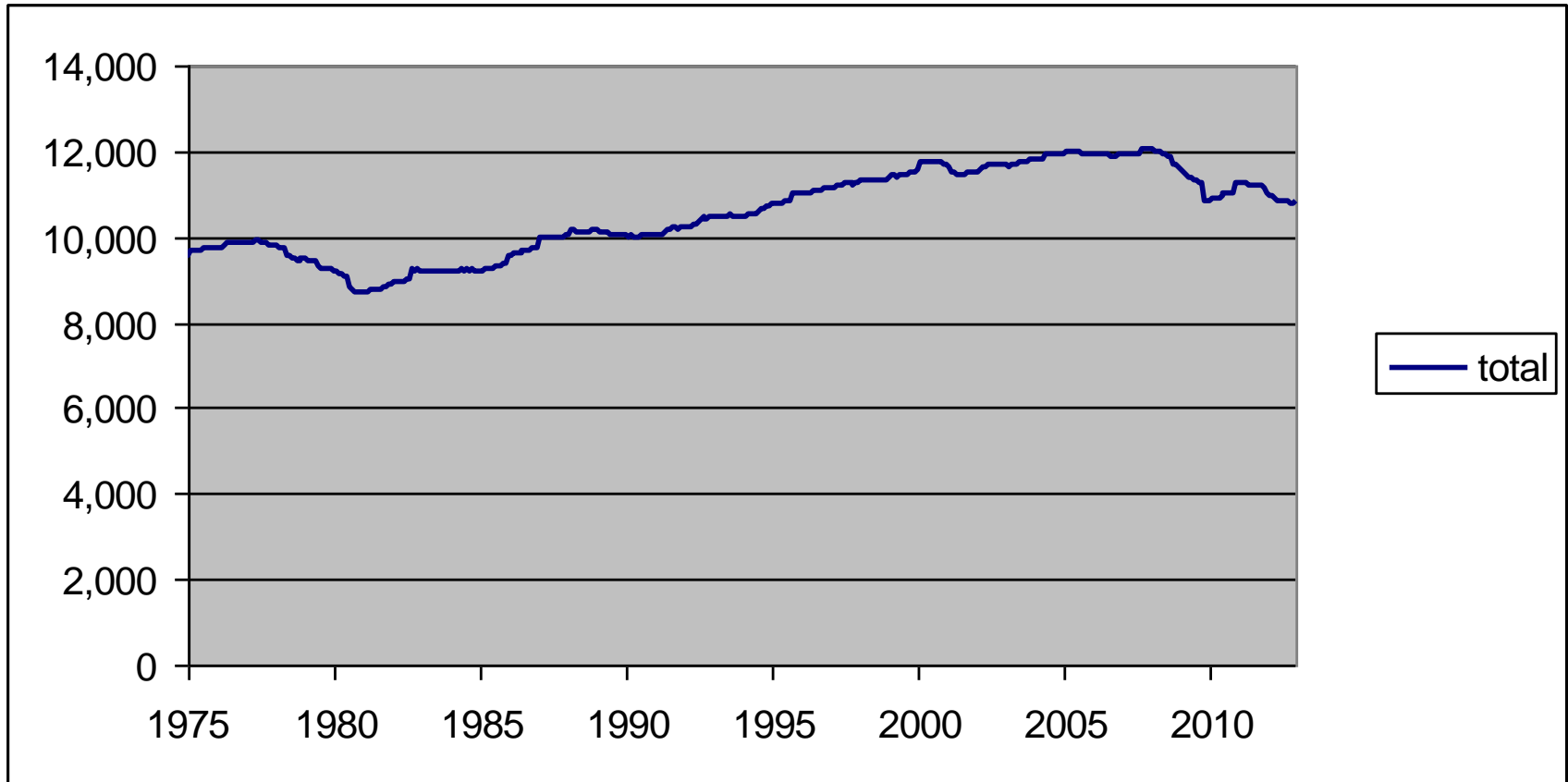# Where has all the carbon gone?

James D. Hamilton

UCSD

U.S. CO2 emissions (millions of metric tons over preceding 12 months)
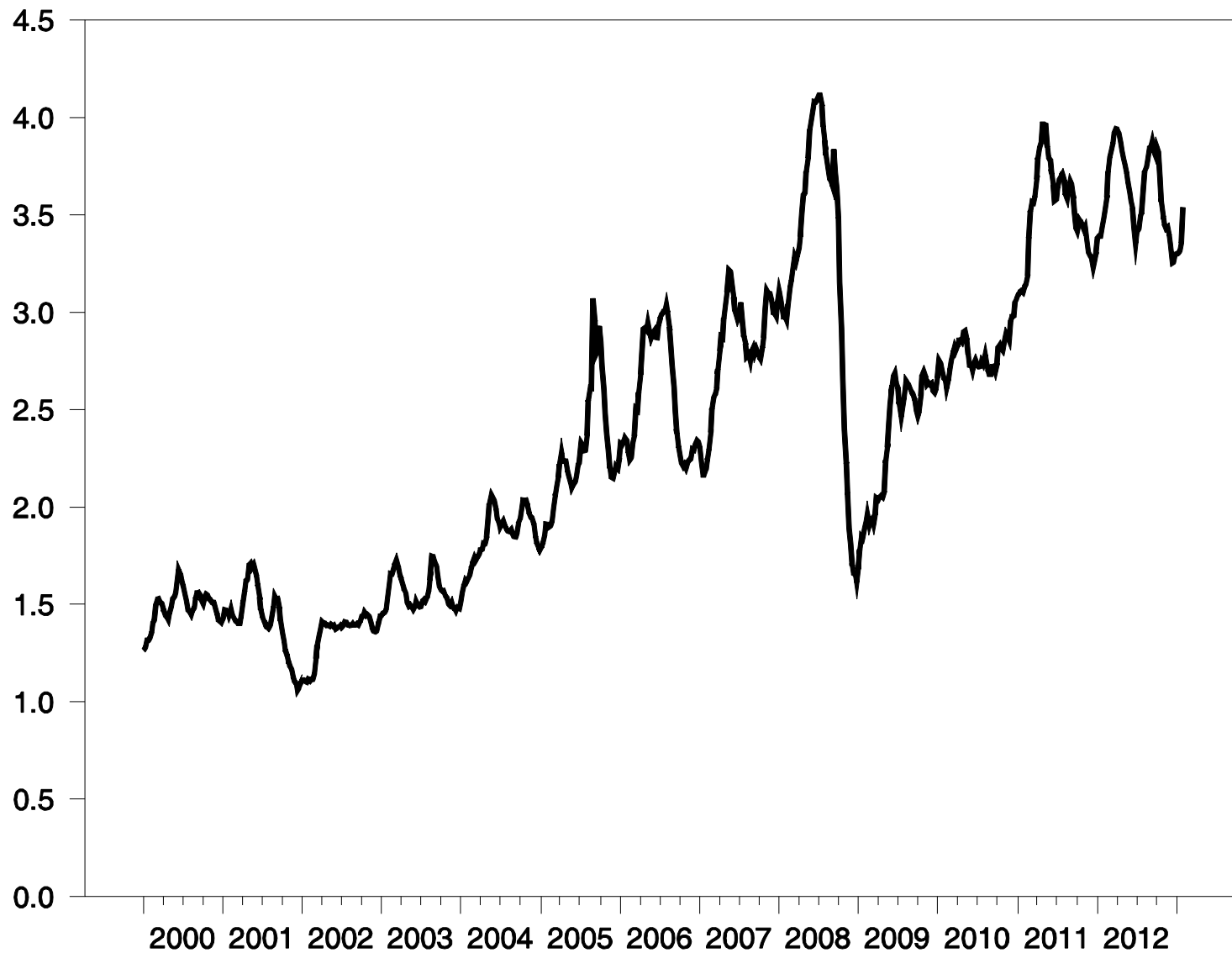

Last 12 months = 10,800 million tons
Lowest since 1995 (from EIA Monthly Energy Review)
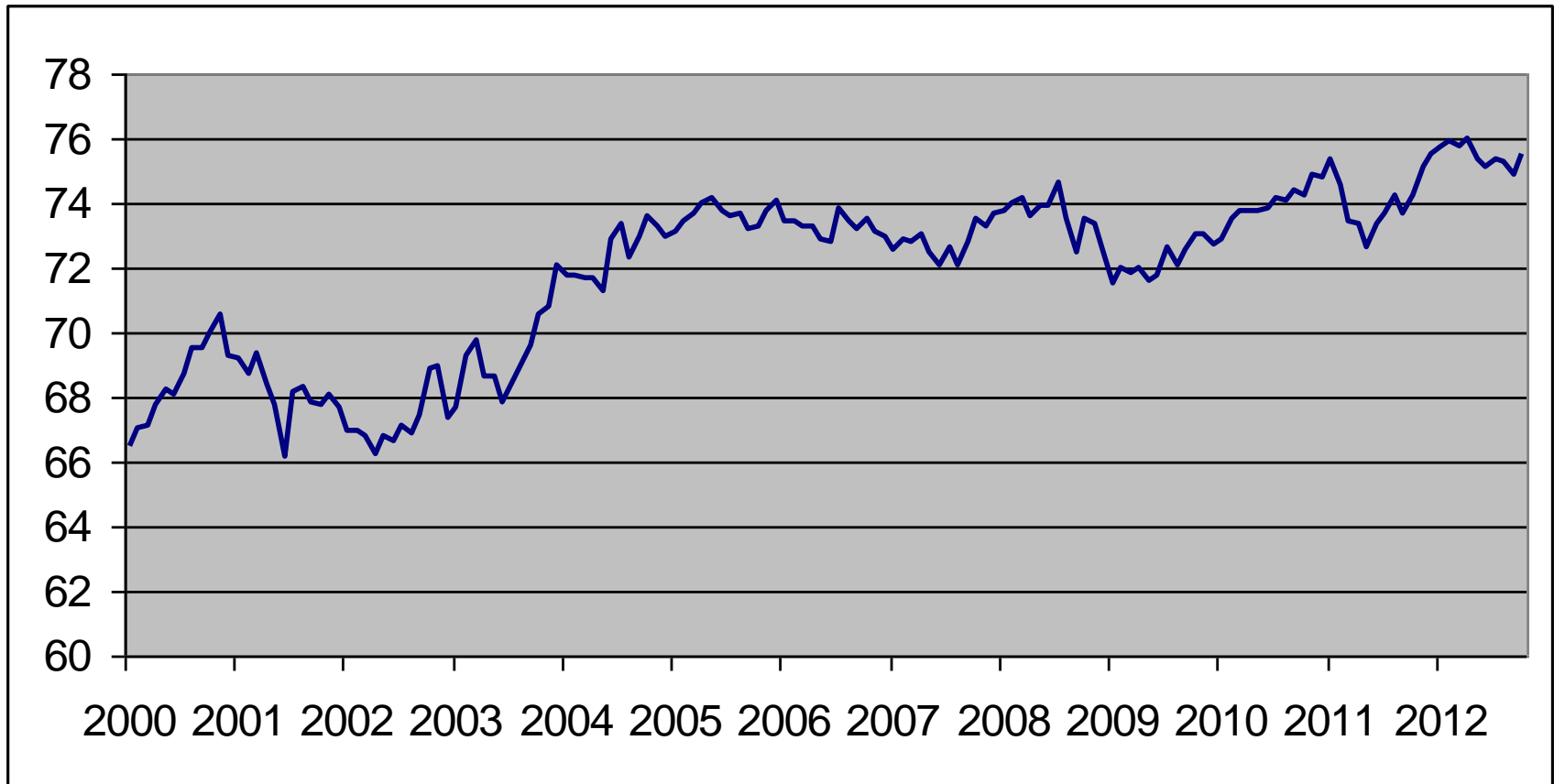
Optimal carbon tax:

- $25 / ton CO_2 = 25¢/ gallon gasoline
- $100 / ton CO_2 = $1.00 / gallon gasoline

Average weekly U.S. retail gasoline price ($/gallon)
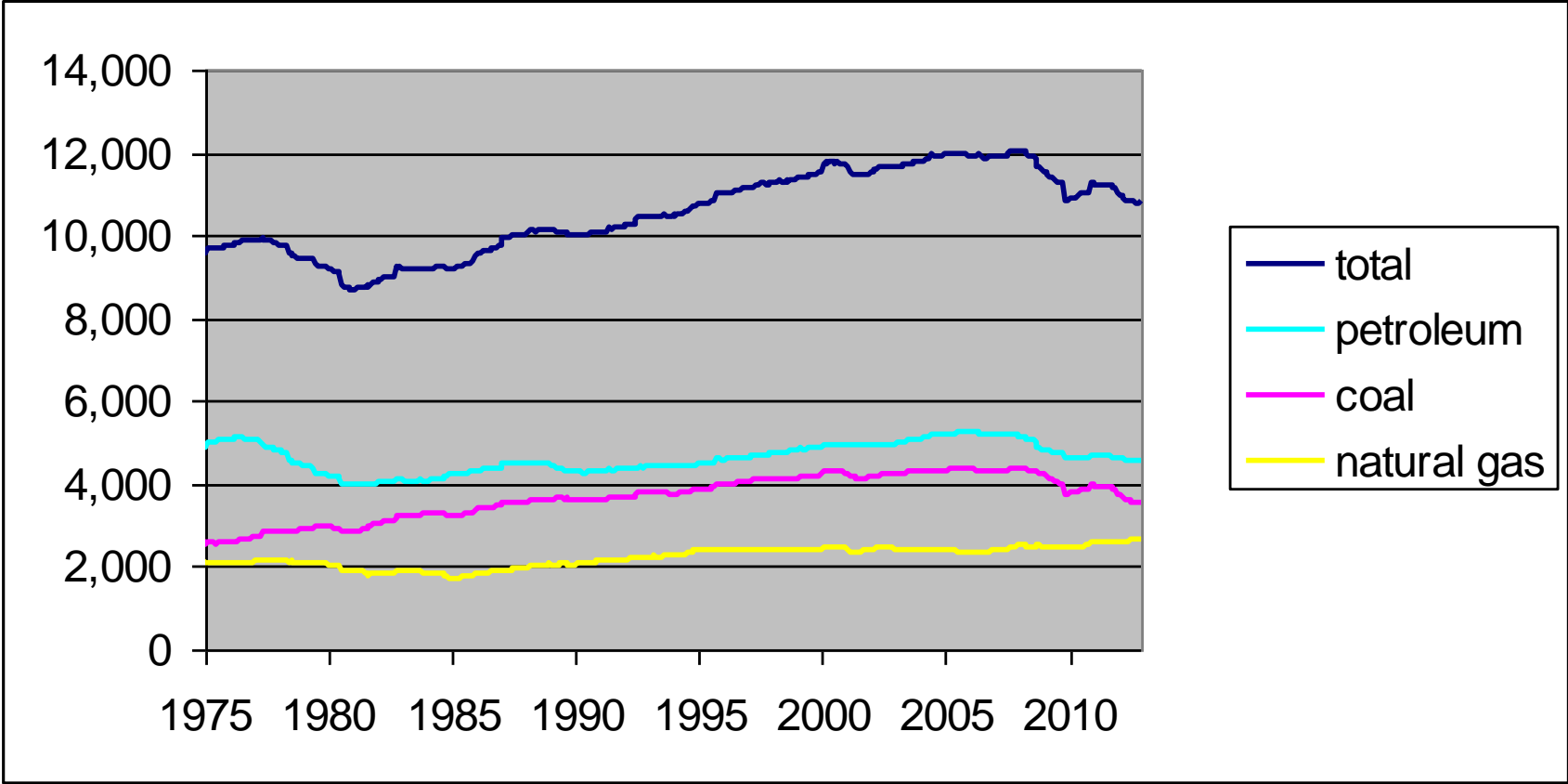

Data source: www.eia.gov/dnav/pet/pet_pri_spt_s1_w.htm

World crude oil field production (millions of barrels per day)

U.S. CO2 emissions (millions of metric tons over preceding 12 months)

Natural gas production has climbed significantly

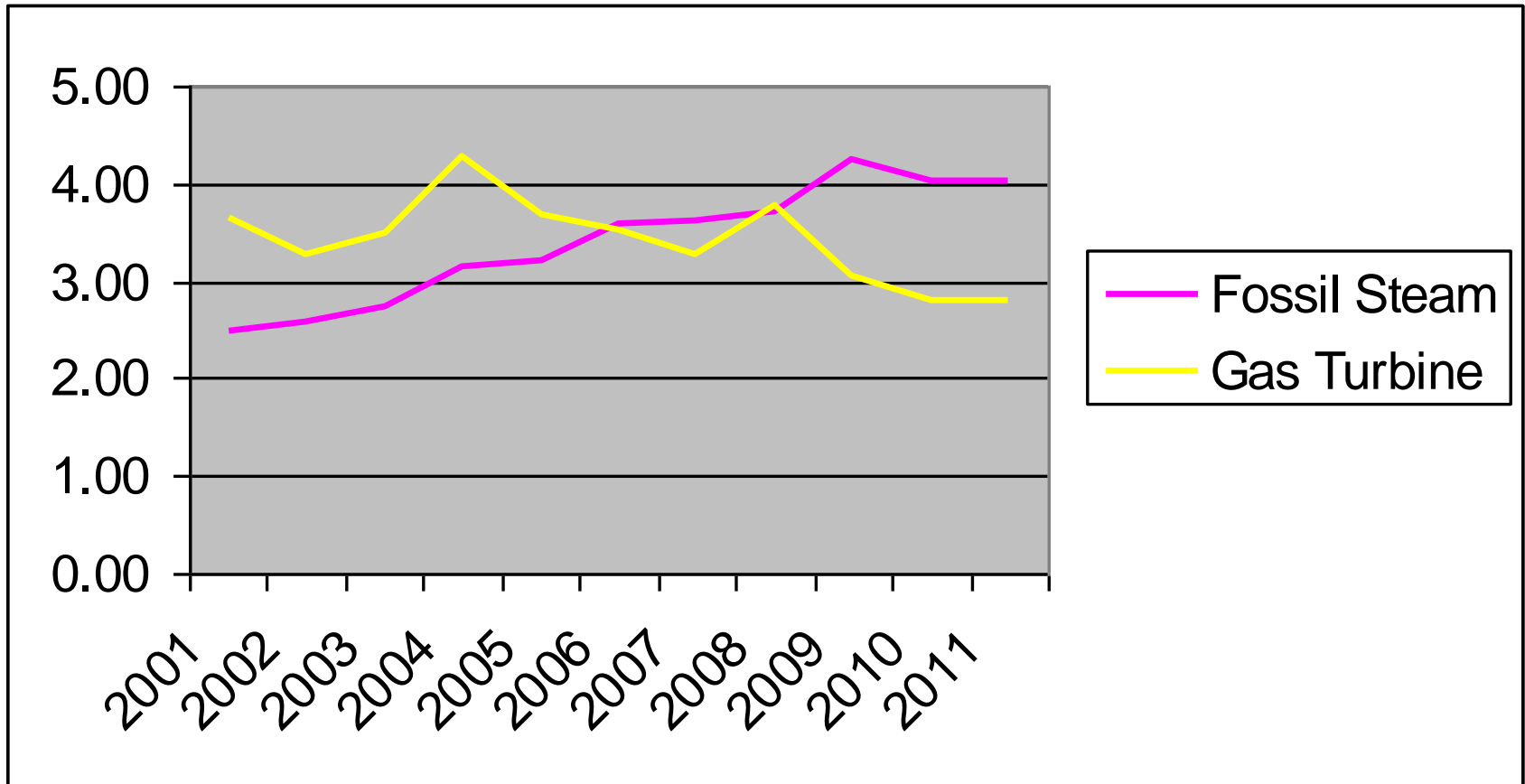**U.S. Natural Gas Gross Withdrawals**

Million Cubic Feet

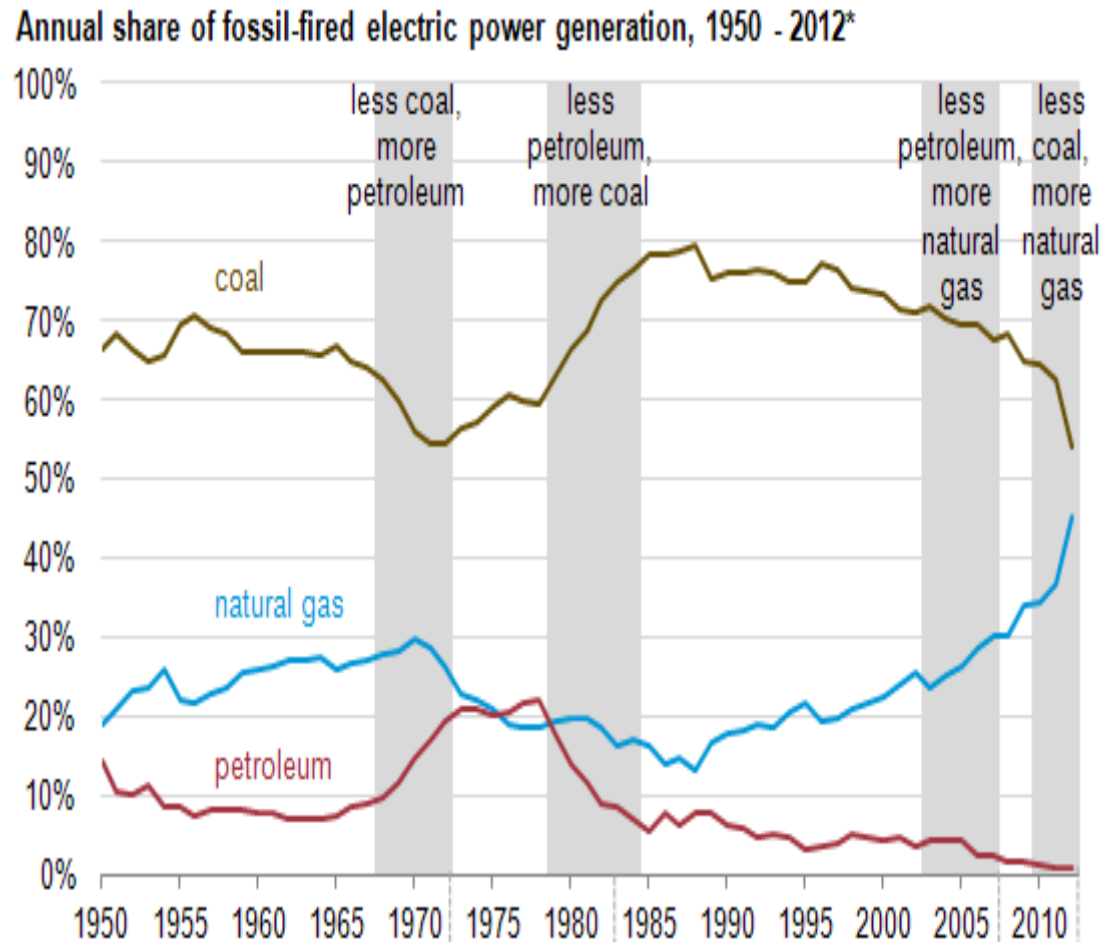— U.S. Natural Gas Gross Withdrawals

eia Source: U.S. Energy Information Administration

Operating cost per kilowatt hour for fossil steam versus gas turbine


Source: www.eia.gov/electricity/annual/html/epa_08_04.html

Natural gas is replacing coal for electricity generation

Annual share of fossil-fired electric power generation, 1950 - 2012*

Lignite coal: 2.13 lb CO2/kwh Natural gas: 1.12 lb CO2/kwh. Source: www.eia.gov/tools/faqs/faq.cfm?id=74&t=11; www.eia.gov/todayinenergy/detail.cfm?id=7090

Price of crude oil and natural gas on equivalent BTU basis
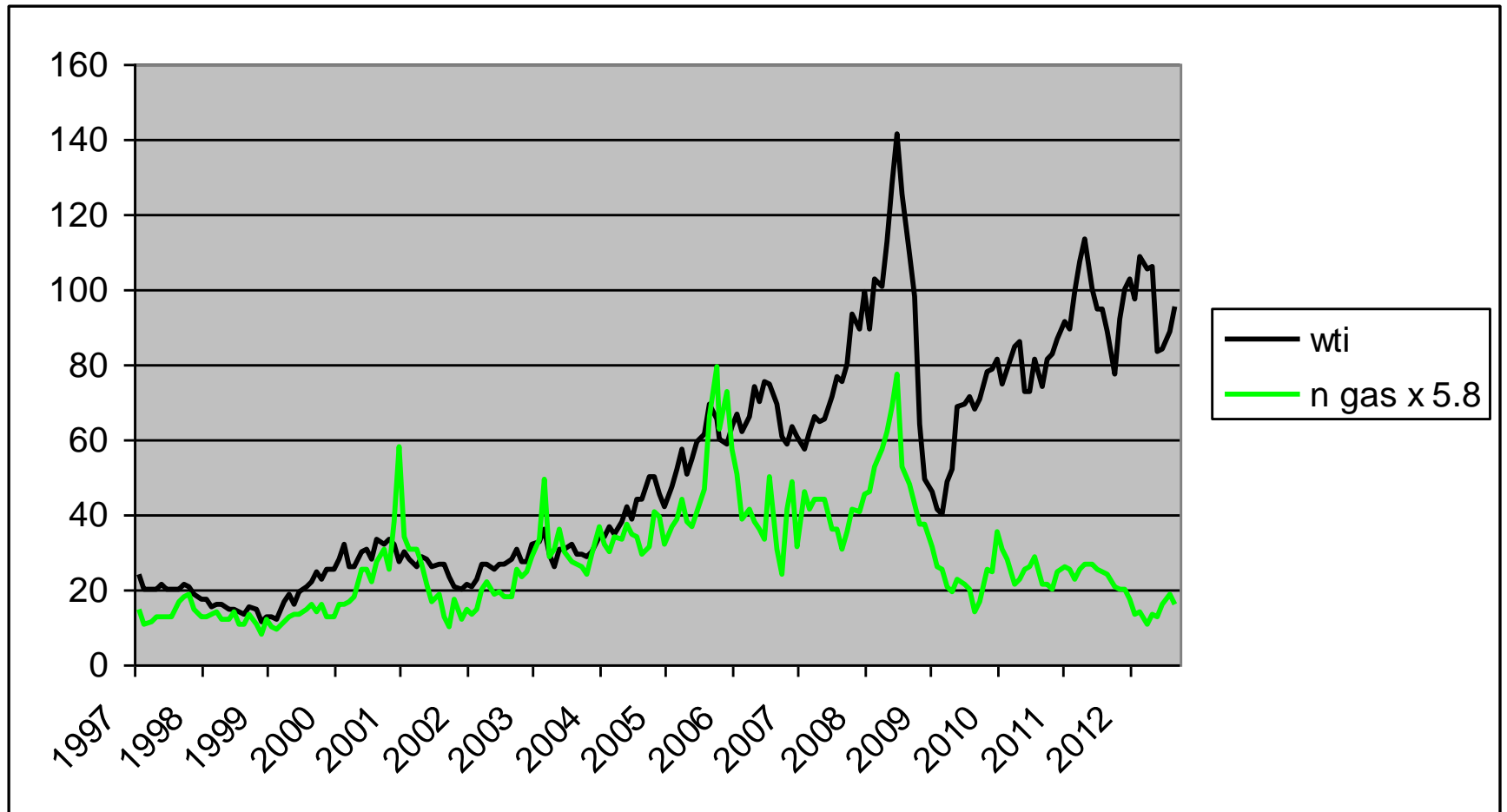
America's Natural Gas Highway
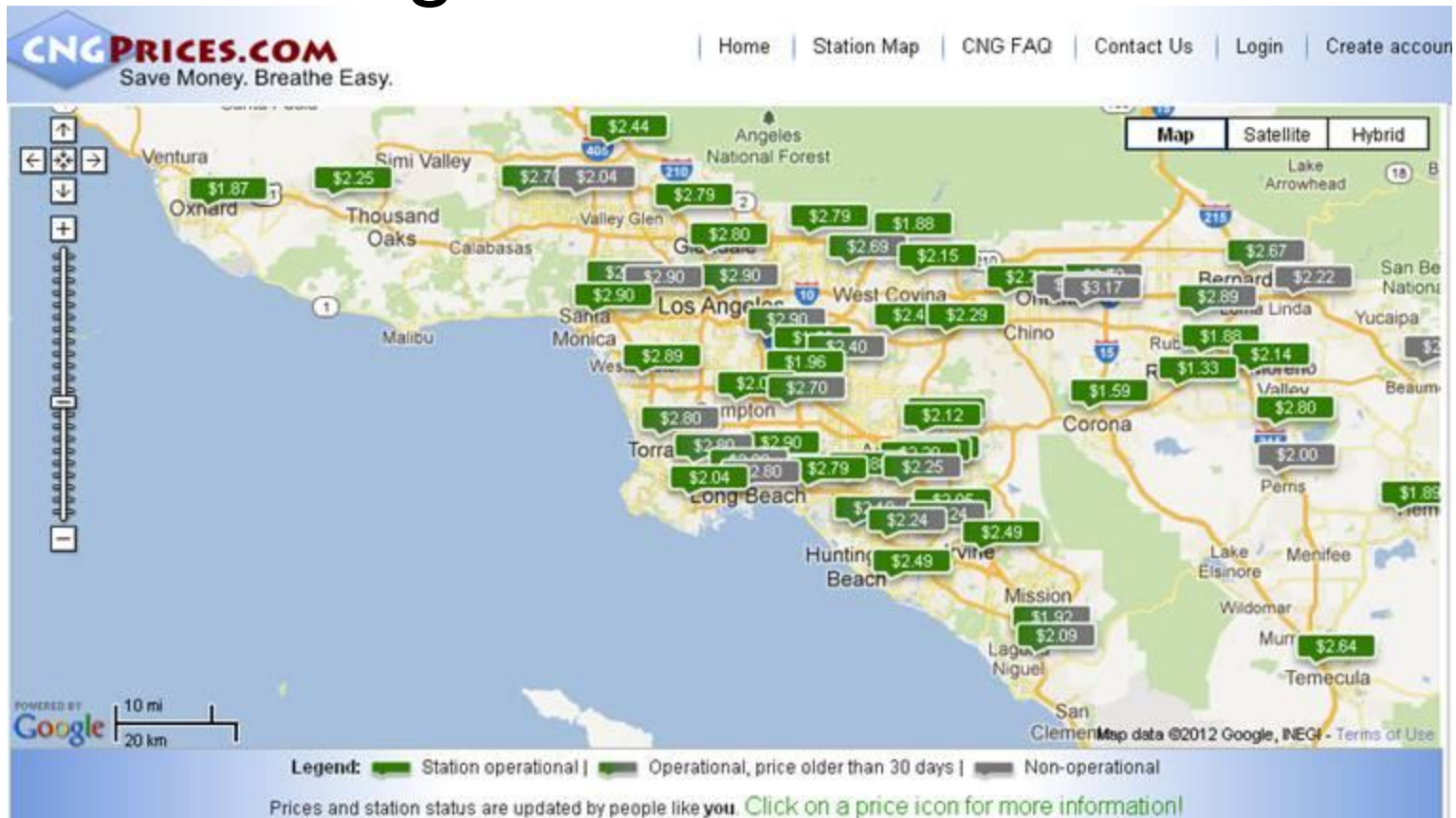LNG truck fueling coast-to-coast and border-to-border

2012/2013 Corridor Plan
○ 2012 Stations
— 2012 Corridors
● 2013 Stations

VIEW STATIONS >

Source: www.cleanenergyfuels.com/buildingamerica.html

Locations and prices for compressed natural gas stations in L.A.

Source: www.cngprices.com/

- March 5, 2013: BNSF Railway announces plan to test locomotives powered by liquified natural gas
- March 5, 2013: Shell announces plan to develop infrastructure to provide liquified natural gas to ships operating in Great Lakes and Gulf of Mexico

Policy suggestions

Don't pick winners, but make playing field even

- renewable fuels standard: why not satisfied by natural-gas-based products?

Proposal for amending Corporate Average Fuel Economy (CAFE)

- x_i = gallons of petroleum-based gasoline that vehicle i uses to travel 1 mile (= 0 for alternative-fuel vehicles)
- N_i = number of vehicles of type i sold by company
- CAFE = $\Sigma\, N_i\, /\, \Sigma\, N_i x_i$