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## **REPI-Based Evaluation for Building a Resource-Efficient and Environment- Friendly Society in China**

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## **Contents**

- **Background**
- **Resource and Environment Performance  
Index (REPI)**
- **REPI-Based Evaluation**
- **Conclusions and recommendations**

## Background

- **Rapid economic growth: 9.7% (1990-2003)**
- **Middle Stage of Industrialization: Resources and Energy intensive**
- **Consumption growth and structural change with per capita GDP over US\$ 1000**
- **Resource supply and environmental challenges**
  - Energy and minerals consumption increase
  - Environmental pollution expands
  - Since late 2002, coal, electricity, oil and freight shortage overall

## Rapid Economic Growth and Its Impacts

- **New round of Rapid Growth**
  - Positive effects: a driving force of global economy
  - Negative Effects: at expense of resources and the environment
- **Two Prospects ahead: unsustainable way or China's model**
- **New Development Concept: Balanced development, Resource-Efficient and Environment-Friendly (REEF) Society**

## REEF Society

- **Prioritized** area of the 11th Five-Year Plan (2006-2010)
- **Core:** putting saving first and increasing resource efficiency, reducing pollutant discharge and environmentally sound treatment of wastes
- **Priorities:** saving energy, land, water and materials, comprehensive use and developing circular economy (reduce, reuse, recycling)
- Adopting comprehensive instruments including institutional arrangement, structural adjustment and technology innovation, etc.

## 2006 China Sustainable Development Strategy Report

- **Theme:** Building a Resource-Efficient and Environment-Friendly (REEF) Society
  - Evaluation of Resource and Environment Performance: experience, problems and implications
  - REPI: Resource and Environment Performance Index -- an efficiency-based indicator
  - Framework and support system for an REEF Society
  - Policy recommendations

## REPI Definition

$$REPI_j = \frac{1}{n} \sum_i^n w_{ij} \frac{x_{ij} / g_j}{X_{i0} / G_0}$$

$x_{ij}/g_j$ : the  $i$ th resource consumption or pollutant discharge per unit of GDP of the  $j$ th country or region;

$X_{i0}/G_0$ : the  $i$ th resource consumption or pollutant discharge per unit GDP of the world or  $j$ th country

**REPI<sub>j</sub>** is the weighted average value of the ratio of selected resources consumption and pollutants discharge performance / intensity

## REPI significance

- The smaller the REPI value, the higher the resource productivity or eco-efficiency
- If REPI =1, Which indicates that  $i$ th resource and environmental performance of  $j$ th country or region equals to that of the world or  $j$ th country ;
- If REPI >1, Which indicates that  $i$ th resource and environmental performance of  $j$ th country or region is smaller than that of the world or  $j$ th country;
- If REPI <1, Which indicates that  $i$ th resource and environmental performance of  $j$ th country or region is bigger than that of the world or  $j$ th country;
- The same weight given to each resource and pollutant performance indicator

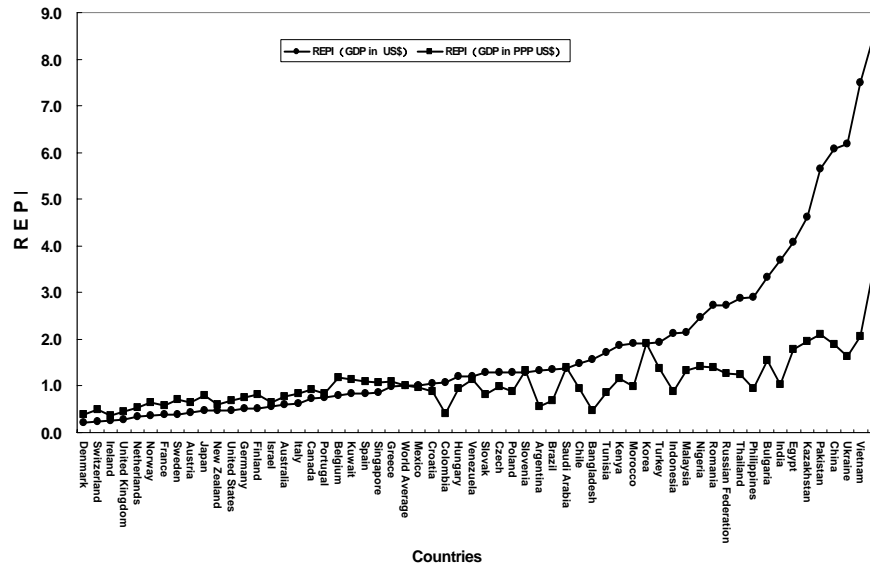
## **REPI-based evaluation for REEF Society**

- **International comparison: 59 countries**
- **China's REPI :1980-2003**
- **China's REPI of 31 provinces in 2003**

## **International comparison of REPI based on five resources**

- **Five resources and raw materials chosen for REPI calculation:**
  - Primary energy;
  - Annual freshwater;
  - Cement consumption;
  - Finished steel;
  - Non-ferrous common metals including copper, aluminum, zinc, lead, nickel, tin, cadmium
- **59 countries selected:**
  - GDP (in US\$) as 96.1% of the world total, and 93.7% in PPP US\$

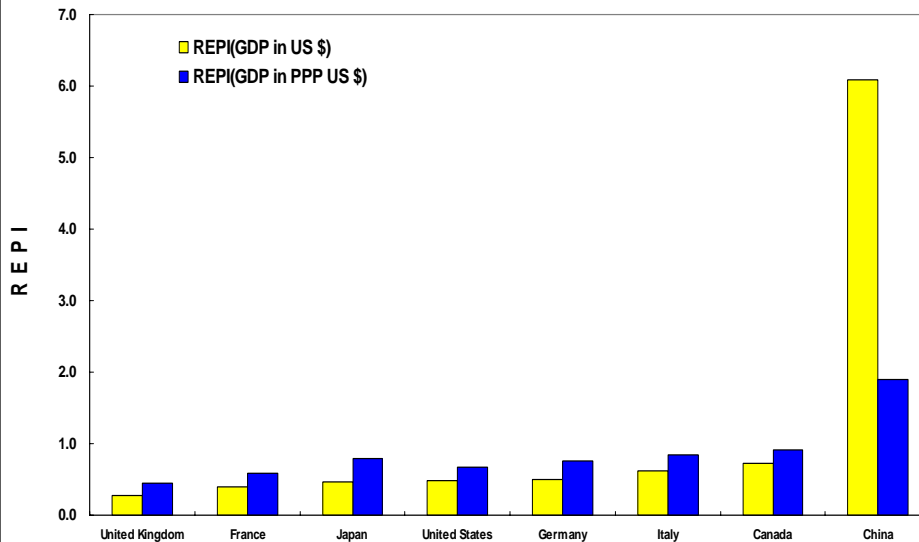
## The REPI of 59 countries based on five resources and raw materials in 2003



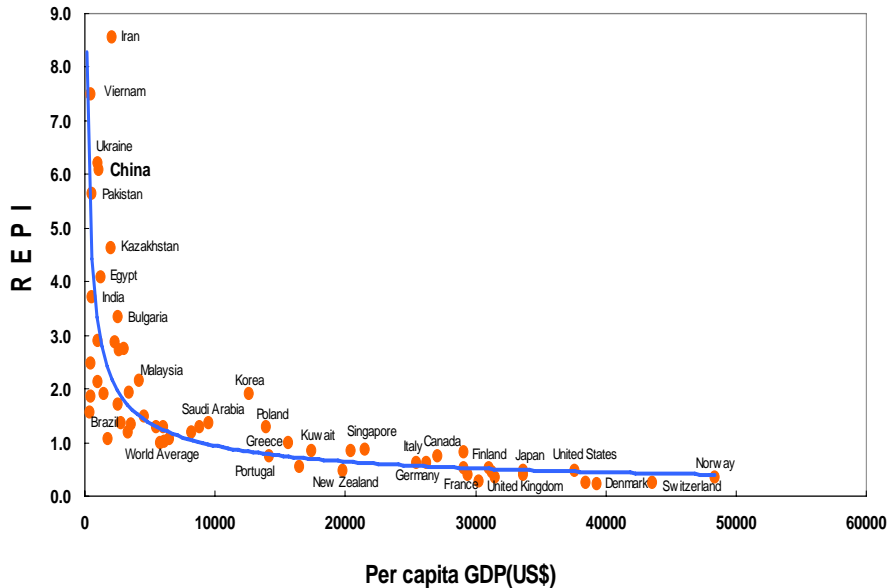
## Comparison of REPI between China and Group 7 countries (G7) in 2003

countries	REPI (GDP in US \$)	China's REPI / G7's REPI (GDP in US \$)	PEPI (GDP in PPP US\$)	China's REPI / G7's REPI (GDP in PPP US \$)
United Kingdom	0.282	21.6	0.446	4.3
France	0.390	15.6	0.588	3.2
Japan	0.465	13.1	0.796	2.4
United States	0.479	12.7	0.681	2.8
Germany	0.507	12.0	0.754	2.5
Italy	0.629	9.7	0.838	2.3
Canada	0.732	8.3	0.916	2.1
<b>China</b>	<b>6.079</b>	<b>1.0</b>	<b>1.896</b>	<b>1.0</b>

## Comparison of REPI between China and Group 7 countries (G7) in 2003



## Relationship between REPI (GDP in US \$) and per capita GDP (US \$) in 59 countries in 2003 (1)



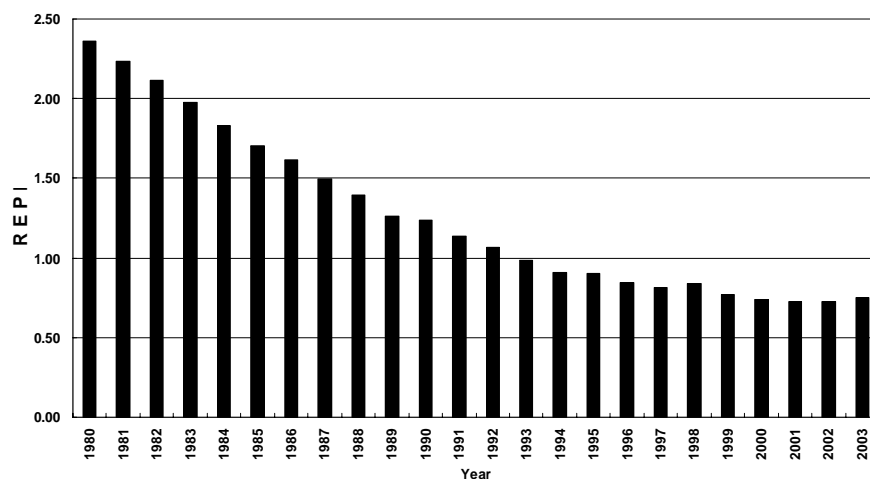
## Relationship between REPI and per capita GDP (2)

- REPI is negatively related to the level of economic development in 59 countries
- When a country is at the lower level of development, it is difficult for the country to have a good resource and environment performance. In general, the turning point is about per capita GDP 3000 US \$
- To build REEF Society, China will face a series of challenges and barriers including institutional arrangement, technology innovation, policy and management, etc.

## China's REPI changing trend based on ten resources and pollutants in 1980-2003 (1)

- Ten resources and pollutants chosen for REPI calculation : primary energy, annual water use, steel, cement, non-ferrous common metals, fertilizer, wastewater discharge, SO<sub>2</sub>, CO<sub>2</sub>, solid wastes discharge
- China's REPI based on ten major resources and pollutants annually decrease by 4.9% in 1980-2003 and 5.6% in 1980-2000
- Since the mid-1990s, the trend of REPI reduction slow down and it rebound in 2003
- In term of trend, It's difficult for China to realize the goals of energy efficiency and pollutant control during the 11<sup>th</sup> Five-Year Program.

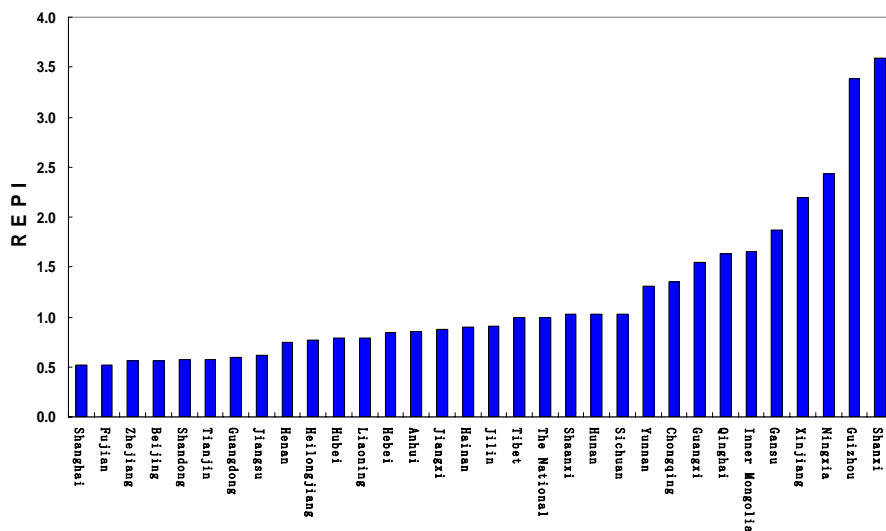
## China's Changing tendency of REPI from 1980-2003



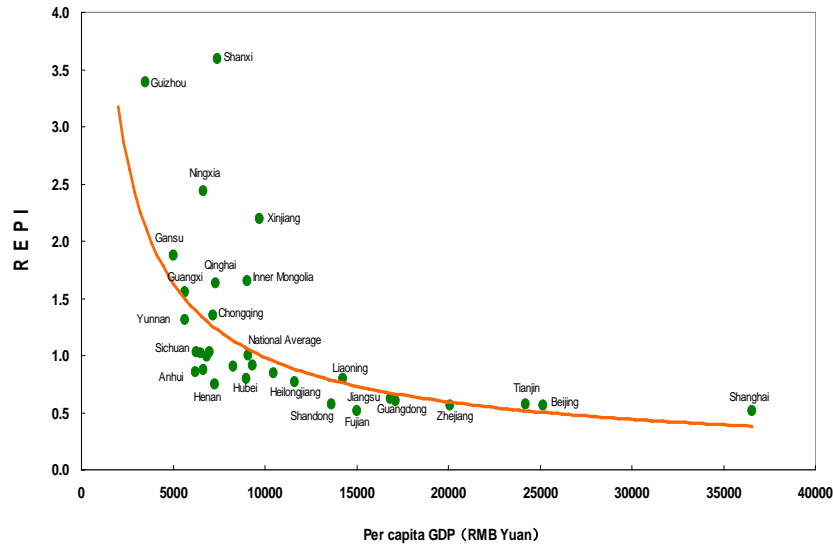
## The REPI of 31 provinces in China in 2003 based on 7 resources and pollutants (1)

- Seven resources and pollutants chosen for REPI calculation : primary energy, water use, land area for construction, total investment in fixed assets( which indirectly represents the demand for raw materials ), wastewater discharge, total volume of industrial waste gas emission, volume of industrial solid wastes produced.
- Shanghai's REPI the lowest, and Shanxi's the highest
- The regions with resource and environmental performance ranking top 10 in 31 provinces located mostly in the eastern China, their REPI ranging from 52% to 77% of the national average
- The bottom 10 located mostly in the western China, with REPI is 1-4 times of the national average

## The REPI of 31 provinces in China in 2003 based on 7 resources and pollutants (2)



### Relationship between REPI and per capita GDP in 31 provinces in China in 2003 (1)



### Relationship between REPI and per capita GDP in 31 provinces in China in 2003 (2)

- The more advanced the regional economic development, the lower the REPI or the higher the resource efficiency
- Per capita GDP in the regions with higher REPI is mostly less than RMB Yuan 10000.

## **Conclusions and recommendations (1)**

- **REPI may be an useful composite indicator to assess progress of REEF at international, regional and industrial levels**
- **For promoting REEF society, corresponding institutional arrangement needed:**
  - To establish regional, industrial and product standards and labeling systems of resource and environmental performance, including energy consumption, material consumption and pollutants discharge per unit of GDP or product standards.
  - To give priority to the formulation of energy, water, land and pollutants performance standards and a timetable for implementation

## **Conclusions and recommendations (2)**

- To strengthen the regulatory functions of government
- Institutional arrangement needed, including removing institutional obstacles and improve policy designs,  
for example: to reform and establish resource property rights management system ,resource pricing system, market access system , extended producers responsibility system, green procurement system, etc.

**Thanks for your Attention**

For more information

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