

**Symposium on “The International Center for  
Renewable Energy & Turbulence/Aerospace”**



# **Electric Power for Sustainable Development**

**Jorge A. Rodríguez-Ruiz  
Executive Director**

**Puerto Rico Electric Power Authority  
May 31, 2007**

# Agenda

- Introduction (Who We Are)
- Sustainable Development
- PREPA Strategic Plan
- Our Vision
- Conclusion





# Who We Are

---

- Among Public Power Utilities in the United States, PREPA is\*:
  - 1<sup>st</sup> by Electric Customers Served
  - 1<sup>st</sup> by Electric Revenues
  - 5<sup>th</sup> by MWh Sales
  - 6<sup>th</sup> by MWh generated

\* *American Public Power Association – Annual Directory & Statistical Report 2007-08*

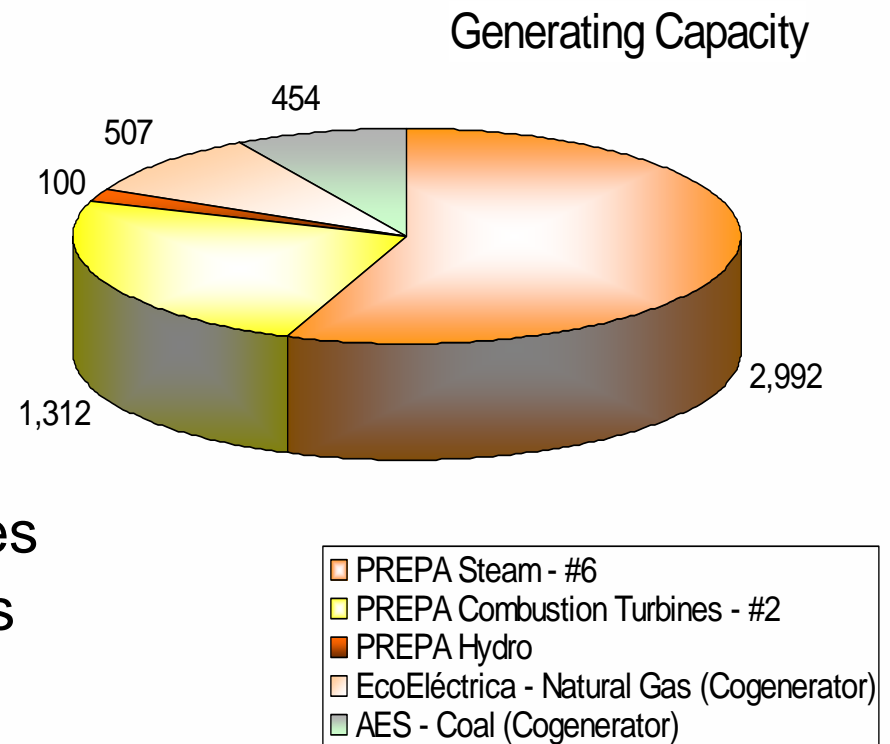




# Who We Are

## Electrical System Infrastructure

- Production
  - Installed capacity: 5,365 MW
  - Peak Demand: 3,685 MW
- Transmission and Distribution
  - Transmission Lines: 2,379 miles
  - Distribution Lines: 30,480 miles
  - Substations:
    - 38 kV: 278
    - 115 kV: 45

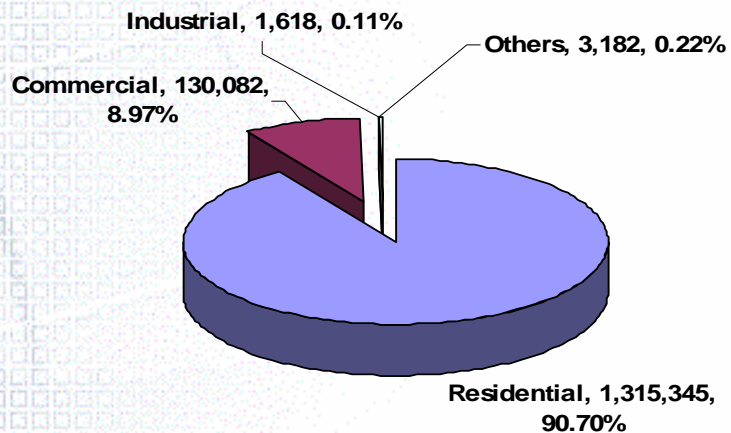




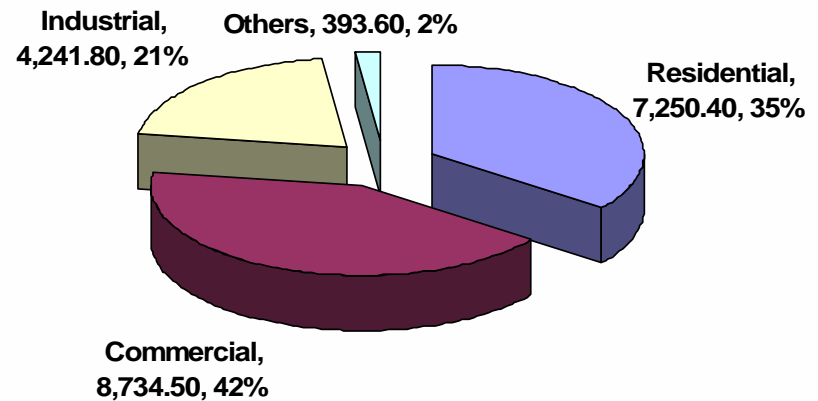
# Who We Are

## Statistical Data

Customers by Class



Sales (MkWh) by Class





# Sustainable Development

## What is Sustainable Development?

- Development which satisfies the needs of the current generation without sacrificing the possibilities of future generations to take care of their own needs.
- Requires optimum use of resources.  
(Do more with less, generating less waste)
- Covers three policy areas:

Economic, Social and Environmental







# Economic Development

- Produces great benefits:  
Education, health care, better home, longer life expectancies, more comforts, more income.
- Desired and needed
- Has environmental consequences
- Electric power is a product demanded by the public as a result of economic development.
- Electric power demand will continue to increase.





# Economic Development

## In Puerto Rico:

- The economic development model promoted the creation of industry and commerce which are essential for sustainability.
- Since 1970 environmental compliance is incorporated into economic activities. (Monitored by the JCA y la *EPA*).
- Since then, the Public Environmental Policy establishes that sustainable development will be promoted.







# Competitiveness

---

- International Institute for Management Development: a body of economic knowledge that analyzes the facts and policies that model the ability of a nation to create and maintain an environment that sustains the creation of more value for it's businesses and more prosperity for it's people.
- It is not spontaneous, it must be created: result of a continuous improvement in quality, requires the maintenance of comparable advantages to reach and sustain a position, analysis of procedures, systemized processes, coordinated efforts, knowledge, efficiency and efficacy.
- Also included are economic, social and environmental aspects.



# PREPA's Operational Requirements

---

- **Legal**

- P.R. Electrical Public Policy
- PURPA (*Public Utility Regulatory Policy Act*)
- Environmental Compliance

- **Social and Economic**

- Electric power demand growth projections
- Cost of service
- Reliability and Security of Service



# Puerto Rico Energy Policy

---

- Established 1993 by executive order OE-1993-57
- PREPA, Natural Resources Department, Transportation and Public Works Department and the Energy Administration Office are commissioned to establish strategies to manage sources of energy.
- PREPA to establish a plan for fuel diversification including renewable energy. Does not establish sources nor quantity.
- In order to comply with the responsibility of the Energy Policy PREPA establishes the Generation Strategic Plan in 2002.





# Local Characteristics that Affect Electrical System Planning

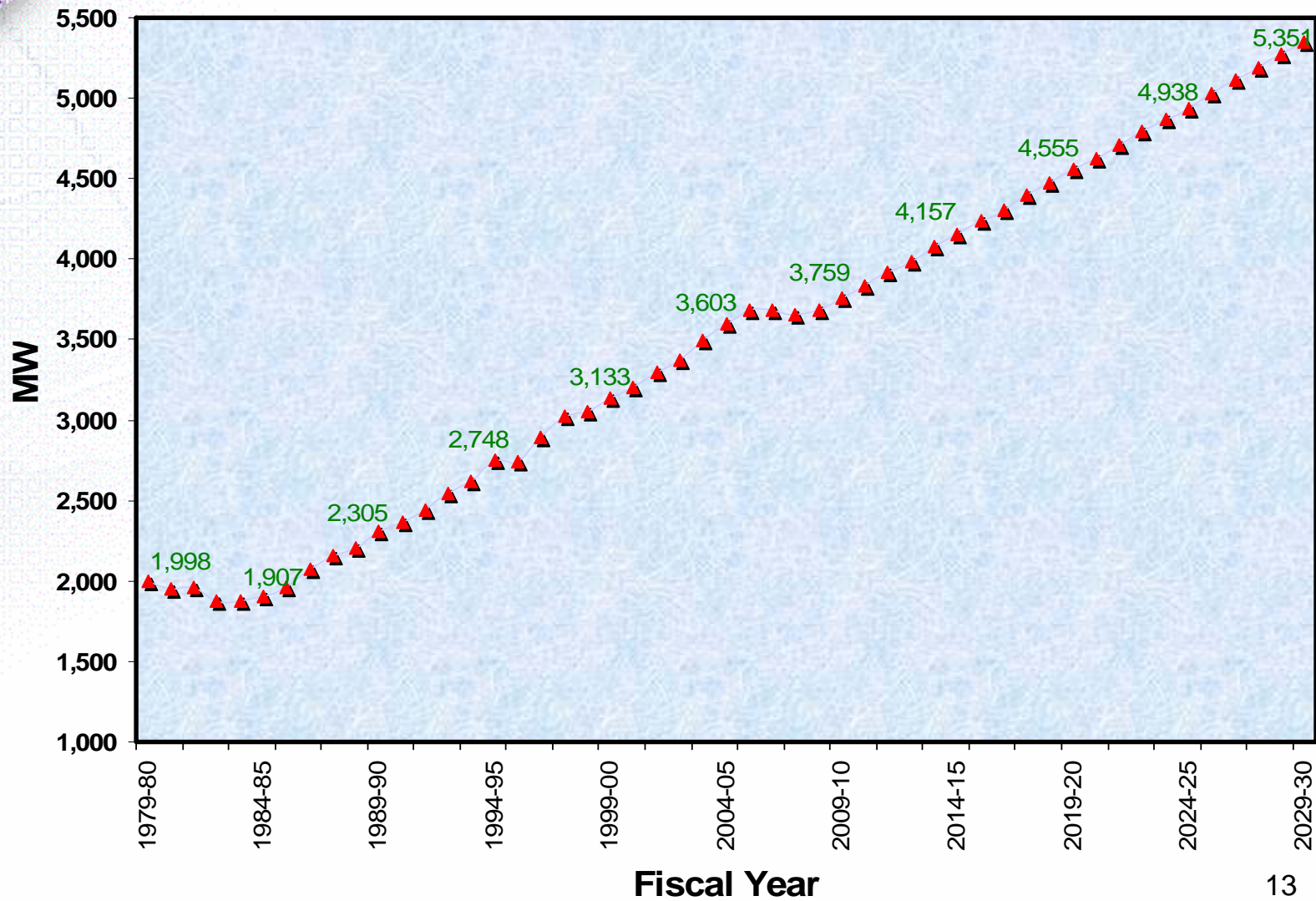
---

- Isolated system
- Few water reserves
- No fuel reserves
- High oil dependence
- High energy consumption per unit area
- Large number of clients (over 1.4 millions)
- Limited service area extension



# Electric Power Demand in Puerto Rico Historic and Projected

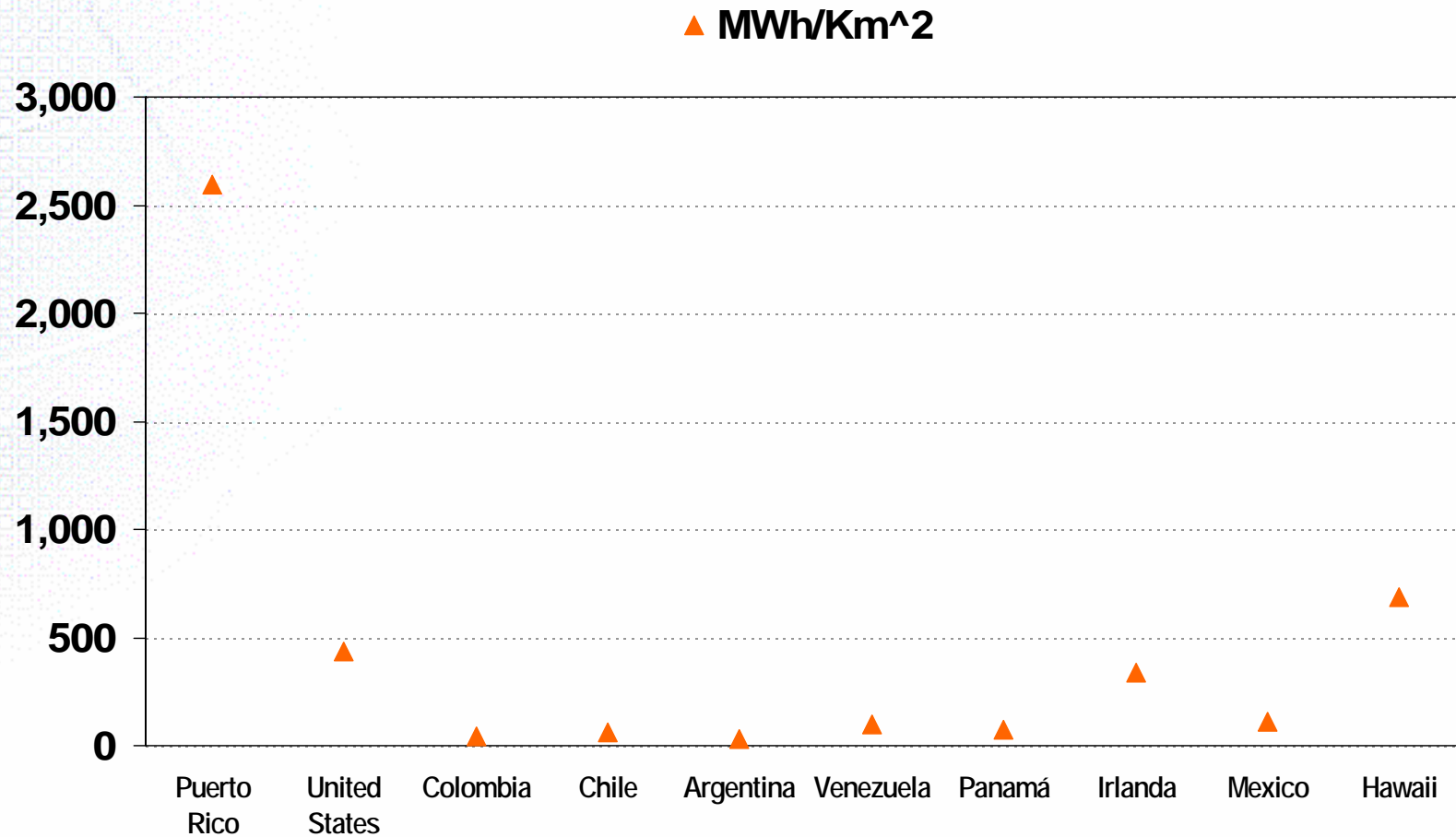
*Maximum Demand - MW*





# Electrical Use Density

Puerto Rico's electrical use density is high







# PREPA's Strategic Plan

---

## **Strategically Integrates:**

- Generation Capacity Expansion Plan
- Fuel diversification
- Electricity cost reduction
- Geographic diversity in the installation of future generation facilities
- Environmental considerations
- Diversification of corporate income sources

# PREPA's Strategic Plan Cont.)

## Current Strategic Plan

Short Term (Less than 2 years)	Medium Term (2 to 5 years)	Long Term (6 to 10 years)
<ul style="list-style-type: none"> <li>• Promote efficient energy use in Puerto Rico.</li> <li>• Extend the useful life to out system and optimize the efficiency with advanced technology. (<i>retrofit</i> principal components and install advanced control equipment)</li> <li>• Specialized studies for the development of renewable energy.</li> </ul>	<ul style="list-style-type: none"> <li>• Natural Gas Development: Convert to use Natural Gas: Aguirre Combined Cycle Cambalache San Juan Units 5 and 6</li> <li>2008: Gasoducto del Sur from EcoEléctrica to Aguirre.</li> <li>2010: Gasoducto del Norte</li> <li>• Development of Wind Generation Alternatives</li> <li>• Transmission and Distribution Electrical Infrastructure Development.</li> </ul>	<ul style="list-style-type: none"> <li>• Alternative fuel development. Social, economic and environmental aspects will always be considered in the evaluation.</li> <li>• Continue to evaluate alternative energy sources.</li> </ul>



# PREPA's Strategic Plan Cont.)

## Energy Conservation

- 2006 campaign: “Yo Ahorro Energía” (I save energy)
  - EPA Energy Star Membership
  - Legislative
- PREPA endorsed various legal measures that promote energy conservation. Also, submitted proposals to aid in the success of their implantation. For example:
- Net Metering
  - Economic incentives for renewable energy applications.
  - Smart Growth urban development.
  - Reliability requirements for solar and wind energy production







# PREPA's Strategic Plan Cont.)

## Renewable Energy

- Studying alternatives with development potential.
- Advanced negotiations for the purchase of energy from wind parks.
  - 2010.

Arecibo	50 MW
Guayanilla	<u>45 MW</u>
	95 MW
- Studying proposals for the purchase of power from waste to energy projects. Advise the government on the need to collaborate between agencies in order to negotiate the development of a proposal.
- Evaluating a proposal for the purchase of power from an OTEC (Ocean Thermal Energy Conversion) plant.



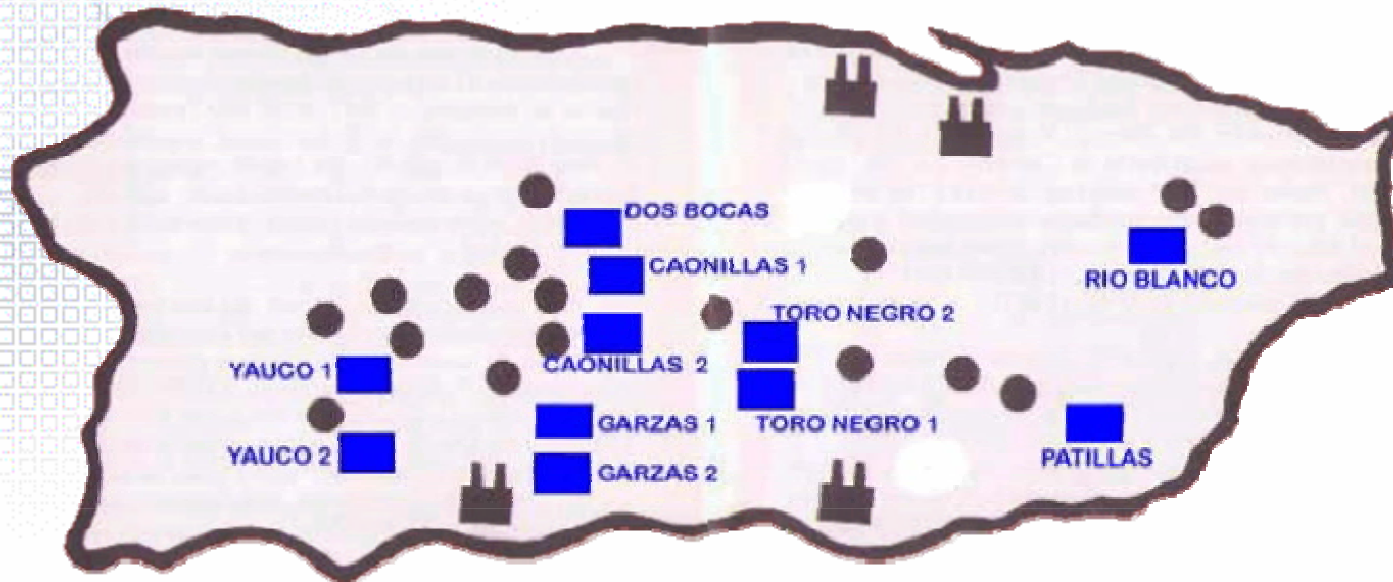
*Renewable energy technologies need more incentives and legal aids to promote their establishment.*



# PREPA's Strategic Plan Cont.)

## Renewable Energy - Hydro

Potential : 99.7 MW, Capacity Factor: 17%



### Reforestation Program

On lands adjacent to PREPA administered dams and reservoirs.

- ❖ Contribute to the development of watersheds
- ❖ Reduce lake sedimentation.
- ❖ Extend reservoir's useful lifespan.
- ❖ Increase the ecological value of the area.
- ❖ Provide food and habitat for wildlife.

# PREPA's Strategic Plan Cont.)

## Study of Renewable Energy Alternatives With Development Potential

Source	Advantages	Disadvantages
Hydro	<ul style="list-style-type: none"> <li>•Low operational cost</li> <li>•High reliability</li> <li>•Long life</li> <li>•Low environmental impact</li> <li>•No emissions</li> </ul>	<ul style="list-style-type: none"> <li>•Hard to license a new project</li> <li>•Depends on water supply</li> <li>•Sedimentation</li> </ul>
Wind	<ul style="list-style-type: none"> <li>•Low operational cost</li> <li>•No emissions</li> <li>•Short development and construction period</li> </ul>	<ul style="list-style-type: none"> <li>•Intermittent</li> <li>•High capital costs</li> <li>•Low capacity factor</li> </ul>
Biomass	<ul style="list-style-type: none"> <li>•High capacity factor</li> <li>•Can contribute to the management of municipal solid waste</li> <li>•Liquid bio-fuels produce less emissions than fossil fuels</li> </ul>	<ul style="list-style-type: none"> <li>•High operational and capital costs</li> <li>•Inflexible Dispatch</li> </ul>
Ocean Thermal	<ul style="list-style-type: none"> <li>•High capacity factor</li> </ul>	<ul style="list-style-type: none"> <li>•Not a commercial technology</li> </ul>
Fuel Cells	<ul style="list-style-type: none"> <li>•Can use a variety of fuels</li> <li>•No emissions</li> <li>•Modular</li> <li>•High efficiency</li> </ul>	<ul style="list-style-type: none"> <li>•High operational and capital costs</li> </ul>
Solar-PV	<ul style="list-style-type: none"> <li>•Low operational costs</li> <li>•Available throughout Puerto Rico</li> <li>•Local experience with the technology</li> </ul>	<ul style="list-style-type: none"> <li>•High capital costs</li> <li>•Low capacity factor</li> <li>•Intermittent</li> </ul>



# PREPA's Strategic Plan Cont.)

---

## Renewable Energy

### Study by EPRI International Inc.

- Wind energy integration impact study.
- Intermittent energy integration level which can be integrated without affecting system reliability and quality of service.
- Combined impact study of municipal waste and wind parks.
- Interconnection of Distributed Generation.





# PREPA's Strategic Plan Cont.)

---

## Energy Policy Act 2005 (EPACT05)

PREPA is in the process of evaluating the EPACT05 standards. These are in the Public Utilities Regulatory Policy Act (PURPA), Title XII.E. Electric utilities like PREPA must consider adoption of these standards by the following dates:

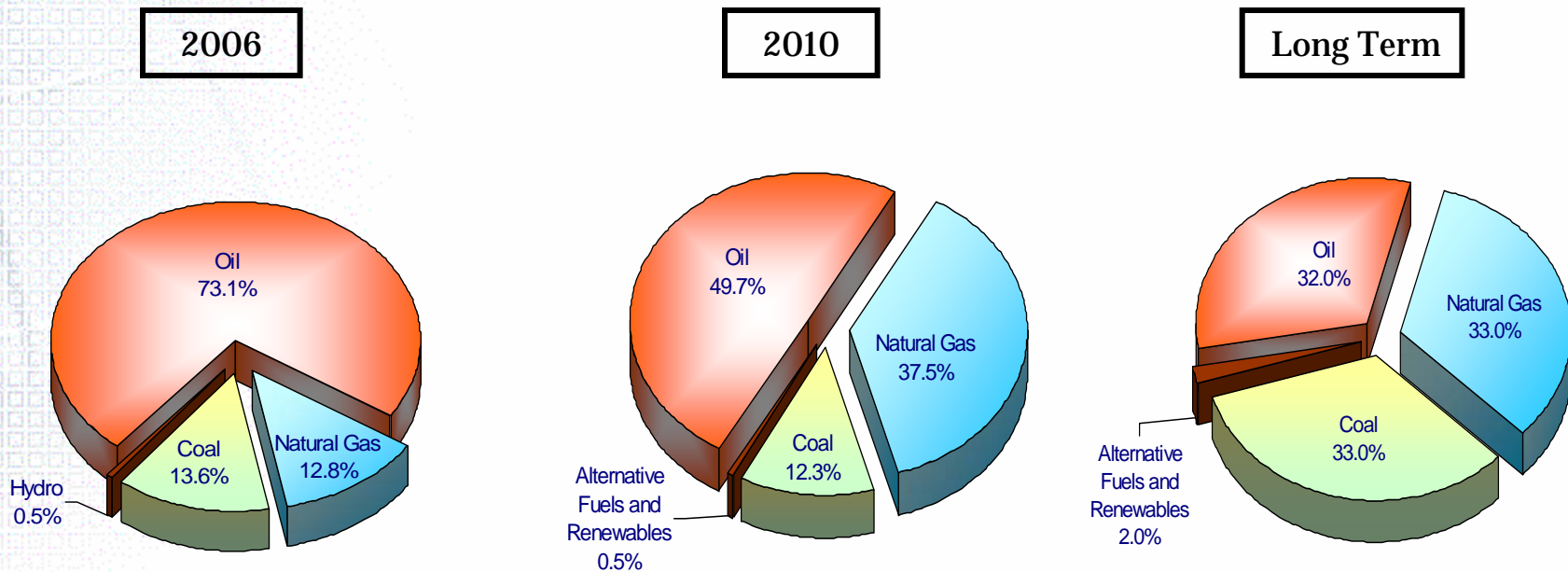
<i>Time-based metering and communications</i>	August 8, 2007
<i>Interconnection standards for distributed resources</i>	August 8, 2007
<i>Net Metering</i>	August 8, 2008
<i>Fuel diversity</i>	August 8, 2008
<i>Fossil fuel generation efficiency</i>	August 8, 2008



# PREPA's Strategic Plan Cont.)

## Fuel Diversification

### Projected Production with Current Policies: PREPA and Public



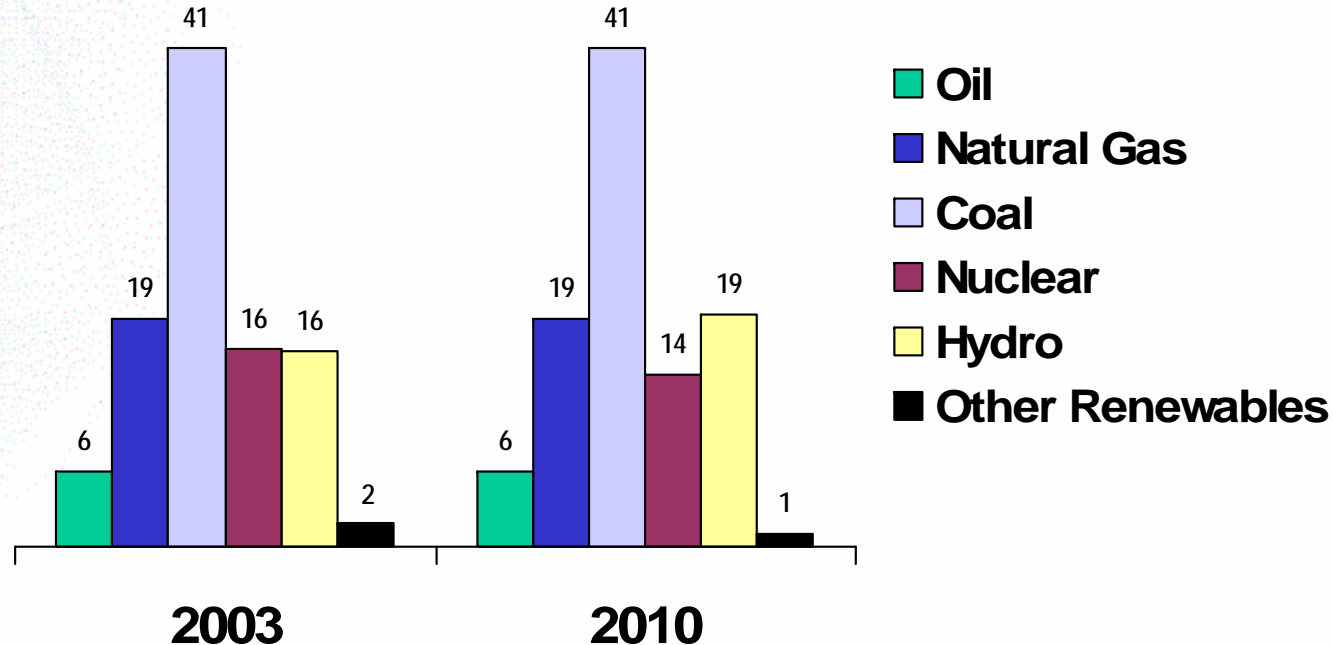
PREPA's policy for diversity needs the support of an active and visionary Public Policy

Diversification of energy alternatives is recognized worldwide as the best strategy for sustainable economic development.



# Fuel Diversification

Worldwide Production by Source (%)



*International Energy Outlook 2006, EIA-DOE: Much of the projected growth in renewable generation results from the expected completion of large hydroelectric facilities in non-OECD Asia, where the need to expand electricity production with associated dams and reservoirs often outweighs concerns about environmental impacts and the relocation of populations. Nonetheless, the renewable share of world installed capacity falls slightly, from 23 percent in 2003 to 22 percent in 2030.*



# Our Vision

---

## Where do we want to go with renewable energy:

- PREPA performs studies to support this objective.
- More can be achieved if the proper policies and actions are taken.

## How to get there:

- Local and international collaboration
- Increase of knowledge
- Action







# Our Vision

## What needs to be taken in account for Public Policy:

- Tax Incentives: to promote conservation, alternative energy sources.
- Education: develop social values that promote sustainable development.
- Innovated structural design: Integrate aspects of conservation and energy efficiency, including renewable energy sources.
- Externalities: There is no consensus in how to apply them. Nevertheless EPA has begun to consider them in justifying environmental regulations.
- Studies and Policies of the United states Government.



# Conclusion



- The Government's Public Policy is key to reach sustainable development and competitiveness. It must be a dynamic policy.
- The development of the electrical system must integrate diverse solutions: combinations of generating and transmission facilities, diversification of energy sources, including renewable sources with the greatest potential in Puerto Rico, energy efficiency alternatives and demand side management.
- Puerto Rico Electric Power Authority is committed to the sustainable development of Puerto Rico. Our Strategic Plan will provide viable solutions related to sustainable development in other areas of the economy.

