



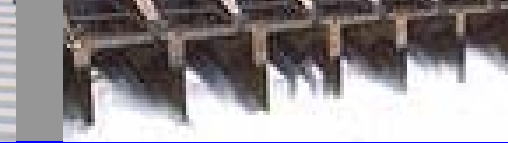
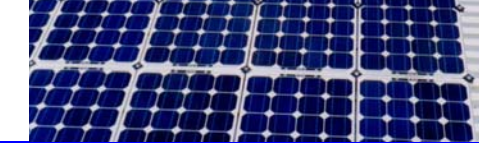
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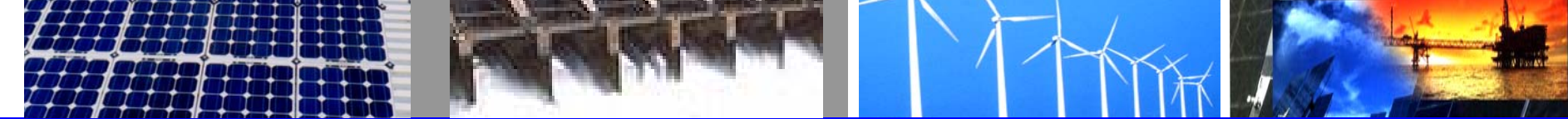
## APEREC PROJECTS ON NEW AND RENEWABLE ENERGY IN THE APEC REGION

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**Vice President**  
**Asia Pacific Energy Research Centre**



# OUTLINE

- **INTRODUCTION OF APERC**
  - **APERC's ROLE & ACTIVITIES**
  - **RECENT & CURRENT PROJECTS**
  - **NRE PROJECTS UNDERTAKEN**
  - **COLLABORATION WITH OTHER INSTITUTIONS**
- **SUMMARY OF FINDINGS**
- **CONCLUSION**



## INTRODUCTION OF APERC

- ❖ APERC's main objective is to conduct energy research in order to foster a region-wide understanding among APEC economies of global, regional and domestic energy demand and supply trends and energy issues facing the region.
- ❖ The research themes are categorised as follows:
  - Regional energy demand and supply outlook
  - Regional energy market analysis
  - Energy infrastructure development
  - Energy policy analysis
  - Sustainable energy development

**APERC**  
Asia Pacific Energy Research Centre

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### New Publication

**APERC Research Reports 2004**

**NEW!**  
New and Renewable Energy in the APEC Region (2004)

**NEW!**  
Nuclear Power Generation in the APEC Region (2004)

Electric Power Grid Interconnections in the APEC Region (2004)

Energy in China : Transportation, Electric Power and Fuel Markets (2004)

Energy Investment Outlook for the APEC Region (2003)

Natural Gas Market Reform in the APEC Region (2003)

Energy Efficiency Programmes in Developing and Transitional APEC Economies (2003)

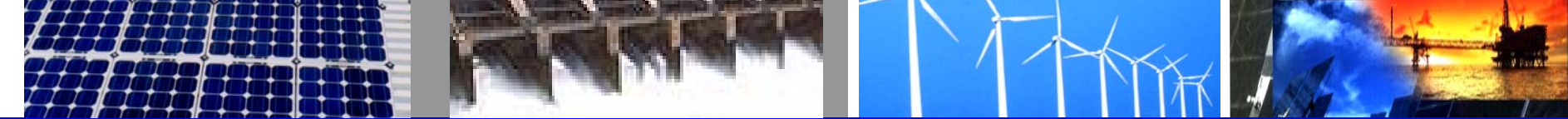
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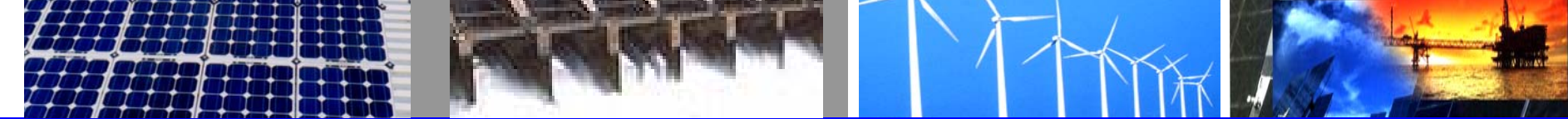
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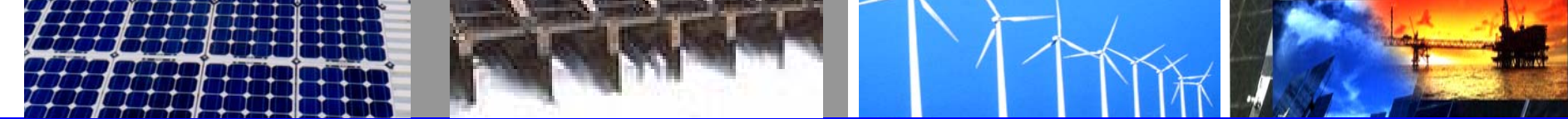
## Research for 2003/04

- ❖ Energy in China: Transportation, Electric Power and Fuel Markets
- ❖ Electric Power Grids Interconnection in the APEC Region
- ❖ Nuclear Power Generation in the APEC Region
- ❖ New and Renewable Energy in the APEC Region
  - Prospects for Electricity Generation



# Current Projects

- ❖ Long-term Energy Demand and Supply Outlook
  - Energy & Water Consumption
  - Aging & Energy Consumption
  - Urbanization & Energy Consumption
- ❖ Renewable Electricity in the APEC Region
  - (With a focus on internalising externalities)



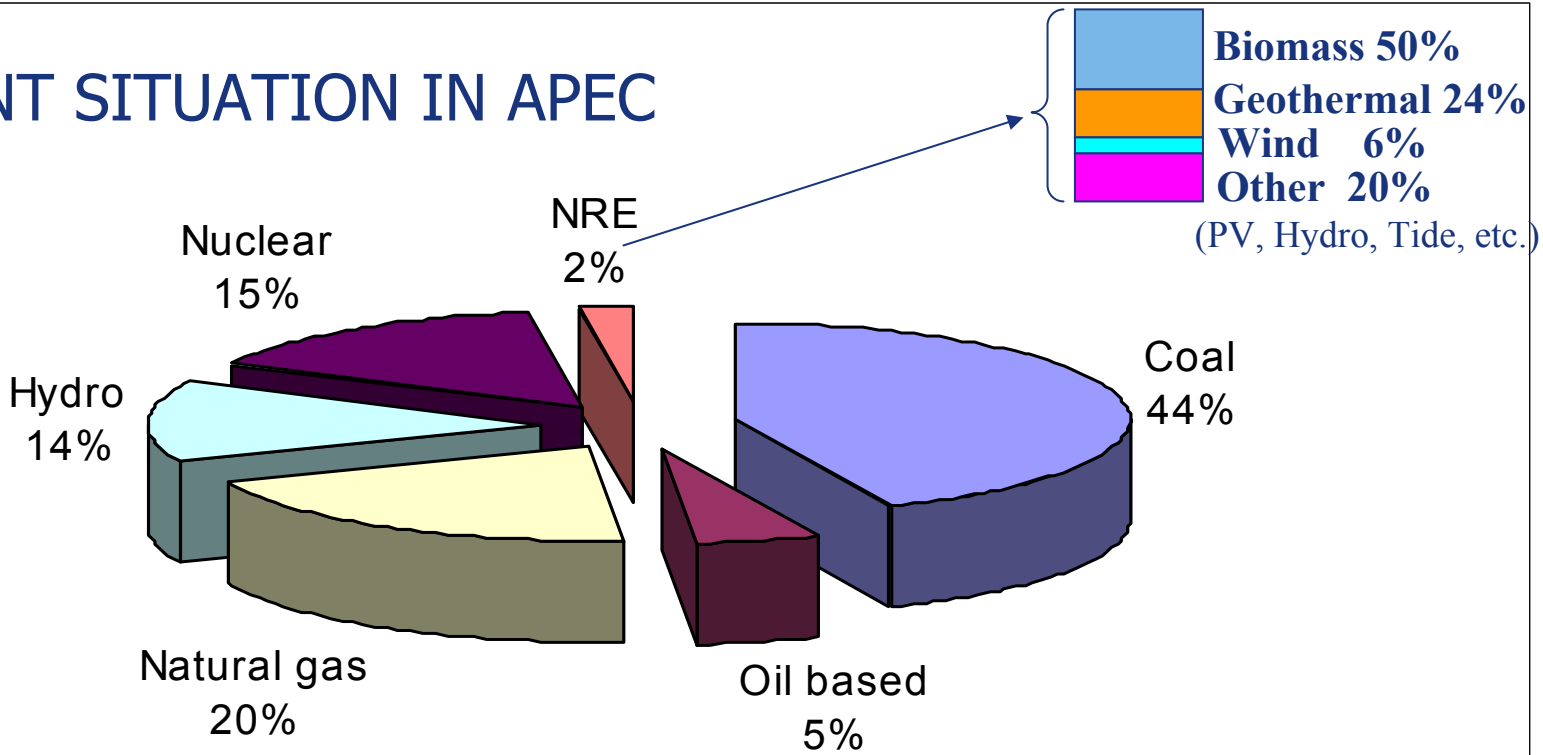
## NRE-Related Research Projects

- Sustainable Electricity Supply Options for the APEC Region (2001)
- Making the Clean Development Mechanisms Work (2001)
- Energy Demand and Supply Outlook 2020 (2002)
- Alternative Development Scenarios for Electricity and Transport to 2020 (2002)

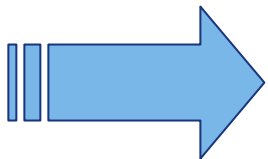


# Summary of Findings

## PRESENT SITUATION IN APEC

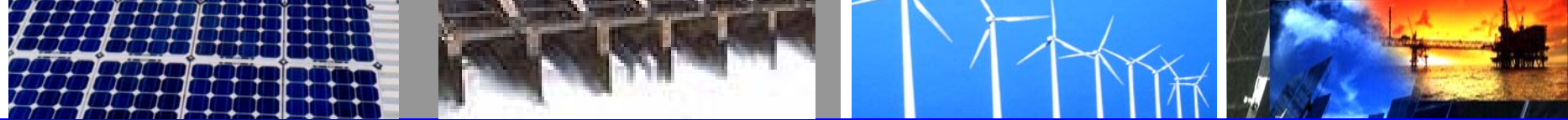


## PROJECTED APEC ELECTRICITY PRODUCTION FOR YEAR 2005



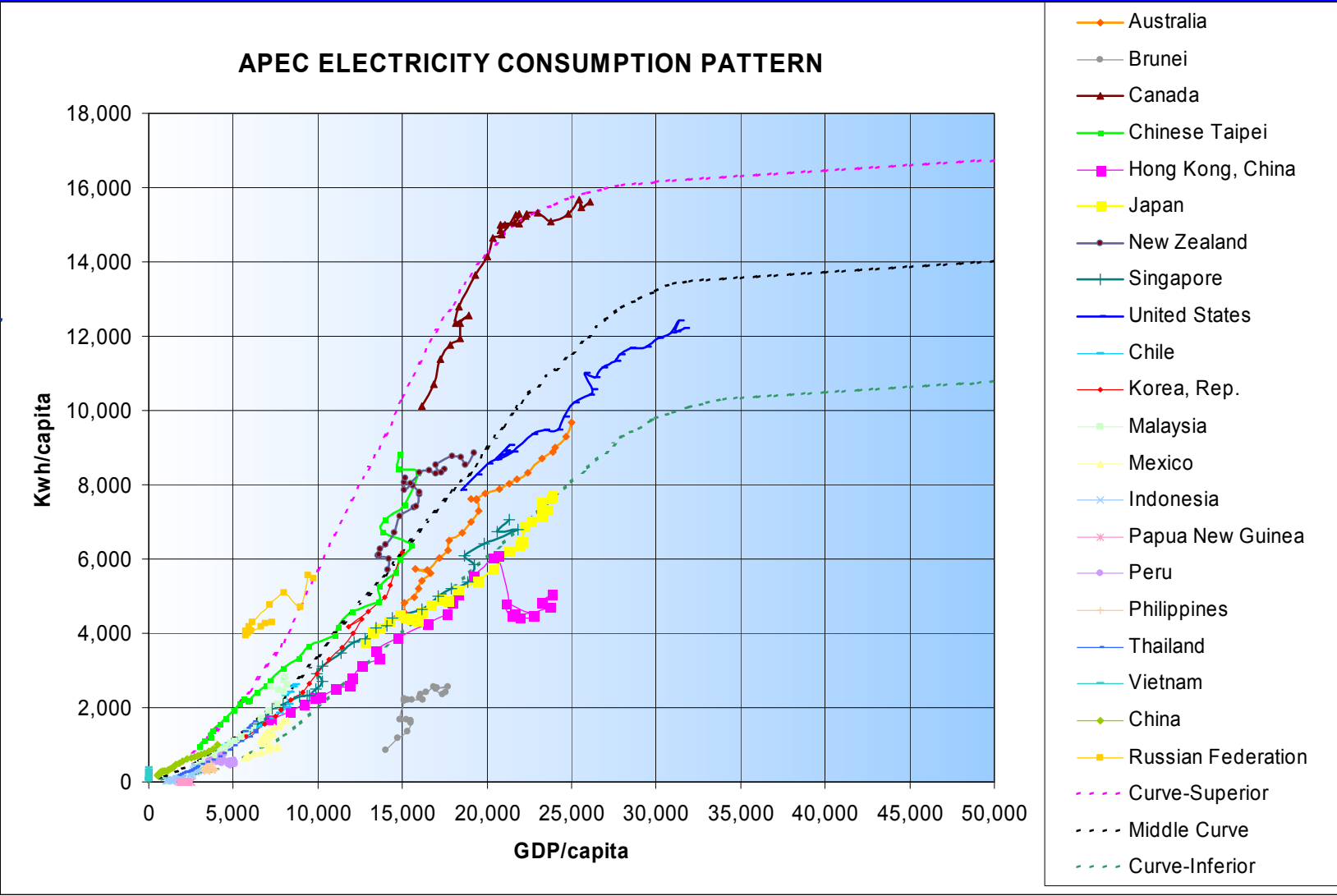
**NRE still a minor player in the energy sector due to lack of competitiveness under current policy and market rules.**

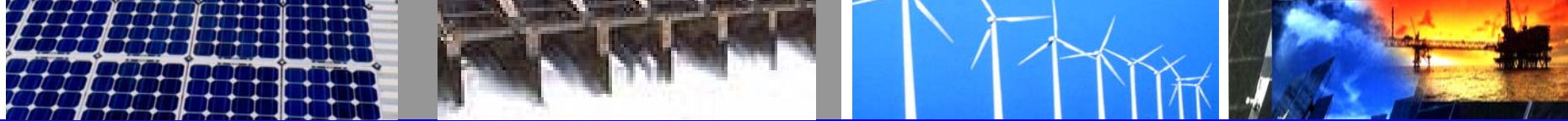




# ELECTRICITY CONSUMPTION TRENDS

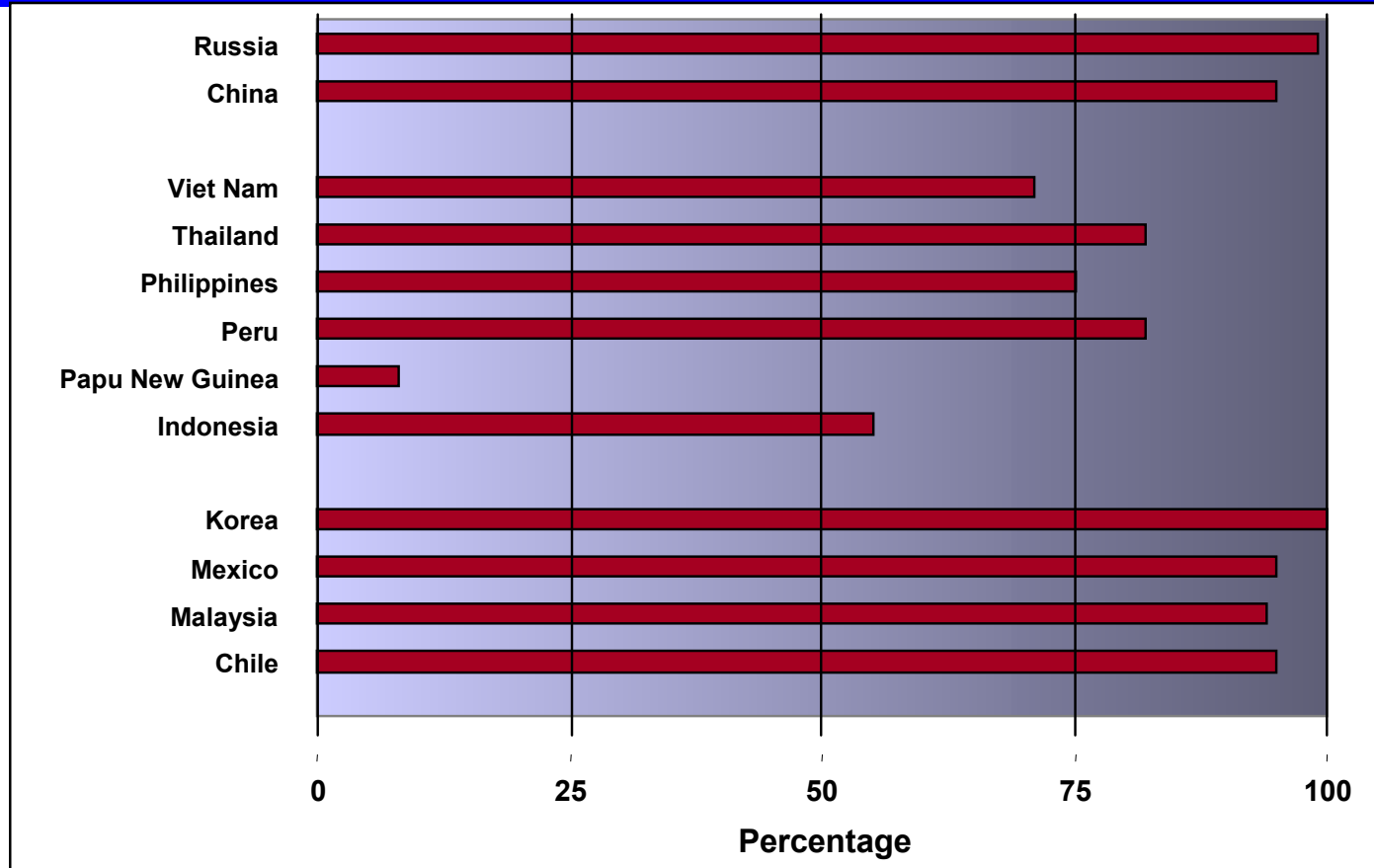
- S-shape pattern
- Clusters for different regions
- APEC Electricity demand growth is 2.8 percent annually





# ELECTRICITY CONSUMPTION TRENDS

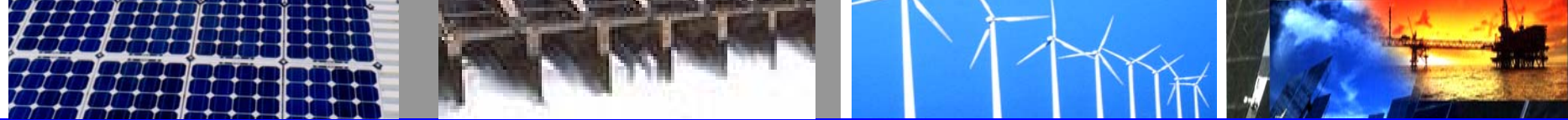
Electrification level (%) in selected APEC economies



- 1600 million people have no access to electricity in the world.
- 200 million people in APEC region ditto



Growth will be concentrated in developing economies



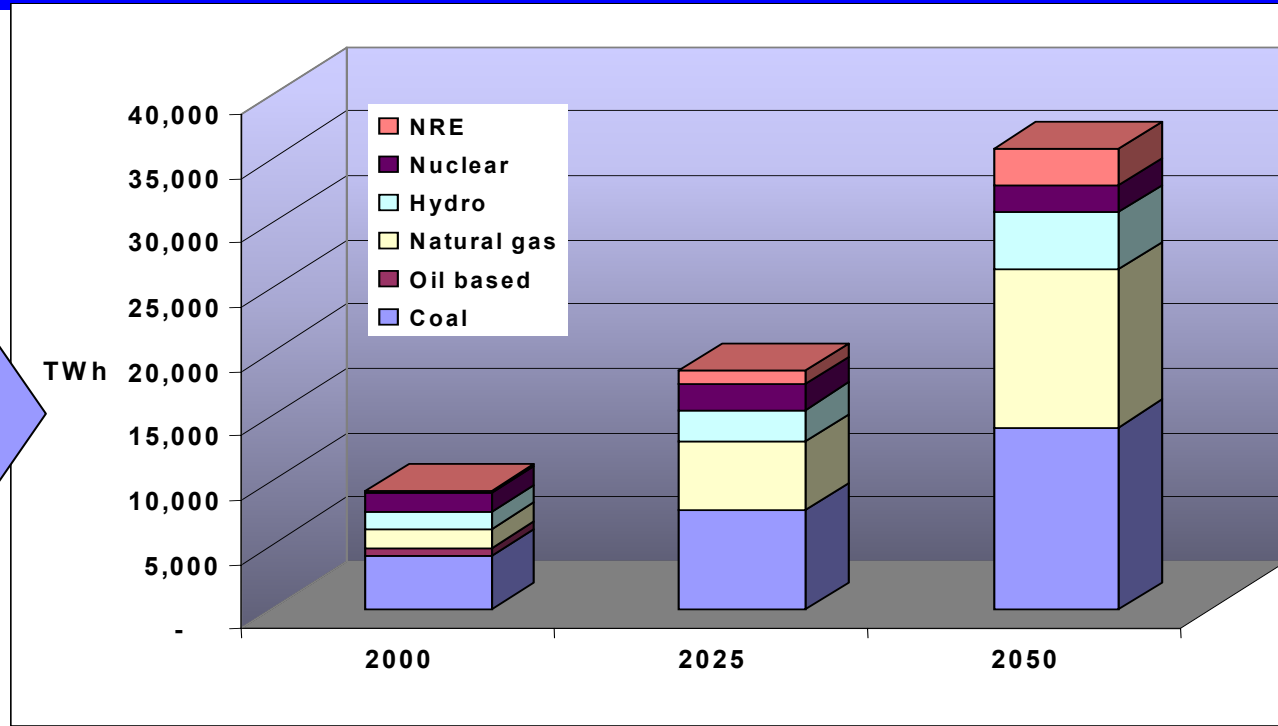
# REFERENCE SCENARIO

## Reference Scenario 2000-2050

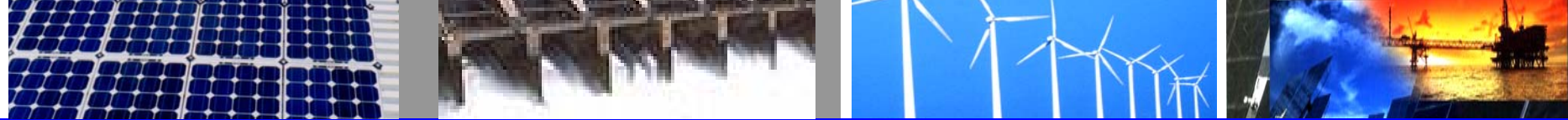
- Coal share around 40 percent,
- Oil will decline to a minimum,
- Hydropower expected to remain around 13%
- Natural gas to account for a third of total electricity production
- NRE accounts for only 8%

**BUT:**

- Oil and gas reserves may prove inadequate to support demand
- International agreements may increase pressure for cleaner technologies
- Security of supply

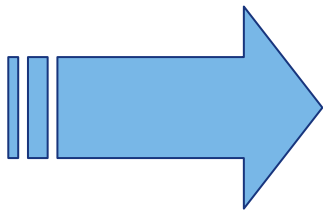
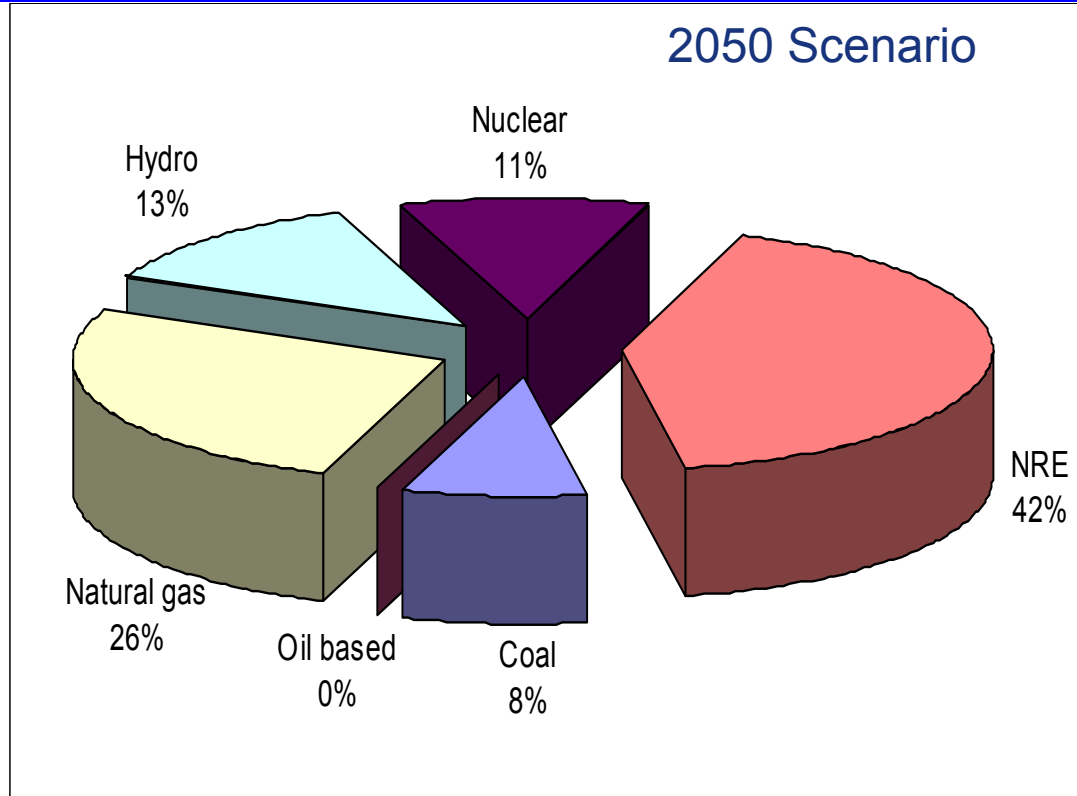


**An alternative scenario is needed**



## ALTERNATIVE SCENARIO

- 2050 Scenario to achieve similar level of CO2 emissions as of 1997 in APEC region
- Coal electricity power generation is decreased steadily.
- Oil electricity production is phased out.
- Natural Gas source is similar as the Reference scenario.
- Nuclear is moderately increased (but total share decreases from 15% to 11%)



**The main change would come from NRE**



# FUEL AND CO2 EMISSIONS

## Accelerated Deployment

- NRE technologies will be fully competitive after 2010
- Coal power generation is decreased 2% annually starting in 2010

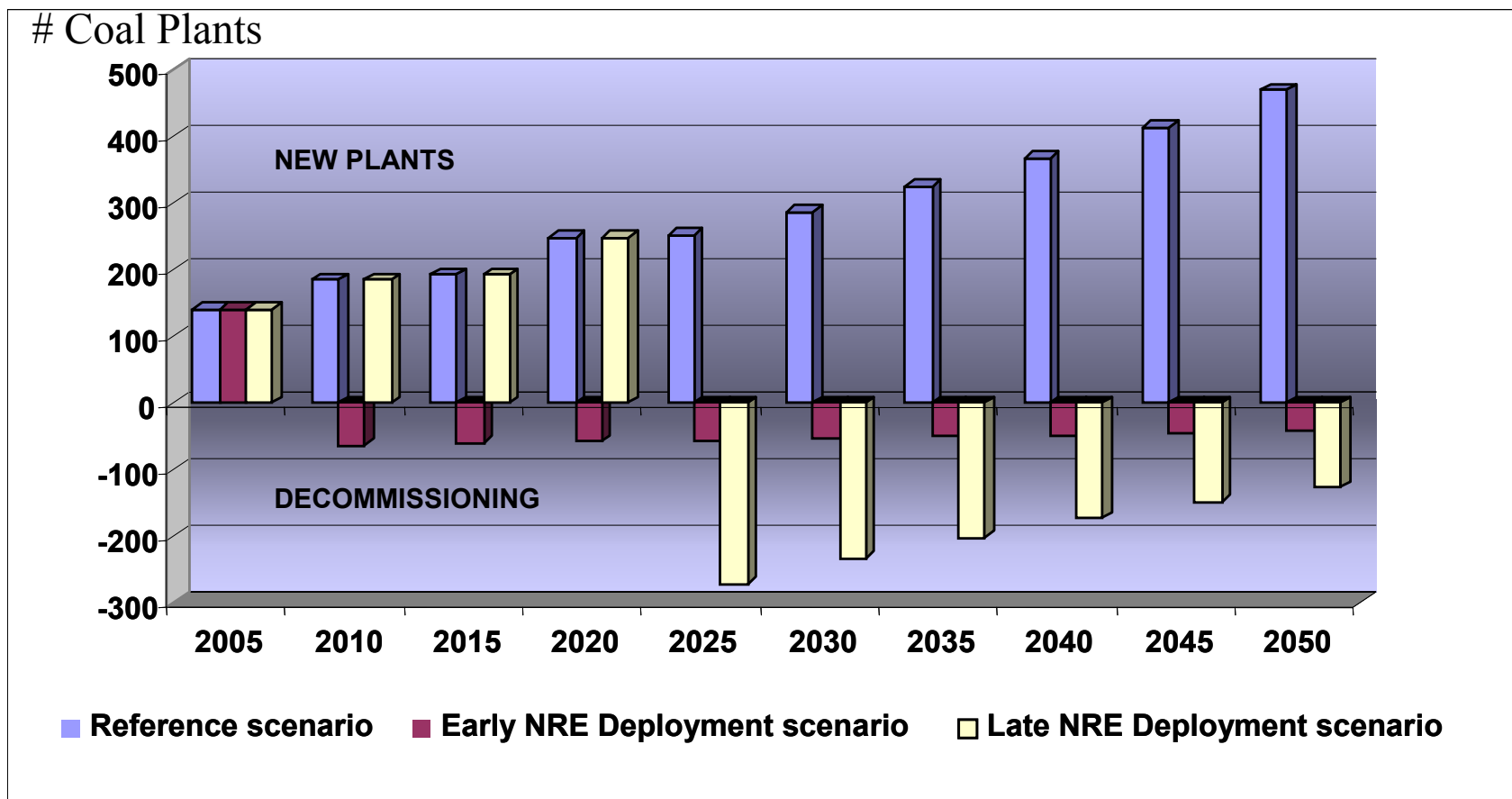
## Delayed Deployment

- NRE technologies will be fully competitive after 2020
- Coal power generation is decreased 3% annually starting in 2020

| Fuel               | Scenarios            |                  |
|--------------------|----------------------|------------------|
|                    | Accelerated Scenario | Delayed Scenario |
| Coal [million ton] | 85,213               | 67,591           |
| Oil [million bbls] | 3,600                | 0                |
| Natural Gas [BCM]  | 10,180               | 10,180           |

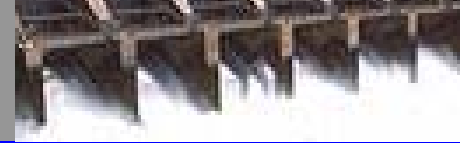
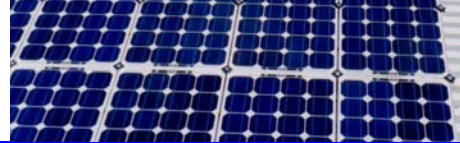
| Total Values for period 2000-2050                                    | Scenarios |                      |                  |
|--|-----------|----------------------|------------------|
|  | Reference | Accelerated Scenario | Delayed Scenario |
| CO2 Emissions [million tons CO <sub>2</sub> ]                        | 628,674   | 374,306              | 423,050          |
| Estimated Cost [trillion US\$]                                       | 12.38     | 4.90                 | 4.03             |
| Estimated Savings with respect to reference scenario [trillion US\$] | -         | 7.48                 | 8.35             |

# PHASING OUT TECHNOLOGIES: Example of Coal plants

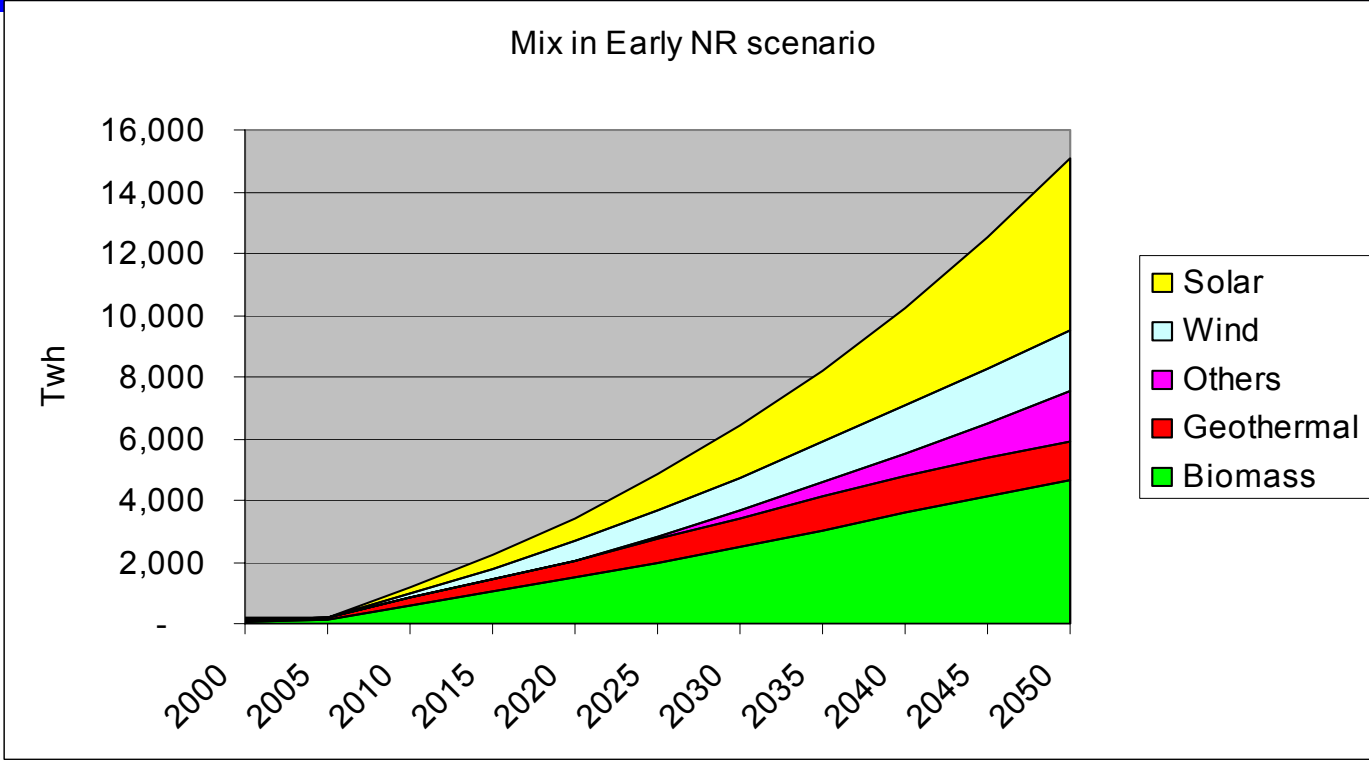


- There is a political cost for delaying the decision
- and also an economical one from decommissioning costs

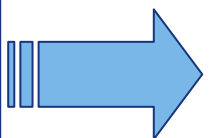
# CHALLENGE ON NRE TECHNOLOGIES



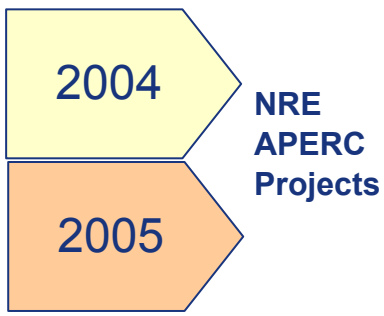
| NRE Electricity Technology | % Average Growth rate 2000- 2050 |
|----------------------------|----------------------------------|
| Biomass                    | 8.6                              |
| Geothermal                 | 7.4                              |
| Others                     | 16.9                             |
| Wind                       | 13.2                             |
| Solar PV                   | 11.1                             |



**NRE will have to grow on average above 10% yearly**

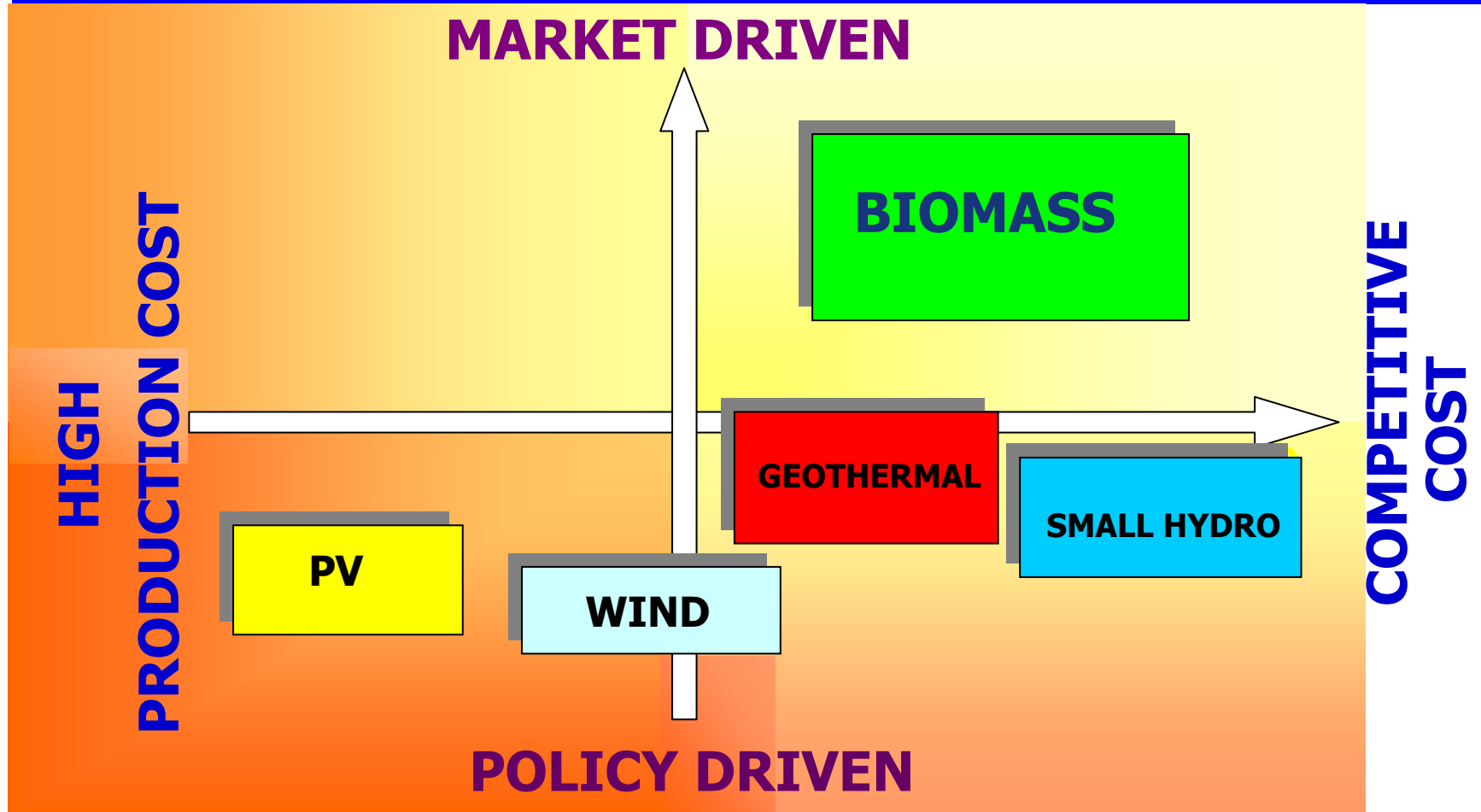


- NRE resource availability
- Adequate technical development of NRE technologies
- **Implementation of NRE technologies in real markets**



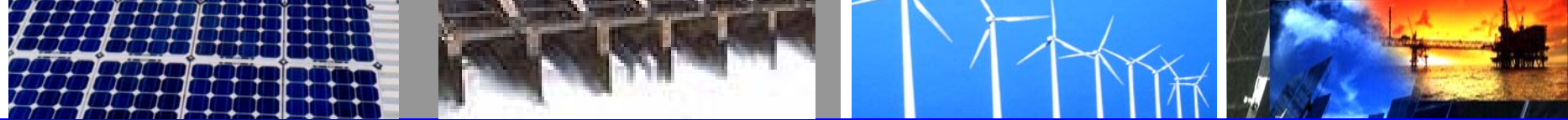


# THE POLICY AND MARKET FORCES

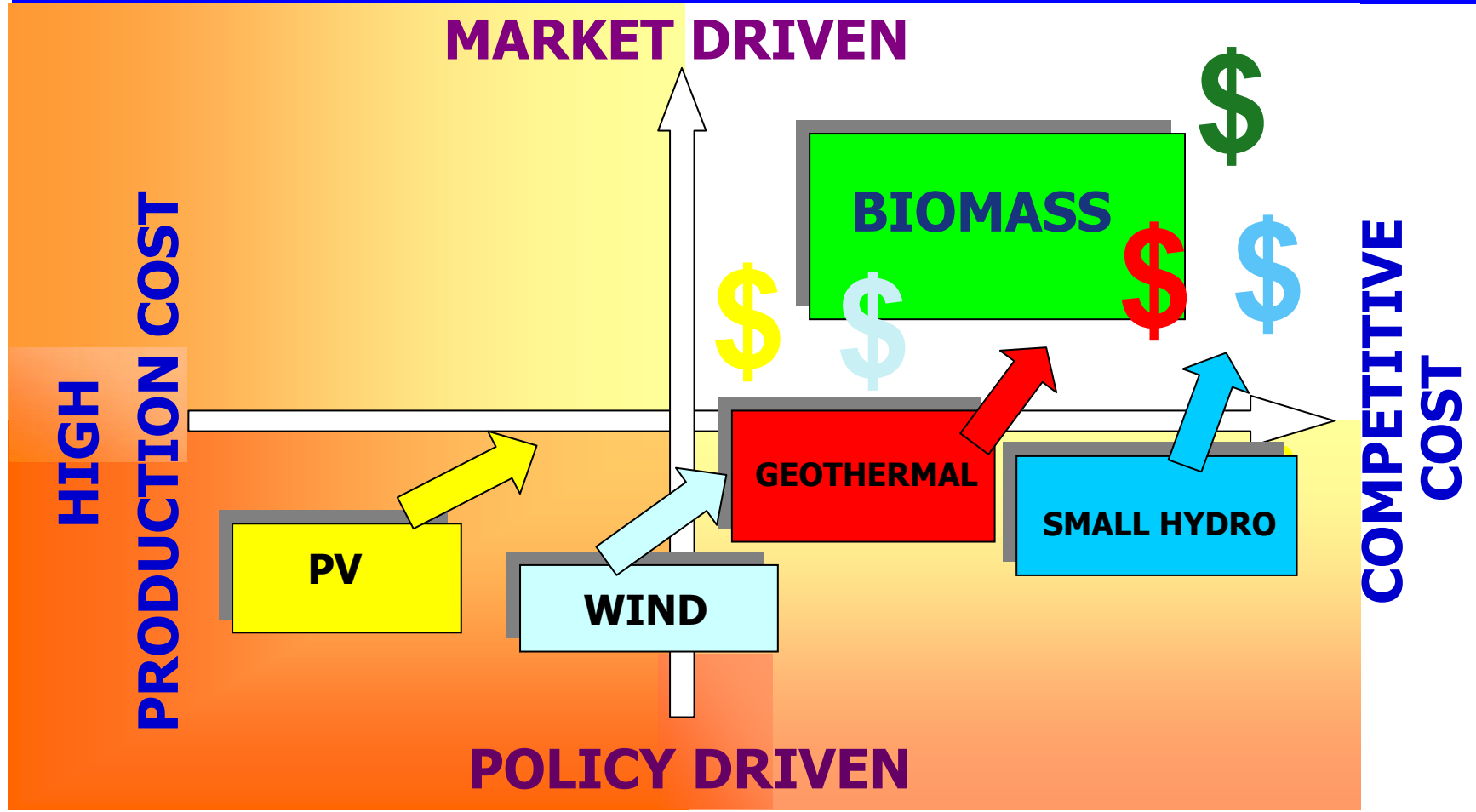


**Implementation of NRE technologies requires both political and market changes**

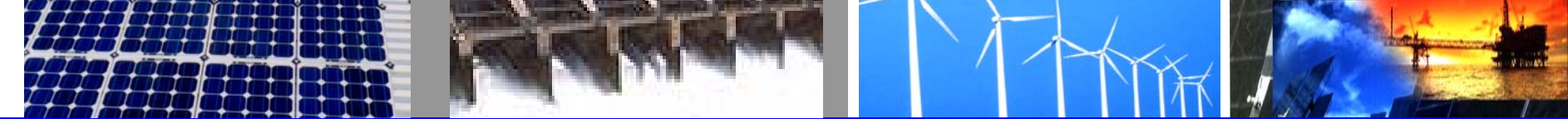




# THE POLICY AND MARKET FORCES

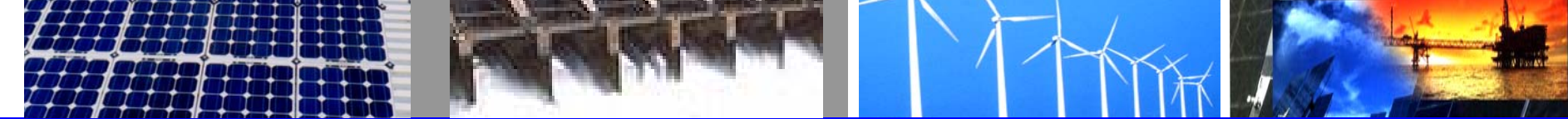


**Dissemination of NRE technologies driven by market profit**



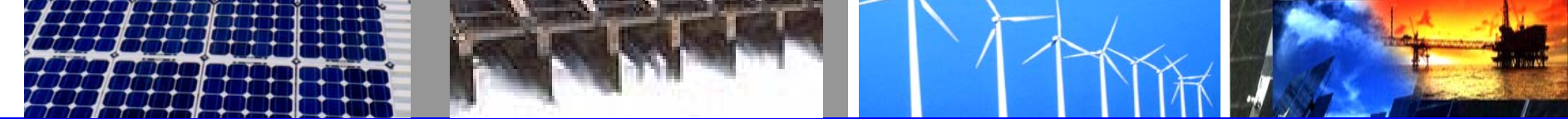
## FOCUS OF CURRENT NRE PROJECT

- High oil and gas price is an impetus for the development of renewable electricity
- Assessing the real costs of providing electricity
  - Analysis of the potentials for levelling the playing-field by internalising external costs for both fossil fuels and renewables
  - Qualitative analysis of the different subsidies in favour of renewables and tax policies against it
  - Alternative Scenario based on externalities-reflected electricity costs



## FOCUS OF CURRENT NRE PROJECT (2)

- Assessing renewable energy supply potential based on:
  - Investment costs of renewable technologies;
  - Costs of conventional electricity technologies;
  - Price of carbon; and
  - Price of oil and gas in the future



## EXTERNALITY COSTS

### ❖ Internalised costs of energy

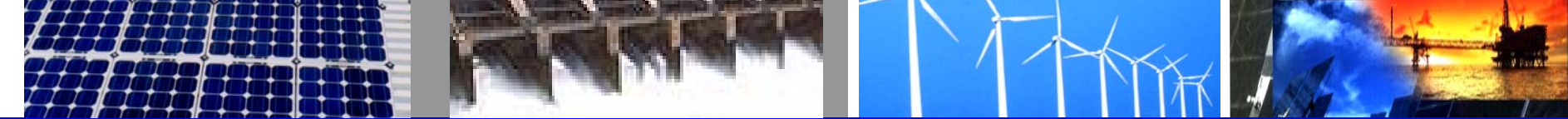
- Cost of coal/fuel
- Capital costs
- Labour costs

### ❖ Externalised costs of energy

- Community health (respiratory illness resulting from  $PM_{10}$ ,  $SO_x$ ,  $NO_x$ , VOC, etc.)
- Ecosystem health (e.g. acid deposition)
- Infrastructure degradation (roads)
- Global warming (greenhouse gas emissions)
- Smog ( $SO_x$  and  $NO_x$  transformations)

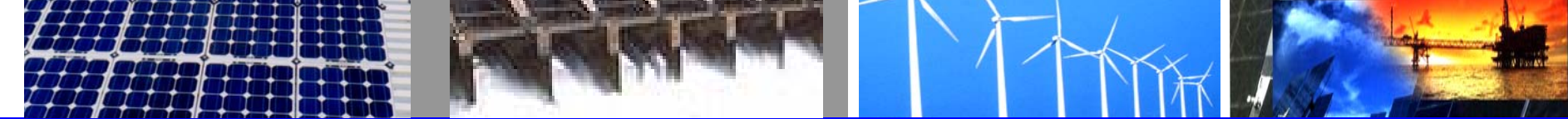
### ❖ Externalised benefits of energy

- Energy security
- Employment
- Fuel substitute (inefficient wood/biomass stoves)



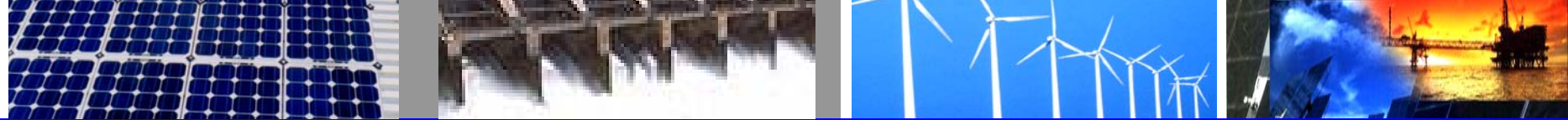
## What is Externality and How it is Measured?

- ❖ Externalities are defined as benefits or costs, generated as a byproduct of an economic activity, that do not accrue to the parties involved in the activity
- ❖ Environmental externalities are benefits or costs that manifest themselves through changes in the physical-biological environment
- ❖ The 2 methodologies employed in measuring Externalities are :
  - ❖ Abatement cost approach
  - ❖ Damage cost Approach
    - ❖ Top-down
    - ❖ Bottom-up

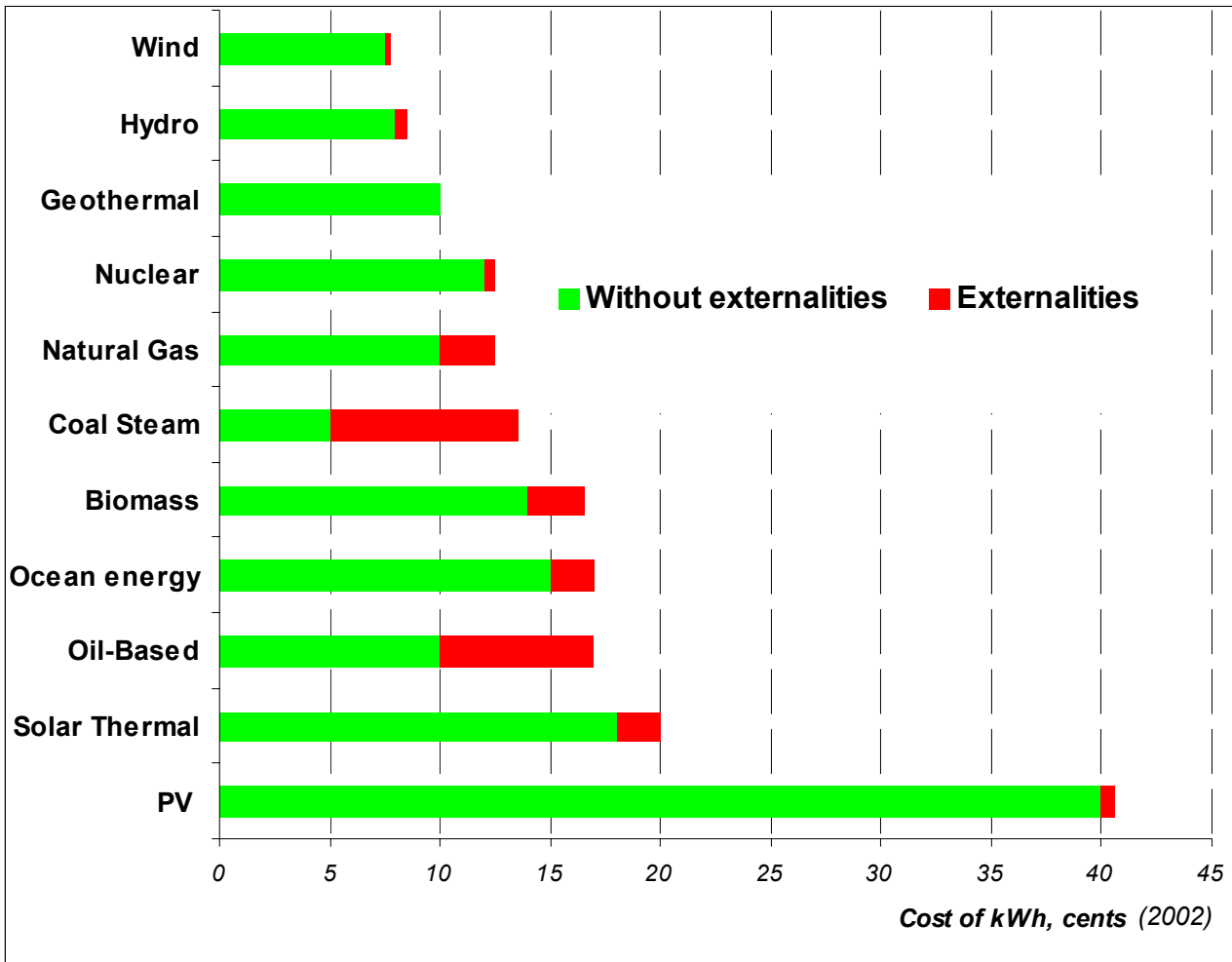


## Externality Issues

- ❖ No consensus on the parameters to be considered as externality
- ❖ No consensus on the values to be assigned to each parameter. Different economy/region has different values
- ❖ Some are difficult to quantify, e.g. global warming
- ❖ Renewables also have external costs



# Externality Costs



Only some renewables become more competitive, even after the inclusion of external costs

Source: Owen, A.D, 2002



## SUMMARY

- In the absence of further technological breakthrough, renewables still require favourable policy support in the foreseeable future
- Subsidies for nuclear and fossil-fuels in various forms should be phased out in order to level the playing field for renewables
- Greater deployment of NRE requires clear market rules for Distributed Generation