# Will the Refining Industry Survive the Clean Air Act?

**Presented to AWMA, Gulf Coast Chapter; April 2012**


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## QUESTION - BOTH ECONOMIC AND POLITICAL QUESTION

Answer requires discussion of on-going, contemporaneous Clean Air Act (CAA) requirements, which are applicable to petroleum refineries

Typically these are control requirements for criteria pollutants

Recent developments regarding control of greenhouse gas (GHG) emissions under Clean Air Act are now a large factor

Since GHG developments are recent, costs related to such control is largely unknown

# OVERVIEW: PETROLEUM REFINING STRATEGIC SITUATION

## Current Petroleum Refining Economic Situation

**Current Major Issues Regarding CAA** *(Reference: Charles Drevna, President, NPRA 2011 letter to Darrell Issa, Chairman, House Committee on Oversight and Government Reform)*

EPA Greenhouse Gas (GHG) Regulation through CAA

Proposed Ozone NAAQS

E15 and Renewable Fuels Standard (RFS)

Construction delays caused by federal and state permitting requirements (added by me)

**CAA Complexity**

# CURRENT PETROLEUM REFINING ECONOMIC SITUATION

Since 2010, oil companies said they would close seven U. S. refineries with 1,300,000 barrels a day of crude (BBL/D) capacity

Refining closures are viewed as a last resort

Industry thinks reductions of one million to two million BBL/D are needed [1]

There is a long-term decline in fuel demand due to regulatory and economic shifts [1]

- Regulations to increase fuel efficiency of U. S. cars (CAFE standard) and to triple amount of bio-fuels blended into gasoline will reduce gasoline demand
- Increased electric vehicles and use of compressed natural gas across U. S. commercial vehicle fleets

[1] *Deloitte Center for Energy Solutions (2010)*

# CURRENT PETROLEUM REFINING ECONOMIC SITUATION

**Congress shows no desire this year for passing a law to reduce GHG emissions**

**EPA is moving forward with rules that impact refiners when they upgrade their facilities (for example, GHG PSD and GHG NSPS)**

Projections by Department of Energy's Energy Information Administration ("EIA") indicate a demand drop is similar to one in late 1970s

Recession followed by more fuel-efficient cars, tougher air-pollution regulations and reduced fuel demand

Die-off of inefficient refining capacity

**Competition from state-of-the-art refineries in the Middle East, India, and China**

# LIKELY SCENARIOS

Elimination of excess capacity where refiners close inefficient plants or plants needing upgrades

# BASIC ALTERNATIVES FOR REFINERY SHUTDOWNS

Sell refinery and related assets

- Quickest way to exit an operation in the red
- Over-capacity problem remains

Shutdown facility/remediate site

- Represents an economic hit
- Political aspect - refinery and suppliers/maintenance companies have many employees
- Environmental issues regarding closure of refinery are important

# BASIC ALTERNATIVES FOR REFINERY SHUTDOWNS - CONTINUED

## Discontinue refining operations and convert to a crude oil/products terminal

Terminals/storage facilities remaining are valuable assets - can be profitable

May avoid remediation costs

Expected growth of imports and exports - increasing number of export refineries elsewhere

Converted refinery could process bio-fuels

"Crude Topping" units

## BASIC ALTERNATIVES FOR REFINERY SHUTDOWNS

Performance improvement

Most refiners have already done cost reduction programs

## RECENT CLOSURES

**Announced in last six months**

ConocoPhillips – Trainer, PA – 185,000 BBL/D – Idled September 2011

Sunoco – Marcus Hook, PA – 335,000 BBL/D – Idled January 2012

Sunoco – Philadelphia, PA – 178,000 BBL/D – To be sold or idled by July 2012

Hovensa/Hess – U. S. Virgin Islands – 350,000 BBL/D (was 500,000 BBL/D) –
Converted to fuel terminal in February 2012

**Total – about 1,000,000 BBL/D; all on East Coast**

# REFINERY REGULATION UNDER CAA

Petroleum refining industry is one of few industries where CAA requirements that are aimed at industry are of two types

CAA requirements mandating specific product qualities for the purpose of reducing the environmental impacts associated with the downstream use of the product

CAA requirements directed at reducing refinery emissions

## EPA'S REGULATION OF REFINING INDUSTRY

EPA's recent control actions for both criteria pollutants and for GHGs

Compliance with EPA's control requirements for GHGs

- There are no GHG control requirements in CAA per se
- CAA statutes were adapted by court decisions, then by EPA to regulate greenhouse gases
- GHG control costs are largely unknown mainly because GHG regulation is relatively new

Construction delays caused by federal and state permitting requirements

## EPA'S REGULATION OF REFINING INDUSTRY – CONTINUED

Proposed Ozone NAAQS

E15 and Renewable Fuels Standard (RFS)

CAA Complexity

CAA Cost

On-going compliance costs with CAA requirements for criteria pollutants

## EPA GHG REGULATION THROUGH CAA

In early 2010, EPA issued GHG standards for automobiles

EPA then ruled that automobile GHG standards trigger CAA regulation of all new major stationary sources/major modifications to existing stationary sources that produce GHG emissions

Requires PSD permits for such sources

EPA promulgated "Tailoring Rule" so that PSD permits would only apply to modified sources with potential to emit 75,000 tpy of GHGs instead of 250 tpy or 100 tpy (new sources = 100,000 tons)

Refinery industry believes that EPA's PSD requirements for GHG emissions will likely create significant delays in state permitting process

PSD requirements are being added to existing CAA permitting requirements: NNSR, Maximum Achievable Control Technology ("MACT"), revised $SO_2$ and $NO_2$ NAAQS

PSD regulations will require Best Available Control Technology ("BACT") for GHGs

Industry believes that "BACT is not yet established for GHGs" and EPA has provided, "at best, vague guidance regarding what could constitute BACT"

## EPA GHG REGULATION THROUGH CAA

**In December 2010, EPA entered into a court settlement with environmental activist groups and several states that requires EPA to propose regulating GHGs under New Source Performance Standards ("NSPS") – Preliminary EPA notice in FR on January 2, 2011**

Proposal was due in December 2011
EPA postponed the proposal in November 2011

It is expected that refinery standards will not be issued until after EPA completes GHG performance standards for the power sector

Proposed in March 2012

NSPS requires emissions performance standards for new or "modified" existing refineries; GHG NSPS requires any regulated facility to install Best Demonstrated Technology ("BDT")

EPA is required to consider cost when developing NSPS and BDT – **but** refining industry frequently has significant disagreements with EPA over cost-effectiveness

## EPA GHG REGULATION THROUGH CAA – CONTINUED

Texas is currently under a FIP wherein EPA administers GHG PSD program within state

EPA Region 6 is agency responsible for issuing PSD permits for major sources (per Tailoring Rule) of GHGs under FIPs

Texas still retains approval of their plans and PSD programs for pollutants that were subject to regulation before January 2011, i.e., regulated NSR pollutants other than GHGs

EPA will issuing permits for just GHG emissions while state's PSD programs will issue a permit for non-GHG emissions (Precedent in Texas: 1977 to early 1980s)

# CAA COMPLEXITY

Many legal writers believe U. S. environmental regulatory system is based on rational polluters model

Rational pursuit of their self-interest guides compliance decisions

Regulators therefore deter pollution through fines, penalties, and rules

## CAA COMPLEXITY

Generally, regulatory requirements are

Too numerous

Too difficult to understand

Too fluid

Too hard to find

## OZONE NAAQS

A CAA provision requires EPA to revise NAAQS every five years and "as may be appropriate" in accordance with sections 108 and 109(b) of CAA

NAAQS regulates six criteria pollutants - one is ozone

NAAQS primarily deals with ozone by controlling emissions of VOCs and NOx

In 2008, EPA finalized a new NAAQS ozone standard of 0.075 ppm

EPA is revisiting this recent standard, and is proposing a 0.060 to 0.070 ppm ozone requirement

Per NPRA, setting NAAQS at such levels is "approaching current ozone background levels, even in rural areas"

According to "EPA's own numbers" costs could be "$19 to $90 billion annually"

## E15 AND RENEWABLE FUELS STANDARD (RFS)

**Ethanol is an economic factor for the refining industry largely because every gallon of ethanol sold in the U.S. replaces a gallon of gasoline**

In November 2010, EPA approved a conditional, partial waiver that allows gasoline containing 15 percent ethanol ("E15") to be sold for use in vehicles that are model year ("MY") 2007 and later

Industry's concerns are:

EPA does not have legal authority to grant a partial waiver under Section 211(f)(4) of CAA

Section 211(f)(4) states EPA has to determine that any fuel or fuel additive 'will not cause or contribute to a failure of *any* emission control device or system." E15 would likely be marketed under same regime as regular gasoline, therefore, there is a **high likelihood of consumer misfueling**

## E15 AND RENEWABLE FUELS STANDARD (RFS) - CONTINUED

Industry believes that "several studies show gasoline blends containing more than 10 percent ethanol could lead to engine damage in older vehicles and non-road engines, such as those in chainsaws, lawnmowers, boats and snowmobiles"

An increased ethanol blend could also damage older cars' catalytic converters

This is a problem because sufficient testing to assess impact of these fuel blends on all automobiles – both old and new – and non-road engines has not been completed

E15 waiver contains a proposal for E15 misfueling mitigation - industry believes this warning label posted at the gas station is an ineffective warning device

There is also a CAA "One Pound Waiver" problem with E15. The CAA allows the E10 vapor pressure to increase to 8.8 psi in ozone NAAs (one pound above the "normal" limit). This waiver is not available to E15. This limitation would preclude E15 use in NAAs in summer months, because the lower 7.8 psi standard would be exceeded on hot days.

# CAA COSTS - REGULATORY IMPACT OF CAA ON PETROLEUM REFINING COSTS/COMPARE COSTS TO NET U. S. REFINING INCOME

Cost of regulations, which control criteria pollutants and which are associated with petroleum refinery control under CAA

Cost estimates were developed by EPA during regulation development phase of each regulation

If an EPA source is not available, available non-EPA sources cited

Develop numbers for overall current costs for refiners to comply with CAA

Costs are summed and totals present annualized cost of refining industry's CAA compliance expenditures

Total cost of compliance with regulation and estimated contribution of petroleum refining industry to that cost

# CAA COSTS ESTIMATES - EXCLUSIONS

Environmental Tort Lawsuits

- Big dollars
- Hard to quantify (sometimes confidential settlements)

Future U.S. Cap and Trade Legislation

- Even Bigger dollars
- GHG “Cap and Trade” legislation may return
- Panic over perceived “climate extremes”

## CAA COSTS ESTIMATES - INCLUSION

Any Currently Promulgated, Proposed or Announced
CAA Statutes or Regulations

# COST ESTIMATES EXAMPLE EQUATIONS

Total Annual Cost of Regulation (Million $/Year) from Federal Register proposal

times "Refinery factor" equals

Total Annual Cost of Regulation (Million $/Year) to Refineries

Summation of Total Annual Cost (Million $/Year) of all Refinery Regulations equals total Refinery CAA Cost to Refineries

Divided by Total Annual Refinery Sales (*Performance Profiles of Major Energy Producers 2009*, EIA (2010))

times 100

Equals Total Refinery CAA Cost **Percent** of Total Annual Refinery Sales

## COST ESTIMATES EXAMPLE EQUATIONS

Example 1: MACT for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units

Total Annual Cost of Regulation (Million $/Year) from Federal Register proposal: $47.3

times “Refinery factor”: 1.0

equals Total Annual Cost of Regulation (Million $/Year) to Refineries: $47.3

## COST ESTIMATES EQUATIONS

Example 2: MACT for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters

| | |
|---|---|
| Total Annual Cost of Regulation (Million $/Year) from Federal Register proposal: | $490 |
| times "Refinery factor": | 0.1 |
| equals Total Annual Cost of Regulation (Million $/Year) to Refineries: | $49.0 |

# COST ESTIMATION SUMMARY TABLE

| Regulatory Category Name | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|
| Total Nonattainment Costs | 3485.4 |
| Emission Standards for Mobile Sources (Fuels) Costs | 967.7 |
| Total 40 C.F.R. PART 61 – NESHAPs Costs | 3.05 |
| 40 C.F.R. 63 MACT Standards Costs | 652.02 |
| NSPS 40 C.F.R. PART 60 Costs | 194.45 |
| Total Permits and Enforcement Costs | 1000 |
| Total GHG Costs (if Known) | 572 |
| Summary | |
| Total Refinery CAA Costs | 6874.62 |
| Total Annual Refinery Sales | 521,463 |
| Total Refinery CAA Cost Percent of Total Annual Refinery Sales | 1.32% |

# Cost Estimation for Individual Regulations

| Regulation Name | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|---|---|
| **Nonattainment** | | | |
| **RACT Categories Applicable to Petroleum Refineries [06/07]** | 136 | 1 | 136 |
| **Old 1-Hour Ozone SIP Measures-VOC and $NO_x$ [07]** | 317 | 0.1 | 31.7 |
| **Houston-Galveston-Brazoria Area Highly Reactive VOC Rules Analyses [07]** | 146 | 0.23 | 33.6 |
| **8-Hour Ozone Analysis [07]** | 735 | 0.1 | 73.5 |
| **Evaluation of Unidentified Measures [07]** | 7580 | 0.05 | 379 |
| **Proposed Ozone Standard (below 0.075 ppm) [07]** | 55,000 | 0.05 | 2750 |
| **$PM_{2.5}$ NAAQS Attainment Analysis ($PM_{2.5}$ Precursors: $SO_2$, $NO_x$, and $NH_3$) [07]** | 376 | 0.1 | 37.6 |
| **$PM_{10}$ NAAQS Attainment Analysis [08]** | 130 \ | 0.1 | 13.0 |
| **Controls for $SO_2$ and Lead NAAs [08]** | 296 | 0.1 | 29.6 |
| **Controls for $NO_2$ NAAs [08]** | 13.7 | 0.1 | 1.4 |
| **Total Nonattainment** | | | 3485.4 |

| Regulation Name | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|---|---|
| Emission Standards for Mobile Sources (Fuels) | | | |
| Oxygenated Fuels Program [09] | 141 | 0.1 | 14.1 |
| Low-sulfur Diesel Fuel (0.05% Sulfur in 1993) [09] | 1260 | 0.1 | 126 |
| Diesel Fuel Sulfur Limits (15 ppm) [09] | 1300 | 0.1 | 130 |
| California Reformulated Diesel [09] | 130 | 0.1 | 13 |
| Federal RFG: Phase I and II [09] | 1441 | 0.1 | 144.1 |
| Gasoline Fuel Sulfur Limits: Tier II [09] | 1900 | 0.1 | 190 |
| California Phase I, II, III RFG [09/10] | 2251 | 0.1 | 225.1 |
| RVP Regulations of 1989 and 1992 [10] | 650 | 0.1 | 65 |
| Off/Non-Road Diesel Sulfur - Phase I and II [10] | 600 | 0.1 | 60 |
| E15 and the Renewable Fuels Standard (RFS) [10] | 4 | 0.1 | 0.4 |
| Total Fuels | | | 967.7 |

| Regulation Name | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|---|---|
| 40 C.F.R. PART 63 – NESHAPs Standards | | | |
| Equipment Leaks of Benzene | 0.4 | 0.1 | 0.04 |
| Benzene Storage Vessels | 0.1 | 0.1 | 0.01 |
| Benzene Transfer Operations | 30 | 0.1 | 3.0 |
| Total 40 C.F.R. PART 61 – NESHAPs | | | 3.05 |

| Regulation Name | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|---|---|
| 40 C.F.R. PART 63 – MACT Standards | | | |
| National Emission Standards ("MACT") for Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry ("SOCMI") | 230 | 0.1 | 23 |
| MACT for Organic Hazardous Air Pollutants from the SOCMI for Process Vents, Storage Vessels, Transfer Operations, and Wastewater | | | |
| MACT for Organic Hazardous Air Pollutants for Equipment Leaks | | | |
| MACT for Organic Hazardous Air Pollutants for Certain Processes Subject to the Negotiated Regulation for Equipment Leaks | | | |
| MACT for Hazardous Air Pollutants for Industrial Process Cooling Towers | 12.5 | 0.1 | 1.25 |
| MACT for Gasoline Distribution Facilities (Bulk Gasoline Terminals and Pipeline Breakout Stations) | 11.4 | 1 | 11.4 |
| MACT for Marine Tank Vessel Loading Operations | 101.7 | 0.7 | 71.2 |
| MACT for Hazardous Air Pollutants from Petroleum Refineries | 110 | 1 | 110 |
| Hazardous Waste Combustors | 63 | 0.1 | 6.3 |
| MACT for Hazardous Air Pollutants for Petroleum Refineries: Catalytic Cracking Units, Catalytic Reforming Units, and Sulfur Recovery Units | 47.3 | 1 | 47.3 |
| MACT for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline) | 25 | 0.3 | 7.5 |
| MACT for Hazardous Air Pollutants for Stationary Combustion Turbines | 43 | 0.5 | 21.5 |
| MACT for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines | 213 | 0.5 | 106.5 |
| MACT for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters | 490 | 0.5 | 245 |
| MACT for Site Remediation | 9 | 0.1 | 0.9 |
| MACT for Hazardous Air Pollutants: Asphalt Processing and Asphalt Roofing Manufacturing | 1.73 | 0.1 | 0.17 |
| Total 40 C.F.R. PART 63 - MACT Standards | | | 652.02 |

| Regulation Name | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|---|---|
| 40 C.F.R. PART 60 – NSPS Standards; Note: The Total Annual Cost of Regulation (Million $/Year) is based on the Regulation's FR Proposal. | | | |
| NSPS for Industrial/Commercial/Institutional Steam Generating Units | 165 | 0.5 | 82.5 |
| NSPS for Small Industrial/Commercial/Institutional Steam Generating Units | 38 | 0.5 | 19 |
| NSPS for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007 | 31 | 1 | 31 |
| NSPS for Storage Vessels for Petroleum Liquids for Which Construction, Reconstruction, or Modification Commenced After May 18, 1978, and Prior to July 23, 1984 | 1 | 0.3 | 0.3 |
| NSPS for Volatile Organic Liquid Storage Vessels (Including Petroleum Liquid Storage Vessels) for Which Construction, Reconstruction, or Modification Commenced After July 23, 1984 | 9 | 0.3 | 2.7 |
| NSPS for Asphalt Processing and Asphalt Roofing Manufacture | 2 | 0.1 | 0.2 |
| NSPS for Equipment Leaks of VOC In the SOCMI for Which Construction, Reconstruction, or Modification Commenced After January 5, 1981, and On or Before November 7, 2006 | 0.4 | 0.1 | 0.04 |
| NSPS for Equipment Leaks of VOC In the SOCMI for Which Construction, Reconstruction, or Modification Commenced After November 7, 2006 | 0.8 | 0.1 | 0.08 |
| NSPS for Bulk Gasoline Terminals | 3 | 1 | 3 |
| NSPS for Equipment Leaks of VOC In Petroleum Refineries for Which Construction, Reconstruction, or Modifications Commenced After January 4, 1983 and On or Before November 7, 2006 | 0.4 | 1 | 0.4 |
| NSPS for Equipment Leaks of VOC In Petroleum Refineries for Which Construction, Reconstruction, or Modifications Commenced After November 7, 2006 | 0.03 | 1 | 0.03 |
| NSPS for Volatile Organic Compound (VOC) Emissions from Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Processes | 9 | 0.1 | 0.9 |
| NSPS for Equipment Leaks of VOC from Onshore Natural Gas Processing Plants | 2 | 0.1 | 0.2 |
| NSPS for Onshore Natural Gas Processing; $SO_2$ Emissions | 102 | 0.1 | 10.2 |
| NSPS for VOC Emissions from SOCMI Distillation Operations | 9 | 0.1 | 0.9 |
| NSPS for VOC Emissions from Petroleum Refinery Wastewater Systems | 1.3 | 1 | 1.3 |
| NSPS for VOC Emissions from SOCMI Reactor Processes | 5 | 0.1 | 0.5 |
| Commercial and Industrial Solid Waste Incineration Units | 12 | 0.1 | 1.2 |
| NSPS for Stationary Compression Ignition Internal Combustion Engines | 57 | 0.5 | 28.5 |
| NSPS for Stationary Spark Ignition Internal Combustion Engines | 19 | 0.5 | 9.5 |
| NSPS for Stationary Combustion Turbines | 4 | 0.5 | 2.0 |
| Total 40 C.F.R. PART 60 – NSPS Standards | | | 194.45 |

| Regulation Name | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
|---|---|---|---|
| Permits and Enforcement | | | |
| NNSR Review {See Note 1.} | 40 | 1 | 40 |
| PSD Review {See Note 2.} | 64 | 1 | 64 |
| Regional Haze Rule (Clean Air Visibility Rule) [10/11] | 231 | 1 | 231 |
| Title V Permits {See Note 3.} | 40 | 1 | 40 |
| Refinery Settlement Agreements [11] | 616 | 1 | 616 |
| Texas Flex Permits "Deflex" {See Note 4} | 9 | 1 | 9 |
| Total Permits and Enforcement | | | 1000 |
| **Regulation Name** | Total Annual Cost of Regulation (Million $/Year) | "Refinery" Factor | Total Estimated Annual Cost of Regulation to Refineries (Million $/Year) |
| GHG Regulation under the CAA | | | |
| GHG Reporting Rule {See Note 5.} | 24 | 1 | 24 |
| Prevention of Significant Deterioration (PSD) and GHG Title V Permits [12] {See Note 6.} | 210 | 1 | 210 |
| Refinery GHG NSPS {see Table 3B} [14/15] | 284 | 1 | 284 |
| Marketing Costs | 52 | 1 | 52 |
| Total GHG | | | 570 |
| Summary | | | |
| Total Refinery CAAA Costs | | | 6874.62 |
| Total Annual Refinery Sales | | | 521,463 |
| Total Refinery CAAA Cost Percent of Total Annual Refinery Sales | | | 1.32% |

Note 1: Tech manpower and monitoring costs - $1.43 million per refinery per 5 year period; 140 refineries. Note 2: Tech manpower and monitoring costs - $2.29 million per refinery per 5 year period; 140 refineries. Note 3: Tech manpower and monitoring costs - $1.43 million per refinery per 5 year period; 140 refineries.
Note 4: $3 million per refinery annualized over 5 year period; estimated 15 refineries.
Note 5: Tech manpower and monitoring costs - $0.17 million per refinery per 1 year period; 140 refineries.
Note 6: Tech manpower and monitoring costs - $7.50 million per refinery per 5 year period; 140 refineries.

# CONCLUSION: WILL THE REFINING INDUSTRY SURVIVE THE CLEAN AIR ACT?

**Answer: YES, but (in speaker's opinion):**

**Refined U. S. gasoline demand will gradually decrease over the next century - according to the EIA, U.S. total refining capacity will drop from about 18 million BBL/D in 2012 to about 16 million BBL/D in 2035**

Between now and 2035, Gulf Coast will begin to supply most of East Coast's U. S. demand; East Coast refining capacity will shrink

After 2035, Gulf Coast will also start to supply some of West Coast demand and some of Midwest demand

Reasons: Likely decline in Alaska production, improvements in pipeline technology, increasing differential between local environmental regulations on West Coast and Gulf Coast

**Increasing CAA requirements such as GHG regulation via the CAA, the proposed ozone NAAQS and the E15 mandate, together with downward U.S. gasoline consumption will increase refining business pressures**

## MACROCONCLUSION

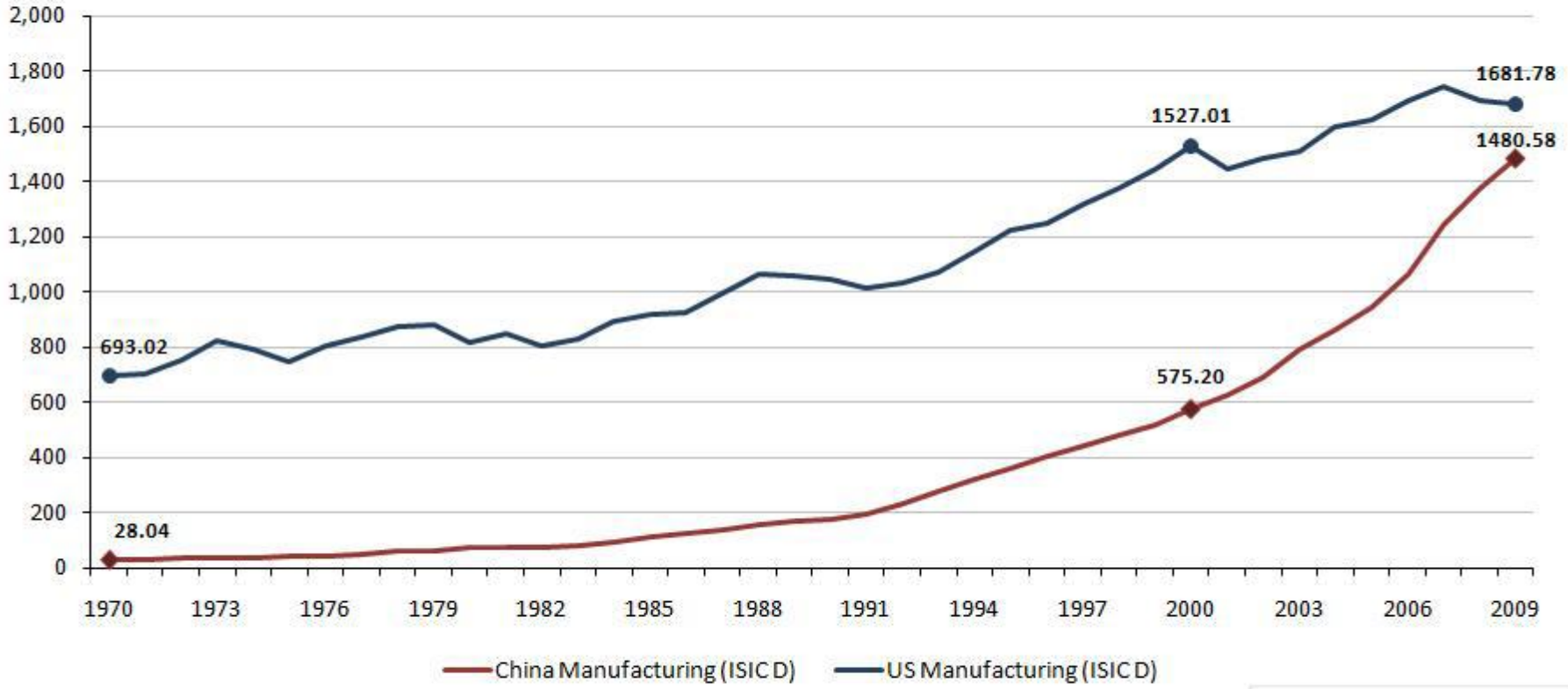
**U.S. won WWII and arguably "won" the Cold War**

**Thereby, becoming the world's sole superpower**

**However, apparently next up is….**

# Manufacturing Value Added in the U.S. and China, 1970-2009

*Real value added by economic activity*
*At constant 2005 prices, billions of US$*

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## MACROCONCLUSION

**Many factors are at play in the U.S. versus China "Economic Race", but**

**One of the factors hurting the U.S. in this competition is the massive number of regulations with which U.S. industry has to comply**

# QUESTIONS

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