INTERNATIONAL SEMINAR ON BIOENERGY & SUSTAINABLE RURAL DEVELOPMENT

A GLOBAL PERSPECTIVE on BIOENERGY

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CASA DE GOBIERNO

MORELIA, MICHOACÁN, MEXICO

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- **Present Market for New and Renewable Energy Sources (N & R)**
- **Future market for N & R Energy Sources**
- **Are Energy Policies Important?**
- **Biomass and Other N & R Costs**
- **Barriers to Be Removed to Foster N & R**
- **Policies to Mitigate Barriers**
- **Policies to Promote Biomass and Other N & R**

Table 2 – Renewable Electricity Grid-Based Generation Capacity Installed as of 2000 (Megawatts) - (Martinot et al, 2002)

Technology	All countries	Developing countries
Wind power	18,000	1,700
Small hydropower	36,000	19,000
Biomass power	**38,000**	**30,000**
Geothermal power	8,500	3,900
Solar thermal power	350	0
Total renewable power capacity	100,000	55,000
Large hydropower	680,000	260,000
Total world electric power capacity	3,400,000	1,500,000

Table 1
Renewable Energy Markets in Developing Countries

Application	Indicators of Existing Major Markets
1. – Rural residential and community lighting, TV, radio, and telecomm	**11 million households receive lighting from biogas** 950,000 households with solar home systems (out of 300-500 million households not connected to electric grid) 170,000 household-scale wind-power generators 25,000 PV-powered cellular and satellite phones (serving a rural community)

Table 1
Renewable Energy Markets in Developing Countries

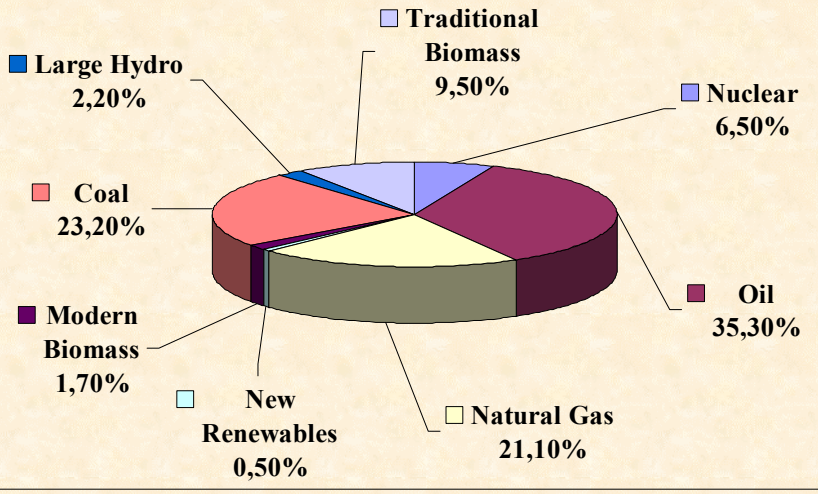
Application	Indicators of Existing Major Markets
3. – Village-scale mini-grids	5,000 small hydro mini-grids (relative to 100,000 diesel-powered mini-grids) 200 solar or wind hybrid village mini-grids (with diesel)
4. – Rural residential and commercial cooking	250 million more-efficient biomass stoves out of 1billion households that use biomass for cooking) 7000 solar cookers 20000 households cook with biogas fuel

Table 1
Renewable Energy Markets in Developing Countries

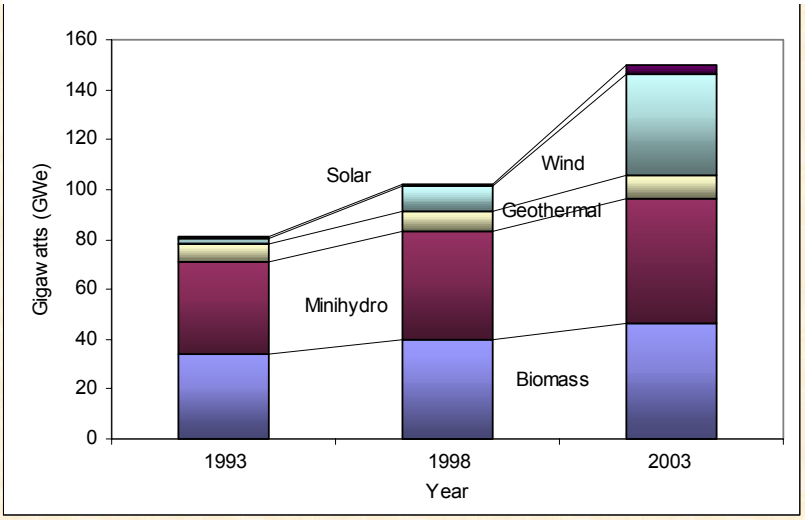
Application	Indicators of Existing Major Markets
5. – Residential/ commercial heating	110,000 homes with solar hot water systems 8700 MWth geothermal direct heat production
6. – Grid-based bulk power markets	55,000 MW installed capacity producing 200,000 GWh/year (mostly biomass and small hydro) (1)
7. – Transport fuels	15 billion liters/year ethanol vehicle fuel produced from biomass 180 million people live in countries mandating mixing of ethanol with gasoline

(1)Some of this capacity serves small village mini-grids rather than central power grids

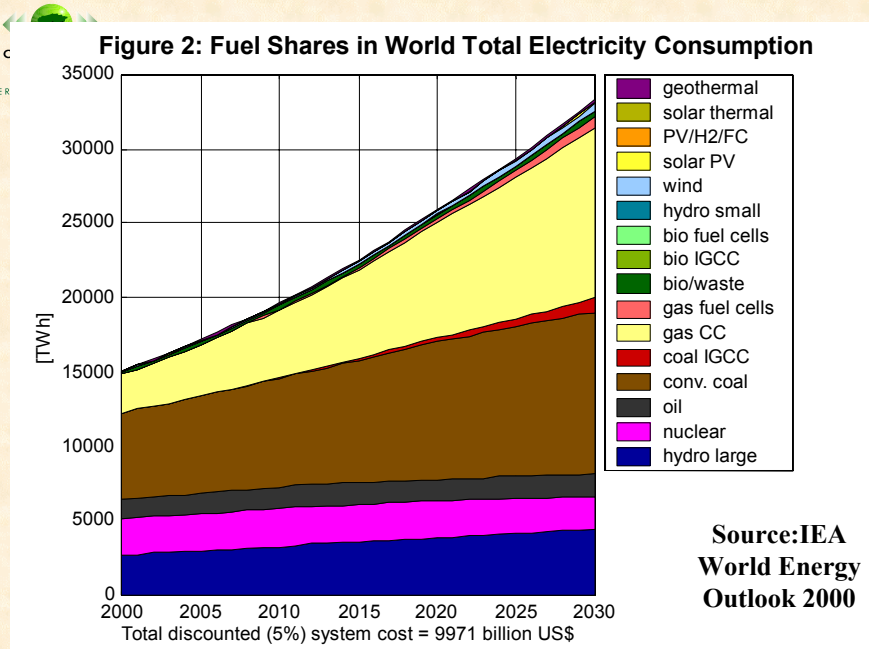
World Consumption of Primary Energy and Renewables, by Energy Type - 1998



New and Renewable-Based Electricity Generation 1993-2003



BUSINESS AS USUAL SCENARIO



Source:IEA World Energy Outlook 2000

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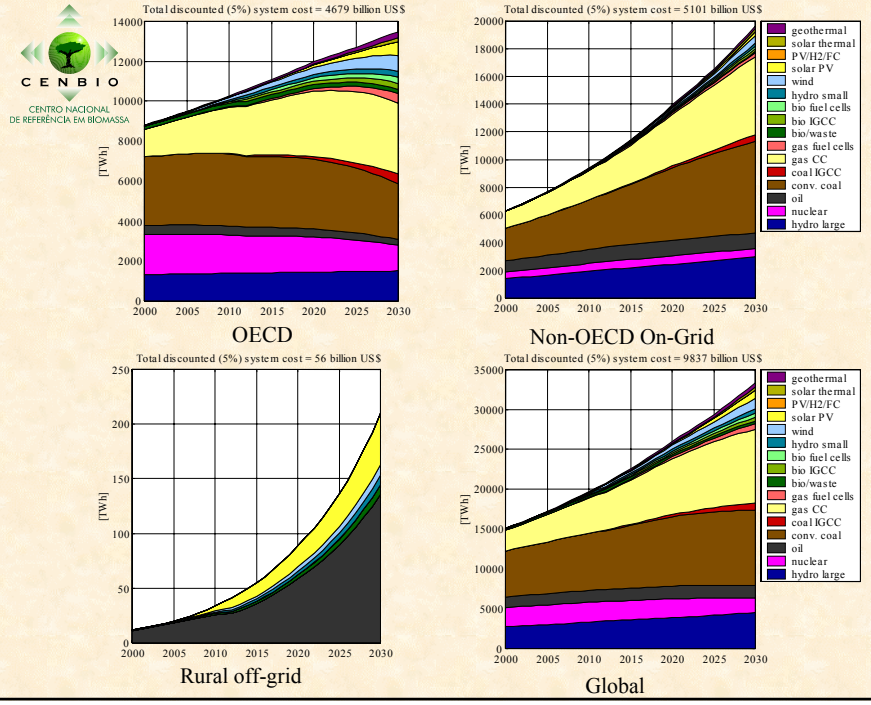
There are a number of conclusions to be drawn from this Business As Usual scenario:

- **significant renewable energy markets will not result from a "business as usual" approach;**
- **fossil dependency will grow, leading to more serious price and supply vulnerabilities;**
- **improved energy services are not likely to reach currently unserved populations; and a significant increase in fossil energy use will cause serious environmental consequences**

The three markets and the global total in the "Diversify Renewables" Scenario

SOURCE: Renewable Enhanced Scenario - IEA's World Energy Outlook 2000



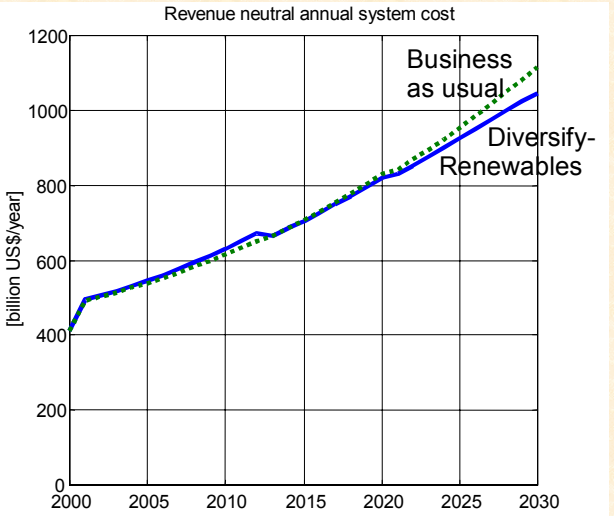
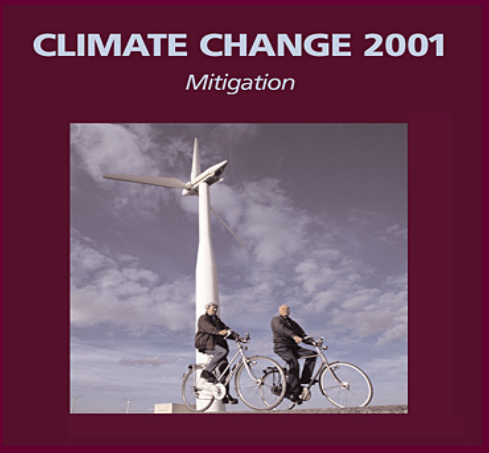


Figure 8 – Comparison of total system costs

"Diversify-Renewables" requires investments in learning for the new renewable energy technologies during the beginning of the period. The effects of these learning investments peak out in 2010-2015 where the additional cost for the alternative reaches a maximum of 3% of total costs. These investments start to pay off after 2015 due to technology learning providing less costly clean technologies and the renewables technologies reducing the reliance on fossil fuels.

IPCC Third Assessment Report



Overview: Mitigation of Climate Cnange

UNFCCC COP 6 Part Two Special Event,

July 2001

Structure of the report (1)

- **Setting the stage: climate change and sustainable development**
- **GHG mitigation scenarios and implications**
- **Technological and economic potentials**
  - **energy and industrial options**
  - **biological options**
- **Barriers and opportunities**

Structure of the report (2)

- **Policies, measures and instruments**
- **Mitigation cost and ancillary benefits**
  - **Costing methodologies**
  - **Global, regional and national costs and ancillary benefits**
  - **Sector costs and ancillary benefits**
- **Decision making frameworks**

Main messages (1)

- **There is a strong link between sustainable development, environmental management and climate change mitigation**
- **Technologies are presently available, in the short term, to stop the growth of global GHG emissions and, in the long term, to limit climate change impacts**

Main messages (2)

- **The problem of controlling emissions is to overcome the many political, economic, social and behavioural barriers to implement mitigation options**
- **Decision making on climate change is risk management; for low level stabilisation, early mitigation action is needed**
- **Integrating mitigation and sustainable development policies improves the prospect of achieving stabilization and sustainable development goals**

2010 Mitigation Potential (under $100 per t C)

- **Energy and other technological options**
  - **1.9 -- 2.6 Gt C/yr**
- **Land use, land-use change and forestry**
  - **about 1 Gt C/yr**

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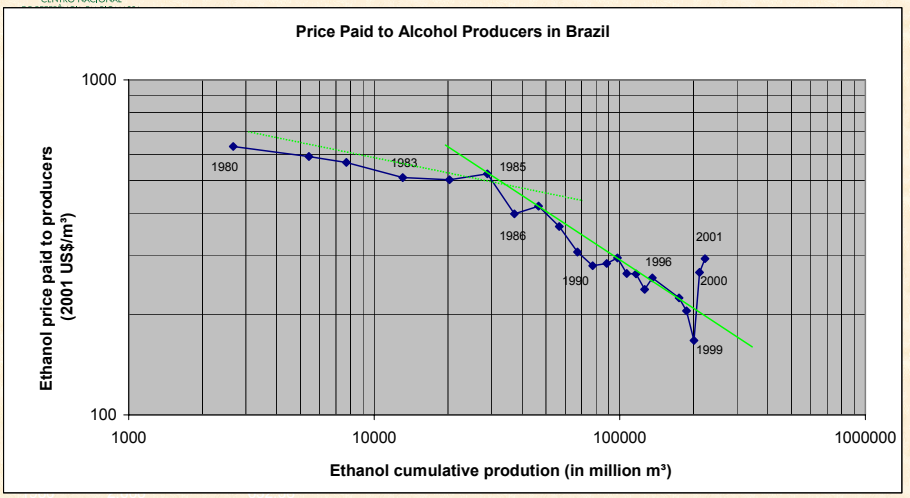
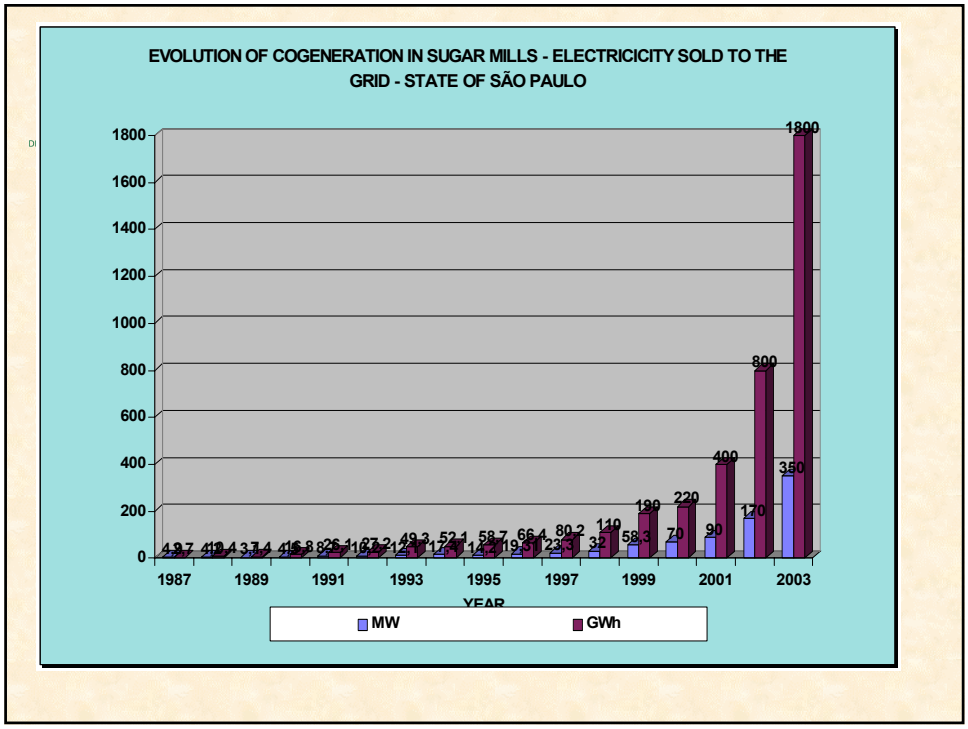
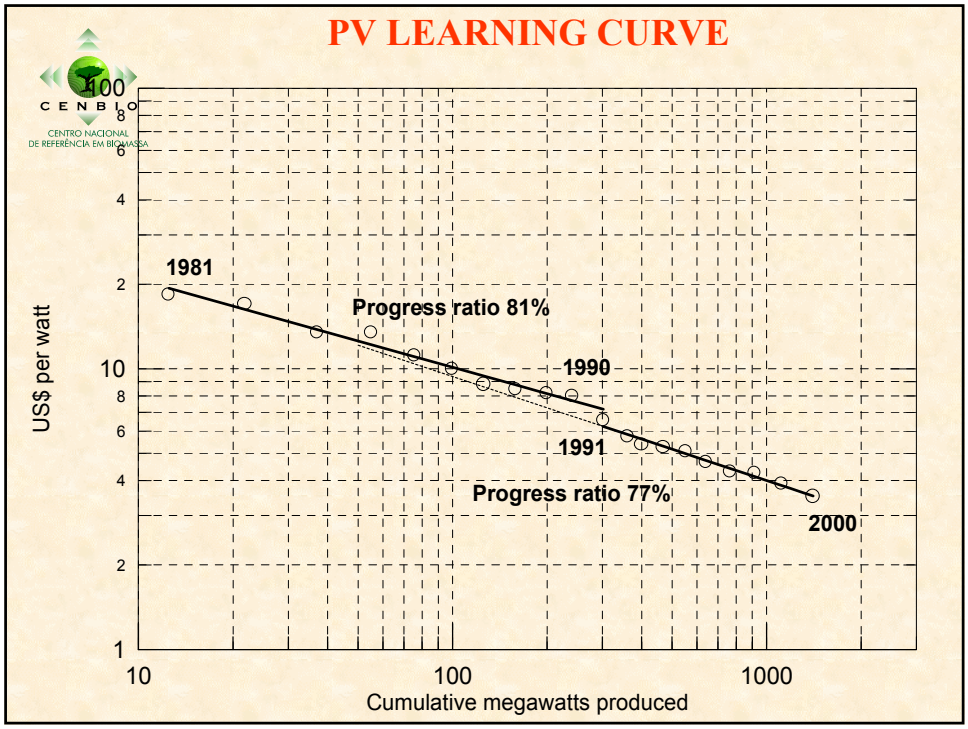


February, 2002


EVOLUTION OF COGENERATION IN SUGAR MILLS - ELECTRICICITY SOLD TO THE GRID - STATE OF SÃO PAULO
1800
1600
1400
1200
1000
800
600
400
200
0
1987
1989
1991
1993
1995
1997
1999
2001
2003
YEAR
MW
GWh


PV LEARNING CURVE
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US$ per watt
100
10
1
1981
Progress ratio 81%
1990
1991
Progress ratio 77%
2000
10
100
1000
Cumulative megawatts produced

WIND ENERGY LEARNING CURVE

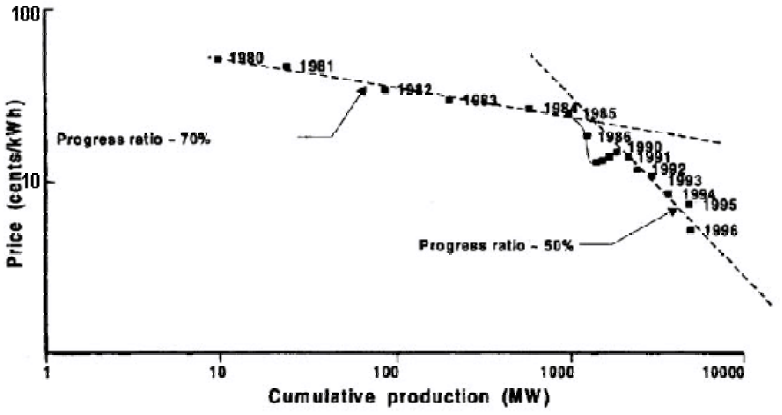
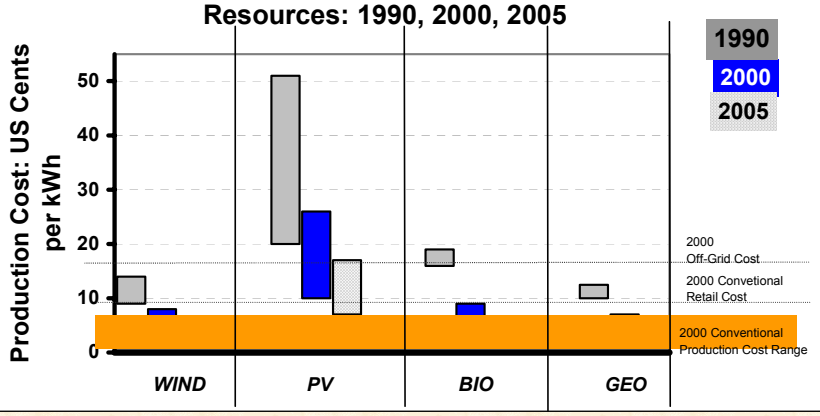


Figure 4:
Production Cost Ranges for Fossil and Renewable Resources: 1990, 2000, 2005

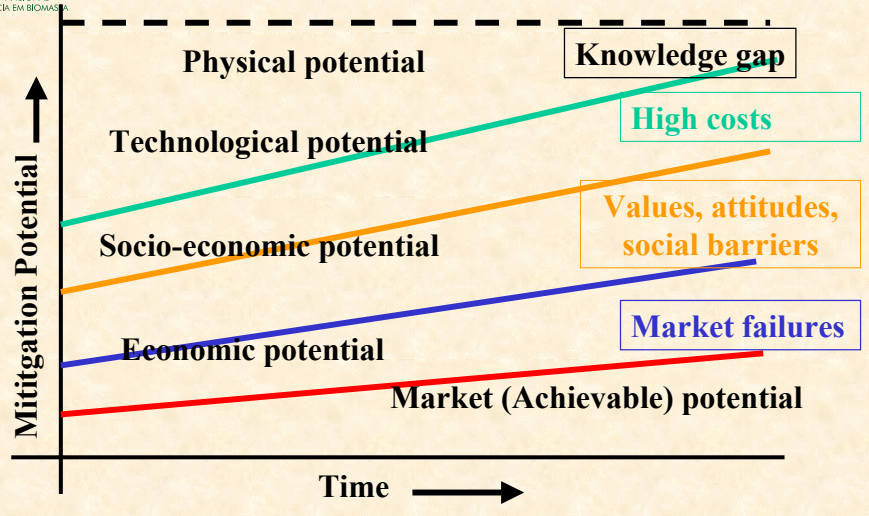


Realizing these Potentials Requires Overcoming Many Barriers to their Implementation

- **Barriers add to the cost of implementation, and reduce the realizable potential**

- **Removal of barriers during capital stock turnover and periods of rapid social change can minimize disruption and mitigation costs**

Opportunities and Barriers -- A Classification



Market and Institutional Barriers (Market Failures) to Achieving Economic Potential: Examples

- Lack of information
- Lack of access to capital, especially for smaller firms
- Absence of full-cost pricing
- Risk aversion in financial institutions, including Multilateral Development Banks
- Trade barriers, such as tariffs or export restrictions

Social and Cultural Barriers to Achieving Socio-economic Potential:Examples:

- Individual behaviour
- Social values and preferences
- Cultural traits and norms
- Gender issues

POLICIES CLASSIFICATION

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- Research, Development and Demonstration
- Financing
- Financial incentives
- Pricing
- Voluntary agreements
- Regulations
- Information dissemination and training
- Procurement
- Market reforms
- Market obligations
- Capacity building
- Planning techniques