



**Asia-Pacific
Economic Cooperation**

2014/PPSTI2/015
Agenda Item: 7-3-1

**Policy Practice and Technology Applications –
Experiences on Low Carbon Emission
Operations in Chinese Taipei**

Purpose: Information
Submitted by: Chinese Taipei



**4th Policy Partnership on Science, Technology
and Innovation Meeting
Beijing, China
17-19 September 2014**



Policy Practice and Technology Applications – Experiences on Low Carbon Emission Operations in Chinese Taipei

Chao-Chiun Liang

**Industrial Technology Research Institute
Chinese Taipei**

2014.8.20

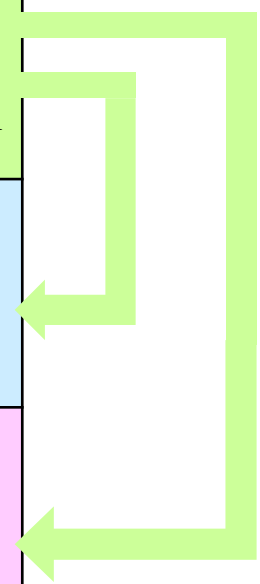


Outline

- Project Overview
- Policy Research
- Field Verification
- Workshop & Training Course
- Conclusion

Project Overview

Policy Research	Chinese Taipei's Policy and Action Plans	Best Practices	Policy Suggestions & Application Model
Field Verification	Shop Floor Analysis & Energy Saving Suggestions	Data Analysis & Performance Evaluation	
Workshop & Training Course	Event Design Speakers and Participants Innovation Tour Preparation	8/25-28 Take Place	Analyze the Questionnaire



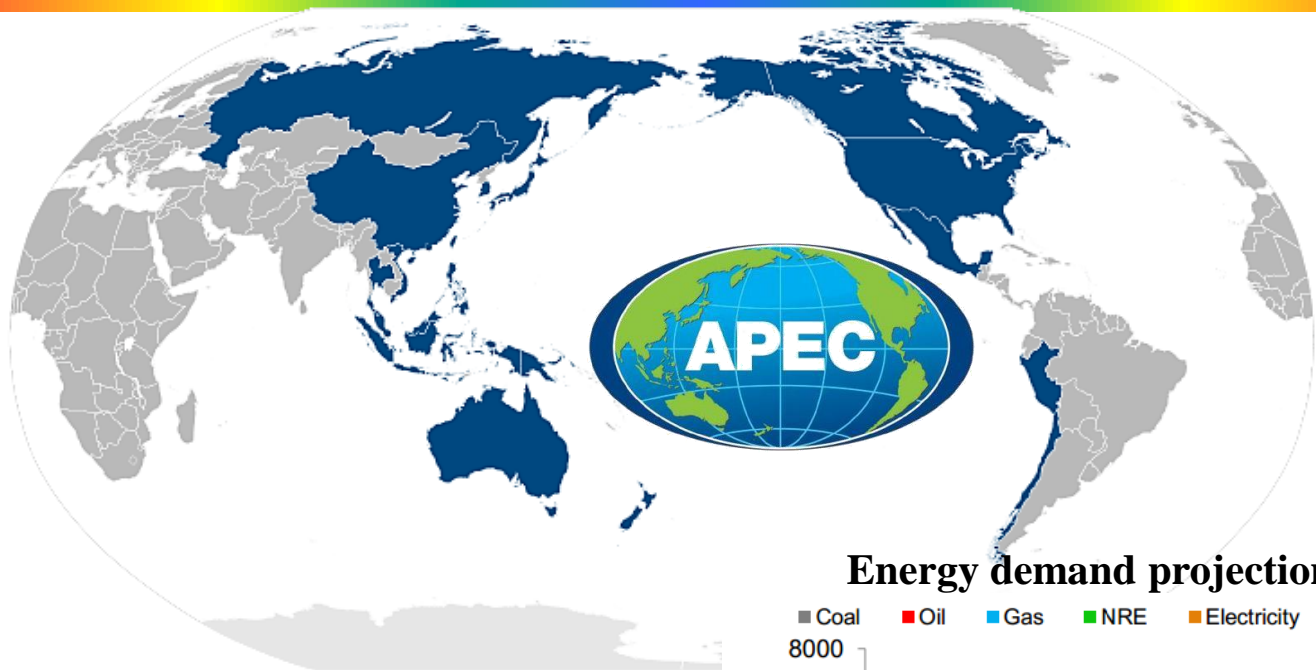
Objectives:

- Deliver **policy suggestions** and **applicable models**
- Promote **collaboration within APEC economies**

Outline

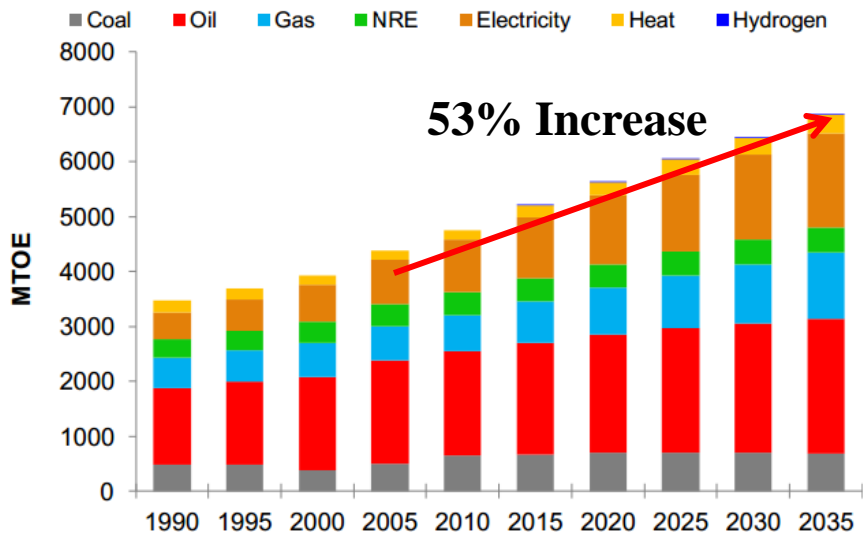
- Project Overview
- Policy Research
- Field Verification
- Workshop & Training Course
- Conclusion

Energy Outlook in APEC



- 60% of world's energy consumption
- Continue to grow by **53%** in 2035 → CO₂ by **46%**

Energy demand projection in APEC

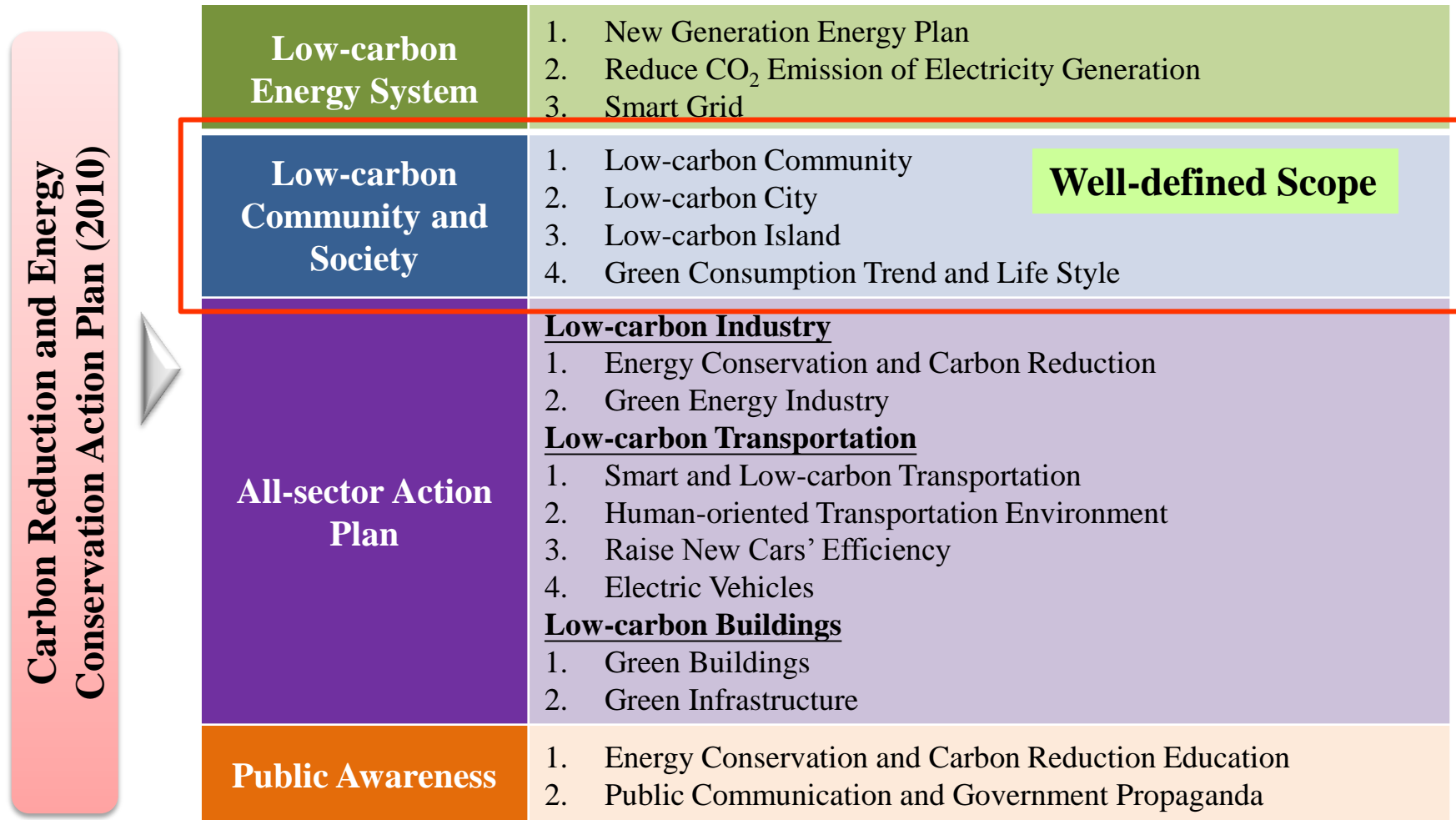


Energy Efficiency Target: Improve **45%** by 2035

Chinese Taipei Energy Saving Project

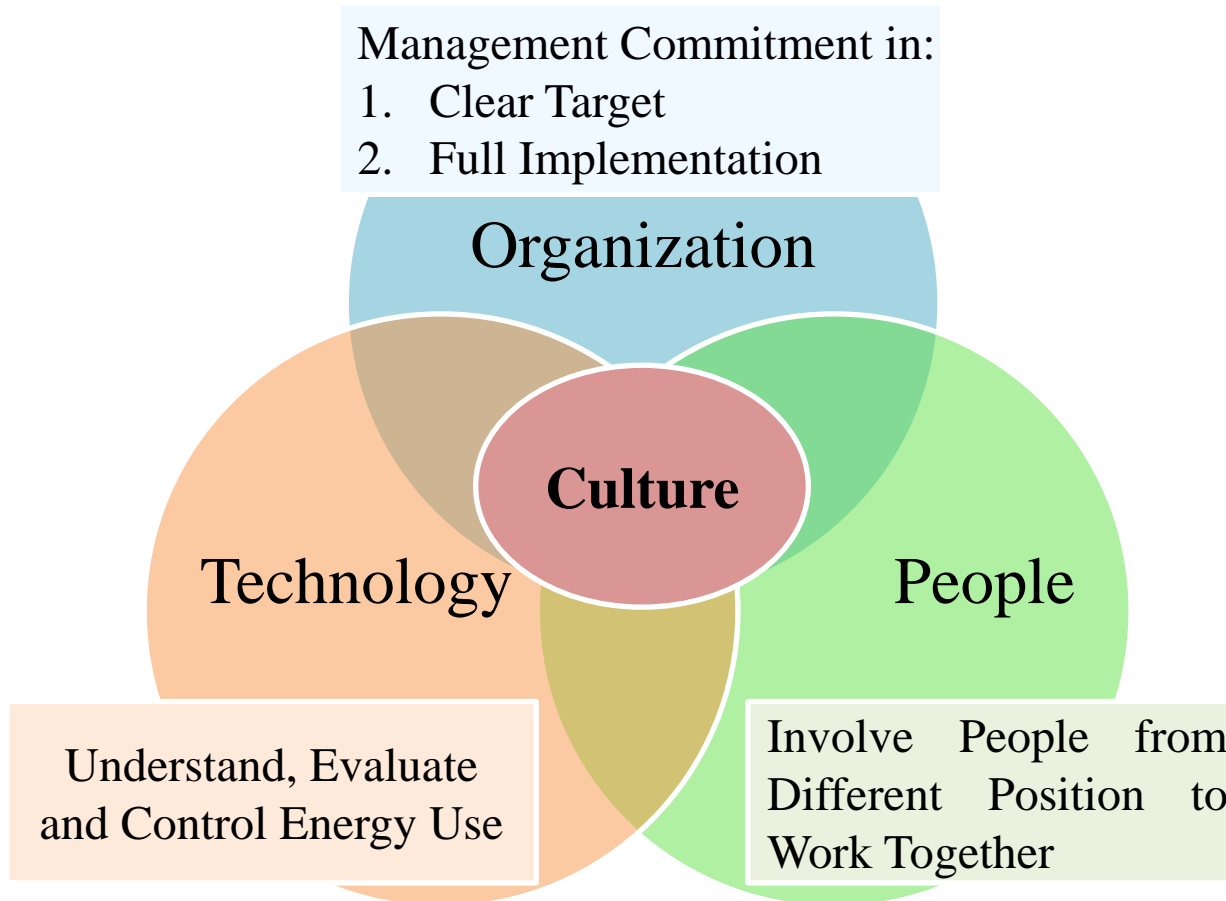
Target : **Aggressive & Voluntary**

- ✓ Aggressive: Energy Efficiency \uparrow 2%/ year, \geq 50% by 2025
- ✓ Voluntary: Achieve 2000 Emission Level by 2025



ISO 50001

Internationally recognized methodology to plan, measure and continually improve energy performance

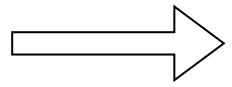


- Shape the energy-efficient **culture** in the industry
- Fosters technology **exchange and cooperation** opportunities

Beyond ISO 50001

Conventional Energy Management

- Inefficient
- Energy Usage Pattern Repeats



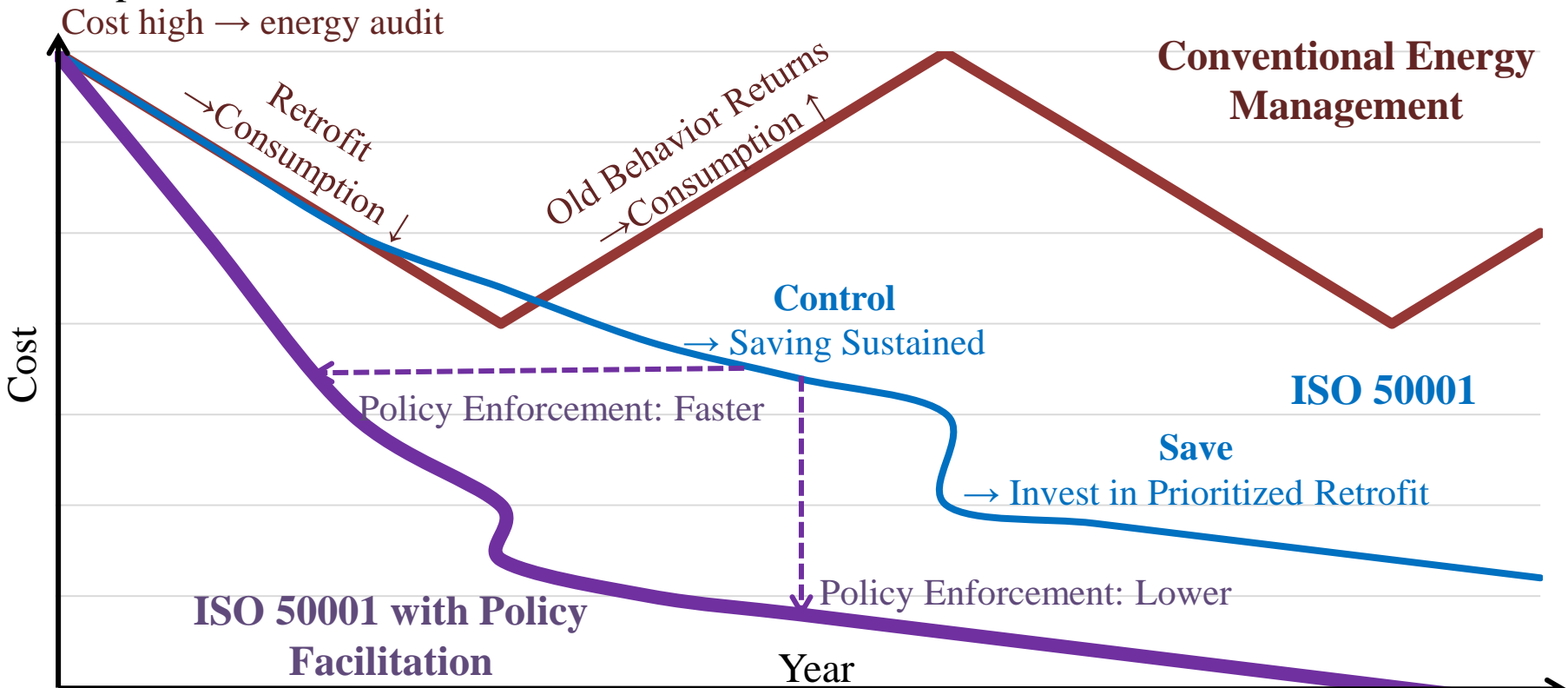
ISO 50001

- Optimized Energy Saving Techniques
- Long-term Effect

+

Policy Facilitation

- Incentives
- Industry Guidelines



Energy Consumption under Different Management Scenarios

Team and Technology Insight

Model: Policy Facilitation+ Promotion Team + Advanced Technology

► Energy Conservation Culture

Integrated Promotion Mechanisms			Advanced Technology		
1. Early Promotion: <ul style="list-style-type: none"> • ESCOs (2005) • Taiwan Industrial Greenhouse and Energy Reduction Corps (2010) 2. Early Participation: <ul style="list-style-type: none"> • AUO ISO 50001 in 2010 (Draft Stage) 3. 2,243 Plants → 640 Thousands kL Oil Equivalent↓; 2 Million Tons CO ₂ ↓ (2012)			Key Industrial Technology Solutions		
			Industry	Technology	Emission↓
Global Certified Company List			Textile	Waste Heat Recovery System	36.6%
			Glass Product	1. Redesign Electric Kiln Furnace 2. Homogenize the Temperature of Melting Process	8%
Rank	Economy	No. of Site	Tape Product	1. Integrate the Solvent Recycling Unit 2. Optimize the Manufacture Process	1,440 ton CO _{2e}
1	Germany	3,441	Automobile	Process Efficiency Evaluation	5-20%
2	France	973	General Manufacture	Examine Equipment and Provide Improvement Solutions	10-30%
3	Netherland	408			
11	Taiwan (Asia's Top 2)	119			
17	Thailand	41			
Source: German Federal Environmental Agency (May, 2014)					



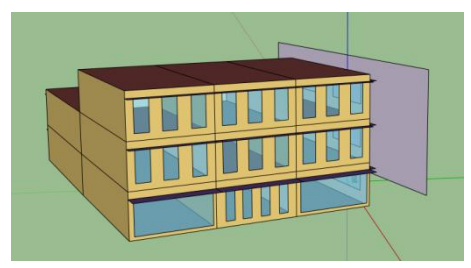
Outline

- Project Overview
- Policy Research
- **Field Verification**
- Workshop & Training Course
- Conclusion

Energy Saving Field Verification

➤ One Garment and One Textile Thailand Factories

Building Model Setup

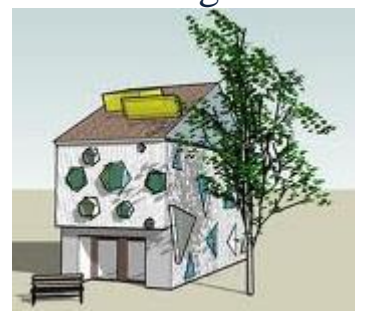


Retrofits Analysis

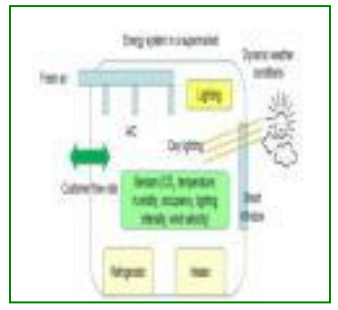
Distribution of Energy Consumption



Energy Retrofit Strategies



Energy Control Strategies



Consulting

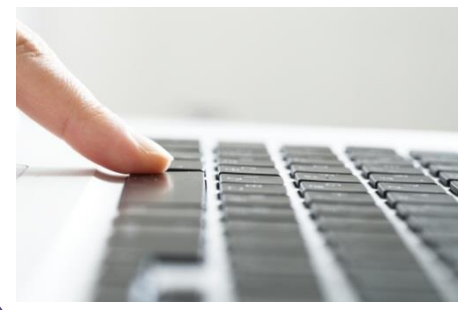


ISO-50001



Next Step

iBEMS Control



Security Control



✓ Les Enphant :

1. Steam Boiler System : Improve Energy Performance, Maintenance and Insulation
2. Lighting System : High Performance Lighting



Outcome

	Energy Conservation (kWh)	Emission Reduction (kgCO ₂)
Lighting	11,404.8 (30%↓)	7,071.0
Steam boiler	7,477.0 (5%↓)	4,635.7
Total	18,881.8 (10%↓)	11,706.7

Assumption: Emission Factor of Electricity = 0.62kg CO₂/kWh

✓ Suratanapat Textile LTD

1. Steam Boiler System : Heat Pump (Biomass → Electricity)
2. Lighting System: High Performance Lighting



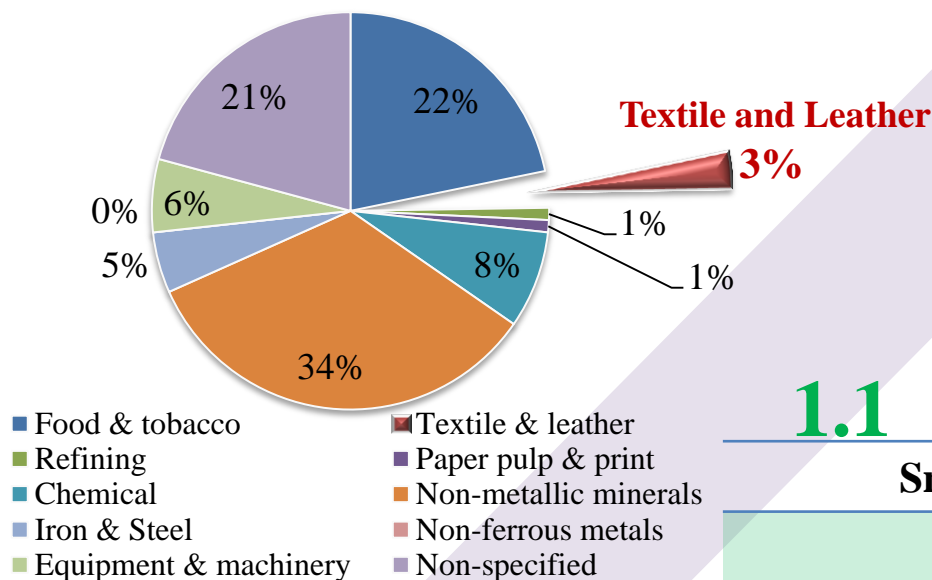
Emission Reduction : 757.6 Tons CO₂ (78.6% ↓)

Stage 1 (Present Project) :

Textile and Garment Industry:

- Occupies Thailand GDP 17%, 3% Industry
- Industry Occupies 32% Emission

Thailand Industrial Emission Distribution



1.2 Energy Management + Control System

Measures	Air Flow, Pressure and Wind Speed Model Real-time Automatic Control Case: IBM + TAIYUAN Textile
Outcome	Energy Consumption ↓33-40 %
Macro Impact	912k Tons CO ₂ ↓ (0.4%)

1.1

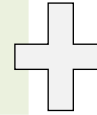
Small-scale Textile Plant Implementation

Measures	Energy Consumption Evaluation Lighting and Significant Energy Consumption Unit Replacement or Upgrade
Outcome	Energy Consumption ↓10%
Macro Impact	228k Tons CO ₂ ↓ (0.1%)

What's Next?

Stage 2 (Future Project) : Expand to other Industries

Chinese Taipei's Technology Innovation



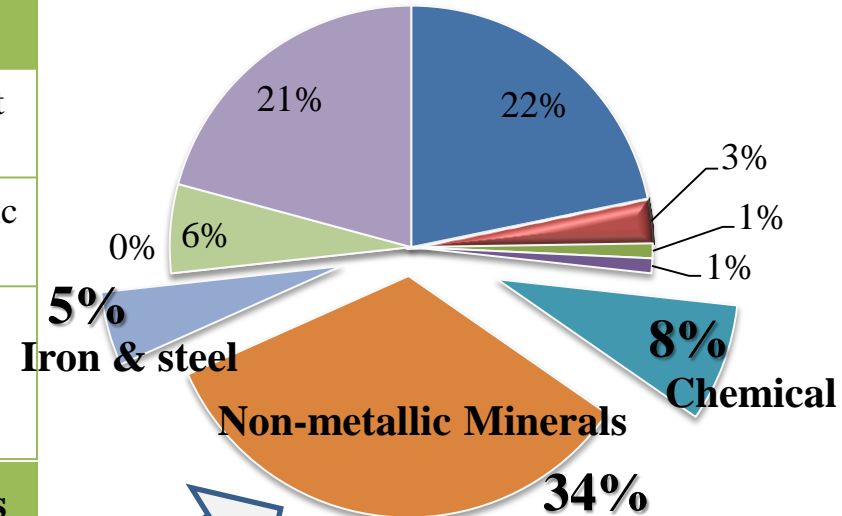
Industries with High Energy Saving Potential

Thermoelectric material and module technology

Application	Recycle the Low-temperature ($\leq 300^{\circ}\text{C}$) Waste Heat → Electricity Generation
Case	500W Small-scale Demo-site (Thermoelectric System, China Steel)
Outcome (Annual)	<ul style="list-style-type: none"> • ↓ Electricity 39.5 Million kWh • ↓ Waste Heat 34G Kcal • ↓ CO₂ 50 Thousand Tons

CO₂ Capture Technology with Calcium Looping Process

Application	Capture CO ₂ (Calcium Looping) → Store CO ₂ (Micro Algae) → Biomass or Energy
Case study	1.9MWth Pilot Plant (Cement Industry)
Outcome	<ul style="list-style-type: none"> • Captures 90% CO₂ (Conversion Rate: 15%) • ↓ Cost of Capture: 28→26 USD/ton
Applicable Industry	Iron & Steel, Petrochemical, Cement and Ceramics Industry



Industrial Implementation (47% Emission)

Macro impact ↓**5,041 Thousand Tons CO₂/year (2.21%↓)**



Outline

- Project Overview
- Policy Research
- Field Verification
- **Workshop & Training Course**
- Conclusion

Key Features

APEC Workshop on Energy Efficiency for a Sustainable Asia-Pacific Community & Training Course on Energy Efficiency

- Date: Aug. 25-28
- Location: Grand Hyatt Hotel, Chinese Taipei
- Objective

An abundant pool for ideas, opinions and opportunities for future collaboration:

Participants	Content
<ul style="list-style-type: none">➤ Speakers from Germany, Thailand, Australia, Netherland and Chinese Taipei➤ Participants from Malaysia, Mexico, Thailand, Peru, Chile, Russia, Vietnam, Indonesia and Philippine➤ Gathered People and their Opinions on Energy Issues from 11 Economies	<ul style="list-style-type: none">➤ Sectors: Government, Industry and RTO➤ Variety of Themes: Policy, Best Practices from Manufacturing, Commercial and Residential Sectors➤ Field Verification in Thailand

The achievement

- 90 Attendants from Industry, Government and RTO
- Exchanged Policies and Best Practices within 11 APEC Economies





Outline

- Project Overview
- Policy Research
- Field Verification
- Workshop & Training Course
- **Conclusion**

Expand Chinese Taipei's Energy Conservation and Carbon Emission Reduction Experiences to other Economies

Policy Research

