Perverse Incentives:
The Untold Story of Federal Subsidies to Fossil Fuels

Environmental Law Institute
Woodrow Wilson International Center for Scholars

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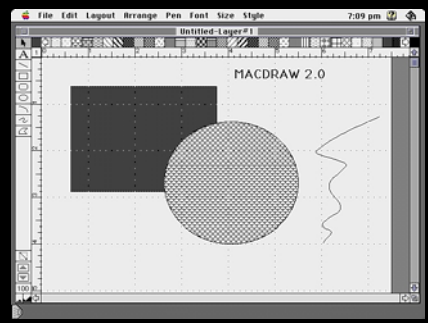
Principles (Then and Now)

As far as possible, analyze and show the entire system

Be clear about assumptions, system boundaries, what is in/what is out, and sources of uncertainty.

Show relative proportions, order of magnitude differences (don’t get lost in the weeds).

Focus on the numbers, not the politics.



UNITED STATES ENERGY SYSTEM

David Bassett. DRAFT. Dec.10.90
Pollution Prevention Division

all items are to scale
Revised 3.22.91; 2.3.92

EMERGING SUPPLY OPTIONS [3]

SOLAR THERMAL | SOLAR PHOTOVOLTAIC | WIND | GEOTHERMAL | BIOMASS | OCEAN-THERMAL | LOW-HEAD HYDRO | METHANE FROM LANDFILLS [8] | OTHER

Electricity Imports 0.4 Q

0.1 Q | <0.01 Q | 0.03 Q | 0.36 Q | 3.2 Q | <0.01 Q | 0.06 Q low-head, 2.8 Q hydro-electric | 1 Q

(e) 1.2 (th) | 6.7 | 10.7 | 3.7 (e), 1.6 (th) | 19.1Q | 5.1 Q

CURRENT PRIMARY ENERGY CONSUMPTION [3]

Coal 19 Q | Oil 34 Q | Natural Gas 18.5 Q | Hydro-electric 2.8 Q | Nuclear 5.6 Q

Notes & References:

1. National Air Pollution Emission Estimates, 1940-1987, 1989. EPA
2. Environmental Trends, 1989. CEQ
3. 1990 Annual Energy Outlook, DOE
4. 1991 National Energy Strategy, DOE
5. Peter Blair, OTA, 1991
6. Paul MacCready, AeroVironment, 1991
7. "Road Vehicles", TRW/US ERDA, 1977
8. EPA to require collection only (ORD)

TRANSPORTATION — 22.2 Q

IC Engines

- 3 Q JET ENGINES
- 3 Q IDLING - TRAFFIC JAMS
- 9.8 Q WASTE HEAT
- 2.4 Q ENGINE FRICTION, ACCESSORIES
- 0.8 Q DRIVELINE FRICTION
- 1.6 Q AERODYNAMIC DRAG

1.6Q USEFUL WORK
(dissapated as brake heat)

INDUSTRIAL — 19.4 Q

84.3 Quads (1989)

- 3 Q WASTE HEAT (combustion)
- 5 Q PROCESS STEAM (est)
- 4 Q PLANT HEATING, SPACE CONDITIONING (est)
- 4 Q SPILLS, LUBRICANTS SOLVENTS (est)
- 3.4 Q PRODUCTS (est)

ELECTRICITY — 29.14 Q

- 19.4 Q WASTE HEAT
- 0.8 Q TRANSMISSION LINE LOSS
- 8.9 Q Electricity
- 0.01 Q Transportation
- 3.1 Q INDUSTRIAL
- 5.8 Q BUILDINGS
- 2.8 Q COMMERCIAL
- 3.0 Q RESIDENTIAL

BUILDINGS — 10.6 Q

- 3 Q WASTE HEAT (est.) (combustion)
- 5 Q SPACE HEATING (est.)
  - loss through glass
  - loss through walls, ceilings
  - loss via infiltration
  - loss via radiation
- 1.5 Q WATER HEATING (est.)
- 0.6 Q OTHER (est.)
- 0.5 Q DISTRIBUTION LOSSES (est.)
  - loss via gas pipeline
  - loss via spills, oil pipeline

SHELTER, COMFORT

- 1 Q MOTORS, DRIVES, CONTROLS
- 1.2 Q LIGHTING
- 0.9 Q REFRIGERATION, A/C
- 0.95 Q A/C, REFRIGERATION, FREEZERS, VENTILATION
- 0.65 Q APPLIANCES, PLUG LOAD
- 1.2 Q LIGHTING
- 1.5 Q A/C, REFRIGERATION, FREEZERS
- 1.1 Q APPLIANCES
- 0.4 Q LIGHTING

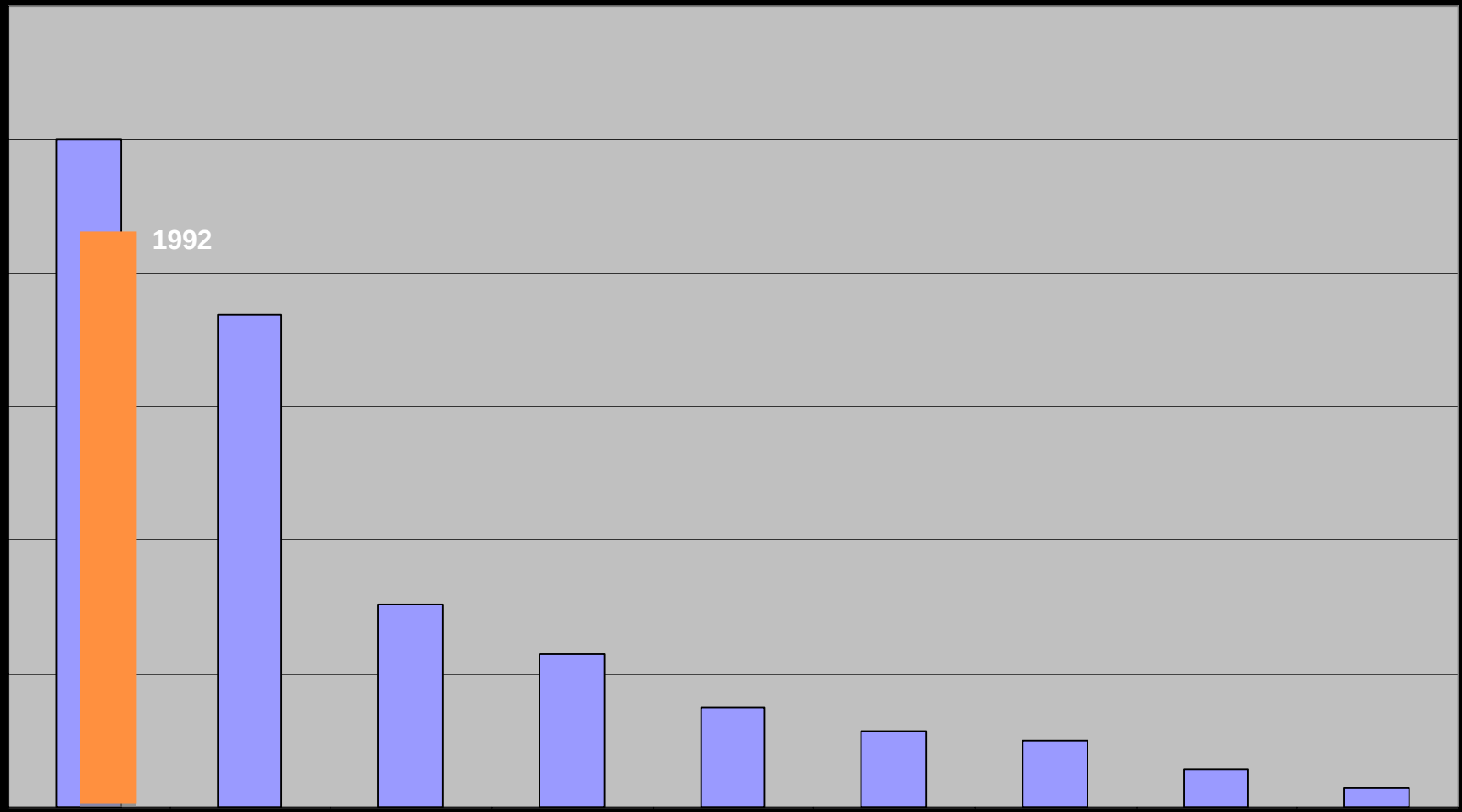
ENERGY SERVICES

MOBILITY, ACCESS | COMMODITIES, PRODUCTS | LIGHTING, HEATING, COOLING, INCREASING PRODUCTIVITY

prevention

FUTURES

International Annual Energy Consumption



Source: Energy Information Agency, International Energy Annual, 2006

Energy Flows in the United States - 2007

in Quadrillion British Thermal Units (Quads or 10^{15} Btu)

Created by David A. Bassett
Funded by David Rejeski
Woodrow Wilson International Center &
The Environmental Law Institute

Scale: 1 Quad = 0.1 inch
0.5 inch = 5 Quads 5.0
1 inch = 10 Quads 10.0

UNTAPPED POTENTIAL and EMERGING TECHNOLOGIES

Ocean-thermal; Tidal; Waves; Energy Storage; Hydrogen, etc.
MSW & Industrial Waste 11+ 0.01
Biomass 20+ 11 3.6
Geothermal 250+ 1.4 2.8 0.4
Solar-Electric Solar-Thermal 80+ 0.1
Conventional & Low-Head Hydro 5.1 2.5
Wind-Electric 3 16-17 27 36 41 0.3

Supply-Side Key: Coal; Petroleum; Natural Gas; Nuclear; Renewables

Fuel Types: Coal 22.77 Q (137 years) | Petroleum 39.82 Q (37-43 years) | Natural Gas 23.64 Q (59-61 years) | Nuclear 8.41 Q | Renewables 6.83 Q
ACTUAL: 2007 Energy Consumption 101.6 Q
Economic Sectors: Transportation 29.1 Q (0.7; 0.5; 1.5) | Industrial 32.32 Q | Commercial 18.43 Q (0.6 0.1) | Residential 21.75 Q (1.6 0.6)
Fuel Mix: 27.4 Q | 9.7 Q | 8.0 Q | 2 | 3.1 | 4.8

Consumption 101.6 Q

Transportation 29.1 Q

- 0.64 Pipelines
- 0.9 Marine
- 3.4 Aviation
- 0.5 IC Engine Idling, Traffic jams
- 14 IC Engine Waste Heat - Conversion from Chemical to Mechanical Energy
- 3.5 Engine Friction & Accessories
- 1.2 Driveline & Rolling Resistance
- 2.3 Aerodynamic Drag
- 2.3 Useful Work / Brake Heat

IC Engines

Industrial 32.32 Q

Primary Fuel 28.9 Q | 3.1 | 3.4 CHP

- Refining & Products 3.4
- Chemicals 2.6
- Paper 2.2
- Primary Metals 1.6
- Food 1.2
- Minerals 1
- Transportation Equipment 0.4
- Wood Products 0.4
- Plastics & Rubber 0.3
- All Other Manufacturing 1.3

8.2 Feedstocks
6 Steam
3.8 Facility Heating & Cooling
3.2 Waste heat (est.) -losses due to heat in flue gas, radiation, convection, conduction

0.66 "Nega-Watts" saved and combustion avoided through Energy Efficiency
1.6 Machine Drives
0.9 HVAC & Lighting 0.9
0.3 Electro-chemical Process 0.3
0.6 Process Support & misc. 0.6

Electricity 42.1Q

21.11 Q | 7.046 Q | 8.41 Q | 3.92
0.56

27.15 currently "Waste" Heat Conversion from Chemical to Electrical Energy

- 0.75 Powerplant Use
- 1.34 T&D Losses
- 0.5 Direct Use

3.43
4.75
4.6

4.6 Q - Electricity Use in Commercial Buildings
4.75 Q - Electricity Use in Residential Buildings

(Note: "Vampire losses" distributed below)
- Space Heating 0.2-0.4
- Lighting 0.14
- Cooling & Ventilation 1.3
- Refrigeration 0.7
- Office Equipment & Computers 0.23
- Cooking 0.63
- Water Heating 0.04
- Other & misc. 0.16 1.4

Buildings 18.9 Q

Commercial 4.6 | Residential 2.9 | 6.6 | 4.75

- Space Heating 1.5 4.75 Space Heating
- Water Heating 0.6 1.3 Water Heating
- Cooking 0.2 0.25 Cooking
- 0.1 Clothes Dryers
- Other 0.7 0.2 Other
- "Nega-Watts" saved and combustion avoided through Energy Efficiency 0.25 0.33 "Nega-Watts" saved and combustion avoided through Energy Efficiency

(Note: "Vampire losses" distributed below) 0.2-0.4
- 0.3 Space Heating
- 0.8 Lighting
- 0.8 Air Conditioning
- 0.5 Refrigeration & Freezers
- 0.1 Cooking
- 0.4 Water Heating
- 0.3 Clothes Dryers & Washers
- 0.35 Plug Load-TV, boxes
- 0.1 Plug Load - computers & printers
- 1.1 Other & misc.

June 7, 2009

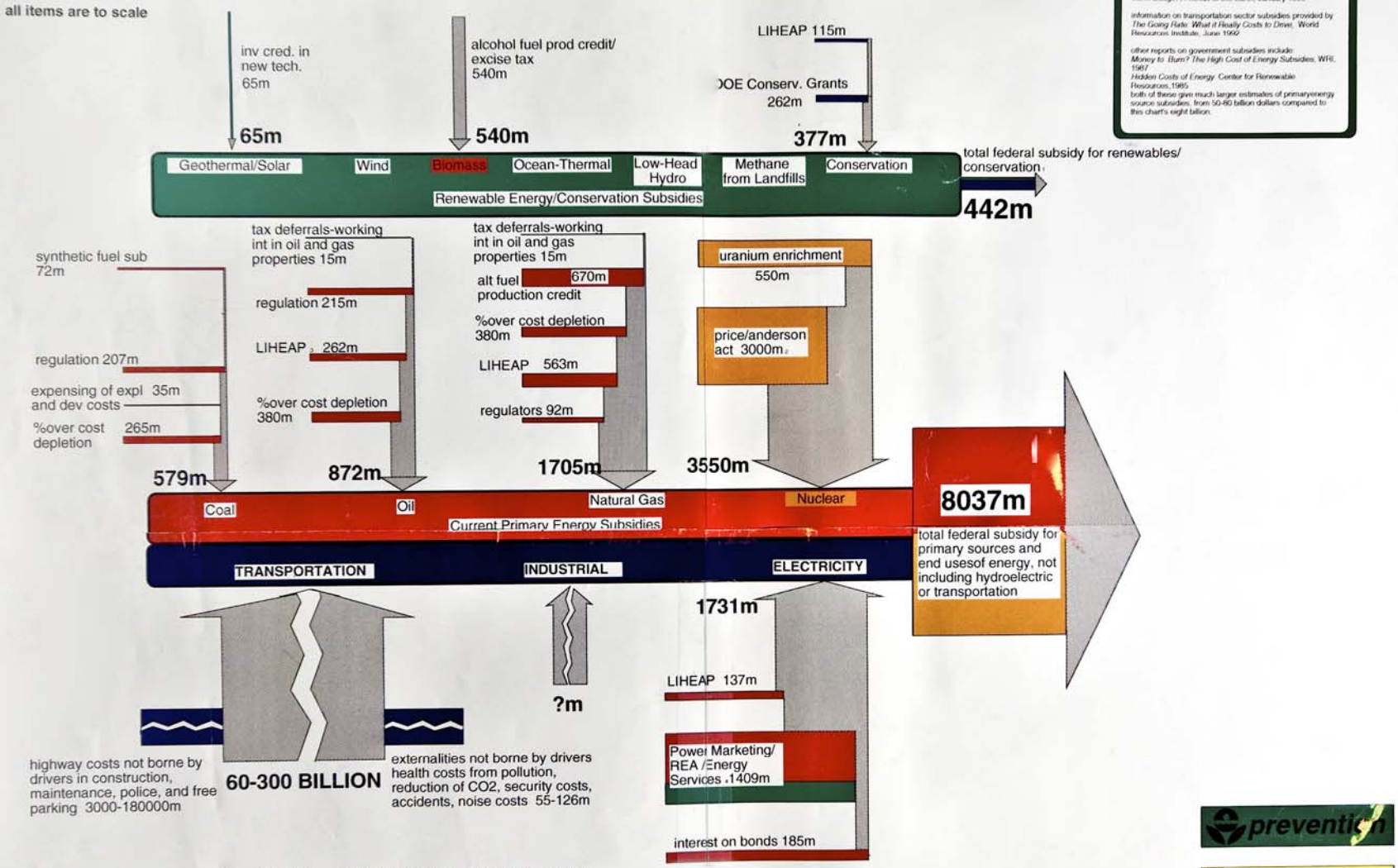
FEDERAL TAX AND DIRECT EXPENDITURES 1992, ENERGY SECTOR

all items are to scale

information on federal studies provided by *Federal Energy Subsidies: Direct and Indirect Interventions in Energy Markets*. Energy Information Administraion, Nov 1992 and
Earth Budget, Friends of the Earth, January 1993

information on transportation sector subsidies provided by *The Going Rate: What it Really Costs to Drive*, World Resources Institute, June 1992

other reports on government subsidies include:
Money to Burn? The High Cost of Energy Subsidies, WRI, 1987
Hidden Costs of Energy, Center for Renewable Resources,1985
both of these give much larger estimates of primaryenergy source subsidies, from 50-80 billion dollars compared to this chart's eight billion.



1 The biomass subsidy is not considered a renewable subsidy. It is actually a production credit for alcohol fuels, given to distributors who blend at least 10% alcohol with motor fuels. The "gasohol" created from this subsidy is largely petroleum, and thus is not a renewable fuel.

*information on specific taxes and subsidies can be found in *Federal Energy Subsidies* published by the EIA write: Energy Information Administration
U.S. Department of Energy
Washington, D.C. 20585

2 Price-Anderson Act of 1959 reduces liability for utilities as of 1988 to 7billion dollars in case of an accident. Dubin and Rothwell(1990) estimated subsidy tobe 3 billion annually in avoided insurance costs. There are many other nuclear subsidies not included in the chart, including future decomissioning and waste disposal costs, which could add billions to the nuclear subsidy total.

3 Low Income Housing Energy Assistance Program, provides utility bill and weatherization assistance to 5.8 million low-income households.

*4 DOE operates 123 hydropower plants below cost giving hydro $400m of this subsidy (Earth Budget)

prevention

FUTURES

Subsidy Analysis

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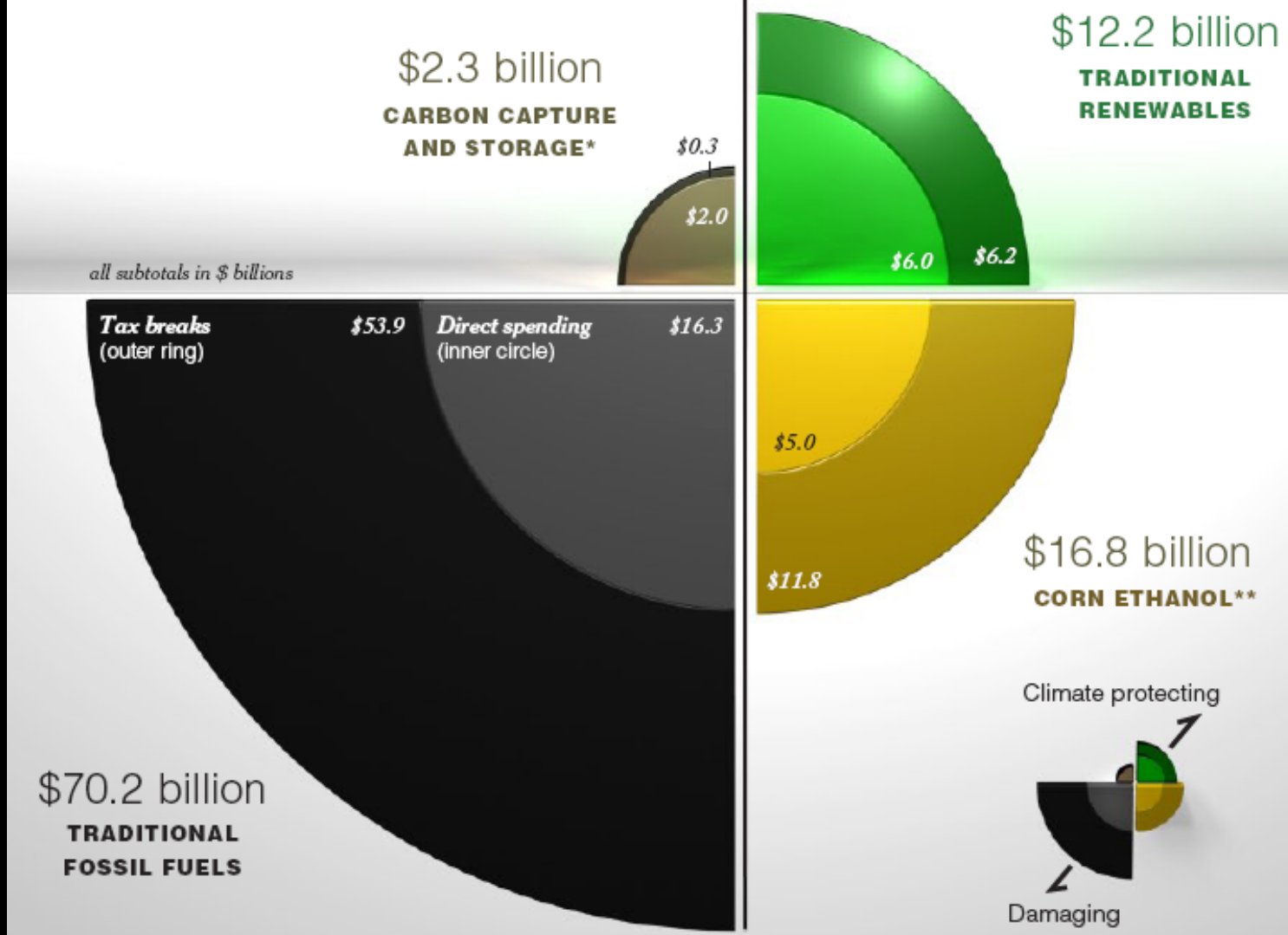
Federal Subsidies *(2002-08)*

FOSSIL FUELS
$72.5 billion

RENEWABLE ENERGY
$29.0 billion



Subsidies to Fossil Fuels

- Generally increased 2002 – 2007 (slight decline 2008)
- Largest subsidy is preferential treatment of income by the Foreign Tax Credit
  - Subsidizes foreign oil production
  - Permanent provision of tax code
  - Increasing
- Close second is Credit for Production of Non-conventional Fuels
  - Phased out

Subsidies to Renewable Sources

- Many subsidies of renewables have had sunset provisions
- Direct spending exceeded tax breaks 3 of 7 years

Methodology

Defining subsidies

"Actions by the U.S. government that provide an identifiable financial benefit associated with the use or production of a fossil or renewable fuel"

Classifying subsidies

- Fossil Fuels: petroleum, natural gas, coal products
- Renewables: wind, solar, hydropower, ethanol, & geothermal

Measuring Subsidies

- Focus on cost to government rather than value to recipient
- Use absolute numbers rather than unit of production
- Use recent, representative timeframe (FY 2002-2008)
- Offset qualifying taxes, fees, & other levies
- Use most accurate data available (no *de minimis* cut-off)

Qualifications

- Study did not examine how subsidies affect energy production or consumption
- Study did not examine whether subsidies benefit consumers or industry
- Study does not offer normative judgments about subsidies

Excluded from the Study

- Standards
- Regulatory interventions
- Non-fuel-specific subsidies to electricity transmission, distribution, & generation
- Non-specific taxes & other subsidies
- Liability limits
- Energy Efficiency