Ministério de Minas e Energia

BRASIL UM PAÍS DE TODOS GOVERNO FEDERAL

Brazil's Current Status in Hydrogen Technologies

IPHE – Steering Committee Meeting

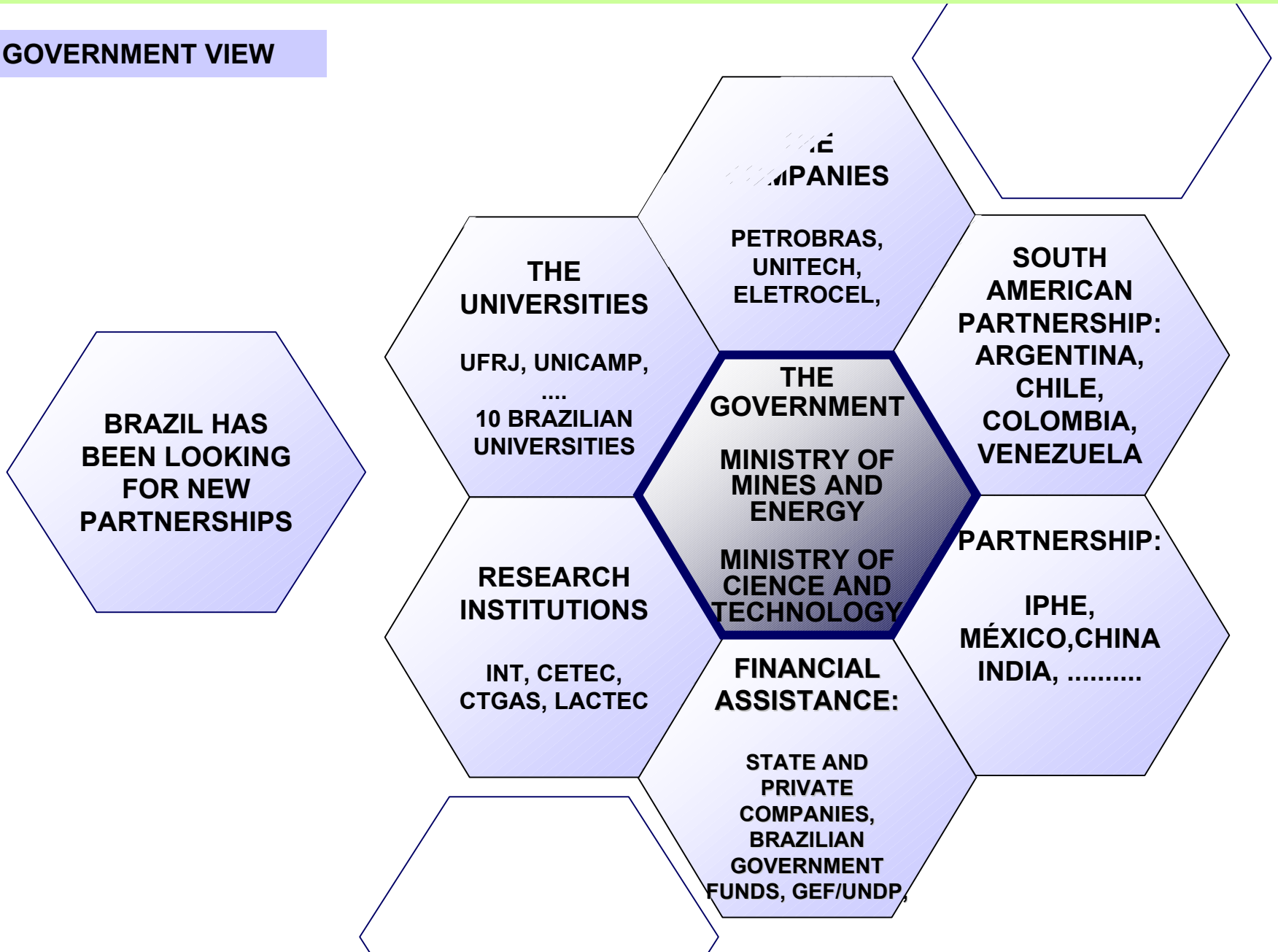
Beijing, China

May, 2004

Maria das Graças Foster
Oil, Natural Gas & Renewable Fuels Secretary
Ministry of Mines and Energy - Brazil

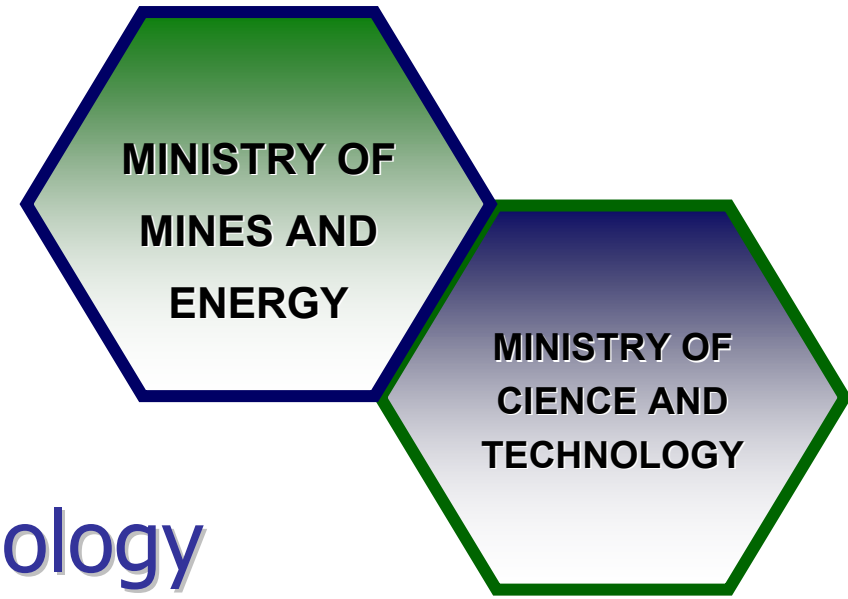
BRAZIL HYDROGEN NETWORK

THE GOVERNMENT VIEW



Brazilian Government Actions

- Ministry of Mines and Energy
- Hydrogen Economy Program:
  - Applications
  - Market and commercialization
  - Demand for R&D&D



- Ministry of Science and Technology
- Fuel Cell Program:
  - Basic and applied R&D program
  - Financial resources to support R&D&D

HYDROGEN R&D IN BRAZIL: 1980 - 2003

NET	AREA	Rede 10/01: N/NE	Rede 11/09: N/NE	UFBA	UFRJ	FUJB/MA	UFPR	USP/Ribeirão Preto	USP/São Carlos	UFSCAR/São Carlos	UNITECH	IPEN	UFMG/CDTN/CETEC	UNESP/Bauru	ELECTROCEL	COPPE/UFRJ	INT e INT/UFF	LACTEC	UEM	CEPEL	UNICAMP	CLAMPER	CENPES/PETROBRAS
		SOME INSTITUTIONS DEVELOPING TECHNOLOGICAL AND RESEARCH PROJECTS																					
Electro-chemistry	Solid Oxide	X		X	X				X	X		X	X	X	X	X							
	PEM, electrodes and membranes	X			X	X	X	X	X	X	X	X		X		X		X			X	X	
	Fuel Cells	X							X		X		X	X	X	X						X	
Reform	Natural Gas	X	X	X	X					X						X	X						X
	Ethanol											X	X				X		X		X		
	System engineering		X		X		X									X							X
Systems	System analysis						X									X		X		X	X	X	
	H_2 generation (electrolysis)								X												X	X	
	H_2 Storage							X								X					X		
	Safety, Codes and Standards																	X					X
	Integration										X							X		X	X	X	

THE BRAZILIAN FUEL CELL PROGRAM

ONE OF THE PROGRAMS UNDER DEVELOPMENT

Program's targets

- PEMFC (Polimer Electrolyte FC): demo projects, membrane electrode assembly, stack assembly, system control
- SOFC (Solid Oxide FC): materials & components
- Fuel Reforming: ethanol & natural gas
- System integration: power conditioning, grid connection, fuel distribution
- Electrochemistry: support to PEMFC, SOFC and to alkaline water electrolysis developments
- Safety, codes & standards

HYDROGEN BRAZILIAN MAIN OBJECTIVES

- To develop technology for hydrogen production, distribution and use, including fuel cell related products, systems and processes.

- To achieve important results concerning:
  - Economic hydrogen production from natural gas reform, water electrolysis and renewable sources.
  - Development of FC knowledge and expertise for distributed power generation.

BRAZILIAN ACTIONS ON HYDROGEN TECHNOLOGY

- Hydrogen production from:
  - water electrolysis,
  - Natural Gas reforming,
  - ethanol and other biomasses reforming or gasification.
- Hydrogen storage technologies, including advanced materials
- PEMFC and SOFC R&D programs

PRIORITY ISSUES ON H2 TECHNOLOGY

- **Short term:**
  - H2 from ethanol reforming
  - H2 from hydroelectricity and NG reforming
  - Use of H2 powered urban buses to improve air quality in large cities
- **Long term:**
  - To supply power to remote off-grid communities
  - Direct ethanol Fuel Cells
  - H2 production from renewable sources such as biomass and from sun and wind driven electrolysys

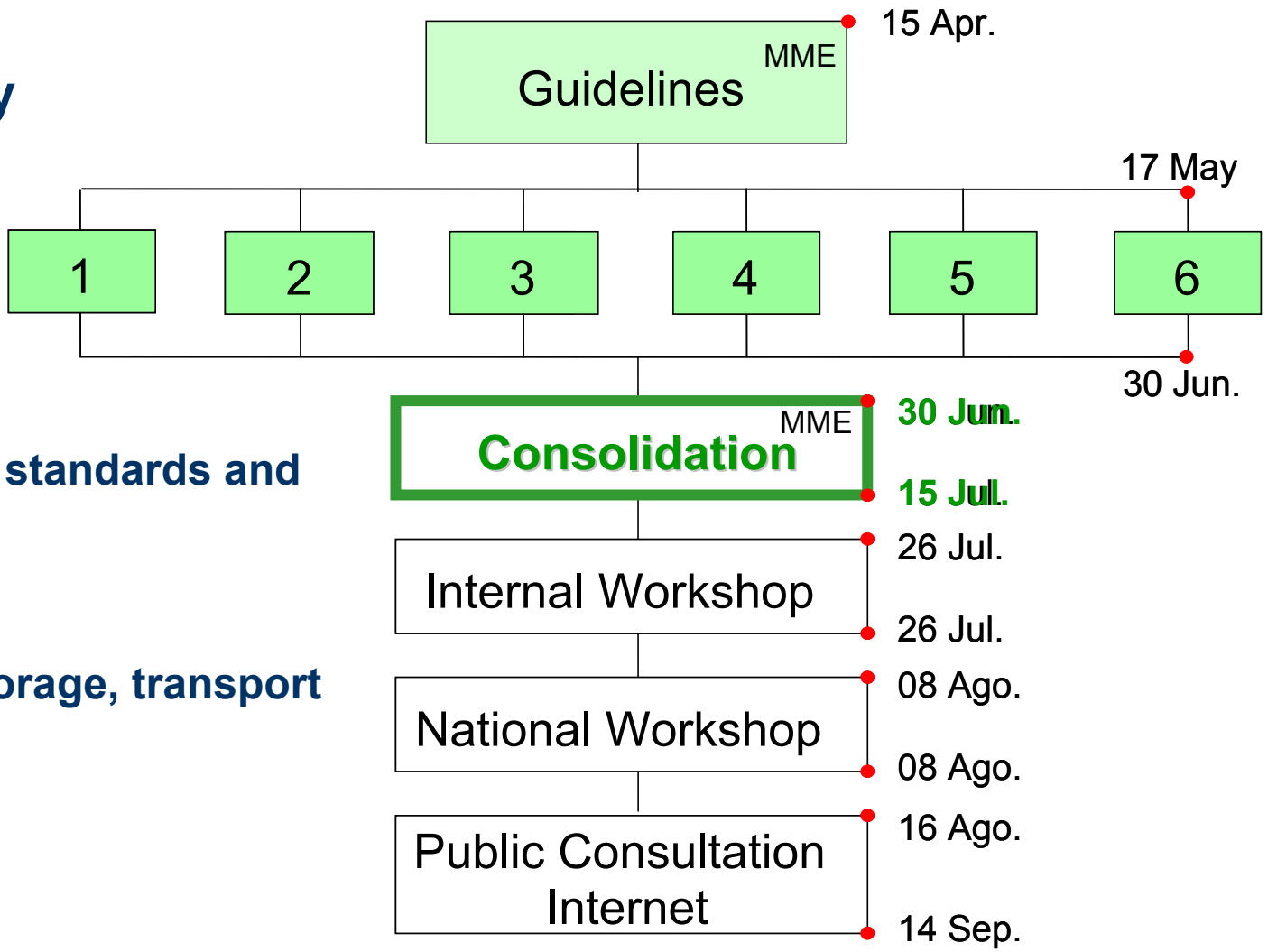
BRAZIL HYDROGEN PRIORITY

BRAZIL H2 ROAD MAP

CREATE SELF-SUSTAINED MARKETS ORIENTED BY THE NEEDS AND RESOURCES OF BRAZIL, CONSIDERING ALSO INTERNATIONAL ENERGY DEMANDS AND POSSIBILITIES

Guidelines for the Brazilian Hydrogen Roadmap

Methodology



1 - Legal ground: codes, standards and regulation

2 - Hydrogen production

3 - Hydrogen logistics: storage, transport and distribution

4 - Conversion systems

5 - Applications

6 - Horizontal activities

Guidelines for the Brazilian Hydrogen Roadmap

1. Legal Ground: Codes, Standards and Regulation

Coordination = **INMETRO**

Time to do it = AUGUST 2004

- SI system and ISO standards
- National normalization for installations and equipment
- Safety
- Standard demands by the agents
- Information broadcasting to the Brazilian society
- Identification of current legislation that may affect the policies
- Certification and homologation of products and processes

Guidelines for the Brazilian Hydrogen Roadmap

2. Hydrogen Production

Coordination = **UNICAMP**

Time to do it = **SEPTEMBER 2004**

- **Hydrogen sources**
  - Water
  - Ethanol
  - Natural Gas
  - Other biomass
- **Energy Sources**
  - Hydraulic
  - Wind
  - Solar
- **Processes**
  - Electrolysis
  - Reform
  - Gasification
  - Pyrolysis
  - Phololysis
  - Biolysis

Guidelines for the Brazilian Hydrogen Roadmap

3. Hydrogen Logistics: Storage, Transport and Distribution

Coordination = **PETROBRAS**

Time to do it = **AUGUST 2004**

- **Distribution Strategies**
  - Centralized production
  - On-site Production
- **Hydrogen Storage**
  - Compressed Gas
  - Intermediate elements (hydrides)
  - Nanostructured Materials
- **Means of hydrogen distribution**
  - Pipelines
  - High pressure containers
  - Hydrides (metallic, complex, metalorganic)
- **Safety Issues**
  - Equipments
  - Procedures

Guidelines for the Brazilian Hydrogen Roadmap

4. Conversion Systems

Coordination = **COPPE**

Time to do it = **AUGUST 2004**

- **Fuel cells**
  - Polymer membrane
  - Solid oxide
  - Ethanol direct oxidation
  - Reversibles
- **Gas turbines**
- **Internal combustion engines**
- **Ancillary systems**
  - Power electronics
  - Instrumentation, control and automation
  - Balance of plant
  - Auxiliary equipments

5. Applications

Coordination = **LACTEC**

Time to do it = **JULY 2004**

- **Focus: hydrogen as an energy vector**

  Distributed electricity generation

  Isolated systems (Amazon and others)

  Hybrid Systems

  Cogeneration Systems (heat/power)

  High quality energy (hospitals, banks, airports, etc.)

  Urban and load transportation (fuel cells)

  Energy storage as hydrogen

6. Horizontal Activities

Coordination = MINISTERY OF MINES AND ENERGY

Time to do it = OCTOBER 2004

- Technologic development and human resources training
- Market development
- Global strategic planning

BRAZIL HYDROGEN PRIORITY

BRAZIL H2 ROAD MAP

November 2004

BRAZIL HYDROGEN PRIORITY

Thank you

BRAZIL CONCEPTS OF THE HYDROGEN ECONOMY

Major Sources and Methods for Producing Hydrogen Will Be:

- Biomass Reforming or Gasification
- Hydro, solar and wind energy driven electrolysis
- Natural Gas Reforming
- Goal for the long term: to use ethanol directly in the fuel cells by its direct oxidation in the anode

Major Method(s) for Distributing Hydrogen Will Be:

- On-site reforming of ethanol and natural gas
- On-site electrolytic hydrogen from renewable sources (hydro, wind and solar)

Major Users of Hydrogen Will Be:

- Remote and Off-grid systems
- Heavy duty transportation (urban buses and fleet vehicles)
- Renewable energy storage systems
- High quality decentralized power generation
- Hybrid and cogeneration systems (heat/power)

Falta fazer

BRAZIL HYDROGEN PRIORITY

Thank you

IDEAS FOR ACHIVING THE VISION……

- To continue pursuing the Technological Developments
- To develop Public Policies
- To foster Private Investments
- To develop Public Education and Outreach
- To increase public and private funding for technology development, public demonstrations and infrastructure development.
- To develop Safety and Performance Codes and Standards

BRAZIL HYDROGEN PRIORITY

Thank you

FINAL THOUGHTS: THE CHALLENGE

.....

It is absolutely necessary to implant a self-sustainable portfolio projects, considering time, price, quality and guarantee of hydrogen supply, produced from different sources and production methods that are environmentally friendly, developed in countries with different economic activities and climate, providing income, curbing social exclusion, misery and illiteracy.

ADDITIONAL COMMENT - "IT IS URGENT THE CREATION OF A TASK FORCE TO:"

Promote collaboration between IPHE members in order to build an effective technological and industrial knowledge on hydrogen technologies in developing countries.

⇩

- Create self-sustained markets oriented by the needs and resources of each country.

⇩

- Improve life quality and create more job opportunities with the development of the hydrogen economy.