引导和鼓励“创新性”融资，吸引境内外的资金

广东省和加州政府要增强促进节能与可再生能源发展的金融政策，引导和刺激各种金融机构对能效与可再生能源项目提供信贷，明确信贷的范围、标准、操作程序和审核方式。同时，鼓励新型的投融资模式，加强技术研发机构、设备生产商、资本管理公司之间的联合，吸引本地及境外的私营部门参与到技术研发与市场推广中，实现资金来源多样化。例如，小额贷款或拓宽中小企业融资渠道的政策有利于推广分布式能源利用装置；以社区为基础的贷款联盟模式，是一种创新性的生态信托，实施成本低且灵活性较强，有利于企业发展经济、并兼顾社区的可持续性^[13]。此外，建立可再生能源的发展投资基金、协助可再生能源公司上市融资等都可实现资金渠道的多元化^[14]。

综上所述，广东省和加州在节能与可再生能源领域拥有广阔的合作前景。现阶段，电力、建筑等部门因其能源消耗量大且具备节能降耗的潜力，被视为首要的合作领域。在解决能源利用瓶颈问题上，广东省和加州还应拓宽视角，一方面制定和实施与其各自财税政策并行不悖的经济激励政策，鼓励企业在节能与清洁能源技术研发和市场化应用方面开展联合投资；另一方面，在中美加强能源与环境合作谅解备忘录的框架下，积极带动中国各省与美国各州开展技术合作、示范和政策交流，以促进全球清洁能源的发展。

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Executive Summary

Guangdong Province and California have been making policy to encourage not just the use of alternative energy sources but also increased energy efficiency in the past few years. China and the U.S. intend to jointly promote clean and efficient energy, cooperate on climate-friendly technology and guide bilateral collaboration between provinces and states on climate change⁴³. This is a great opportunity to promote cooperation between Guangdong and California on clean energy, which can be served as one example for the sub-national collaboration. Regarding clean-energy technology, policies are useful to accelerate technology progress and effective to catalyze markets for renewable energy. This report summarizes policies of China and the U.S., specifically Guangdong and California, to provide incentives and enhance roles of business in energy saving and renewable energy development, and provides analysis of insufficiencies and recommendations for improvement. It also identifies some potential areas for business cooperation and supportive policies.

China National and Guangdong Provincial Energy Saving and Renewable Energy Policies

Important laws, regulations, plans, energy efficiency standards and various incentives at the central and Guangdong provincial levels are summarized. The top legislature of Guangdong emphasized its strategies and measures on energy conservation as early as 2003. However, it has not yet formulated regulations for emerging renewable energy development. As it is outlined in the 11th Five-year Plan for Social and Economic Development of Guangdong, financial incentives such as government guaranteed loan for “Energy-efficient Power Plants” have been provided. Tax credits including corporation income tax, tariff and import value-added taxes are given to companies engaged in energy saving and renewable energy.

⁴³ Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and Environment between the Government of the United States of America and the Government of the People's Republic of China, 2009-07

U.S. Federal and California Energy Saving and Renewable Energy Policies

In the U.S., characteristics of clean energy policies are described as the “carrot and stick” approach. “Energy Star” Program, Energy Policy Act of 2005, Energy Independence and Security Act of 2007, and incentive initiatives of California are elaborated using case studies. For the purpose of encouraging business investment and attracting all stakeholders devoted to renewable energy development, mandatory measures such as renewable energy portfolio standards and market-based instruments such as feed-in tariffs and tax rebates are simultaneously implemented in California.

Analysis of Energy Saving and Renewable Energy Policies

Inadequacies of the aforementioned policies are analyzed. The research concludes that incentives at the national and Guangdong provincial levels have not been made in accordance with the classification of renewables. Some application procedures for fiscal special funds aren’t clearly clarified. Further, quantitative assessment process of policy-making is not sufficient, leading to skyrocketing investment in some equipment such as wind turbines and components. While in the U.S., a comprehensive energy development strategy is missing at the federal level which negatively affects the business to develop clean energy markets; regulations and incentives among states are multifarious and complicated that may hinder energy trade; and incentives for the inter-state infrastructure construction are inadequate.

Policy recommendations are separately proposed. China should strengthen integrity, pertinence and operability of policies; carry out cost-benefit analysis and assessment; increase incentives for raising private capital in technology research and development (R&D); and promote enterprises taking voluntary energy-saving actions. The U.S. should firstly make a federal comprehensive energy strategy; manage the uncertainty of policies to reduce private investment risks; increasingly support the inter-state infrastructure construction; and create incentives targeted to all stages of technology life circle.

Potential Cooperation between Guangdong and California

Potential cooperation on power transmission, especially smart grid, and energy-saving buildings are suggested. The study indicates companies can jointly research clean-energy technologies and invest in commercial applications. This approach is effective for two-side companies in taking on risks and costs, and sharing profits. Meanwhile, joint policies to provide incentives would reduce the risk that either party would take advantages of the other's activities. The governments of the two countries should take positive attitudes to gradually remove unnecessary interventions to energy pricing and encourage multiple financing channels for energy saving and renewable energy.

1 Introduction

1.1 Background

Along with the increasing pressures of promoting economic growth while reducing the greenhouse gas emissions in recent years, upgrading energy efficiency, promoting energy-saving technologies and developing clean energy to reduce consumption of fossil fuels have attracted increasing attention. Those methods will bring huge economic benefits, but also have a significant ability to curb global warming. The governments of the People's Republic of China and of the United States of America signed the Memorandum of Understanding to Enhance Cooperation on Climate Change, Energy and Environment (MOU) in July 2009. The MOU introduced bilateral cooperation on energy efficient and renewable energy technologies. The two countries agreed to provide incentives for engagement at the sub-national level as well as by the business, academic sectors and non-governmental organizations.

GEI launched the project “Research on Energy and Environment of Guangdong Province” with the grant of Rockefeller Brothers’ Fund in September, 2007. The valuable information and experience has been accumulated. As far as we know, Guangdong is one of the most developed provinces in China. The province accounted for 12.5% of China’s gross domestic product (GDP) in 2007. Rapid economic growth is contributed to huge energy consumption that accounted for 8.69% of total domestic energy use, in particular, coal and oil respectively accounted for 52.0% and 24.2% of primary energy consumption in 2007⁴⁴. To achieve its provincial target of reducing energy consumption per unit of its provincial GDP by 16% from 2006 to 2010, Guangdong urgently needs to improve energy efficiency, deploy renewable energy, and develop a low-carbon economy.

GEI facilitated the Chinese government delegation’s participation in the “Governor’s Global Climate Summit 1” hosted in California in November, 2008. We understood many states of the U.S. take clean energy as one major action to address climate change. In particular, renewable energy technologies and green

⁴⁴ Guangdong Statistical Yearbook 2008; China Statistical Yearbook 2008

financing are far ahead in California. The government of California has instituted various policies in the forms of incentive programs and standards to encourage not just the use of alternative energy sources but also increased energy efficiency, which is often described as the “carrots and sticks” approach. Additionally, the delegation of Shenzhen LED (Light-Emitting Diode) Industry Association in Guangdong displayed its own energy-saving products on “Governor’s Global Climate Summit 2” that is also hosted in California this year. Therefore, Guangdong and California are able to take advantage of solid networks for further cooperation and establish an example for province to state collaboration in future.

Clean-energy technologies have been paid more attention due to their significance and effectiveness to address climate change. However, it’s difficult for private sectors to invest in R&D of these technologies, to some extent due to the requests of large amounts of upfront capital, investment risks and uncertain expectation to future revenues. The previous research concerning technology innovation and relevant policies (Grubb, 2004) ^[1] outlines the approaches that policy-makers have to promote technology innovation (see Fig. 1). Policies were divided into technology-push and market-pull policies. The former policies like government-funded research and demonstration are designed to increase the amount of technology “supply”, and the latter policies including preferential tax and subsidies are to provide firms and consumers to apply them with economic incentives. Additionally, Lüthi and Wüstenhagen (2008)^[2] , Langniss (1999)^[3], explained incentives can encourage investment and increase the market share of renewables, which is attributed to relatively lower risk to investors. Therefore, renewable energy policies will play an important role in promoting energy efficiency and accelerating the renewable energy development for some time. They will act as complementary instruments to market power, notably because of the traditionally political nature of the energy sector and the presence of externalities.

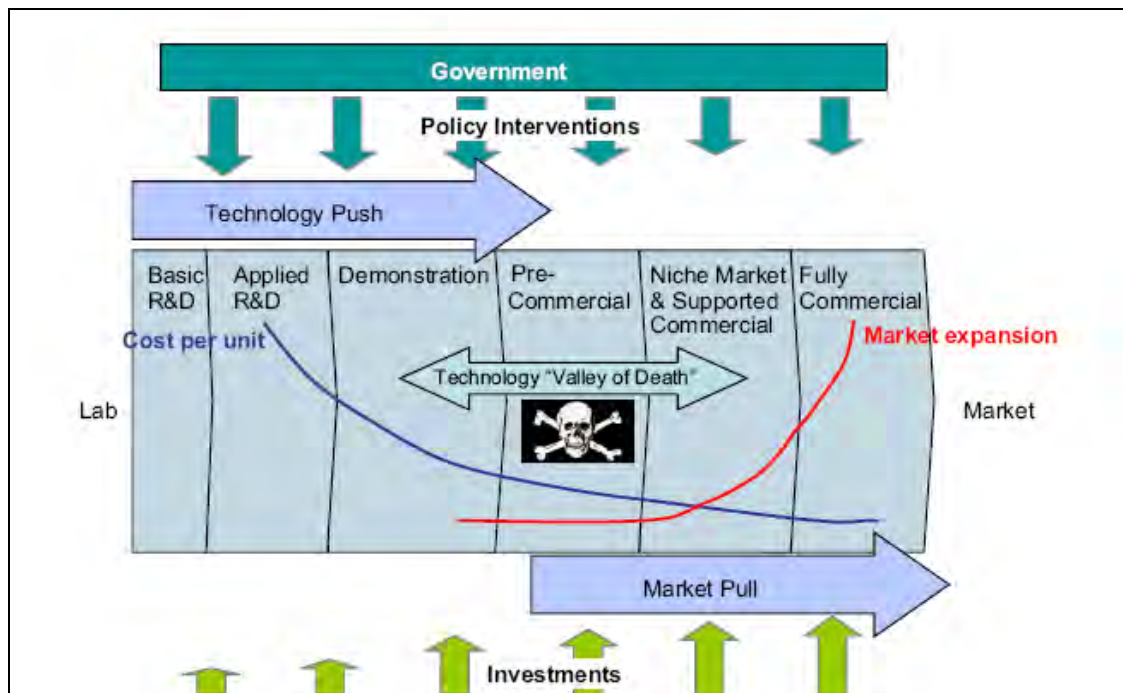


Fig. 1 The innovation chain and technology "Valley of Death" (adapted from Grubb, 2004)

1.2 Objectives and Scope

(1) Objectives of Study

- Summarize policies of China and the U.S., specifically Guangdong and California, including regulatory policies and market-based instruments that are integrated to accelerate investment and expand markets for energy efficiency and renewables;
- Analyze insufficiencies of the aforementioned policies and propose recommendations respectively to improve the effectiveness of government policies;
- Identify potential investment opportunities for enterprises in both countries and put forward suggestions for facilitating business cooperation.

(2) Scope and Specification

"Policies" in this report refer to two types of policies: first, regulatory policies ("command and control" instruments) including laws, regulations, rules and energy efficiency standards; second, incentives (market-based instruments) comprised of grants, subsidies, government guaranteed loans and favorable taxes. To investigate roles of business and mobilize private capital, this report

focuses mainly on mandatory policies and incentives that affect industrial and commercial enterprises. Additionally, China's policy-making and enforcement process is relatively complex, with a large number of entities exerting governance at both national and local levels. Given the differences of energy administrative systems between China and the U.S., policies of the two countries will be described separately in Section 2 and Section 3 within the scope.

With regard to legislation, Chinese laws outline the principles, scope and incentives without details. Subsequently, regulations and implementation rules are promulgated by the State Council or relevant ministries. Regulations at the provincial level are made in accordance with national laws and local administrative affairs. Section 2.1 will briefly introduce laws, regulations, and standards for energy saving and renewable energy development from the central to Guangdong provincial levels. Section 2.2 will highlight two types of incentives: fiscal incentives such as special funds and low-interest loans, and preferential taxes including corporate income tax reduction, import value-added tax exemption and other tax benefits.

In comparison, provisions of the U.S. laws and regulations related to clean energy are elaborated in detail, including the concrete fiscal appropriations each year. Thus, section 3.1 will specify a few influential federal laws and standards that are being successfully implemented. With respect to incentives, California has already identified some goals of renewable energy development, and gradually implemented incentive programs to achieve the targets. Section 3.2 will set forth what methods effectively promote renewable energy development by means of case studies.

2 China National and Guangdong Provincial Energy Saving and Renewable Energy Policies

2.1 Laws, Regulations, Plans and Standards

2.1.1 National level

(1) Laws and regulations

China has put many laws, regulations and rules relevant to energy markets in place. Two most influential laws are the Energy Conservation Law (revised in 2007) and the Renewable Energy Law (2005). Since 1980, the State Council has issued about 30 various statutes for energy conservation administration. In addition, more than 150 regulations and rules on energy conservation have been made, most of which come from the National Development and Reform Commission (NDRC), the Ministry of Construction (MOC) and the Ministry of Transportation (MOT)⁴⁵.

The Energy Conservation Law of the People's Republic of China emphasizes, "Natural resources conservation will be a basic national principle. Security of energy supply and energy conservation should be given the equal importance, which is considered as the energy development strategy." In particular, clause No. 61 specifies the need for fiscal subsidies for energy efficient products such as lighting appliances.

The Renewable Energy Law of the People's Republic of China creates financial incentives for renewable energy⁴⁶, such as government funding for R&D of clean-energy technologies, and tax credits for demonstration projects under the "Catalogue for the Guidance of Renewable Energy Industry Development". Recent revisions (2009) to the Renewable Energy Law emphasize the national planning of renewable energy development; establish an acquisition system for power generation from renewable sources; and create special funds for feed-in tariffs and technology innovation.

⁴⁵ Ma Zhong, etc.. Report on China's Energy Conservation Administration System, 2008-12

⁴⁶ http://www.mep.gov.cn/law/law/200802/t20080202_117982.htm

(2) Plans and Proposals

Developing energy conservation and environmental protection industries have been written in the *National 11th Five-year Plan for Economic and Social Development*. To achieve the designed targets, *The Comprehensive Working Scheme on Energy Saving and Emission Reduction* has been introduced by the NDRC, concretely stipulating fiscal and tax incentives. The following policies have been carrying out with specifications made by relevant authorities.

- 1) Fiscal policies: the government funding for energy efficiency programs that support technology R&D, key demonstration projects, capacity building, information service as well as awarding.
- 2) Tax policies: tax credit for energy conservation and integrated utilization of natural resources; corporate tax deduction and accelerated depreciation for fixed asset investment in equipment and component used for energy-efficient production.
- 3) Financial service: appropriate measures to motivate financial institutions such as commercial banks that can offer low-interest rate loans for energy-efficient projects, and insurance companies and venture capitalists that can directly finance R&D of clean-energy technologies and demonstration projects.

To increase power generation from renewable sources, quota schemes for renewable energy have been proposed in *the Medium and Long Term Plan for Renewable Energy Development*. Certain preferential taxes for renewable energy production are also included in the plan. Industrial projects that are inconsistent with the requirement of this plan are prohibited from getting loans from financial institutions. Additionally, financial support to R&D and demonstration projects of energy-efficient technologies has been arranged in the *Medium and Long Term Plan for Energy Conservation*.

(3) Energy Efficiency Standards

Energy efficiency standards have been playing a significant role in promoting energy conservation. China has adopted more than 20 standards to control the

access to energy-consuming industries and manufacture energy-efficient products. For example, *Design Standards for Energy Efficiency of Public Building* stipulated, “air-conditioning machines with nominal cooling capacity greater than 7100W and using motor-driven compressor unit-types, must have an efficiency ratio not less than the mandatory standards”, which ensure new public buildings will meet energy-saving requirements. Energy efficiency standards are compulsory mandates in China. Some standards are listed below (see Table 1).

Table1 Some Energy Efficiency Standards in China

Time of Implementation	Title of Standards
2007	Limits of Fuel Consumption for Light Commercial Vehicle (GB20997)
2005	Design standard for energy efficiency of public buildings (GB 50189)
2004	Limits of Fuel Consumption for Passenger Cars (GB19578)
1995	Monitoring and testing method for energy saving of steam heating equipments (GB/T 15914)
1995	Monitoring and testing method for energy saving of motor-pump liquid transport system (GB/T 15910)
1994	General principles for monitoring and testing of energy conservation (GB15316)
1994	Monitoring and testing method for energy saving of industrial boilers (GB/T 15317)

2.1.2 Guangdong Province

(1) Local Regulation and Rules

Regulation on Energy Conservation in Guangdong Province was approved by the provincial top legislature in 2003, which strongly favors various actions taken by local governments, enterprises and households to reduce energy consumption and promote solar, wind and other renewable energy. Clauses No.22 and No.23 clearly indicate incentives should be given to companies that carry out R&D of energy-saving technologies as well as manufacture

energy-efficient products.

Verification and Approval of Foreign-invested Projects Tentative Administrative Procedures by Development and Reform Commission of Guangdong requires that basic information on land, water, energy and other natural resources consumption must be involved in the project application documents.

(2) Plans in Guangdong

Plans are the basis of, and prerequisite for carrying out energy-saving administration and renewable energy development. Guangdong has formulated its provincial 11th Five-year Plan for Economic and Social Development and several special plans (see Table 2).

Energy consumption per unit of provincial GDP dropped 2.93%, 3.15% and 4.32% annually from 2006 to 2008. Regarding the goal of reducing energy consumption per unit of provincial GDP by 16% by the end of 2010 outlined in the provincial 11th Five-year Plan, Guangdong has so far reduced 10.4% in total, completing 65% of the original mission⁴⁷. Furthermore, Guangdong government has been actively promoting nuclear power and renewable energy such as wind and solar power. The installed capacity of clean energy approximately accounted for 32.5% of entire electric installed capacity in Guangdong by the end of 2008⁴⁸.

⁴⁷ Guangdong Statistical Yearbook 2009, <http://www.gdstats.gov.cn>

⁴⁸ Low Carbon Economy Forum-Guangdong 2009, WWF and Guangzhou Institute of Energy Conversion of Chinese Academy of Science, 2009-10

Table 2 Various plans related to clean energy in Guangdong

Plan Type	Provisions Related to Energy Saving & Renewables
<i>11th Five-year Plan for Economic and Social Development⁴⁹ of Guangdong</i>	<ul style="list-style-type: none"> ➤ Optimizing energy consumption structure and promoting power generation from natural gas and hydro; ➤ Achieving the goal of power generated from clean energy sources accounting for 53% of total installed capacity in Guangdong by 2010; ➤ Strengthening electric grids construction to ensure smooth power transmission; ➤ Taking projects of nuclear power station, large-scale wind farm and combined heat and power plant as priorities for energy supply security;
<i>11th Five-year Plan for Energy Development of Guangdong</i>	<ul style="list-style-type: none"> ➤ Put forward accelerating renewable energy development and optimizing the energy structure towards clean energies and high efficient energies; ➤ Strengthening inter-provincial collaboration and international cooperation concerning energy;
<i>11th Five-year Plan for Science and Technology Development of Guangdong</i>	<p>Developing the following technologies as top priorities:</p> <ul style="list-style-type: none"> ✧ wind power, solar thermal / photovoltaic; ✧ energy-saving technology in industry, building and transportation sectors; ✧ distributed energy use system and biofuels utilization;
<i>11th Five-year Plan for High-tech Industry Development of Guangdong</i>	<ul style="list-style-type: none"> ➤ New energy industry is considered the key high-tech industry; ➤ Improving investment and financing by broadening the funding source, ➤ Promoting local high-tech business through international cooperation.

(3) Standards and Executives

Guangdong has been strictly carrying out national standards, and has issued a series of provincial standards and interpretations, taking into account the local

⁴⁹ <http://www.gd.gov.cn/govpub/fzgh/sywgy/0200607260010.htm>

economy and energy consumption structure. For example, to implement the national standard “*design standards for energy efficiency of residential building in hot summer and cold winter region*” (JGJ75-2003), the Guangdong Construction Department formulated rules for improving energy efficiency of air-conditioning and heating facilities in 2006.

2.2 Financial Incentives and Taxes

2.2.1 Financial Incentives

Part 1: Central Government Funding⁵⁰

(1) Subsidies for Energy Saving and Clean Energy

A. Solar photovoltaic power

Notice of Implementation of Gold Solar Demonstration Projects jointly issued by the Ministry of Finance (MOF), the Ministry of Science and the Technology and National Energy Administration in July 2009 outlines supporting demonstration projects of independent and large-scale grid-combined solar photovoltaic power generations, granting 50%-70% of total investment for each grid-combined solar photovoltaic power generation.

The MOF provided subsidies to demonstration projects of building-integrated solar photovoltaic systems in March 2009⁵¹. It also proposed that the areas with local fiscal support will be given the priority for subsidies.

B. High-efficiency lighting products

Interim Measures for the Administration of financial subsidies to high-efficiency lighting products was jointly issued by the MOF and the NDRC in December 2007⁵². The subsidies will cover 30% of the agreement price for suppliers selling high-efficiency lighting products to bulk purchasers, and 50% of the agreement price for companies who supply high-efficiency lighting products to urban and rural households.

⁵⁰ Relevant policies are summarized on the basis of many materials from the Ministry of Finance. Refer to <http://www.mof.gov.cn/mof/> for more information.

⁵¹ http://jjs.mof.gov.cn/jinjjianshesi/zhengwuxinxi/zhengcefagui/200903/t20090326_126456.html

⁵² http://nmg.mof.gov.cn/jinjjianshesi/zhengwuxinxi/zhengcefagui/200805/t20080523_34112.html

C. R&D of high-tech products

Interim Measures for the Fund Administration of Optimization of electromechanical and high-tech product import and export structure was jointly developed by the MOF and the Ministry of Commerce in July 2007. The special fund is used to support the establishment of public service platform for electromechanical and high-tech products as well as R&D of nationwide technologies related to energy saving and clean energy. Individual grants will cover up to 50% of actual total investment.

(2) Favorable Loans (or government guaranteed loans)

Administration of Fiscal Fund to Renewable Energy-saving Building Materials (Interim Measures) was made by MOF in October 2008. This is mainly targeted to companies that produce and utilize building materials made from renewable sources. If one company wants to apply for loans from commercial banks to expand its production scale, it will reduce its interest payment of commercial loans with the support of fiscal fund. The fund is also arranged for establishment of technical specification and standards and rewards to consumers who purchase energy-efficient building materials.

(3) Government Procurement for Energy-saving Products

To expand the scope of government procurement for energy-saving products and promote energy-saving products certification, MOF and NDRC have continuously adjusted “government procurement list of energy-saving products”. The latest products category (Sixth version) was issued in June 2009, including air conditioners, lighting appliances, refrigerators, and lots of office equipment such as computers and printers. The governments at all levels and related organizations supported by fiscal budget are required to give priority to purchase energy-saving products.

Part 2: Guangdong Provincial Government Funding

(1) Low-interest Loans for “Energy-efficient Power Plants”

Guangdong applied for Asian Development Bank (ADB) loans that finance “Energy-Efficient Power Plants” in 2006. The first pilot projects with a total of \$35

million were launched in early 2009, lending to companies that implement electrical equipment modification for saving energy and applying new energy-efficient technologies. The second round ADB loans will increase to \$65 million. The interest rate is 10% lower than lending interest rate for 6 months of domestic commercial bank loans. It is estimated that the annual saved electricity will reach the amount of 216 million KWh that equals to 7.16 billion coal equivalent when the first seven pilot projects (\$35 million in total) are completely operated. Approximate 600 million KWh will be saved every year when \$100 million are all loaned for projects.

(2) Arranging Special Funds for Energy Saving

Notice of Organizing Application for Provincial Special Funds for Energy-saving Projects (2008, second round) was jointly issued by Guangdong Provincial Finance Bureau and Economic and Trade Commission, arranging rewards (200 Yuan/t or \$29.4/t) to support key energy-saving projects that would save energy ranging from 2000 tons coal equivalent to 10,000 tons coal equivalent annually. It supplements the central government's incentive that only covers large projects saving 10,000 or more ton coal equivalent per annum. To further support the development of energy service companies (ESCOs), this program points out: "if energy-saving modification projects were implemented by ESCOs, 70% of the reward will be given to ESCOs and the rest to the terminal users⁵³".

The energy-saving rewards can bring economic benefits for companies beside environment benefits, which can encourage voluntary energy saving initiatives. Taking residual heat reuse for power generation at one cement production line (2000t/d) for example, if one 4.5MW installed capacity power station is designed, it requires approximate 30 million Yuan investment. When the power station is operated, the enterprise may save 8134 tons coal equivalent annually based on the calculation of 3.5MW electricity generation capacity, average 7000 hours operation time annually and 332g coal equivalent /KWh for electric generation in

⁵³ Study of Energy and Environment Problems in Guangdong Province, Global Environmental Institute, 2008,12

Guangdong⁵⁴. As such, the enterprise will approximately receive the bonus 1.627 million Yuan, which accounts for 5.42% of the total investment.

(3) Joint Actions for Cleaner Production

In 2007, Guangdong further advanced “Joint Actions of Cleaner Production” that provided financial support to encourage international information exchange on cleaner production as well as introducing foreign advanced technologies and production facilities. In addition, the Guangdong Provincial Finance Bureau will facilitate cleaner production projects meeting the requirements to acquire national public bonds for financing. Government procurement and tendering will give priority to the products with cleaner production methods. ^[4]

2.2.2 Preferential Taxes⁵⁵

(1) Corporate Income Tax

On the basis of the principle of equitable market competition, corporate income tax applied to the foreign enterprises has been almost identical to that of domestic enterprises since January 1 2008. Therefore, national and provincial tax incentives are universal to all enterprises engaged in energy conservation or renewable energy.

Preferential Clauses of Corporate Income Tax

- 1) *Corporate Exemption*: Profits from environmental protection, energy and water saving projects can be completely exempted from corporate income tax from first profit-making year to third year, and allowed a 50 percent reduction from the fourth to sixth years.
- 2) *Corporate deduction*: Scope: equipment and components that are eligible for deduction include environmental protection, energy and water savings, as well as security production according to the relevant national guidance. Amount of deduction: 10% of total investment in the aforementioned field, which can be deducted from the net profits year by

⁵⁴ China's Electricity Statistical Yearbook 2007, 332g coal equivalent/KWh for electric generation in Guangdong in 2006.

⁵⁵ This part is summarized on the basis of materials from State Administration of Taxation, referring to <http://www.chinatax.gov.cn/n8136506/index.html> for more information.

year over a period not exceeding 5 years.

- 3) *Corporate tax credit*: According to the High and New Technology Enterprise Tax Credit, a tax at the rate of 15% for the enterprises engaged in new energy and energy conservation technology; b. eligible enterprises should be recognized by *Measures on the Designation of High and New Technology Enterprises*⁵⁶ and other relevant legal documents.
- 4) *Corporate exemption for High and New Technology Enterprises operated in Special Economic Zones*⁵⁷ (Shenzhen, Zhuhai, Shantou, Xiamen and Hainan) and Shanghai Pudong Development New District: profits can be totally exempted from corporate income tax in first profit-making year and second year, and allowed a 50 percent reduction from third to fifth years.

Concrete measures in Guangdong⁵⁸

Some concrete measures can be made by local authorities and tailored to the economic condition in Guangdong. However, those shall conform to national policies and approved by the MOF and the State Administration of Taxation. For example:

- 1) Corporate income tax of a company engaged in technology-intensive & knowledge-intensive projects and energy production in the old downtown districts that have been authorized to build economic and technology development zones is imposed at the rate of 15%.
- 2) Foreign investment enterprises planned to operate for a period of 15 years or more and engaged in infrastructure construction of transportation and energy in the five special economic zones and Shanghai Pudong Development New District, profits of which can be exempted from corporate income tax from first profit-making year to fifth, and allowed a 50% reduction in subsequent five years.

⁵⁶ http://www.most.gov.cn/zfwj/zfwj2008/200804/t20080428_61006.htm

⁵⁷ http://www.gov.cn/zwgk/2007-12/29/content_847079.htm

⁵⁸ <http://www.zhaoshangyinzi.com/zhengcefagui/2009/06/06/1305/>

(2) Tariff and Import Value-added Tax (VAT)

With regards to wind turbine manufacturing, high-power wind turbines have been included in 16 crucial technical equipment areas according to “*Opinions of State Council on accelerating the revitalization of the equipment manufacturing industry*”. To domestic companies, some crucial technical parts, components and raw materials used for manufacturing special wind turbines have been exempted from customs duties and import VAT since January 1, 2008. Concrete types of the equipment are described in the regulation of State Administration of Taxation.

For foreign investment projects qualifying for the “*Catalogue for the Guidance of Foreign Investment Industries*”⁵⁹ with technology transfer, the self-used equipment, and relevant technologies and components simultaneously imported shall be exempted from customs duties and import VAT, if they’re not included in “*Catalog for Imported Commodities of foreign investment projects excluded from duty-free*” (a total of 20 types) and their expenditure doesn’t exceed the total investment⁶⁰.

VAT rebate policy for foreign enterprises purchasing home-made equipment was introduced in the context of the previous type of VAT and the VAT exemption on imported equipment. However, since the nationwide implementation of VAT reform on January 1 2009, companies purchasing the imported or domestically produced equipment are imposed equally in terms of VAT for the equipment. Hence, the original favorable taxes are gradually being phased out.

⁵⁹ NDRC revised *Catalogue for the Guidance of Foreign Investment Industries* in 2007, which related to the development of energy-saving and new energy industries involving “construction and operation of power plant with clean combustion technology of coal, and construction of new energy power plants (including solar, wind energy, magnetic energy, geothermal energy, tidal energy, biomass, etc.), development of energy-saving technology, resource recycling and comprehensive utilization technology”.

⁶⁰ Ministry of Science and Technology, Ministry of Commerce jointly issued *Catalogue for Encouraging Foreign Investment in High-tech Products*, which is based on *Catalogue for the Guidance of Foreign Investment Industries*, further promoting high technology including “new energy and highly energy-efficient products”.

3 U.S. Federal and California Energy Saving and Renewable Energy Policies

3.1 Key Federal Laws and Standards

3.1.1 Energy Star Program

ENERGY STAR is an international standard for energy efficient consumer products. It was first created in 1992 by the United States Environmental Protection Agency (EPA) in an attempt to reduce energy consumption. The program has gone through several phases and has recently finalized version 3.0. Initiated as a voluntary labeling program designed to identify and promote energy efficient products, ENERGY STAR began with labels for computer products. The program was significantly expanded, introducing labels for residential heating and cooling systems and new homes in 1995⁶¹. For example, ENERGY STAR qualified room air conditioners are at least 10% more energy efficient than the minimum U.S. federal government standards. An ENERGY STAR qualified home uses at least 15% less energy than standard homes built to the 2004 International Residential Code. They usually include properly installed insulation, high performance windows, tight construction and ducts, energy efficient cooling and heating systems, and ENERGY STAR qualified appliances, lighting, and water heaters⁶².

As of 2006, more than 40,000 products certified with Energy Star are available in a wide range of items including appliances, office equipment, lighting, home electronics, and some external power supplies. The EPA estimates that it saved about \$14 billion in energy costs in 2006 alone. The ENERGY STAR program has helped spread the use of LED traffic lights, efficient fluorescent lighting and power management systems for office equipment⁶³.

3.1.2 Energy Policy Act of 2005

The Energy Policy Act of 2005, Public Law 109-58, (EP Act 2005) is a significant federal law that takes major steps towards energy efficiency and renewable

⁶¹ <http://www.energystar.gov/>

⁶² ENERGY STAR Qualified Homes : ENERGY STAR, <http://www.energystar.gov/homes>

⁶³ EnergyStar.gov, "History: ENERGY STAR." Retrieved 1 March 2008

energy. Six titles of energy efficiency, renewable energy, oil and gas as well as other energy issues are included in this act. The *Energy Efficiency Title* of the bill is made up of four subtitles that are federal programs, energy assistance and state programs, energy efficient products and public housing. The *Renewable Energy Title* is further divided into geothermal energy, hydroelectric, insular energy and so on. More than 1800 sections of the act are elaborated according to the nature of different kinds of energy. Some regulatory provisions are briefly described below:

- Section 104-Procurement of energy efficient products: This section requires the US government to purchase products with ENERGY STAR logo. In cases where such products are not available the government should make efforts to procure the most efficient product available.
- Section 140-Energy Efficiency Pilot Program: The federal government shall provide financial assistance to conduct pilot programs for efficiency in both electrical and natural gas use.
- Section 911-Energy Efficiency: The Department of Energy is directed to conduct programs of research, and demonstration with the intent of increasing efficiency in buildings, vehicles, and industrial processes. The goal of these projects is to reduce the overall demand for energy in the US, particularly as is derived from foreign sources. The programs are also intended to reduce the cost of energy and improve the energy security of the US. All of these goals will also have the benefit of reducing the environmental impact of energy. The section also includes provisions for federal funding.
- Section 912- Next Generation Lighting Initiative: The Department of Energy is directed to develop advanced organic and inorganic lighting technology. The program will develop an Industry Alliance including researchers, small businesses, the National Laboratories, and various universities.

The Energy Policy Act of 2005 created a number of incentives to encourage energy efficiency and the development of renewable energy resources. For example, the legislation provides credits to manufactures of highly efficient

refrigerators, clothes washers, and dishwashers. The incentives for refrigerators are tiered depending on the level of energy savings, up to \$175 per unit for products that are 25% or more than the federal minimum-efficiency standard. This approximately accounts for 15%-20% of the refrigerator costs (\$800-\$1200). Washing machines have a single rebate of \$100 per unit if they meet 2007 Energy Star standards. Given the variety of washing machine costs, this incentive is still more than a 10% savings.

3.1.3 Energy Independence and Security Act of 2007

*Energy Independence and Security Act of 2007*⁶⁴ is the subsequent important legislation following the Energy Policy Act of 2005. The act consists of sixteen titles in total: improved vehicle fuel economy (average fuel economy standards, improved vehicle technology, etc.), increased production of bio-fuels (renewable fuel standard, bio-fuel research and development, etc.), improved standards for appliance and lighting, energy saving in building and industry, energy saving in government and public institutions, accelerated research and development (solar energy, geothermal energy, energy storage, etc.), carbon capture and sequestration, improved management of energy policy, international energy programs, smart grid and so on. Federal and state governments' responsibilities are instituted respectively. Several provisions are briefly introduced as follows:

- Title II- Energy Security through Increased Production of Bio-fuels: Renewable Fuel Standard: Renews and increases the previous requirements for the amount of bio-fuels required in the U.S.' energy supply. The new standard requires 9.0 billion gallons in 2008 and increase to 36 billion gallons in 2036. In addition, the additional biofuels cannot be derived from corn starch sources, but instead must be advanced biofuels derived from cellulosic and lignocelluloses since 2016. The biofuels must prove to reduce greenhouse gas emissions by at least 20 percent in the life circle.
- Title IX- International Energy Programs: Section 912 deals specifically with the assistance to China in exporting clean and efficient technologies as well as developing government capacity for their implementation. Section 914

⁶⁴ http://en.wikisource.org/wiki/Energy_Independence_and_Security_Act_of_2007

calls for the encouragement of US companies to become involved with investment in clean and efficient technologies overseas, encouragement is given in the form of preferential treatment as well as granting greater flexibility concerning finance, insurance, etc. for such projects.

- Title VI-Thermal Energy Storage Research and Development Program: The Department of Energy (DOE) shall establish a program of research and development to provide lower cost and more viable thermal energy storage technologies to enable the shifting of electric power loads on demand and extend the operating time of concentrating solar power electric generating plants. The act authorizes the appropriation to the DOE for carrying out this program \$5,000,000 for Fiscal year 2008, increasing step-by-step until \$12,000,000 for Fiscal year 2012.
- Title XIII- Smart Grid: The US congress recognizes the need to upgrade domestic electrical grid systems to improve reliability, security, and efficiency. Section 1305, the Smart Grid Interoperability Framework, outlines the alignment of policy, business, and technological approaches to smart grid initiatives.

3.2 Market-based Incentives of California⁶⁵

The California Energy Commission (CEC) is California's primary energy policy and planning agency, which was created in 1974 and headquartered in Sacramento, the CEC has responsibility for activities that include forecasting energy needs, promoting energy efficiency through appliance and building standards, and supporting renewable energy technologies. Some concrete measures are as follows:

(1) California Feed-in Tariffs

Originally enacted in September 2006, feed-in tariff was designed to promote the use of renewable energy sources. The feed-in tariff⁶⁶, which can be used for nearly any renewable sources, is based on the market price referent from the

⁶⁵ This part is based on the information from the California Energy Commission, more details are available at <http://www.energy.ca.gov/>

⁶⁶ <http://www.cpuc.ca.gov/PUC/energy/Renewables/feedintariffssum.htm>

California Public Utility Commission, and higher rates are provided for solar energy during peak use times (8 a.m.-6 p.m.). This allows customers with eligible energy sources to enter into 10, 15, or 20 year contracts with utilities to sell back the electricity. Eligible sources are limited to less than 1.5 megawatt generators, strongly encouraging the use of these renewable sources.

(2) Property Tax Exclusion for Solar Energy Systems

Property Tax Exclusion for Solar Energy Systems can be used for any type of solar energy system, but cannot be used for systems used to heat swimming pools or hot tubs. Commercial, residential, and industrial installations are eligible if they are installed by a licensed contractor between January 1999 and December 2016. The tax exclusion is for 100% of the value of the system.

(3) California Solar Initiative⁶⁷

The California Solar Initiative (CSI) is overseen by the California Public Utilities Commission and provides incentives for solar system installations to customers of the state's three investor-owned utilities. The CSI Program has a budget of \$2.167 billion over 10 years, and the goal is to reach 1,940 MW of installed solar capacity by the end of 2016. The goal includes 1,750 MW of capacity from the general market program, as well as 190 MW of capacity from the low income programs. These systems will further reduce California's dependence on traditional energy sources by requiring installed systems be connected to the grid.

(4) New Solar Homes Partnership⁶⁸

It is designed for new construction, including multi-family units and low-income housing. The incentive amount will vary based on the size of the system, which can be as small as 1 kW of alternating current and as large as covering the building's total energy needs. If a contractor performs the installation, they must be licensed by the state of California. Self- installations are also allowed. The entire program will provide up to \$400 million in funding over 10 years, for the

⁶⁷ California solar initiative, <http://www.cpuc.ca.gov/PUC/energy/solar>

⁶⁸ <http://www.gosolarcalifornia.ca.gov/nshp/index.html>

purpose of installing solar electric systems on 50% of new home construction by 2016. If construction is in a housing development of six or more units the contract must agree to provide systems on at least 50% of the houses. Rates provided for the installed similar are identical to those provided under the CSI, with the addition that affordable housing units will receive the government rate of \$3.50/W.

(5) Emerging Renewable Energy Program⁶⁹

The primary goal of the Energy Commission's Emerging Renewables Program is to develop a self-sustaining market for emerging distributed generation from renewable sources. The CEC is offering cash rebates on eligible grid-connected small wind and fuel cell renewable energy electric-generating systems that was effective on January 1, 2007, the technologies eligible for ERP funding are:

- ✧ Small wind turbines: small, electricity-producing, wind-driven generating systems with a rated output of 50 kilowatts or less
- ✧ Fuel cell: the conversion of sewer gas, landfill gas, or other renewable sources of hydrogen or hydrogen-rich gases into electricity by a direct chemical process

(6) Self-Generation Incentive Program⁷⁰

This program mainly focused on wind, fuel cell, and advanced storage technologies. For example, wind is eligible for \$1.50/W incentive that covers two-thirds of the installation cost (\$2.40/W), which is significantly encouraging. And fuel cells can receive \$2.50/W to \$4.50/W depending on the fuel types used for energy production. Storage technologies that meet system specifications can receive \$2.00/W. However the total payment cannot be more than the cost of the project. Systems that are manufactured in California are also eligible for an additional 20% incentive.

Incentive rates depend on the size of the system. Taking wind power for example, the first megawatt (MW) receives a 100% incentive, from one to two MW

⁶⁹ <http://www.consumerenergycenter.org/erprebate>

⁷⁰ <http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/index.htm>

receives a 50% incentive (\$0.75/W) and a 25% incentive (\$0.375/W) is given to systems from second to third MW. All systems need to be sized according to individual needs, with a maximum size of 5 MW. The five-year warranty is required to protect against breakdown and degradation in output more than 10 percent of the designed power generation.

(7) Energy Efficiency Financing Program

A loan program⁷¹ designed to improve the energy efficiency of California buildings. Funding is provided only for the public sector, including schools, local government building, and public hospitals. The funding can cover 100% of the project loan needs but only to a maximum amount of \$3 million dollars, the program is capped at \$24 million. Interest rates for loans provided are fixed at 3% and will be paid back from energy savings from the retrofits. The general commercial credit rates are closely related to the Federal Prime Rate with the addition of a certain percent, which is higher than costs of this program loans. For example, general long-term credit rates are currently at around 5.25%.

⁷¹ <http://www.energy.ca.gov/efficiency/financing/index.html>

4 Analysis of Energy Saving and Renewable Energy Policies

4.1 Characteristics of Policies

4.1.1 Summary of National and Provincial Policies

Concerning mandatory policies, *Regulation on Energy Conservation in Guangdong Province* was instituted in 2003, which is one of the earliest provincial-level energy conservation laws in China. Meanwhile, energy efficiency standards on products, equipment and systems are strictly implemented, and provincial administrative rules are issued. Although, the provincial top legislature has not yet formulated regulations for emerging renewable energy development, many plans are in place. These plans are currently capable of guiding the behaviors of market players. However, some plans should be gradually replaced with provincial regulations in the long term.

Concerning financial incentives, a wide range of central and Guangdong provincial incentives for energy efficiency and renewable energy programs have been provided in the following forms: First, subsidies, mainly for pilot projects of new technologies like grid-connected solar photovoltaic power generation. Second, government guaranteed loans, such as the ADB's loan for "Energy-Efficient Power Plants" project in support of terminal energy-saving equipment modification and renovation of energy-saving technologies. Third, feed-in tariffs for wind power based on different wind conditions and project construction requirement. This is an effective way to enhance market competitiveness of electricity generated from renewable sources. Fourth, government procurement targeted to energy-saving products for the purpose of saving fiscal budget and promoting energy-saving technology progress.

Concerning tax incentives, cooperate income tax exemption, production tax credit and other forms of favorables have been proposed by the central government. Based on the *categories of technology and equipment of energy conservation and resource integrated utilization*, tariff and import VAT of advanced energy efficient equipment and components can be deducted or exempted. Having actively carried out the aforementioned tax policies, the government of Guangdong simultaneously made several additional incentives

that were approved by the State Administration of Taxation. For example, high-tech companies encouraged by the domestic industry policy in the energy field can apply for further corporate income tax reductions compared to the national favorable taxes.

4.1.2 Summary of Federal and California's Policies

In the U.S., the characteristics of energy policies can be considered as the “carrot and stick” approach. Mandatory and voluntary Energy efficiency standards were developed and widely used; provisions of the Acts are detailed, operational and targeted. At the sub-national levels, many states carried out various incentives that can simultaneously promote energy producers, end-users, local governments and other relative stakeholders taking actions to achieve the state-wide renewable energy objectives.

Renewable energy development is currently in its initial stage, and thus may not be economically competitive compared with traditional energy sources. The significant impact to California's clean energy development is the California Global Warming Solutions Act of 2006, which proposes some ambitious activities with regards to decreasing greenhouse gas emissions by 2020. That contributes to increasing attention being paid to the power industry, and incentives having been proposed consecutively. In order to gain greater possible environmental benefits and decrease economic loss earlier than would otherwise be many appropriate options are proposed by both federal and state governments. The CEC is responsible for energy policy and planning, including the mandatory measures such as green building standards and the market-based instruments to promote renewable energy, which can be summarized in three following categories:

- Quantity-Minimum Requirement

Quantity requirements will give producers enough information of what production levels are cost-effective. Taking the renewable energy portfolio standard (RPS) of California as an example, it requires renewable energy sources to account for 20% of total energy consumption by 2010. Under some circumstances, a

renewable energy standard may require a certain portion of the nation's electricity to come from clean, renewable sources such as wind, solar, and geothermal.

- **Pricing Management**

There are two kinds of price-controlling options to promote clean energy development. One example is feed-in tariffs. Electrical utility companies are required to provide real-time prices, or higher than average prices to small-scale industrial or residential producers making use of renewable sources. On the opposite side, in some utility jurisdictions the government has instituted a per-kWh levy on electrical use in some utility jurisdictions. Environmental costs will be included in the prices when using traditional energies by imposing such levies.

- **Cost Reduction Policies**

Developing any new technology involves enormous initial capital costs, as does the development of renewable energy. As such, financial support can reduce the initial costs and increase private investment. The most common forms are tax rebates and subsidies for the installation of residential solar panels, making the construction more affordable. Additionally, governments can guarantee loans (possible lower interest) for renewable private sector projects. Typically, these policies will have both an overall cap as well as a cap for individual loans.

4.1.3 Comparison of Policy portfolio

(1) Comparison of mandatory policies

China's energy laws generally focus on the principles and the significance of upgrading energy efficiency and developing renewable energy. The issue-specific regulations and directives are drafted and carried out by the State Council and the ministries such as the details of incentives and supportive measures. In China, both the central and provincial governments make substantial use of planning activities to formulate energy development strategies. The governments take advantage of administrative powers and all kinds of resources to achieve the binding or any targets proposed in plans for economic

and social development.

Comparatively, the US's laws concerning renewable energy have many implementation provisions even including appropriation in each fiscal year besides the elaboration of principles and functions. In addition to developing the minimum energy efficiency standards for products and equipment, some penalties are established to restrict the sales of non energy-efficient products.^[5]

(2) Comparison of economic incentives

The government of Guangdong has adopted lots of economic incentives to attract companies engaged in technology R&D and pilot projects. The overall combination of mandatory instruments and economic incentives instead of only regulatory policies enforced before has been increasingly emphasized in order to improve the energy administrative system. This clearly indicates the trend of “energy policies are considered the complementary instruments and necessary guidance, leaving the market to play the fundamental role in resource allocation to raise the economic efficiency and effectiveness”.

The role of the California's government is a facilitator more than a regulator. The government facilitated market-based instruments to guide the private investment and improve the market mechanism. Moreover, the government has paid more attention to the coordination of different incentives and the integrity of security measures, in particular, the integration of various renewable energy initiatives.

According to previous studies, there exists obvious difference between the feed-in tariffs of two countries.^[6] First of all, feed-in tariff in the U.S. covers a variety of power generation technologies based on the classification of renewable energies. In China, this favorable policy is so far clearly given to wind, hydro and biomass power generations, not cover all kinds of renewables. Additionally, feed-in tariff is regulated by the NDRC instead of the top legislature in China (feed-in tariff is being discussed in the revised draft Renewable Energy Law recently). While 11 United States state legislatures were considering

adopting a feed-in tariff as a complement to their renewable electricity mandates in April 2009.^[7]

4.2 Assessment of Policies

4.2.1 Challenges at the National and Provincial Levels

First of all, some regulations and incentives lack cohesion and only have general principles without details. Moreover, they are not systematically made based on the classification of different renewable energy. This is partially attributed to policy-making process lagging behind renewable energy markets that have been rapid growth and diversification. For example, solar photovoltaic equipment and wind turbines have been gradually scaled up in recent years, however, relevant regulation and incentives are not aligned with solar and wind power generation.

Secondly, some government grants for energy efficiency projects are difficult to apply, which are attributed to complication of the procedure, unavailability of the necessary information or unclear patterns of subsidies. Some enterprises, in particular, small and medium sized companies have limited knowledge of policy specifics or are incapable of bargaining, therefore have not benefitted from these favorable policies. As it is analyzed by many experts, China's policy-making and enforcement process is relatively complex, with a large number of entities exerting governance at both the national and local levels.

Finally, quantitative assessment to the mandatory policies or incentives is insufficient, leading to neglect of supplementary measures. One of negative impacts is contribute to impulsive investment in one specific area within a short term. For example, Guangdong has stimulated wind, hydroelectric power and other renewables with an array of subsidies and preferential taxes. Facilities have been built so fast that electrical grids without any expansion plans may not handle all electricity generated from renewable energy sources. Additionally, wind energy is an industry that requires investment in various fields ranging from materials, technology, standard setting and construction of service system. This imbalance focused on facility manufacturing could undermine the efforts of developing wind power.

4.2.2 Deficiencies at the Federal and California Levels

First of all, although there has been an emphasis on moving away from traditional energy sources for a few years, a comprehensive federal energy-innovation strategy has not yet been created. Without instructive federal policy, different departments within the government may emphasize and support various, even contradictory strategies and technologies. This makes it difficult for the private sector to know which path is advantageous to take. Additionally, individual states, such as California, have already developed their own policies. However, these policies have limited market power and influence compared with a federal strategy.

Secondly, the multitude of states' regulations across the country is becoming one of the largest roadblocks to renewable energy development. Over twenty states have issued many kinds of renewable energy portfolio standards, requiring different renewable energy proportions. Although this discrepancy is to a certain extent unavoidable due to different economic situations between the states, it indeed has negative impacts on energy or electricity trading across the states.

Thirdly, inter-state infrastructure constructions are sometimes not attached high attention by the federal government. For example, the electrical grid systems of individual states lack connectivity between the various utility companies. What's more, thousands of utility companies create conflict or incompatibility in the electricity generation from renewable energy sources and transmission. Private sectors are unsure of the variety of legal, regulatory and environmental demands of each state that the transmission lines run through and therefore won't invest in the unprofitable areas without financial support.

Lastly, though many incentives are available to renewable energy, they have not covered all sorts of renewable energy. Companies may not have access to capital-intensive industries without government funding. Additionally, more complex and risky financing structures are created in the process of application for government grants. While quite a few ideas work well in the laboratory they have not yet reached commercial viability. Costs of renewable sources such as

solar can already be brought down when production is given sufficient incentives.

4.3 Experience and Recommendation

4.3.1 Suggestions for China's Improvements

Technologies, products and services related to renewable energy are currently becoming the focus of energy development in most countries. Laws, regulations, standards and incentives are generally integrated in the national strategy, accumulating lots of successful experience that China can learn from. Guangdong should make efforts to take into account local economic situations and characteristics of energy structure in its policy-making process. Specific measures are as follows:

- Strengthen the integrity, pertinence and operability of policies

The individual policies including national laws, Guangdong provincial regulations and incentives established by different legislatures or governmental departments should be compatible and consistent. Procedures of applications for government grants or guaranteed loans must be clarified, and the approval process should be simplified, transparent and supervised. Updated policies are best published in a timely manner through official websites, media or relative channels. Outdated policies which are incompatible with the current economic development should be amended.

To streamline the process, it is necessary to establish incentives based on the unique attributes of each form of renewable energy. The government also should integrate energy efficiency standards in order to provide more convenience to enterprises. Taking Fuel Economy Standards for example, it is important to find a balance between rigid provisions and flexible options to provide a basis and time-frame for manufacturers improving technologies and the production line. According to the International Energy Agency (IEA) statistics, energy efficiency standards have been adopted by thirty-four countries as a well-established policy to promote energy saving by the end of 2006.

- Carry out cost-benefit analysis and assessment to policies

Successful policies generally include clearly stated goals, with benchmarks to measure progress and determine whether they achieve the intended objectives, and encourage formal review processes and feedback loops between policy makers and implementers. Taking experience of California as an example, Senate Bill 1389 (Chapter 568, Statutes of 2002) requires the California Energy Commission (CEC) to conduct assessments and forecasts of all aspects of energy industry supply, production, transportation, delivery and distribution, demand, and prices. So the CEC publishes an Integrated Energy Policy Report every two years⁷². The government of Guangdong should adopt quantitative assessment such as a cost-benefit analysis to alternative policy options and take supplementary measures to guarantee the effectiveness of policies. Vice-director of Chinese Wind Association is calling on the government to consider a systemized rather than hasty approach⁷³ “When it comes to wind energy in China, it is actually not about how willing the government should be to invest in wind energy; rather it is how the government should ensure that such investment will achieve long-term benefits.”

- Increase incentives for R&D of advanced technology

Life-cycle of technology comprises five phases: research, demonstration, deployment, diffusion and commercially application⁷⁴. Green technology investments have unique characteristics that complicate financing, such as high front-end capital needs and long payback periods.^[8] As it mentioned above, incentives in Guangdong mainly focus on pilot projects but neglect the fundamental R&D, contributing to incapability of manufacturing crucial equipment and components. Therefore, the government should increase incentives probably in the forms of subsidies or low interest loans to offset large initial capital demand and reduce high risks from uncertain profits.

⁷² The California Energy Commission, http://www.energy.ca.gov/2009_energypolicy/index.html

⁷³ http://www.chinadaily.com.cn/bizchina/2009-09/11/content_8680007.htm

⁷⁴ UNFCCC, Expert Group on Technology Transfer, Recommendations on future financing options for enhancing the development, deployment, diffusion and transfer technologies under the Convention

- Encourage business taking voluntary actions on clean energy

To encourage business voluntarily being committed to upgrading energy efficiency, the government may sign voluntary agreements with the enterprises, and then, invite a third party to conduct regular assessment and audit. Bonuses will be awarded to the enterprises that achieve the emission reduction targets. In addition, the government may carry out energy certificate programs that provide information of energy performance to the public. It is better to formulate government-oriented, market-driven, and public participation mechanisms to advocate sustainable production and consumption models.

4.3.2 Suggestions for U.S. Improvements

- Develop a federal comprehensive energy-innovation strategy

One comprehensive and systematic strategy for clean energy development may be established, guiding the states to formulate and implement their own energy plans. It's helpful to coordinate various position and requirement of energy development and avoid duplication of facility construction and over-capacity. Under the federal strategy, California can plan its renewable energy industries suitable to the characteristics of natural resources and economic structure, make policies for sub-federal and international investment and display the comparative advantages.

- Manage uncertainty of policies and reduce investment risks

California needs to establish long-term incentive programs for renewable energy, though it has already taken on an important step with the creation of production tax credits. The tax credits currently implemented are typically for a few years and will then be renewed. Unstable policies increase investment risks to business. According to a study of the role of national policy on adapting climate change carried out by World Resources Institute, policies need to be designed explicitly and be effective in a range of possible futures, and be able to respond to both anticipated and unanticipated changes in underlying conditions.^[9] Thus, extending the validity period of policies like a long-term production tax credits will be helpful to guide business engaged in renewable energy instead of traditional fuels.

- Support technology R&D and inter-state infrastructure construction

Firstly, the U.S. federal government should provide adequate funding such as setting the explicit appropriation to inter-state infrastructures in each fiscal year. Secondly, California should continue increasing funding for scientific advancements of renewable energy, supporting both public research institutions such as universities since funding for education has declined, and private sectors probably in the form of tax rebates. It likely increases the number of companies involved in technology R&D and attracts more investment, if investors predict having consecutive financial support.^[10]

- Explore more incentives targeted to various stages of technology

Government needs to take different measures in the entire technology life-cycle, integrating financial institutions, technology investors, academic institutes and other stakeholders into clean energy development⁷⁵. California's government is better to make clearly different incentives depending on the stage of technology life cycle (see Table 3).

Table 3 Incentives at different stages of technology life circle

All Stages Dimensions	Research and Development	Demonstration (Pilot Projects)	Diffusion and Commercialization
Stakeholders	Inventors, Research institutions, Universities, Governments	Large enterprises, Research institutions, Joint-venture corporations, Governments	Corporation, Wholesalers, Governments
Capital Resources	Government grant or budget, Public funding	Fiscal support, Private capital (venture capital)	Corporation investment, Banking loans, Stock, Funds, Bonds, Government guaranteed loans
Incentives	Subsidy, Guidance, Planning, Publicity	Subsidy, Standards, Planning, Allowance	Price-setting, Standards Favorable taxes, Low-interest loans,

⁷⁵ Zou Ji, Wang Ke, *etc.*. Study of Innovative Cooperation Mechanism for International Technology Development and Transfer, 2009-01

5 Potential Cooperation in Energy Saving and Renewables

5.1 Smart Electric Grid

11th Five-year Plan for Economic and Social Development of Guangdong Province outlines “accelerating development of nuclear power and promoting utility of electricity generated by natural gas and hydro; achieving the goal of 53% of power derived from clean energy sources by 2010; enhancing construction of national and provincial electrical grids to ensure the smooth transmission”. Meanwhile, California’s government has proposed incentive programs to develop solar power, particularly encouraging individual households to use small scale electricity generation from renewable sources. However, the nature of natural resources, such as wind velocity which is unstable, may become an obstacle to renewable generating electricity. Smart grid is an effective way to solve it. Statistically, smart grid is one of the world’s fastest growing industries in the recent years, significantly promoting clean energy development⁷⁶.

There are a lot of advantages concerning smart grid. First of all, a smart grid system allows instantaneous switching from one power source to another. The capability to switch between energy sources is important to not only integrate renewable sources but also make the electric grid safer and more reliable. Additionally, smart grid supports the decentralized or distributed power production and demand-side management. Many heavy industrial plants, such as cement or steel manufactures, may have their own electrical production facilities and sell the surplus electricity back to the grid utility companies in support of smart grid. Last but not least, both electricity and information from the consumers’ electrical meters are free to flow in either direction by using smart grid. In this regard, a smart grid system will lessen the need for excess production that is used to prevent unexpected disruptions. The use of a smart grid allows customers to be charged at variable rates depending on real-time generation costs.

Currently, smart grid development is still at the initial stage in China. It will

⁷⁶ <http://www.deloitte.co.uk/TMTPredictions/technology/SmartGrid-electricity-grid-efficiency.cfm>

probably be packaged within the construction of ultra-voltage grid and electrical grids linking urban and rural areas, according to the general planning of State Grid Corporation of China. In Guangdong, the provincial government is taking initiatives to strengthen the construction of national and provincial grid to ensure the smooth of electricity transmission.

California launched statewide advanced metering deployment in 2006. California Public Utilities Commission (CPUC) and California Energy Commission are joint regulatory agencies, recently engaging in relevant legislation. The CPUC developed state-wide smart grid vision and consistent framework, also provided information service to help California entities compete for U.S. Department of Energy Economic Stimulus Funds. Guidance and standards are being explored by CPUC to regulate smart grid development⁷⁷. Three large Investor-Owned Utilities (IOUs) have significant smart grid initiatives in progress, including Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric. The IOUs will install nearly 12 million smart meters serving both high intensity areas and individual households in the upcoming years, mainly in San Francisco, Los Angeles, and San Diego. Advanced electrical grids are in place now for customers with greater than 200 kilowatt maximum demand.

Thus, Guangdong and California can cooperate on grid development such as technologies and pilot projects to facilitate integration of solar and other “variable resources” into the national electric grids. Companies that have advanced technology and construction experience in California may invest in the power industry, especially ultrahigh-voltage transmission systems or other forms of grid in Guangdong. Guangdong represents a large and fast growing market for huge electricity demand partly due to the urbanization. On the other hand, Guangdong can make a significant contribution to California’s smart grid development. For example, Build Your Dreams (BYD) Auto in Guangdong is manufacturing high efficiency energy storage products, parts of which are essential to successful operation of smart grid.

⁷⁷ Smart grid in California, California Public Utilities Commission, 2008-12

5.2 Energy-Saving Buildings

California has proposed Energy Efficiency Financing Program for the building industry, providing low-interest loans to schools, government departments and other public facilities for the energy-saving projects. And profits from energy-saving measures will be used to repay the loan. In California, the Energy Efficiency Standards for Residential and Nonresidential Buildings were established in 1978 in response to a legislative mandate to reduce energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. The currently effective 2005 Standards for building projects superseded 2001 Standards, but will be replaced by 2008 Standards on January 1, 2010. California's building efficiency standards (along with those for energy efficient appliances) have achieved remarkable outcomes, saving more than \$56 billion in electricity and natural gas costs since 1978. It is estimated the standards will save an additional \$23 billion by 2013⁷⁸.

Meanwhile, 11th *Five-year Plan for Building Energy Conservation of Guangdong Province* proposed that new buildings must be strictly qualified for energy efficiency standards; solar heating systems and solar PV technology should be explored and applied for building to improve energy efficiency; security measures need combine mandatory standards with incentives. In July 2009, deputy director of Guangdong Province Construction Department further proposed the governmental willingness of gradually improving various incentives in future. In particular, fiscal budget will be arranged by all levels of government to support some crucial energy saving projects, capacity building of energy-saving management and so on.

Ministry of Housing and Urban-Rural Development of People's Republic of China and the United States Department of Energy have signed the Understanding of Memorandum to strengthen cooperation on energy efficient buildings⁷⁹. Guangdong and California have common interests in sustainable

⁷⁸ <http://www.energy.ca.gov/title24/>

⁷⁹ http://qhs.ndrc.gov.cn/dtjj/t20090824_297677.htm

building initiatives, advocating business investment in efficient heating systems through improved insulation and other energy-saving projects. Therefore, Guangdong and California are capable of carrying out extensive collaboration in green building.

5.3 Recommendations for Increased Cooperation

- Provide incentives to leverage joint business investment

Technology innovation is the fundamental solution to energy and environmental crisis, which have become the consensus of scientists and politicians worldwide. Some experts suggested that a joint research fund should be established to conduct prioritized projects by U.S. and Chinese research institutes⁸⁰. However, high energy-efficient technologies are generally mastered by private sectors in developed countries. To deployment of best practice technologies, joint investment is better for business leaders from different nations. Domestic and foreign enterprises may finance the programs together, sharing costs, risks and profits based on the proportions of their original contribution. This approach effectively protects intellectual property rights and promotes renewable energy. Meanwhile, joint policy initiatives to provide incentives by both governments would reduce the risk that either country would take advantages of measures made by the other. ^[11]

- Remove subsidies to traditional fuels and enhance market power

The governments of the two countries should gradually remove the unnecessary control to energy pricing, especially subsidies to traditional fuels. As it is proposed in "Climatic change Solution II" by the World Wide Fund for Nature, technology costs of renewable energy will decrease comparatively faster in the countries with high energy price than that with low energy price⁸¹. In addition, those subsidies to traditional fuels essentially offset the government funding for renewable energy. Taking China's petroleum price as an example, its conservative retail price made by NDRC may hinder renewable energy development. ^[12] Although this problem may be fixed at national levels,

⁸⁰ Initiatives from US-China Clean Energy Forum, <http://www.cleanenergyforum.org/Initiatives.cfm>

⁸¹ Report on Climate Change Solution II, World Wide Fund for Nature, 2009

Guangdong and California should also take initiatives. For example, California could replace the special tax credits for gasoline; and Guangdong may improve energy pricing in the special economic zones within its authority.

- Encourage multiple financing channels and expand capital sources

All kinds of financing models and financial service should be encouraged for multiple capital sources. The legislature can develop specific rules to clarify standards, scope, procedures and audit supervision of the credit. The governments of Guangdong and California both need to stimulate financial institutions to provide loans for energy efficiency projects and attract the overseas capital except for domestic investment. For instance, opening more financial channels for small and medium sized companies is conducive for promotion of distributed energy utilities. Community-based lending alliances are also an innovative model providing relatively low implementation costs and considerable adaptive flexibility. Such approaches take into account the sustainability of the community.^[13] To expand financing channels, renewable energy development investment fund should be established to absorb commercial banks, venture capital and other possible financial sources.^[14]

In a word, Guangdong and California have extensive prospects for energy cooperation. At the moment, power and building industries are considered as two top priorities due to their huge energy consumption and tremendous reduction potentials. Multiple collaborations can be explored with the guidance of forward-seeking policies, which combine statutes with incentives. Moreover, Guangdong and California can serve as an example and ally more provinces and states of the two countries to take joint actions on energy and climate change. These comprehensive initiatives will be effective at breaking through energy bottlenecks and ultimately achieving the prosperity of global renewable energy market.

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