Industrial Energy and the Iowa Energy Center's Industrial Program

Iowa Energy Center Advisory Council

May 18, 2012

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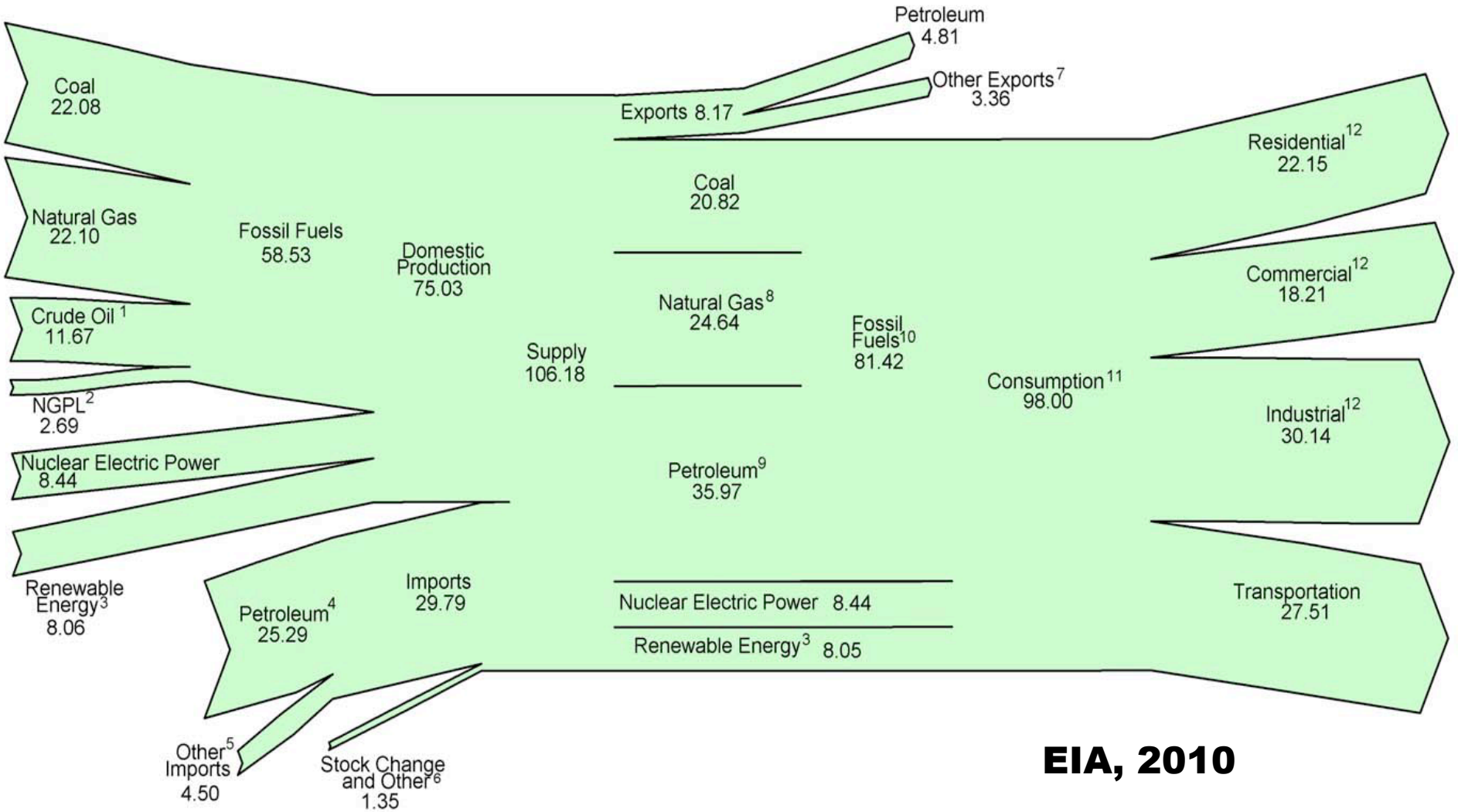
Industrial Programs Manager

Outline of Presentation

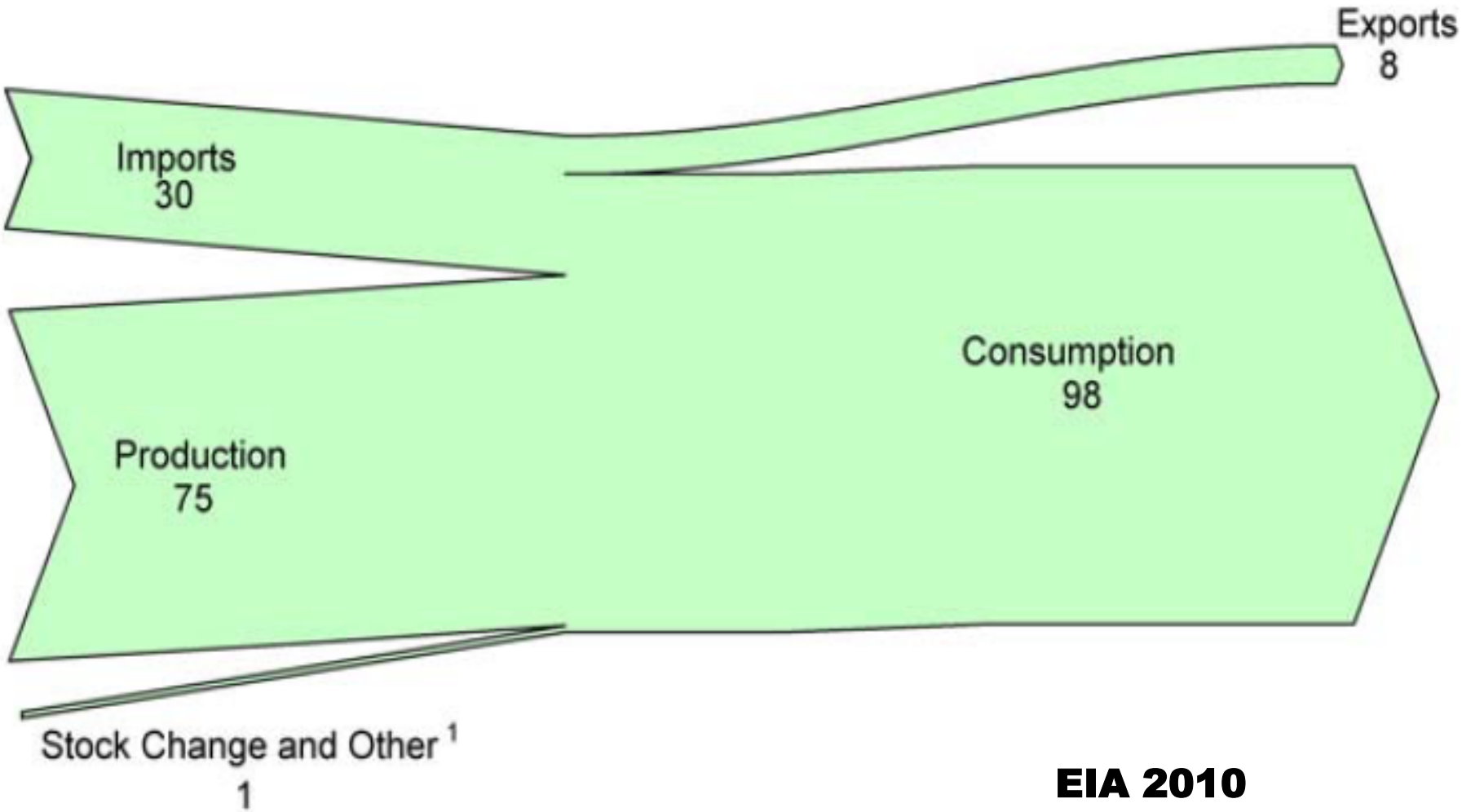
- Introduction to Industrial Energy
- IEC Industrial Program History
- IEC Industrial Program Current

U.S. Energy Flow, Quadrillion Btu



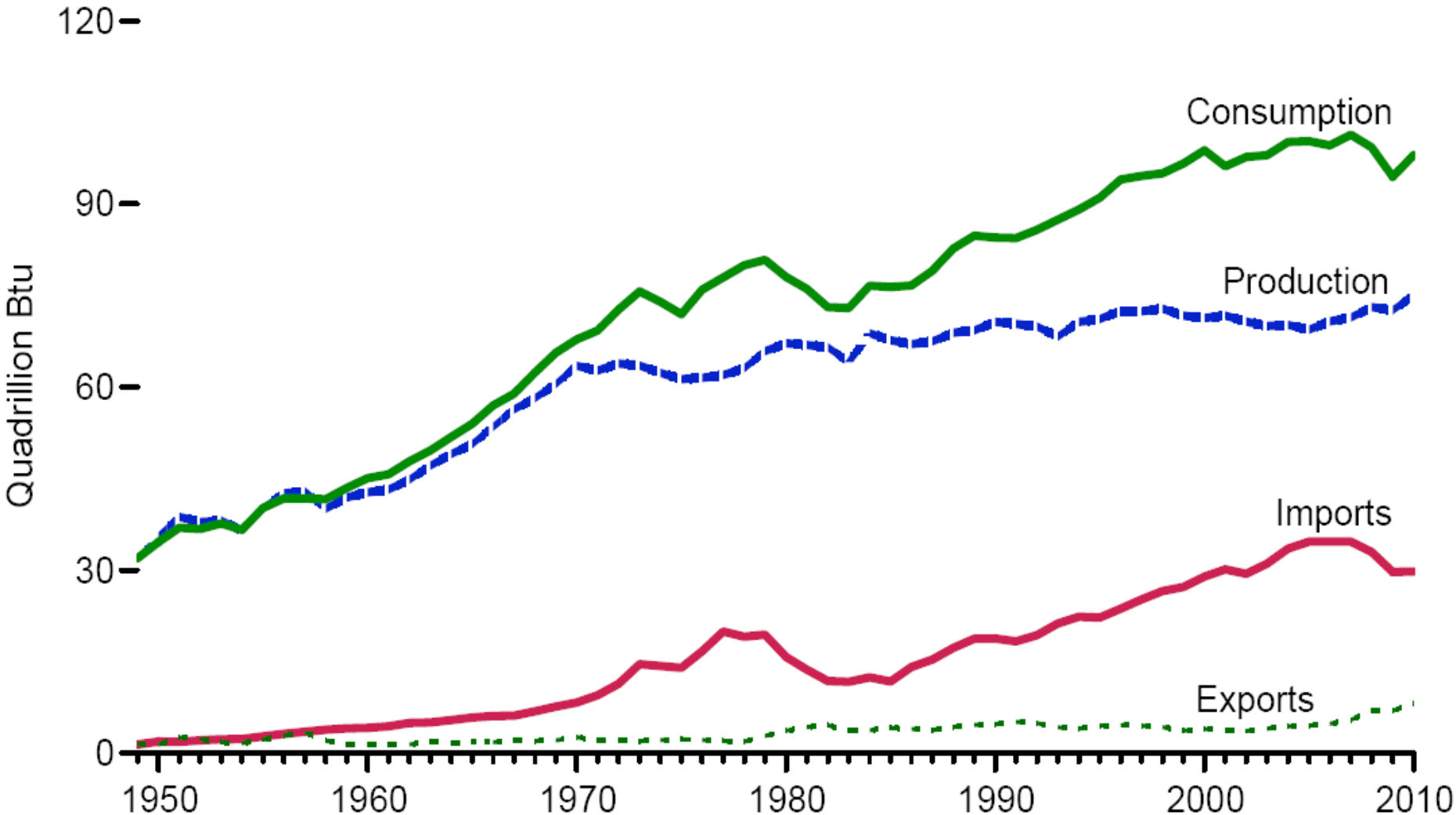
EIA, 2010

U.S. Energy Flow, Quadrillion Btu

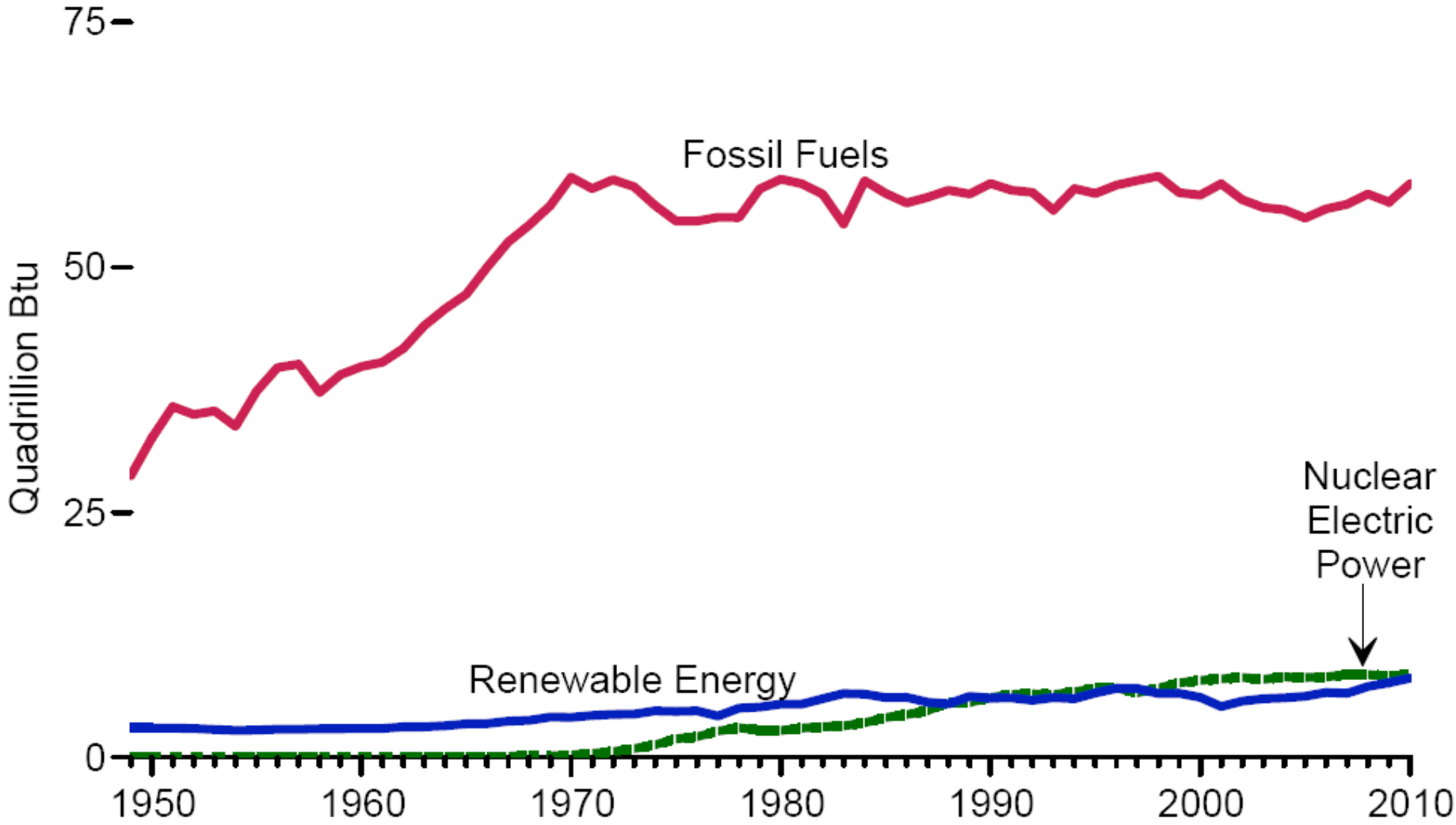


EIA 2010

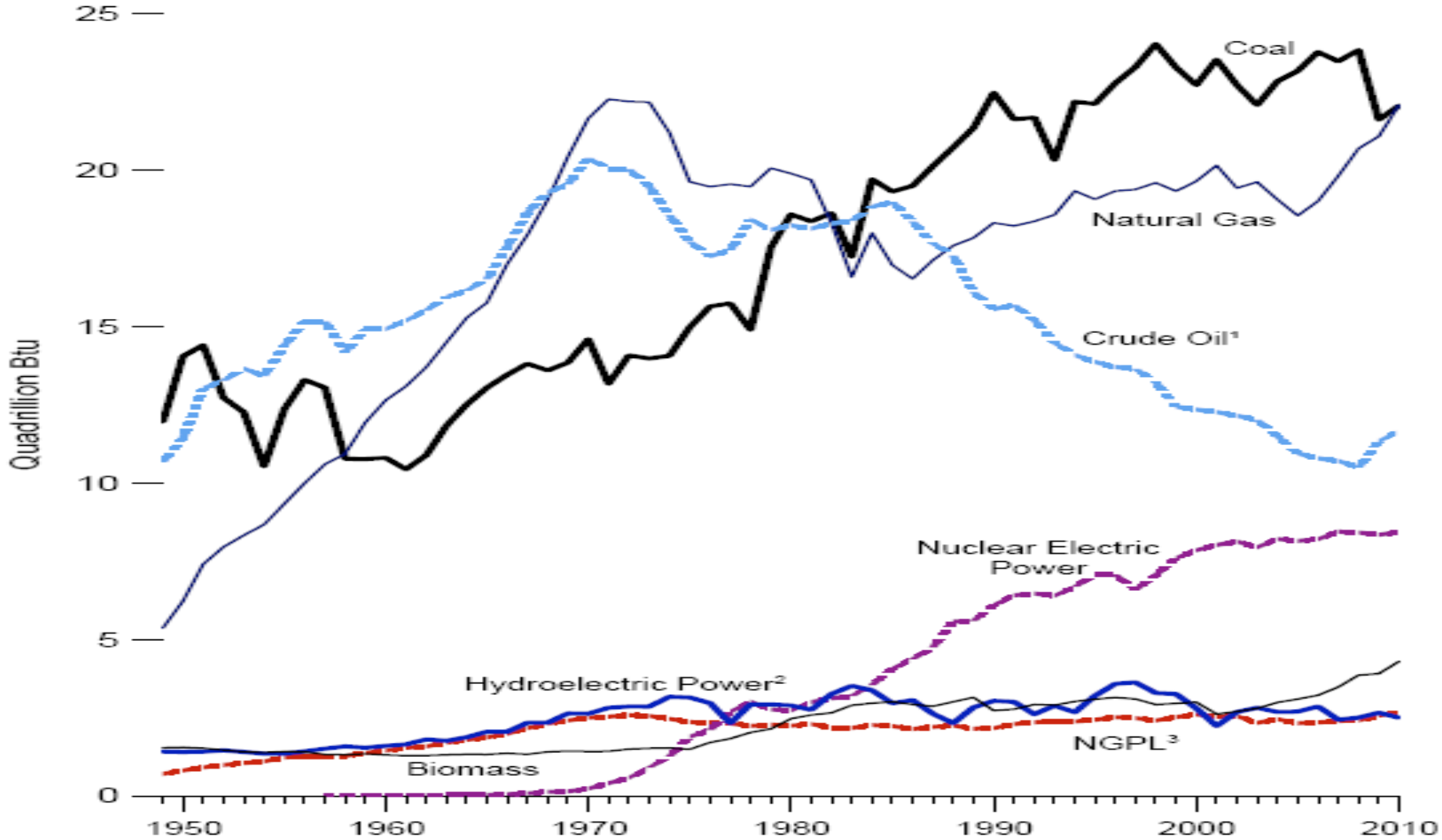
U.S. Energy Overview Trend



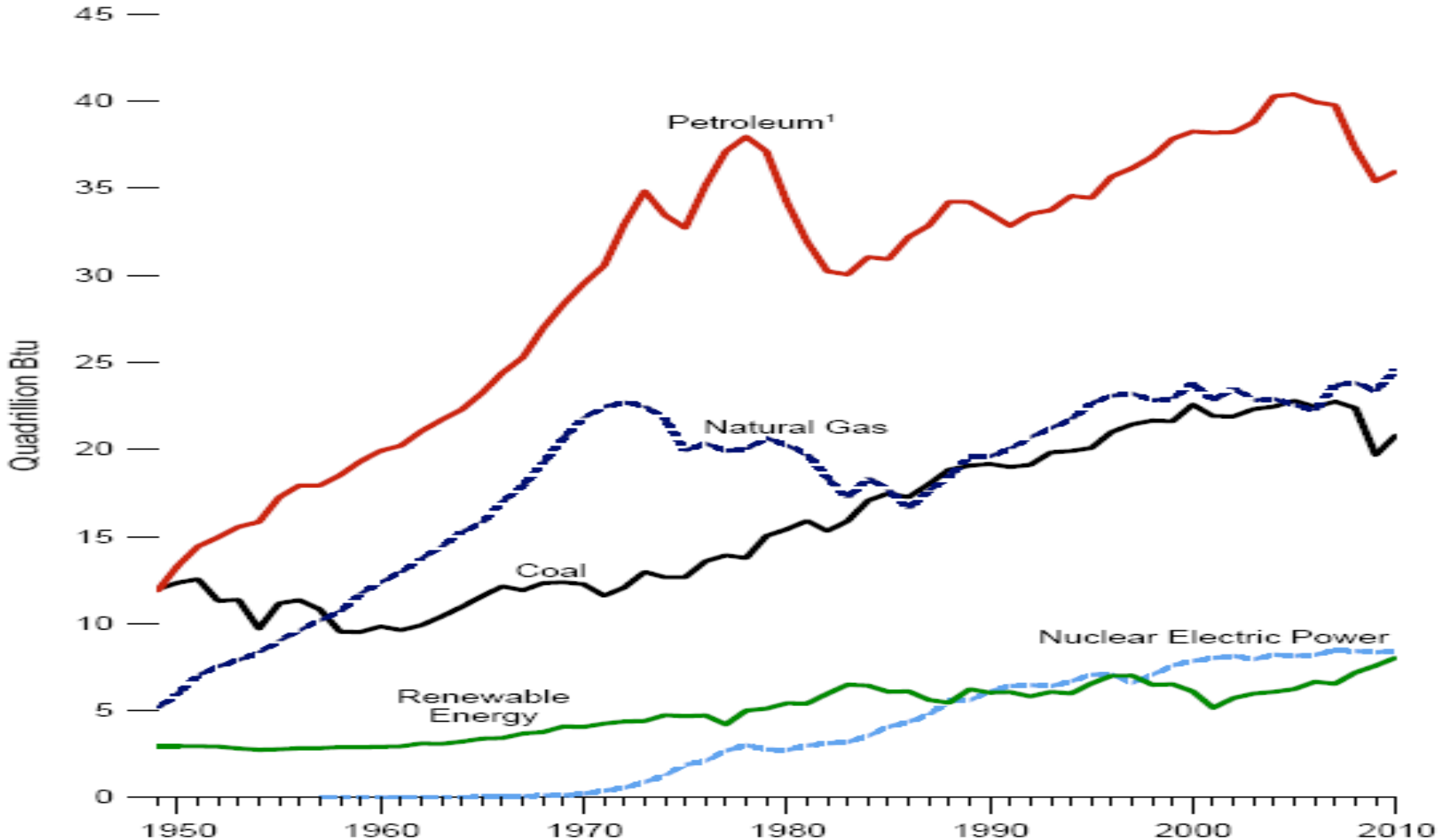
U.S. Energy Production Trend



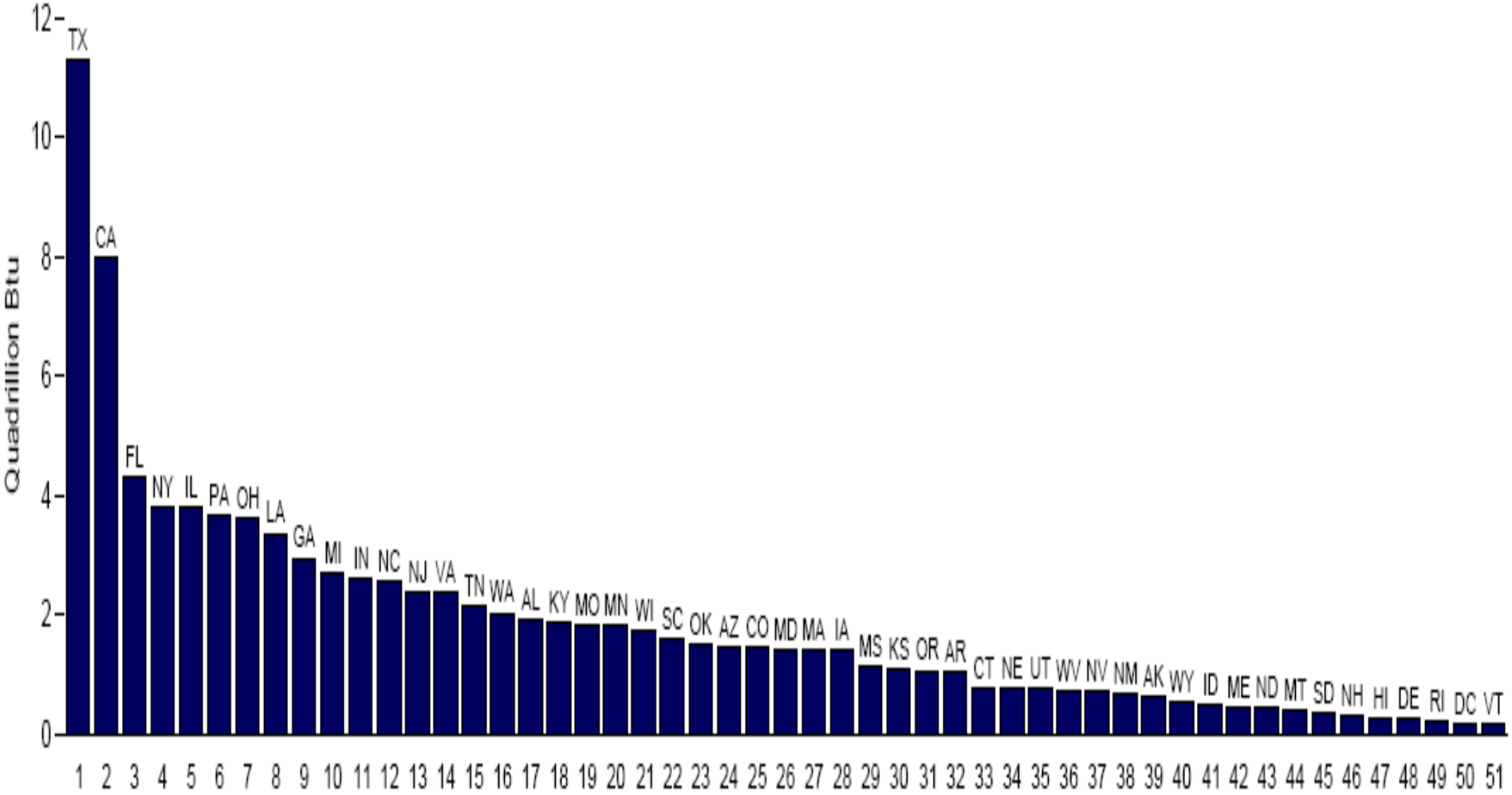
U.S. Energy Production Trend



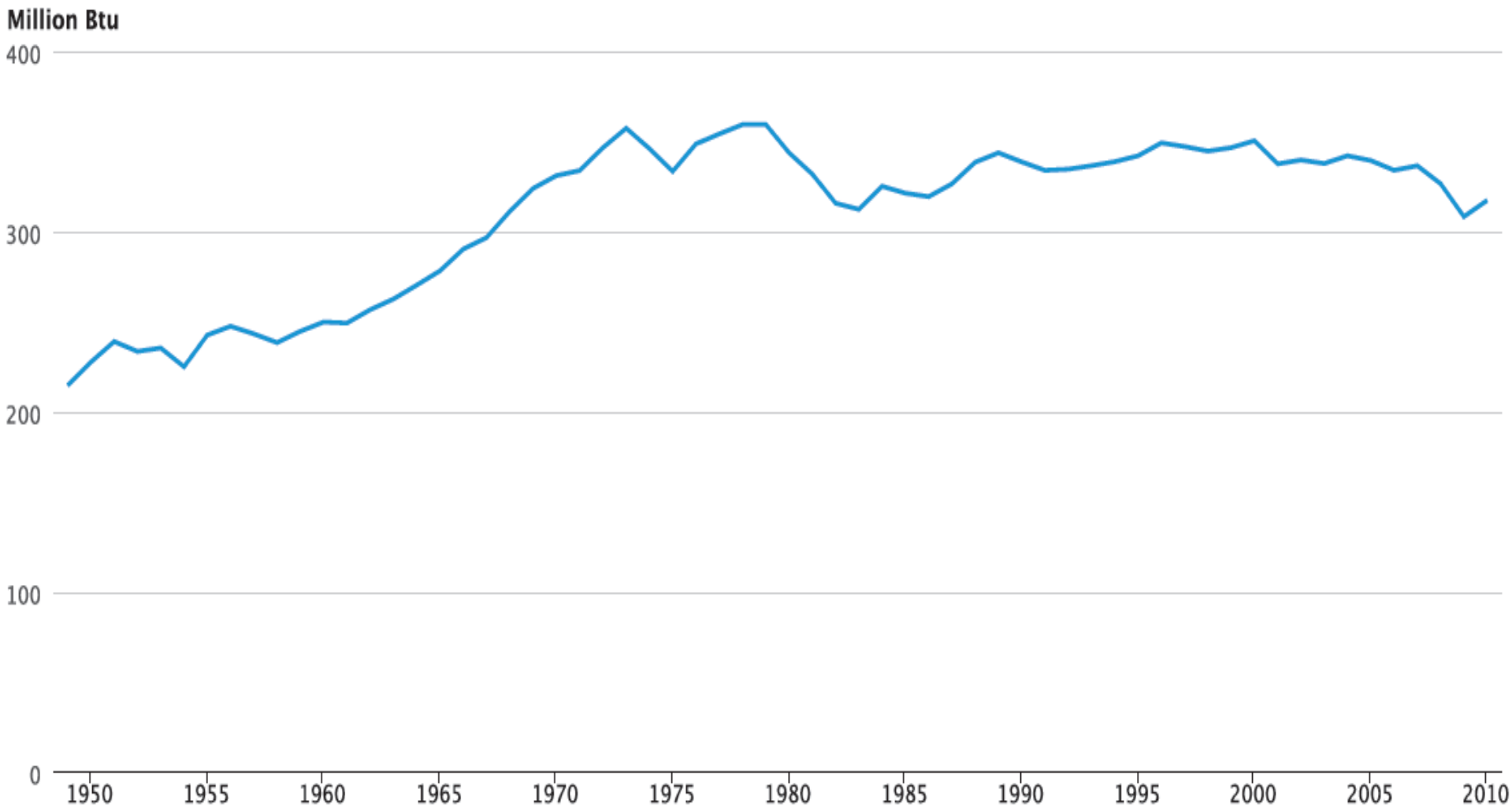
U.S. Energy Consumption Trend



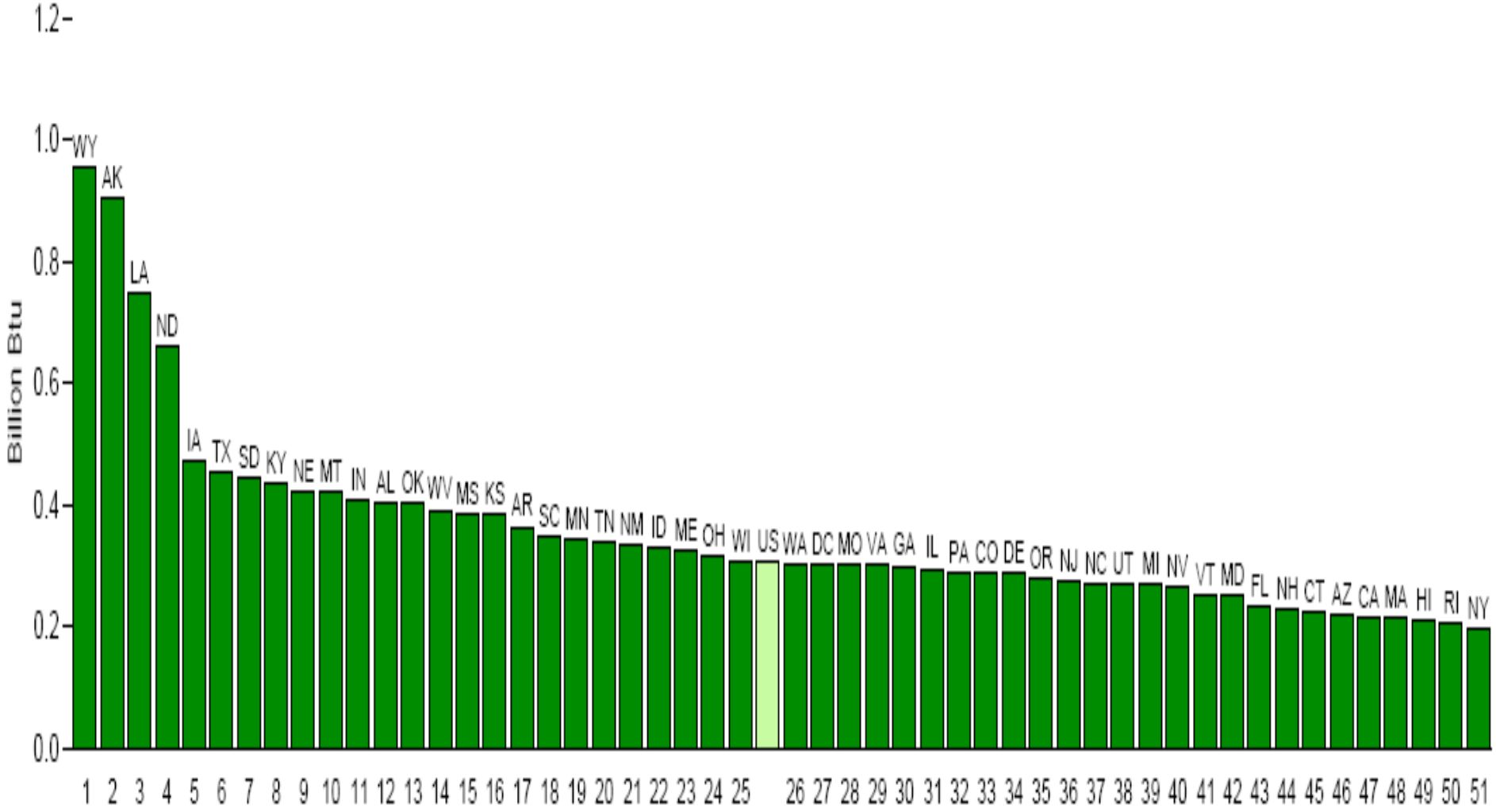
U.S. Consumption by State, EIA 2010



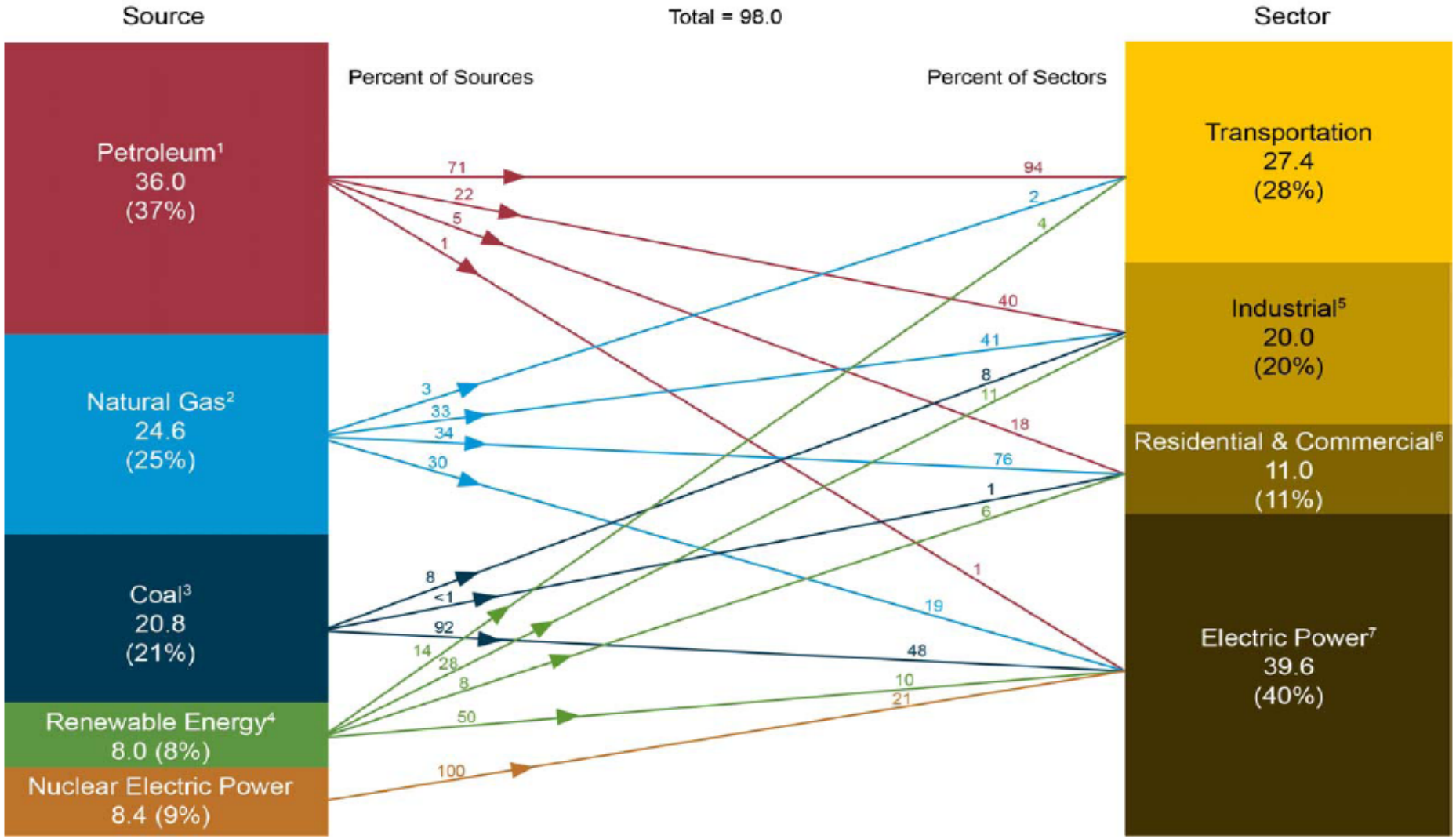
U.S. Consumption Trend per Capital, EIA 2010



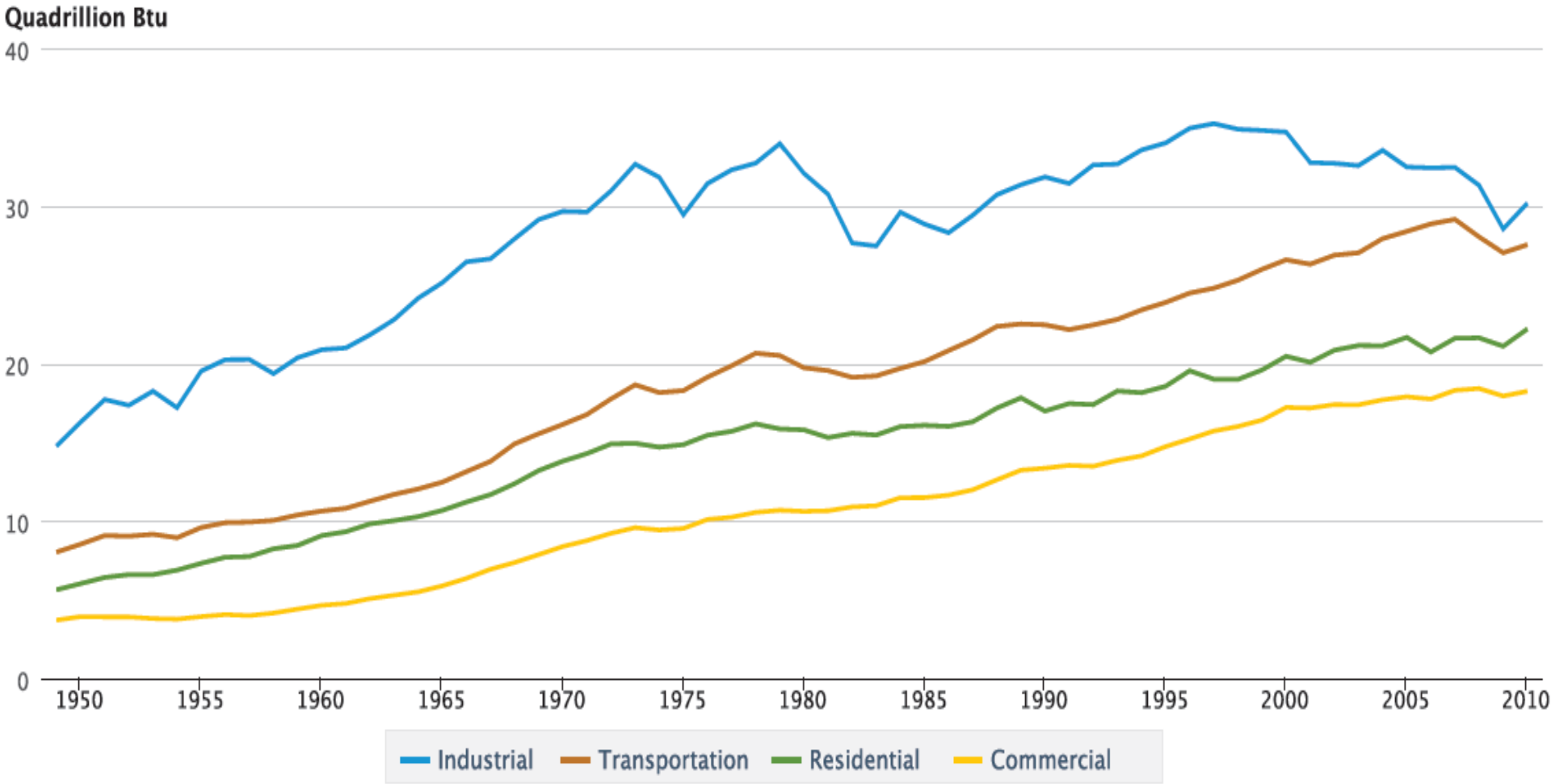
U.S. Consumption by State per Capital, EIA 2010



U.S. Primary Energy Consumption by Source and Sector, EIA 2010, (Quadrillion Btu)

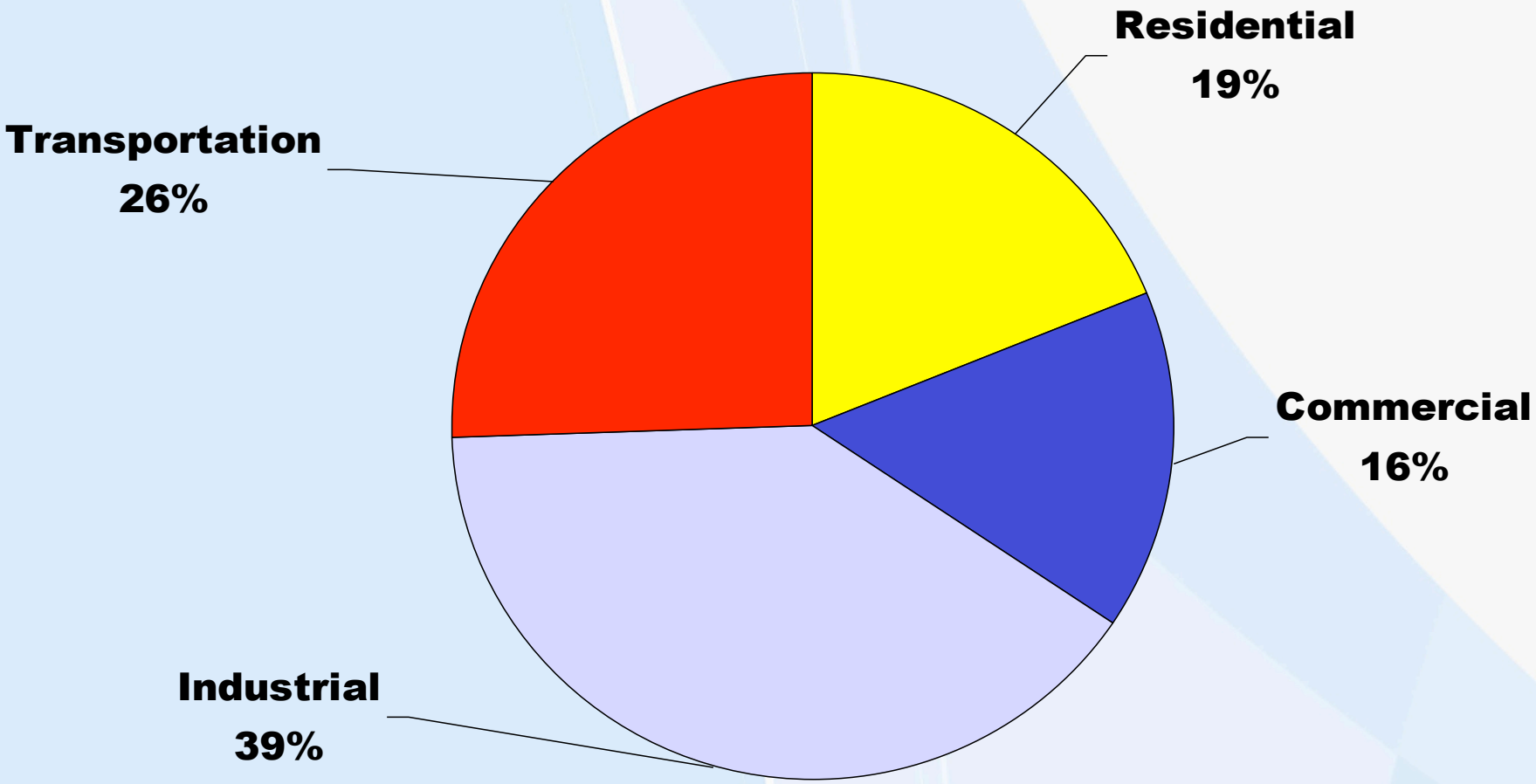


U.S. Energy Consumption Trend by Sector



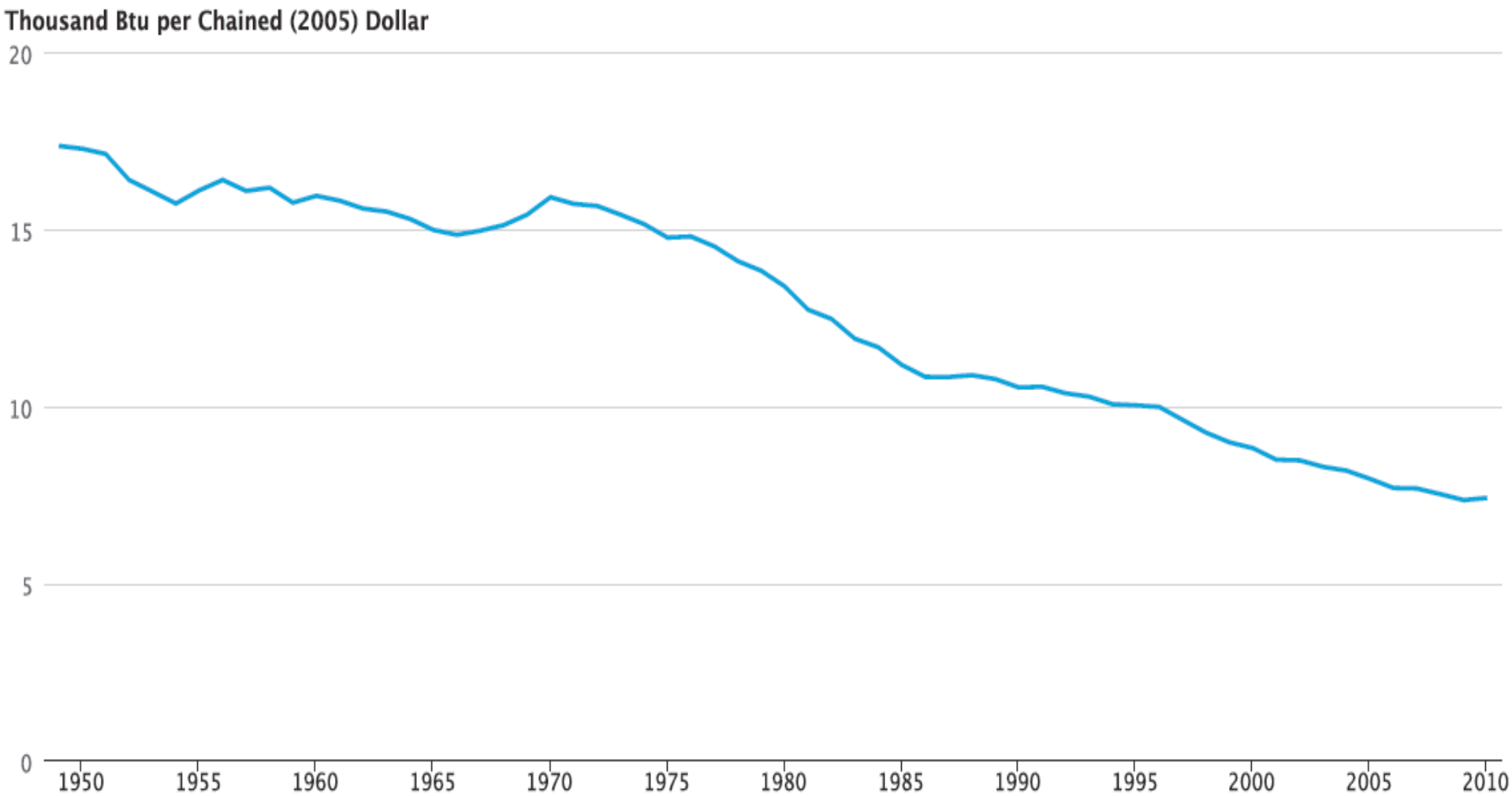
U.S. Energy Information Administration, *Annual Energy Review*, Table 2.1a.

Iowa Energy Consumption by Sector, 2007



EIA, 2009

U.S. Energy Consumption per $ GDP

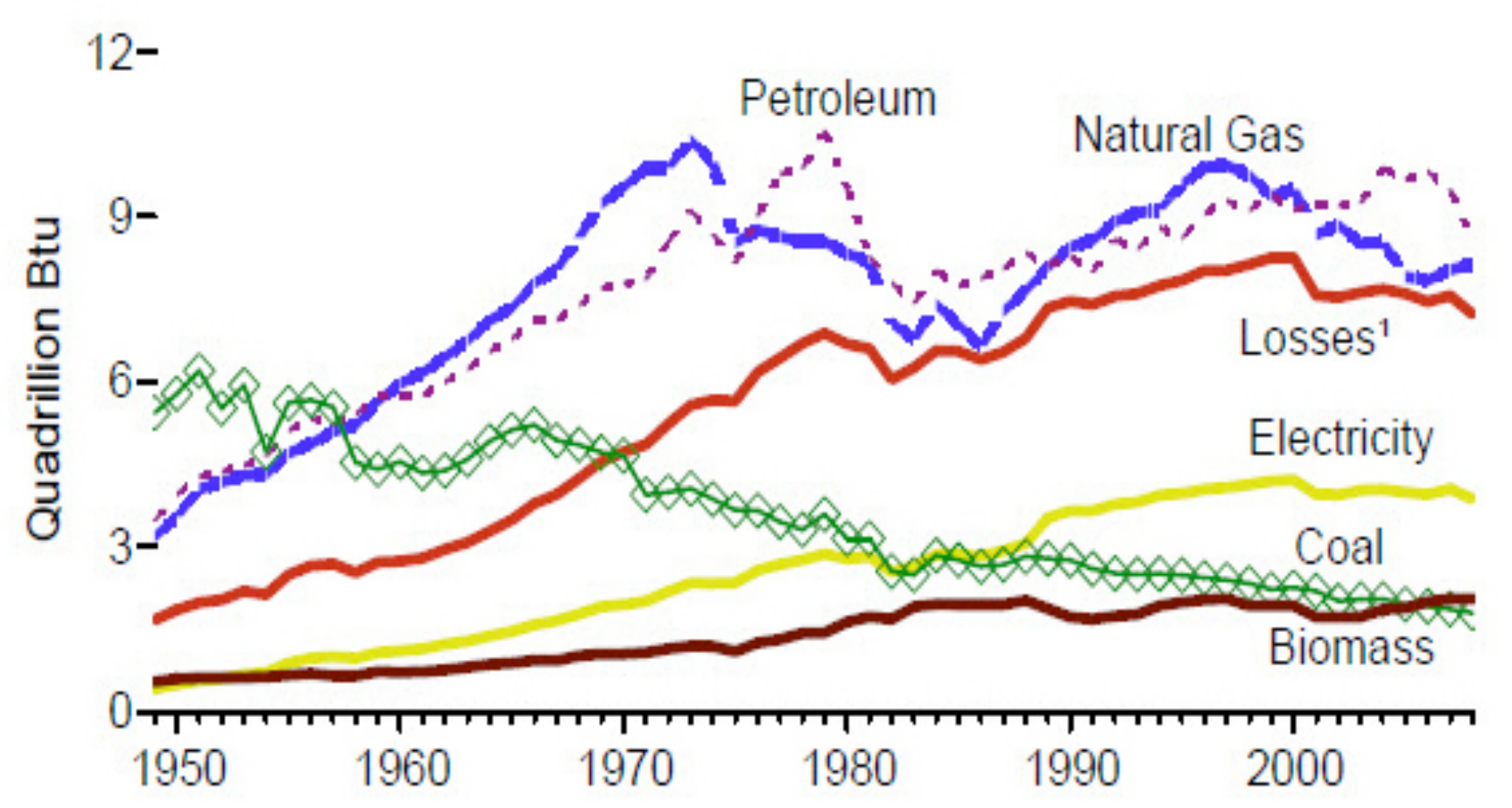


U.S. Energy Information Administration, *Annual Energy Review*, Table 1.5

U.S. Energy Intensive Trends

- On average, U.S industrial sector has decreased their energy consumption almost every year since 1992 while increasing the gross industrial product
- Overall energy intensity – the amount of energy it takes to produce one dollar's worth of goods – has decreased by 53%.
  - 1970 – 17,990 BTUs to produce $1 of goods
  - 2010 – 8,455 BTUs to produce $1 of goods
- Energy Intensity reductions result from
  - Energy efficiency improvements (nearly half)
  - Move away from energy-intensive industrial activities and products
  - Productivity improvements

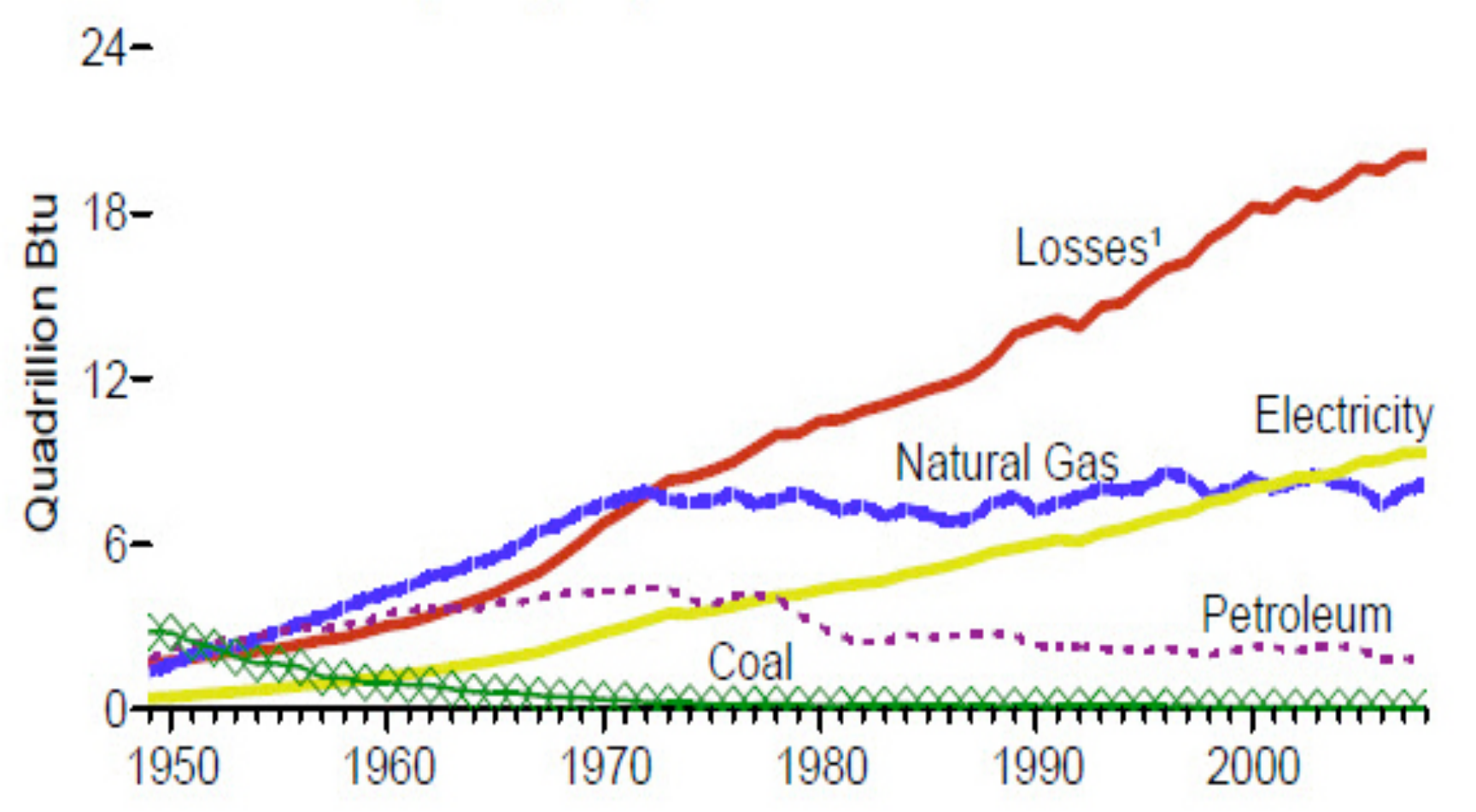
U.S. Industrial Total Energy Consumption



1 Energy lost during generation, transmission, and distribution of electricity.

EIA, 2009

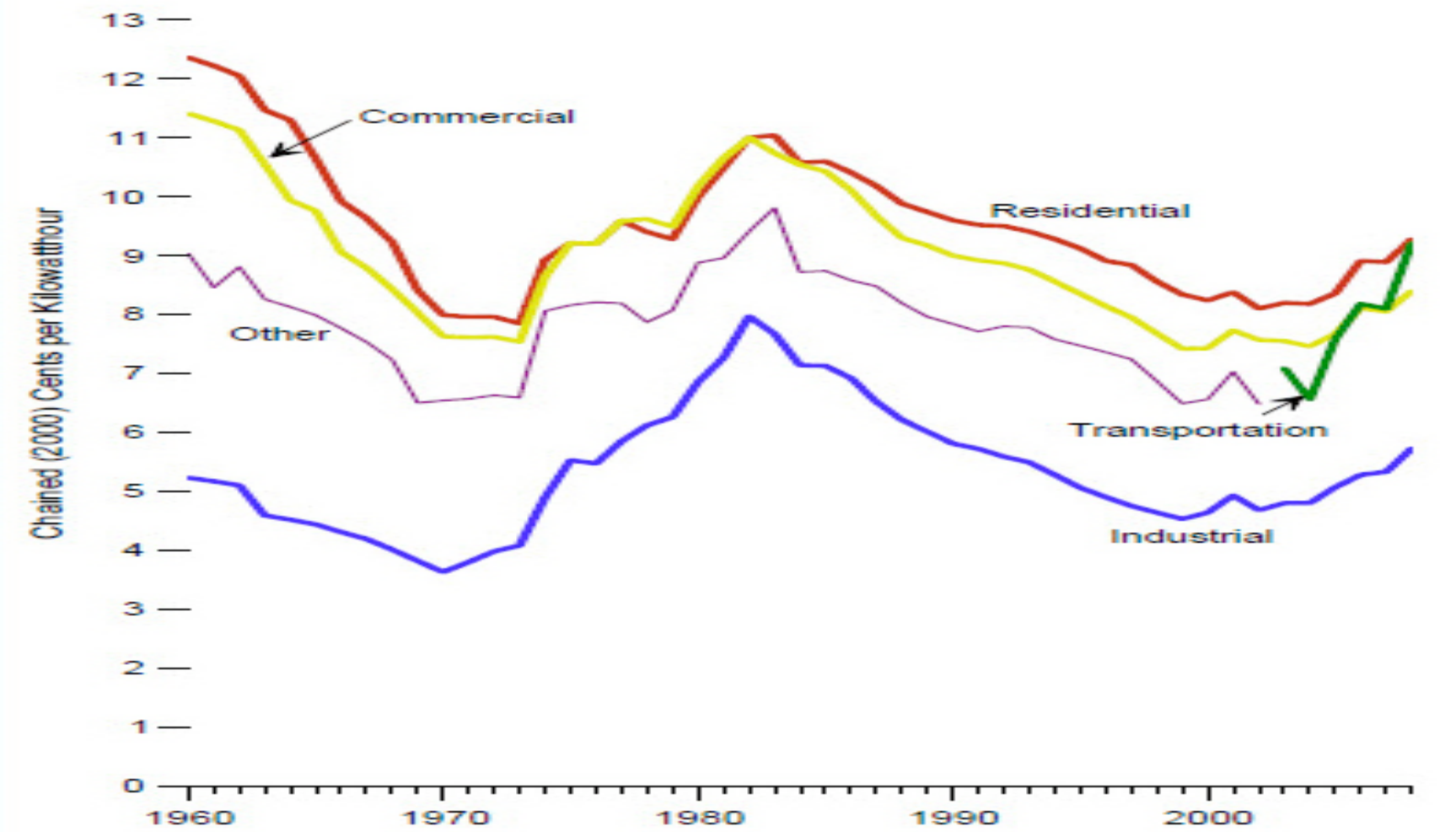
U.S. Residential & Commercial Total Energy Consumption



[1]Energy lost during generation, transmission, and distribution of electricity.

EIA, 2009

U.S. Average Retail Prices of Electricity by Sector



[1]In chained (2000) dollars, calculated by using gross domestic product implicit price deflators.

EIA, 2009

Energy & Priorities

There are many opportunities to reduce energy,

But generally

Saving energy is not a high priority activity

Despite What You May Hear

- All the Energy Projects have NOT been done
- All the "low hanging fruit" has NOT been picked
- Typical energy savings of 10-20% are achievable
- On average, energy efficiency can achieve savings at an average cost of $0.03 per kWh saved (ACEEE, 2009)
- Leading plants in energy efficiency are incorporating energy into their continuous improvement and quality control systems as a part of everyday business operations
- Ancillary benefits often not accounted for
  - Employee safety
  - Overall waste reduction
  - Decreased maintenance
  - Improved product quality
  - Decreased operating cost

IEC Industrial Program History, Chapter 1

- **Began with a 1993 grant to UNI Metal Casting Center (MCC)**
  - **Objective to save Crane Valve, Washington, IA from bankruptcy by improving energy efficiency and productivity while reducing waste**
  - **Developed the frame work for the IEC's *Total Assessment Audit***
    - *Improve the economic viability, competitiveness, and profitability of Iowa's manufacturing plants through: (a) energy efficiency and management practices; (b) appropriate or state-of-the-art process management and technology applications; and (c) enhanced waste reduction programs.*
  - **Credited for keeping the facility open**
  - **Completed with MCC staff**
- **TAA becomes the cornerstone of the industrial program**
  - **Multiple grants to refine the methodology and demonstrate it's effectiveness through case study documentation**

IEC Industrial Program History, Chapter 1

- **TAA not sustainable by IEC alone**
  - **Case studies in nearly 30 facilities**
    - Varied in depth from simple audit to full plant holistic assessments
  - **Full plant holistic assessments across major Iowa industries**
    - Food processing
    - Metal casting
    - Metal fabrication
    - Printing
    - Air Filter
    - Steel Minimill
    - Plastics
  - **Cost and time prohibitive**

IEC Industrial Program History, Chapter 1

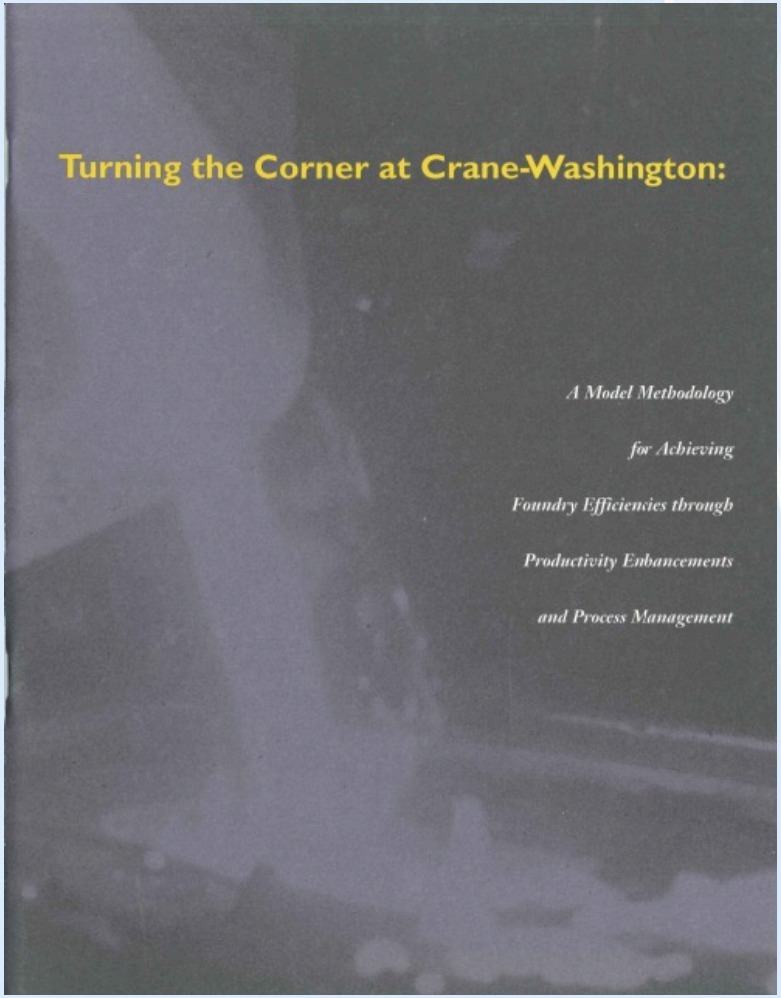
- **TAA transition to commercialization**
  - **Grant to Iowa Manufacturing Extension Partnership**
    - Mentoring role
  - **Alliant Energy's Synergy Plus program**
    - Five additional case studies
    - Mentoring role
  - **Department of Energy – Industrial Technologies Program**
    - Plant Wide Assessment Program

TAA impact

Steel Manufacturers Association 2005 Recycler of the Year Award

North Star Steel, Wilton, IA

Total Assessment Audit (TAA)



INDUSTRIES OF THE FUTURE
BestPractices

Plant-Wide Assessments

August 2001

OFFICE OF INDUSTRIAL TECHNOLOGIES
ENERGY EFFICIENCY AND RENEWABLE ENERGY, U.S. DEPARTMENT OF ENERGY

Benefits

- Identify areas for cost and energy savings, and emissions and waste reduction
- Receive expert technical assistance in improvements to industrial systems
- Access software tools to assist in decision making
- Share costs of assessment and leverage resources

Visit www.oit.doe.gov/bestpractices to read case studies of actual plant assessments.

Plant-Wide Assessments Help Industry Identify Energy and Cost Savings Opportunities

Plant-wide energy assessments identify overall energy use in manufacturing processes —which can account for 10 percent or more of an industry's total operating costs—and highlight opportunities for best energy management practices for industry, including the adoption of new, efficient technologies. The U.S. Department of Energy's Office of Industrial Technologies (OIT) works with companies to characterize findings and document savings that can be replicated in other facilities and other industries for multiplied savings. On average, the findings from a single assessment can be replicated in at least seven other facilities with equivalent systems and energy use. For a relatively low initial investment, companies that participate in assessments can expect to realize a minimum of $1 million in savings annually from energy costs, waste reduction, and increased productivity—usually with a payback of less than 18 months.

Solicitations Encourage Companies to Participate

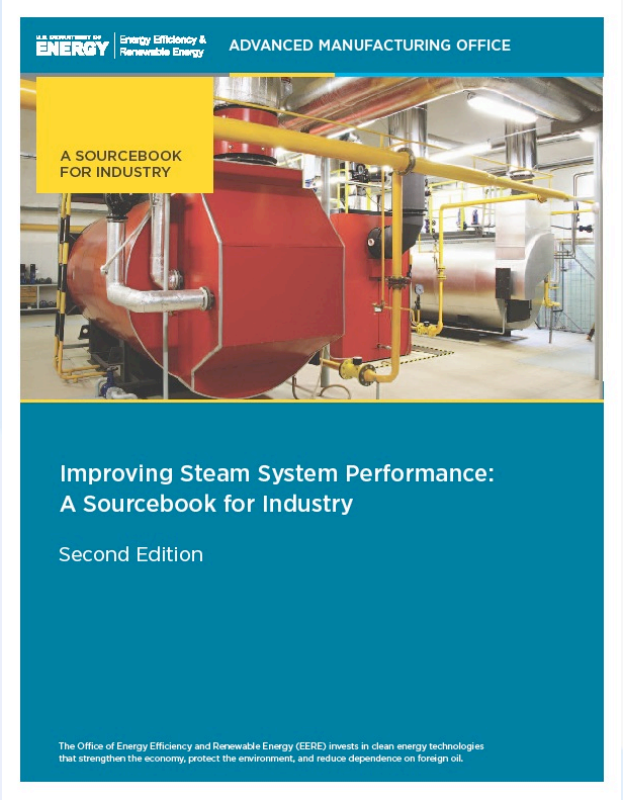
Interested companies are invited to submit proposals in response to a solicitation offered once a year. Specifically, proposals are sought where industry-defined teams will be considering the adoption of best available and emerging technology using state-of-the-art tools, information, process engineering techniques, and best practices for operating and planned plant support and process systems. Only industrial sites that fall within the OIT Industries of the Future (IOF) initiative are considered for an award. This includes the forest products, chemicals, petroleum, steel, aluminum, metal casting, glass, mining, and agriculture industries. Funding of up to $100,000 is available for each project selected, with a required industrial cost share of at least 50 percent. Companies are strongly encouraged to develop and work closely with teams which could be composed of their resource and equipment suppliers, engineering firms, and other third party entities. Solicitation information is posted to the OIT and BestPractices Web sites (www.oit.doe.gov/bestpractices), and is sometimes advertised in industry trade magazines.

Plant assessments address a variety of generic and industry-specific technology areas, and a variety of plant/process optimization methods. Proposal writers should also consider demand-side energy management best practices and technology implementation in: plant steam delivery and process heating systems, electric-motor systems (including motors, drives, pumps, fans, blowers), compressed air systems, and heat exchange optimization (e.g., pinch technology); as well as, supply-side options using cogeneration and combined heat and power system technologies.

IEC Industrial Program History, Chapter 2

- **National Collaborations**
  - Recognized that the IEC has neither the resources or credibility to influence industry on energy issues alone
  - Leverage time and funding to create meaningful tools, information, education for Industry
  - Have a voice that helps direct the focus and pathways
- **Collaboration Efforts**
  - Motor Challenge
  - Compressed Air Challenge
  - Steam Systems Best Practices
  - Iowa Industries of the Future
- **Collaboration Impacts**
  - Midwest Energy Efficiency Alliance, 2004 Inspiring Efficiency Impact Award

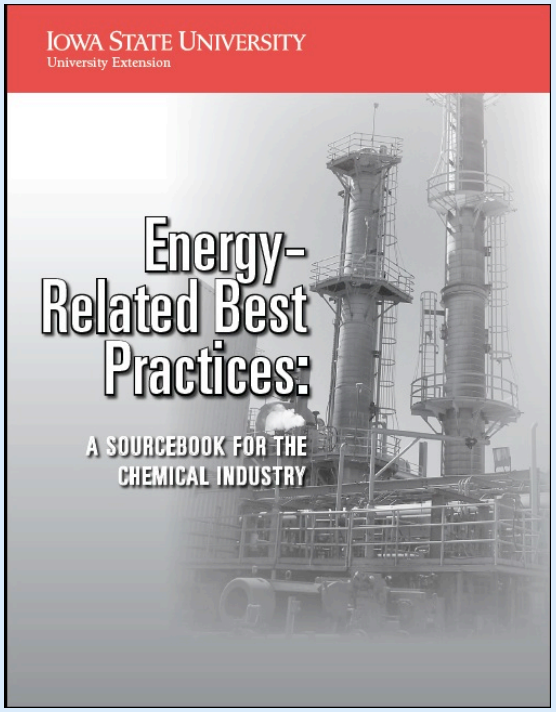
IEC – National Industrial Collaborations

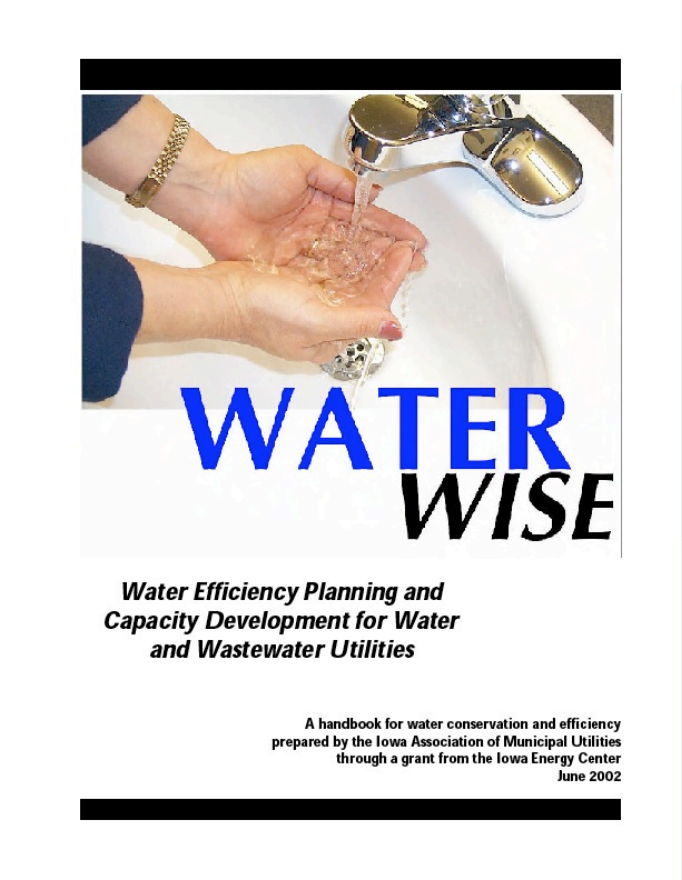


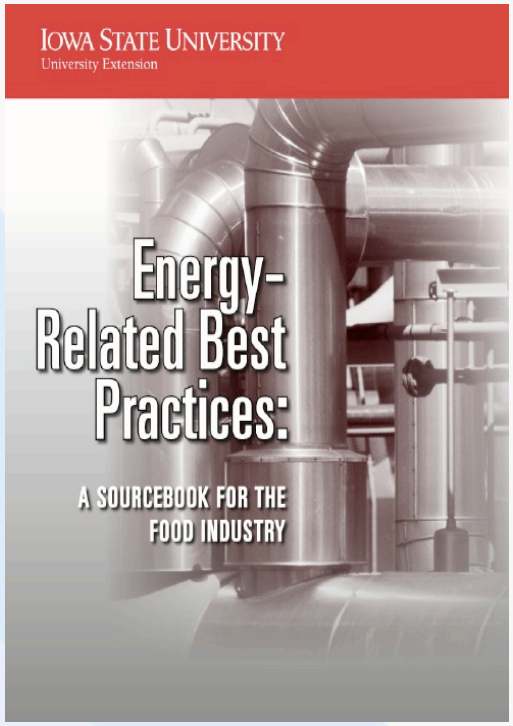
IEC Industrial Program History, Chapter 3

- IEC Sponsored Research with Industry Partners
  - Ted Smith, UI, HON Industries
  - Gerald Colver, ISU, Whirlpool
  - Christoph Beckermann, UI, Sivyer Steel, Keokuk Steel Casting, SSAB
  - ErWei Bai, UI, Gerdau Ameristeel
  - Andrew Kusiak, UI, MidAmerican Energy, Des Moines Wastewater Reclamation Authority
  - Vik Dalal, ISU, Iowa Thin Film/Powerfilm

IEC Sponsored Industrial Information







IEC Industrial Program History, Chapter 4

- State Based Collaborations
  - Partnership for Industrial Energy Efficiency
  - Farm Energy Task Force

Partnership for Industrial Energy Efficiency

PIE2

PARTNERSHIP FOR INDUSTRIAL ENERGY EFFICIENCY

What is PIE2 and their Mission?

- **PIE2 is:**
  - A public/private partnership for the purpose of furthering the overall energy efficiency in various industries located in the State of Iowa.
- **Goal**
  - reducing the State of Iowa's dependence on out-of-state energy sources; reducing the generation of greenhouse gases; and the improvement of Iowa's manufacturing overall profitability.
- **Objectives**
  - Developing and disseminating awareness, educational materials and tools, research and other special projects concerning methods for improving industrial energy efficiency in Iowa.

PIE2 History

- Original "collaborators"
  - Alliant Energy
  - MidAmerican Energy
  - CIRAS (Center for Industrial Research and Service – ISU)
  - Iowa Energy Center
- Recognized that collaborators were "crossing paths" frequently.
- "Smelled" like the wheel was being reinvented
- Need was identified in late 2005/early 2006 to start actively collaborating on industrial energy efficiency interests.

PIE2 History

- Common Mission:
  - Help industrial customers improve energy efficiency of their operations
  - Provide energy efficiency education opportunities to industrial customers
  - Share information between "collaborators"
- Initial meeting began in 2006
- Might be considered the forerunner to the IUB/OCA's Energy Efficiency Collaborators group (with an industrial focus).
- PIE2 is an "ad hoc" group and not a formalized organization.
- Focused on developing and sponsoring educational and research opportunities that will benefit Iowa's industrial sector

PIE2 Membership

1. Alliant Energy
2. Black Hills Energy
3. CIPCO
4. CIRAS
5. Corn Belt Power Cooperative
6. Energy Solutions-OTB
7. Iowa Association of Electric Cooperatives
8. Iowa Association of Municipal Utilities
9. Iowa Department of Economic Development
10. Iowa Energy Center
11. Iowa State University
12. Michaels Energy
13. MidAmerican Energy
14. Van Meter Industrial
15. ?Iowa Industrial Energy Group?

Educational Events

- Compressed Air Systems (CAC)
- Motor and Drive Systems
- Industrial Lighting Systems
- Industrial Refrigeration Systems
- Justifying Energy Efficiency as a Business Investment
- Natural Gas Energy Efficiency
- Pumping Systems Optimization
- Steam Systems

Research Opportunities

- **Completed**
  - **Electric motor replacement/rewind decision making survey. (initial PIE2 project)**
- **New**
  - **Utilized Lean Six Sigma Planning Process**
    - Led by Brian Wakeham, Alliant Energy

PIE2 Industrial Research Results

TOPIC	Colin	Chad	Regi	Gary	Shelly	Bill	Dave	Joel	Paul	Lit	AVG
Provide evidence that conducting energy analyses for industrial processes using a systematic approach to optimize the energy efficiency of the entire process is more effective than targeting specific discrete components of a system. Provide guidance on how to conduct a comprehensive system evaluation.	2	6	2	1	4	2	3	6	7	3	3.6
Update the "Motor Survey" (originally conducted a number of years ago by CIRAS, Iowa Energy Center, and Alliant Energy) incorporating a study on VSD's, their applications, energy savings, etc.	1	8	11	11	10	3	1	3	1	11	6.0
Create new CIRAS Best Practices	8	11	5	5	11	1	4	11	10	8	7.4
Update/modernize one or more of the CIRAS Best Practices documents published earlier.	9	10	7	7	9	4	5	10	3	6	7.0
Energy usage intensity in water and wastewater applications (IAMU is currently planning on moving forward with this initiative and will be requesting a grant from the IEC.)	7	1	9	4	8	1	2	1	8	4	4.5
Confirm how establishing an effective baseline for energy efficiency improvements may result larger energy savings and provide guidance on how to develop an effective energy baseline.	4	2	8	10	2	5	6	7	6	9	5.9
Quantity the value of reducing peak demand and managing load factor (control and timing of energy use) and provide guidance how best to implement an effective load management program.	11	7	10	8	6	7	9	5	11	10	8.4
Evalulating the practice (and expense) of installing energy submeters and using the data for its value for energy management and as an asset management tool -- can we develop anecdotal evidence that investing in energy submetering system will lead to the reduction of energy consumption.	5	3	3	2	1	8	10	2	2	2	3.8
Confirm (or not) that the development and implementation of an effective written facility/plant energy management program will lead to a larger reduction in energy usage/costs longterm (as compared to not having a plan).	3	4	1	6	3	10	7	8	4	1	4.7
Confirm (or not) that developing and implementing an effective employee energy awareness training leads to quantifiable energy savings resulting from changes in employee behavior	10	5	4	9	7	9	8	9	9	5	7.5
Prepare a "best practices" guideline on the design and installation of energy metering equipment.	6	9	6	3	5	6	11	4	5	7	6.2

Research Opportunities

- **New**
  - **Energy analysis of industrial process systems**
  - **Evaluation of energy submeters as an effective means for better data collection for energy management plans**

Questions?