

行政院環境保護署  
Environmental Protection Administration  
Executive Yuan R.O.C. (Taiwan)

## Voluntary GHG Reduction Initiatives in Taiwan

Dr. Hui-Chen Chien  
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Executive Yuan R.O.C. (Taiwan)

## Taiwan's Overview

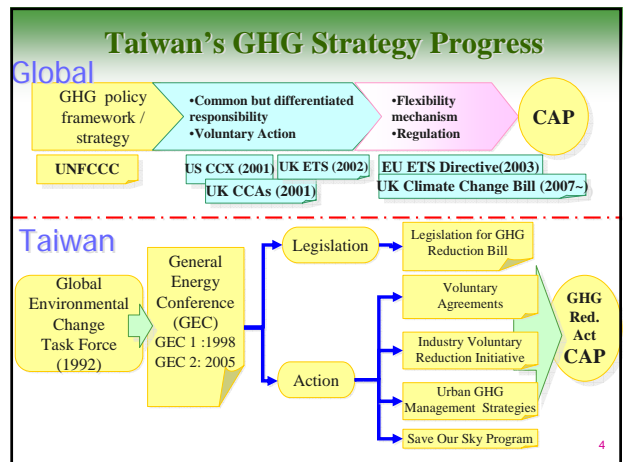
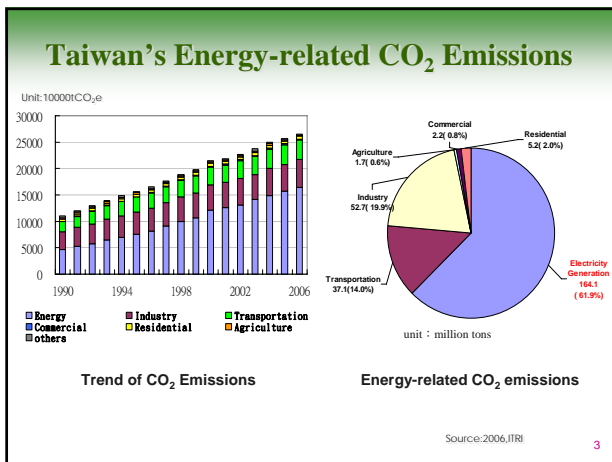
◆ **Economic Status:**

- Population: 22,876,527 (MOI<sup>1</sup>, 2006)
- Per capita GDP: USD 24,980 US\$2000 using ppp (IEA<sup>2</sup>, 2005)
- GDP growth rate: 4.68 % average, 2.3 fold growth between 1990 and 2006 (DGBAS<sup>3</sup>, 2006)
- World's 18th largest economy (World Bank, 2006)
- Major industries <sup>4</sup>: Electronics (22%), Petrochemical (19%), steel (10%), IT (7%), food processing (5%), textile (5%).

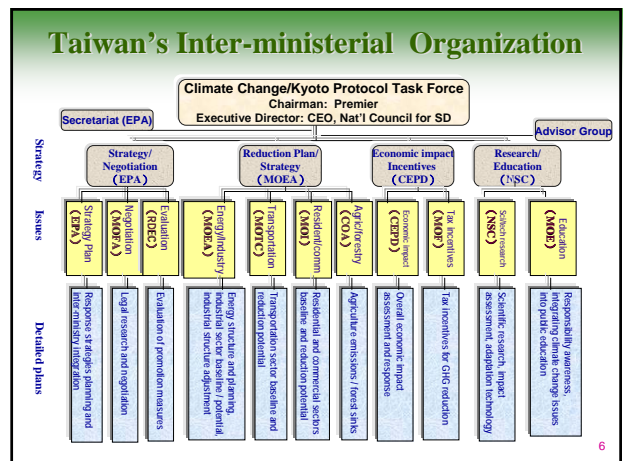
◆ **2005 GHG Emissions <sup>4</sup>:**

- Total GHG emissions of 261.28Mt.CO<sub>2</sub>e, about 0.96% of the global total
- Major emission index:
  - Per capita emission is 11.41 tons of CO<sub>2</sub>
  - Per unit GDP (based on PPP) emission is 0.46kg of CO<sub>2</sub>

1. MOI: Ministry of the Interior  
2. IEA/OECD: Key World Energy Statistics, 2007  
3. DGBAS: Directorate General of Budget, Accounting and Statistics  
4. DGBAS, 2004, based on GDP proportion.



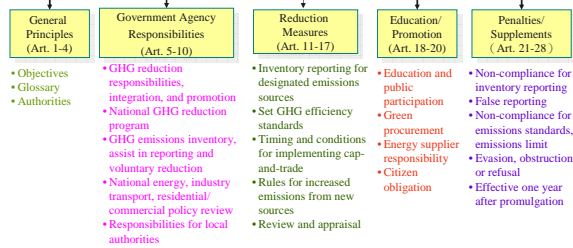
- ## Taiwan's Energy Policies and Measures
- Promote Renewable Energy**
    - Legislating "Renewable Energy Development Bill", which shall provide a favorable framework for sustainable development of renewable energy.
    - The goals for renewable energy development in 2010: 3%-5% of total energy supply, or 10% of power generation capacity (about 5000 MW).
  - Expanding the Usage of Natural Gas**
    - Natural gas consumption is expected to be 13 million tons by 2010, 16 million tons by 2020, 20~22 million tons by 2025.
  - Improve Energy Efficiency**
    - Energy efficiency and energy productivity will increase over 2% per annum.
  - Improve energy transformation efficiency**
    - Applying high efficiency power generating equipment. Enhancing efficiency of new coal-fired power plants from 35% to 40%, new gas-fired power generating plants from 45% to 53%.
  - Continuing promotion of co-generation system**
    - The capacity of co-generation is expected to be 8GW by 2010, and 10GW by 2025.
  - Promotion Strategy of Carbon Dioxide Reduction Technologies**
    - The annual budget of this program is about 280 million NT dollars from 2007.



## Taiwan's GHG Reduction Bill

- Submitted to Legislative Yuan in 2006.
- The first among developing countries
- Consistent with the spirit of the UNFCCC and the Kyoto Protocol

### GHG Reduction Bill Framework



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## Taiwan's Save Our Sky Campaign



### Objectives

#### Short Term:

Promote energy conservation.

#### Long Term:

Change consumers' habits toward green consumption.

### Task Forces:

Energy Efficiency (MOEA), Green Consumption (EPA), Public Education (MOE), Green Transportation (MOTC), Green Landmark (MOI), Promotion (MOEA & EPA)

### Strategy:

Education and Reward.

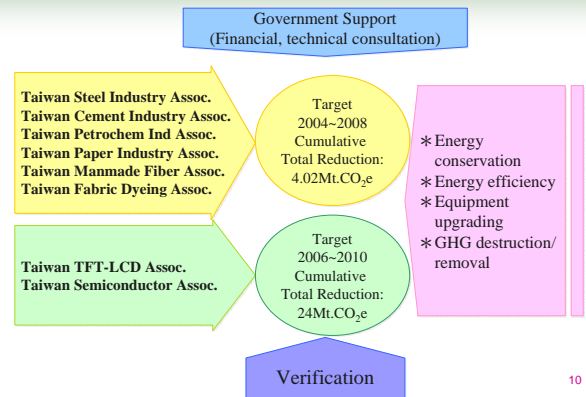
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## Taiwan's Urban GHG Strategies

Taipei and Kaohsiung have joined ICLEI to learn and share experiences of GHG management at local government level. The initiative currently comprises 630 local governments and organizations around the world.

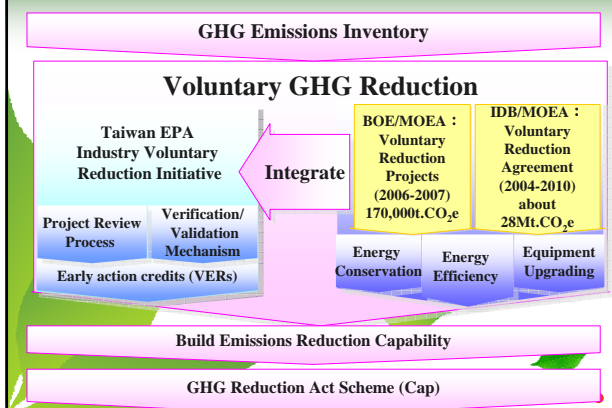


## Taiwan's Voluntary Reduction Agreements



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## Taiwan's Industry Voluntary Reduction Initiative



## Taiwan's Industry Voluntary Reduction Initiative

### Objectives

#### Government:

- Capacity building for promoting GHG reduction management
- Establish scheme to verify and recognize voluntary reduction
- Consistent with international standards

#### Industry:

- Reduce long-term cost through energy efficiency improvement
- Respond to international trend
- Improve corporate image

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### Taiwan's Industry Voluntary Reduction Initiative

- Industry Participants**
  - Power, petrochemical, steel, cement, paper, manmade fiber, dyeing, semiconductor, TFT-LCD, electronics industries, and others with GHG reduction potential
  - Gradually expand to other industries and sectors such as transportation, residential/ commercial, etc.
- Project types**
  - Fuel switch, efficiency improvement, renewable energy, recovery/reuse to reduce GHG emissions, or use forestation, carbon capture and storage for GHG removal.

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### Taiwan's Industry Voluntary Reduction Initiative

- Certification Principles**
  - Additional
  - Verifiable
  - Permanent
  - Transparent
  - Conservative assumptions, values and procedures
- Use of voluntary credits**
  - Offset new sources
  - Industry voluntary offsets
  - Banking (early action credits)

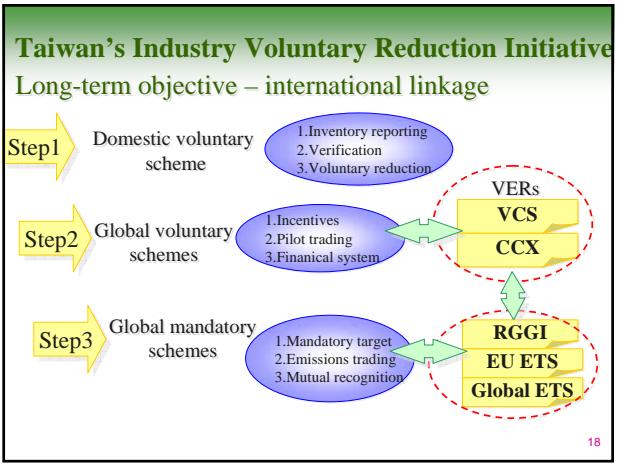
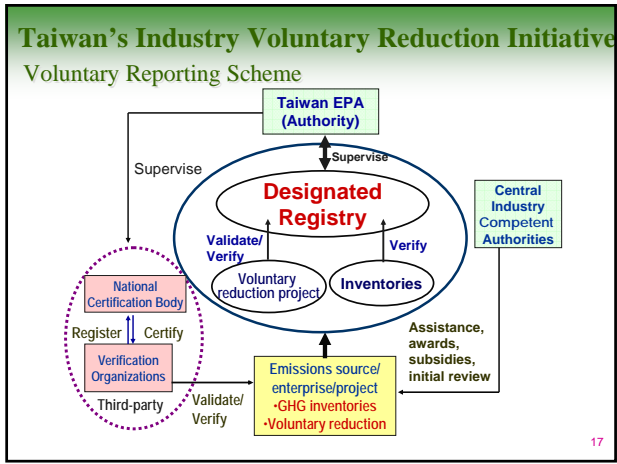
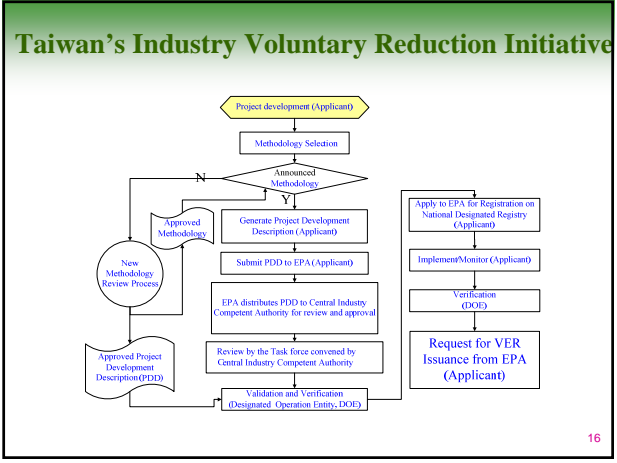
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### Taiwan's Industry Voluntary Reduction Initiative

- Project review process**
  - Consistent with major schemes around the world.
  - Government conducts the initial review.
  - Project has to be validated and verified by 3rd-party verifiers based on ISO 14064.
  - For new methodologies, we have designed a case-by-case review mechanism

Note: Initial project review by EPA, then forward to central industry competent authority, convene review panel for review.

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## Conclusions

- **Taiwan is moving toward low-carbon economy**
  - GHG Reduction Bill legislation
  - Industry energy efficiency improvement
  - Residential, commercial, transport energy conservation
  - Clean technology R&D, promote green industries
  - NGO, industry organization participation
- **Join international dialogue and be a part of the global scheme.**
- **GHG reduction requires concerted global efforts in order to avoid leakage.**

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## Comments please...



Black-faced Spoonbills (photo by Ta-ching Chou)

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Taiwan in COP13/MOP3



Taiwan's GHG Management Development in the Industrial Sector

Voluntary Action beyond Kyoto Protocol

Professor Young Ku

National Taiwan University of Science and Technology

Bali, Indonesia  
December 9th, 2007

www.epa.gov.tw

### Road Map of Tackling Global Climate Change

- 1992: Establishment of Working Group for Environment Change under Executive Yuan
- 1998: First National Energy Forum held
- 2002: First Draft of National Communication
- 2004: Promotion of Voluntary Agreements  
Demonstration projects for GHG verification
- 2005: Establishment of registration platform for industrial inventory  
Second National Energy Forum held
- 2006: Reviewed Greenhouse Gas Reduction Bill by Legislative Yuan  
Published CNS 14064  
Establishment of Taiwan Industry Greenhouse Gas Office
- 2007: Drafting Taiwan Industry Voluntary Reduction Program  
Set up of Taiwan Greenhouse Gas Designated Registry

### Taiwan's GHG Management Development Schedule

2004-2005	2006	2007	2008	~	2012
develop inventory (GHG protocol and methodology)	TEPA GHG information system planning (information system, off-line operation and on-line reporting)	develop GHG pilot verification protocol and regulations			
		Established national GHG registration platform (July 2007, formally open)			
		National GHG registration platform pilot inventory registration (30 factories registered)			
			National GHG registration platform verification/validation registration)		
Promote industrial GHG voluntary agreement (by TEPA, IDB and EP)		Promote industrial reduction pilot program (establish verification and validation methodology and principle)			
					GHG cap and trade pilot

### Major GHG Management Program Items in Taiwan

- Public awareness and information services
- Providing technical assistance
- Promote voluntary agreements and demonstration projects
- Establish greenhouse gases inventory, verification and registration mechanism



### Public Awareness and Information Services

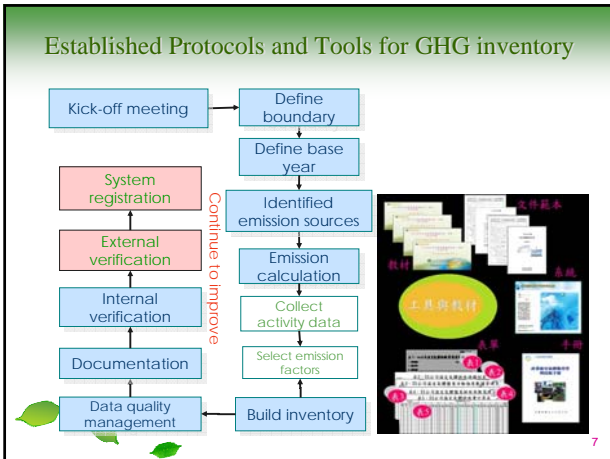
- Since 1994, more than 500 seminars and workshops related to GHG management have been held by various organizations in Taiwan.
- Several newsletters and periodicals related to GHG management were published.



### Providing Technical Assistance

- The promotion of GHG management issues are closely related to the implementation of ISO 14000 EMS standards.
- All certified EMS technical assistance professionals are encouraged to take an advanced course on GHG issues prior to their application for renewal of registration.
- Videos, cross-sector guidance manuals, and sector-specific technical manuals have been made available for various industries.
- Provide various electronic tools related to GHG issues to industries.





### Promote Voluntary Agreements and Demonstration Projects

- Since 1994, IDB has initiated voluntary GHG management agreements (VAs) with various energy-intensive industries.
- Since 2004, TEPA has implemented voluntary GHG management agreements with TLA and TSIA.
- More demonstration projects have been initiated by industries in various sectors for the verification of GHG emission and the validation of GHG reduction.

### Establish Greenhouse Gases Inventory, Verification and Registration Mechanism

- Inventory**
  - Adopt major international inventory specifications
  - Reference to ISO 14001 for GHG inventory management protocol
  - Promote bottom-up emission inventory to assist organizations finding potential reduction opportunities.
- Verification**
  - Promote external verification by third party to ensure the GHG emission baseline
  - Establish verification mechanism suitable for domestic needs and for international accreditation
- Registration**
  - Designation of national GHG inventory and reduction registration platform
  - The platform is built for voluntary registration to industrial sector

### International Specifications for GHG Inventory

ISO <http://www.iso.org>  
MOEA promulgated CNS 14064 (<http://www.bsmi.gov.tw>)

- ISO 14064-1**: For organization level GHG quantification
- ISO 14064-2**: For project level GHG quantification
- ISO 14064-3**: For GHG verification and validation
- ISO 14065**: For the needs by GHG verification and validation organization

[www.ghgprotocol.org](http://www.ghgprotocol.org)

- Standard**
  - Accounting principles
  - organization/operation scope
  - GHG emission report
- Guidance**
  - Target and inventory design
  - GHG emission sources
  - Inventory quality control
  - GHG emission verification
  - GHG reduction calculation and targeting
- Calculation tools**
  - Electronic devices
  - Based on IPCC and modified for industries after use
  - 2 categories: general industry tool and industry specific tool (15 industries)

### Promotion of GHG Inventory Management for Various Industries

- 2004 TEPA completed GHG inventory to 12 factories in 6 major energy intensive industries, including petroleum, steel, power, photo-electronic, cement, paper and semi-conductor industries and established inventory tools.
- 2006 TEPA completed GHG inventory for 18 factories, including car manufacturers, waste incineration technology etc., and established pilot registration platform.
- 2007 TEPA completed 4 factories of energy intensive industry verification and established verification guidance.
- Involvement of national accreditation body (TAF) on GHG management.

### GHG Verification and Registration

Item	under	Energy Bureau	Industrial Development Bureau**	EPA
category		Energy Industry	All Industries except energy	All business
format		File upload	On-line registration	File upload

\*\* provided by IDB at the end of October, 2007

The bar chart shows the number of factories verified by industry sector from 2005 to 2007. The sectors are: oil refinery, waste recycle, power generation, paper industry, petrol industry, LCD industry, cement industry, power generation, steel industry, and semi-conductor. The total number of factories verified increased from 2 in 2005 to 6 in 2006, and to 32 in 2007.

## Current Situation and Future Expectation

- **The operation capability has been built, the next step would be actual reduction**
  - Taiwan GHG inventory pilot operation has gained experience from the demonstration and relevant tools, manual, system and registration platform have been established for industries to use. Therefore, the operation capability has been built.
  - The government is promoting for voluntary reduction at the present moment and collecting comments from all sectors to find mutual recognition on the reduction goal and acceptable process. The industry must establish correct concept in achieving "actual reduction" as soon as possible.
- **To prohibit global warming through international experience and cooperation by joint reduction efforts**
  - Global warming is irreversible, it is the responsibility of all countries, enterprises, societies, and individuals to reduce GHG.
  - Taiwan is a member in the global village therefore we expect to exchange reduction experience with international organization, and promote for cooperation to fulfill our responsibility for GHG reduction.



## The strategies of PFC Emission Reduction in TSIA





**Joseph KC Mou**

Taiwan Semiconductor industry association

Taiwan Semiconductor Industry Association

## Outline

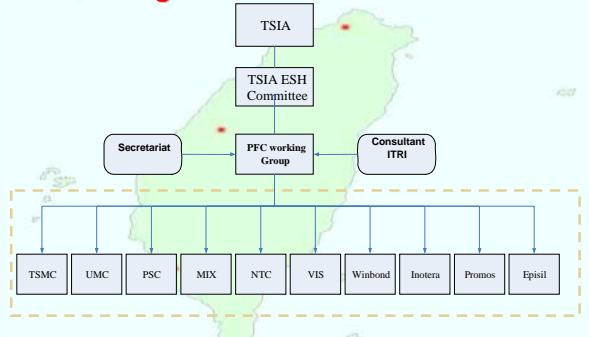
- TSIA Organization
- PFCs Emission Reduction Technologies
- PFCs Emission in TSIA
- Validation and Verification Plan
- Conclusion



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Taiwan Semiconductor Industry Association

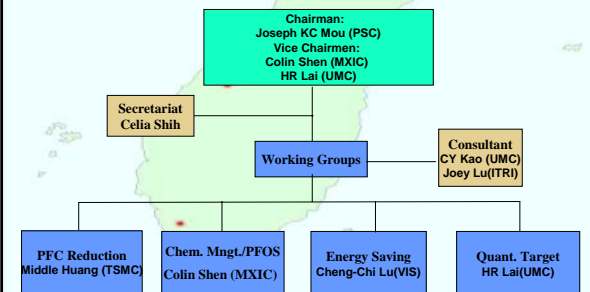
## TSIA Organizational GHG Boundaries



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Taiwan Semiconductor Industry Association

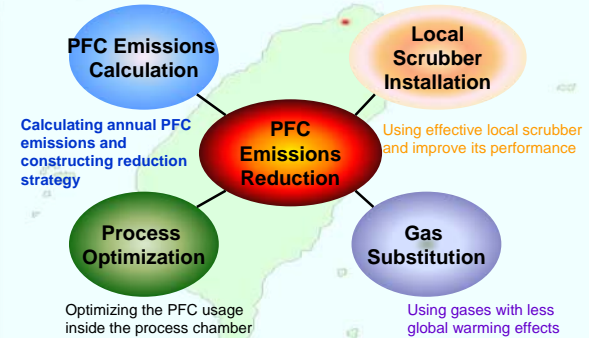
## ESH Committee Organization



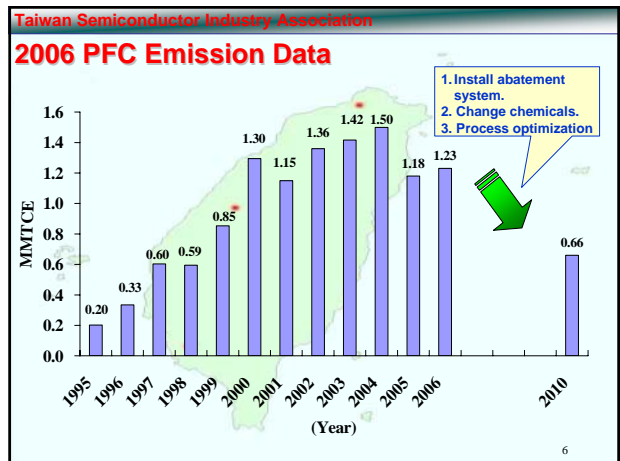
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Taiwan Semiconductor Industry Association

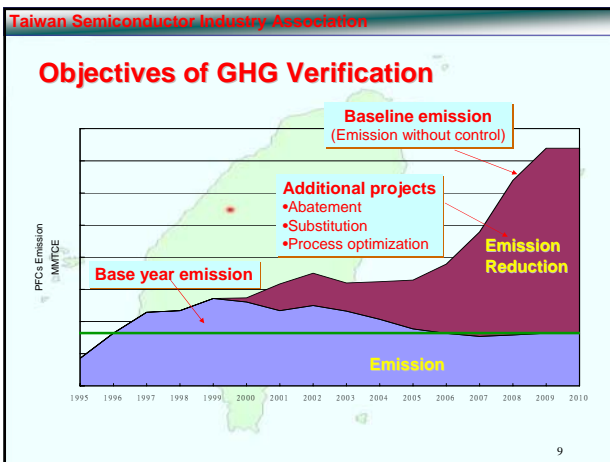
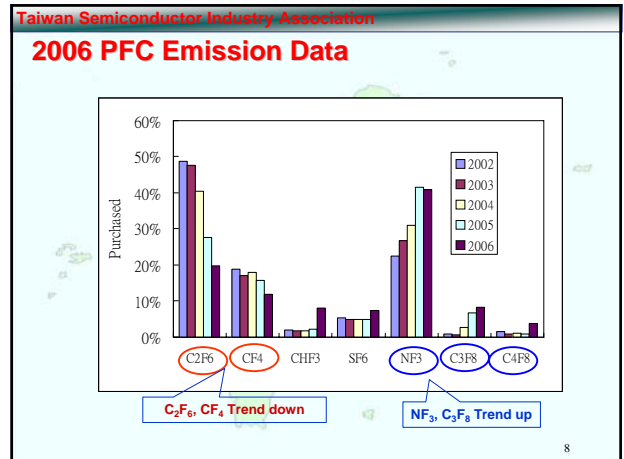
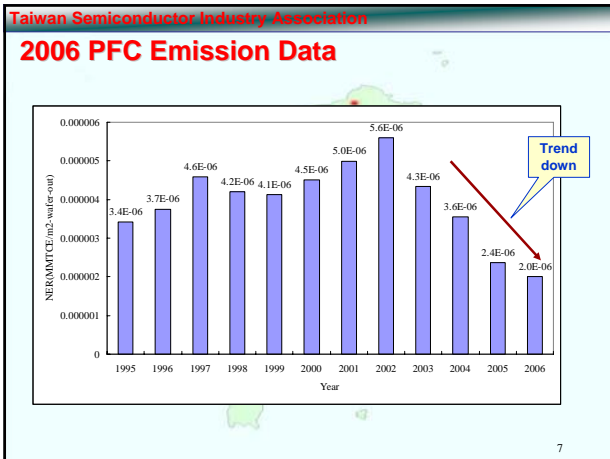
## PFCs Emission Reduction Technologies



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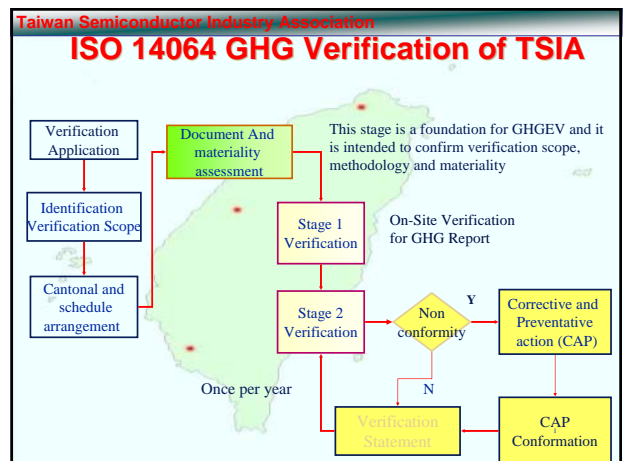


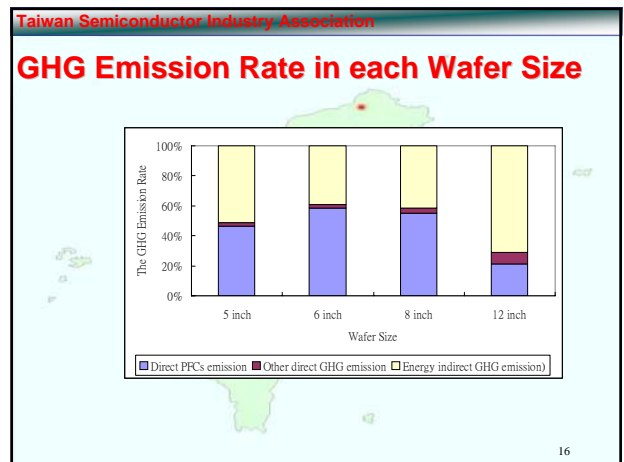
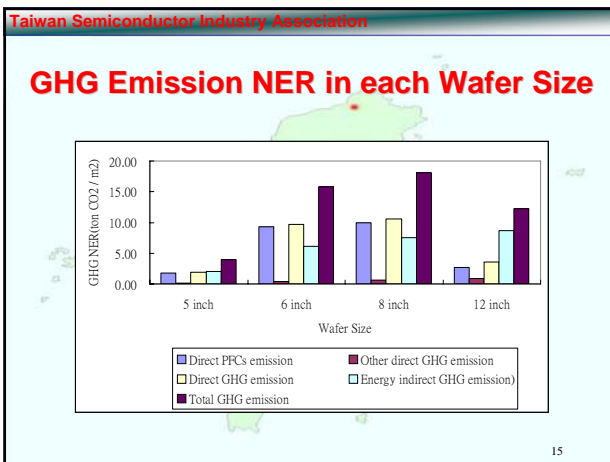
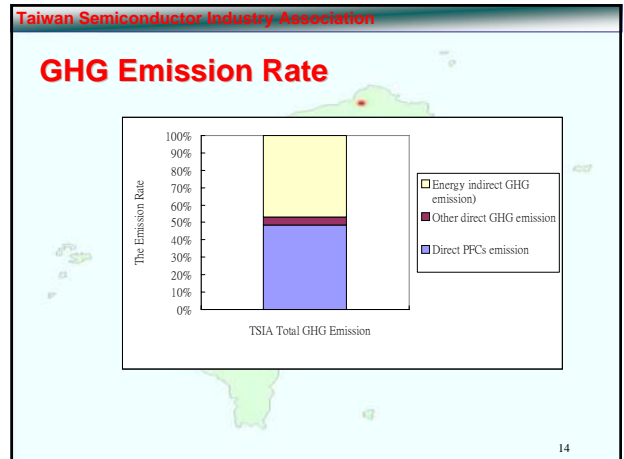
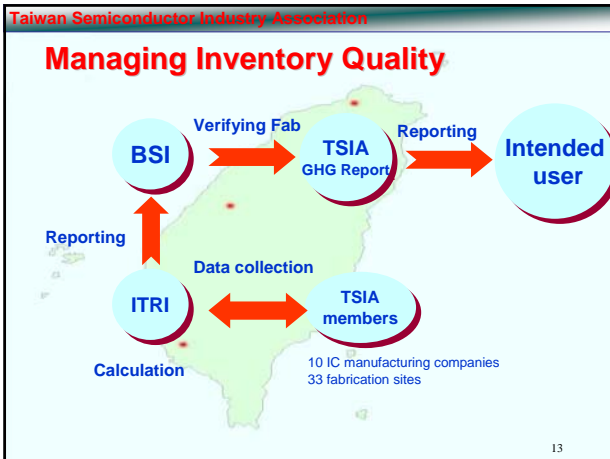




- Taiwan Semiconductor Industry Association
- ### GHG Verifications Report
- Follow ISO 14064-1, 2
  - Key items
    - Setting boundaries
    - Calculation Formula
    - Monitoring
    - Assessing and reducing uncertainty
    - Managing inventory quality
    - Report format
    - Level of Assurance
  - Implementation
    - BSI, ITRI and TSIA Cooperation
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- Taiwan Semiconductor Industry Association
- ### Setting Operational Boundaries
- ISO 14064-1
    - Direct greenhouse gas emission
      - PFCs
      - VOC
      - N<sub>2</sub>O
      - Using Fuel
      - Wastewater plant
      - Refrigerant
    - Energy indirect
      - Imported electricity
    - Other indirect
- 11





- Taiwan Semiconductor Industry Association
- ### Conclusions
- TSIA already signed a voluntary reduction memorandum with Taiwan EPA to reduce the use and emission for PFCs.
  - Taiwan Semiconductor industry will comply with WSC and Taiwan EPA strategies to reduce PFCs emission.
  - TSIA will continue to develop energy-saving to reduce greenhouse gas emission and achieve sustained development as the goal
  - Getting more the information of GHG emission
    - Verification of the amount of emission reduction & annual emission data from 2000 to 2010
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Taiwan Semiconductor Industry Association

Thank you for your pay attentions.

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# The GHG Reduction Experiences and Strategies of China Steel Corporation (CSC)

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Bali, Indonesia  
Dec. 10, 2007



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- I. Historical and Trend
- II. Projects and Performance
- III. Business As Usual (BSU) Scenario
- IV. Future Directions and Strategies

### I. Historical and Trend

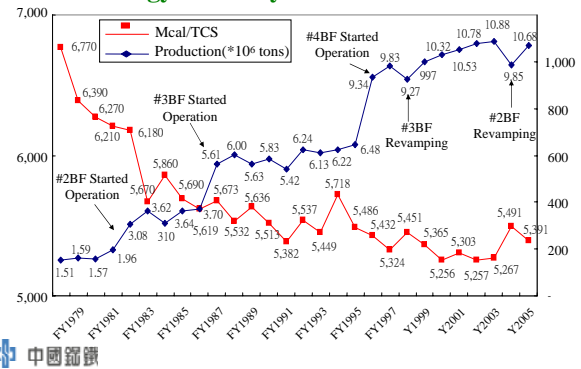
#### 1. Energy Saving Activities

- **Early Actions:** Energy saving has been a measure to cut down production cost since early operation of CSC (resulting in a significant CO<sub>2</sub> reduction).
- **Main energy saving measures:** Including 100% continuous casting, efficient and large production facilities, high production rates and yields, various waste heat recovery and waste recycling installations.

#### 2. Energy Intensity

- Compared to 1979, CSC's energy intensity has decreased by ~20% (**Fig. 1**), and CSC's specific energy consumption in 2006 was 5,391 Mcal/tcs (22.5 GJ/TCS) which is near the world top level.

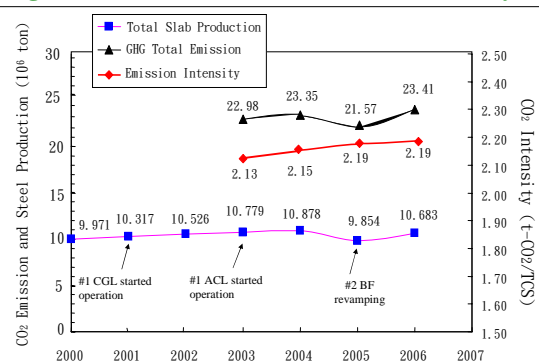
**Fig. 1: Trend of Steel Production and Energy Intensity**



### 3. GHG (Green House Gas) Inventory

- **CO<sub>2</sub> Inventory and Intensity:** Since the 1st National Energy Conference in 1998, CSC has calculated its GHG inventory following IPCC methodology. Recently, CSC has switched to the ISO and GHG Protocol methodology. By transforming the inventory into CO<sub>2</sub> intensity, it can be cross compared with international steel mills.
- **Verification:** A trial external verification for CSC inventory was conducted in 2006 and a formal one is under way. Actual consumption data from production departments will be cross-checked with purchasing, storage and financial records.

**Fig. 2: Trend of CO<sub>2</sub> Emission and Intensity**



## II. Projects and Performance

### ◆ Internal Reduction Projects:

1. Energy-saving Process and Improved Yield: Planned and implemented by Engineering and Production Divisions, with assistance from Technology Division.
2. Optimal Energy Management: Utility Department set up short, medium, and long term plans and put them into action, including improving power generation efficiency and switching to low carbon fuels or purchased power.
3. Energy-saving Products: Including high-strength, low iron-loss, treatment-free steels etc, for the energy saving of customers and final users.

### ◆ Internal Reduction Projects (continued)

4. Enhance Waste Heat Recovery: Utility Department, R & D, and operation plants form a task force and select the best ones for implementation (under CSC's limitation, in space).
5. Energy Diagnosis and Continual Improvement: A special task force was formed to assist all operation units to find potential areas for improvement.
6. Promote Utility Energy Saving: Extensively applied to pumping systems, illumination, heat isolation, air conditioning etc, via design, procurement, maintenance, and daily practice.

### ◆ External Reduction projects

#### 1. Regional Energy Integration

- Energy Synergy: CSC has established a energy network in local community by supplying nearby plants with surplus energy products such as steam from waste heat or combined heat and power (CHP) plant and N<sub>2</sub>, O<sub>2</sub>, Ar from oxygen plant.
- Multiple Benefits: Through this network, not only the production costs of the participating plants are reduced, but also the overall energy efficiency are improved and the associated CO<sub>2</sub> and air emissions was reduced significantly.

### ◆ External Reduction projects (continued)

2. Replace Cement by BF Granulated Slag Powder: Replacing each ton of cement will result in 0.79 ton CO<sub>2</sub> reduction. CSC cooperated with academia and downstream plants to promote the slag powder industry for a market >5 million ton per year.
3. Optimal Use of Plant Residues: CSC has achieved "Zero-Waste" target since July 2002 with a variety of external recycling projects, thus reducing GHG emission via natural resource conservation and avoiding waste treatment.
4. Energy-saving Service and Others: Assisting CSC Group companies and customers to save energy, and diffusing experiences to other SMEs.

### ◆ Main Energy Saving Since 1997

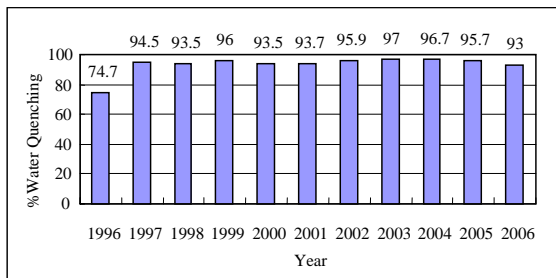
Projects	Reduction (in 1000 ton-CO <sub>2</sub> /Year)	Remark
Waste Heat Recovery	1,300	Accumulative results during 1997~2006
2010 Energy-Saving Project	260	Energy saved in 2005~2006
District Energy Integration	162	Up to 2006, calculated based on oil equivalence
Replacing Cement with BF Granulated Slag	2,170	275 million ton slag by CSC, ~3 million ton Imported

### ◆ Regional Energy Integration

-Estimated Energy Saving and CO<sub>2</sub> Reduction

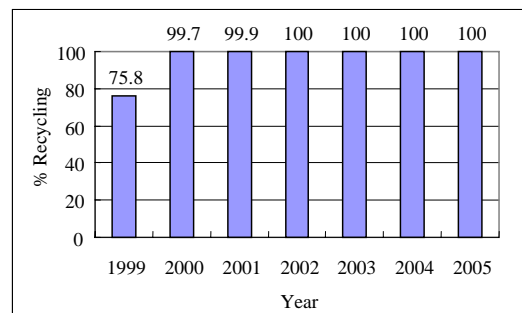
	2006	2008	2013	Total
Energy Saving (net KL Fuel Oil/Year)	72,342	76,960	60,800	210,100
CO <sub>2</sub> Reduction (net Ton/Year)	162,200	+154,200	+153,000	469,400

◆ **High Water-Quenching Ratio of Blast Furnace Slag (~100% Replacing Cement)**



\* Water-Quenching Ratio is lower due to start up of newly relined #2 blast furnace.

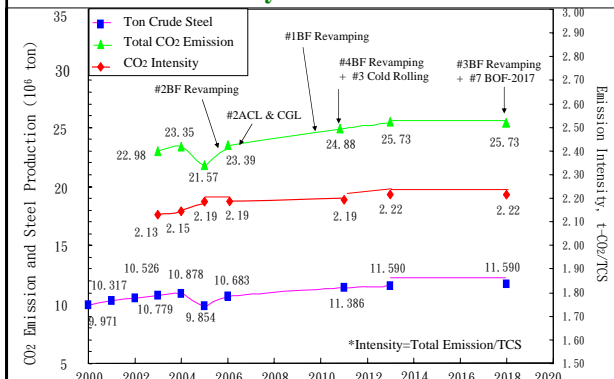
◆ **100% Recycling of Dust and Sludge (Zero Landfill Since July 2001)**



**III. Business As Usual (BSU) Scenario**

1. **“Double 2000” Expansion Project:** To meet further needs of domestic steel market, CSC initiated a “Double 2000” expansion project in early 2007. There are major production increases and value-added new operations in CSC Group’s two production sites (CSC and Dragon Steel). The projected CO<sub>2</sub> emission of CSC is shown in **Fig. 3**.
2. **Allocation of Additional CO<sub>2</sub> Quota:** Under current situation, it is not easy for CSC to acquire additional CO<sub>2</sub> quota from Taiwan government for business expansion. To solve this problem by internal and external reduction measures seems necessary.

**Fig. 3: Projected Production, CO<sub>2</sub> Emission and Intensity for CSC in “Double 2000”**



**IV. Future Directions and Strategies**

**1. Basic Principles**

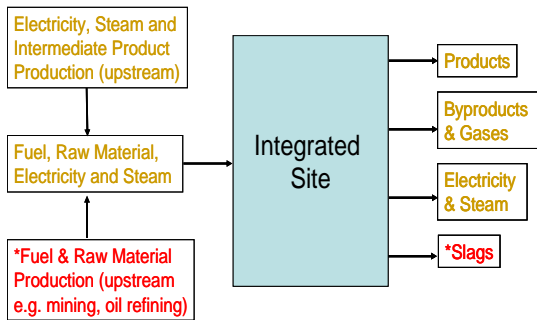
- (1) **Fundamentally Sound:** Obtain a good overview through widespread information collection and in-depth study. Borrow international experiences.
- (2) **Proactive Attitude:** Participate in major domestic and international activities with certain contribution.
- (3) **Progressive Actions:** Stepwise approach, pick low-hanging apples first.
- (4) **Cost-Effectiveness:** “Simple is better”. Apply “Producing more with less” not only in technical issues but also in other related issues.
- (5) **Fit Indigenous Conditions:** Better actions and results.

**IV. Future Directions and Strategies (continued)**

**2. Benchmarking for CO<sub>2</sub> emission**

- (1) **Target Index for CO<sub>2</sub> Emission:** Benchmarking in CO<sub>2</sub> intensity for an integrated steel mill can be used as a target index for CO<sub>2</sub> emission in Voluntary Agreement or when “Cap and Trade” is applied (e.g. like the “Benchmark Covenant” in the Netherlands and Belgium).
- (2) **Need Common Basis for Cross-Comparison:** With the coordination of steel associations, a common basis for CO<sub>2</sub> benchmarking could be formulated (**Fig. 4**). Under this common basis, a benchmark in energy consumption and CO<sub>2</sub> emission could be determined.

**Fig. 4: Establish a Common Basis for Energy Intensity and CO<sub>2</sub> Benchmarking (Hot-Roll Product Basis)**



#### IV. Future Directions and Strategies (continued)

##### 3. Prepare and Propose for “Cap and Trade”

- (1) **Fundamentally Sound Basis:** The rules adopted should comply with good-practice principles such as “common but differentiated obligations”, “cost-effectiveness”, “fair and simple”, and “encouraging early actions” etc.
- (2) **Reasonable and Simple Rules for Allocation:** For large businesses, the CO<sub>2</sub> emission quota can be determined by multiply CO<sub>2</sub> intensity benchmark by the total production at the base year(s), provided the energy/CO<sub>2</sub> intensity benchmarks could be derived.

#### IV. Future Directions and Strategies (continued)

##### 4. Internal Reduction at CSC

- Continue efforts in following areas:

- (1) **Low Energy Steel Products:** CSC has formulated 8 Strategic Alliance groups with downstream steel customers to develop high-value-added steel products, including higher grade energy-saving steel products.
- (2) **Energy Saving:** To save energy by 192 Mcal/TCS (3.6%) in CSC by 2012, with energy intensity approaching 5,200 Mcal/TCS or 21.7GJ/TCS. CO<sub>2</sub> will be reduced by 630,000 ton, while CO<sub>2</sub> intensity reduced by ~0.06 Ton/TCS.

##### 4. Internal Reduction at CSC (continued)

- (3) **Waste Heat Recovery:** CSC has very limited land space. It is not easy to install facilities to recover waste heat, upgrade emission control and for business expansion. Nevertheless, CSC is committed to do its best in optimization.
- (4) **Higher Efficiency for Power House:** Additional energy saving can be realized in the internal power house with the following measures:
  - revamping the old #1 power house to improve its energy efficiency
  - replacing steaming coal by low carbon energy sources such as natural gas or purchased electricity.

##### 5. Participation in External Reduction

- Cover wide varieties, grouped as follows:

- (1) **Low Carbon Public Projects:** To invest in clean transportation projects to cut down CO<sub>2</sub> emission, such as Taiwan High Speed Rail, Kaohsiung Mass Transit System and the connecting bus lines. Regional CO<sub>2</sub> capture and sequestration opportunities will also be considered when available.
- (2) **Low Carbon Energy Projects:** Look into investment opportunities in fuel efficiency additives and devices, waste energy recovery, bio-diesel, renewable energies, and energy service companies (ESCO), clean coal, as well as promote the use of these energies.

##### ◆ Participation in External Reduction (continued)

- (3) **Cooperative Voluntary Reduction:** Establish domestic credit-sharing rules for CVR borrowing from JI (Joint Implementation). Apply these rules to CSC’s cooperative projects such as Granulated BF Slag and Regional Energy Integration. Select suitable ones for international VERs (Verified Emission Reductions).
- (4) **Reduction Funds:** Reduction funds will be allocated by CSC Group to facilitate reduction projects at research and demonstration stages. A wide range of activities is covered, including energy service and ESCO, new energy demonstration, fuel efficiency trials, studies to promote low carbon energies, energy benchmarking studies etc.

**Thank You Very Much  
for Your Attention!**

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# Voluntary Carbon Market

## A Bottom Up Innovative Alternative?

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2007/12/10

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## PART I: Compliance & Voluntary

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## Carbon + Market ?

- A carbon market is a market for
  1. greenhouse gas **emission reductions** (credits) and
  2. **rights to release** greenhouse gas **emissions** (allowances).

(Erik Haites, 2007)

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## Compliance vs. Voluntary<sub>(1)</sub>

- |                                  |                                  |
|----------------------------------|----------------------------------|
| □ Mostly KP Members              | □ Including Non State & others   |
| □ Open Ending Participation      | □ Not Universal Participation    |
| □ Regulations, Large Scale       | □ Project Base, Small Scale      |
| □ Binding Targets & Timetable    | □ No Binding Targets & Timetable |
| □ Cap-and-Trade                  | □ Cap-and-Trade & Maybe not      |
| □ Additionality                  | □ Suspicious Additionality       |
| □ Tradable Credits or Allowances | □ Offsets                        |
| □ Compensation by Essence        | □ Variable Value Purposes        |

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## Compliance vs. Voluntary<sub>(2)</sub>

- |  |  |
|--|--|
| □ A Common & Credible Procedures   | □ Not a Common & Credible Procedure              |
| □ Credible Monitoring Process  | □ Non-Crediable Monitoring Process               |
| □ Unambiguous Property Rights (Value) for Reduction Credits & Allowances | □ No Clear Property Right Characters for Offsets |
| □ Transparency regarding Credibility                                     | □ No so Transparent                              |

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## Contemporary Voluntary Carbon Market

- During 2006 the voluntary market accounted for estimated sales of about **13.4 MtCO<sub>2</sub>e** at an average price of about 2006 **US\$4.10/tCO<sub>2</sub>e**.
- According to the forecast addressed by Erik Haites the annual sales of Voluntary Carbon Market will hit 250 MtCO<sub>2</sub>e (120 to 400 MtCO<sub>2</sub>e) during 2008-2012 at an average price of 2006US \$10/MtCO<sub>2</sub>e.
- At that time, the voluntary market would represent about 15% of the total market. (P.S., KP market: Annually, 475 MtCO<sub>2</sub>e(CDM), 16(JI), 820 MtCO<sub>2</sub>e(EU phase I), 280 MtCO<sub>2</sub>e(EU phase II)

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## The Vision for Voluntary Carbon Market

- Trexler estimated that US demand for voluntary offsets could almost double annually to 250 MtCO<sub>2</sub>e by 2011.
- With a compliance market of 2006 US \$5 to \$25 billion, the voluntary market would represent about 15% of the total market.

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## Why Voluntary Market<sup>(1)</sup>

- **Innovative and Flexible** for variable supplies.
- **Lower Transaction Cost:**  
For a CDM offset project approved the cost is US\$50,000 – US\$ 250,000 ( Krolik, 2006 op.ct. Ricardo Bayon & etc. p.12 ) ; for a small scale project, according to UNDP, it's 14-22% of the net present value of its revenue from carbon credits ( Id., p.13).
- **Lower Entry Barrier:** the registration process when lacking of jump-start capital.

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## Why Voluntary Market<sup>(2)</sup>

- **Easier Financing Conditions:** for wider coverage of methodologies; i.e., Nature Conservation can work to obtain a forest protection project finance which has yet been recognized as an admissible concept under "avoided deforestation" illustrated by the KP.
- **Public Awareness:** It provides a means for individual participation vis-à-vis company and organization which might benefit to the transportation and residential sector target. Environmentalist take this as an educational tool
- **Avoid the Possible Political Postpone**

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## The Main Obstacle of the Voluntary Carbon Market Development

- According to Erik Haites, the growing vision of the voluntary market is contingent on satisfactory resolution of concerns about the **integrity of the emission reductions being sold.**
- **Trust building shall be the top issue.**

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## Crucial Features for a Reliable Voluntary Carbon Market

- The **integrity of the offsets** offered varies significantly with regard to the: ( Erik Haites, 2007)
  - **Additionality** (reductions not already occur),
  - **Actual existence of the emission reductions** (monitor & claim verification),
  - **Exclusion of double-counting** (the same emission reductions are not sold to several buyers),
  - **Permanence of the reduction**, and
  - **Existence of community benefits**

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## Who are the Stakeholders

- Governments
- Companies
- Non-profit organizations offer to offset emissions from vehicle use, air travel, and other energy consumption for individuals
- Other entities not subject to a regulatory obligation to reduce their emissions.
- Individual under a bundled product scheme (i.e., sale of green energy products)

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## How the Market Functions

- The voluntary carbon market can be;
  1. Accomplished by a single entity; i.e., HSBC's carbon neutral operation project of 2004 in purchasing offsets from Germany, India, Australia and New Zealand. (US\$750,000 in amount)
  2. Backed up with a Regional Greenhouse Gas Initiative (RGGI) or a private trading system; CCX
  3. A national supported project; i.e., Energy Integration Project of China Steel, Taiwan

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## A Model Market

- Members of the Chicago Climate Exchange (CCX) made a **voluntary, legally-binding commitment** to reduce their GHG emissions by 1% per year from their 1998-2001 baseline, a 4% reduction during 2006. 40
- The members had an **overall emissions limit** of 221 MtCO<sub>2</sub>e for 2006. 41 The CCX transacted 10.3 MtCO<sub>2</sub> in 2006 at an average price of US\$3.80.42 p.14

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## PART II

### Voluntary Market as a Bottom Up Approach:

Following the Track of US RECs Experiences

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## Long Existing Energy Sector Related Voluntary Markets

- The voluntary carbon market predated all regulated carbon markets (since 1989)
- The evolving history has been closely related to the Energy sectors; i.e., AES (American Electricity Company's investment in an agro-forestry project in Guatemala) (Bayon, 2007, at p.11)

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## Energy Policy in Reflection of the National Differentiation

- It's been kept emphasized on the innovative and creative energy policy to tackle the GHG control issues. (3E Strategy)
- Also, it was argued that different energy policy shall be applied to adapt to each country's unique security, environment and industry conditions.

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## The Compatibility between RECs & GHG Voluntary Markets

- For the energy sector, the GHG regulations tend to be taken as part of the traditional Air Quality Control efforts.
- In turns, energy industry's experiences in voluntary market becomes important; e.g., Renewable Energy Certificates (RECs) trading system of US.

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### PART III

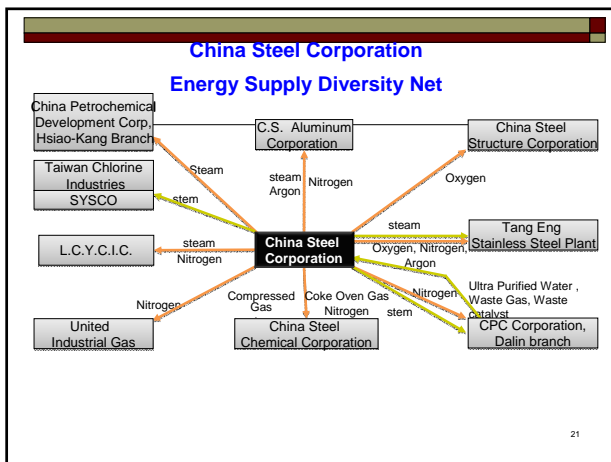
#### A Combination Model of Taiwan: A Regional Based Energy Integration Project of China Steel

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#### Regulation + Voluntary Trading + Policy Support

- The Clean Air Act regulation concerning variable type of gases or steam.
- The Trading Scheme Initiated by China Steel since 1997 ( Regional Energy Integration Project of Seashore Industrial Zone)
- Under the auspices of government policy in overcoming the legal and other obstacles

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#### Energy Integration Project

##### Between China Steel Corp. and Seashore Industrial Park

- During the process of steelmaking, tremendous amount of steam emit into atmosphere. Those energies can be recycled for cogeneration.
- For instance, air separation plants produce O<sub>2</sub>, N<sub>2</sub> and Ar.
  - O<sub>2</sub>: the key material of steelmaking
  - N<sub>2</sub>: difficult to be recycled
  - Neighborhood factories can use two gases together to prevent resources from wasting.
- Recycled steam may enhance energy efficiency and reduce CO<sub>2</sub> emission.

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#### A Glance on the Project & Its Achievements

- The industrial zone is located in Kaoshung of Taiwan. Most of the enterprises therein are energy consumption oriented;
- The Project encourages the trading among the residing factories to exchange their wasted and/or surplus resources for others' uses.

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- While the Project may facilitate the clean air law's implementation to improve the air quality in the region, also, it's been proved to be beneficial to the GHG control by diminishing the petroleum consumption for steam generation.
- The trading volume has increased significantly by 20-30% annually.

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## Air Quality Improvement Project

- Supply of waste steam can reduce the operation and emission of boiler works

Year	Plant	Benefits from the sales of stem (tonne/year)			
		TSP	SOx	NOx	CO <sub>2</sub>
before 2004	China Steel Chemical Corporation	2	21	15	6,559
	C.S. Aluminum Corporation, Linhai Branch	2	22	15	6,779
	L.C.Y.C.I.C.	29	294	204	91,235
	China Steel Chemical Corporation	11	110	76	34,076
	Total	44	446	310	138,649
2004 added	Tang Eng	3	32	22	10,007
	Taiwan Chlorine Industries	7	70	48	21,583
	SYSCO	3	32	22	10,007
	Total	13	134	93	41,597
added in the future	CPC Corporation, Dalin branch (Phase1)	34	343	238	106,436
	CPC Corporation, Dalin branch (Phase2)	68	686	476	212,871
	ISK TAIWAN	2	17	12	5,241
	Total	103	1,045	725	324,548
	Total	161	1,626	1,128	504,794

## Special Features of the Case

- Various types of Participants.
- Most of the participants are energy consumption oriented.
- Exchange wasted and/or surplus resources/industrial gases.
- Trading volume: increase 20-30% annually.
- Added benefits (so-called **co-benefits effect**):
  - (1) Improve air quality in the region under Taiwans' Air Pollution Controlling Act.
  - (2) Diminish the usage of petroleum for steam generation among participants.
  - (3) Save energy cost of some participants.
  - (4) Reduce CO<sub>2</sub> emission consequentially.

## Highlights on the Case

- Neither a binding nor legally binding project.
- Trading targets: Not greenhouse gases.
- Does Not create tradable offsets or allowances.
- No baseline and timetable.
- Business-as-usual (BAU) emission.
- No Cap, no additionally.
- No Standards and methodologies.
- No Monitoring and Verification Process.
- No credibility.

## PART IV What's in Need to Turn a Voluntary Project into A Market

## The Formulation of Market Features

- For all the important factors need be included; it's convincible to categorize them into three dimensions:
  1. Policy & Law
  2. Technology & Standard (including certify)
  3. Business Model & Financial Accountability

## Dimension One: Law & Policy

## A Comprehensive Four Stage Coverage

- Stage One: Product Creation
- Stage Two: Product Verification & Certification
- Stage Three: Product Distribution  
Stakeholders: Retailers, Investors, Brokers, Exchange & Registries
- Stage Four: Product Consumption

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## Issues (1)

- Stage One: Concept vs. Project (Is Buyer's Funding Available?)
- Stage Two: **Life Cycle** of Creation Recognized by the Market; VERs count on Legitimate Third Party Verification; e.g., how many years to generate VERs for the pay back of various technologies, the amount of GHG destroyed, displaced or stored. For others, **Additionality, Performance, Leakage (transfer emission to another location), Double Counting, Ex-ante & Ex-post Accounting, Co-Benefits**. (Certify Program: CCB Standards, CCX, Climate Neutral Network, Green-e, ISO 14064 Standard, Voluntary Carbon Standard, Voluntary Gold Standard, WRI/WBCSD Protocol)

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## Issues (2)

- Stage Three: **Stakeholders & Value Chain Creation**. Also the **finance mechanism & Exchange Platform** (CCX is the only exchange trading voluntary carbon credits on the membership basis.) Public Trust and Registration (Database to record The Accomplishment)
- Stage Four: To offset 4 types of emissions; Internal Emission, Product Life Cycle Emission, Event Emission, Individual Emission.

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## Core Policy Issue: Additionality

- Making sure a real GHG emission is being allowed into the atmosphere for each offset retired.
- It's crucial to maintain the integrity for each credit or allowance granted.
- The key work is to figure out the "baseline"
- Five tests developed by WRI/WBCSD Greenhouse Gas Protocol for Project Accounting has now been widely accepted. (including Investment, Technology, Regulatory, Common Practice and Timing) (Bayon & etc.P.24)

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## In Taiwan

- In addition to the contemporary Clean Air Act, We proposed a very first GHG Mitigation Act (Draft) in the world.
- We mainly follow the WRI/WBCSD Protocol for the certification and verification.
- The government is promoting the related services industry and support the possible VERs related cases, including the forestry project.

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## Dimension Two: Technology & Standard

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## The Integrity Issues

- This growth is contingent on satisfactory **resolution of the integrity issues** as mentioned above. The issue should be solved mainly on the technology basis.
- A cap is important. On the other hand, the **cap can be designed in an innovative way**. For instance, to establish a cap on greenhouse gas emissions associated with electricity consumption in New South Wales.
- Certificates can be generated by accredited projects that reduce emissions or **enhance removal of greenhouse gases**. (e.g., **New South Wales-ACT Greenhouse Gas Abatement Scheme** )

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## Technical Compatibility

- In Nov. 2005, IEA addressed in "New Commitment Options: Compatibility with Emissions Trading" that the technical compatibility includes;
  1. Dynamic target (in associated with economic growth)
  2. Binding target with price caps
  3. Non-binding targets
  4. Sector-wide targets/mechanisms
  5. Action targets
  6. Allowances and Endowments
  7. Long-term Permits

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## In Taiwan

- The inventory technology has been mature.
- The project implementation capacity is well developed.
- The regulatory related technology is in progress.

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## Dimension Three: Business Model & Financial Accountability

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## A Game of Smoke & Mirrors?

- Mark Trexler: "The voluntary market could grow by an order of magnitude or two orders of magnitude and it's still **not going to impact the problem**." (Trexler, 2006)
- Uniformity: **risk of non-delivery**; **the quality standard of the carbon credits** (NGO criticism)
- Transparency: **not legally binding** so the market suffers for fragmentation and a lack of widely available impartial information. (variable types on case by case basis)
- **Registration**
- **Regulation**: Regulation is the key to drive a large scale demand.

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## What Need to be Solved from Stakeholder's Perspective

- **To company**: can not be done **in normal course of business** and hard to evaluate the **cost effective** performances; **risk of non-delivery** and **poor in quality** (loosing good will); confusing for variety
- **To environmentalist & buyers**: lack of regulation cannot reach the scale necessary to impact the problem, in turns, fail the scheme.

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## Energy Industry's Experiences

- "Act locally, Benefit & Trade globally" (COP 11)
- For instance, in RECs case, a non-profit institute the Center for the Resource Solutions established in 1997 the Green-e Renewable Electricity Program to build consumer confidence in green power.(set environment product standards and ask for information disclosure form the companies)
- Green marketers pay annual fee and take an annual audit and also the Environmental Trust.

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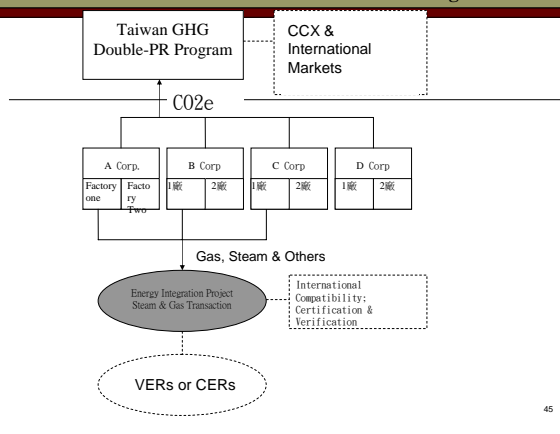
## RECs Market as A Combination

- In the US
- Both buyers and sellers of RECs claim to justify their activities in terms of carbon emissions reductions
- On the other hand, the voluntary carbon credit sellers sell RECs as a substitute for CO<sub>2</sub> emission reductions
- It was thought that much of the voluntary RECs market will use the carbon market as a convenient outlet.

(Ricardo Bayon, Amanda Hawn & Katherine Hamilton Voluntary Carbon Markets pp.105-6)

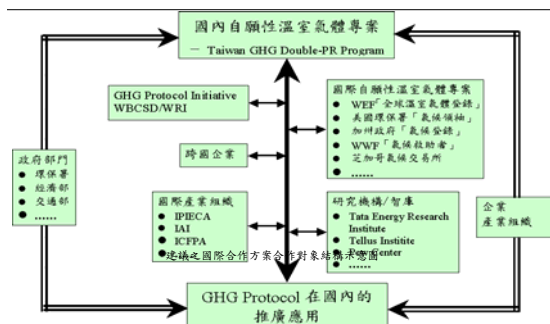
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## An Illustration of Taiwan GHG Double-PR Program



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## The International Cooperation in Long Term Perspective



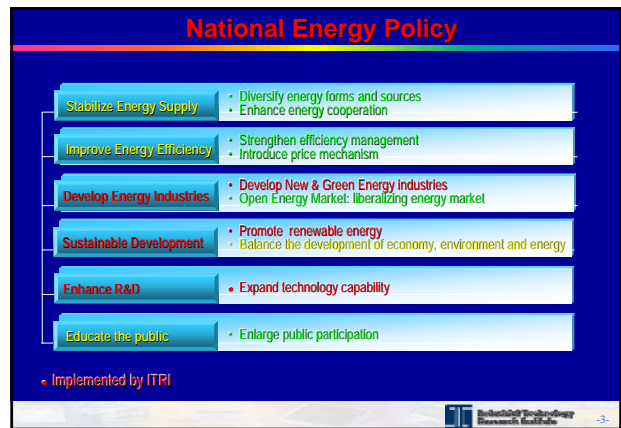
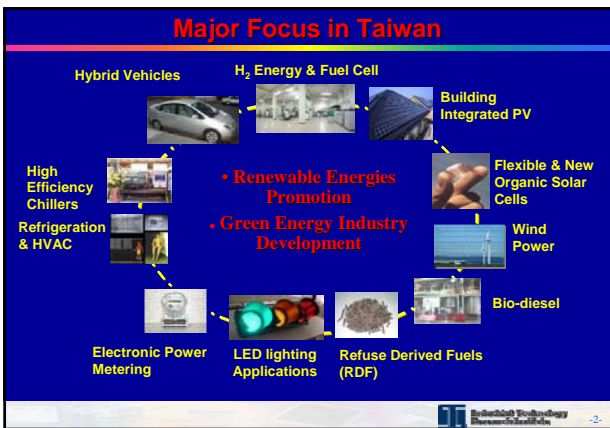
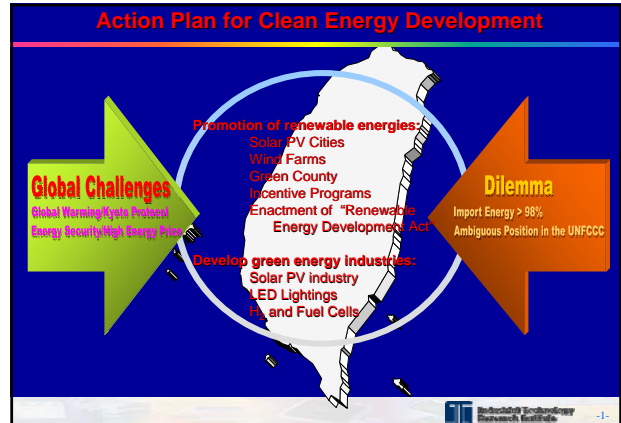
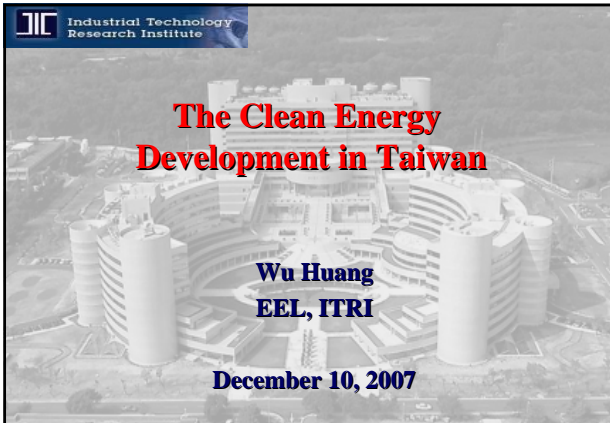
## Main References

- Erik Haites, Carbon Markets prepared for: United Nations Climate Change Secretariat Bonn (Margaree Consultants Inc. 2007/8/20)
- Ricardo Bayon, Amanda Hawn & Katherine Hamilton, Voluntary Carbon Markets (2007)

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Thanks for the Listening

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**Criteria for Prioritizing New Energy Technologies Development**

Criteria Item	Solar PV	Energy Supply		Industry Effectiveness			Technological Advancement			
		Securely Enhancement	Clean and High Efficiency	Niches & Complex Areas	Reliance of Domestic Industry	Commercialization	Innovation	Advancement	First Priority	Second Priority
Renewable Energy	Solar Thermal	●	●	●	●	○	○	●	X	
	Biomass Energy	●	●	●	●	○	○	●		V
	Wind Power	●	●	●	●	○	○	●		V
	Ocean Energy	●	●	○	○	○	○	○		
	Hydrogen & Fuel Cell	●	●	○	○	○	○	○		
New Energy Conversion	Hybrid-Vehicles	●	●	●	●	●	○	○	X	
	Gasification	●	●	●	●	○	○	○		
	Carbon Sequestration	○	○	○	○	○	○	○		
	Methane Hydrate	●	●	○	○	○	○	○		
Energy Conservation	Refrigeration & HVAC	●	●	●	●	●	●	●		V
	LED Illumination	●	●	●	●	●	●	●		
	Building Energy Management	●	●	●	●	○	○	○		
	Combustion & Heat Utilization	●	●	●	○	●	○	○		

High ● Mid ◆ Low ○

**Targets of Renewable Energy Promotion**

Year	2007 (Sep.)		2010	
	Status		Targets	
	Installed Capacity (MW)	Share of total (%)	Installed Capacity (MW)	Share of total (%)
Renewables				
1. Hydropower	1,922.5	4.26	2,179	4.22
2. Wind Power	277	0.6	2,150	4.20
3. Solar Photovoltaics	1.73	0.00	21	0.04
4. Geothermal Energy	—	—	50	0.10
5. Biomass	655.2	1.45	750	1.44
<b>Total</b>	<b>2,856.4</b>	<b>6.33</b>	<b>5,150</b>	<b>10.0</b>
<b>Share of renewable energy in terms of total installed capacity</b>		<b>6.33%</b>	<b>10.0%</b>	



### "Renewable Energy Development Act" Under Review by the Congress (final draft)

- Setting a goal of 6,500MW for renewable energies utilization
- Adopting a fixed Feed-in Tariff Scheme :
  - Different tariff for different form of renewable energies
  - Purchase price for renewable energy shall be reviewed after every three years period
- A special-purpose Fund shall be set-up deriving from the following sources :
  - Electricity sectors
  - Government's fiscal year budget

### Wind Power

- Current Status: 277 MW (Sep. 2007)
- Targets: 2,150 MW by 2010
- Strategies:
  - Remove obstacles for wind farm projects in progress.
  - Generate detailed wind resource maps to locate potential wind sites.
  - Review incentive measures for enhancing the development of wind energy.



Maillao: 2.64 MW



Chungtun: 2.4 MW



Chupei: 3.5 MW

### Solar Photovoltaic Systems

- Current Status: 1.73MW (Sep. 2007)
- Targets: 21 MW by 2010.
- Strategies:
  - Promote demonstration projects such as Solar City, Solar Top, Solar Campus, etc, and mandate development at public buildings.
  - Establish solar PV systems in remote areas
  - Develop PV industries.



Presidential Hall: 10.5kW  
• Annual generation: 1,100 kWh/kW



Southern Taiwan U. of Tech: 10 kW  
• Annual generation: 1,300kWh/kW



Penghu County Hall: 3 kW  
• Annual generation: 1,200kWh/kW



A household: 4.2 kW  
• Annual generation: 1,100 kWh/kW

### Solar Thermal Water Heater Systems

- Current Status: The installed area of heat collectors has reached 1.6million m<sup>2</sup> with about 400,000 households installing, 5.4% of the total.
- Targets: Total installation area of 2.15 million m<sup>2</sup> (about 540,000 Installed households) by 2010.
- Strategies: Extend incentive measure to building-integrated and large-scale applications.



Hualien College, Hualien County  
Solar Thermal Water Heater System  
Installation area: 77m<sup>2</sup> (for 115 students)



Diwan College, Tainan County  
Solar Thermal Water Heater System  
Installation area: 307.5m<sup>2</sup> (for 450 students)

### Biomass

- Current Status: 655 MW
- Targets: 750 MW by 2010.
- Strategies:
  - Promote district RDF systems for waste treatment and power generation.
  - Arrange for the sale of biogas power at a premium rate.
  - Assist private enterprises in establishing power plants fueled by agricultural wastes, such as rice husks.
  - Promote RDF systems fueled by industrial wastes for power generation.



RDF demon plant in Hualien  
BOE Project, Tech. developed by ITRI



Biogas power plant,  
Municipal waste landfill, Taipei

### Bio-diesel

- Current Status: 18,000 KL (kilolitres) yielded from waste cooking oils in 2007
- Targets: 100,000 KL by 2010.
- Strategies:
  - Develop production technology for commercialization.
  - Establish Green County Demonstration Program
  - Utilize marginal agricultural lands to grow energy crops
  - Promote B2 supplied in all filling stations by 2011



3,000 kl/yr Bio-diesel demo plant in Chiayi  
BOE Project, Tech. developed by ITRI



Road-test of bio-diesel truck in Taipei city

### Leveraging Existing Technological Strengths

**High-Tech Clusters**

- Semiconductors
- ICT Hardware
- ICT Software
- LCD, PDP
- Precision Machinery
- Metal Peripherals
- LCD, PDP
- LCD & Components
- Semiconductors
- Fundamental Metals
- Multi-layer thin film materials
- Deposition processes (CVD, Sputtering)

➤ *Excellent potential for new energy industries*

➤ *Goals: strong player in*

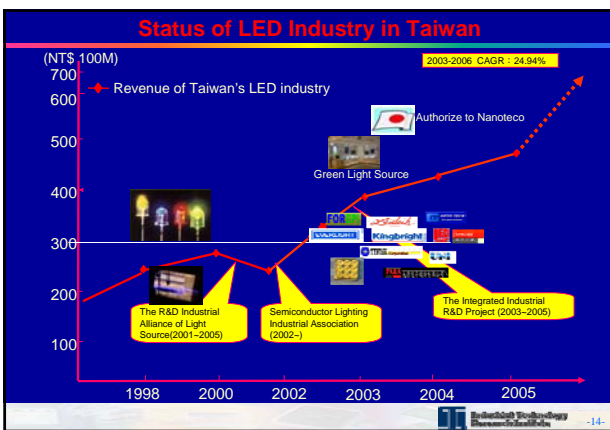
- LED Illumination
- Solar PV
- H<sub>2</sub> & Fuel Cell

Industrial Technology Research Institute -12-

### Status of LED Industry in Taiwan

- World ranking: **No.1 in volume, No.2 in revenue.**
- Strong infrastructure. Established nearly 100 key IPs.
- The competitiveness of solid state lighting industry will improve greatly by combining the ICT (Information and Communication Technology) industry's capabilities in design and manufacture.
  - develop high-efficiency LED (>100 lumens / Watt)
  - develop key patents
  - develop innovative applications

Industrial Technology Research Institute -13-



### White LED lighting Demonstration - LED Lamps

**Social Education Hall of Taipei City**

- 4W LED lamp replace 20W halogen lamps, saving: 80%
- 18W LED lamp replace 120 W PAR38 lamp, saving: 85%

**ITRI' Exhibition Room**

- 6W LED lamp replace 50W halogen lamps

Industrial Technology Research Institute -15-

### Status of PV Industry in Taiwan

RANK	Co.	MWp/y	World Mark share	Process Flow			
				Polysilicon	Ingot / wafer	Solar Cell	PV Module
1	Sharp (JPN)	324	27	●	●	●	●
2	Kyocera (JPN)	105	8.8	●	●	●	●
3	BP Solar (UK)	85	7.1	●	●	●	●
4,5	Mitsubishi (JPN)	75	6.3	●	●	●	●
4,5	Q-Cells (DE)	75	6.3	●	●	●	●
6	Shell Solar (NL)	72	6	●	●	●	●
Overseas Companies				Sino American Silicon Products (80t) Green Energy Technology (under construction) (25)			
Taiwanese Companies				Motech (35, 2.9) E-on Solar Tech (8) DelSolar (under construction) (25) EverBright - China Electric - T SEP - NCT (1) Unigery - LuckyPower - TTI - GP (0.2)			

Sources: ITRI, PIDA; PV News, Sept. 2005

Industrial Technology Research Institute -16-

### Next Generation Solar Cells

- Low cost, flexible, portable
- Innovative technologies (Dye-sensitized, organic polymer, etc)
- Broad applications in entertainment, transportation, architecture, military industries

**ITRI'S Program**

Materials (MCL) → Molding (EOL) → Manufacturing equipment (MSL) → System integration (PVTC)

Examples: Dye Sensitized Solar Cell, Polymer-based Solar cell

- To develop the poly-silicon materials
- To establish whole industry chain structure
- To develop the next generation solar cell

Industrial Technology Research Institute -17-

### Establishing Fuel Cell & H<sub>2</sub> Energy Key Technologies

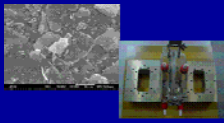

**Hydrogen**

- ❖ Pd membrane for enhanced hydrogen production
- ❖ Metal & chemical hydrides for hydrogen storage

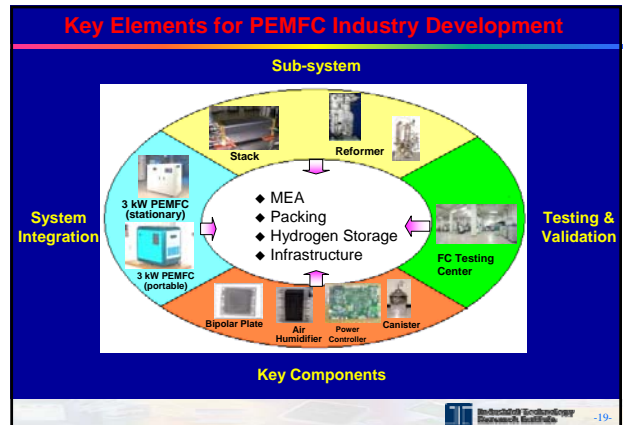
**PEMFC**

- ❖ Key components development in composite & metallic bi-polar plates, gas diffusion layer/electrodes and fuel reformer
- ❖ System integration
- ❖ Testing and Validation


**Establish Taiwan Fuel Cell Industry**

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### ITRI's Fuel Cell Test Center



300~600 W In-House Test Stations and 2, 5 & 12 kW Industry-Standard Test Stations

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### Closing Remarks

- ❖ Energy security and global warming are global issues of great concerns and challenges. Development of clean energy is regarded as a vital part of Taiwan's energy policy. We will increase our usage of clean energy in an attempt to achieve a balance in environmental protection, energy security, and industrial development.
- ❖ In addition to on-going promotional programs, enhanced new initiatives to promote renewable energies and develop strategic green energy Industries have been proposed, which will initiate new investments and cooperative opportunities. We are looking for international partners to build up win-win cooperative models.

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*Thank you for your attention*



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