

# Striving to the best policy instruments portfolio for a sound material cycle society - Concept and Evaluation Framework

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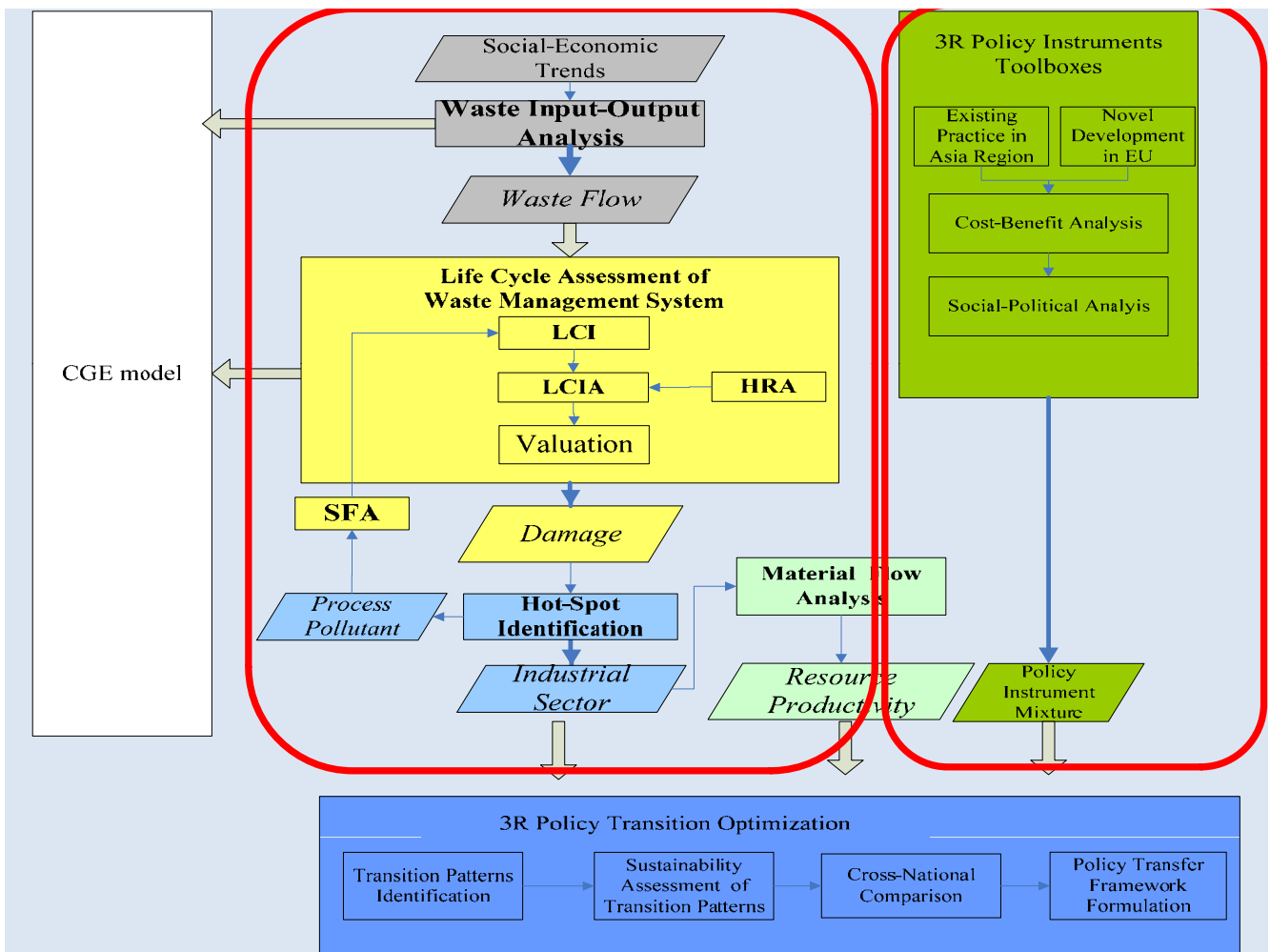
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Oct. 7<sup>th</sup> , 2010



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## Policy Instruments of WM/RCs

	command and control	market-based	informational	voluntary agreements
Material Consumption	Product Standard/	•Resource Tax •Subsidies for secondary Materials	•Eco-Labeling	Green Public Purchasing
Waste Generation	Mandatory Sorting/	Pay as You Throw/ Waste Treatment Fee		Industrial Pledge
Waste Treatment/ Resource Recycling	Emission Standard / Technical Guidance	Incineration (or Landfill) Tax Recycling credit scheme	• Discard Exchange • Recycling Competition	•Stewardship Of E-waste Recycling

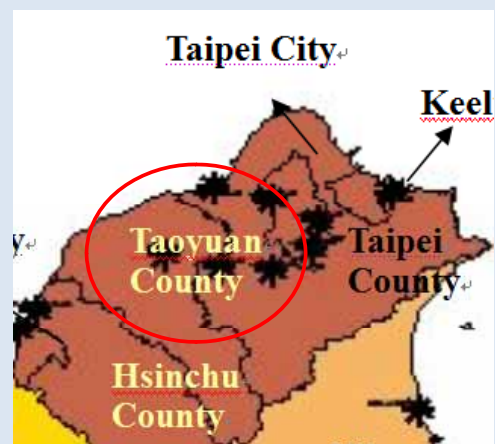
# Criteria of Policy Instrument Selection

- Resource and Waste Reduction
- Environmental Impact
- Social Acceptance
- Economic Burden
- Administrative Management

	Waste Reduction	Environmental Impact Reduction	Economic Burden	Administrative Management	Social Acceptance
Substance restriction					
Source Separation					
Product standards					
EPR					
Taxation					
Recycling credit scheme					
Pay as you throw					
Subsidies for secondary Materials					

## Local Experience:

*Applying multi-criteria decision-making methods to optimize the pay-as-you-throw (PAYT) policy in Taoyuan County*



# Introduction

- In Taiwan, PAYTs is viewed as effective market-based policy instrument in MSW management.
- Status of Implementation
  - Taipei City adapted this policy since 2000.
  - Taipei County will execute PAYT in this December.
  - During the mayors election, PAYT become major topic of MSW management.
- However, since MSW generation decrease dramatically after national mandated MSW sorting policy executed since 2002. Is there still meaningful to spend significant administrative effort and considerable costs to promote PAYT?

# Alternative Formulation

## Four Alternatives

- **County-wide enforcement**
- **Partial enforcement** :Partial enforcement refers to enforcing PAYT in municipal townships with denser population
- **Maintaining the status quo**
- **Reinforcement of MSW sorting**

## MSW generation forecasting

**Step1** Selecting the “*reference district*” by Self-organizing map method of Artificial Neural Network.

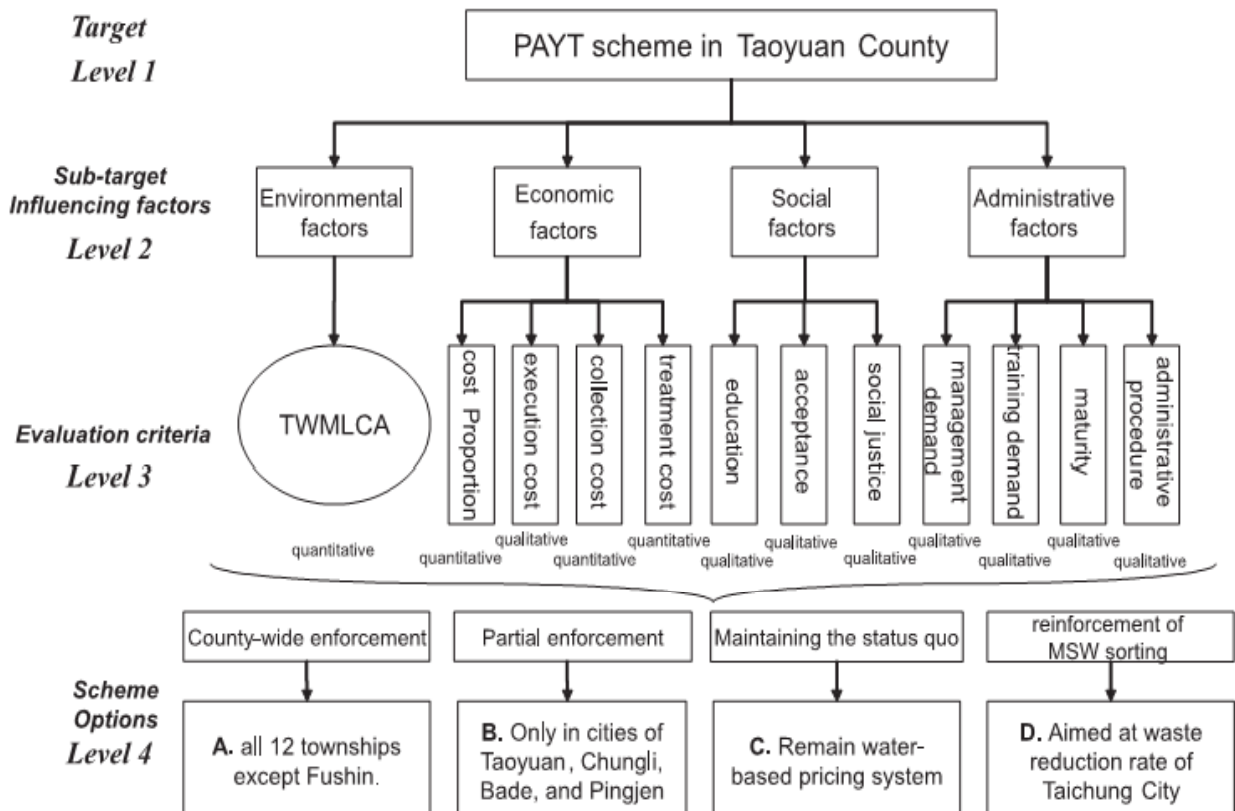
**Step 2** Establishing the multiple regression model of MSW of “*reference district*”

**Step 3** Forecasting the MSW flow of each alternative.

# MSW flow forecasting

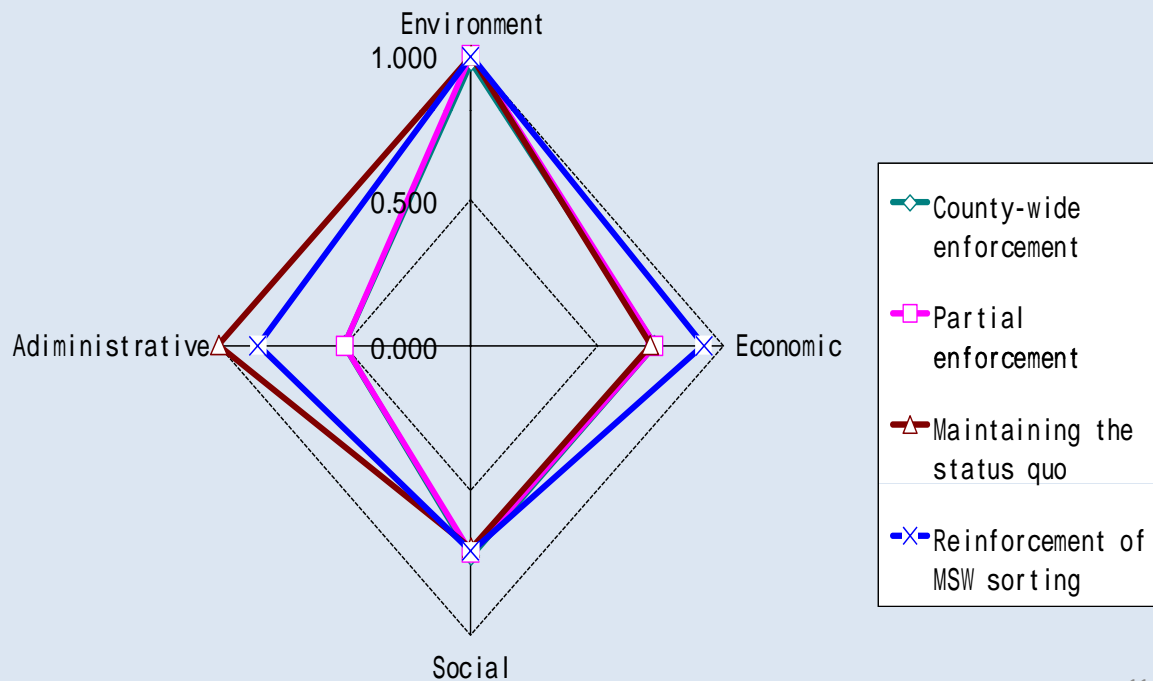
Alternative	County-wide enforcement	Partial enforcement	Maintaining the status quo	Reinforcement of MSW sorting
The decreasing rate of waste collection	-64.1%	-54.8% <sup>a</sup>	-40.4%	-62.0%
Volume of MSW collection (ton year <sup>-1</sup> )	223 939	281 734	371 776	237 038
The increasing rate of waste recycling	15.18 <sup>b</sup>	15.18	15.18	19.56
Volume of MSW recycling (ton year <sup>-1</sup> )	220 021	220 021	220 021	279 582
The increasing rate of food waste recycling	0.77	0.66 <sup>a</sup>	0.50	1.33
Volume of food waste recycling (ton year <sup>-1</sup> )	81 940	77 054	69 441	107 865

## Structure of evaluation on feasibility of MSW reduction in Taoyuan County



## Evaluation Result

Weighting factor derived by AHP :EPA officials, local Bureau of Environmental Protection officials, researchers, and representatives from environmental protection groups were invited to evaluate the weight of each criterion



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## Implications of PAYT study

- MCDM can be applied to include diversify consideration of policy instrument evaluation.
- Setting the “**Business as Usual**” and “**Alternative to the policy instrument**” are all necessities of policy instrument evaluation.

➔ *Is this a suitable framework to identify the best policy instruments portfolio for Resource Circulation ?*

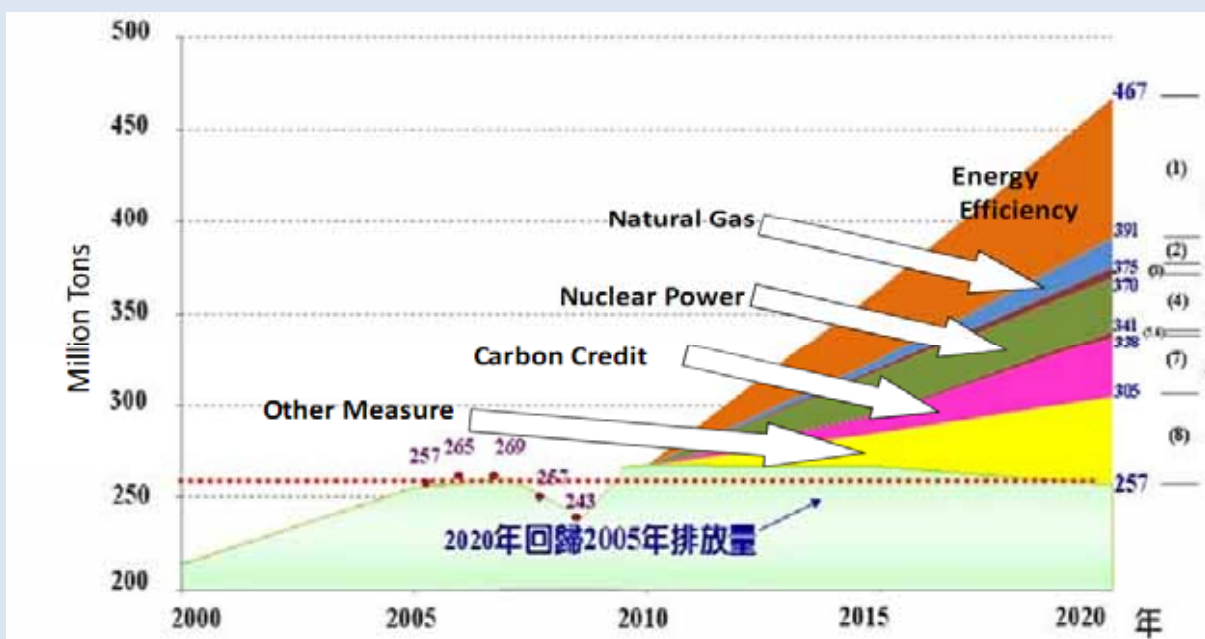
*Limitation :*

➔ *• MCDM methods are seldom applied to evaluate combination of alternatives.*

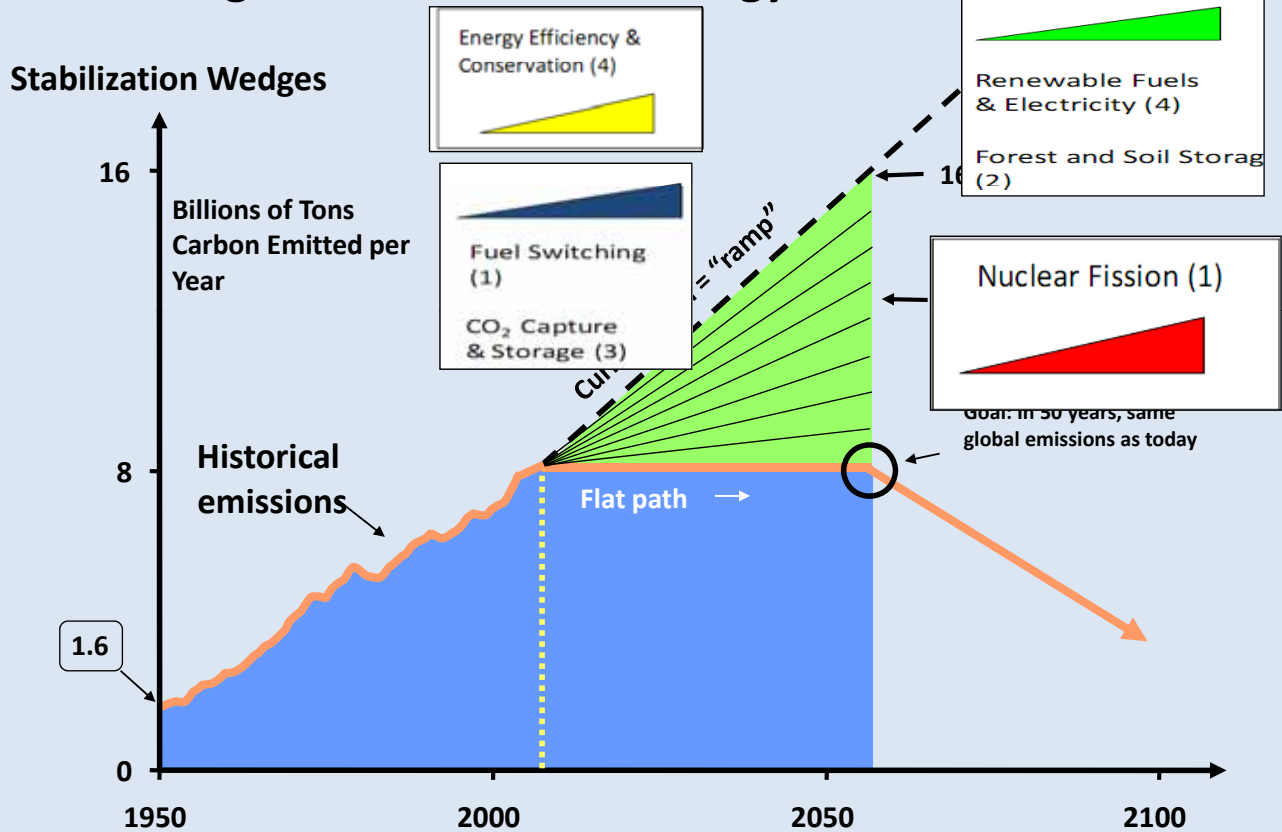
*Evaluation Framework to indentify the best policy instruments portfolio for a sound material cycle society*

## Learning from Climate and Energy Policies Evaluation(1)

- Apply Energy- Economic Model such as MARKAL to optimize the least cost policy instrument portfolio



## Learning from Climate and Energy Policies Evaluation(2)



Pacala and Socolow, 2004

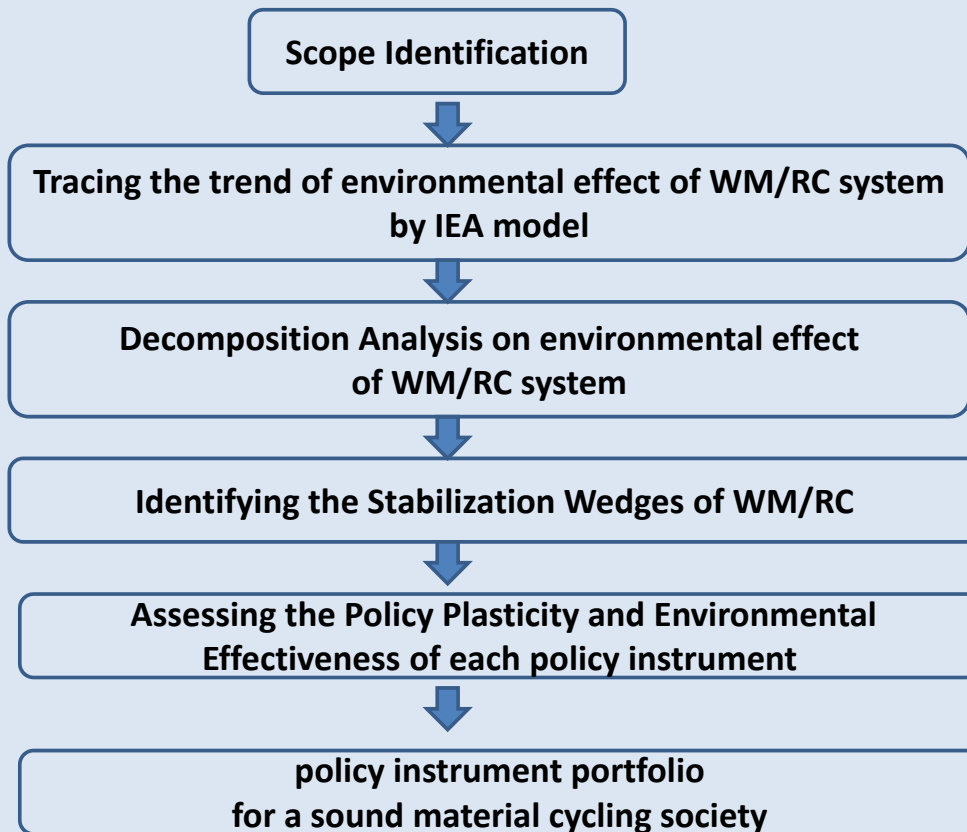
## Evaluation Framework

- **Basic Concept**

- Adapting the “Stabilization Wedge” concept
- Setting the environmental goal of WM and RC system
- Reflecting the social and economic issue through introducing “policy plasticity” factor.
- Focusing on the main driving factors.



# Evaluation Framework

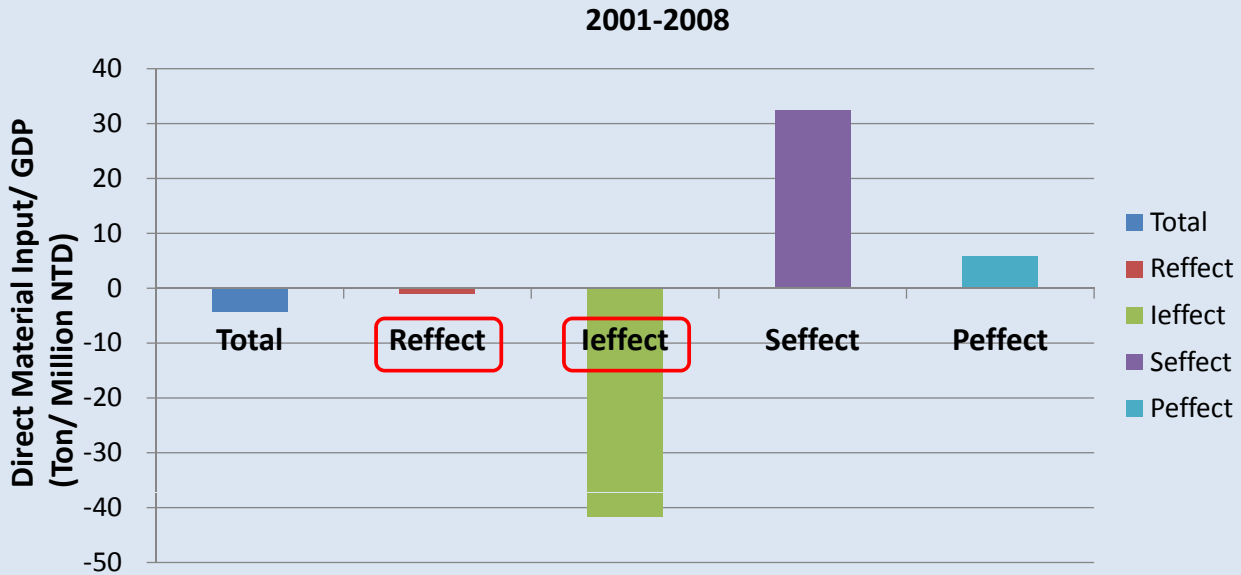


## Decomposition Analysis on environmental effect of WM/RC system

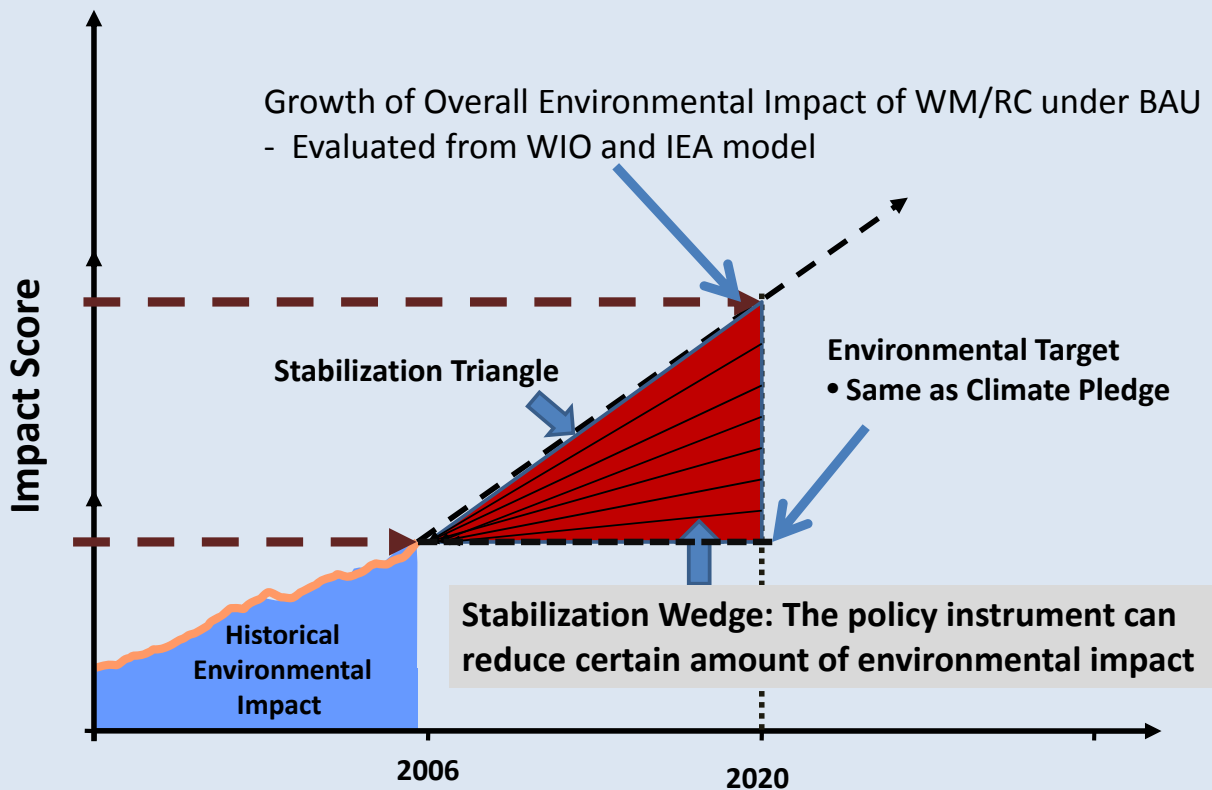
- **Decomposition Analysis:**
  - index decomposition analysis
  - structure decomposition analysis
- It was applied to trace the key driver of resource productivity. (Hashimoto, 2008)
- By combining with IEA model, the traditional “weight-based” and “single criteria” decomposition analysis can become impact-oriented and including multiple environmental issues.
- **Expect Outcome : 1. key resource types 2. industrial sectors**

# Decomposition Analysis on environmental effect of WM/RC system

- The Key Factors changed Taiwanese resource productivity
- The material efficiency is the main factor leads to the improvement of resource productivity.
- The recycled resource only contribute less than 3% of overall DMI



## Identifying the Stabilization Wedges of WM/RC



# Policy Plasticity and Environmental Effectiveness of each policy instrument

Policy Plasticity:

- The penetration rate and influence of **voluntary and informational** instrument.
- The price elasticity of **market-based instrument**.
- The administrative effectiveness of **command and control instrument**.

	Policy Plasticity	Waste and Resource Reduction	Environmental Impact Mitigation
Resource Tax			
Standard of Recycled Material Additive			
"Top Runner" Program			
National-Wide PAYT			
Ban of "One-Time Use" Package			

Future Development  
and Application in ARCR project

## Future Development

- The WIO and IEA model developed in the first year provide fundamental assessment tool.
- The tool to evaluate the “embodied environmental impact” of resource and material consumption will be integrated.
- The above evaluation framework will be tested in Taiwan.

## Application in ARCR project

- Policy Instrument Portfolio Evaluation can provide “top-down” examination on how to improve the resource circulation and waste management.
- The difference of the each participatory countries’ background are able to reflect by Decomposition Analysis.
- This evaluation framework is “environmental-oriented”, therefore, applying MCDM on specific policy instrument is still necessary.