



SUSTAINABILITY

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Vision & Results
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PERSI AT ECOBUILD, DECEMBER 8, 2010

About IEEE

World's largest professional association

- more than 395,000 members in more than 160 countries; 45 percent from outside the US

Leading developer of voluntary, consensus-based international standards involving today's leading-edge electrotechnologies

- portfolio of more than 900 active standards and more than 400 standards in development

About IEEE

38 Professional Societies and 7 Councils

Sponsors over 1,100 conferences in 73 countries

Publishes nearly a third of the world's technical literature in electrical engineering, computer science and electronics

Societies and Councils

- IEEE Aerospace and Electronic Systems
- IEEE Antennas and Propagation
- IEEE Broadcast Technology
- IEEE Circuits and Systems
- IEEE Communications
- IEEE Components, Packaging and Manufacturing Technology
- IEEE Computer
- IEEE Consumer Electronics
- IEEE Control Systems
- IEEE Dielectrics and Electrical Insulation
- IEEE Education
- IEEE Electromagnetic Compatibility
- IEEE Electron Devices
- IEEE Engineering in Medicine and Biology
- IEEE Engineering Management
- IEEE Geoscience and Remote Sensing
- IEEE Industrial Electronics
- IEEE Industry Applications
- IEEE Information Theory
- IEEE Instrumentation and Measurement
- IEEE Intelligent Transportation Systems

Societies and Councils (cont.)

- IEEE Lasers and Electro-Optics
- IEEE Magnetics
- IEEE Microwave Theory and Techniques
- IEEE Nanotechnology Council
- IEEE Neural Networks
- IEEE Nuclear and Plasma Sciences
- IEEE Oceanic Engineering
- IEEE Power Electronics
- IEEE Power and Energy
- IEEE Product Safety Engineering
- IEEE Professional Communications
- IEEE Reliability
- IEEE Robotics and Automation
- IEEE Sensors Council
- IEEE Signal Processing
- IEEE Social Implications of Technology
- IEEE Solid State Circuits
- IEEE Systems, Man, and Cybernetics Society
- IEEE Council on Superconductivity
- IEEE Ultrasonics, Ferroelectrics, and Frequency Control
- IEEE Vehicular Technology

Many Faces of Sustainability

2009 IEEE INTERNATIONAL SYMPOSIUM ON SUSTAINABLE SYSTEMS AND TECHNOLOGY

SPONSORS

- IEEE COMPUTER SOCIETY COMMITTEE ON ELECTRONICS AND THE ENVIRONMENT
- IEEE SOCIETY ON SOCIAL IMPLICATIONS OF TECHNOLOGY

GEOSS

THE GLOBAL EARTH OBSERVATION
SYSTEM OF SYSTEMS



GEOSS

**77 Countries + European Commission
56 Additional Intergovernmental, International and Regional
Organizations with a mandate on Earth Observations**

One professional society: IEEE Committee on Earth Observations

- Understanding environmental factors affecting human health and well-being,
- Improving the management of energy resources,
- Understanding, assessing, predicting, mitigating, and adapting to climate variability and change,
- Improving water resource management through better understanding of the water cycle,
- Improving weather information, forecasting and warning,
- Improving the management and protection of terrestrial, coastal and marine ecosystems,
- Supporting sustainable agriculture and combating desertification, and
- Understanding, monitoring and conserving biodiversity

Standards

The Computer Society LAN, MAN, standards committee is sponsoring IEEE P802.3az for **energy efficient Ethernet**

The Corporate Advisory Group is sponsoring a new project IEEE P1888 “**Remote Ubiquitous Green Community Control Network Protocol**”

The Industry Applications Society is sponsoring new standards projects for **metering and energy management in industrial and commercial power systems** IEEE P3001.8, P3005.7

IEEE 1547 series which provides a set of standards for **interconnection of distributed resources including renewable resources such as wind and solar to the electric grid** as well as a number of photovoltaic standards

Standard for **Quantifying Greenhouse Gas Emission Credits from Small Hydro and Wind Power Projects, and for Grid Baseline Conditions,** sponsored by the Power and Energy Society

Outreach

DISCOVER Magazine, NSF, ASME, IEEE-USA Congressional Briefing Series;

- Smart Grid, Energy Storage, Energy Efficiency, Biofuels

R&D Caucus Briefing on Smart Grid and PEVs

Selected briefings on P2030 Smart Grid Standards

Conferences

- **IEEE International Symposium on Electronics and the Environment**
- **IEEE International Requirements Engineering Conference: Requirements Engineering for a Sustainable World**
- **IEEE Committee on Earth Observation and GEO GEOSS Workshops**
- **Oceans '08 and 09**
- **Middle-East Power Systems Conference**
- **IEEE Rural Electric Power Conference**
- **IEEE Power India Conference**
- **IEEE International Conference on Sustainable Energy Technologies**
- **IEEE Energy 2030**
- **International Conference on Clean Electrical Power**
- **International Conference on the European Electricity Market**
- **Annual North American Power Symposium**
- **Electrical Power & Energy Conference**
- **Asia-Pacific Power and Energy Engineering Conference**
- **IEEE Power & Energy Society (PES) Annual Meeting**
- **IEEE Photovoltaic Specialists Conference**
- **IEEE Energy Conversion Congress and Exposition**
- **IEEE International Symposium on Technology and Society**
- **Plug-In Hybrid Electric Vehicles**
- **IEEE Green Technologies Conference**

Publications

IEEE Transactions on Automatic Control

- Covers the theory, design and application of control systems, encompassing components, and the integration of these components, as are necessary for the construction of such systems.
- Sustainability-related articles include: Kouvaritakis et al. (2006) on quantitative approaches to sustainable development policy assessment.

IEEE Intelligent Systems Magazine

- Bimonthly publication of the IEEE Computer Society, provides peer-reviewed, cutting-edge articles on the theory and applications of systems that perceive, reason, learn, and act intelligently.
- Sustainability-related articles include: Wang and Tang (2004) on management and control strategies for transportation systems through the lens of sustainable development.

IEEE Power and Energy Magazine

- Dedicated to disseminating information on all matters of interest to electric power engineers and other professionals involved in the electric power industry. Feature articles focus on advanced concepts, technologies, and practices associated with all aspects of electric power from a technical perspective in synergy with nontechnical areas such as business, environmental, and social concerns.
- Sustainability-related articles include: Rahman (2007) on renewable energy's role in achieving sustainable development, and Gurney (2005) on the hydrogen economy.
- **ALMOST ALL THE PUBLICATIONS OF OUR 38 SOCIETIES AND 7 COUNCILS HAVE ADDRESSED SUSTAINABILITY**

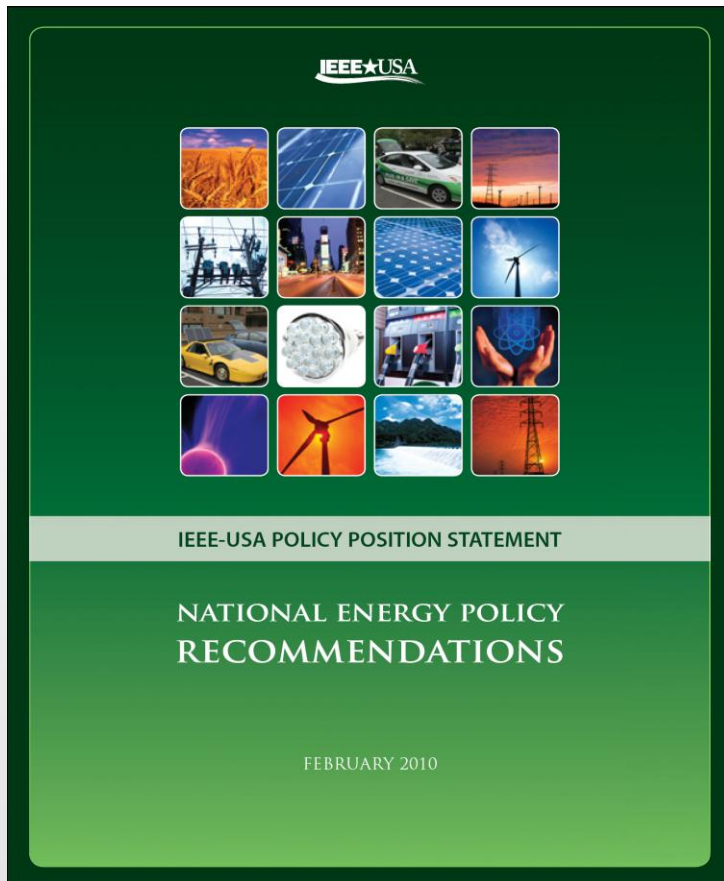
IEEE-USA

Organizational unit of IEEE created in 1973 to support the career and public policy interests of IEEE's U.S. members

~215,000 U.S. members

Recommends policies and implements programs to benefit the U.S. members, the profession, and the public in areas of economic, ethical, legislative, social and technology policy concern

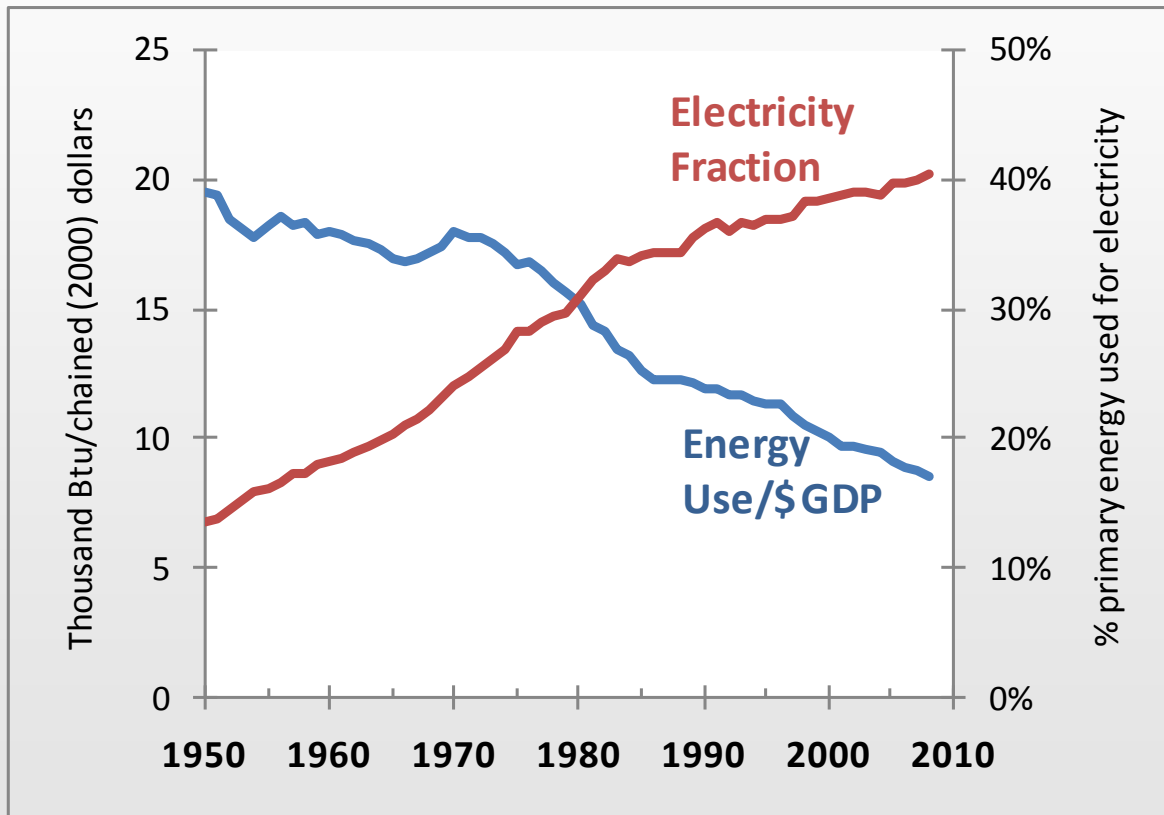
Energy Policy



- ✓ **Increasing Energy Efficiency**
- ✓ **Reducing Our Dependence on Oil by Transforming Transportation**
- ✓ **Greening the Electric Power Supply**
- ✓ **Building a Stronger and Smarter Electrical Energy Infrastructure**

We Need Electricity

PATH TO SUSTAINABILITY



Electrification

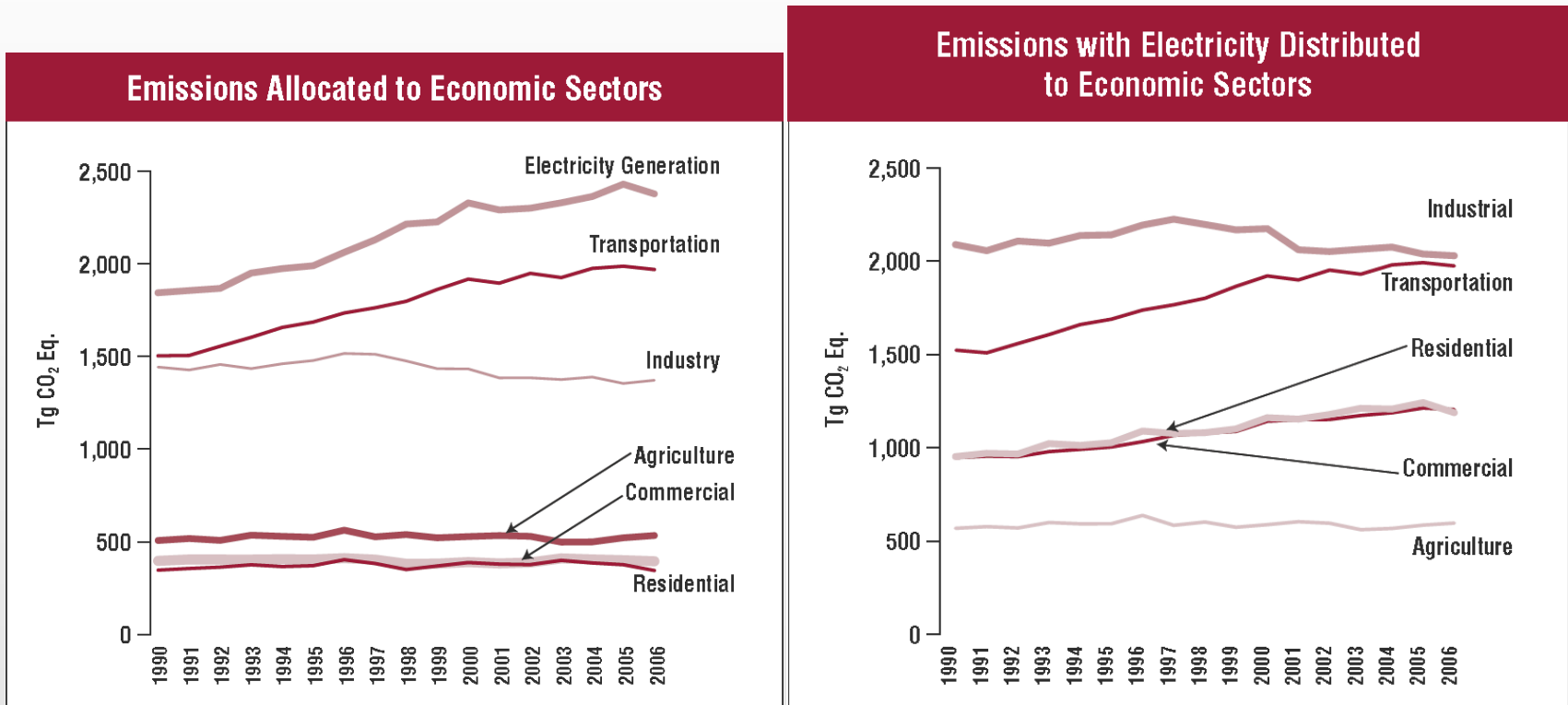
Electricity use is increasing in both absolute and RELATIVE terms

Increasing energy productivity

It takes less-and-less energy to fuel the economy

GHG Emissions

Mitigation efforts focused on electricity generation



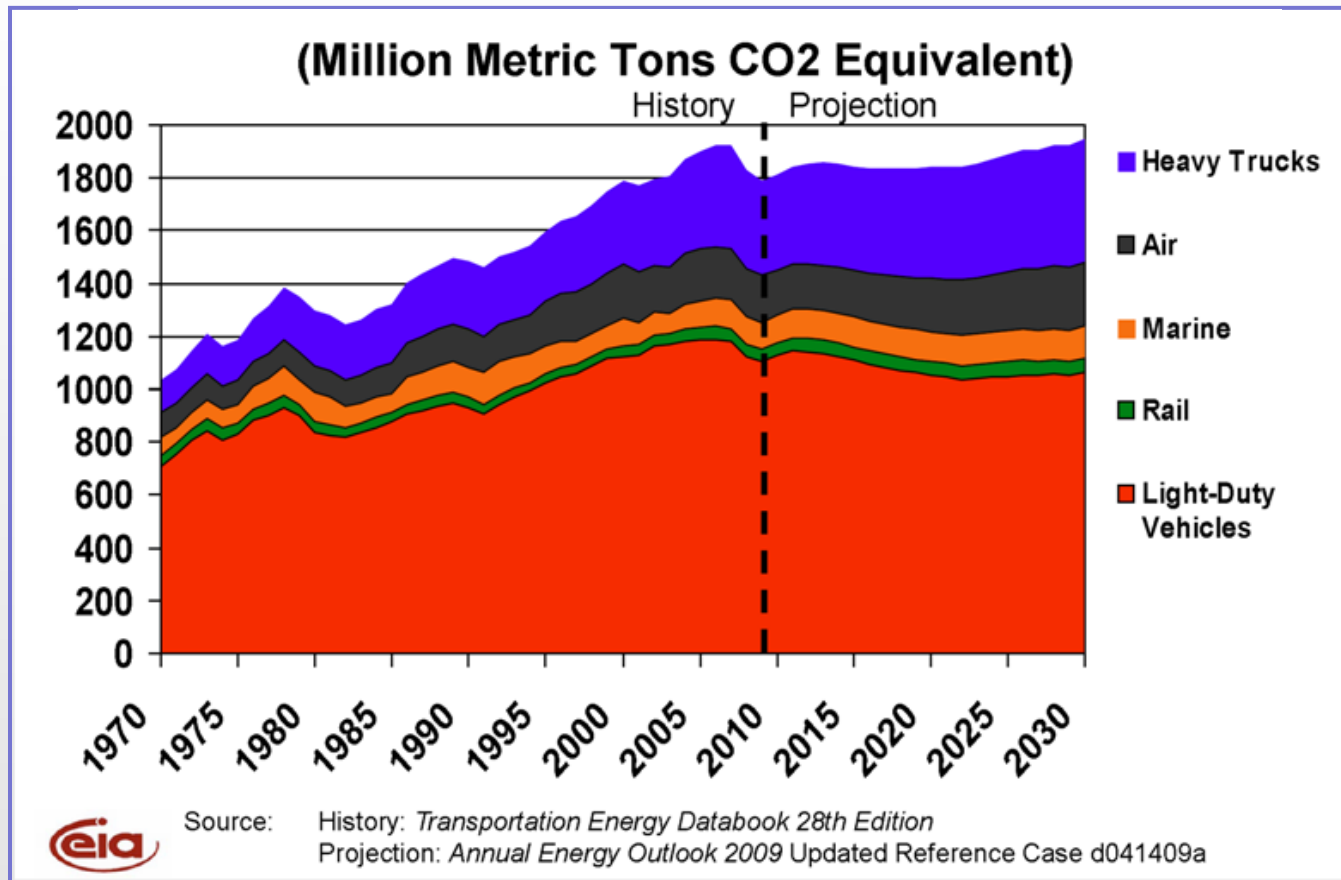
Source: Inventory of U.S. Greenhouse Gas Emissions and Sinks:1990-2006, EPA 430-R-08-005 April 2008

Energy Policy

*ESTABLISH VISIBLE AND SUBSTANTIAL
NATIONAL ENERGY EFFICIENCY AND
CONSERVATION PROGRAMS*



Transportation



Source: Conti, J., U.S. Greenhouse Gas Emissions in the Transportation Sector, Asilomar presentation, July 2009

Energy Policy

MAXIMIZE ELECTRIFICATION OF THE TRANSPORTATION SECTOR



Energy Policy

***BUILD AND DEPLOY GENERATING
CAPACITY TO SUPPLY RELIABLE
ELECTRIC SERVICE***



Energy Policy

***MAXIMIZE THE USE OF ELECTRIC
POWER GENERATED BY SUSTAINABLE,
ECONOMIC AND ENVIRONMENTALLY-
ACCEPTABLE TECHNOLOGIES***



Energy Policy

MODERNIZE THE NATION'S ELECTRIC TRANSMISSION GRID

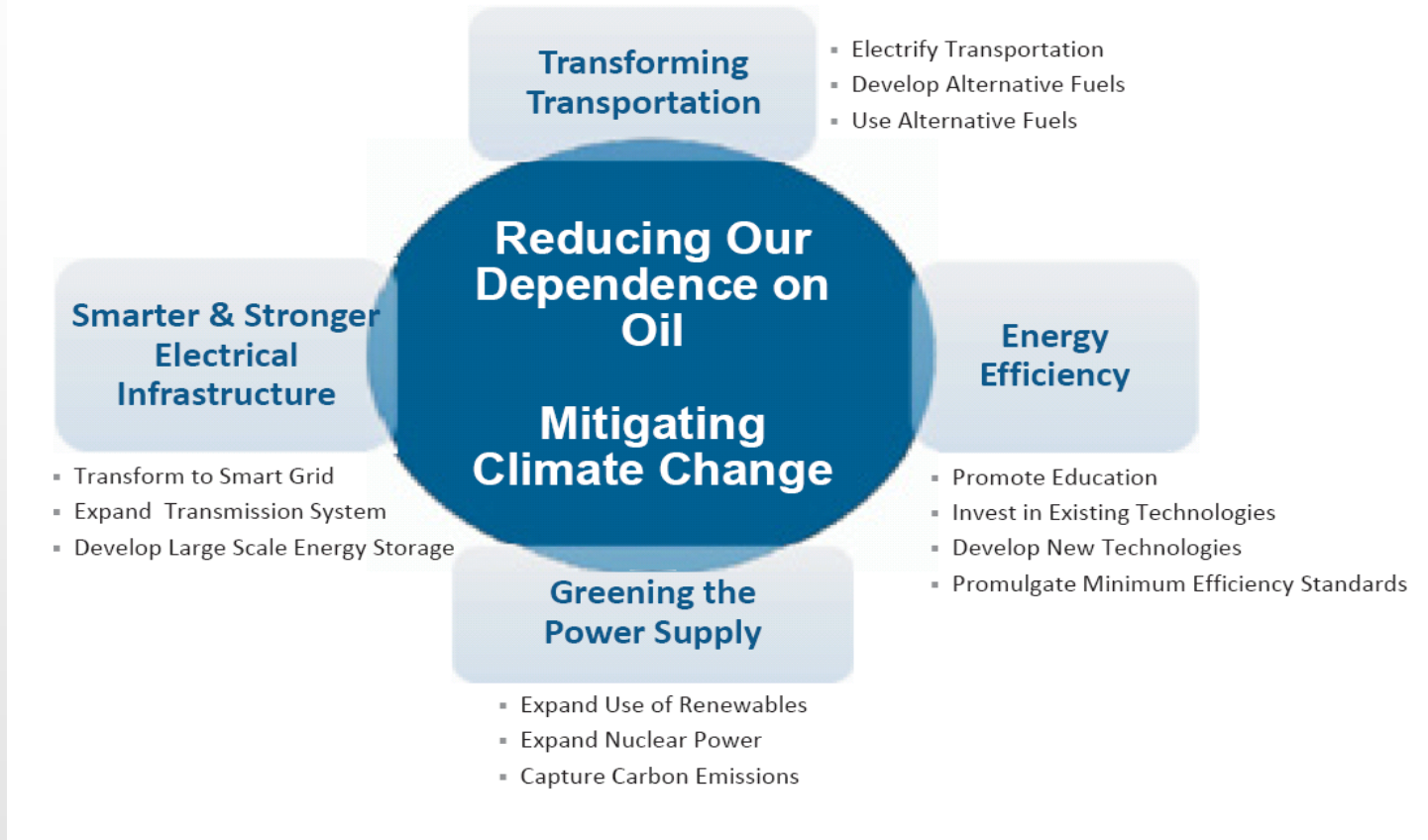


Energy Policy

**PROVIDE A *LONG-TERM* COMMITMENT
TO ENERGY RESEARCH, DEVELOPMENT
AND DEMONSTRATION**



IEEE-USA Recommendations





AICHE ASME AIME IEEE ASCE
Carbon Management



TECHNOLOGIES FOR CARBON MANAGEMENT

A Founder Societies' Project Initiative

Project Activities

- Principal elements
 - Scorecards
 - Gaps & Barriers
 - Carbon Measurement
- Electric Power and Transportation selected for initial technology focus (about 70% of US CO₂ emissions)
- Website established to share information
<http://www.aiche.org/FSCarbonMgmt/>

Scorecards

A COMMON SENSE APPROACH TO CARBON MITIGATION PORTFOLIO ASSESSMENT

- To identify options that could generate a *significant reduction* in greenhouse gases in the 2020 and 2050 timeframes
- Simple approach (qualitative)

Electric Power Scorecard

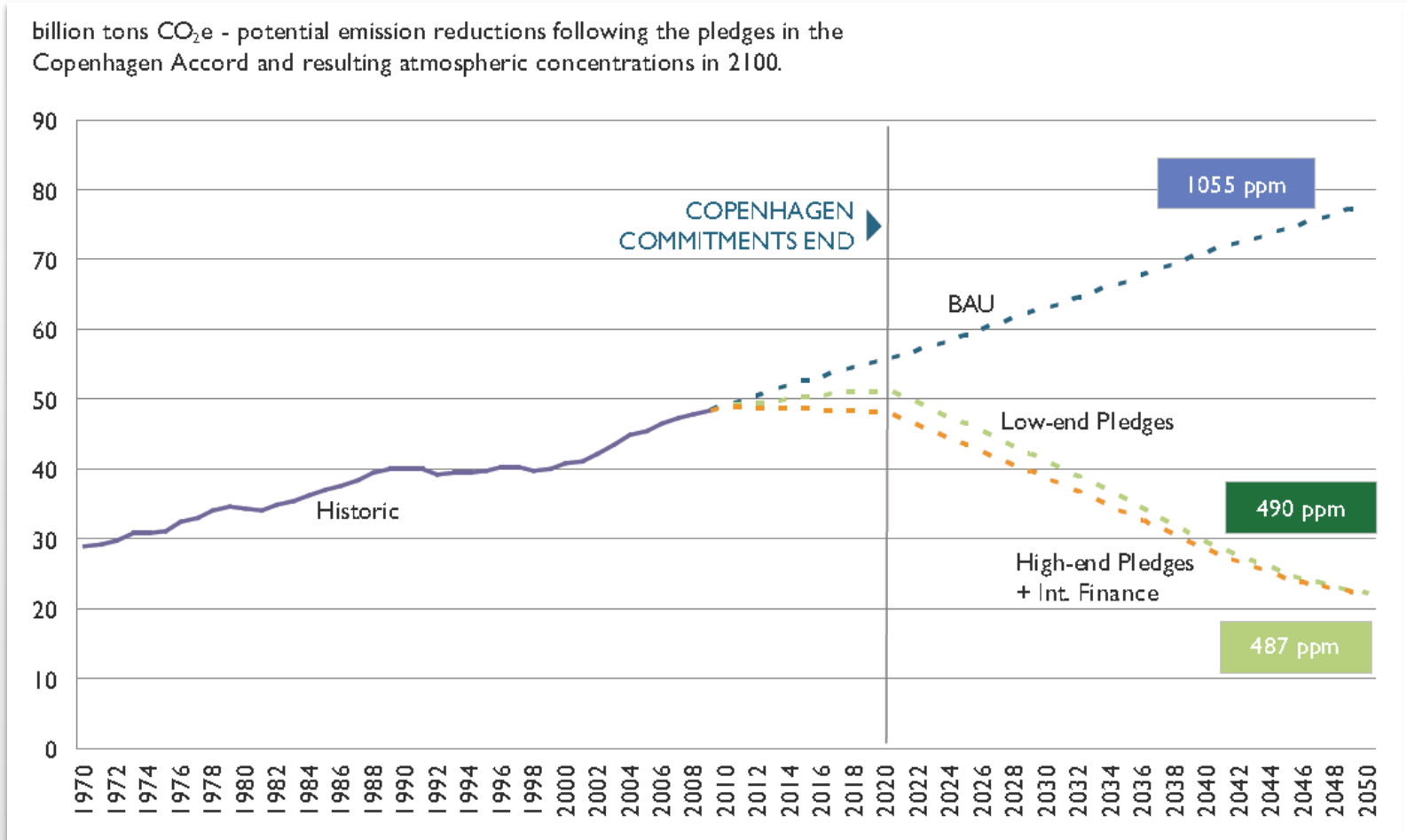
OPTIONS		ATTRIBUTES						
Main Category	Subcategory	GHG Reduction Potential	Technology	Financial	Environmental	Risk	Social-Political	Implementation Timing
NATURAL GAS	Simple or Combined Cycle w/o CCS							
	With CCS							
COAL with CCS	Existing Plant Retrofit							
	New Plant (e.g., IGCC, other advanced coal)							
COAL w/o CCS	New Plant (e.g., IGCC, other advanced coal)							
WIND	On-shore							
	Off-shore							
SOLAR	Photovoltaics							
	Concentrating Solar Power							
NUCLEAR	Life Extension							
	On-site Expansion							
	New units (Generation IV technology)							
HYDRO								
BIOMASS	Co-firing w/o CCS							
	Co-firing with CCS							
	100% biomass							
GEO THERMAL								
DISTRIBUTED GENERATION								
Scores								
A = best		Very high	Very high	None to minor	None to minor	None to minor	Very high	Very high by 2020
B		High	High	Low	Low	Low	High	High by 2020; very high by 2050
C		Somewhat	Somewhat	Somewhat	Somewhat	Somewhat	Somewhat	Some by 2020; high by 2050
D		Low	Low	High	High	High	Low	Low by 2020; some by 2050
E = worst		None to minor	None to minor	Very high	Very high	Very high	None to minor	Minor by 2020; low by 2050

Gaps & Barriers

Workshop Objectives:

- Focus on **promising** technology options
- Define principal
 - knowledge & technology gaps and
 - implementation barriers
- Develop recommendations to address gaps and barriers
- Define role for Engineering Societies

What's "promising?"



Source: T. Houser, Copenhagen, the Accord, and the Way Forward, *Peter G. Peterson Institute for International Economics*, March 2010

Electric Power

2020

2050

Natural Gas (w/o CCS)

Resource availability, access, transport to market
Environmental/water issues for shale gas

GHG emissions

Coal with CCS

RD&D, public acceptance
Regulatory (permitting, liability)

Cost, storage capacity and leakage risk
Pipeline infrastructure

Wind

Geographic location, grid infrastructure and storage
Environmental issues, esthetic acceptance

Higher efficiency
Off-shore wind cost and characterization

Solar (PV and thermal)

R&D for cost reduction, efficiency

Materials availability & recycling
Grid infrastructure and storage

Nuclear life extension

Permitting

Nuclear: On-site expansion

Capital cost and financing
Workforce and supply chain

New Nuclear – Gen IV

Gen IV R&D, fuel availability
Waste, proliferation

Observations

Addressing the gaps and barriers requires solutions spanning technology, regulation, and policy

Public and decision makers' expectations of the pace and scale of technology change are much higher than can realistically be achieved given the current state of technology, regulation and policy

GHG Measurement Thrusts

Early Adopter Experiences

- Continue to document experiences, gaps and obstacles early adopters see across industry sectors

Direct Measurements

- To identify methods, best practices, and standards to enable an organization (i.e., regulated community) to transparently, accurately, consistently, comparably, completely, and directly measure GHG emissions

GHG Measurement Protocols

- Identify the key GHG measurement provide a comparative assessment of their optimal application and to enable comparative calculations
- Outcomes: Assessment Report, “Web Comparator”

New Starts

CCS Network

Metrics & Boundaries

Adaptation

Carbon Management Conference

Bottom Lines

