



經濟部能源局

Bureau of Energy, Ministry of Economic Affairs

APEC EGNRET-24 Meeting

Chinese Taipei's Experience in Alternative Transport Fuels: Successes and R&D Challenges

Bureau of Energy
Ministry of Economic Affairs
Honolulu, Hawaii
May 17-19, 2005



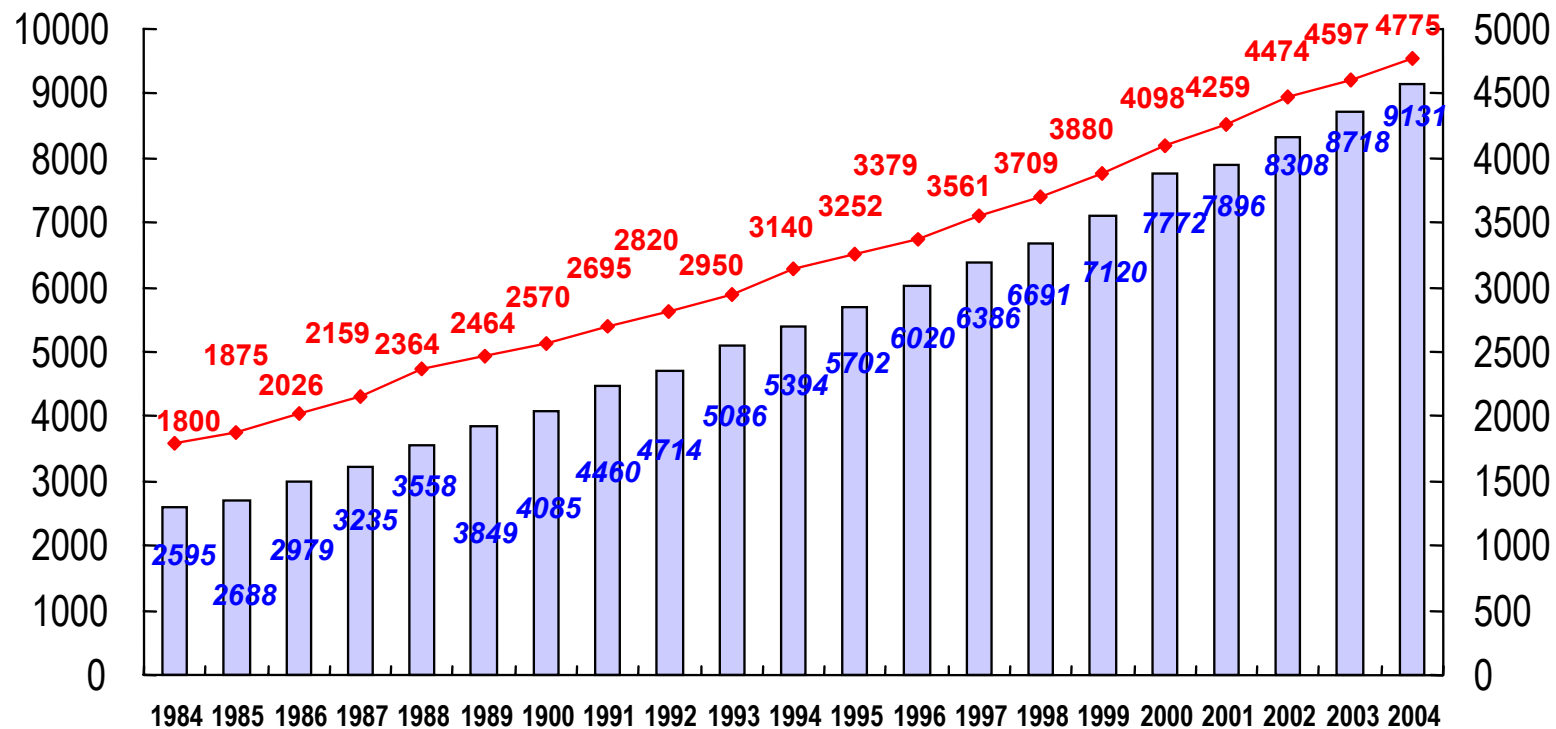
Changes in Energy and Electricity Consumption Per Capita

1984-2004

- ▶ Average Annual Growth Rate of Energy Consumption Per Capita: 5.0%
- ▶ Average Annual Growth Rate of Electricity Consumption Per Capita: 6.5%

Per Capita Electricity Consumption
(kWh/ Capita)

Per Capita Energy Consumption
(LOE / Capita)



■ Per Capita Electricity Consumption (kWh/Capita) ◆ Per Capita Energy Consumption (LOE/Capita)



3,000 t/y Bio-diesel Demo Plant

• Taiwan NJC Corp. (Chiayi)



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



Opening ceremony, Oct 7, 2004



中華民國政府 | 經濟部能源局

Advantages of Bio-diesel

- Renewable energy
- Safe to handle and transport
- Biodegradable
- Can be used alone or mixed in any ratio with petroleum diesel fuel
- More eco-friendly and lower pollution
- Improving the image of Diesel cars



Bio-diesel van



3-year Promotion and Subvention Program for Bio-diesel

- The first demo plant of bio-diesel with a capacity of 3000 tons/year was established in Chiayi by ITRI under support of Bureau of Energy.
- **The Environmental Protection Administration (TEPA) launched a first 3-year Promotion and Subvention Program to six counties and cities in order to reach a reduction and improvement of air quality by employing bio-diesel in the public transportation and garbage trucks.**
- The benefits of this program can achieve a reduction of 13%, 11%, 18% in carbon dioxide, hydrocarbons and particulates, respectively.



• Potential for Bio-diesel Utilization in Taiwan

Demand for Diesel fuel in public and cargo transportation is around 1.6 m kiloliter. It is estimated that potential for bio-diesel utilization in Taiwan could reach 0.32 m kiloliter per annum.



Research on Bio-diesel and Bio-hydrogen at ITRI

➤ Raw Materials

- Microalgae culture
- Energy crops planting

➤ Bioconversion Process of Bio-diesel Production

- Stability study on biocatalyst activity
- Transesterification process
- Immobilization technology
- Bioreactor design and scale-up

➤ Hydrogen Production with Complex Microbial

- Species screening and gene clone
- Co-immobilization technology
- Stability for long-term operation
- Bioreactor design and scale-up



Bioconversion of Bio-diesel



Major Research Activities on Bio-diesel Producing Technology at Universities

Professor Cherng-Yuan Lin

Department of Marine Engineering

National Taiwan Ocean University

- Major research scope:
 - (i) Bio-diesel influences upon the performance of diesel engine
 - (ii) The processes study of bio-diesel production

Professor Jyh-Ping Chen

Graduate Institute of Biochemical and Biomedical Engineering

Chang Gung University

- Major research scope:
 - (i) Immobilization techniques of lipase and cell
 - (ii) The bio-diesel production using bio-catalysis processes



Challenges for Bio-diesel Applications

- ◆ Cost of bio-diesel is incompetitive to petroleum diesel
- ◆ Insufficient and unstable supply of feedstocks for producing bio-diesel
- ◆ Unstable qualities of waste cooking oil and animal fat based feedstocks
- ◆ Public acceptance
- ◆ Insufficient support organization for analysis and testing



Strategies for Promoting Bio-diesel

1. Enhance R&D capability and promotion

- Improving the related technologies to increase competitiveness through R&D
- Supporting the government and the domestic industries in planning bio-diesel production plants
- Cooperating with domestic enterprises in building related business through technology transfers
- Establishing the manufacturing and marketing systems for bio-diesel through demonstration programs.



Strategies for Promoting Bio-diesel

2. Expand the source of biomass as a long-term strategy

- Planting energy crops (e.g., rapeseed and sunflower) on fallow lands,
- Cultivating micro-algae with high grease content on salt pans
- Conducting evaluation and verification through R&D and demonstration programs to provide technical backup for the government



Future Plan (Draft) for Bio-diesel

Overall Potential□kilo liter□			
Feedstock	Potential	Percentage	Target
Waste Cooking Oil	150~200x10 ³	30%	45~60 x 10 ³
Energy Crops	300~400x10 ³	70%	215~280 x 10 ³
Total	450~600x10 ³		265~340 x 10 ³

Current Program

1,200 kl/yr

- Garbage truck in 13 cities
(B20)

Phase 1

100,000 kl/yr

- B2 in all stations
- B20 in urban area

Phase 2

250,000 kl/yr

- B5 in all stations
- B20 in urban area



Announcing:

APEC EGNRET-25 Meeting

to be hosted by

Chinese Taipei

October 31-November 2, 2005

and

**International Conference on
Biomass**

November 3-4, 2005



APEC Workshop on Roadmapping Future Fuels Technologies
April 27-29, 2005
Vancouver, Canada

<http://strategis.ic.gc.ca/epic/internet/inscpc-cpsc.nsf/en/Home>

Next meeting

August 10-12, 2005
Kenting, Chinese Taipei

announcement will be sent out later to all EGNRET representative



The Vancouver Workshop on Road-mapping Future Fuels Technologies

•Approach to Developing Technology Roadmaps:

The Vancouver and Chinese Taipei workshops are designed to facilitate the development of technology roadmaps. The questions that will be consistently referred to in this process include:

- (1)Present situation - where are APEC countries now in terms of energy requirements?
- (2)Future aspirations - in 5-10 years, where do you want your countries to be?
- (3)Barriers to progress - what is stopping you from getting there?
- (4)Solutions and the way forward - what needs to be done to overcome the barriers?
- (5)Issues in the longer term - what energy and fuel issues do you see in the 10-20 year timeframe?



Steps in completing the roadmap will include:

- Analyse regional needs and priorities in the energy (transportation) area, and the challenges and opportunities to meet these. This includes identifying how regional needs will change over time, and projections of how technologies will be able to meet them.
- Identify the key technologies and skill competencies in which the individual countries have a competitive advantage.
- Identify key opportunities for technological innovation.
- Identify barriers related to development or acquisition of the technology (could include such things as skills requirements; standards and regulatory requirements).
- Identify the critical qualities that the product or technology must possess. These are the critical attributes of the future system (e.g., a Roadmap focussing on fuel cells might consider as critical attributes for a future system: cost-effectiveness, energy efficiency, safety, and reliability).
- Specify when the technology will be needed and potentially available. There might well be a gap between demand and being able to meet that demand.
- Quantify performance targets to inform the implementation plan. These targets are in reference to the critical attributes the final product or technology must possess.
- Recommend technology alternatives to be pursued, based on an evaluation of cost, time lines, performance and other factors.
- Define the actions necessary to develop the technologies for implementation.
- Map out a logical, prioritised sequence of technology acquisition and/or diffusion.
- Identify appropriate roles for the public and private partners in the process.