



**Asia-Pacific  
Economic Cooperation**

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ON THE IMPLEMENTATION OF GOVERNMENT  
ENERGY EFFICIENCY PROGRAMS**

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**Session 3: Experience and Best Practice  
in Specific Economies (cont'd)**

# 中国节能工作进展情况

## Progress of energy efficiency work in China

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### 一、我国节能基本情况

#### Basic conditions of energy conservation in China

### (一) 能源消费特点

#### Characteristics of energy consumption

#### ●能源消费以煤为主

Coal takes the dominant position in China's energy consumption

#### ●石油、天然气、水电等能源比重上升

The percentage of petroleum, natural gas and hydraulic power has increased

#### ●工业用能为主导

The percentage of industrial energy consumption is high.

### (二) 节能进展情况

#### Progress of energy conservation

#### 1. 节能宏观管理得到进一步加强

The macro-administration of energy conservation has been further strengthened

#### (1) 完善节能法规, 加强监督管理取得很大进展

China has achieved great progress in improving the laws and regulations on energy conservation and in strengthening supervision and management.

- 1998年1月《中华人民共和国节约能源法》颁布实施  
The Law of the People's Republic of China on Energy Conservation enacted on January 1998.

● **22个省区市制定了节能法实施办法等70余项地方法规**

22 provinces, regions and municipalities have formulated more than 70 relevant local rules and regulations

● **上海、云南、甘肃等地方建立了节能监察中心开展节能执法监察和节能监测，依法进行节能监督管理。**

Shanghai, Yunnan and Gansu have set up energy conservation supervision centers to carry out energy conservation law enforcement and energy conservation monitoring and conduct energy conservation supervision and administration according to law

**(2) 制定了主要用能产品强制性能效国家标准**

China has formulated compulsory national standards of energy efficiency for the main energy-consuming products.

**(3) 建立了节能产品认证制度**

The endorsement labeling system has been established.

**(4) 研究建立能效标识制度**

The study of information labeling system is underway.

**(5) 研究探索基于市场的节能新机制**

China is exploring various market-based new energy conservation mechanisms.

● **节能技术服务机制**

Energy conservation technology service mechanism

● **推行节能自愿协议机制**

Mechanism of voluntary agreement for energy conservation

● **节能信息传播传播机制**

Energy conservation information propagation mechanism

● **强制性能效标识制度**

Compulsory energy efficiency identification system

● **电力需求侧管理(DSM)**

Power demand side management (DSM)

**(6) 开展节能宣传和国际交流与合作**

China has carried out publicity and international exchange and cooperation in respect of energy conservation.

**(7) 开展政府机构节能工作**

Government energy management program was launched.

## 2. 能源利用效率明显提高

- **万元产值能耗大幅下降。2002年每万元GDP能耗2.68吨标准煤。** The energy consumption per RMB10,000 of output value has dropped drastically
- **主要产品能耗降低，缩小与国际先进水平差距**  
The energy consumptions of main products have dropped and the gap with the advanced international levels has narrowed
- **节能效益显著**  
The benefits of energy conservation are remarkable
- **重大节能技术示范和推广取得成效**  
The demonstration and popularization of key energy conservation technologies has produced remarkable effects

## 二、目前正在采取的主要节能措施

Main measures currently taken for energy conservation

- (一) **促进结构节能和能源结构优化**  
Promotion of structural energy conservation and optimization of energy structure
- (二) **发展重点节能技术**  
Development of key energy conservation technologies
- (三) **完善节能法规和政策**  
Improvement of the laws, regulations and policies on energy conservation
- (四) **进一步加强能效标准、标识和认证工作**  
Further enhancement of the work of energy efficiency standard, endorsement label and information label

## 二、目前正在采取的主要节能措施 (续)

Main measures currently taken for energy conservation (continued)

- (五) **积极推广符合市场经济要求的节能新机制**  
Active popularization of the new energy conservation mechanisms that meet the requirements of market economy
- (六) **推动政府机构节能**  
Facilitate Government Energy Management Program

祝大会圆满成功!  
Success to the  
Conference!

*Thanks!*

## Funding Public Sector Energy Efficiency Projects in China: Alternative Considerations

For APEC Symposium on the implementation of government energy management programs

Jiang Lin  
Lawrence Berkeley National Lab  
Kunming, China  
August 3-4, 2004

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## Outline

- ESCO development in China
  - Experience from the World Bank/GEF project
  - Barriers/risks analysis
- Difference in funding EE projects in Public and Private Sectors
- Financing Mechanisms for Public Sector
  - ESCO
  - Revolving Loan Fund
  - Internal Fund
- Capacity and Infrastructure Building
  - Project finance
  - Project Design, Integration, Installation, and Commissioning
  - Performance Verification and Monitoring

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## ESCO Development in China

- World Bank/GEF China Energy Conservation Project
  - Started in 1997, with \$26 million grant and \$65 million loan pool, plus Chinese government contributions
  - Set up three Energy Management Companies (Beijing, Liaoning, and Shandong)
  - Performance contract as core business model (shared savings model)

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## ESCO Development in China

- Since 1997
  - Over 300 EC projects have been implemented
  - Over RMB 450 million investment
  - Over 90% of projects with paybacks < 2 years
- Phase II
  - Develop Loan Guarantee Facility, \$26 million GEF grant
  - Facilitate the scaling up of the ESCO industry

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## Key Barriers

- Energy cost is only a small part of overall cost;
- Lack of understanding of energy efficiency technologies among technical and management staff;
- Priority of capital investment focused on expanding their market and production, not on improving energy efficiency;
- Unaware of energy efficiency opportunities;
- Cost-savings are not directly apparent in corporate accounting;
- Lack of financing from local banks for energy efficiency projects.

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## Barriers to EE project financing

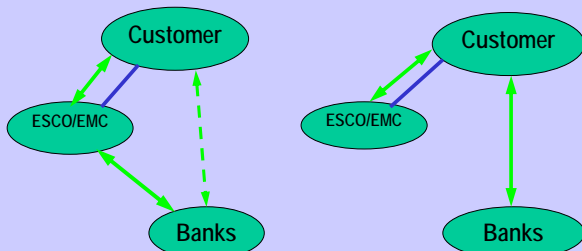
- Bank lending practice: asset-base financing, little experience with project financing
- EMC not credit worthy
- Small project sizes leading to high transaction costs
- Banks do not understand the energy efficiency technologies

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## Shared vs Guaranteed Savings Models

- Shared Savings
- Guaranteed Savings



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## Advantages of Government Markets

- Customer is stable
  - A university isn't going anywhere
- Customer is a good credit
  - Government isn't going anywhere
- Customers have long time horizons
- Strong public interest in energy efficiency – saves public operating money

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### Advantages of Government Markets

- Most opportunities are in government buildings
  - HVAC, Lighting, Motors/Fans/Pumps, Commissioning
  - Technology risks better understood than those in industrial processes
  - High replication potential due to heterogeneous technologies
- Government leadership in this area will help build critical capacity and infrastructure for promoting ESCO in private sector
  - Project financing
  - Performance Verification and Monitoring, Commissioning

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### Alternative Financing Mechanism

- California Energy Commission (CEC)
  - Energy Efficiency Financing Program
- Texas State Energy Conservation Office (SECO)
  - Texas LoanSTAR Program

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### CEC Energy Efficiency Financing Program

- Initiated in 1979, \$10 million revolving loan
- Subsequent funding includes \$50 million in 2001 as part of response to energy crisis
- Total equity about \$76 million in 2001
- Total loan: about 160 million,
- Over 370 applicants
- Average about 300k

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### CEC Program Eligibility

- Schools (public or *non-profit*)
- Hospitals (public or *non-profit*)
- Cities
- Counties
- Special districts
- Public care institutions (public or *non-profit*)

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## What Types of Projects are Eligible for Loans?

- Energy audits
- Feasibility studies
- Lighting
- Motors or variable frequency drives and pumps
- Building insulation
- Heating and air conditioning modifications
- Automated energy management systems/controls
- Energy generation including renewable energy projects
- Streetlights/LED traffic signals

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## Key Terms and Conditions

- **How Much Is Available?**
  - The maximum loan amount is **\$3 million per application**.
- **Criteria For Loan Approval**
  - Energy efficiency projects must be technically and economically feasible. Projects must have a simple payback of **10 years or less** based on energy costs savings.
  - Loans for energy projects must be repaid from savings within **15 years**.
- **Interest Rate - 3.95 percent currently**

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## Texas LoanSTAR program

- Loan for Saving Texas Resources – *LoanSTAR*
  - started in 1989 by Texas Legislature as a revolving loan fund at about \$98 million,
  - the saving streams from the EE projects are used to pay back the loan (capital and interests)
  - Low interest: 3% at present,
  - Long payment term: maximum 10 years
- Outstanding for its monitoring and verification requirement, able to prove energy savings through metering data

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## Texas LoanSTAR program

- LoanSTAR program has distributed more than \$200 million in loans to 169 public institutions over the years.
- program has saved Texas more than \$144 million in energy costs, and savings grow every year.
- Over the next 20 years, Texas's SECO estimates that Texas LoanSTAR will save state taxpayers \$250 million.
- Currently, about \$25-30 million per year of loan is made
- Emission reductions
  - CO2 1.5 million ton
  - NOx 5418 tons
  - SO2 3563 tons

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### Leveraging the purchasing power of Government to improve EE

- Major energy using equipment are part of government procurement
  - Room AC, Lighting, Office Equipment
  - Little incremental cost
- Retrofit of Government Facilities
  - Small incremental cost
- New Government Buildings
  - Little incremental cost

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### Other funding sources

- Funding often available to deal with energy crisis
  - 2001 California, and 2004 selected provinces in China
- However, focus on short-term loan management, often little devoted to reduce long term load
- Creating a Public Benefit Charge to pay for energy efficiency improvements

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### Summary

- Government sector is a good candidate for ESCO business model
- Government leadership in this area will help build critical capacity and infrastructure for promoting ESCO in private sector
- Government could also set up revolving loan funds for its agencies for EE projects
- Energy efficient procurement can reduce the long-term energy use

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# Execution of Taiwan Government Sector Energy Management Program



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Energy Conservation Technology Development Center  
CTCI Foundation  
August 2-3, 2004

## Contents

- I Preface
- II Concepts of Energy Saving
- III Energy Consumption in Chinese Taipei
- IV Energy Saving Policy
- V Energy Saving Programs
- VI Successful Case
- VII Conclusion

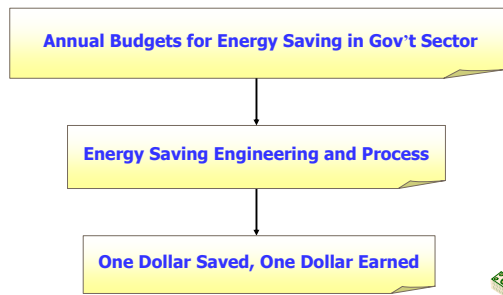
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## I Preface

- How To Implement Energy Saving ?
- How Much Energy Can We Save ?
- Where Does The Money Come From ?
- How To Verify Energy Saving ?



## II Concepts of Energy Saving



### III Energy Consumption in Chinese Taipei

#### 1. Electricity Consumption in Chinese Taipei Annual Energy Stats

	Electricity Consumption	2001	2002	2003
National Totals	(M kWh)	175,909	186,408	195,964
Annual Growth	%	-	+5.97%	+5.13%
Commercial Sector	(M kWh)	19,062	19,907	20,855
Annual Growth	%	-	+4.43%	+4.76%

Source : Energy Bureau, Ministry of Economic Affairs of Chinese Taipei

### III Energy Consumption in Chinese Taipei (Cont'd)

#### 2. Government Consumption of Electricity

User Type	Public Sector Category of Public Users	(1)2002/02-2003/01		(2)2003/02-2004/01		Change			
		Annual Total kWhs (1)	Number Recorded( 2)	Annual Total kWhs (3)	Number Recorded( 4)	Annual Total kWhs		Number Recorded	
						(3)-(1)	Change (%)	(4)-(2)	Change (%)
1	Central Gov't	3,325,142,832	8,737	3,357,197,584	8,825	32,054,752	1.0	88	1.0
2	Local Gov'ts	3,319,167,456	37,918	3,329,337,284	40,857	10,169,828	0.3	2939	7.2
3	Financial Institutes	628,732,999	4,224	618,191,315	4,159	-10,541,684	-1.7	-65	-1.6
4	Public Enterprises	6,271,185,572	18,344	6,350,530,694	18,385	79,345,122	1.2	41	0.2
Sum		13,544,228,859	69,223	13,655,256,877	72,226	111,028,018	0.82	3,003	4.34

Note: Total Electricity Consumption Growth in 2003 is 111M kWhs, or 0.82% , Total number reported increase by 3,003( 4.34%).

Source : Energy Bureau, Ministry of Economic Affairs of Chinese Taipei

### IV Energy Saving Policy

1. Requests on Energy Savings in Gov'tal Offices.
2. Energy Efficient Appliances and Energy Efficiency labeling.
3. Energy Efficient HVAC and Lightings.
4. Public Sector Energy Consumption Filings on Internet.
5. Optimal Temperature Control in Office.
6. Energy Efficiency in Green Building Projects.

### IV Energy Saving Policy(Cont'd)

#### 1. Requests on Energy Savings in Gov'tal Offices

“Governmental Offices Energy Saving Measures” Based on “Action Plan on National Energy Conference” Implemented by the Executive Yuan in 2000 to Set up Energy Management System and Energy Saving Goals:

(1)Energy Saving Goals: No Annual Growth in Electricity Consumption (by kWh/m<sup>2</sup>) and Per Capita Oil Consumption (by Liter/per person) as Minimum Requirement.

(2)Based on Green Products Procurement Priority Ordinance, Products with Energy Efficiency labeling as First Choice in Gov't Procurement.

(3)Energy Consumption on Building's Outer Shell of New or Renewing Constructions Must Meet the Construction Tech. Codes Requirements: Lower than 80, 90, 115 Respectively in Northern, Central and Southern Chinese Taipei ( by kWh/m<sup>2</sup> per year).

## IV Energy Saving Policy(Cont'd)

### 2. Energy Efficient Appliances and Energy Efficiency labeling



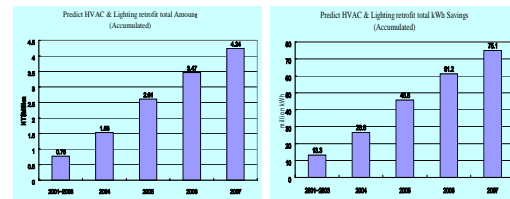
- (1) Energy Efficient Appliances and Energy labeling Promotion by the National Sustainable Development Action Plan.
- (2) Energy labeling System Launched Since the End of 2001 Has Saved Energy 15% on Labeled Appliances such as HVAC, Refrigerators, Dehumidifiers, TV Sets, Cloth Washers, Electric Fans and Fluorescent Lights, for 18 Firms and 152 Products.



## IV Energy Saving Policy(Cont'd)

### 3. Energy Efficient HVAC and Lightings

Promotional Committee For Nuclear-Less Home in 2003 Has Launched a Retrofit Program for Energy Efficient HVAC and Lightings in the Public Sector Finished by Dec. 2007.



## IV Energy Saving Policy(Cont'd)

### 4. Public Sector Energy Consumption Filings on Internet

To Add Accuracy to Energy Statistics and for the Setting up of Energy Standards and Total Consumption Control, Internet Filings on Energy Consumption by the Public Sector are Required since March 2003.



### 4. Public Sector Energy Consumption Filings on Internet(Cont'd)

Item	Time	Topic	Venues	Number of Meetings	Attendants
1	2003.01.15~02.24	Introductory Exhibits on Government Internet Filings of Energy Consumption	Taipei, Taoyuan, Taichung, Chiayi, Tainan and Kaohsiung	15	1,465

## IV Energy Saving Policy(Cont'd)



### 5. Optimal Temperature Control in Offices

Ordinance on Optimal Temperature Control in Gov'tal Offices,  
Launched in July 2003 :

- (1) Room Temp. No Lower Than 26°C in Gov'tal Offices and Meeting Rooms.  
(Relative Humidity at 50~60% , Room Air Velocity at 0.2~0.3 m/s)
- (2) Zero Annual Growth on Electricity.
- (3) Annual Budgets for Retrofitting HVAC of 8-Year Older and Room Air Conditioners of 5-Year Older, with Low Energy Efficiency ( Power Consumption Per RT Higher than 1.2KW).

## IV Energy Saving Policy(Cont'd)



### 6. Energy Efficiency in Green Building Projects

- (1) National Sustainable Committee Est. in 1996 Adopted "Green Building" as the Main Action Plan in the Sustainable Development Policy.
- (2) Green Building Project Promoted in White Papers on Buildings by the Interior Ministry, as Sustainable Green Buildings Adopted by the EPA's White Papers on Environmental Protection Administration.
- (3) "Green Building labeling System" Aimed for Ecological, Energy Efficient, Waste Reduction and Healthy Buildings, Initiated in Aug.1999.

## 6. Energy Efficiency in Green Building Projects (Cont'd)

- (4) Nine Evaluation Indicators for Green Buildings
- i. Ecological Diversity
  - ii. Magnitude in Greenizing
  - iii. Water Conservation in Earth Base
  - v. Daily Energy Saving
  - vi. CO<sub>2</sub> Reduction
  - vii. Waste Reduction
  - viii. Indoor Quality
  - ix. Water Resource
  - x. Improvement on Sewerage and Garbage

## 6. Energy Efficiency in Green Building Projects (Cont'd)

- (5) Review Process  
Green Building Labeling System in Two :
- i. Green Building Label Award: For Green Buildings Passing the Above Nine Evaluation Indicators with Usage Permit.
  - ii. Candidature Green Building Certificate: For Newly Unfinished Construction with Construction Permit, but Passing the Above Nine Evaluation Indicators, Deemed as "Semi-Green Building".

**6. Energy Efficiency in Green Building Projects (Cont'd)**

(6) A Case of Energy Efficiency labeling  
( National Test Building of EPA)

i. Out Shell Energy Saving : To Avoid North-East Wind and Sunlight from West, the Design of the Building with Multiple Heat Insulating Structures Creates Enough Shade, Features in Significant Energy Efficiency and Considered as Masterpiece in Outer Shell Loading.



環檢大樓東西向剖面圖



圖：本館建築設計之特色，在於建築師以多層之遮陽結構，創造出自然之遮陽效果，有效降低建築之熱負荷。

(6) A Case of Energy Efficiency labeling  
( National Test Building of EPA) (Cont'd)

ii. Ice-Storage System Design :  
With Ice-Storage System to Make Ice at Off-Peak Night Hours and Melt-ice at Daytime, Significantly Reduce Peak-Hour Electricity.



Ice-Storage System

iii. Energy Saving Design on Lightings :  
Using High Efficiency Lightings with Electronic Ballast (E.B.T). Has Significantly Saved Power Consumption.



High Efficiency Lightings

**V. Energy Saving Programs**

1. Comprehensive Energy-Savings Technical Services
2. Training Courses for Energy Managers
3. Promotion and Diffusion
4. Energy Saving Tactics



**1. Comprehensive Energy-Savings Technical Services**

(1) Central Air-Conditioning Systems

- i. Air Conditioners Accounts for 40%~60%of Total Power Consumption in Offices.
- ii. To Reduce Power Consumption by the Load Variation on Air Conditioners is the Main Target of Energy Saving.
- iii. Optimal Control System to Operate HVAC at Highest Efficiency in Line with Loading Factors can Reasonably Reduce Power Consumption.



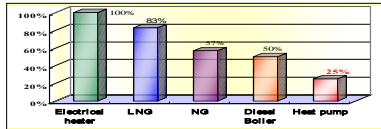
## 1. Comprehensive Energy-Savings Technical Services (Cont'd)



### (2) Heating Systems

#### i. System Features :

COP (Coefficient of Performance) of Heating Equipment, Diesel Boiler, Gas Boiler or Power-Heated Boiler, Average around 0.80 ~ 0.95.  
 COP of Heat Pump Water Heaters Increased to 2.0 ~ 5.0 Can Reduce Energy Consumption and Money Spent on Heating Equipment 50~75%.  
 Heat Pump Can Also Provide Other Benefits such as Cool Air, Dehumidifying, Air Purifying, Safety, Ease At Installing and Operation, as well as Environment Friendliness.



## 1. Comprehensive Energy-Savings Technical Services (Cont'd)

### ii. Application :

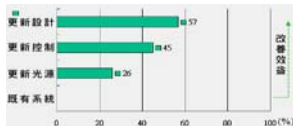
Heat Pump System Very Useful in Schools, Hotels, Restaurants, Hospitals, Swimming Pools, SPA, Villa Mansions, Dormitories, of which Water Heating Accounts for about 1/3 of Energy Consumption.



## 1. Comprehensive Energy-Savings Technical Services (Cont'd)

### (3) Lighting Systems

- Electricity Bill is a Main Fixed Cost, Accounts for about 20%-35% of Total Power Consumption.
- Applying High Efficiency Lighting Systems Can Reasonably Reduce Power Consumption.
- Energy Conservation Center in Chinese Taipei Introduces Green Lighting Technology Has Saved Electricity Consumption over 30%.



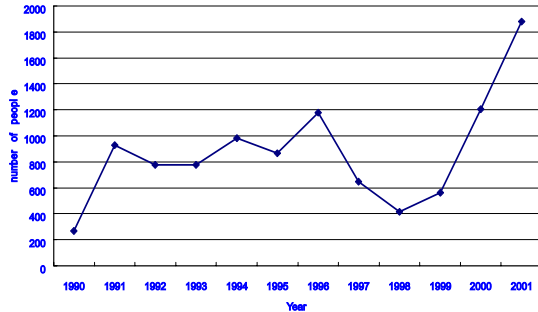
## 2. Training Courses for Energy Managers

Based on Energy Management Law and "Action Plan on National Energy Conference Resolution" in 1999 :

- Set up Advisory, Inquiry and Data Base Management System.
- Skilled Worker Training Course.
- Activities on Research and Promotion.
- Top-Down Promotion of Energy Saving Concepts by Training Class for Energy Managers, Combining Technology with Work Experience.



**Total Trained 1990~2001: 10,495 Skilled Workers**



**3. Promotion and Diffusion**



(1) Tactics in Promotion

- i. Automatic Energy Saving Measures by the Gov't Sector as a Role Model for the Private Sector to Follow Suit.
- ii. Public Awareness Program on Energy Saving.
- iii. Accomplishing the Maximum Energy Saving with the Minimum Costs in Promotion.

**3. Promotion and Diffusion (Cont'd)**



(2) Main Tasks in Promotion

**i. Energy Saving Logos on Cup Saucers :**

- a. Focus on "Energy Saving Targets in Government Offices".
- b. Inducing the General Public to be Aware of Gov't Measures on Energy Saving.
- c. Putting Energy Saving Ideas into Daily Life: Mindful of Energy Saving through Tea Drinking in Office.



**ii. Pencil Box with Energy Saving Slogans :**

- a. Implementing Governmental Energy Saving.
- b. Public Awareness in Energy Saving while Using Pencil Box.

**3. Promotion and Diffusion (Cont'd)**



**iii. Spread of Energy Saving Advertisements :**

- a. Promotion of Energy Labeling Products.
- b. SMART Consumer Education : Informing People to Save Money while Saving Energy.
- c. Tips on Energy Saving with Easy Methods.





### 3. Promotion and Diffusion (Cont'd)

#### (3) Energy Saving Tactics

- i. Matching Grants from Energy Management Funds to Subsidize Those Gov't Institutes Filing Budgets for Energy Saving Retrofits.
- ii. For Others Short of Money in Retrofitting, Recyclable Fund Loaned for Future Repayment.
- iii. Promoting ESCOs: Joint Forces with ECTDC and Other Research Institutes, Experts, Scholars and Private ESCOs, to Engage in the Retrofitting Programs and to Foster the ESCO Industry.

### IV Successful Case

#### 1. Taichung County Government :

Energy Saving Program between 2001 & 2003 Has Cut Electricity Bills by 2.36 Million NT\$, or 20%; Demonstrative Exhibits Held for County-Affiliates Afterwards to Promote Energy Saving Downwards.

#### 2. Items Engaged :

- (1) Power System Improvement
  - i. Control of HVAC Chillers at Peak Hours: Peak Load Down 22kW.
  - ii. Power Factor Increase to 0.96.
- (2) Lighting System Improvement
  - i. High Efficiency Electronic Ballast Widely Used.
  - ii. Mandatory Lights Off Measures at Noon-Rest Hours.
  - iii. Sunlight for Lightings at Central Opening Area; Lightings by Window Half Off.

### IV Successful Case (Cont'd)

#### (3) HVAC System Improvement

- i. Installed Electronic Temp. Control to Cooling Tower.
- ii. Indoor Temp. Set to 26~28°C to Cut Electricity Consumption by HVAC.



#### (4) Office Equipment

- i. Elevator Usage Control For Lower Floors.
- ii. Large Water Heating Equipment with Time-of-Use Switch.
- iii. Running Hours Control for Air Circulating in Underground Parking Lots.
- iv. Gasoline use Control on Vehicles.



### IV Successful Case (Cont'd)

#### 3. Performance of Energy Savings :

Electricity Bill Cut by NT\$ 2.36 Million in 2003, around 20%.



## IV Successful Case (Cont'd)

### 4. Demonstrative Effects :

- (1) Leading Role by Some Local Gov't Facilitates Future Follow-Ups in the Same Sector.
- (2) Top-Down Policy from the Highest Administration with Energy Saving Consciousness Help Public Awareness in Energy Saving.
- (3) Financial Support from the Central Gov't Enhance the Incentives for Public Sector Energy Saving Programs, and Set Role Models for Private Sector.



## VII Conclusion



Annual Energy Stats of Chinese Taipei Has Shown the Primary Effect of Gov'tal Electricity Saving at Annual Growth Rate at 1%, Compared with the National Avg. at 5%. This also Meets the Resolution by the 1998 National Energy Conservation Which Mandates the Gov't Sector to Initiate Energy Saving Programs and Lead the Private Sector to Follow Suits.

