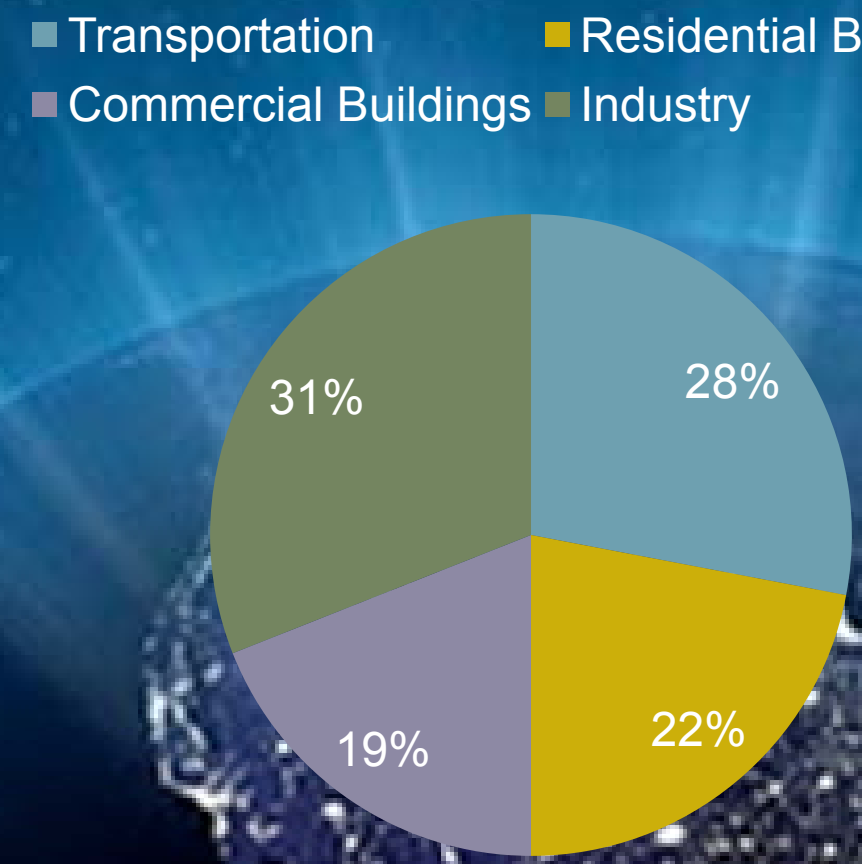
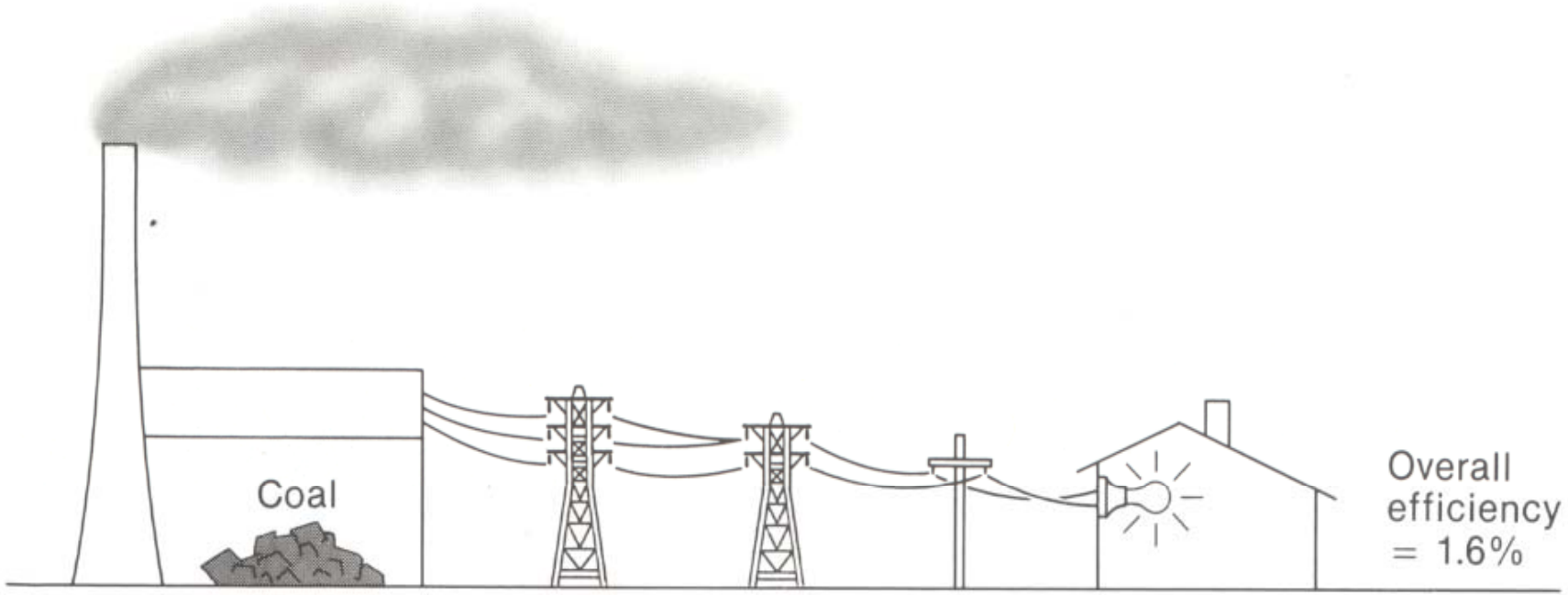
Glenn E. Schweitzer

- Framework for U.S. Energy Efficiency Programs
- U.S. Goals/Policies
- Government Programs to Stimulate Energy Efficiency
- Frontier Research Supported by U.S. Government

Energy Use in United States



Example of Potential for Energy Efficiency



Overall efficiency for chemical energy to light energy conversion.

$$= E_1 \times E_2 \times E_3$$
$$= 0.35 \times 0.90 \times 0.05 = 0.016$$

Challenges in Introducing Energy Efficiency

- General
  - Energy needs big and expensive systems
  - Energy systems are privately owned
  - Energy systems governed by economics, modulated by government
- Reducing Demand
  - Many interested parties
  - Users demand benefits: economics, convenience, personal requirements
  - Price, standards, personal behavior important
  - Little attention is given to system optimization
- Supply
  - Few centralized facilities with distribution networks
  - Supply changes require decades
  - Power and fuels have thin profit margins
  - Government regulation of markets
  - Requirements for transportation and for stationary facilities are separate problems

Barriers to Energy Efficiency

- Pricing not determined by availability
- Lack of information
- Landlord-tenant and builder-buyer relationships affect cost sharing
- Additional demand must offset lower cost
- Poor installation
- Lack of access to credit
- Efficiency upgrades seldom increase value of buildings

Major Conclusions of Analyses of Energy Situation in United States

- Consider both higher energy prices and policy measures, which could save up to 30% of energy usage.
- Emphasize energy-efficient technologies in buildings where savings could be greatest.
- Incorporate energy-efficient design and construction in new buildings and major subsystems.
- Encourage sustained public and private support to overcome formidable barriers to energy efficiency.

Overarching U.S. Goals

- Reduce energy-related greenhouse gases from 2005 levels by
  - 17% by 2020
  - 82% by 2050
- Reduce petroleum consumption from current levels by
  - 18% by 2020

Reducing Energy Use by 35 Quads per Year by 2030 (30% Reduction)

Buildings (electrical heating)	
Residential	6.4 Quads
Commercial	8.0
Buildings (gas heating)	
Residential	1.5
Commercial	1.5
Transportation (cars and light duty trucks)	10.7
Industry	7.7
Aviation	--
Heavy Trucks	--

Examples of Strategies to Reach Goals

- Stationary sources
  - Increase clean energy to 80% by 2040: solar, wind, nuclear, clean coal
  - Modernize the grid: power electronics
  - Increase efficiency of appliances, CHP, HVAC
  - Make commercial building space 20% more energy-efficient
  - Reduce company energy bills by $40 billion per year
- Mobile sources
  - Alternative fuels: biofuels
  - Progressive electrification: batteries
  - Vehicle efficiency: light weight, ICE efficiency

Examples of Steps towards Clean Energy

- Deploy existing technologies
  - Establish six appliance standards per year beginning in 2012
  - Double renewable energy generation: 2012
  - Retrofit one million homes: 2013
  - One million electric vehicles on road, including 500,000 plug-in hybrids: 2015
- Discover New Solutions
  - Validate two carbon capture geological reservoirs: 2014
  - Complete two natural technology user facilities: 2015
  - Certify design of small modular nuclear reactor: 2016
  - Facilitate five commercial-scale carbon capture demonstrations: 2016
- Lead Broad National Efforts
  - Reduce Dept. of Energy emissions by 28%: 2020
  - Promote energy literacy and sustainability
  - Provide sound information for industry and population

Economic Stimulus Program (2009)

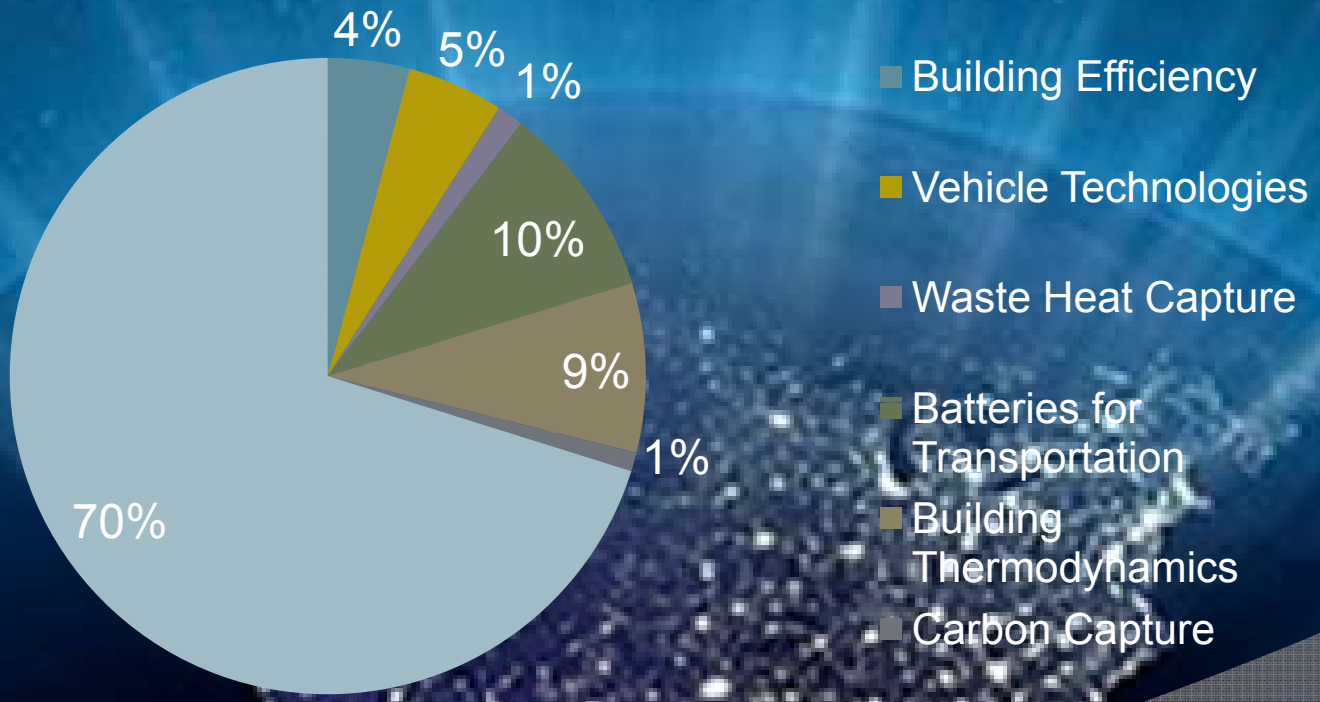
- Improved Energy Efficiency within Government Facilities
- Purchase of Fuel-Efficient Vehicles by Local Governments
- Expanded Public Transportation
  - High Speed Rail
  - City Transit Systems
- Replacement of Inefficient Consumer Appliances
- Weatherization of Buildings
- Expanded Research
  - Smart Grids
  - Batteries

Budget Priorities of U.S. Department of Energy (2012), Highest to Lowest

1. Vehicles
2. Buildings
3. Solar
4. Weatherization
5. Biomass
6. Industrial
7. Wind Geothermal
8. Fuel Cells

Energy Efficiency Research Funding

Total Energy Research Funding: $400 million
Energy Efficiency Funding: $104 million



Examples of Energy Efficiency Research Projects

- Round 1: $151 million budget
  - Large-Scale Energy Reductions through Sensors, Feedback, & Information Technology
  - High Energy Permanent Magnets for Hybrid Vehicles and Alternative Energy
  - Carbon Nanotube Membranes for Energy-Efficient Carbon Sequestration
- Round 2: $106 million budget
  - Batteries for Electrical Energy Storage in Transportation
    - $35,000,000 allocated to 10 projects
- Round 3: $92 million budget
  - Building Energy Efficiency through Innovative Thermodevices
    - $30,000,000 allocated to 16 projects

Energy Consumption

	Total Energy Consumption (Quads)	Per Capita Consumption (Million BTU)	Energy Intensity (BTU/US $)
Russia	30	214	81,000
United States	100	335	9,000
North Carolina	3	300	7,000
World	470	72	12,000