Challenges Faced by Clean Generation Resources Under Electricity Restructuring

Symposium on
The Changing Electric System in Florida and
What it Means for the Environment

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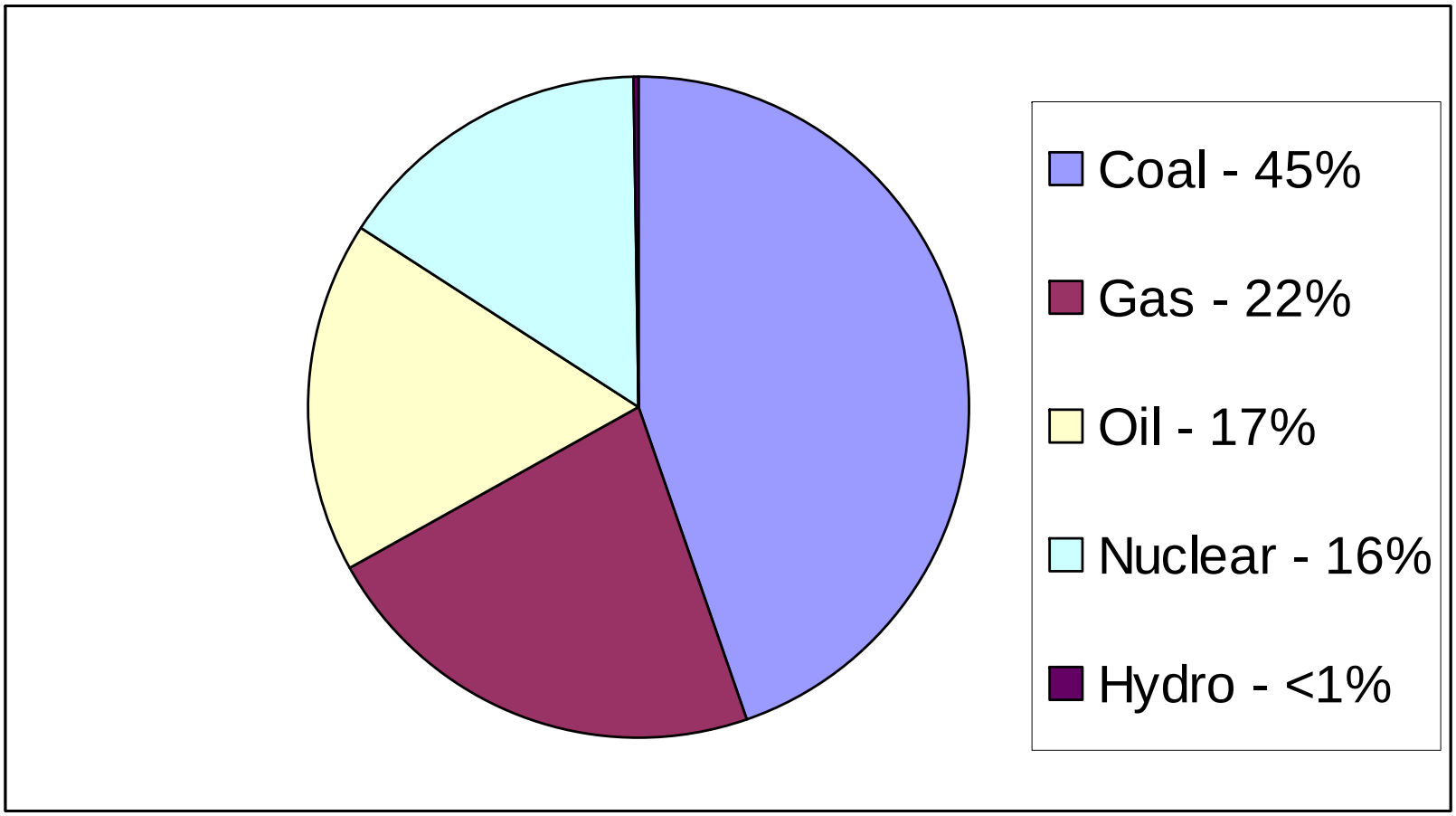
Overview

- Key question facing environmentalists:
  - Will restructuring result in environmental improvement or degradation?
- What will be the impact on various electricity resources?
  - Existing fossil units.
  - Existing nuclear units.
  - New gas units.
  - New renewable facilities.
  - Green power.
  - Energy efficiency.
- How will these resources fare under restructuring, given economic and environmental conditions?
- Policy options to promote environmental improvement.

Existing Sources of Generation in Florida



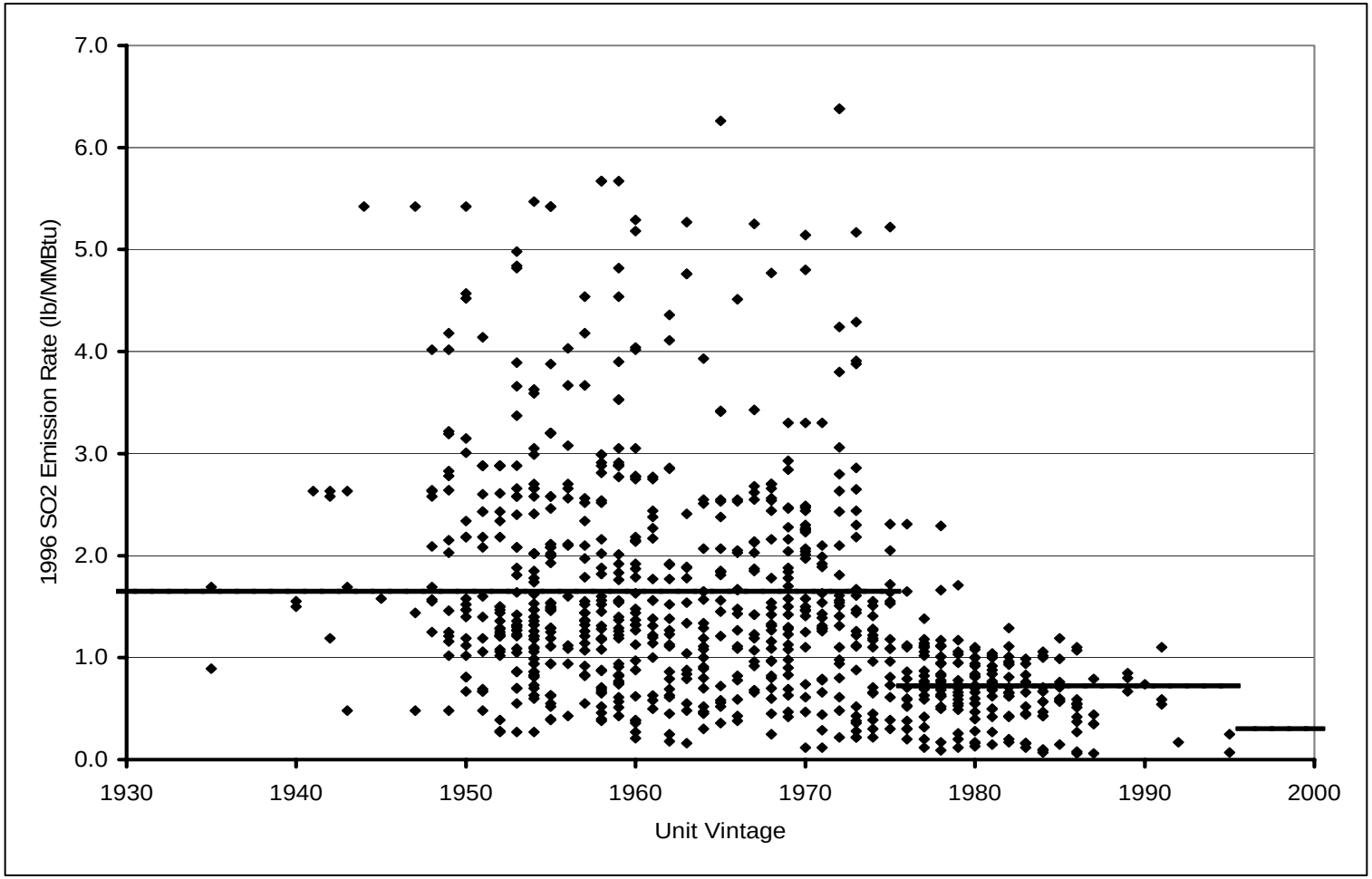
Environmental Impacts of Various Types of Generation Units

- Coal units tend to have the highest emissions of SO2, NOX, CO2, and heavy metals (e.g., mercury).
- Emissions from coal units vary widely across the country, with more recent units having lower emissions of SO2 and NOX.
- New combined-cycle gas units have essentially no SO2 emissions, relatively low NOX and CO2 emissions.
- Most renewable resources have no air emissions. Land and water impacts vary, but tend to be lower than those for conventional facilities.

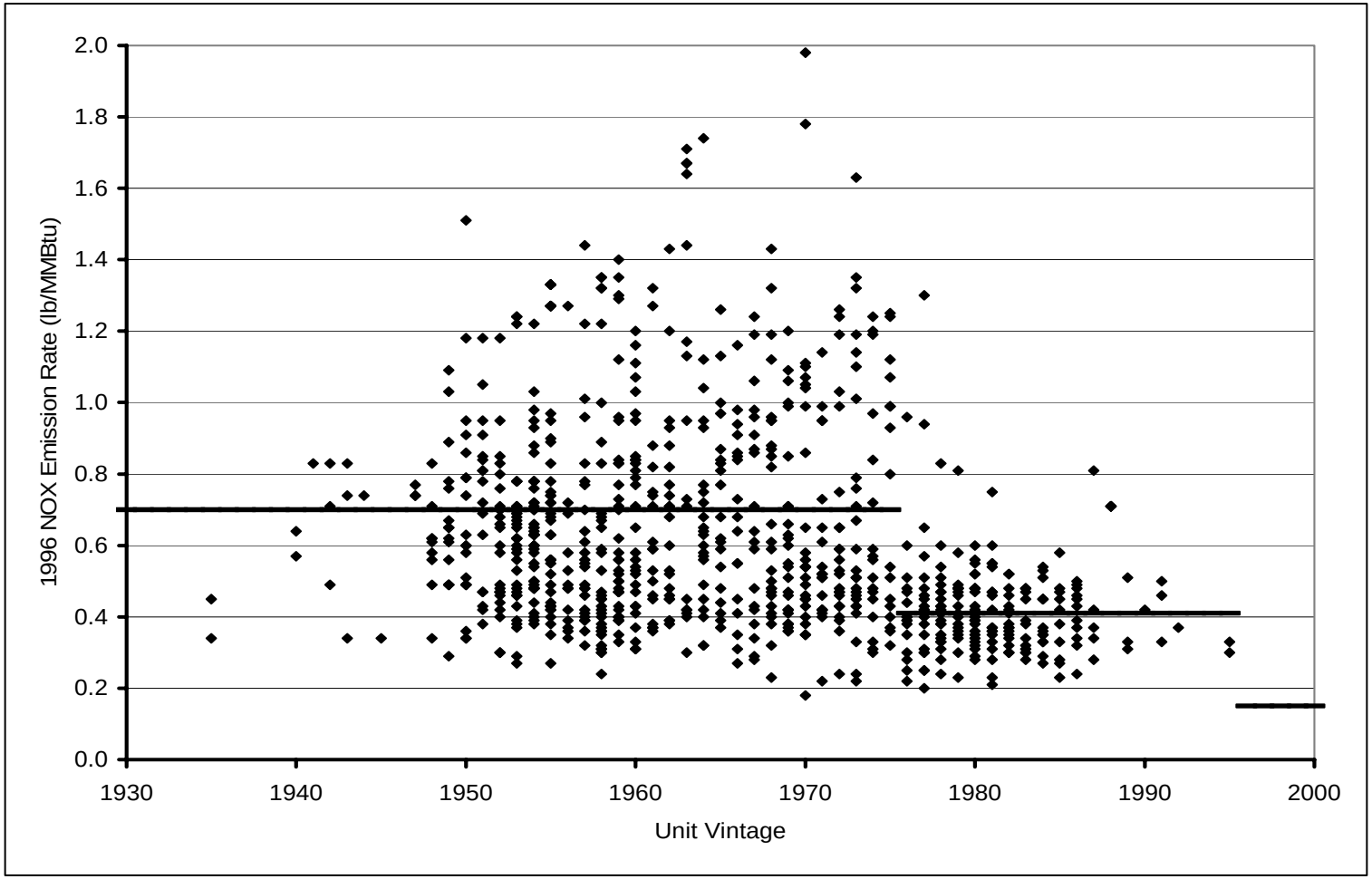
Typical Air Emission Rates of Existing and New Generation Facilities

	SO_2 Emissions (lb/mwh)	NO_X Emissions (lb/mwh)	CO_2 Emissions (lb/mwh)
Existing Coal	12.0	4.5	2,100
Existing Oil	13.1	3.7	2,125
Existing Gas	0	2.5	1,375
New Gas CC	0	0.3	800

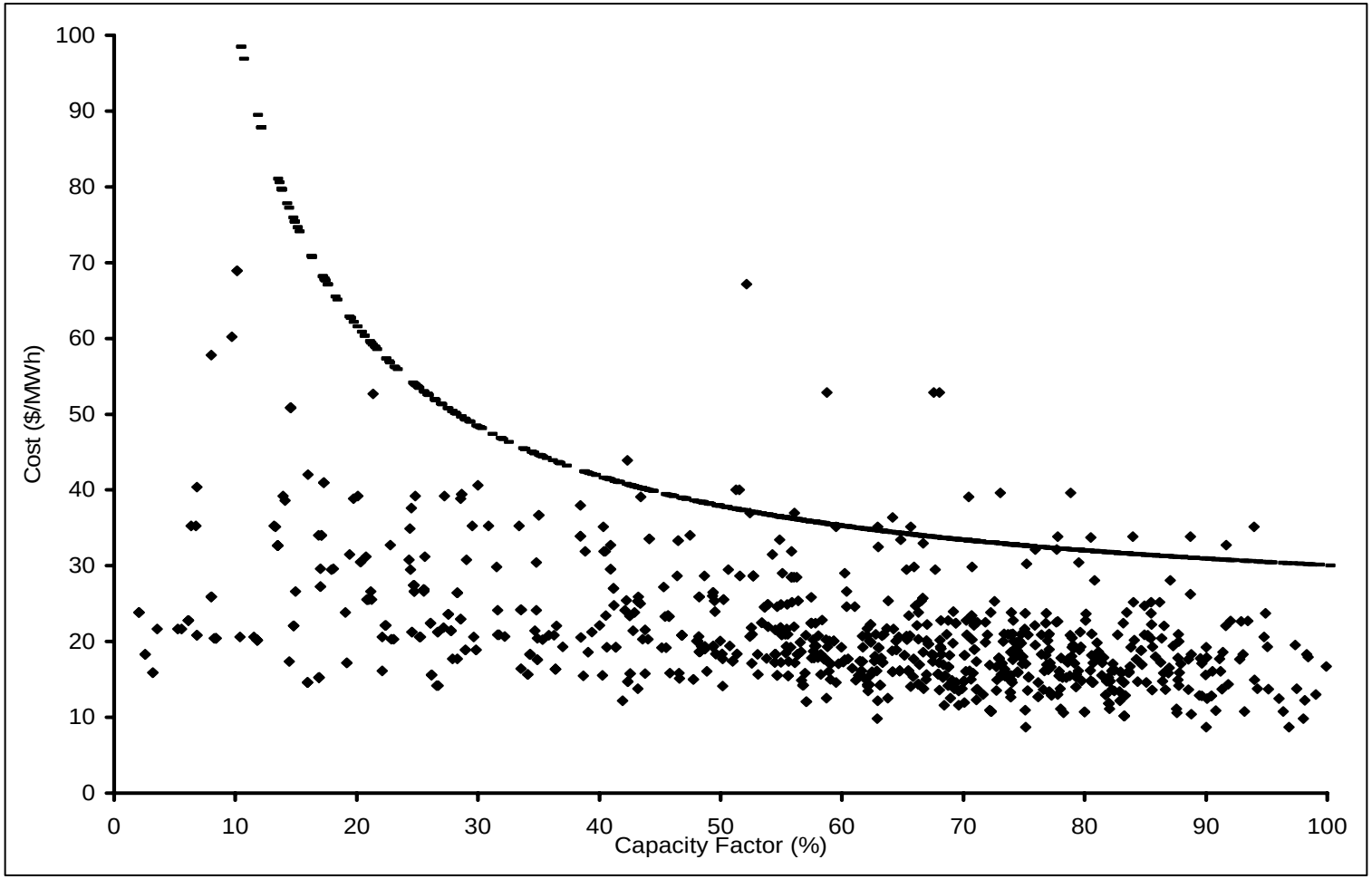
1996 SO2 Emission Rates of Existing Coal Plants, by Vintage



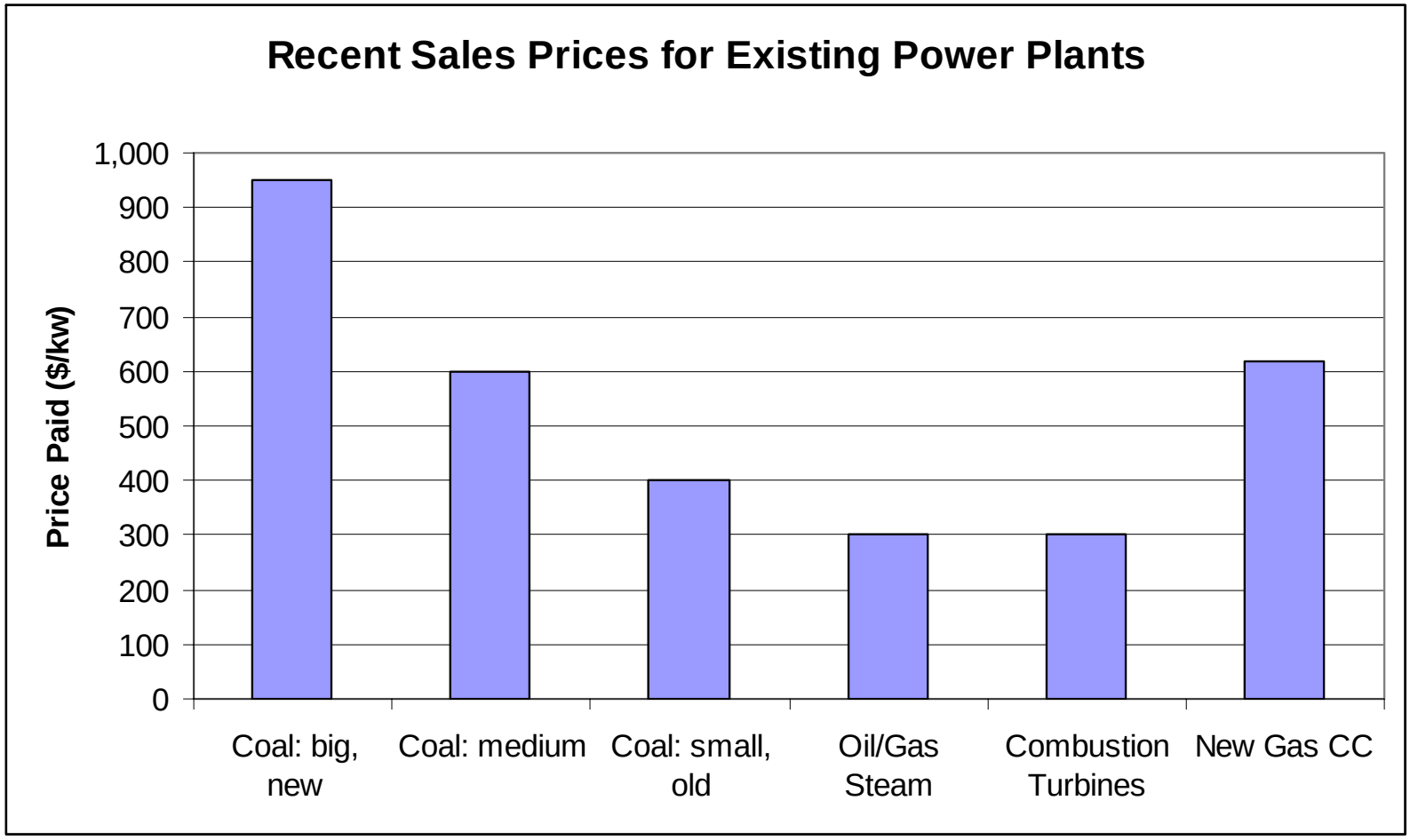
1996 NOX Emission Rates of Existing Coal Plants, by Vintage



Existing Coal Units Tend to be More Economic than New Gas CC Units



Recent Sales of Existing Power Plants Indicate That They Have a High Market Value, And Are Unlikely to Be Retired Soon



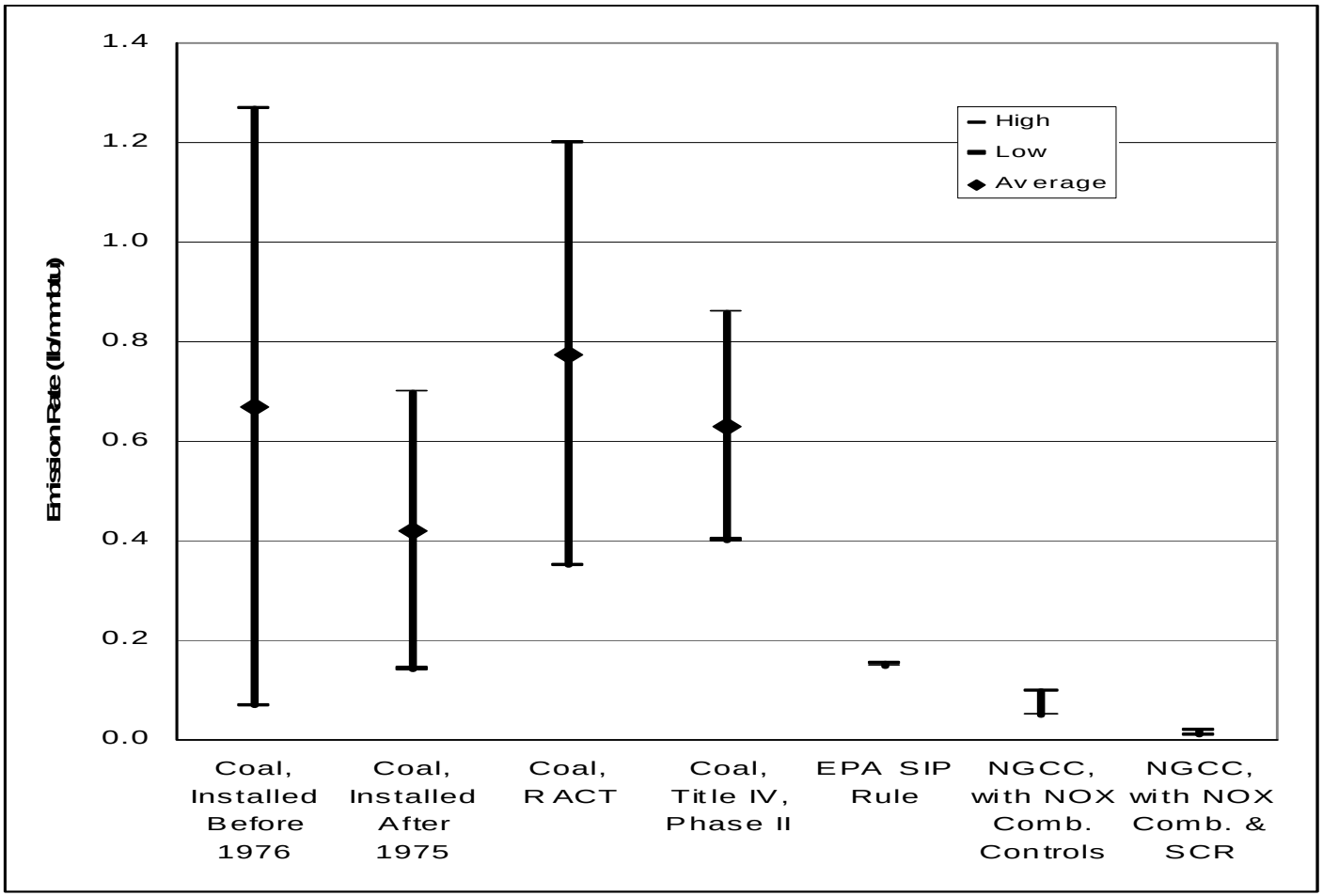
The Grandfathering Effect -- Inconsistent Environmental Regulations May Create Barriers to Entry for New Cleaner Resources

- In non-attainment areas, New Source Review (NSR) requires lowest achievable emission rate (LAER) technology for new units, but less stringent reasonably available control technology (BACT) for existing units.
- In attainment areas, NSR requires BACT for new units, but essentially no requirements for existing units.
- In non-attainment areas, NSR requires new sources to purchase NOX offsets from existing sources, potentially providing market power to owners of existing sources.
- SO2 and NOX allowance schemes do not allocate allowances equitably to new sources, thereby disadvantaging new gas or renewables.

Typical NOX Emission Rates for Existing Coal and New Gas Units

	Emission Rate (lb/MMBtu)	Emission Rate (lb/MWh)
Existing Coal Units in US:		
Average of plants on-line in 1975 and earlier	0.07 -- 1.27	0.7 -- 12.7
Average of plants on-line after 1975	0.14 -- 0.70	1.4 -- 7.0
RACT or state NO_X standards	0.35 -- 1.20	3.5 -- 12.0
Phase II of Title IV NO_X program, May 2000	0.40 -- 0.86	4.0 -- 8.6
New Gas Combined Cycle		
With low-NO_X combustion controls	0.05 -- 0.10	0.34 -- 0.68
With low-NO_X combustion and SCR controls	0.01 -- 0.02	0.07 -- 0.14

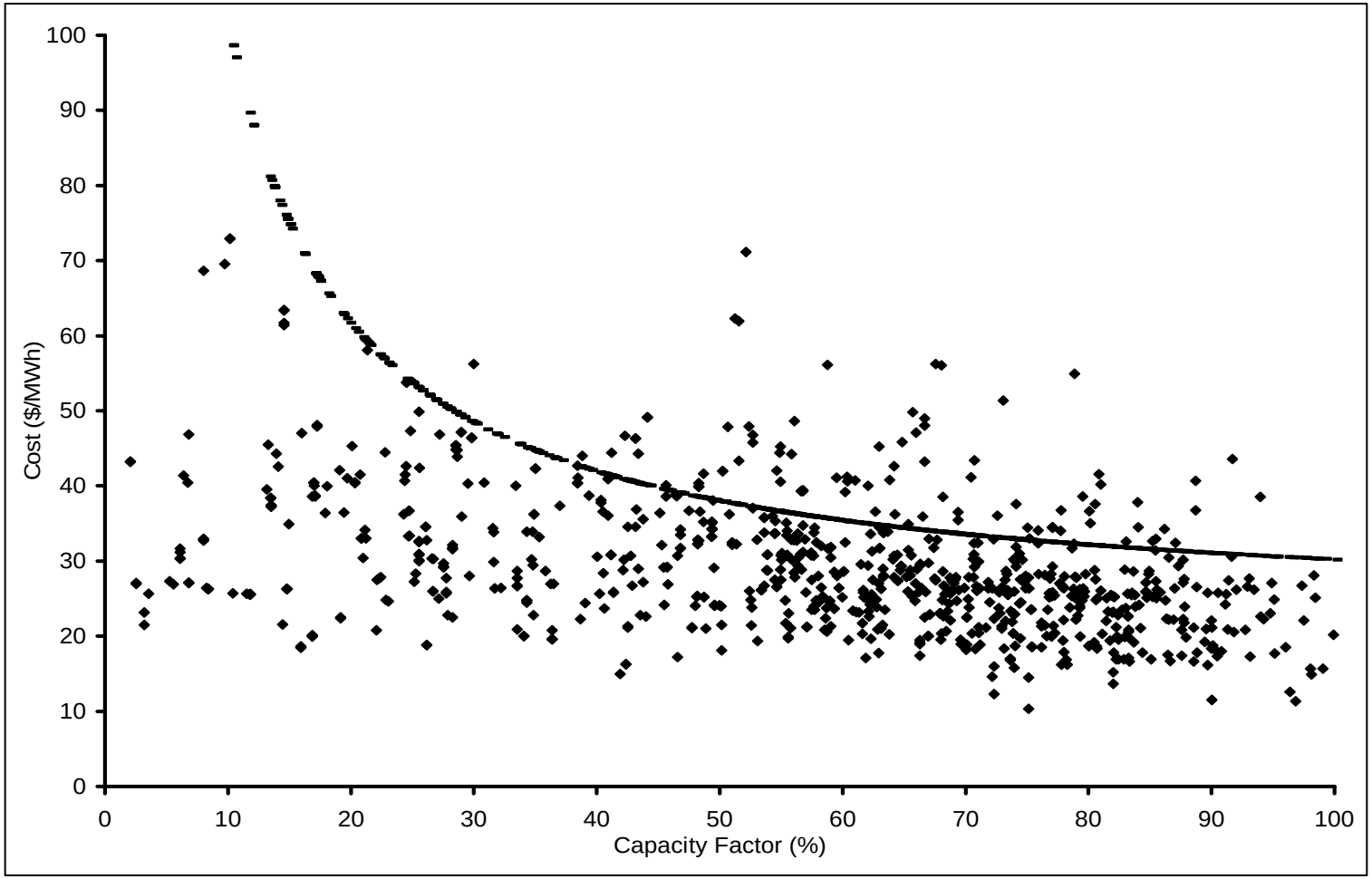
Typical NOX Emission Rates for Existing Coal and New Gas Units



Implications of the Grandfathering Effect

- Some new fossil units and some new renewable resources will face barriers to entry.
- These barriers both hinder competition in the electricity industry and delay important environmental improvements.
- These barriers to entry might not be large in themselves, but when combined with other barriers in the electricity industry (e.g., comparable transmission access), they may be enough to jeopardize new units.

Even If Grandfathering Effect is Removed, New Gas Is Still Less Economic Than Most Coal Units



Implications of Environmental Regulations in Florida

- There currently are no areas in Florida in non-attainment for ozone (NOX).
- The SO2 allocation inequities will affect Florida.
- Florida is not currently subject to regional NOX reduction requirements (e.g., the EPA NOX SIP Call), therefore the inequities caused by NOX allocation schemes do not apply.
- Georgia is subject to the EPA SIP Call, and some parts of Georgia are in non-attainment for ozone -- which might encourage new sources to locate in Florida for the purpose of bypassing Georgia's tighter regulations.

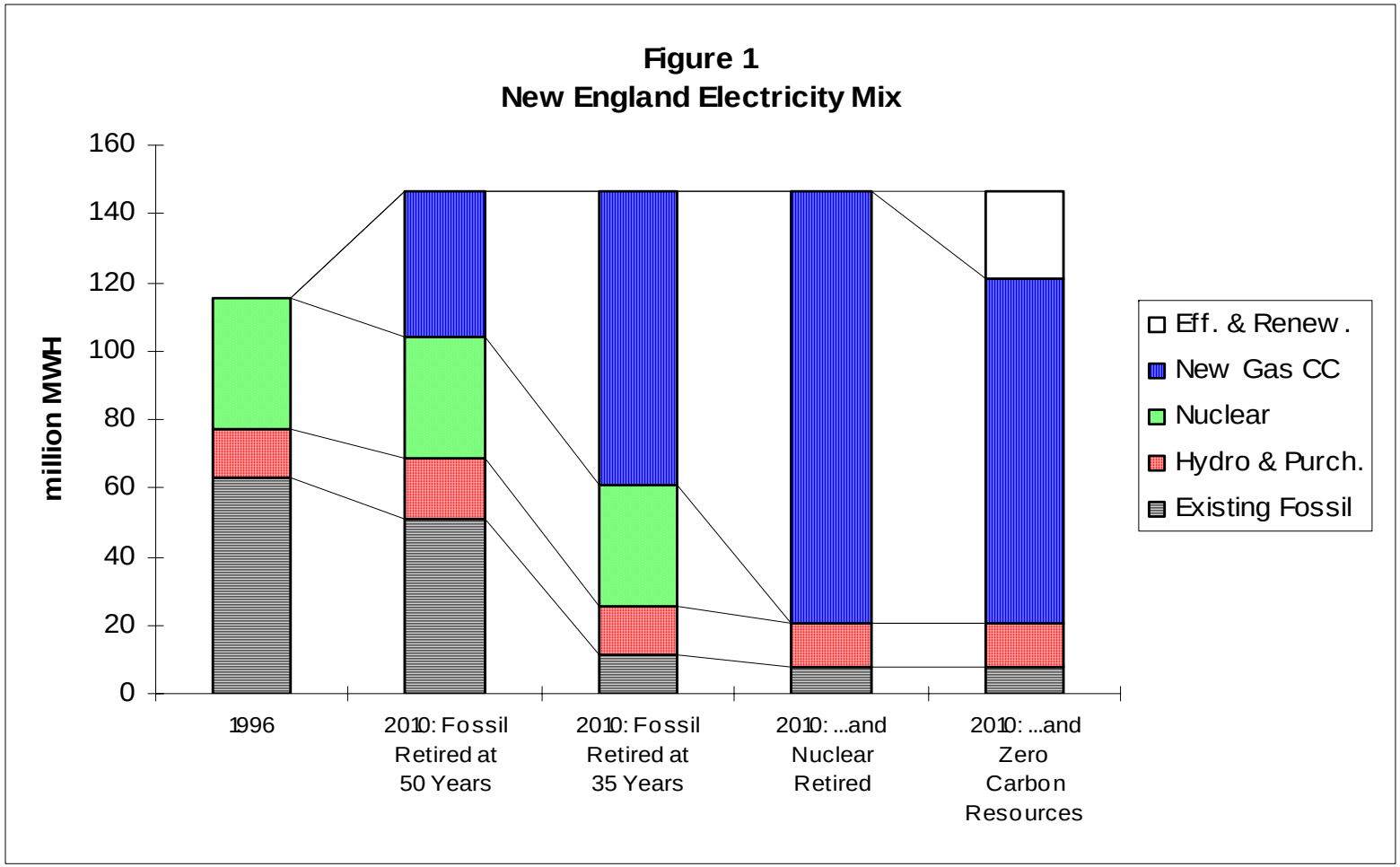
Implications of Power Plant Economics and the Grandfathering Effect

- Restructuring will not necessarily lead to cleaner natural gas units replacing generation from existing coal plants.
- However, there are many new gas units currently being planned, permitted, or constructed in the US. In Florida there are plans to build 3,500 MW of new merchant power plants.
- It remains to be seen whether many of these new gas units:
  - Will ever be constructed and operated.
  - Will promote the retirement of coal units.
  - Will displace generation from coal units.
  - Will be used primarily to meet new load.

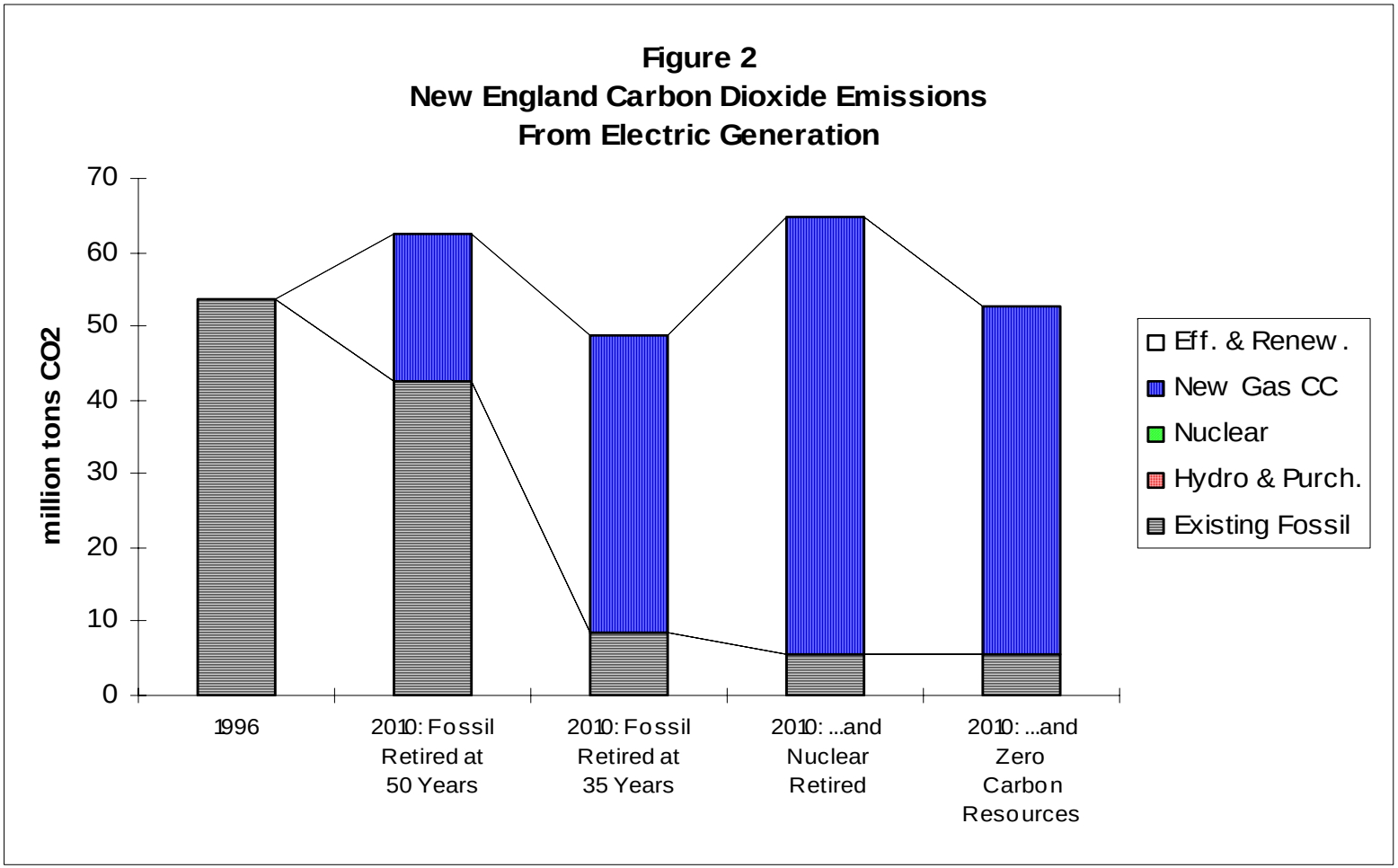
Even if Natural Gas Does Replace Coal Generation, There Will Still Be a Problem With CO2 Emissions

- Natural gas units have lower CO2 emissions than coal, but still have significant levels of emissions.
- Kyoto Protocol requires that the US reduce 1990 level of CO2 emissions by seven percent by 2008 to 2012.
- As natural gas is used to meet new load growth, CO2 emissions will increase.
- If natural gas is used to replace retired nuclear units, then CO2 emissions will increase drastically.
- Study of New England found that nuclear retirements would lead to an increase in CO2 emissions of 21 percent over 1990 levels by 2010, even if coal generation is replaced by gas generation.

New England Electricity Mix in 2010, Under Different Resource Scenarios



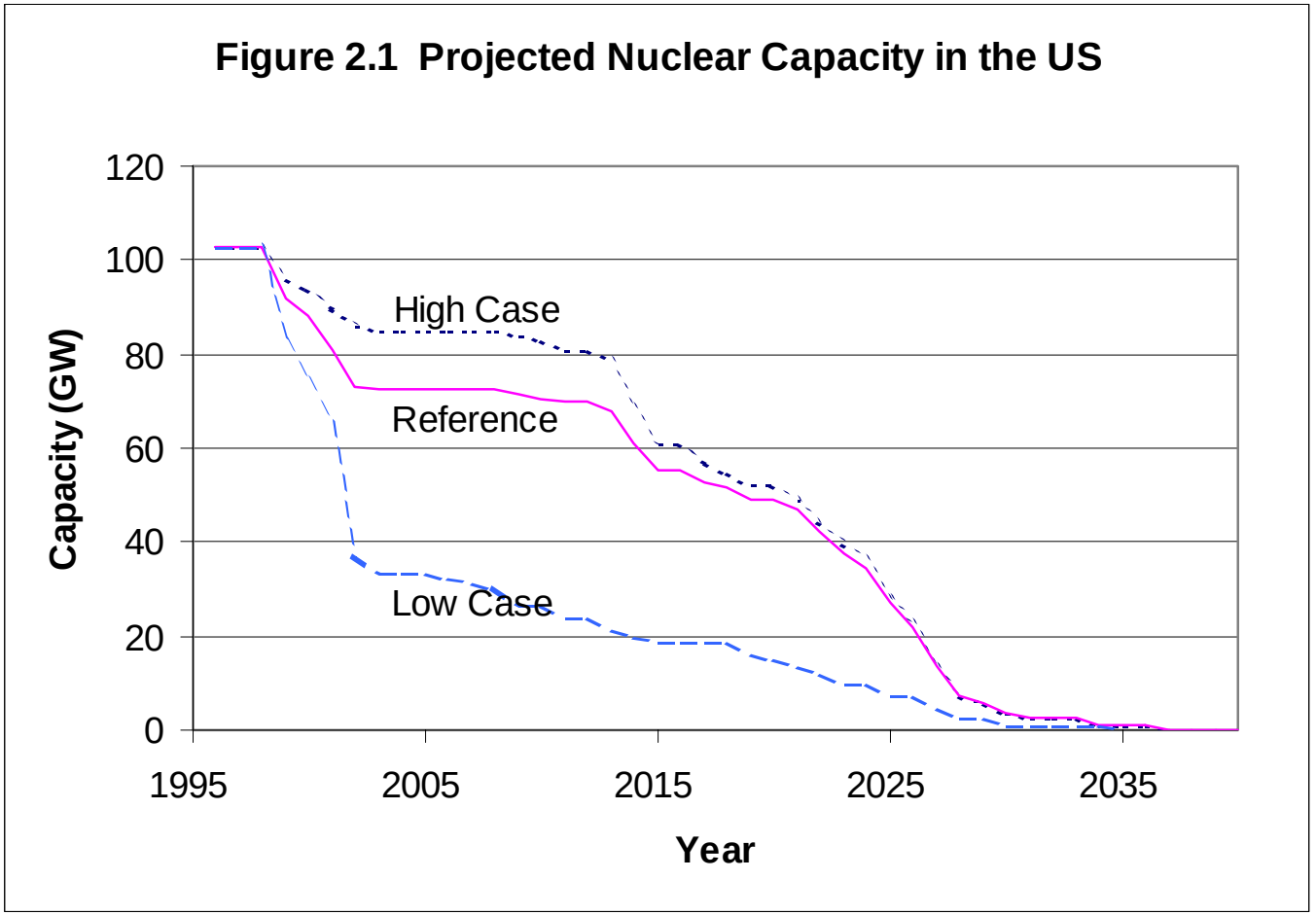
New England CO2 Emissions in 2010, Under Different Resource Scenarios



Impact of Restructuring on Nuclear Units: Summary of Recent Analyses

- Moody's Investor Services 1995: At least ten nuclear units might be closed in the event of electricity restructuring.
- Rothwell 1997: Roughly two dozen nuclear units are are risk of early retirement under restructuring.
- Interstate Natural Gas Association 1998: Thirty-four nuclear plants are vulnerable to shutdown in a competitive market.
- Public Citizen 1998: Forty two nuclear units would not be competitive in a restructured electricity market.
- Synapse 1999: Reference case indicates thirty-four nuclear units are uneconomic. High case suggests 20 units are uneconomic while, Low case suggests nearly all US nuclear units are uneconomic.

Potential Nuclear Retirements Under Restructuring (Synapse 1999)



Impact of Restructuring on Renewable Resources

- Most renewable resources are not yet economically competitive with conventional generation resources.
  - A few exceptions: wind (in some locations), photovoltaics (in some locations), some hydro, some biomass.
- To the extent that restructuring reduces the cost of electricity, renewables will take longer to reach commercial viability.
- Green power products might help boost renewable resources, but the extent remains uncertain because:
  - Residential customers are only a portion of electricity customers.
  - Many customers are reluctant to pay additional costs of environmental protection if other customers are not required to.
  - Requires that a reasonably competitive market be in place -- this may take many years, especially in low-cost states.

Impact of Restructuring on Energy Efficiency

- Energy efficiency measures still face many market barriers, despite being cost-effective.
- Those barriers are not addressed by restructuring.
- Under restructuring, customers and energy companies tend to place a higher priority on price, as opposed to efficiency and total cost.
- Utilities have severely reduced their DSM budgets in response to restructuring.
  - Corporate interest focused on profit-making ventures.
  - Less interest in mitigating generation costs.
  - Greater concern about regulatory support for DSM.
  - Less certainty about customer longevity.

Original Question: Will restructuring result in environmental improvement or degradation?

- It depends. Primarily on the environmental policies adopted.
- In the absence of policies to promote clean resources, there is likely to be trends toward:
  - more coal generation;
  - significantly more natural gas construction and generation;
  - some early nuclear retirements;
  - less renewable resources;
  - less energy efficiency by electric utilities;
  - a small contribution of new renewables through green power.
- In sum, these trends imply:
  - Higher emissions of SO2, NOX and heavy metals.
  - Significantly higher emissions of CO2.
  - Greater land, water, noise impacts of new unit construction.
  - Less production of nuclear waste.

Key Policies to Promote Environmental Protection Under Electricity Restructuring

- System benefits charge -- for energy efficiency investments and for renewable resources.
- Renewable portfolio standard.
- Environmental disclosure requirements.
- Generation performance standards.
- Policies to support green power.
- Policies to address inconsistent environmental regulations:
  - NSR provisions applied to all sources.
  - All resources -- existing and new, conventional and renewable -- allocated SO2 and NOX allowances equitably.
- Policies to respond to retirement of nuclear units.

Suggestions Regarding the Design and Implementation of Environmental Policies

- Policies must be carefully designed and articulated.
  - e.g, Massachusetts RPS, Maine RPS.
- Policies must be supported over time -- beware of attempts to undermine environmental objectives.
  - e.g., Connecticut RPS, Massachusetts SBC, disclosure policies.
- Policies should not necessarily depend upon a competitive marketplace.
  - e.g., Green power in Massachusetts, customer aggregation.