# COMPARATIVE ADVANTAGE IN ETHANOL PRODUCTION: U.S. GRAINS VERSUS SUGAR

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USDA/OCE/OEPNU

Energy From Agriculture:

New Technologies, Innovative Programs and Success Stories

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# OVERVIEW

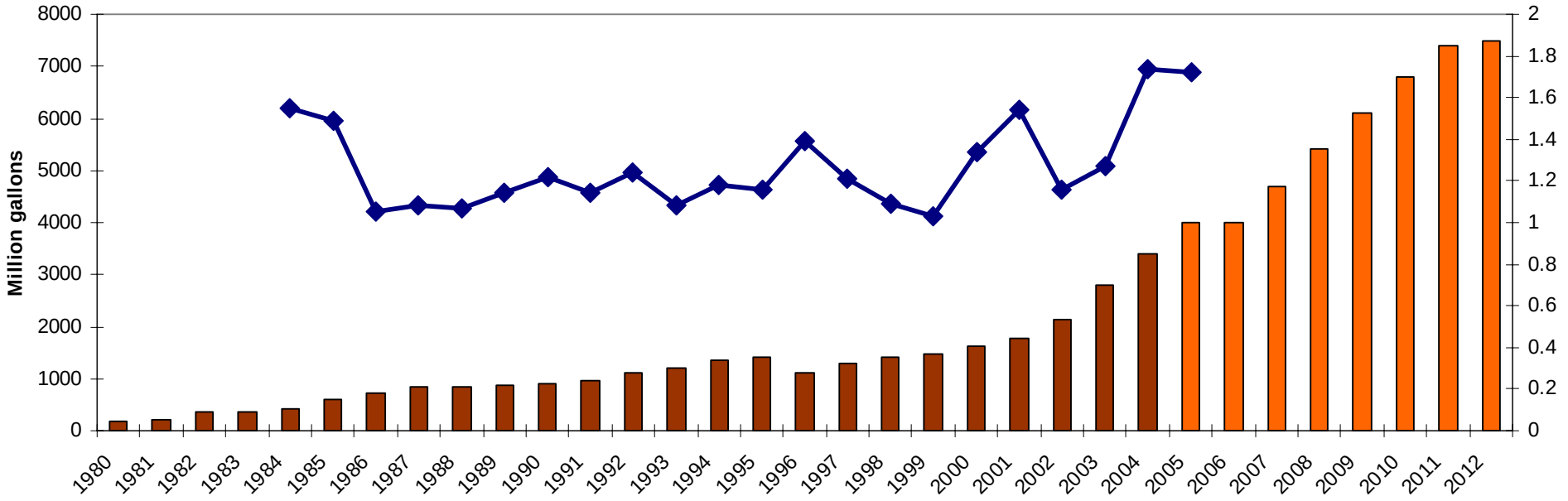
- US ethanol industry
- Feedstock for ethanol
- Starch-ethanol versus sugar-ethanol
- Conclusions

# Industry at a Glance

- Number of operating ethanol plants (92), Plants under construction and expansion (35)
- Current production capacity, 4,286million gallons per year (MGPY)
- 2005 production, about 4,000 MG
- Projected production capacity, 5,950 MGPY by early 2006
- Size, less than 1 to over 300 MGPY
- Location, 21 States
- Process, wet and dry
- Feedstock %:

| | |
|---|---|
| Corn | 97 |
| Sorghum | 2 |
| Waste | 1 |

# Ethanol Production and Prices

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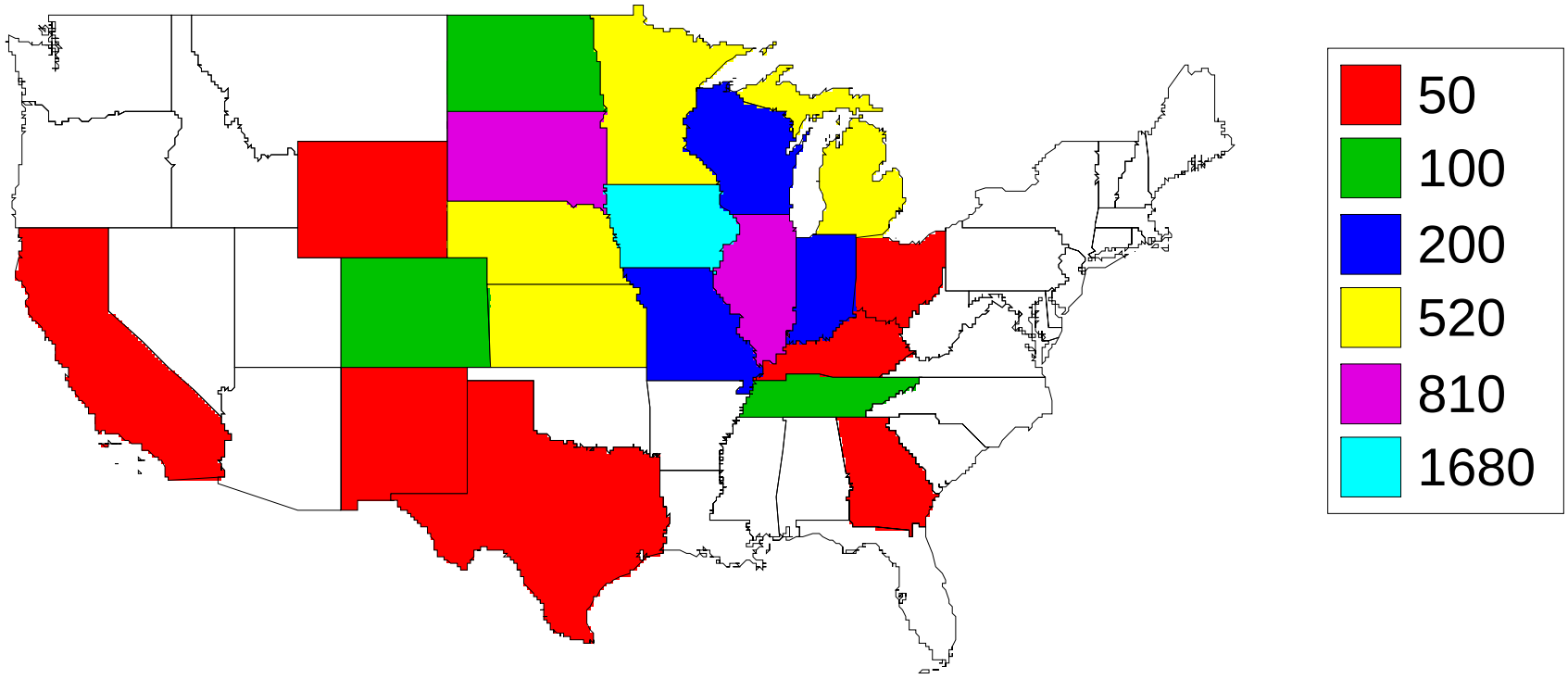
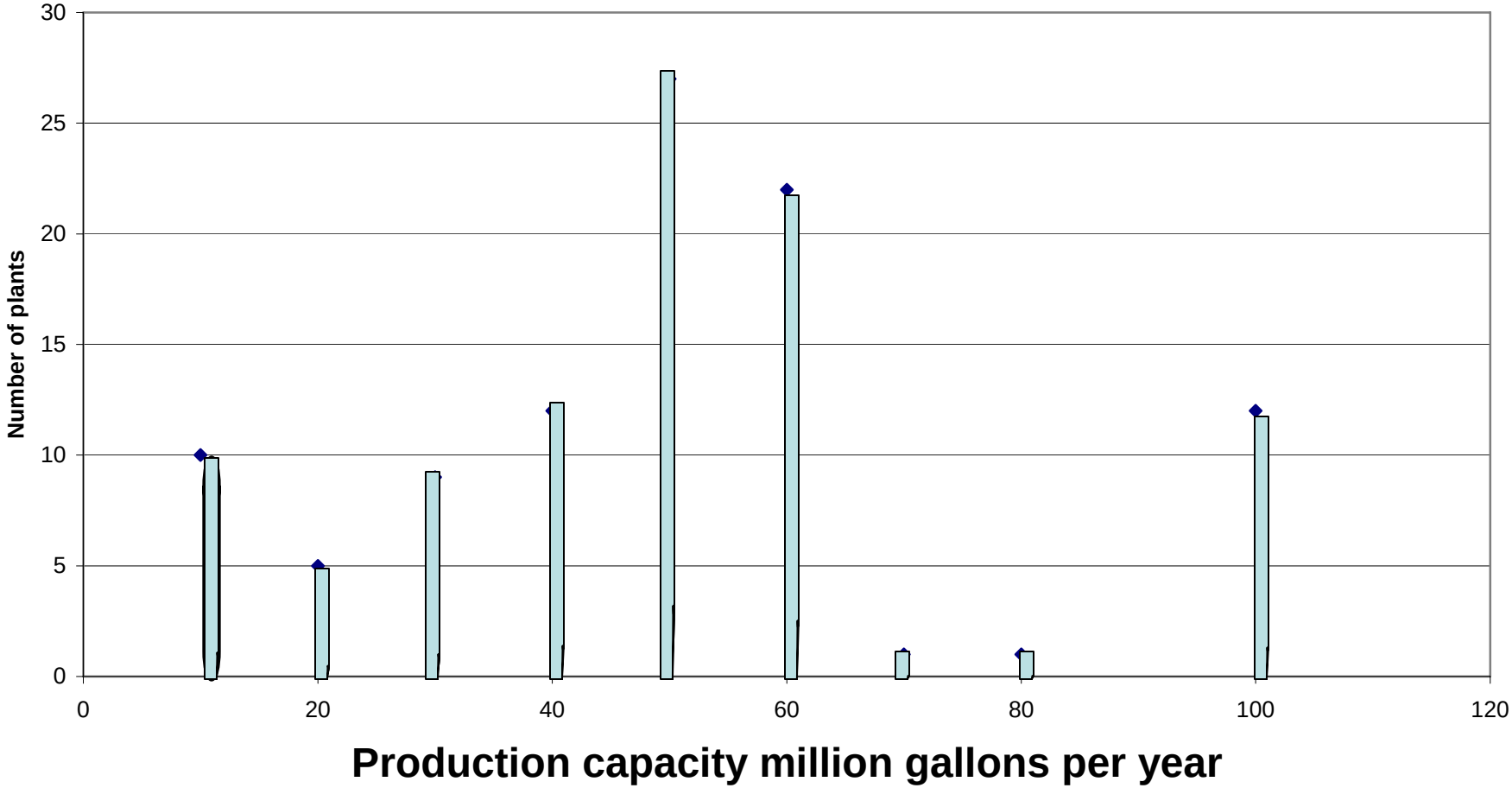
# US ethanol production Capacity

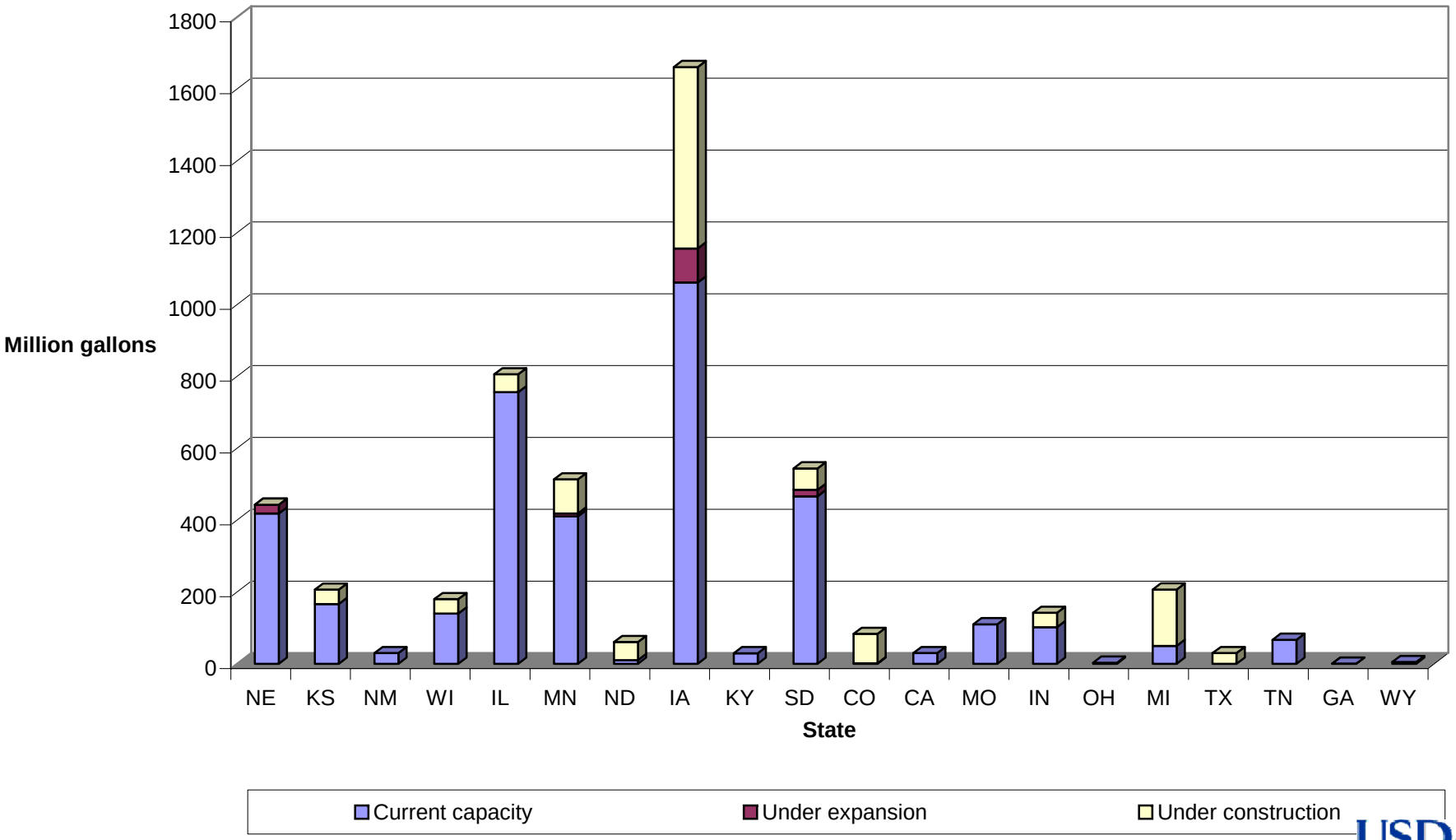



USDA

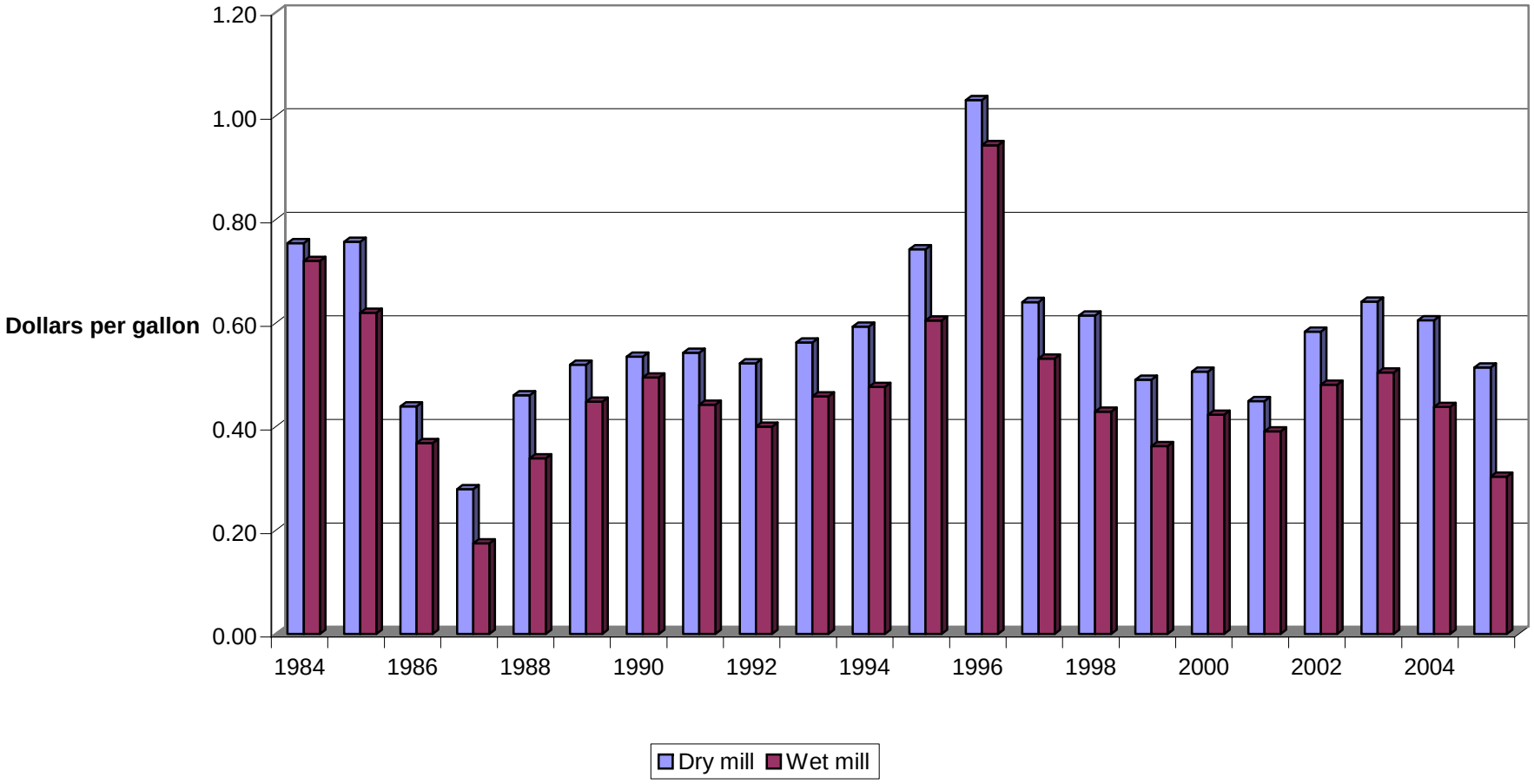
# US ethanol plants: plant capacity distribution



# Ethanol production capacity per year



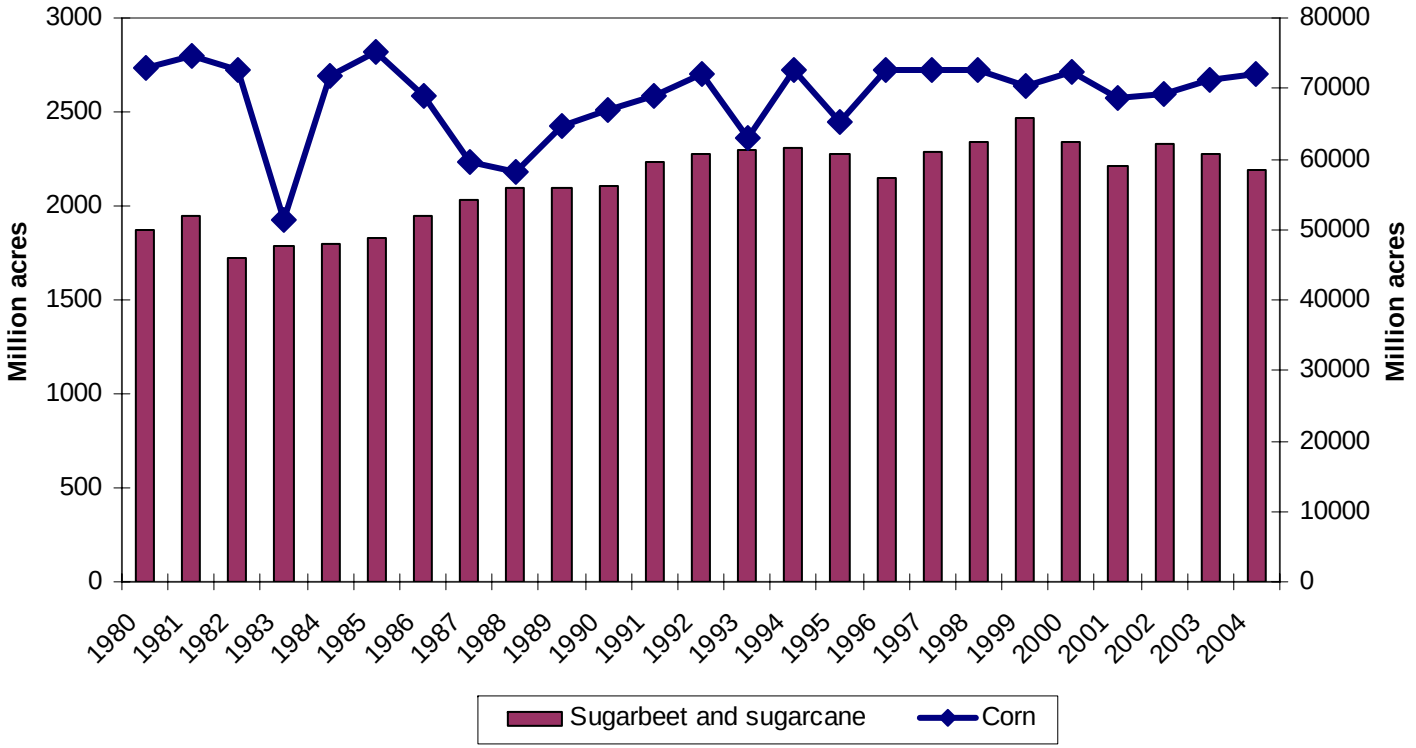
# Net corn costs per gallon of ethanol, dry and wet milling process



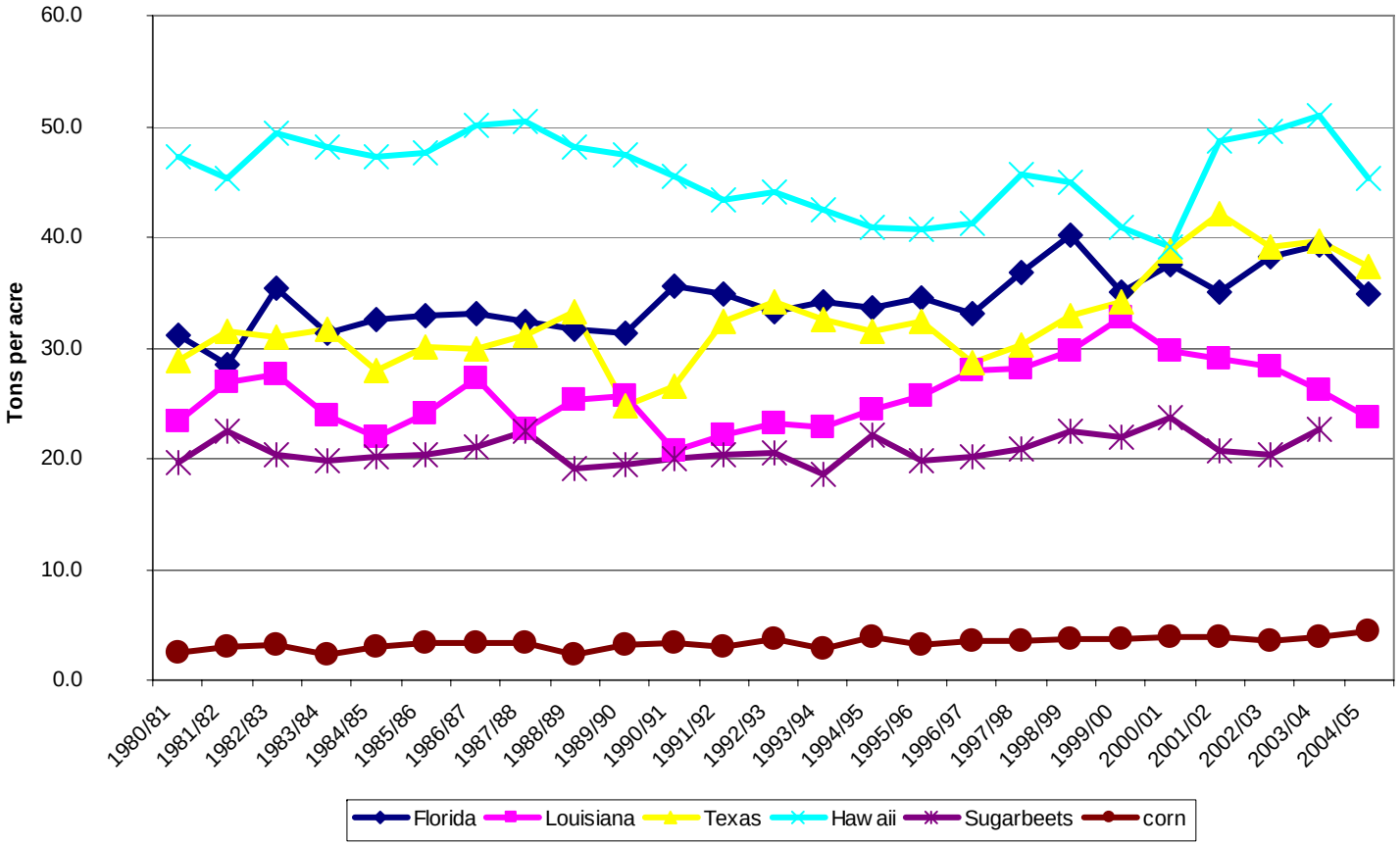
# Feedstock for Ethanol

- Corn and other grains
- Sugarcane
- Domestic and imported raw sugar
- Sugar beets
- Refined beet sugar
- Molasses

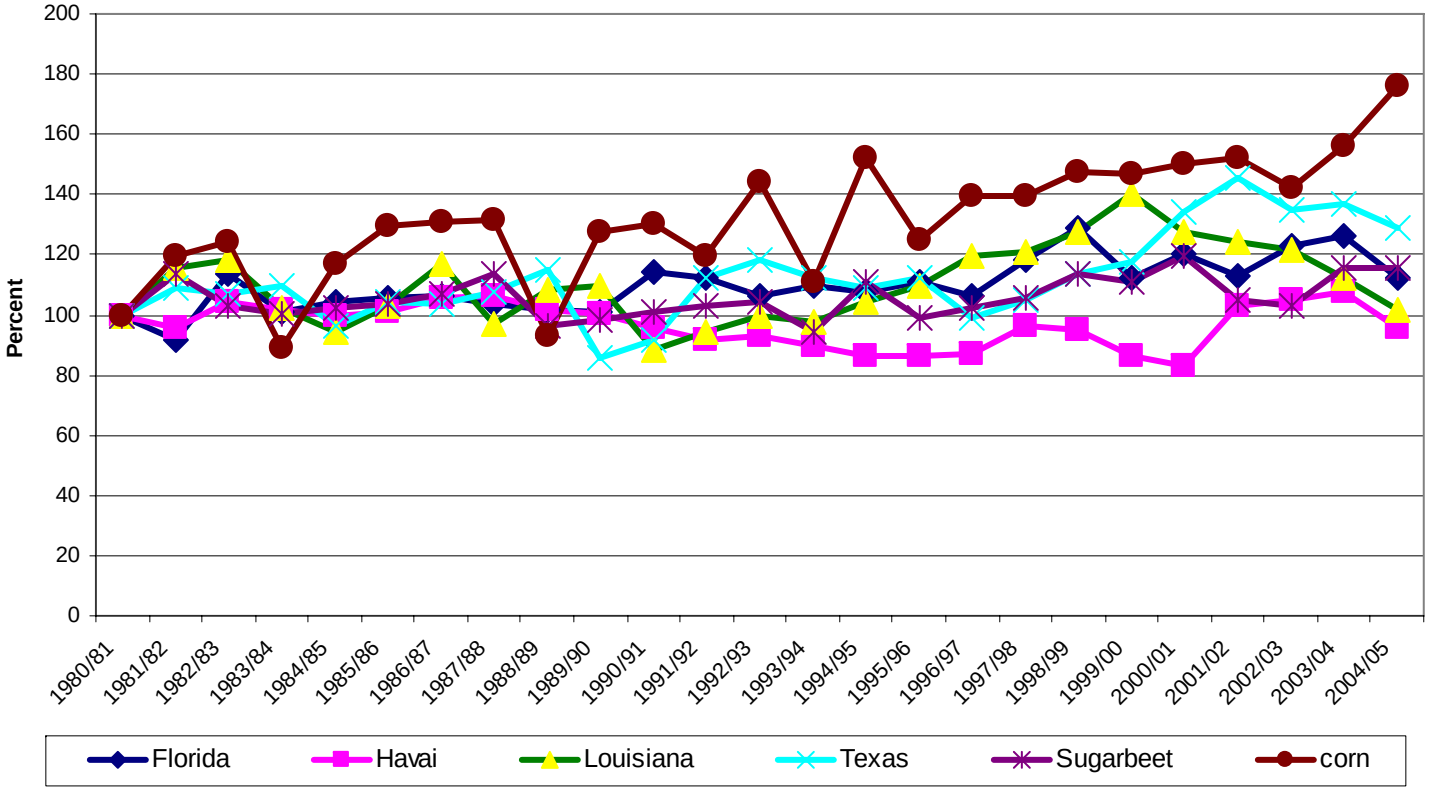
# Area harvested, sugar crops and corn



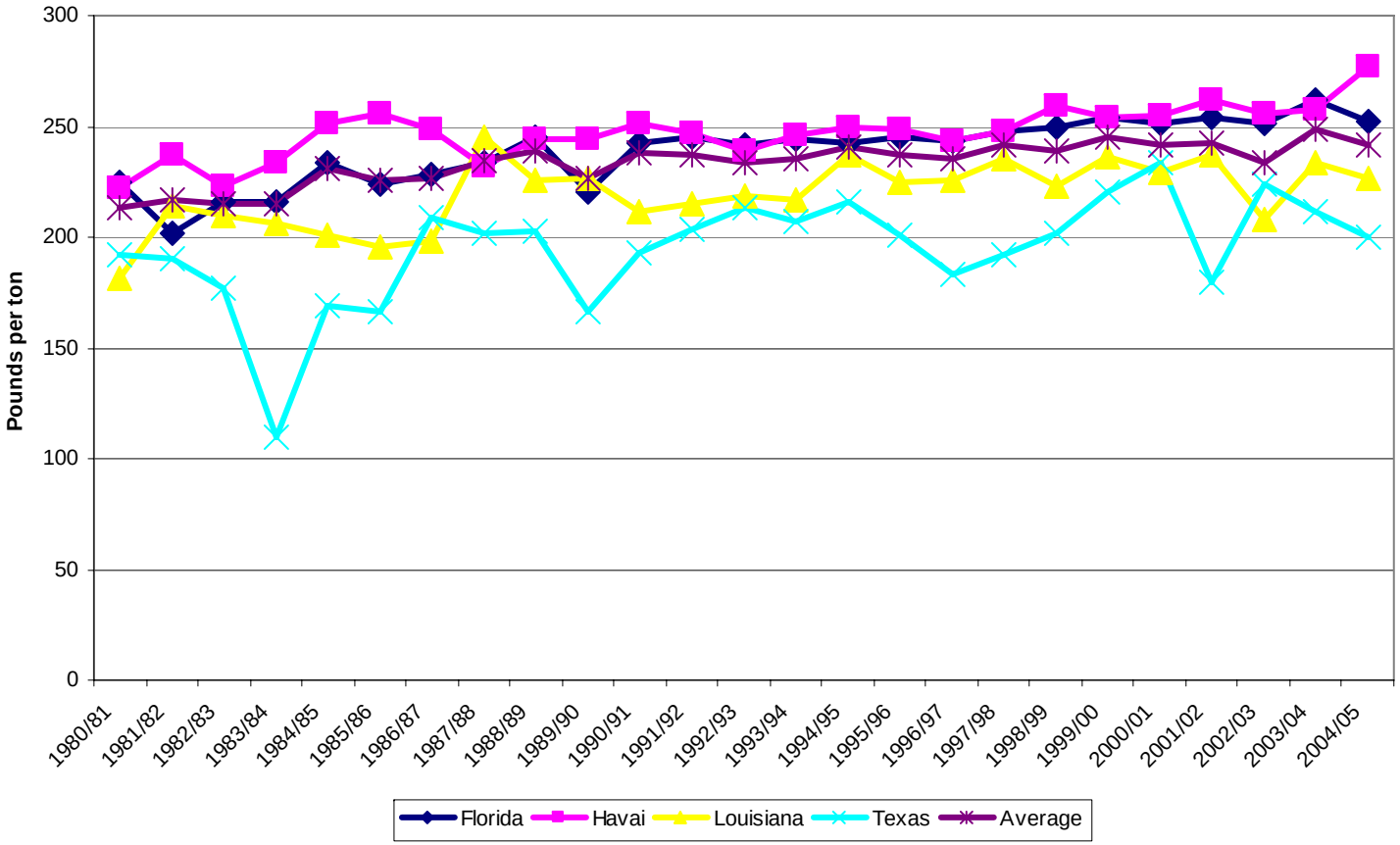
# Yield per acre, sugar crops and corn



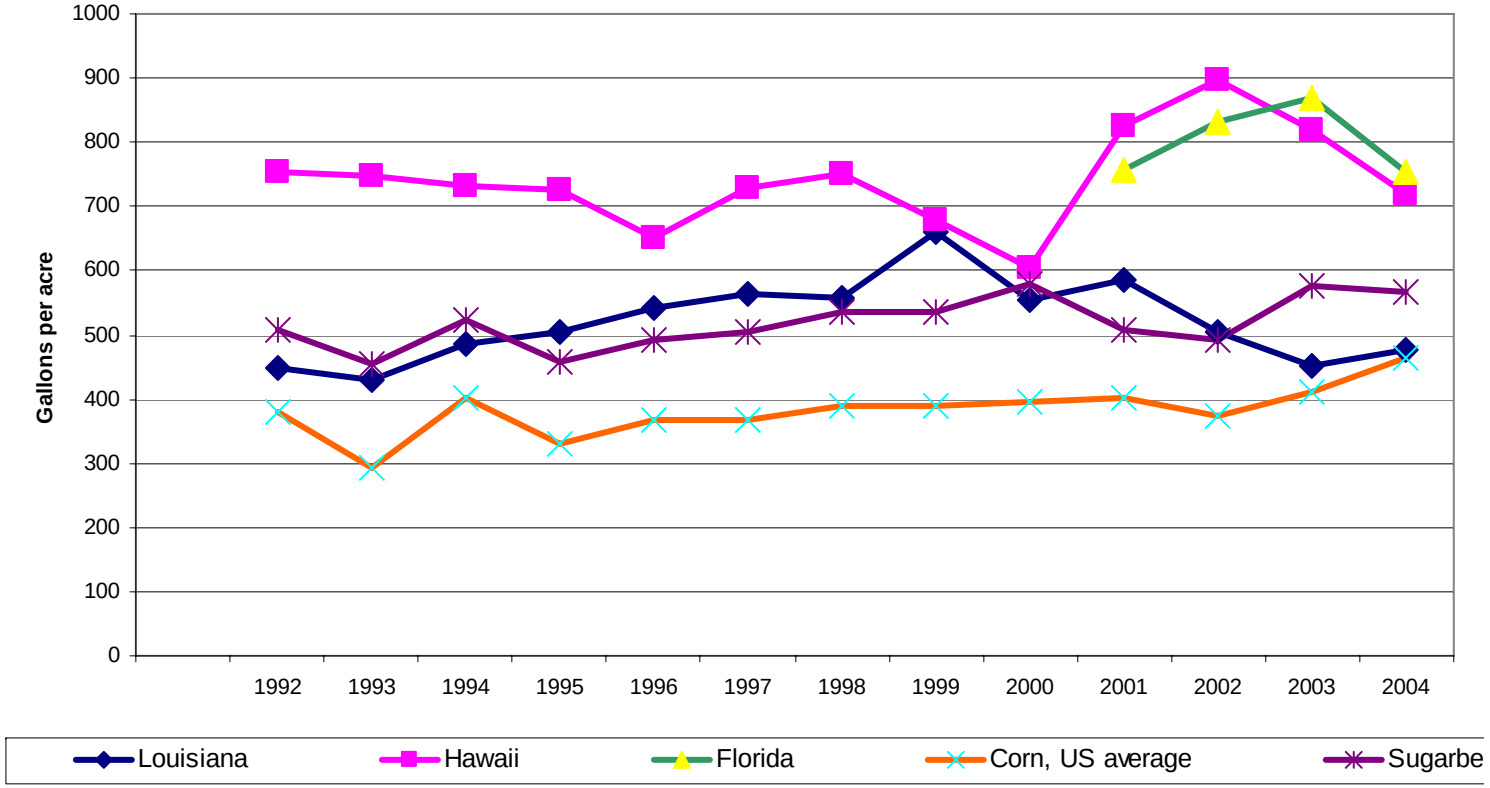
# Yield per acre, sugar crops and corn, 1980=100



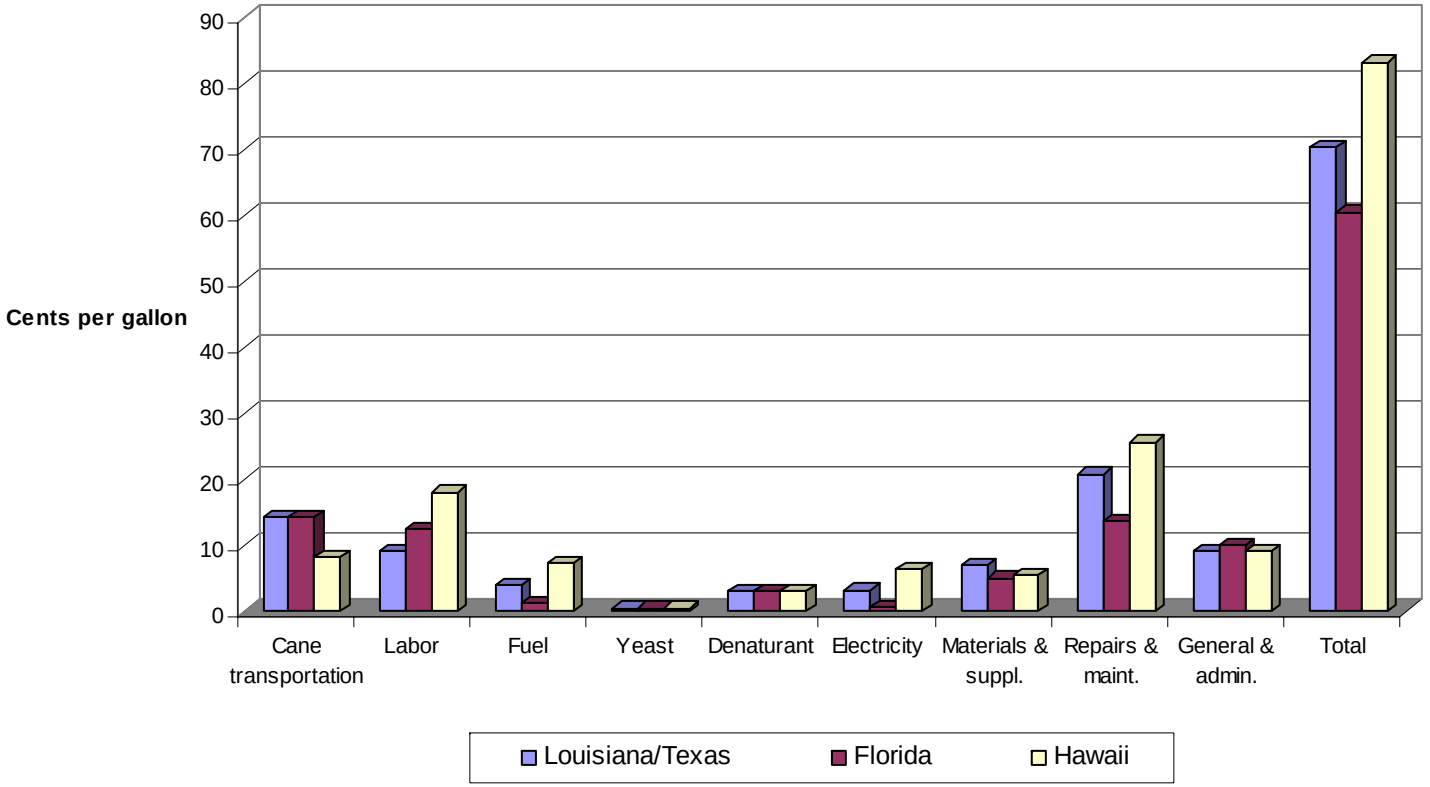
# Raw sugar yield per ton of cane



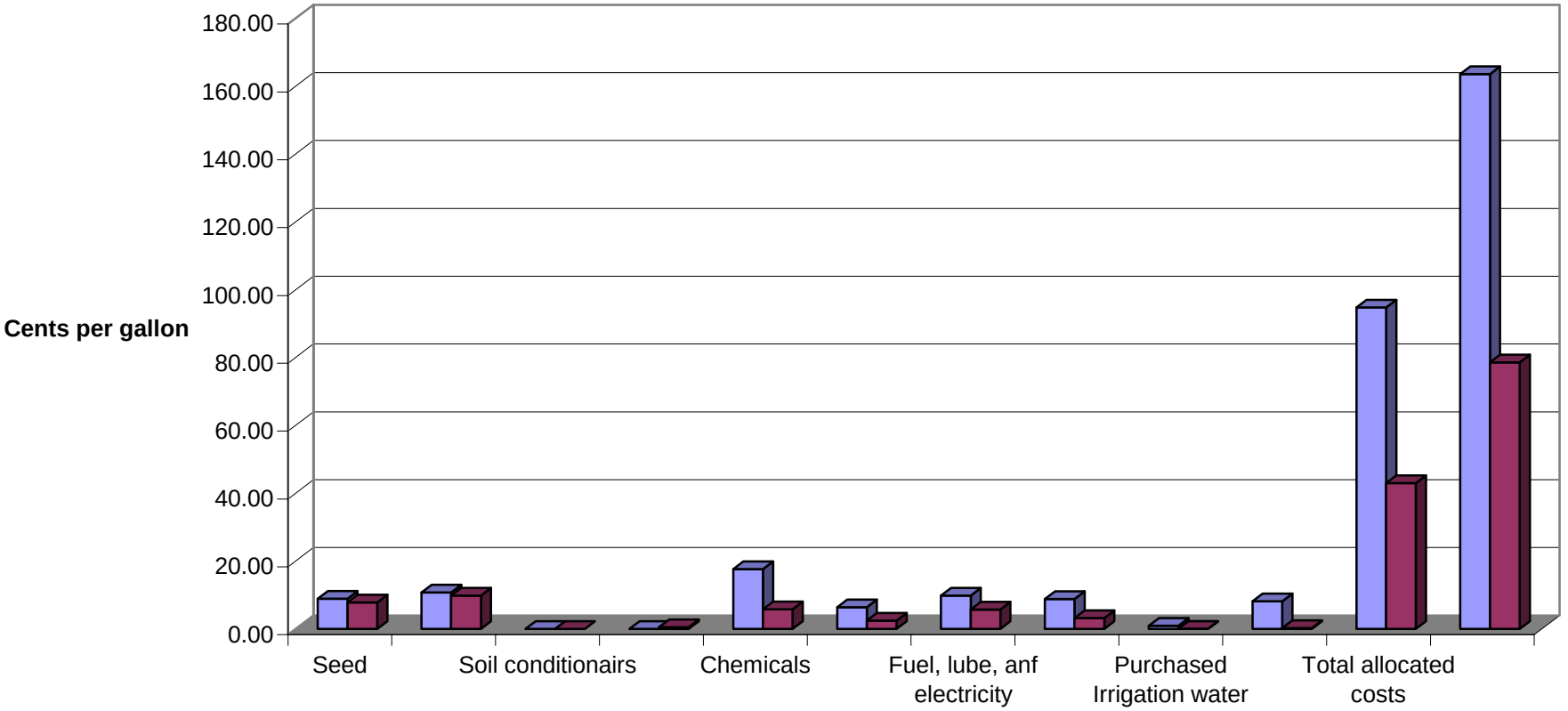
# Ethanol yield per acre per year, sugar crops and corn



# Cash operating costs: sugarcane-ethanol, 1992-96 average

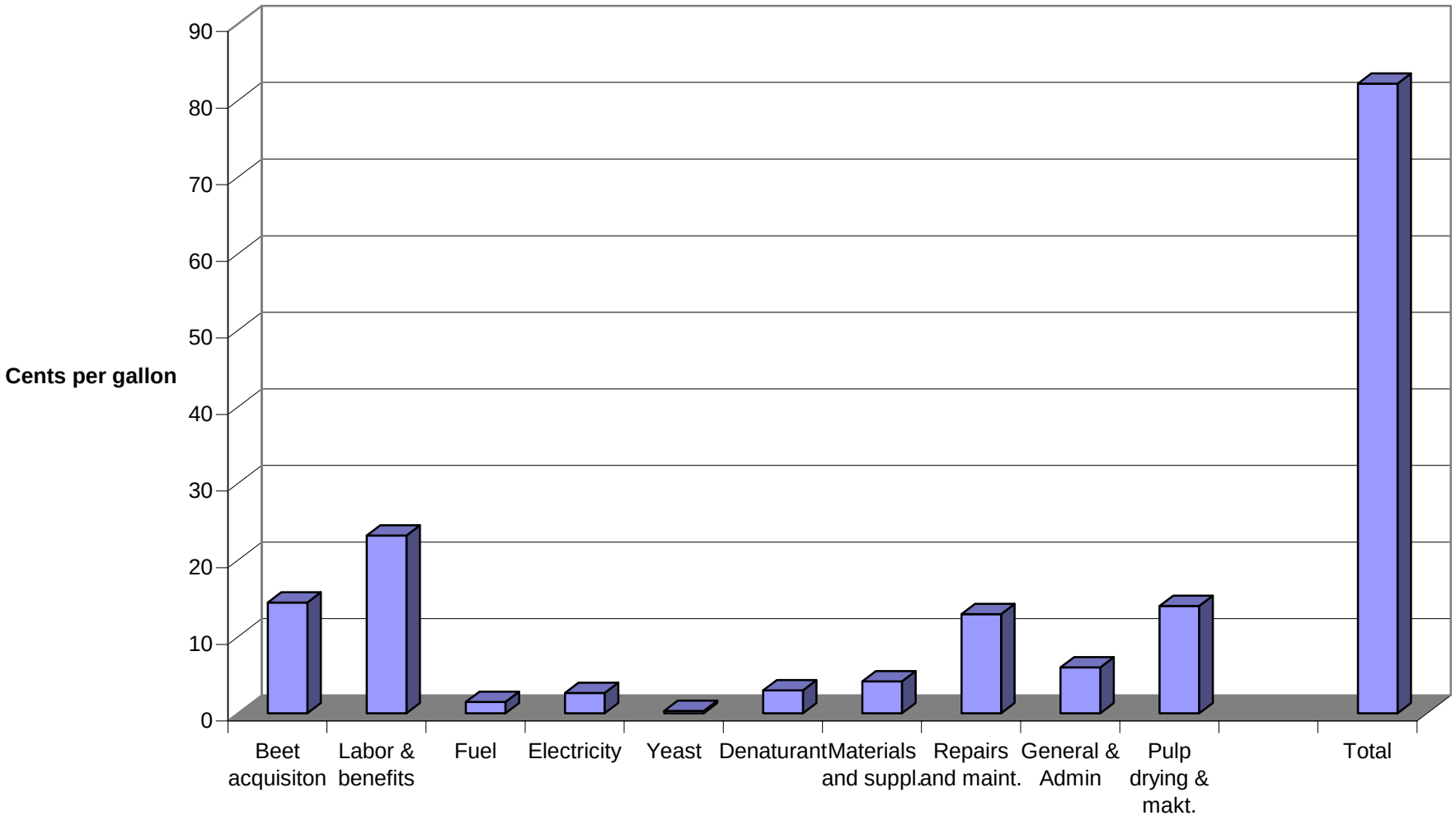


# Feedstock costs per gallon of ethanol, 2003-04 average

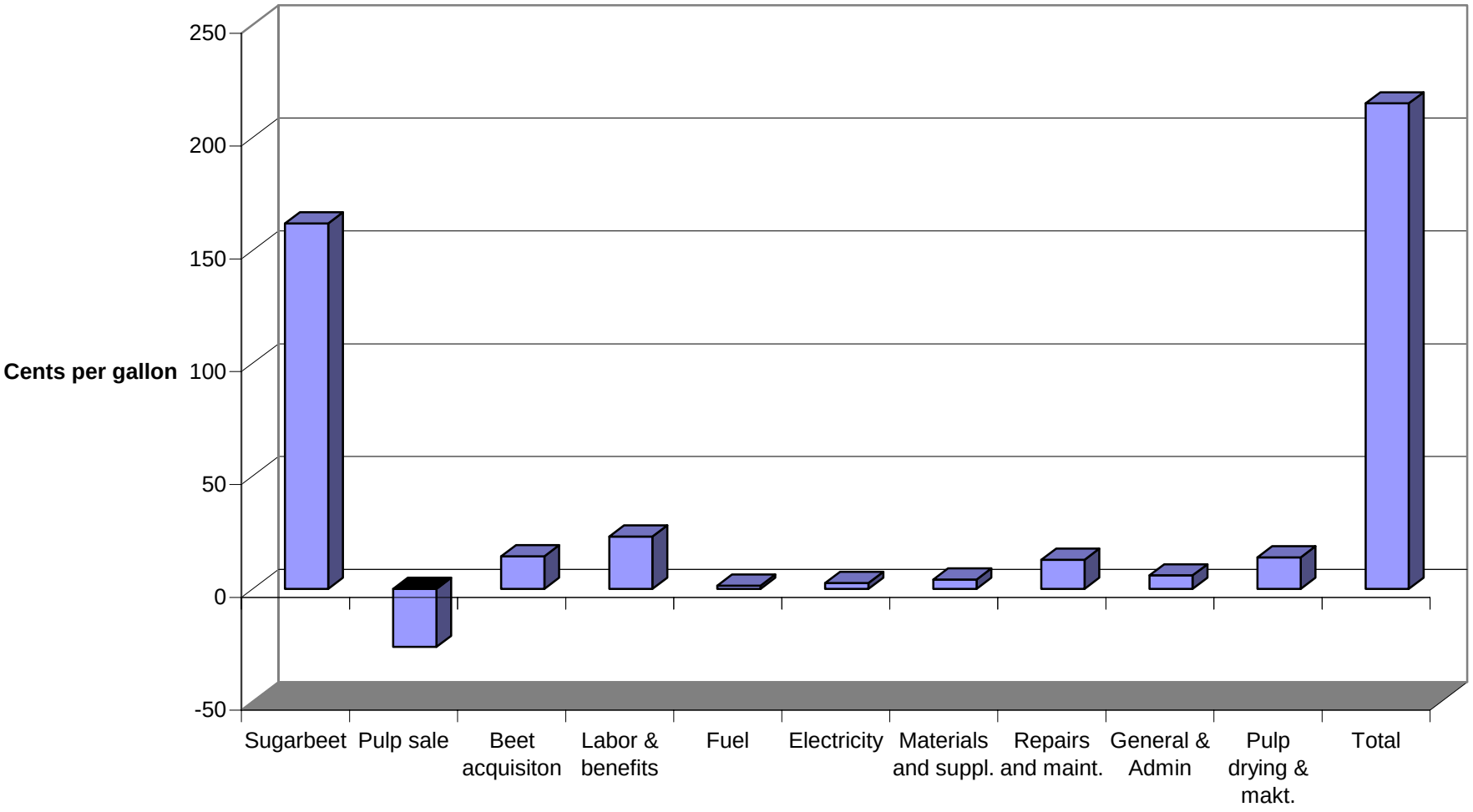



Total costs, sugar beets and corn, ARMS

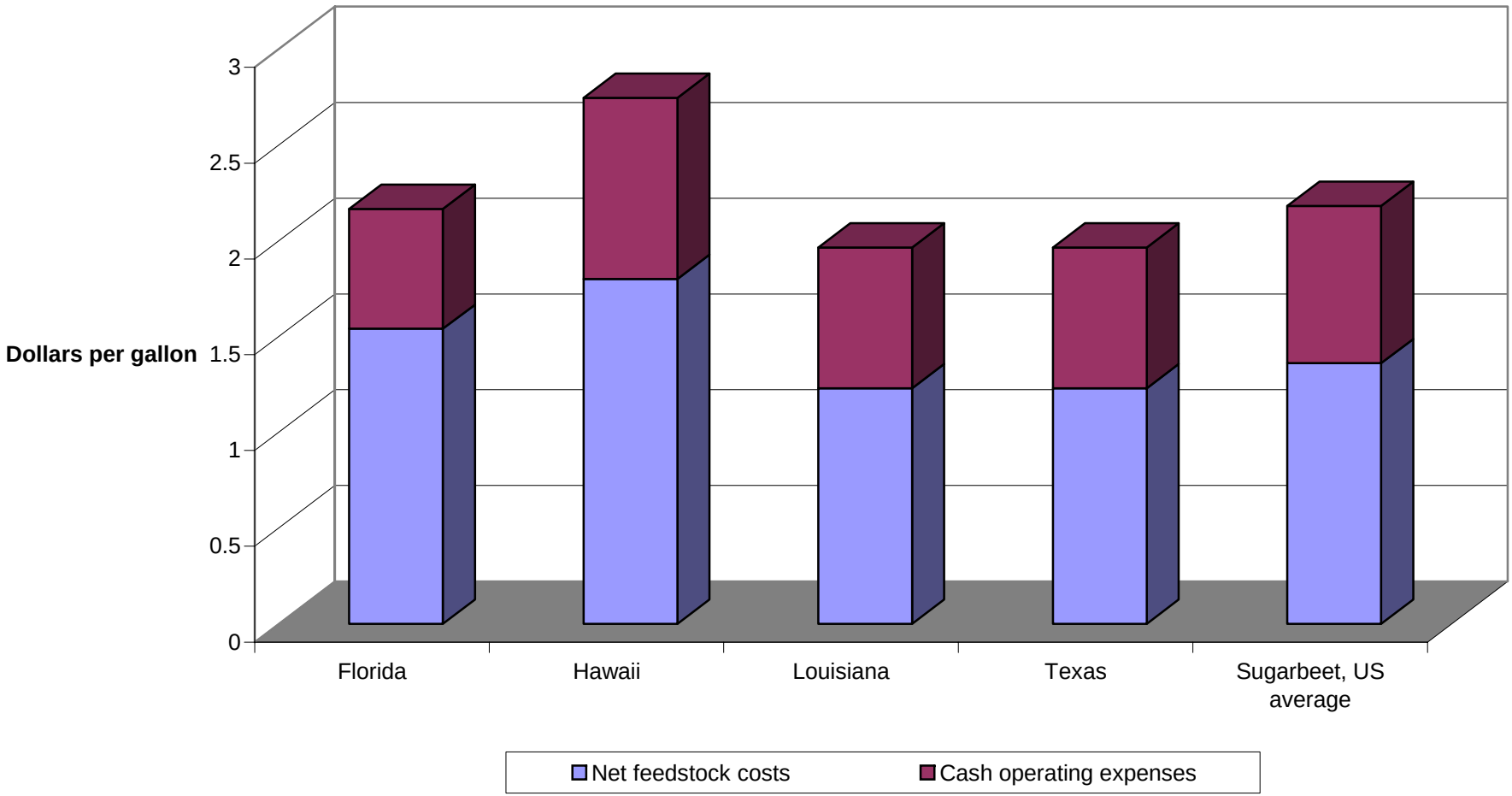
# Sugarbeets-ethanol processing costs



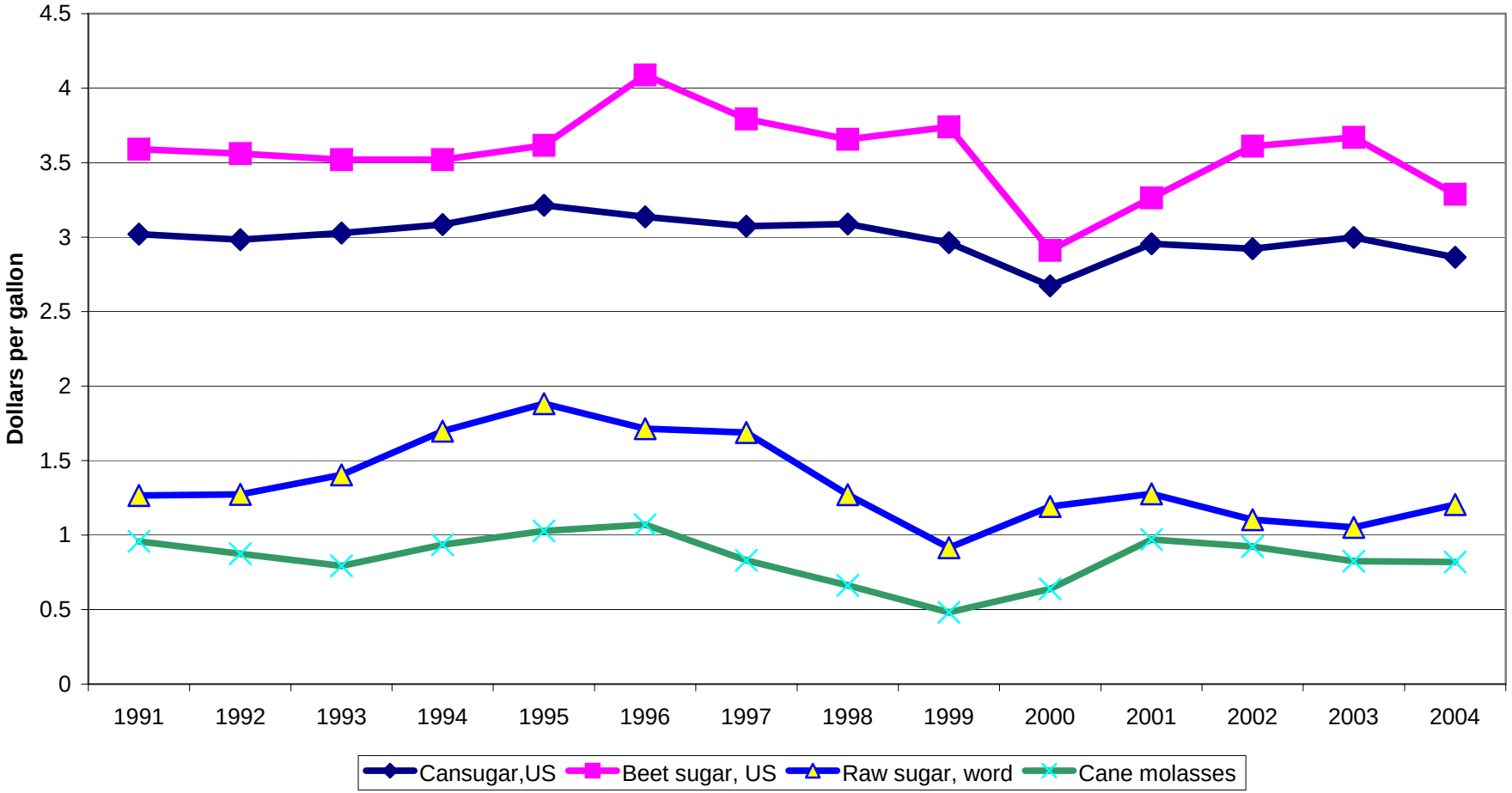
# Ethanol production costs, sugarbeet



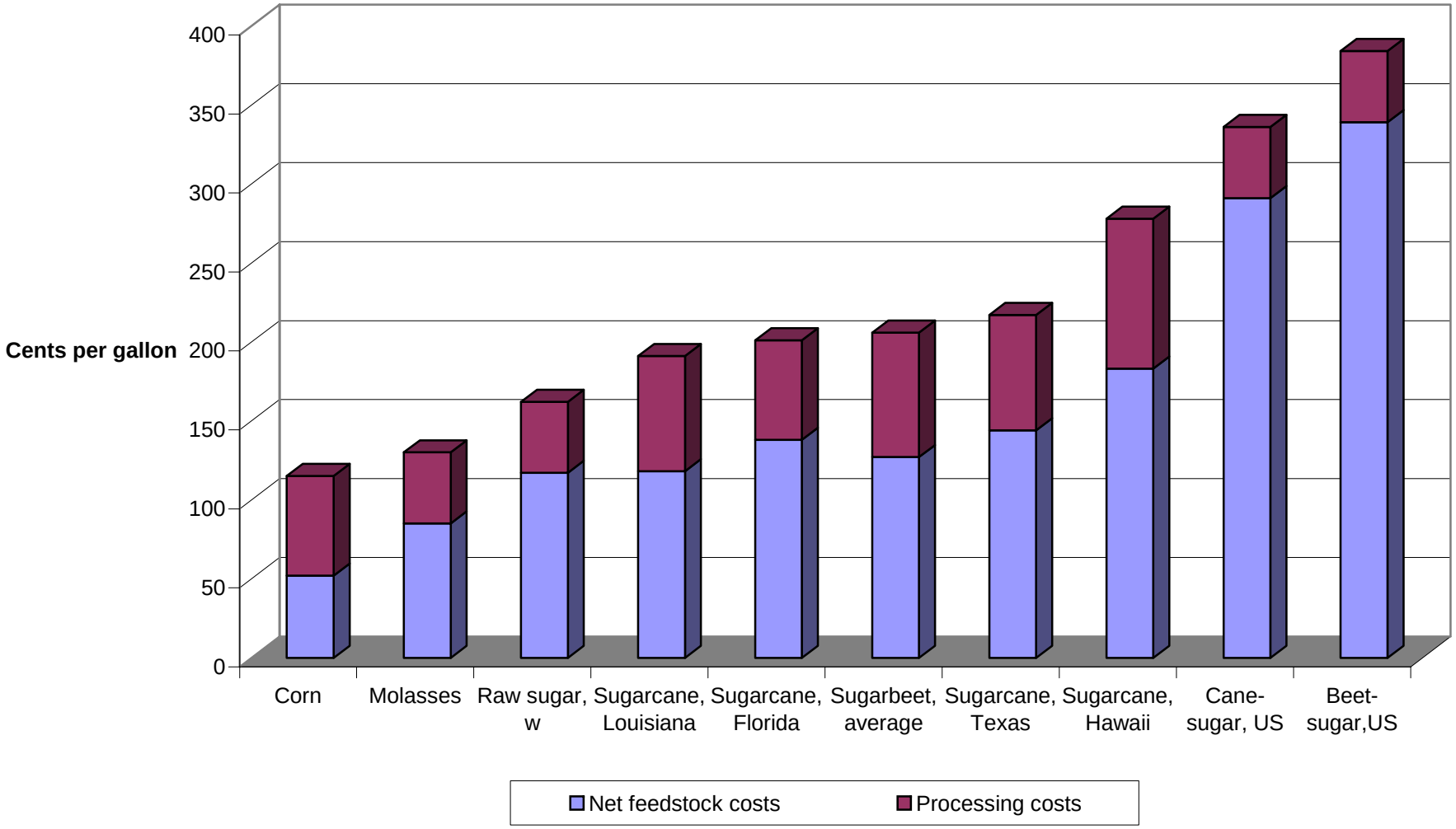
# Sugar crops-ethanol production costs, 1992-96 average



# Feedstock costs per gallon of ethanol, raw sugar, beet sugar and molasses



# Ethanol Production costs, starch and sugar (5 year-average)



# Sugarcane-ethanol: Advantages

- Higher ethanol yield per acre
- Lower energy costs
- Higher net energy balance
- Bagasse is used for production of steam & power (CHP)
- Could received 2.5 credits for every gallon
- Lower VOC emissions

# Sugarcane-ethanol: Disadvantages

- Higher feedstock costs
- Higher cane transportation costs
- Higher processing costs
- Higher labor use and labor costs
- Higher expenses for repairs, maintenance, and parts
- Higher expenses for general and administration

# Conclusions

- New technologies offer remarkable cost saving opportunities in processing corn and other raw materials to ethanol
- The existing sugarcane and sugar beet processing plants can be converted to ethanol plants at much lower costs than building new plants
- To produce ethanol, it is more cost efficient to convert beet and cane juice compared to raw and refined sugar