

Energy Uncertainty: Implications for the U.S. Food Supply Chain

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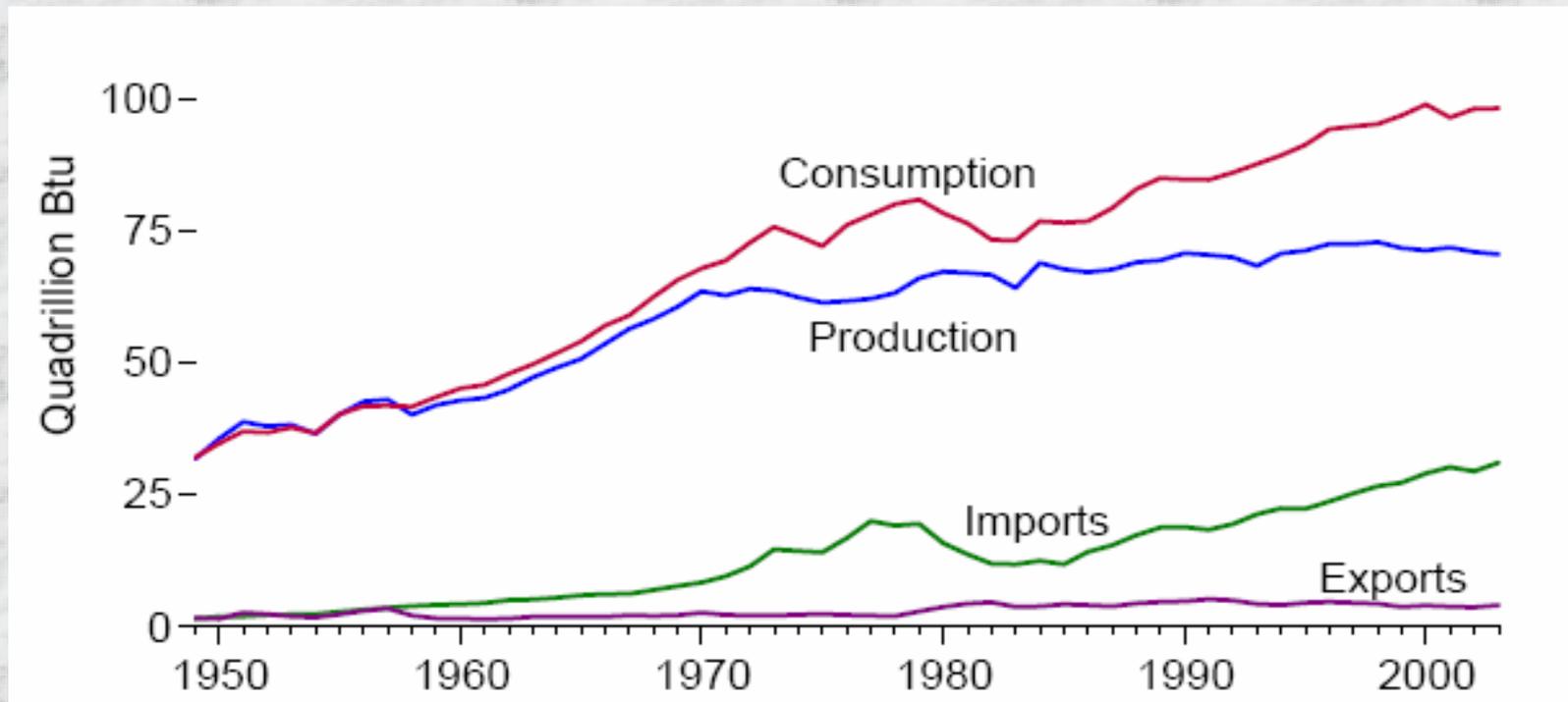


THE OHIO STATE UNIVERSITY

Agenda

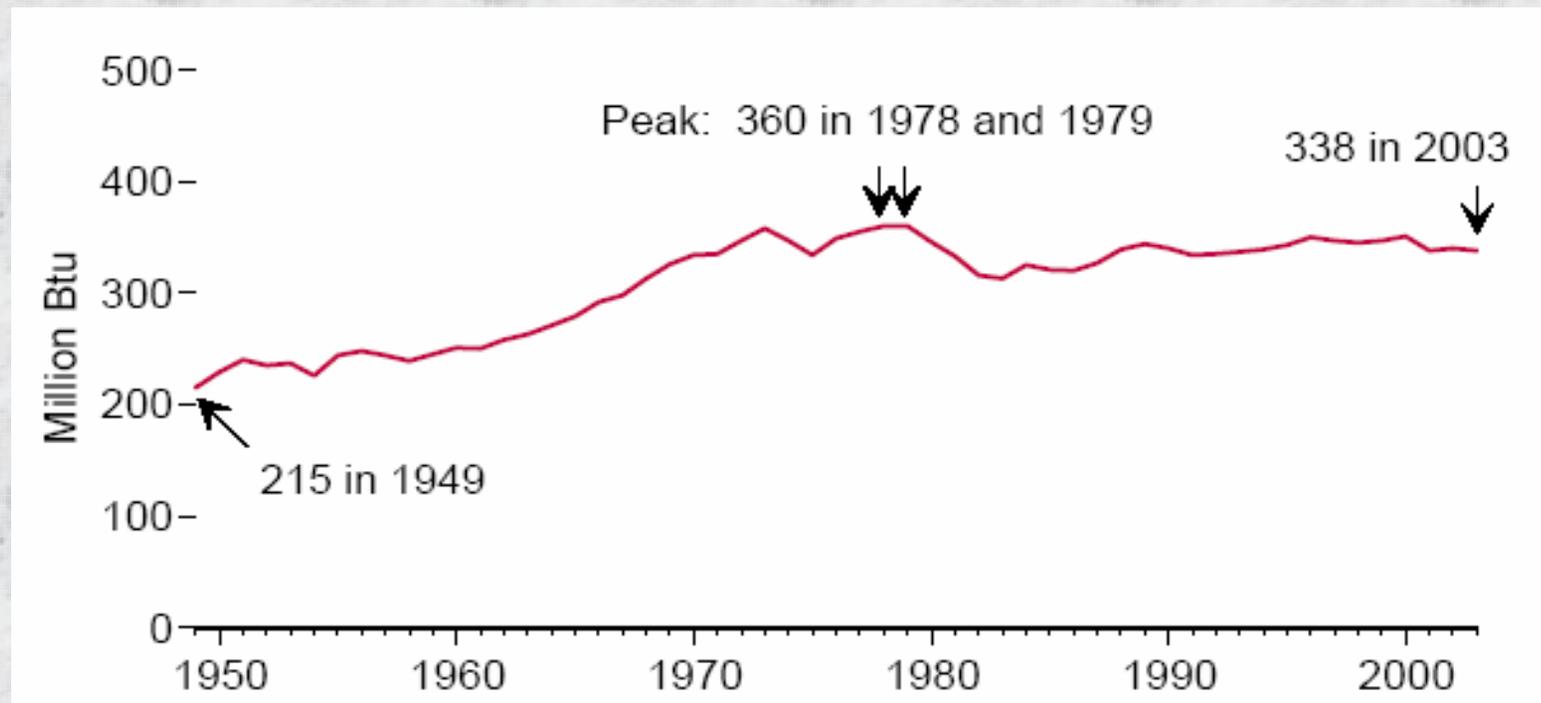
- ❖ **Examine energy use in the U.S.**
- ❖ **Analyze the economic contribution and interdependencies of the food and agriculture cluster of the economy**
- ❖ **Estimate the potential cost of energy supply disruption on the food supply chain**

Energy Consumption, U.S., Annual 1949-2003



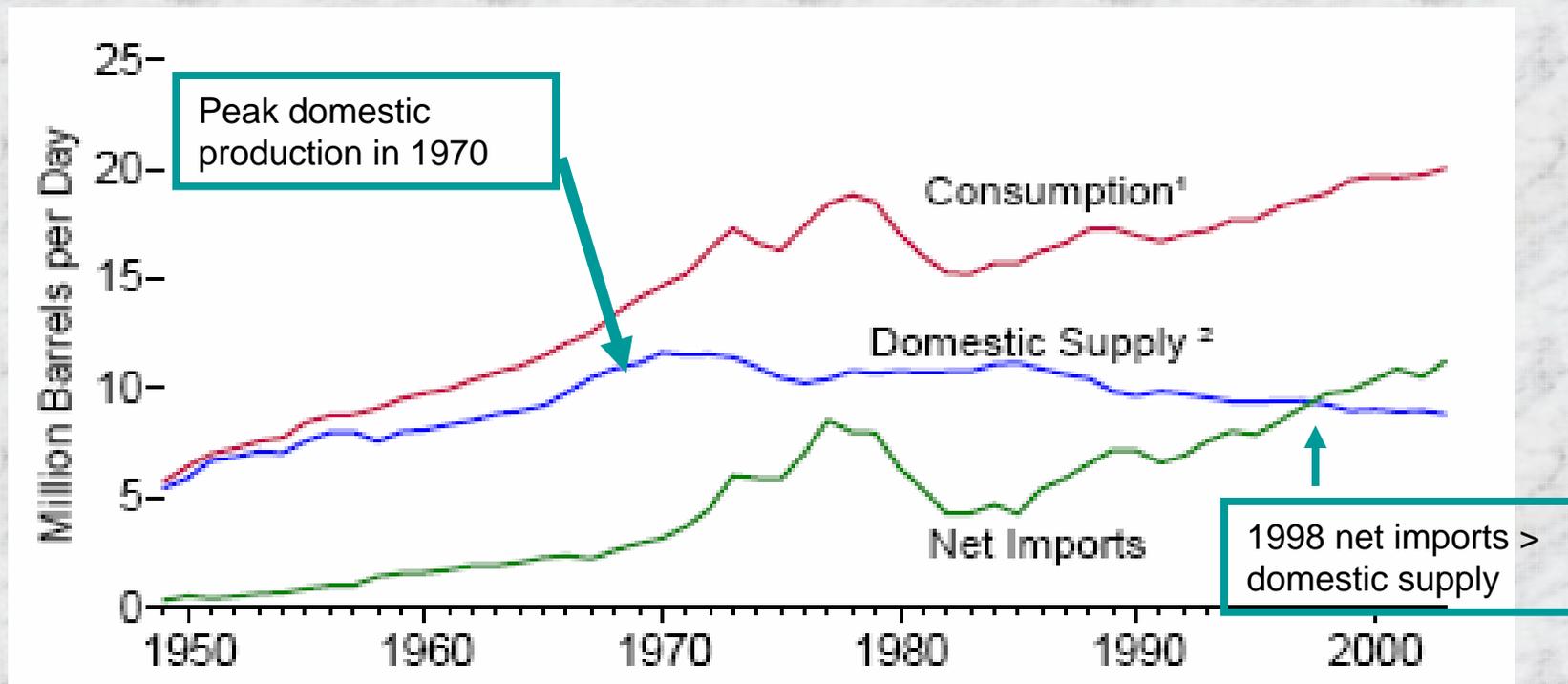
Source: DOE

Energy Consumption Per Capita, U.S., Annual 1949-2003



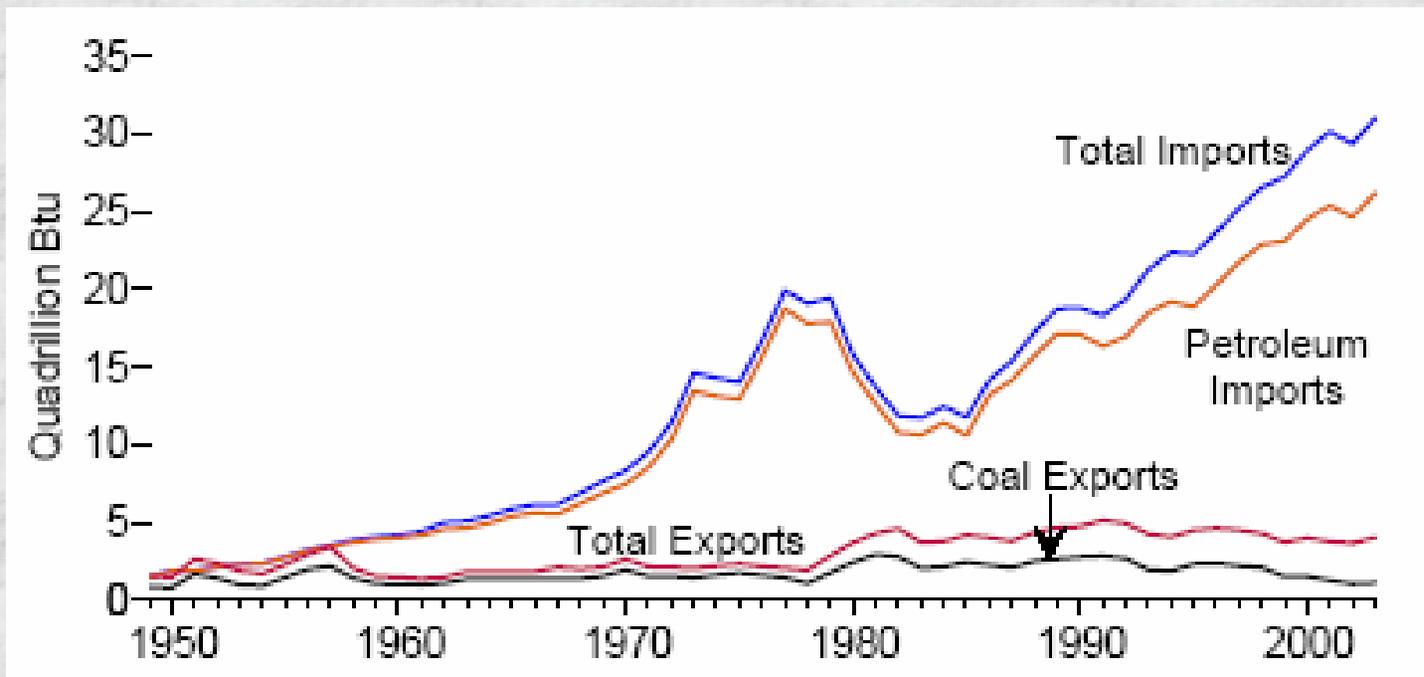
Source: DOE

Energy Consumption, Domestic Supply, and Imports, U.S., Annual, 1949-2003



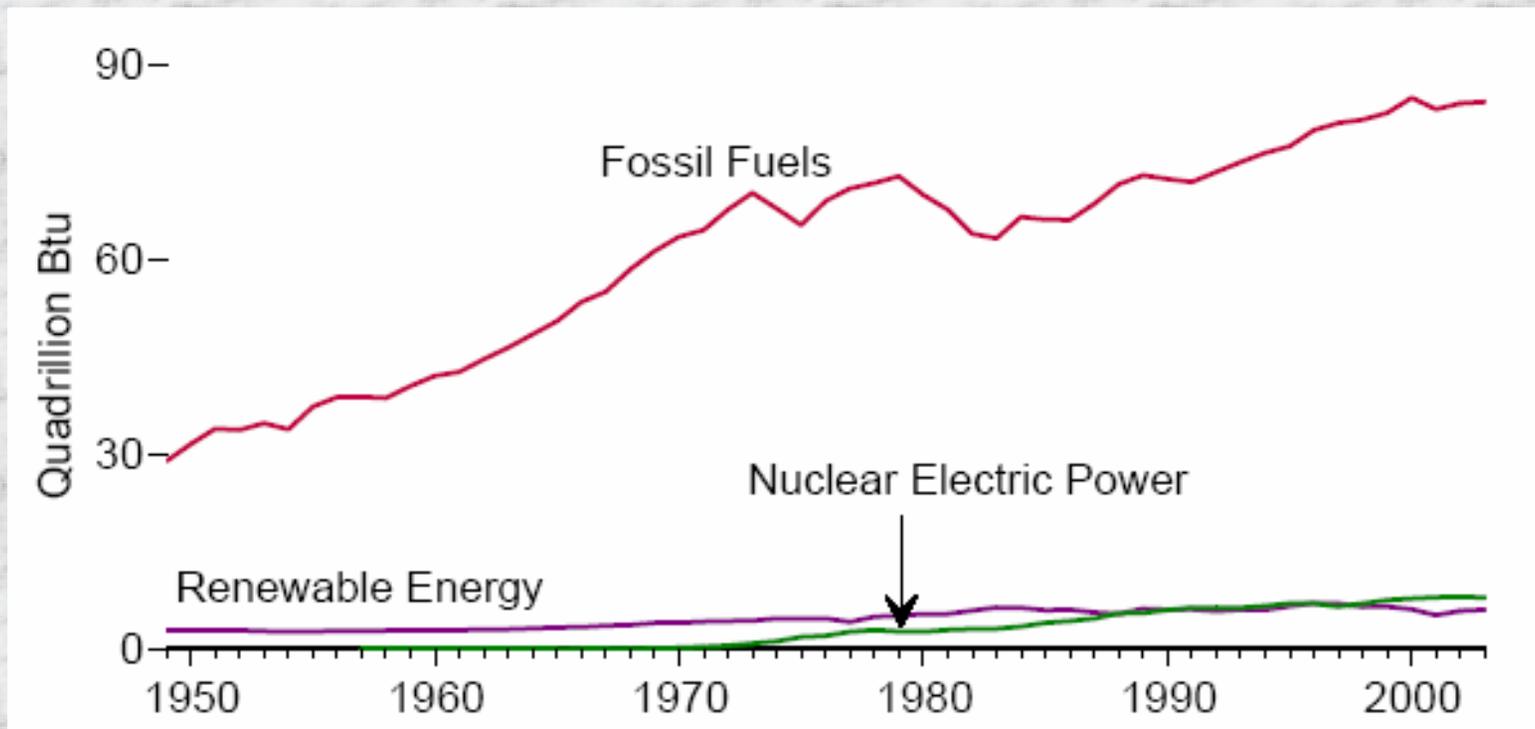
Source: DOE

Energy Imports and Exports, U.S., Annual 1949-2003



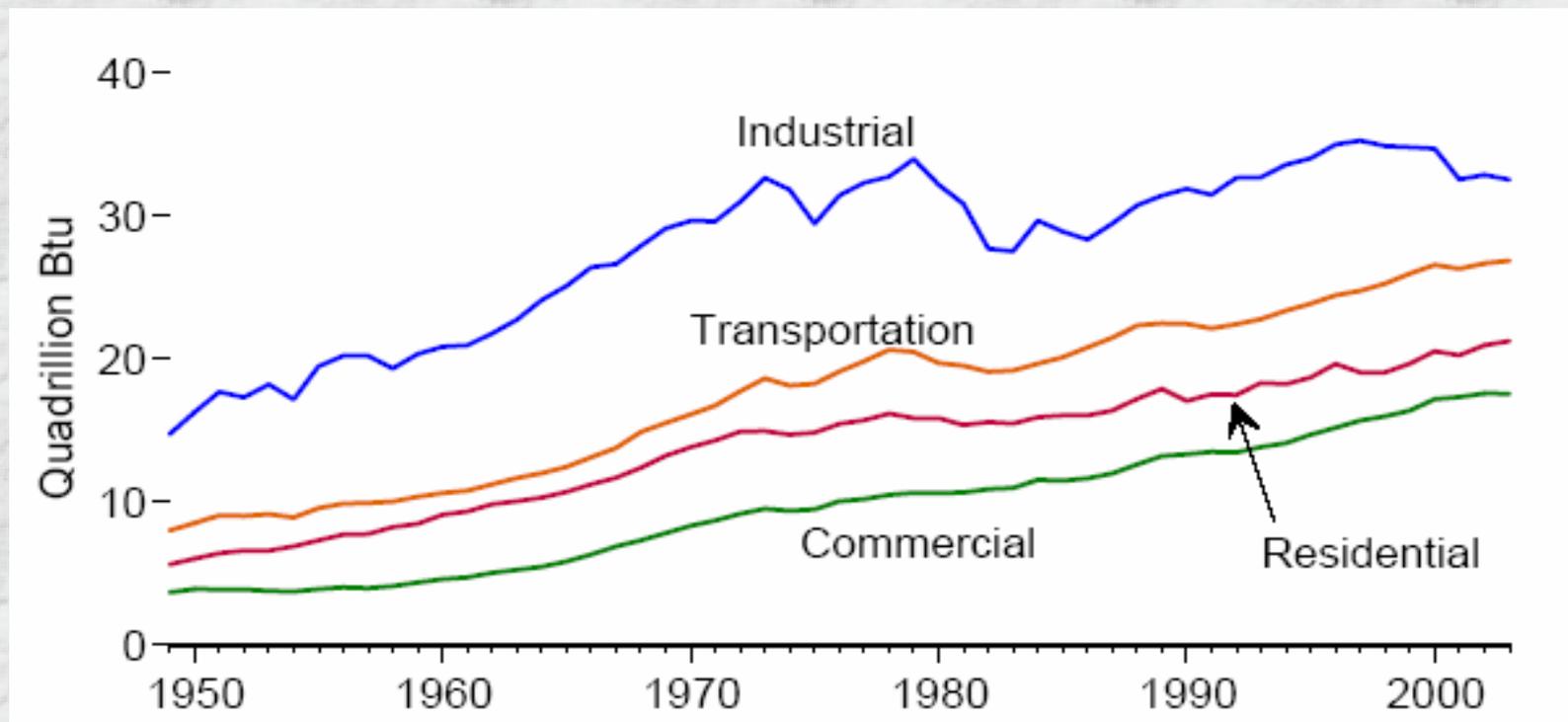
Source: DOE

Energy Use by Source, U.S., Annual 1949-2003



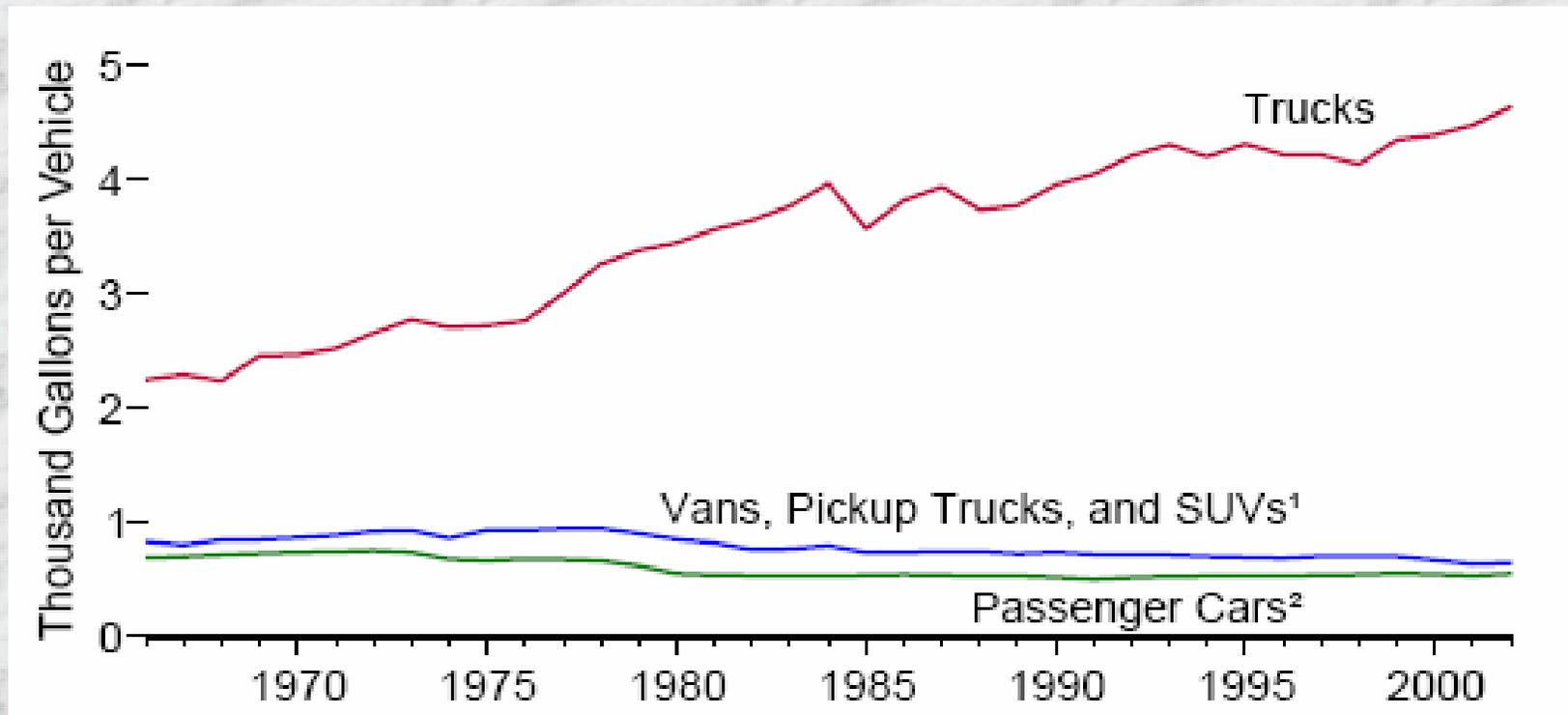
Source: DOE

Energy Use by End Use Sector, U.S., Annual 1949-2003



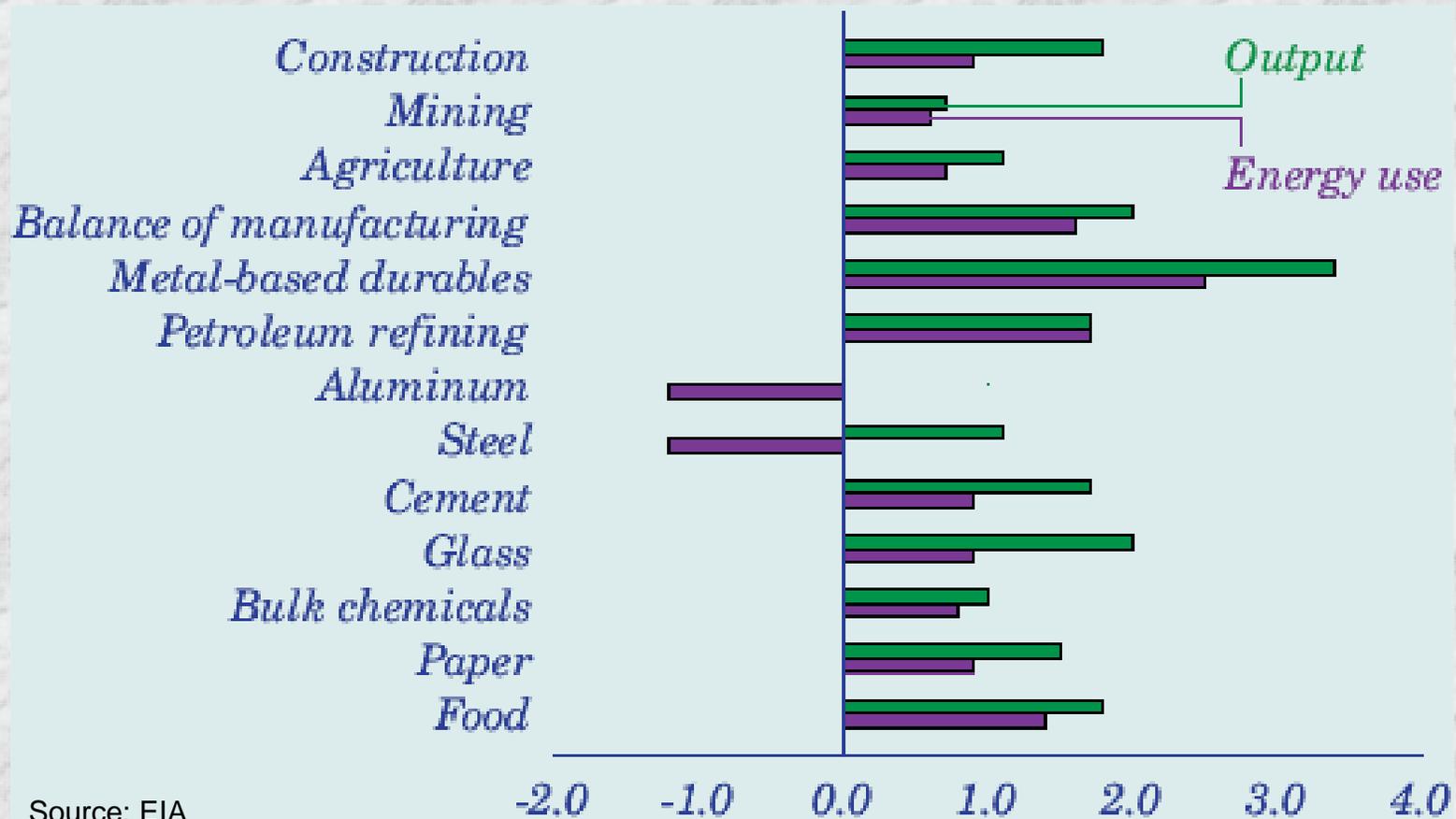
Source: DOE

Motor Vehicle Fuel Consumption, U.S., Annual, 1965-2003



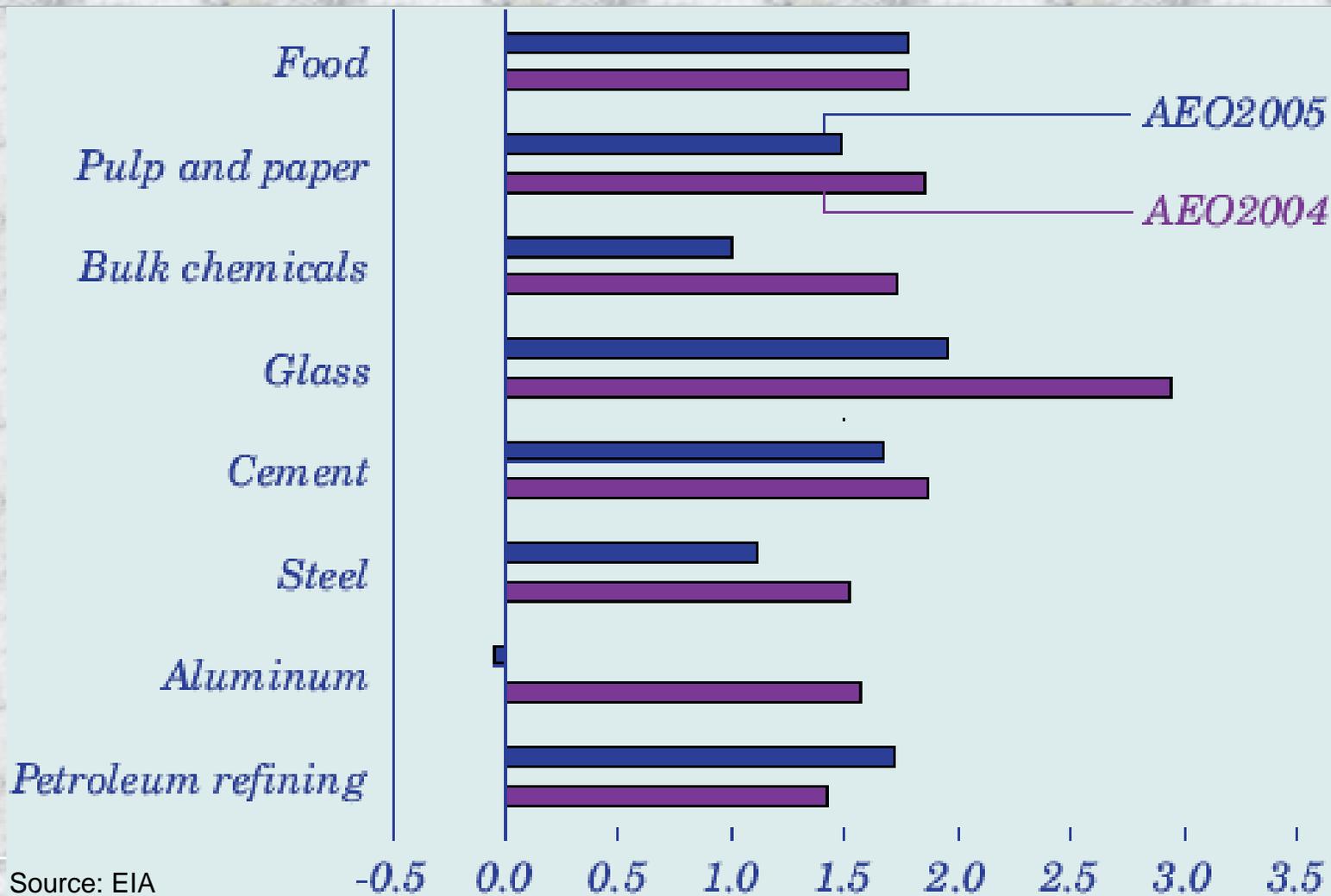
Source: DOE

Projected Average Growth in Output and Energy Use by Sector, U.S., 2003-2025



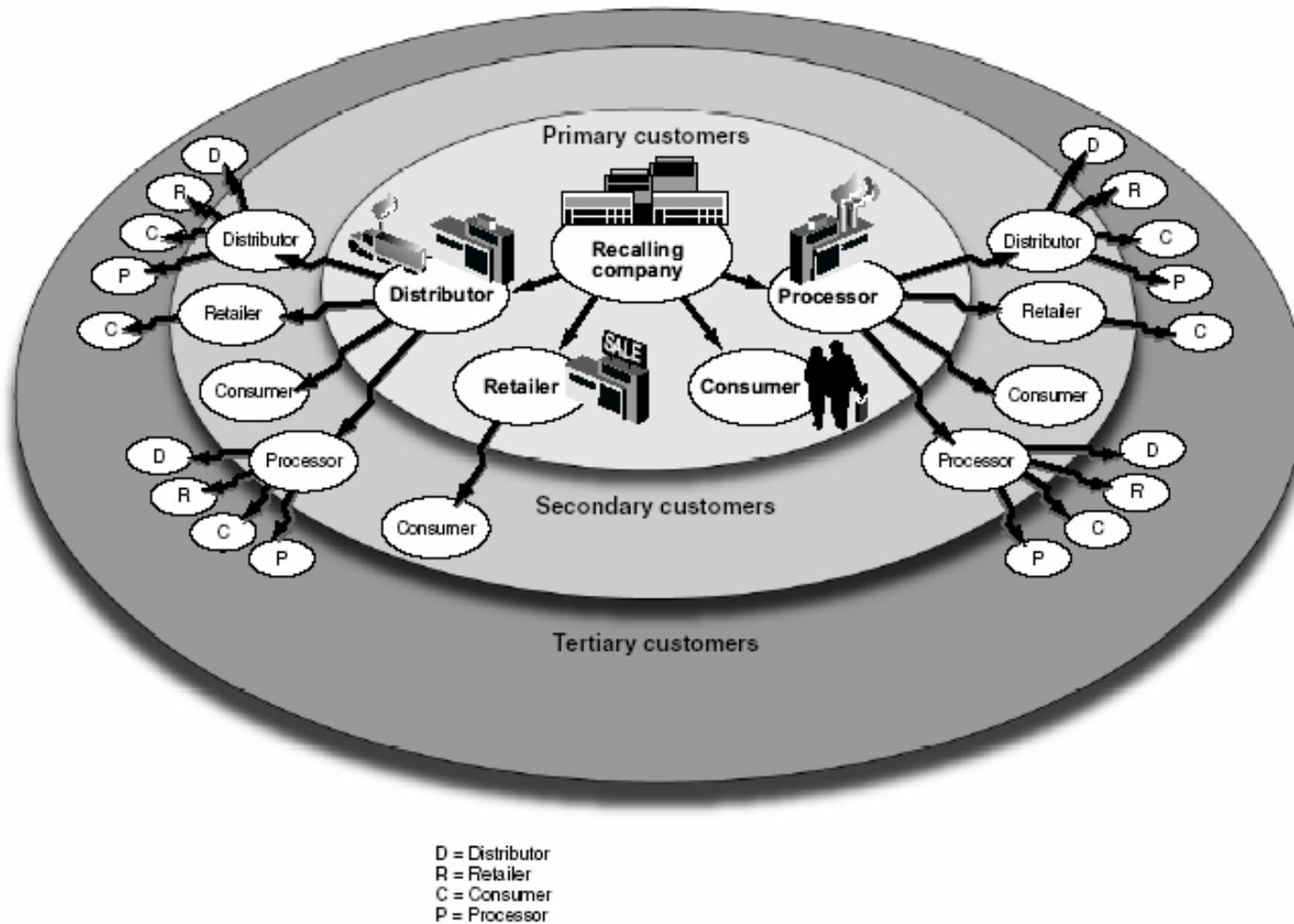
Source: EIA

Projected Growth in Output for Energy-Intensive Industries, 2003-2025, %/yr



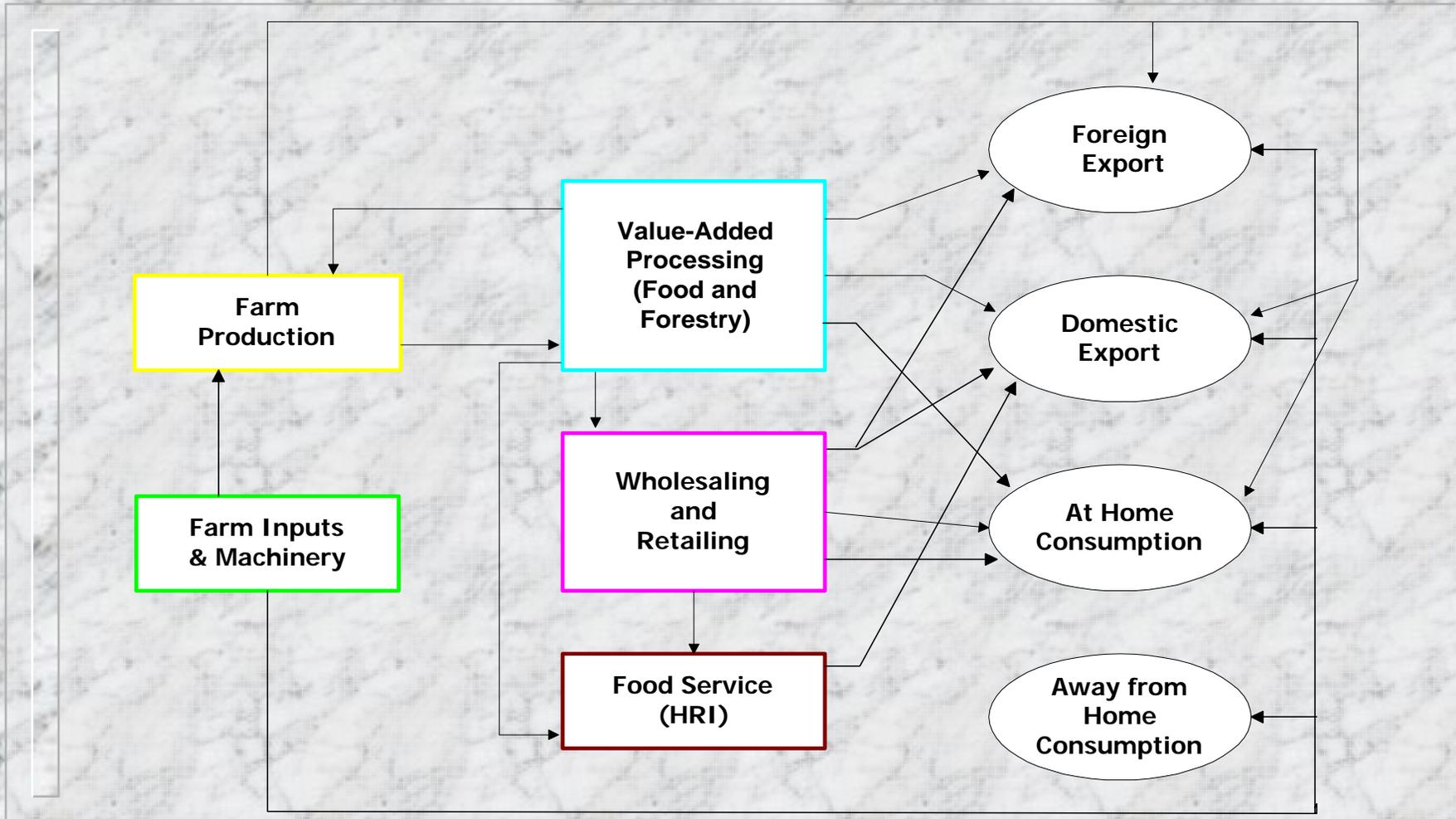
Source: EIA

Schematic of Supply Chain Interdependencies



Major Linkages in Food System

Economic Transaction Flows Among Sectors



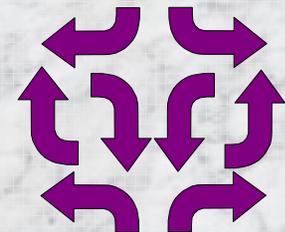
USFOOD: A United States Food Industries Input-Output Model

- ❖ **USFOOD tracks every dollar of output from an industry in terms of which industries are supplied**
- ❖ **The food and agriculture industries of the economy are aggregated into five broad and vertically-linked sectors that form the supply chain cluster**



Example of Economic Interdependencies

- ❖ **Some output from corn production is input into dry and wet corn milling**
- ❖ **Some co-product output from milling is input into livestock feed (CGF) as is some output directly from corn production**
- ❖ **Some output from milling is HFCS, an input for the soft drink bottling industry**

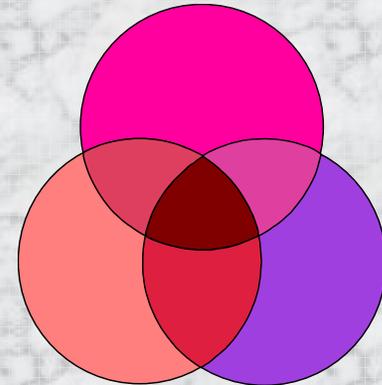


What USFOOD Measures

❖ For each sector, dollar amounts of:

- Output
- Gross state product
- Income
- Employment

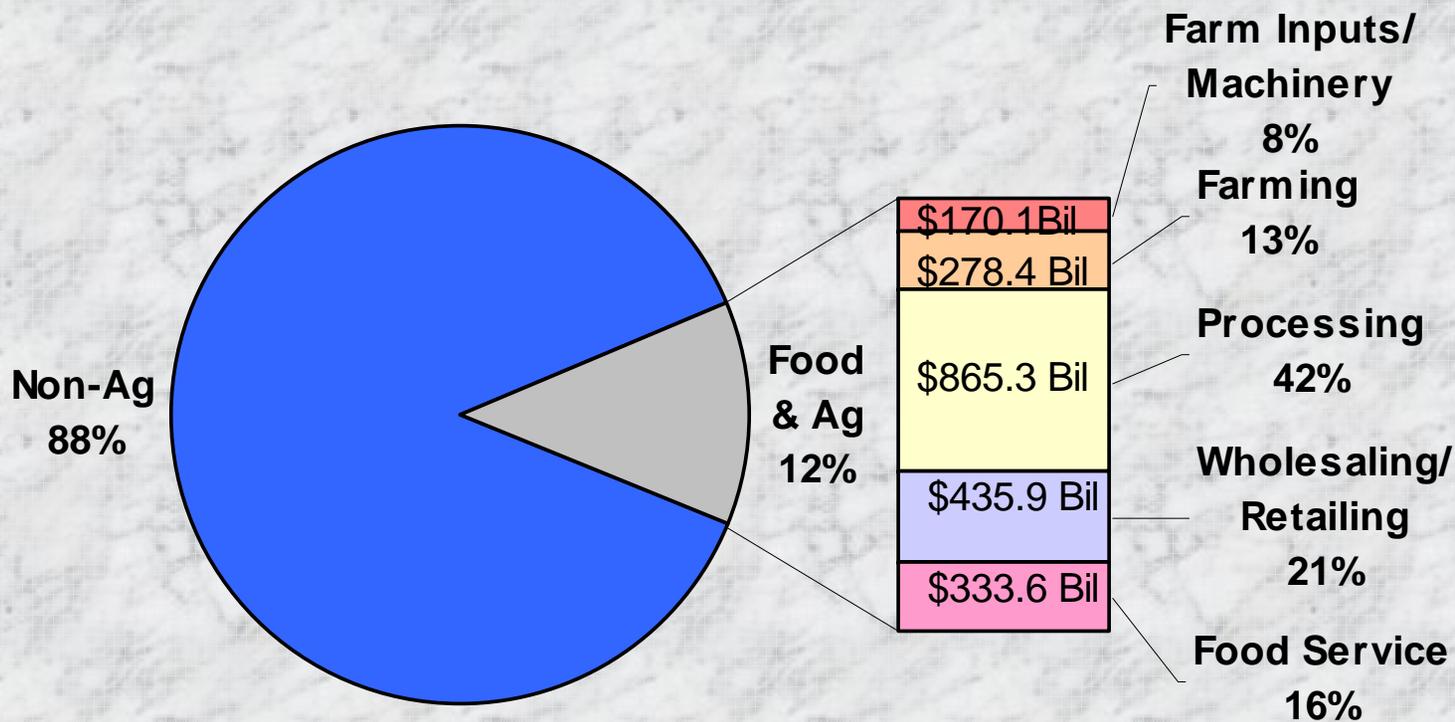
❖ Multipliers for each sector



Multipliers

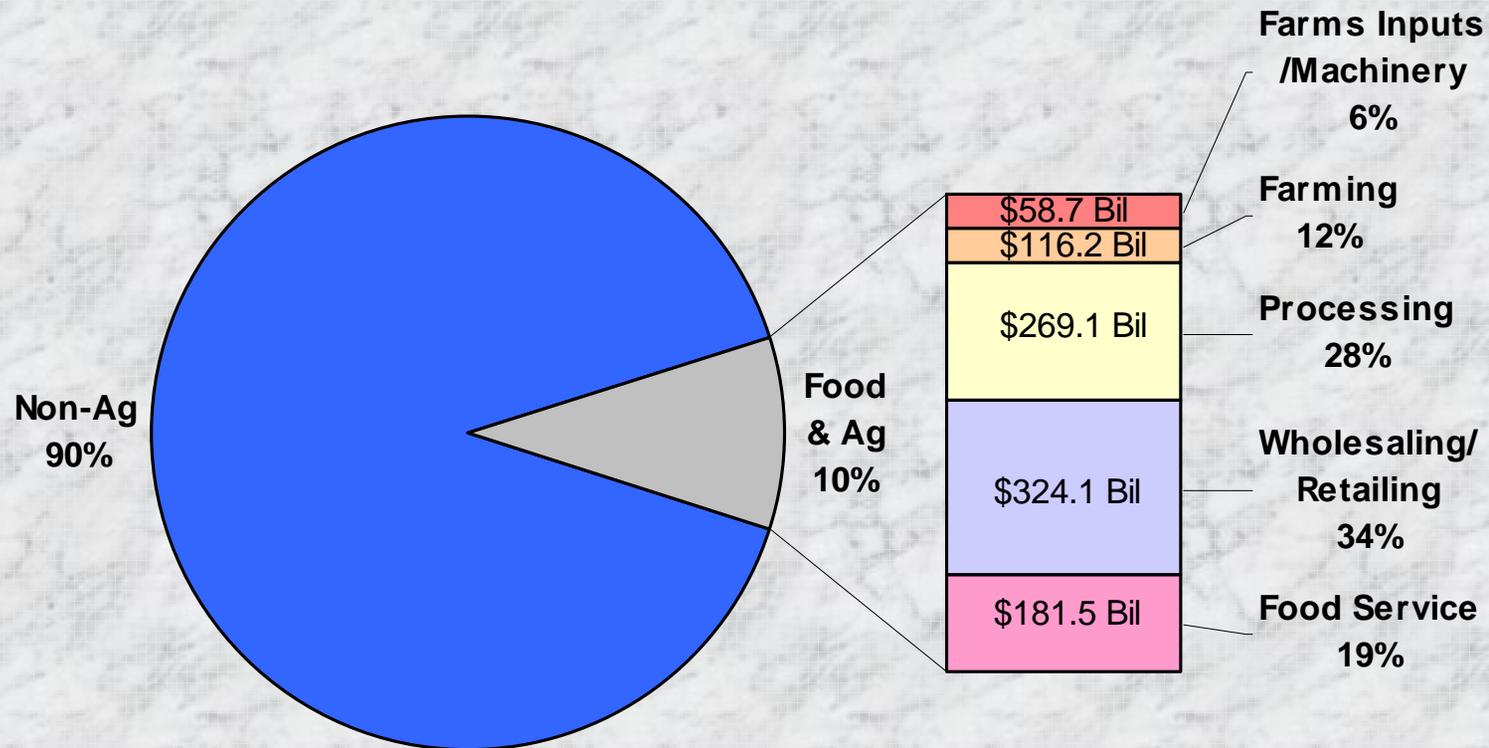
- ❖ **Multipliers are estimated for output, value added, income, and employment**
- ❖ **Example: an *income multiplier***
 - ❖ **measures the intuitive notion that a portion of income earned by one individual or industry is spent**
 - ❖ **it becomes income to a second individual or industry**
 - ❖ **in turn, the second individual spends a portion**
- ❖ **Measures of the ‘ripple’ effect throughout the economy**

U.S. Economic Output, Food & Agriculture Cluster, 2000



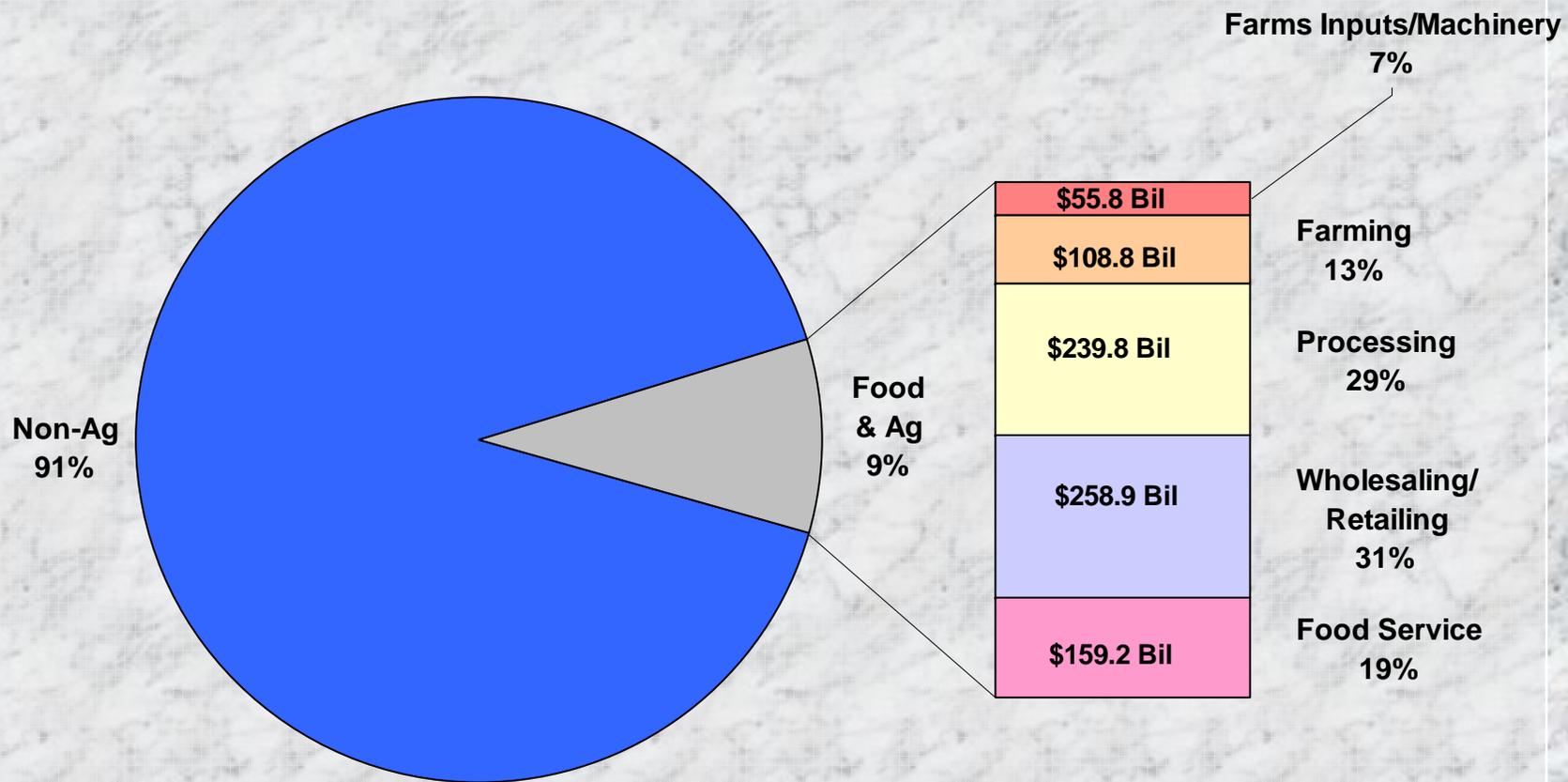
Total Output: \$17.2 Tril Food & Ag Sectors: \$2.1 Tril

U.S. Gross Domestic Product, Food & Agriculture Cluster 2000



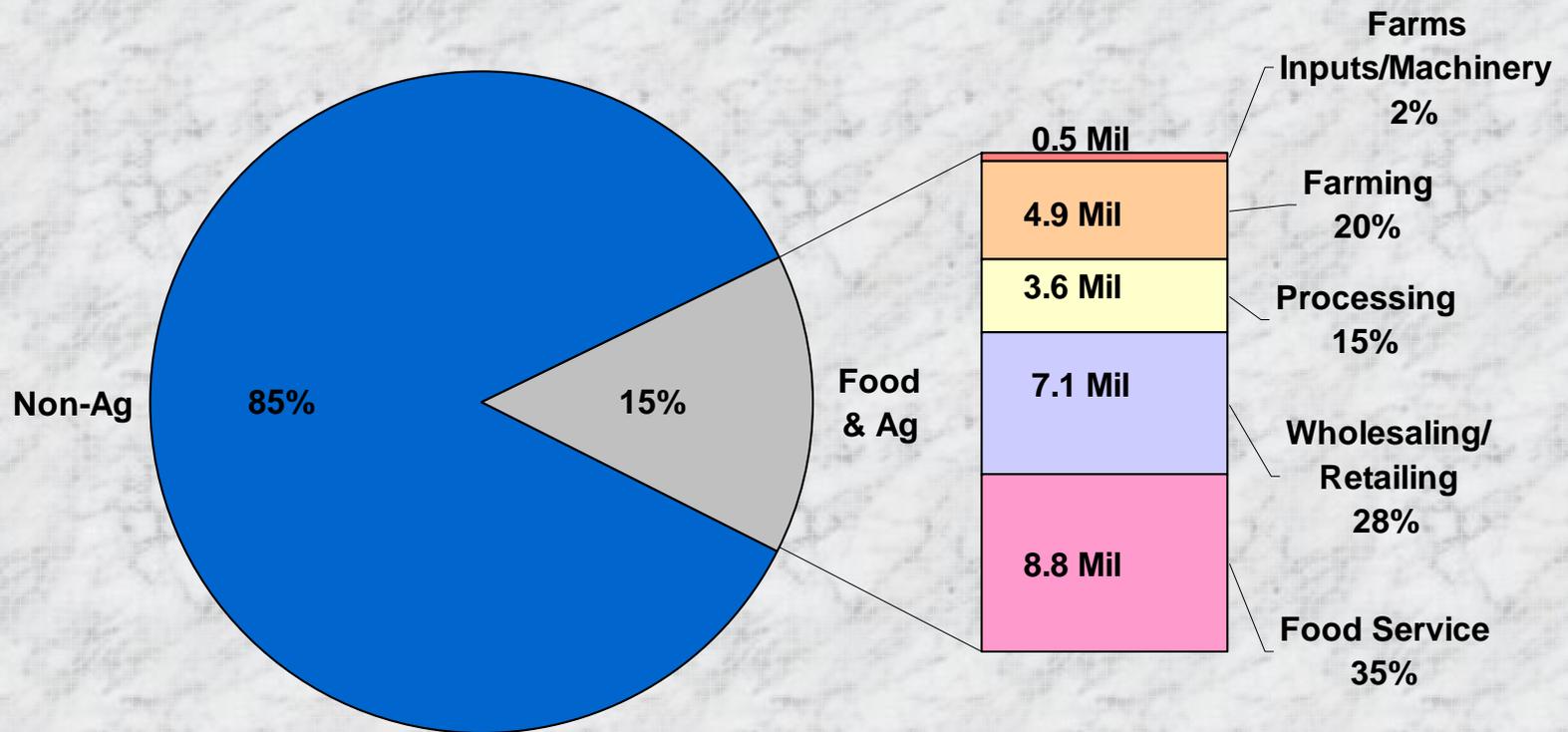
Total Gross State Product: \$ 9.8 Tril Food & Ag Sectors: \$949.6 Bil

U.S. Income, Food & Agriculture Cluster, 2000



Total Income: \$9.1 Tril Food & Ag Sectors: \$822.6 Bil

U.S. Employment, Food & Agriculture Cluster, 2000



Total Employment: 168.5 Mil Food & Ag Sectors: 8.8 Mil

Conclusions: Food & Agriculture Cluster

- ❖ Food and agriculture cluster contributes about \$949.6 billion out of a total \$9.8 trillion GDP economy**
- ❖ Food and agriculture cluster contributes about:**
 - \$1 of every \$8 of output**
 - 1 of every 7 jobs**
 - \$9.50 out of each \$100 GDP**

Economic Costs of Energy Price Shocks

- ❖ **Depends on**
 - **the price of oil**
 - **the nation's level of oil consumption**
- ❖ **Economic effects are roughly the same regardless of the level of oil imports**
- ❖ **U.S. economy realizes substantial gain from importing relatively low cost oil rather than relying on more expensive domestic oil**

Measures of Vulnerability to Energy Disruptions

- ❖ **The concentration of world oil production**
- ❖ **Oil intensity of the U.S. economy (ratio of use to GDP)**
- ❖ **Excess world oil production capacity**
- ❖ **The level of world oil stocks**
- ❖ **Energy use in the U.S. economy**
- ❖ **The oil dependency of the U.S. transportation sector**

Energy Vulnerability

- ❖ **For the U.S., all the measures of vulnerability are expected to remain the same or worsen over the next decade except for oil intensity**
- ❖ **Oil intensity is expected to improve some over the next decade (measured by EIA as BTUs consumed/\$ GDP)**
- ❖ **Oil intensity measure expected to decline steadily from 9.47 to 6.57 between 2003 and 2025**

Economic Effects on Food Supply Chain

- ❖ **Use USFOOD model multipliers to estimate food supply chain effects**
- ❖ **Multipliers food processing supply chain ranges**
 - **Output from 1.9420 to 2.5077**
 - **Employment from 4.0925 to 11.5093**
 - **GDP from 1.9472 to 4.8739**

Economic Cost of Energy Disruption on the Food and Agriculture Cluster

- ❖ Scenario analyzed is an increase in oil price of 45%**
- ❖ Change in GDP is estimated in 1997 GAO report for this scenario**
- ❖ Estimated reduction of \$50 billion per year in GDP**
- ❖ What is the influence of this on the food supply chain?**

Economic Cost of Energy Disruption on the Food and Agriculture Cluster

- ❖ \$50 billion GDP reduction = \$7.5 billion initial reduction shock in supply chain GDP**
- ❖ Using the GDP multiplier for processed food results in an estimate of \$16.9 billion reduction in GDP for the food supply chain**
- ❖ 11% reduction in GDP for the food processing sector of the food supply chain**
- ❖ 2% reduction in entire food supply chain GDP**

Economic Cost of Energy Disruption on the Food and Agriculture Cluster

- ❖ \$50 billion GDP reduction = \$7.5 billion initial reduction shock in supply chain GDP**
- ❖ Using the jobs multiplier for processed food results in an estimate of nearly 69,200 jobs lost**
- ❖ Nearly 4% reduction in jobs for the food processing sector of the food supply chain**

Implications of Price Increase from Energy Disruption on the Food and Agriculture Cluster

- ❖ Substantial increase in oil price results in significant food supply chain GDP response**
- ❖ Based on food supply chain multipliers:**
 - 11% reduction in GDP for the food processing sector of the food supply chain**
 - Nearly 4% reduction in jobs for the food processing sector of the food supply chain**

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