



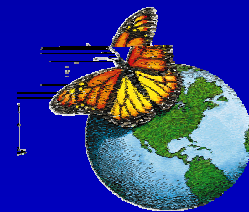
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The Benefits of Wind Power



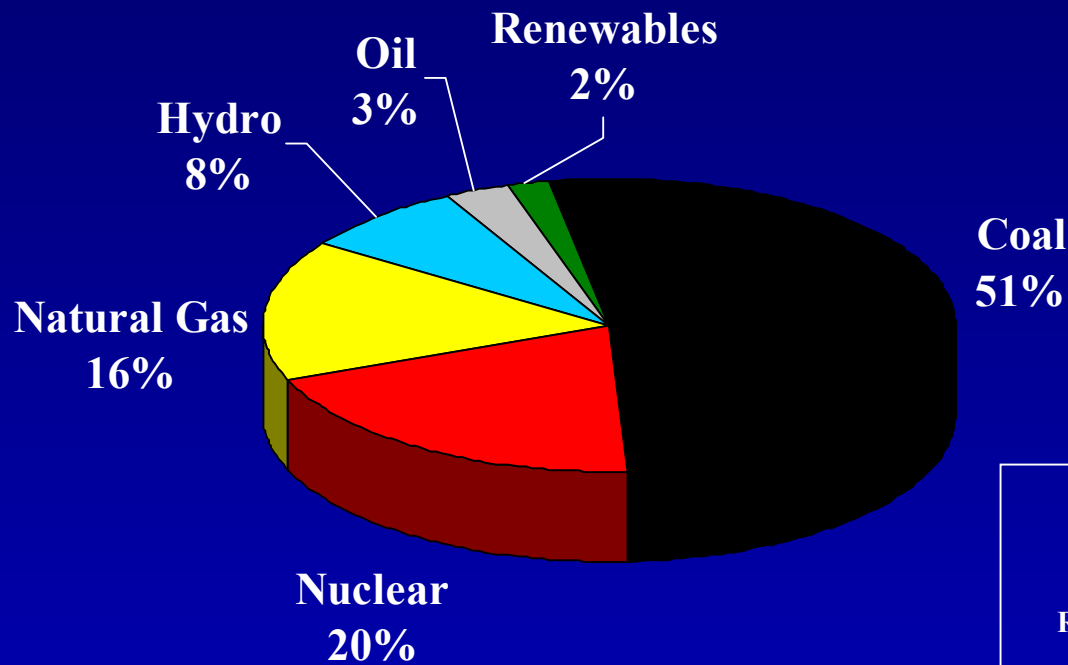
Alan Noguee
Energy Program Director
Union of Concerned Scientists

December 5, 2002
WENEICC Conference

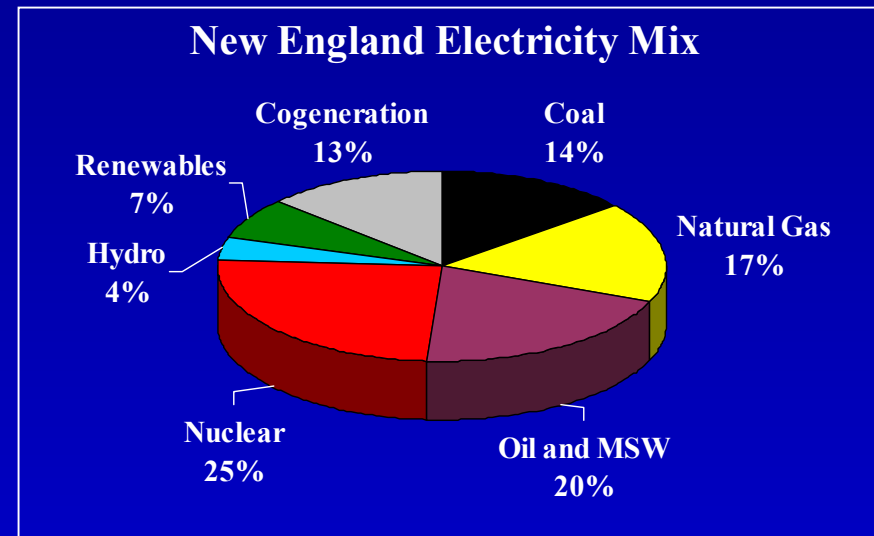




Current U.S. Electricity Mix



* Dependency on fossil fuels - natural gas - forecasted to grow significantly over next two decades.





Current Energy System is *UN-sustainable*

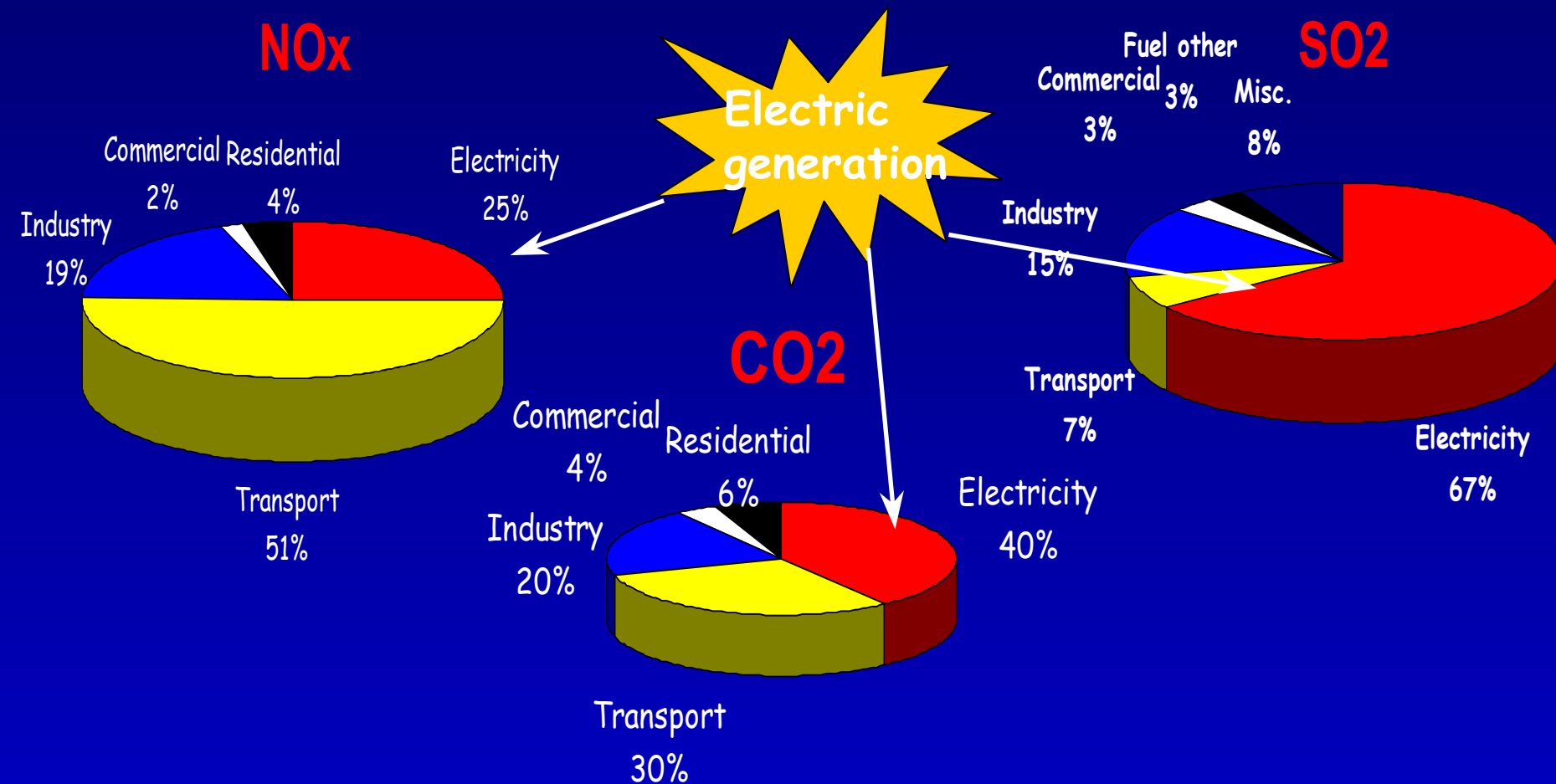
- * Air Pollution
- * Land and Water Degradation
- * Climate Change
- * Public Health Impacts
- * National Security

Emissions	Problems	Impacts
NO _x , SO ₂ →	Acid Deposition	-- Acidifies lakes & streams --Forest damage
CO ₂ →	Climate Change	--Extreme weather --Reduced crop yields & impacts to natural systems
NO _x , SO ₂ →	Fine Particulates	--Premature mortality --Lung & heart disease
Hg →	Mercury Deposition	--Bioaccumulation --Toxic to humans
NO _x →	Nitrogen Deposition	--Excess nitrogen loading in sensitive water bodies --Harms aquatic plants & animals
NO _x →	Ozone Smog	--Respiratory harm --Crop damage
NO _x , SO ₂ →	Regional Haze	--Reduced visibility in National Parks



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Electricity is a Major Contributor to Air Pollution and Climate Change

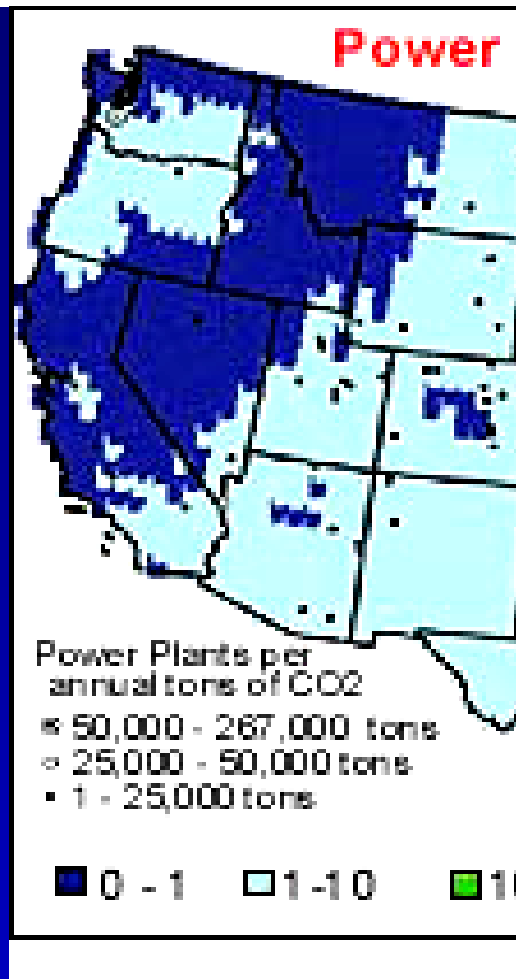


Source: EPA, 1998



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Environmental impacts **Air pollution harms human health**



* ~30,000 early U.S. deaths each year from power plant particulates

Smog impacts (all sources):

- * 6.2 million asthma attacks
- * 117,300 ER visits
- * 58,600 hospital admissions



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Environmental impacts

Mountaintop removal coal mining

- * 15-25% of southern WV mountain tops removed
- * 300,000 acres of forests
- * 1,000 miles of streams buried



Source: Citizens Coal Council

<http://www.citizenscoalcouncil.org/mtr.htm>



Global Warning on Warming

Scientific Consensus

- ✦ **Climate change is real and underway.**

From “maybe” to “definitely and growing”

- ✦ **It is in part human-made.**

IPCC (2001): “There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.”

- ✦ **If nothing is done to reduce emissions, impacts will be severe.**

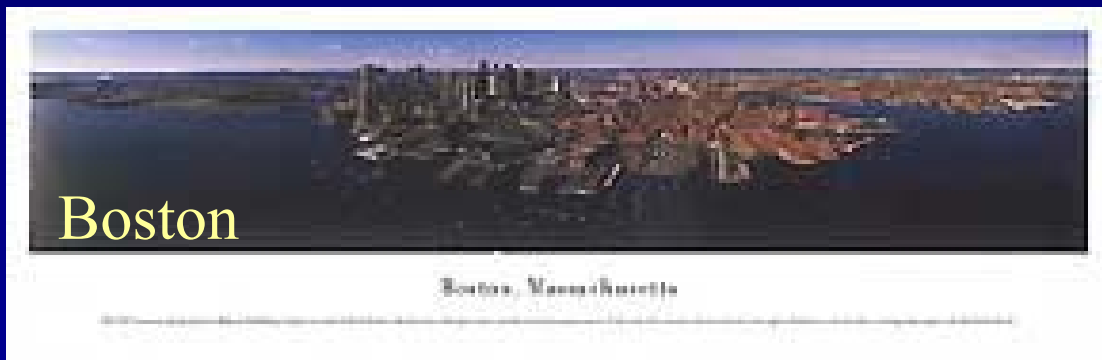
Sea-level rise, health impacts, significant environmental degradation





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Projected Temperature Changes for New England (by 2100)

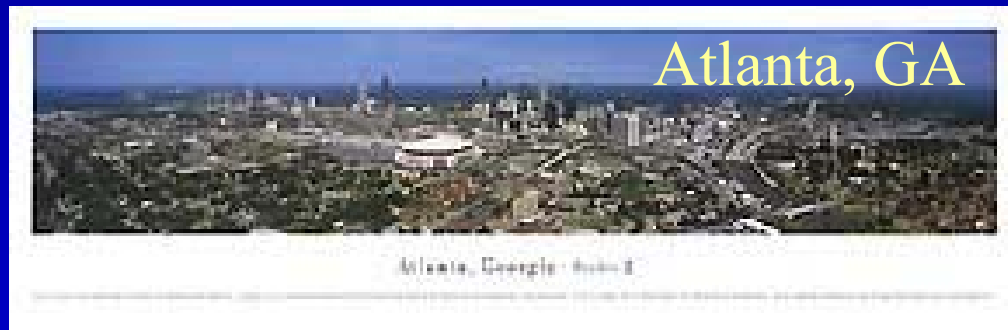
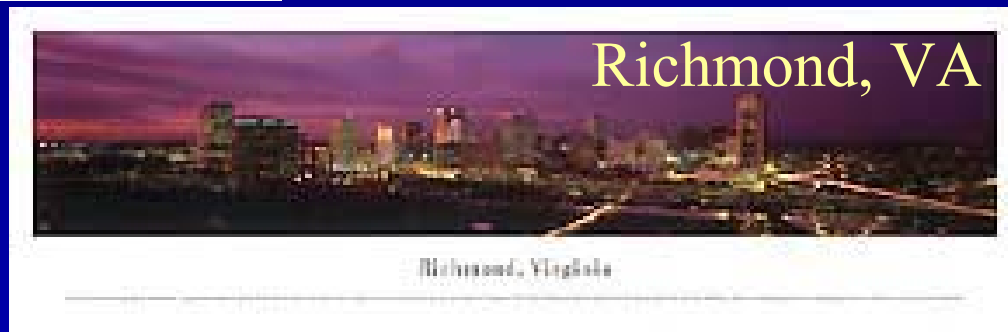


*“Confidence in the ability
of models to project future
climate has increased.”*

10-30% increase
in precipitation

+ 6°F =

+ 10°F =



Potential Climate Change Impacts

Climate Changes



Temperature



Precipitation

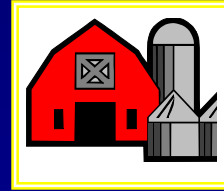


Sea Level Rise



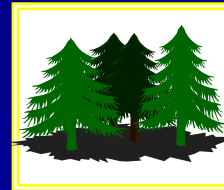
Health

Weather-related mortality
Infectious diseases
Air-quality respiratory illnesses



Agriculture

Crop yields
Irrigation demands
Pest outbreaks



Forests

Change in forest composition
Shift geographic range of forests
Forest health and productivity
Pest outbreaks



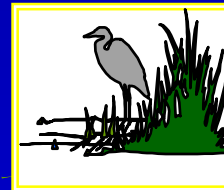
Water Resources

Changes in water supply
Water quality
Increased competition for water



Coastal Areas

Erosion of beaches
Inundation of coastal lands
Costs to protect coastal communities



Species and Natural Areas

Shift in ecological zones
Loss of habitat and species



Already observed impacts in New England

- ✓ +0.7 °F for region
- ✓ Milder winters
- ✓ Earlier maple sap flow
- ✓ Earlier ice-out dates
- ✓ Reduced snowfall, shorter snow cover
- ✓ Slight increase in precipitation (coastal)
- ✓ Increase in heavy rainfall events
- ✓ Higher number of extreme events
- ✓ Greater climate variability








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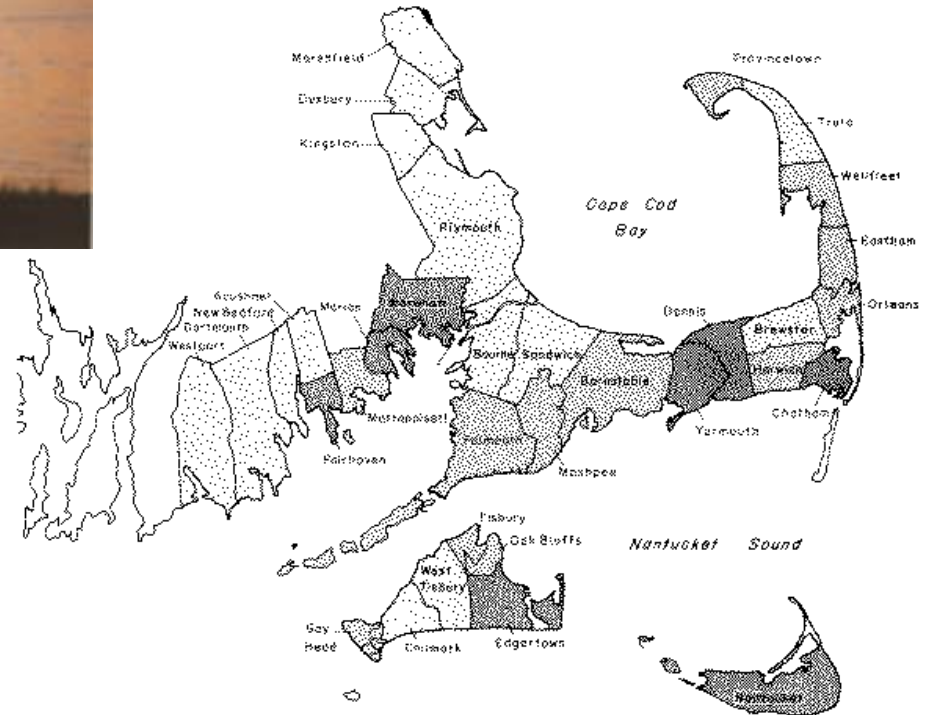
Historical Land Loss due to Sea-Level Rise



Avg. rate: 1 inch/decade

KEY

-  less than 1% / century
-  1-2% / century
-  more than 2% / century



“Each year, on average,
65 acres of upland are
passively submerged by
a combination of rising
sea and subsiding land.”
Giese & Aubrey, 1994



Energy Insecurity

- * **Disruption at a key power plant, refinery, transmission hub or pipeline can break flow of power or fuel to millions and create cost spikes**
- * **Breach of nuclear reactor core or spent fuel storage cask would be catastrophic**
- * **Our economy is vulnerable to Persian Gulf politics and OPEC's market power**
 - **Political events in Middle East precipitated last three major oil price shocks; each was followed by US recession**



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Wind Energy: *A central remedy*

* Abundant, home grown fuel supply

- Renewables are only energy sources indigenous to New England
- No fuel to mine, refine, transport or store
- No cooling water needed

* Zero emissions

- No air or water pollution, hazardous wastes

* Decentralized energy supply

* Benefits consumers and the economy



Hull, MA



Lolland, Denmark



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Wind Energy Resources are Abundant

U.S. technical potential:

- * Over 4 times current U.S. electricity use

New England technical potential:

- * Nearly 70% of total current sales (not including offshore resources)

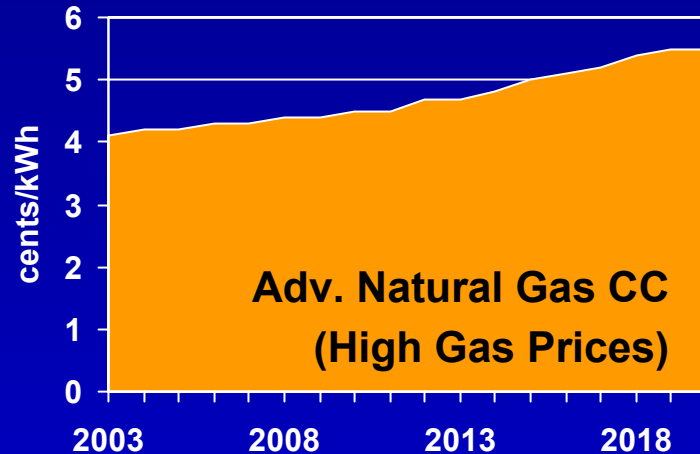
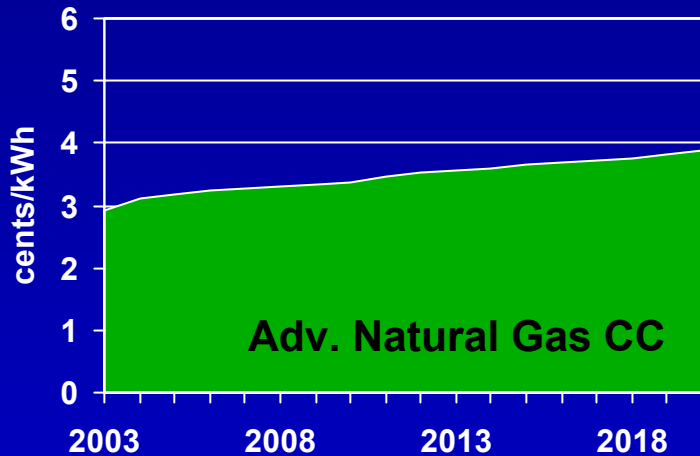
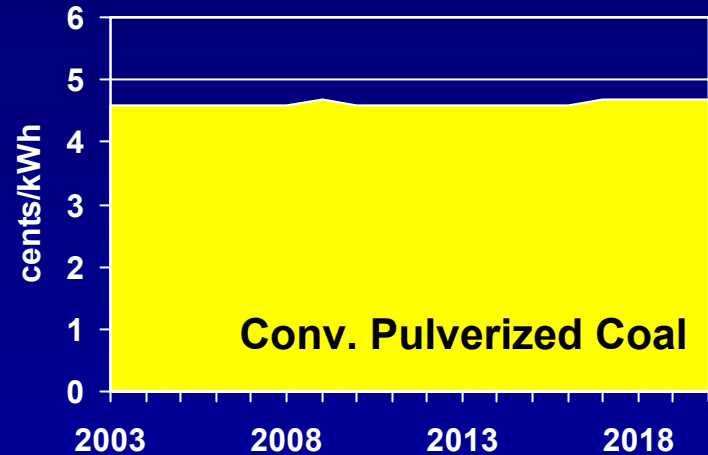
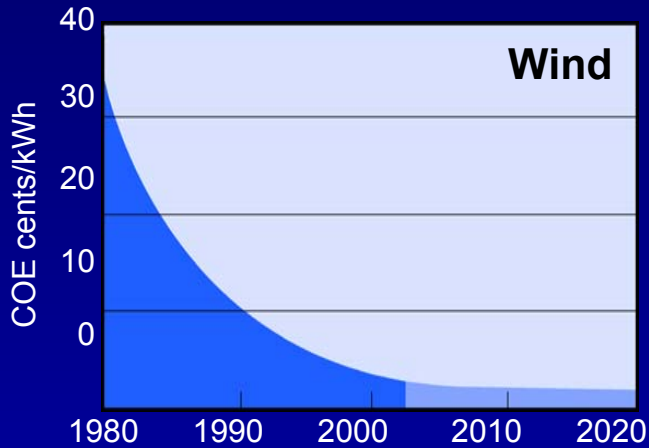




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Energy Cost Trends:

R&D and Market Growth Lower Cost of Wind



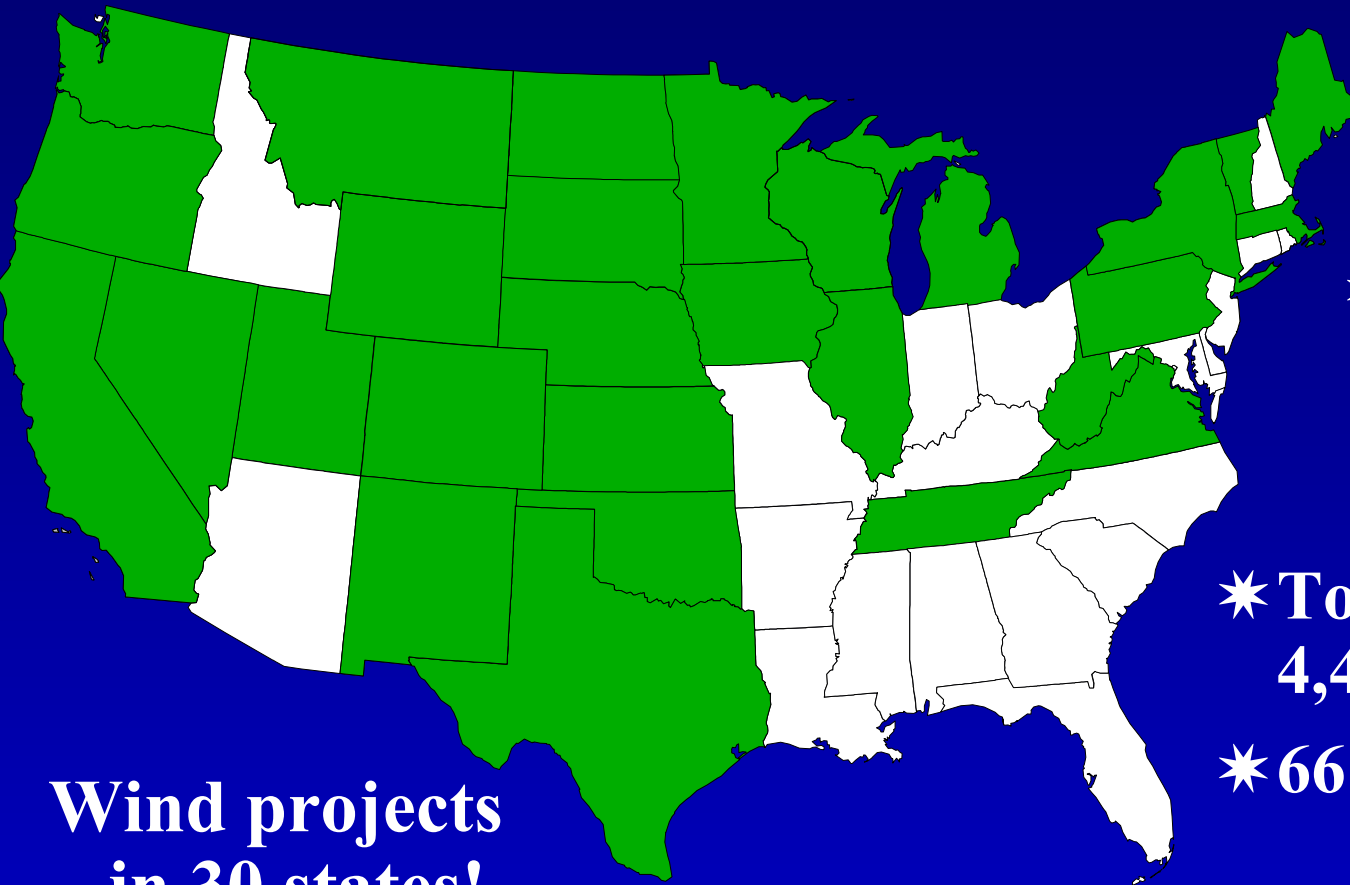
Source: NREL Energy Analysis Office, EIA projections for AEO 2002

Levelized cents/kWh in constant \$2000



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Wind energy: *Fastest growing energy source worldwide*



**Wind projects
in 30 states!**

***25-30% annual
growth rate
worldwide**

***Total U.S. capacity:
4,423 MW**

***66% growth in 2001**



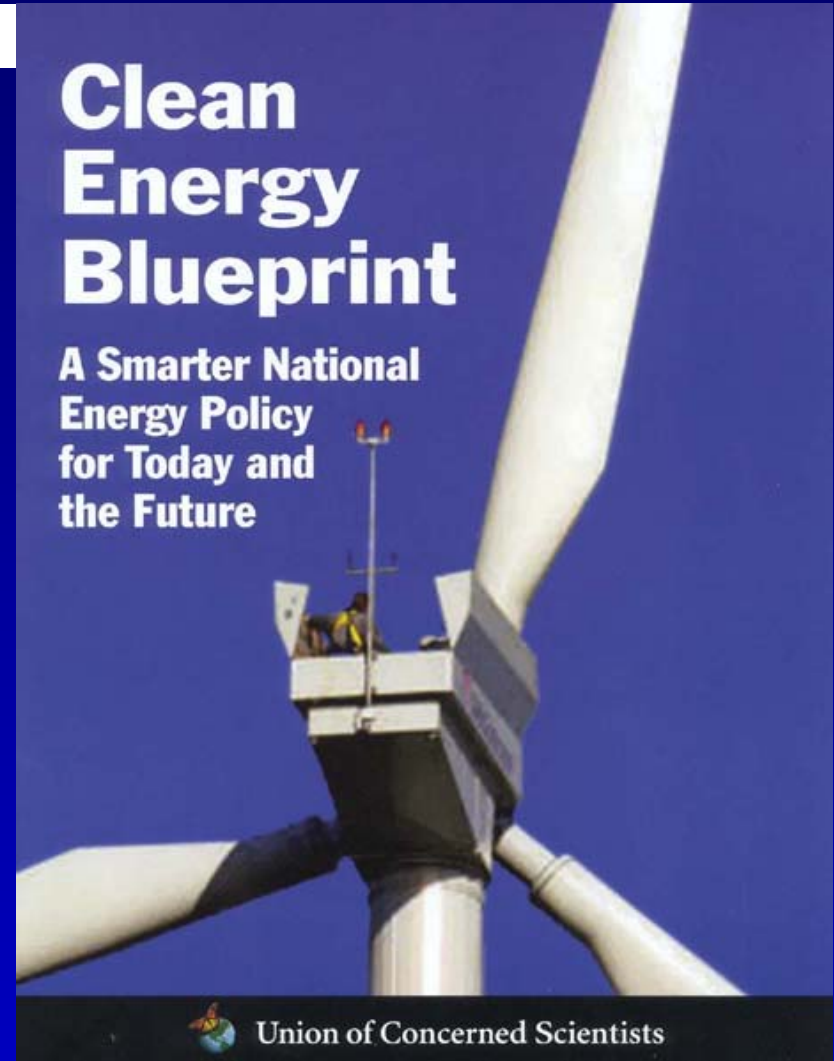
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Efficiency and renewable energy policies for a sustainable future

- ❖ America could produce at least 20% of our electricity from wind, solar, biomass energy sources by 2020
- ❖ ...and save money!
- ❖ Enacting a suite of energy efficiency & renewable energy policies

Clean Energy Blueprint

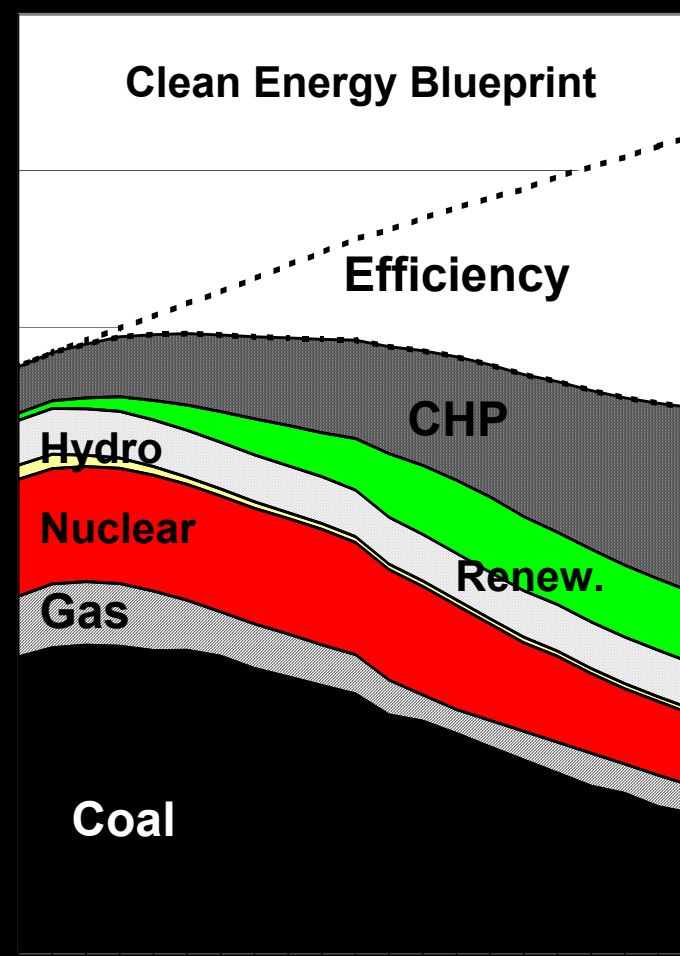
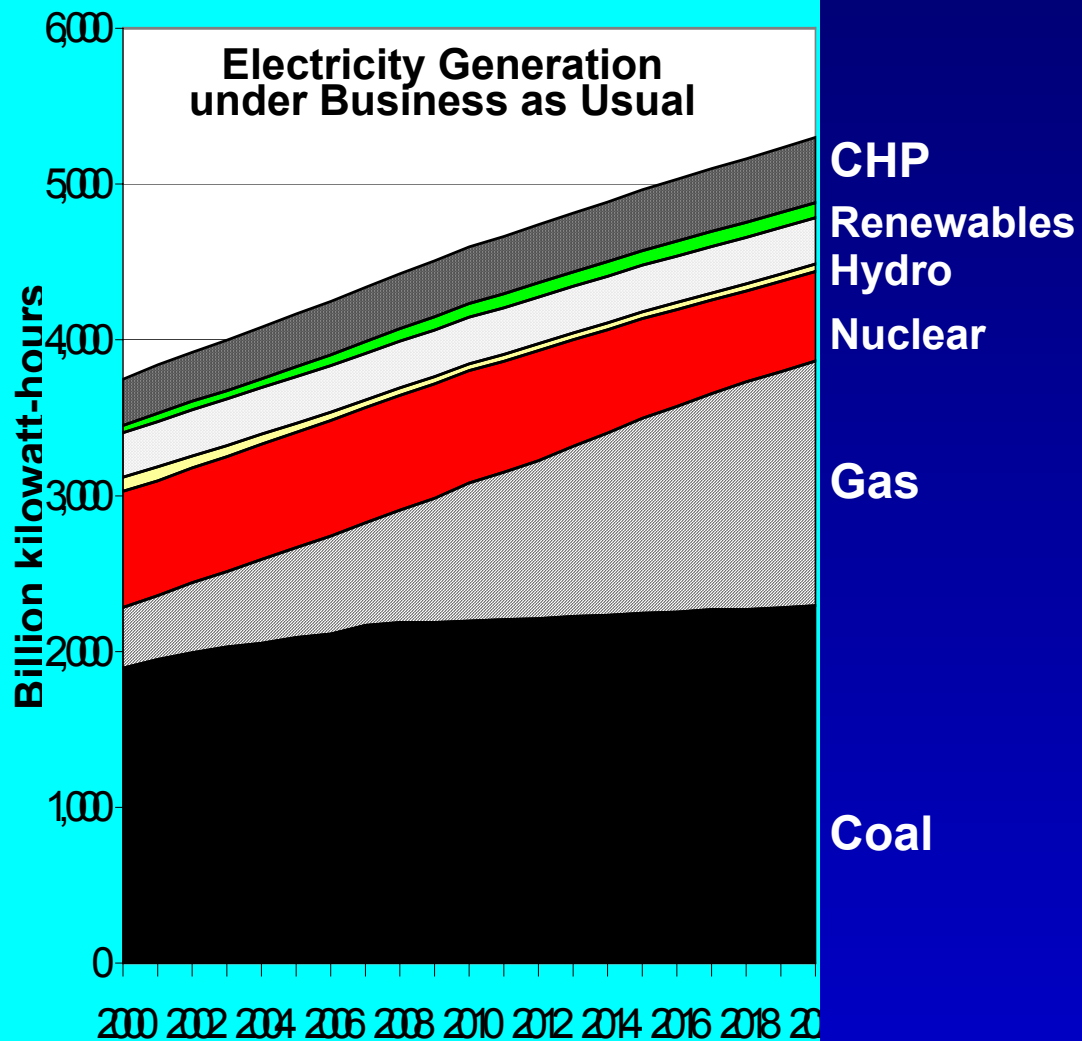
A Smarter National
Energy Policy
for Today and
the Future





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Clean Energy Blueprint vs. Business as Usual

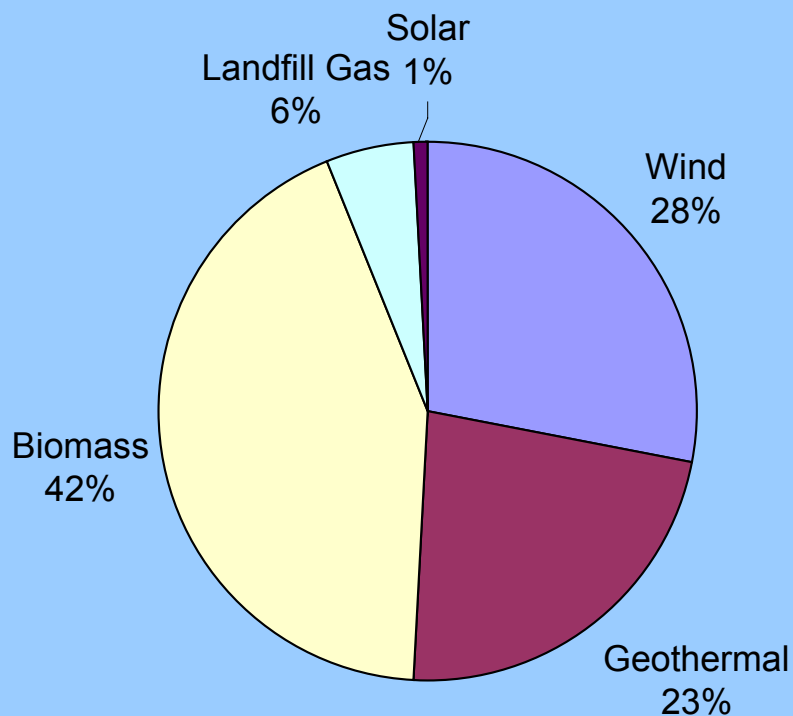




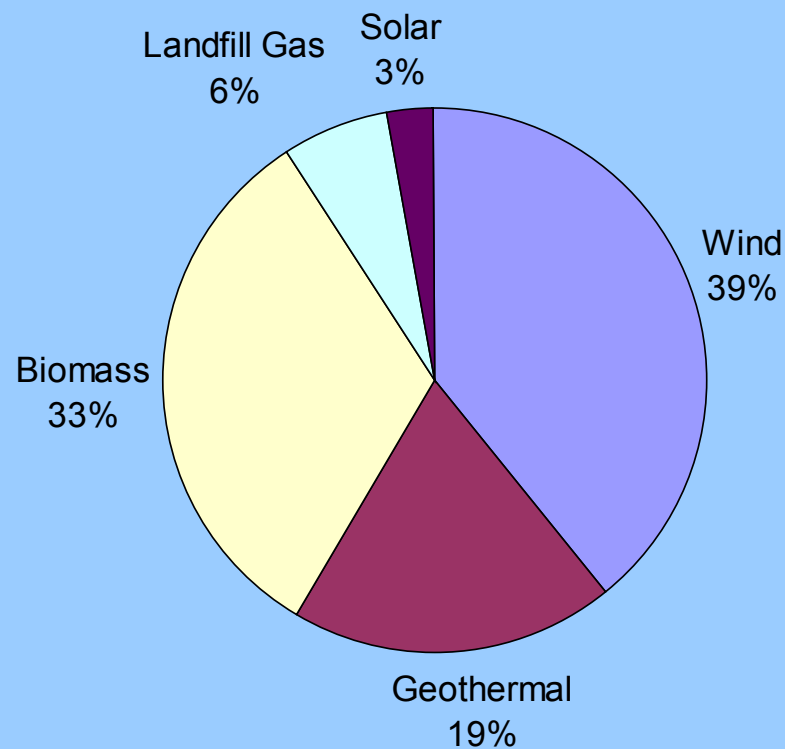
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Renewable energy generation in *Clean Energy Blueprint*

2010



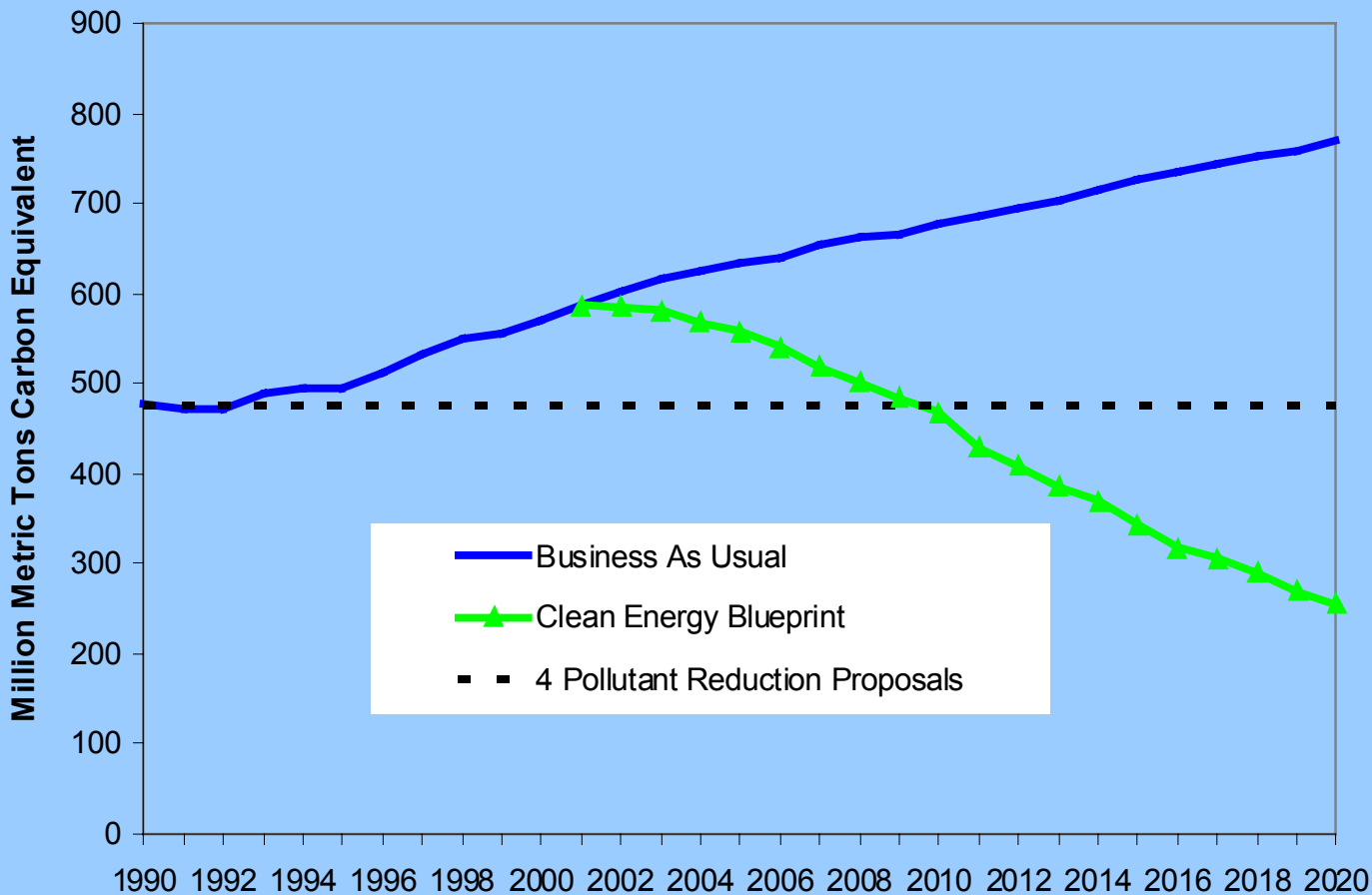
2020





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Power plant carbon emissions in *Clean Energy Blueprint*



***CO₂**
reduced 67%
from business
as usual by
2020

***Cumulative**
savings of
\$440 billion

***\$350 per**
year per
household in
2020

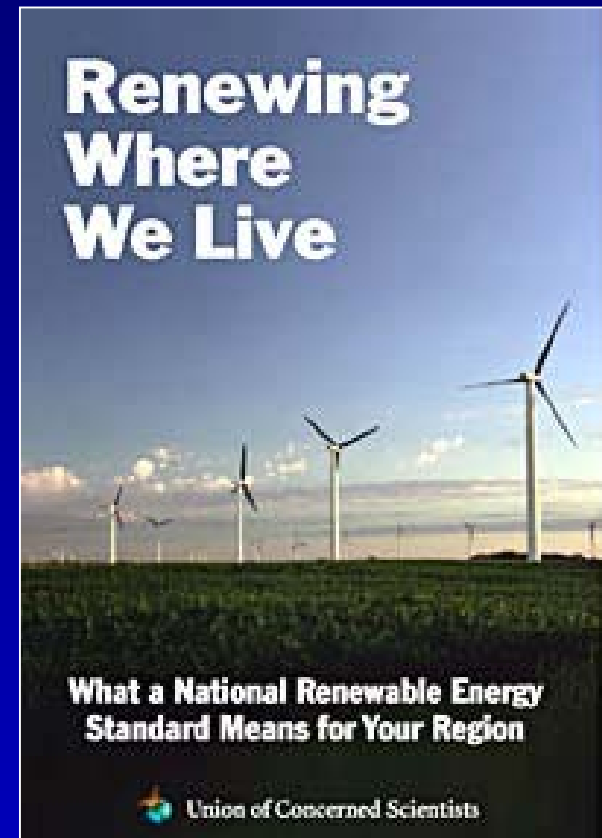


Economic Benefits

* UCS *Renewing Where We Live* -

By 2020, produce 20% of our electricity from renewable energy:

- Nearly \$80 billion in new capital investment
- Nearly \$5 billion in new property tax revenue for local communities
- \$1.2 billion in lease payments to farmers, ranchers, and rural landowners from wind power alone
- Save consumers \$4.5 billion between 2002 and 2020

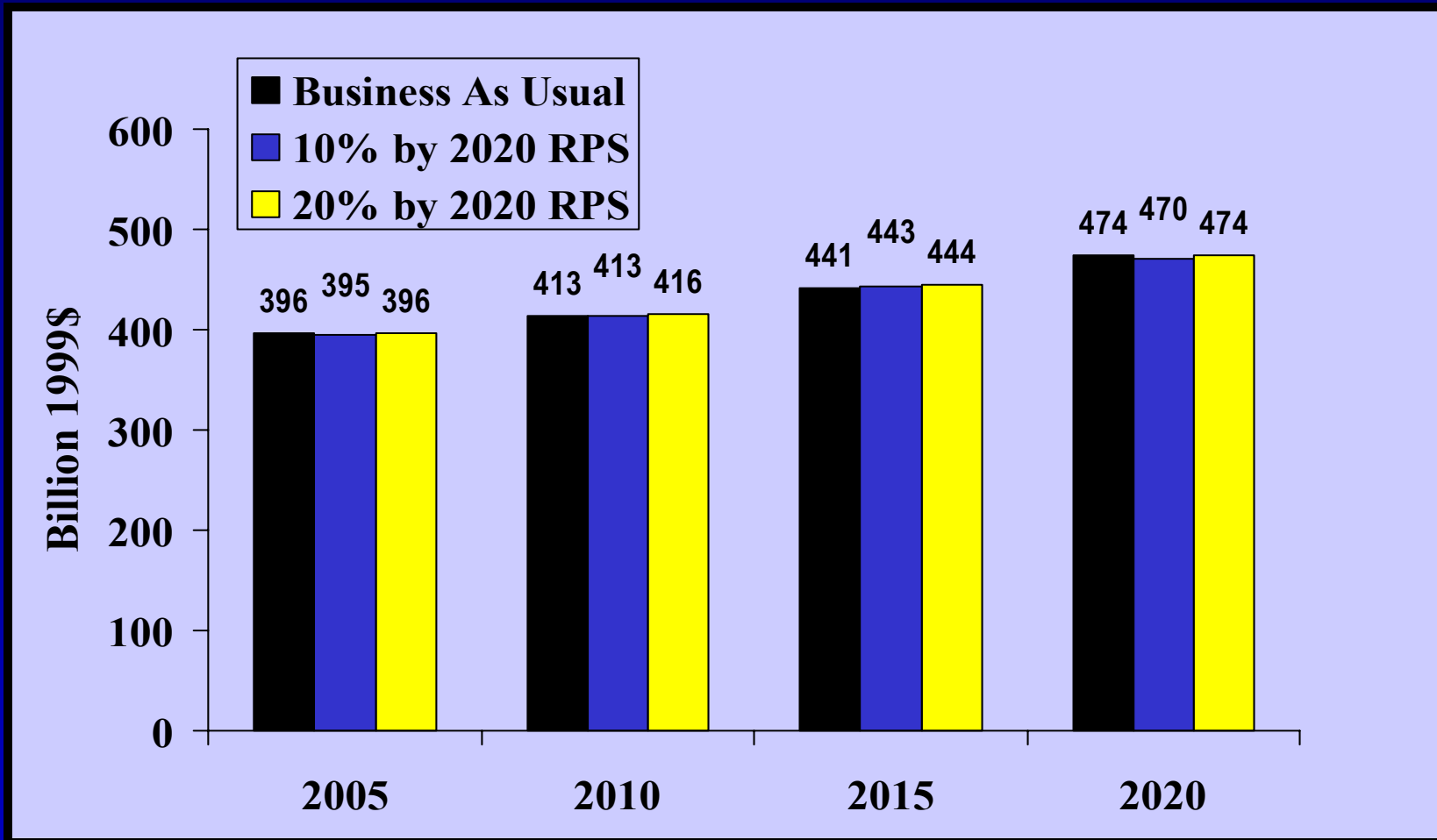




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EIA analysis: Renewable energy standard costs almost nothing

Total Consumer Energy Bills (excluding transportation)



Source: EIA, *Strategies for Reducing Multiple Emissions...* July 2001, Table E3.



Impacts of Wind Energy

Potential Impacts of Wind Energy

- * Land requirements
- * Wilderness impacts & avian mortality
- * Noise
- * Aesthetics
- * Some pollution in manufacturing & construction

Most issues can be addressed with:
- *Careful planning*
- *Early stakeholder involvement*



Energy Sustainability

No single energy source is perfect

We need to strive for:

- Diversity of clean sources
- Energy Efficiency

So that we can achieve:

- Long-term reliability, affordability
- Reduced risk to public health, environment

Wind must play major role in sustainable energy future



Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

www.ucsusa.org