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HESS CORPORATION
1 Hess Plaza
Woodbridge, NJ 07095

CHRISTOPHER S. COLMAN
Deputy General Counsel
(732) 750-6535
FAX: (732) 750-6944
Email: ccolman@hess.com

November 29, 2010

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ENVIRONMENTAL QUALITY BOARD

Via Hand Delivery
Environmental Quality Board
Rachel Carson State Office Building
16th Floor
400 Market Street
Harrisburg, PA 17101-2301

Re: Proposed Rule: Commercial Fuel Oil Sulfur Limits for Combustion Units/ 40 Pa.B. 5456, Saturday, September 25, 2010 (the "Fuel Sulfur Rule")

To Whom It May Concern:

These comments on the proposed Fuel Sulfur Rule are submitted upon behalf of Hess Corporation ("Hess"), as well as HOVENSA L.L.C. ("HOVENSA") in which a subsidiary of Hess has a 50% ownership interest.[1] Hess Corporation operates a 70,000 BPD stand alone catalytic cracking facility in Woodbridge, New Jersey (the "Port Reading Refinery"). HOVENSA operates a crude oil refining facility in St. Croix, United States Virgin Islands, which is one of the largest refineries in the world. Collectively, Port Reading and HOVENSA have historically supplied approximately 10 to 13% of the heating oil consumed in the Northeast of the United States. Hess and HOVENSA believe that this proposal to reduce the sulfur content of home heating oil to 15 ppm by 2012 will cause significant harm to consumers in Pennsylvania by raising the price of both No. 2 fuel oil (in this comment letter, the terms No. 2 Fuel Oil and home heating oil mean a No. 2 fuel oil with a sulfur content of 2000 ppm or more) and diesel fuel by 15 to 25 cents per gallon.

Additionally, by requiring refiners to supply the new fuel specification in less than 2 years, it is also unprecedented and unfair by not providing refiners who have continued to make an important product used by millions of consumers adequate time to retool to make the new fuel. No other major fuel specification change has ever been made in such a short period of time and doing so will disrupt markets for diesel fuel for both road and home heating use in Pennsylvania and elsewhere. Any reduction in fuel oil sulfur content must allow at least four years for refiners to add additional processing capabilities.

[1] These comments are submitted in the undersigned's capacity as counsel to HOVENSA.

Hess and HOVENSA also oppose the rule requirements to reduce the sulfur content of residual fuel oil to .5%, because there is a very limited supply of such fuels nationally and no refiner will make capital investments or use higher cost low sulfur crudes to produce these lower sulfur fuels, because each gallon of residual fuel oil is worth less than the crude oil from which it is refined. Producing lower sulfur residual fuel oils is unsustainable economically and environmentally and will place users of this fuel in Pennsylvania at a severe competitive disadvantage. The size of this market in Pennsylvania means that any reduction has a miniscule impact.

Finally, we express our concern that the timing of this rule proposal appears to have been deliberately delayed to (i) make it inconvenient for the public to comment by making the comment due date the day after the Thanksgiving weekend and (ii) avoid appropriate legislative oversight. The PADEP should withdraw this rule proposal and reintroduce it later to ensure that the Legislature and the public can comment and provide adequate time for those comments to be given proper consideration.

I. The Costs Impacts Of This Rule On Both Heating Oil And Road Diesel Will Be Severe

A. This Rule Will Cause The Cost of Road Diesel and Home Heating Oil To Rise by Approximately 20 Cents or More Per Gallon.

1. Requiring Use Of USLD in Pennsylvania, In Combination With New York's Law, Will Drive Up USLD Demand By Over 50% In the Central Atlantic Region

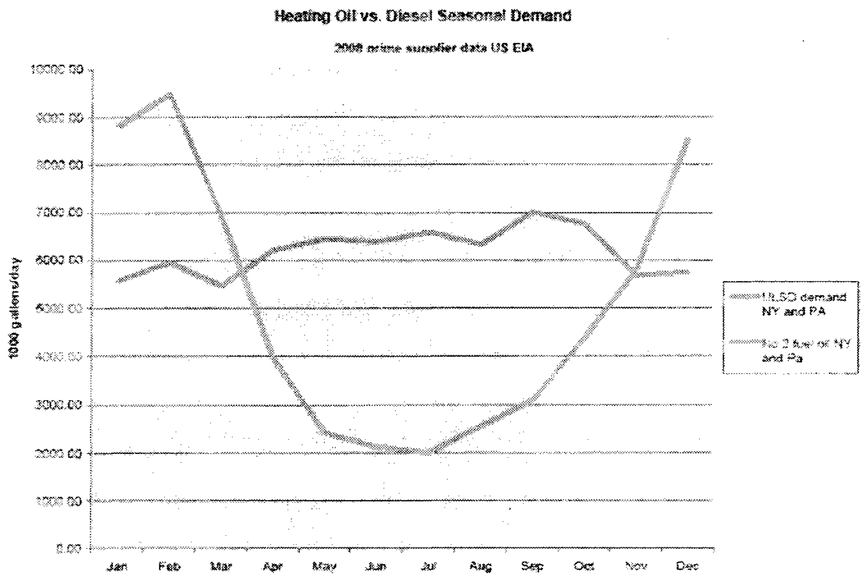
Pennsylvania is the third largest consumer of home heating oil in the United States. The state consumes approximately *891 Million Gallons* of No. 2 Fuel Oil each year.[2] PADEP has proposed to adopt a 15 ppm standard for No. 2 Fuel Oil for residential, commercial and industrial applications in 2012. This timing coincides with the recently enacted law in New York, requiring use of 15 ppm diesel fuel instead of No. 2 Fuel Oil for all heating purposes. New York is the largest consumer of No. 2 Fuel Oil, consuming approximately 1.4 Billion Gallons annually. Thus, in a very short period of time, approximately 2 Billion Gallons of No. 2 Fuel Oil will have to be replaced by Ultra Low Sulfur Diesel. As of 2009, the entire Central Atlantic Region (PADD 1B) consumed approximately 3.7 Billion Gallons of USLD.[3] This means that the amount of ULSD supplied to the Central Atlantic region will have to rise in less than 2 years by over **50%!**

This effect is greatly magnified by the fact that fuel oil use for space heating is concentrated in a four month period in the winter time. During December, January and February, No. 2 fuel oil use is approximately 3.5 million to 4 million gallons per day, while in July and August, demand is approximately 700,000 to 1,000,000 gallons. USLD demand, by contrast, is relatively constant, varying by much smaller amounts. The graph

[2] Data source is US EIA "Distillate Fuel Oil and Kerosene Sales by End Use" using the average of 2007 and 2008

[3] Data source is US EIA "Prime Supplier Sales Volumes" for PADD 1B for 2009.

below shows the seasonality of demand for New York and Pennsylvania for 2008 for No. 2 Fuel Oil and ULSD.



During December through February, fuel oil demand often exceeds ULSD demand in Pennsylvania and in other Northeast states. During cold snaps, this is especially the case. This means that large demand spikes of more than 100% of current ULSD demand will, as a result of this rule, now affect consumers of heating oil and road diesel in Pennsylvania.

2. Requiring Use Of USLD in Pennsylvania by 2012 Will Eliminate Suppliers for Fuel Oil to the State By Not Giving Refiners Time To Invest in Additional Capacity

At the same time, this rule will eliminate supplies from refiners, like Port Reading, that currently do not make ULSD and cannot do so without a substantial capital investment in processing technology and sufficient time to construct the needed processing facilities. This is also the case for two Pennsylvania refiners, United and American, which cannot expand their current USLD production without capital projects and for ConocoPhillips and other heating oil producers outside the Northeast. Less than two years is simply insufficient for refiners to invest to expand supplies of these changes. Part III, Section discusses in greater detail the cost and impacts of these changes and the relative complexity of them. HOVENSA cannot make additional supplies of ULSD without either a major capital investment or processing changes that will substantially reduce the volumes of other petroleum products made at the refinery.[4] Collectively, these refiners historically account for a large share of the No. 2 Fuel Oil market for the Northeast region, and the specification change in Pennsylvania will eliminate substantial supplies of distillate product from the Pennsylvania market.

[4] Even with processing changes, the additional amount produced would be far less than if a capital project was implemented to convert No. 2 Fuel Oil blending materials to ULSD blendstocks.

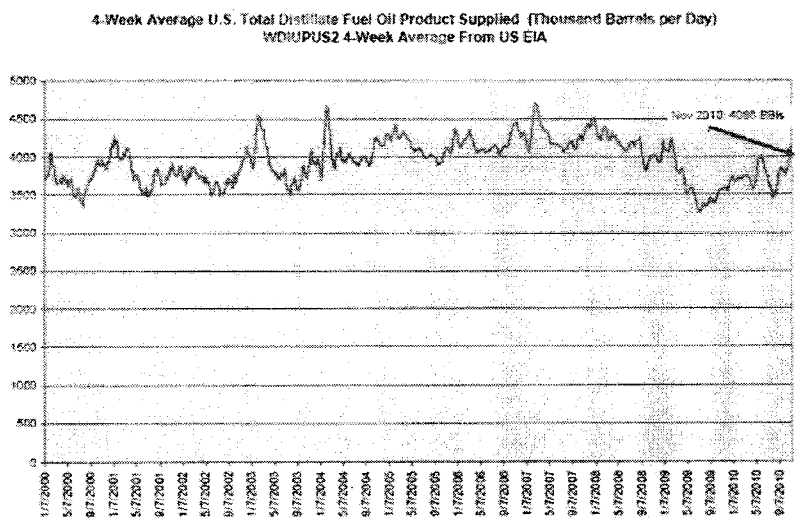
The sudden demand increase for ULSD caused by this rule must also be coupled with refinery closures, the largest of which have been in the East and have also reduced supplies of distillate to this region. These are:

Refinery	Capacity in bbls/day
Delaware City, Delaware	182.000 (expected to reopen)
Yorktown, Virginia	70,000
Eagle Point, New Jersey	145,000

Refineries nationwide are experiencing record or near record losses and many are hanging on by a thread. This rule presents particular difficulties for smaller refineries like Port Reading, American and United which cannot afford major capital investments in the current regulatory climate.

3. Diesel Demand Is Recovering In The United States And Is Projected to Grow Elsewhere.

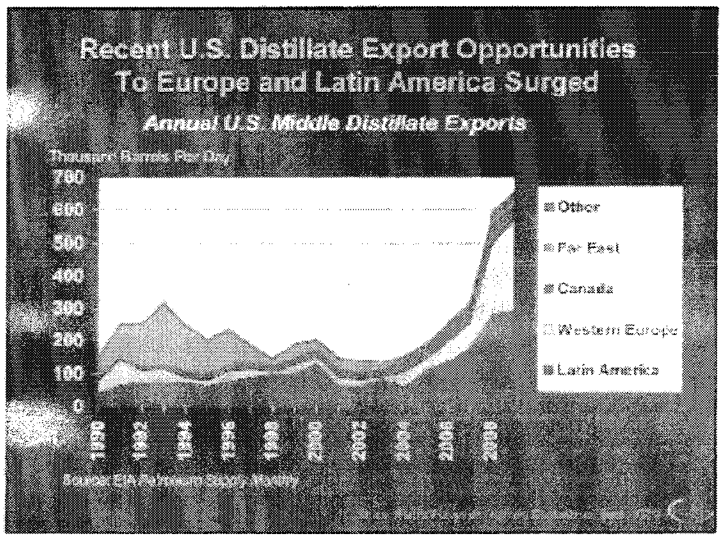
Some proponents of ULSD heating oil have posited that supplies will be ample, because of the demand decline in the United States and elsewhere resulting from the current recession. However, current data does not support this conclusion and these studies appear to be outdated. As this graph shows, since the trough in 2009, USLD demand in the United States has been recovering and growing at a relatively rapid rate:



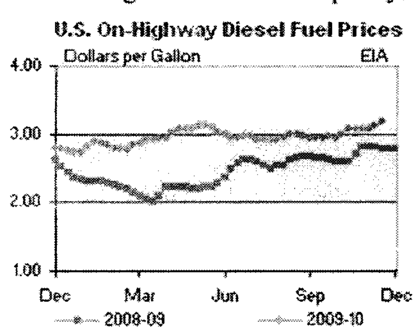
Demand for distillate is projected by the US EIA to rise in both Europe, which is a net importer of ULSD and the United States. See, http://www.eia.gov/pub/oil_gas/petroleum/presentations/2010/atlanticbasin/atlanticbasin.pdf

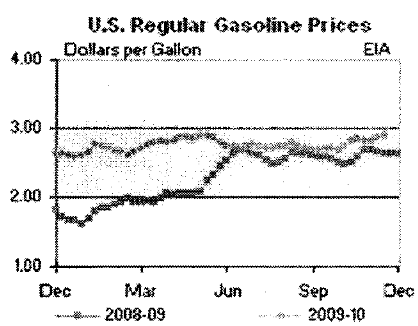
More importantly, demand elsewhere in the world for low sulfur distillates has been rising quickly in rapidly growing countries such as China and India. Demand for ULSD has also been rising in some new markets that have recently begun using ULSD for transportation fuel, such as Chile.

The result has been a relative surge in exports of distillate:



The effect of the demand increase worldwide is that USLD prices have been rising as the market becomes tighter. These two graphs from EIA show that diesel has been rising relative to gasoline over the past year





Diesel has risen 39 cents per gallon since November, 2009 vs. 26 cents for gasoline and about 20 cents for crude oil prices.[5]

Even if it were the case that there is excess supply in the Gulf Coast (there is not, because of the rise in demand world wide), it also must be borne in mind that availability in the Gulf or Midwest does not translate into availability in Pennsylvania, because of Jones Act

[5] Data source for crude oil: US EIA "Weekly All Countries Spot Price FOB Weighted by Estimated Export Volume (Dollars per Barrel)."

shipping laws[6] and pipeline constraints. In most cases, in part because of closure of regional refineries, the additional quantities of distillate fuel required will have to be imported, with additional shipping and distribution environmental impacts

Some stakeholders have argued that since 86%[7] of the current United States distillate pool is at 15 ppm, the remainder should also meet this standard. As discussed in detail elsewhere in this comment letter, this would be a mandate which is costly and not needed.

Moreover, assuming that the number cited is correct nationally, it misses the point regionally and understates the impact of the mandate. Fuel oil use is concentrated in the mid-Atlantic and New England. In states like Pennsylvania, heating oil and road diesel use are roughly equal. Thus, the refineries which serve this market (concentrated in the Northeast, Canada and the Virgin Islands) are configured to make a 2000 ppm (or higher) S No.2 Fuel Oil product and cannot be readily converted to make ULSD without either substantial capital expenditures or facilities changes that decrease the overall amount of petroleum products produced. Conversely, in most of the rest of the country, road diesel accounts for nearly all of the demand for No. 2 fuel, so that those refineries make a very high proportion of ULSD. According to a Hart Fuels study, about 35% of PADD 1 distillate and 40% of heating oil is supplied by U.S. East Coast refineries. U.S. Gulf Coast refineries provide 52% of distillate and 44% of heating oil. HOVENSA and Eastern Canada refineries make up 12% of distillate and heating oil.[8] *Ultra Low Sulfur Heating Oil Assessment,* Hart Fuels, February, 2010, copy attached. Thus, regionally (and for those refineries that serve this region) the percent of output produced of heating oil vs. road diesel is much lower than 86%. For example, Port Reading produces100% heating oil and does not produce USLD.

4. *The combined effects from this rule of diminished supply and increasing demand will raise prices to consumers of heating oil and diesel by about 20 cents per gallon, costing consumers in Pennsylvania*

Any time a combination of substantially increased demand is combined with diminished supply, the result will be to raise prices. In this case, because the rule will affect both the supply and demand for USLD, it will affect both road transportation costs and space heating costs, not just heating costs as the PADEP assumes.

Hess and HOVENSA retained Hart Fuels, a respected industry analyst, to undertake a study of the impact of lowering the heating oil specification by 2012 on the market price of diesel fuel for both road and heating use. A copy of that report *Ultra Low Sulfur Heating Oil Assessment,* is attached to these comments as noted above. The author concludes as follows:

"Summary

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[6] The Jones Act requires use of almost non-existent US flag vessels to move petroleum products between US ports. This has been a consistent constraint on supply in much of the US.
[7] The reference is from the author's notes and the actual number may be immaterially different
[8] Hart's conclusions are fully consistent with data available from the US EIA.

- Production of ultra low sulfur heating oil will cost 5 to 9 cents per gallon above high sulfur diesel.
- Given the tight market outlook, higher market premiums, 20 to 30 cents per gallon, should be expected to prevail until additional desulfurization capacity can be brought on line.
- With ultra low sulfur heating oil requirements for NY and NJ, the market would not have capability to respond to a cold weather surge in demand. A spike in demand will result in highly volatile markets with heating oil premiums reflecting market shortage conditions: 30 to 60 cents per gallon."

Pennsylvania is a much larger market than is New Jersey for heating oil and should have an even greater impact on pricing if it mandates a 2012 switch to ULSD. This report is being updated and the update will be provided shortly.

Pennsylvania uses approximately 2 billion gallons of distillate fuel annually for heating and road transportation. Thus, a 20 cent increase in the cost of distillate resulting from this rule will cost Pennsylvania consumers 400 Million Dollars annually.

E. The Hart Fuels Projected 20 Cent Increase Is Fully Consistent With The Diesel Price Spike That Resulted In 2006 With The Introduction Of ULSD.

In December 2000, EPA published the final on road diesel rule. The rule required refiners to produce at least 80% 15 ppm S diesel fuel beginning in June 2006, which reduced the sulfur content from 500 ppm, which had been in place since the early 1990's.[9] This rule allowed refiners 5.5 years to make the changes to their refineries needed to comply with the new fuel specification. In contrast, PADEP is proposing a much greater sulfur reduction in No. 2 Fuel oil from 2,000 to 5,000 ppm S currently to 15 ppm S, in less than two years. As noted above, No. 2 Fuel Oil forms a much greater percentage of the distillate used in the Northeast and Mid-Atlantic than is the case for the rest of the United States and much of this supply comes from regional refineries. Regionally, depending on the season of the year, between 25% and 50% of the distillate pool will have to be converted to ULSD to accommodate this specification change.

The price experience during the specification change from 500 ppm diesel to USLD provides an important guidepost to the impact that can be anticipated from the New York law and the proposed Pennsylvania regulation. This experience is consistent with the Hart Fuels report. Even with a 5.5 year lead time, some refiners chose not to invest in ULSD or, if they did, the quantity of ULSD was less than the 500 ppm diesel that they made before the specification switch. It also eliminated foreign suppliers of road diesel, particularly since Europe was and is a net importer of ULSD. The result was a pronounced tightening of the US market for road diesel, as supply diminished in face of stable or increasing demand.

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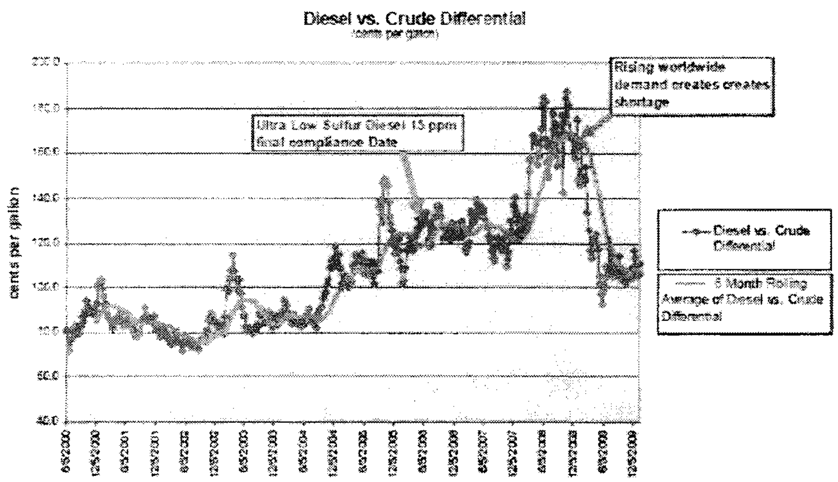
[9] The basis for the selection of the 15 ppm specification is discussed below. We note that the 500 ppm road diesel rule shuttered a dozen or so refineries, including Hess' Purvis MS facility.

The very significant change in the market resulted in a significant and long lived price spike in road diesel. As can be seen in the following graph, the historic differential between crude oil and diesel (500 ppm) was 80 to 90 cents per gallon, although the differential began to widen in 2005 to $1-$1.10.

Crude vs. Diesel

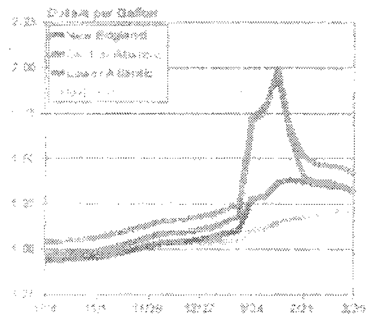


After ULSD was introduced in mid 2006, the differential settled at approximately $1.30, and stayed there until the advent of the "Great Recession." This means that the product had risen in price, because of a sudden supply decrease. This pattern supports Hart Fuel's projected price increase of 20 to 40 cents across the entire regional distillate market, not just heating oil

F. Hart Fuels Projections Are Also Consistent With The Winter 1999-2000 Price Spike.

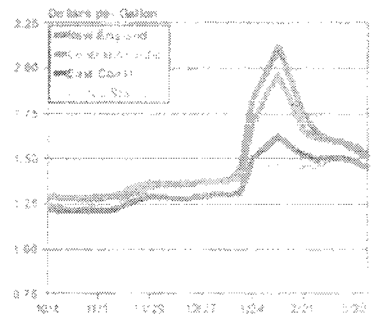
During January and February, 2000, an extreme cold snap hit the Northeast, which, in combination with high demand in December 1999 which drew down stocks, caused heating oil prices to rise by as much as 79 cents per gallon (66%). At the same time, it increased the regional price of 500 ppm S road diesel by a similar amount:

Figure 9. Retail Residential Heating Oil Prices, Winter 1999/2000



Source: Energy Information Administration, Weekly Petroleum Status Report, DOE/EIA-0208(2000-12) (Washington, DC, March 24, 2000), Table C3, based on data collected by State energy offices.

Figure 10. Retail On-Highway Diesel Prices, Winter 1999/2000



Source: Energy Information Administration, Weekly Petroleum Status Report, DOE/EIA-0208(2000-12) (Washington, DC, March 24, 2000), Table 12.

The US Energy Information Agency wrote a detailed and instructive analysis of this price increase, which appears at
http://www.eia.doe.gov/oiaf/servicerpt/nehfuel/index.html#execsum
What is particularly noteworthy is that the price spike was caused by an increase in demand that EIA estimated at approximately 40%. The combined effect of the New York law and the proposed PADEP Fuel Sulfur Rule is a 50% change in demand, and that change is much higher in the winter. Moreover, as opposed to 1999-2000, the shortage was ended primarily by deliveries of No. 2 Fuel Oil from Europe and Asia. These products would not be available under the Fuel Sulfur Rule because they exceed the temporary cap standard of 500 ppm. At a very minimum, this will raise the duration and extent of a price spike and could even result in runouts.

B. Even Using PADEP's Projections of Price Increases, Consumers Do Not Benefit By A 15 PPM specification in 2012

The rule preamble makes the following projections regarding long term price increases between 15 ppm, 500 ppm and 2500 ppm No. 2 Fuel oil:

> In a 2008 report entitled "Northeast Heating Oil Assessment," the National Oilheat Research Alliance (NORA) estimated that there would be a 6.3¢ to 6.8¢ per gallon incremental production cost for 500 ppm versus 2,500 ppm sulfur content home heating oil(No. 2 commercial fuel oil), including capital costs. Costs are estimated to be as much as 8.9¢ per gallon for 15 ppm sulfur content versus 2,500 ppm

As noted above, Hess and HOVENSA believe that this estimate is low because it does not account for the demand spike created by this rule nor does it assess the impact on fuel users other than space heating entities. However, even if we assume that this is correct, this rule is VERY costly to Pennsylvania consumers. PADEP's proposal yields a statewide projected cost increase for all No. 2 Fuel Oil users of $79 Million dollars annually.

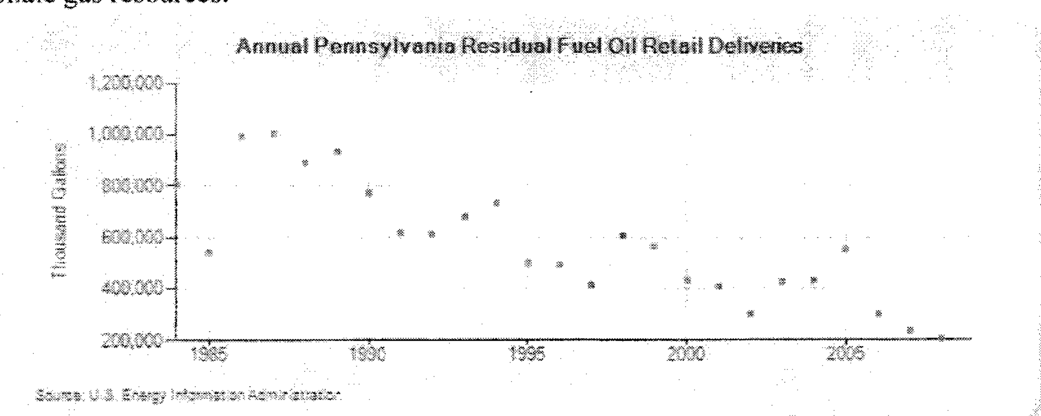
The purported economic benefits of this rule to consumers will not materialize, at least in the short and intermediate term, and thus will not offset these increased costs. That is assuredly true for condensing boilers, at a very minimum because of the long turnover time of a boiler/furnace fleet and the higher capital and operating costs of these installations. A more detailed review of these issues appears in Sections III.A. 4 and 5.

II. The Environmental Benefits of this Rule Are Overstated and Do Not Justify Its Adoption at this Time.

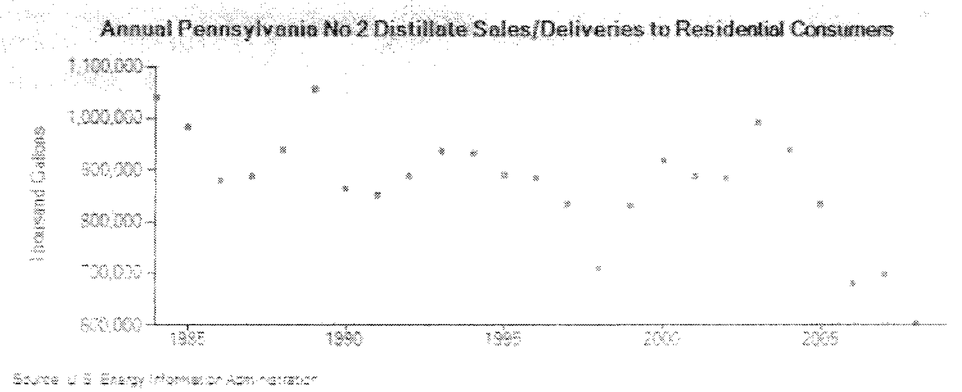
A. Visibility Cannot Be Used as Basis to Adopt A Rule Effective In 2012

Hess and HOVENSA do not believe that the visibility SIP requirements can serve as a basis for the proposed controls, effective in 2012, for several reasons:

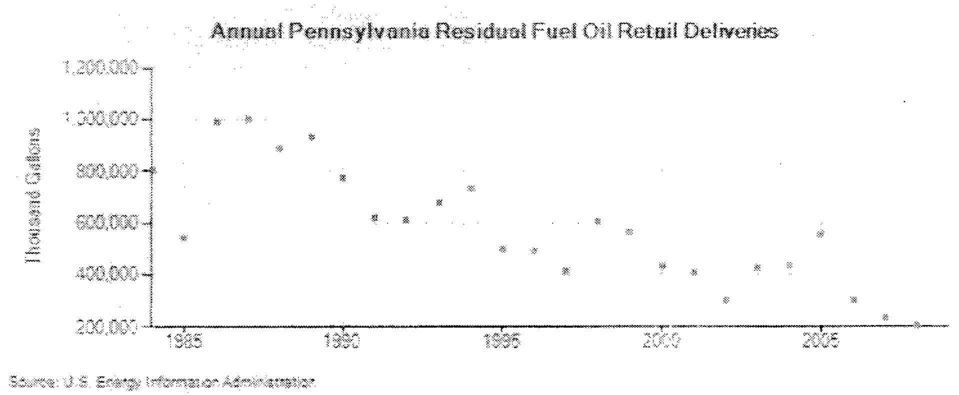
- There are no Class 1 air areas in Pennsylvania and this rule cannot be justified at this time as being required by federal law. The state has NO federal obligation to propose this rule at this time, because it does not have any obligation to show "reasonable further progress" toward attaining visibility standards in other states. Even if it did, the first milestone is not required until 2018, so that as regards visibility, Pennsylvania is **voluntarily** proposing this rule. Moreover, the proposal would have minimal (and probably unmeasurable) benefits on even those Class 1 air closest to Pennsylvania, which are hundreds of miles away from most parts of Pennsylvania. That is because Pennsylvania's SO2 inventory is not predominantly for heating oil and is stated in the rule preamble to be 2-3% of the regional SO2 emissions[10]. Moreover, even that inventory amount is drastically overstated, because it is based on a 2002 inventory, which is now drastically out of date. Since 2002, distillate and residual fuel heating oil demand have fallen sharply in Pennsylvania. The graphs below show that No. 2 heating oil use in Pennsylvania fell by almost 25% since 2002 and residual fuel use by 33%. These levels are expected to continue to fall as customers switch to cheaper natural gas, a trend likely to be accelerated in Pennsylvania by development of the Marcellus Shale gas resources.



[10] This point is discussed in detail below.



- A similar but more severe demand decline since 2002 can be observed in residual fuel deliveries in Pennsylvania. Notably, about 50% of this demand is for marine vessel fuel, so that actual usage in Pennsylvania is now even lower.

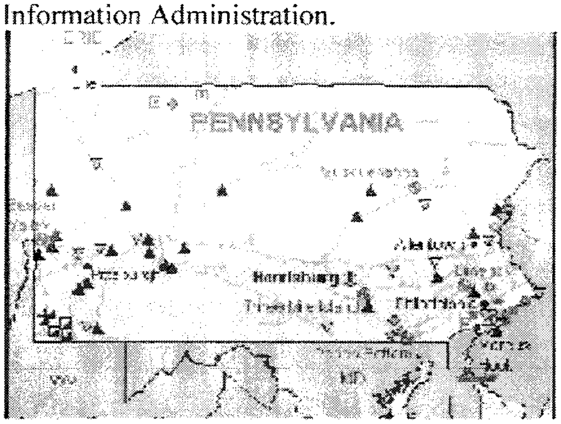


- Heating oil is a wintertime fuel and reductions have little effect outside of Pennsylvania. During the wintertime, information published by NESCAUM and MANE-VU make it quite clear that very local emissions, trapped by inversions, are the main cause of the most serious visibility dimishments. Indeed, the information published by these organizations suggest that the long term increase in PM in these areas is due to increased coal fired power generation in the Midwest (and probably Pennsylvania), which has caused winter and summer levels of PM to nearly equalize over several decades. This is supported by comments received by PADEP on non-attainment classifications in Pennsylvania.
- The rate of transformation of SO2 to sulfate aerosol particles declines in wintertime, so that SO2 emissions on a regional level play a limited or no role in localized visibility dimishments in distant Class I air areas
- PADEP appears to determine the cost effectiveness and benefits of the controls on sulfur in fuels based on reductions (overestimated as noted above) of SO2, not PM 2.5. Because the rule is based on control of PM 2.5, both for the PM 2.5 NAAQS and visibility, this is not an accurate representation, since not all SO2 is converted to PM 2.5 sulfate particles, particularly in winter.

- Based on the (i) the extremely limited benefit to Class I air areas, (ii) overstated emissions inventory for fuel oils and (iii) the lack of any legal driver to adopt a visibility standard by 2012, there is no rational or basis to impose hundreds of millions of dollars in higher costs[11] on Pennsylvania consumers for distillate and residual fuel oil to benefit wilderness areas far from Pennsylvania.

B. PM 2.5 Cannot Be Used as Basis to Adopt A Statewide Rule Effective In 2012

1. PADEP has failed to show that this rule is needed to meet the PM-2.5 NAAQS. The reason that Pennsylvania does not meet the PM 2.5 standard should be plainly obvious from a comparison of the two maps below. The first map shows the location of coal fired power plants (black triangles) in Pennsylvania, as reported by the US Energy Information Administration.



The second map is a map of PM-2.5 non-attainment areas:

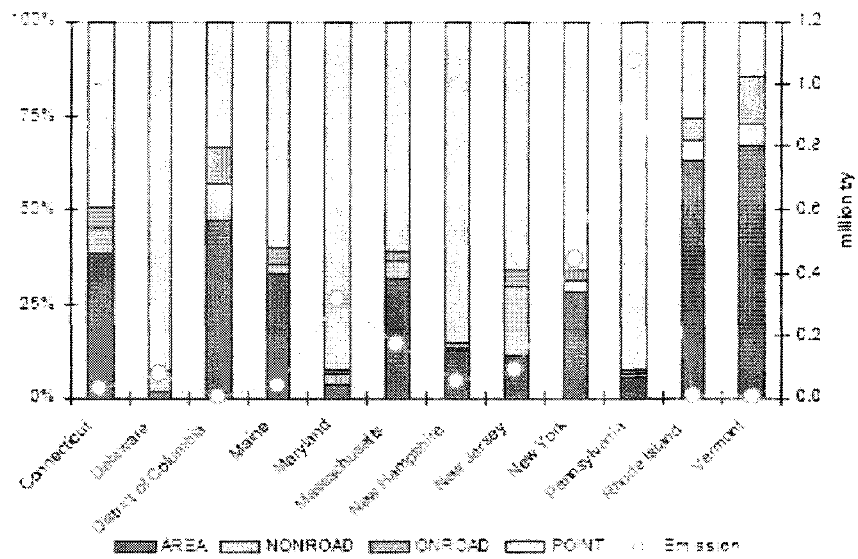
The overlap between the PM-2.5 non-attainment areas and coal fired power plants is strikingly clear. This should be equally clear from the statement in the preamble that

[11] The basis for this estimate of economic impacts is discussed below.

electric utilities at 71% are "by far the largest source of SO2 emissions" in the MANE-VU region. This is almost certainly higher in Pennsylvania, which has many coal fired power plants. For example, Pennsylvania is nearly 10 times larger than New York in the net generation of electric power from coal and nearly 15 times larger than New Jersey. See, http://www.eia.gov/cneaf/electricity/epm/table1_7_a.html

This point is explicitly discussed in NESCAUM's 2006 "Contributions to Regional Haze in the Northeast and Mid-Atlantic United States" (the "NESCAUM paper"). Figure 4.2 of the NESCAUM paper clearly shows that area sources, which include home heating oil users but is not exclusively that category are a tiny fraction of SO2 emissions in Pennsylvania:

Figure 4-2. SO_2 (Bar graph: Percentage fraction of four source categories. Circle: Annual emissions amount in 10^6 tons per year)



The NESCAUM Paper goes on to discuss this graph as follows:

"

> Figure 4-2 shows the percent contribution from different source categories to overall, annual 2002 SO2 emissions in the MANE-VU states. The chart shows that point sources dominate SO2 emissions, which primarily consist of stationary combustion sources for generating electricity, industrial energy, and heat."

As is discussed elsewhere in this comment letter, the fraction attributable to heating oil has fallen substantially since 2002 because of sharp declines in the use of No.2 fuel oil and in Residual Fuel Oil.

The NESCAUM paper then proceeds to discuss coal impacts to the Class I areas at page 5-6:

> *"The bars on the left show the fraction of total sulfate measured at each site that is contributed by the "sulfate/coal" source profile as determined by the source apportionment models. The bars on the right show the fraction of each "sulfate/coal" source profile that is composed of sulfate. Figure 5-5 suggests that: (1) large sources contribute 70–90 percent of the total sulfate measured at*

these sites, and (2) that the contribution from these large sources consists of 50–90 percent sulfate."

This definitively ties coal usage to the identified NAAQS non-attainment areas and to visibility impairment.

Likewise, in the very recent 11/2009 "*Attainment Demonstration And Base Year Inventory Pittsburgh-Beaver Valley Fine Particulate Nonattainment Are*a", fuel oil is not even mentioned as a needed control. Area sources, who are the primary users of home heating oil, emit about 2% of the SO2 emitted by stationary sources. It makes no rational sense to claim that a regulation targeted at a tiny fraction of the SO2 emissions in Pennsylvania—and a percentage that is falling-- is needed or necessary to achieve compliance with the PM-2.5 NAAQS. This is particularly true with respect to the PM.2.5 annual standard, since heating oils are primarily used in the winter. This means that (i) less SO2 is converted to sulfate particles in the winter and (ii) heating oil has almost no effect on the annual average for almost 3/4ths of the year.

2. This Rule Cannot Be Justified As SIP Rule For Areas Of The State That Meet The PM-2.5 Standard.

Finally, substantial parts of Pennsylvania are in attainment with the 1997 and 2006 PM-2.5 standards. For these areas that are in attainment, PADEP cannot use the PM-2.5 SIP process as an excuse to regulate emissions from the combustion of fuel oil, nor should this requirement be included in the SIP. Indeed, areas that are themselves in attainment but are deemed to contribute to non-attainment in another area are already included in the non-attainment areas subject to SIP requirements. Thus, it is facially insufficient for PADEP to conclude that emissions need to be regulated statewide in order to comply with the PM-2.5 NAAQS. Even for those areas that are not in attainment, PADEP has failed to demonstrate that this measure is needed for attainment. That is clearly the case for the Pittsburg-Beaver Valley area where this measure was already judged by PADEP not to be necessary.

C. NOx And Ozone Cannot Be Used To Justify This Rule And Are Irrelevant Considerations Because Most Heating Oil Is a Wintertime Fuel

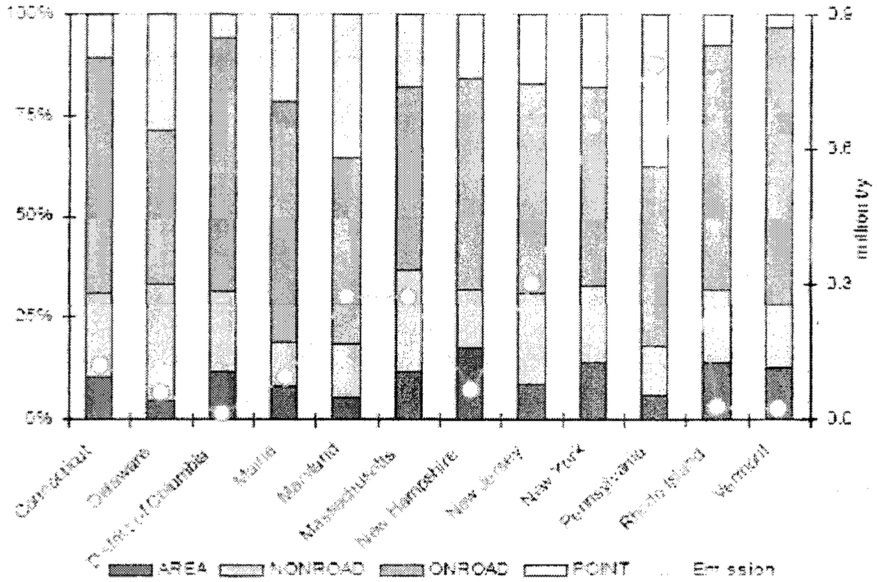
This statement appears in the preamble:

> "There are several important cobenefits of this proposed rulemaking. Emissions of nitrogen oxides (NOx), which contribute to a number of public health and environmental problems in the northeast, including unhealthy levels of PM2.5 and ground-level ozone, would also decrease with the use of low-sulfur content commercial fuel oil due to furnace and boiler efficiency improvements."

This assertion also does not provide a justification for this rule and should be withdrawn because it simply ignores the actual facts and science. It is critical to note Pennsylvania's use of No. 2 fuel oil is primarily for home heating. This means that its use is most concentrated in the months of January and February. For example, EIA reports that for the volumes of sales in Pennsylvania for July and August, 2009 are about 17.5% of the usage for the months of January and February, 2010. Yet Ozone is almost entirely a summertime issue, as a result of higher temperatures causing atmospheric reactions with NOx that create ozone. These conditions are not, obviously, present in wintertime.

The rule proposal also tangentially mentions nitrogen oxides as a factor in particulate matter pollution and visibility impairment. However, No. 2 Fuel Oil represents a tiny fraction of the NOx inventory in Pennsylvania. As stated in the 2006 MANE-VU *$PM_{2.5}$ and Regional Haze Air Quality Problems in the MANE-VU Region: A Conceptual Description (MANE-VU paper)* "Power plants and mobile sources generally dominate state and national NOx emissions inventories." Graph 4-5 from the NESCAUM paper demonstrates the minor contribution from area sources

Figure 4-5. NO_X (Bar graph: Percentage fraction of four source categories. Circle: Annual emissions amount in 10^6 tons per year)



Equally important, the sources cited by PADEP in support of this rulemaking make it quite clear that nitrate particles are not the major factor in visibility impairment, as Table 1-4 from MANE-VU paper shows:

Table 1-4. Particle extinction and percent contribution for 20 percent worst days

20% Worst-day particle extinction (Mm^{-1}) /% Contribution to particle extinction						
Site	SO_4	NO_3	OC	EC	Soil	CM
Acadia	69.2/ 64%	8/ 7%	11.2/ 10%	4.3/ 4%	0.5/ 0%	1.9/ 2%
Brigantine	127.1/ 66%	15.7/ 8%	24.2/ 13%	7/ 4%	1/ 1%	5.4/ 3%
Great Gulf	76.6/ 68%	3/ 3%	14.4/ 13%	3.9/ 3%	0.6/ 1%	3/ 3%
Lye Brook	87.3/ 67%	9.1/ 7%	15.3/ 12%	4.8/ 4%	0.6/ 0%	1.8/ 2%
Moosehorn	58.5/ 60%	6.4/ 7%	11.9/ 12%	4.4/ 5%	0.4/ 0%	2.1/ 3%
Shenandoah	155.5/ 79%	5.8/ 3%	16.1/ 8%	5.7/ 3%	0.7/ 0%	2.5/ 1%

As stated in this report "Nitrate generally accounts for a substantially smaller fraction of fine particle mass and related light extinction than sulfate and organic carbon regionally in MANE-VU."

D. This proposal will probably raise GHG emissions in the short and medium term, not lower them, and will not materially enhance boiler and furnace efficiency.
We also disagree with the characterization that lowering the sulfur content of fuel oil will reduce greenhouse gas emissions. First, as will be discussed below in much greater detail, it is not plausible to state that lower sulfur heating oil enables more efficient boilers. More important, even if this statement was accurate, it is likely incorrect to view this fuel from a lifecycle perspective as reducing greenhouse gas emissions, particularly since boiler fleets turn over in an approximately 25 year time frame. That is because (i) desulfurizing fuel oil is an extremely energy intensive process which will emit GHGs to burn the fuels needed for the desulfurization process and (ii) desulfurization of distillates is generally accomplished by hydrotreating. To produce the hydrogen needed for the hydrotreating process, most refineries must "crack" natural gas or refinery fuel gas to obtain the hydrogen needed for the process. The result of this process is, ironically, to produce large amounts of CO2, because the carbon atom in the hydrocarbon being cracked is oxidized to CO2. Worse, the amount of hydrogen needed for hydrotreating the part of the distillate pool not already at 15 ppm is much greater than the hydrogen needed for the "first round" of desulfurization for gasoline or for the much small reduction from 500 ppm S diesel to ultra low sulfur diesel. In Port Reading's case, the desulfurization process would roughly DOUBLE the overall amount of CO2 presently emitted from a highly efficient refinery, because of the energy inputs and the amount of hydrogen needed to treat the blendstocks used at Port Reading to produce fuel oil to the ultimate 15 ppm end level. Port Reading also anticipates other negative environmental impacts if Port Reading were to install equipment to comply with the standard:

- NOx increase of 92 tons, from fired sources. Ozone season impact as opposed to fuel oil use which is in winter
- CO increase of 114 tpy
- Water use increase of 75MM gallons/yr

In this case, refineries in Pennsylvania which presently make home heating oil, to continue to operate economically, will have to take similar steps to desulfurize heating oil. This proposal will raise rather than lower GHG emissions and may have other collateral emissions impacts in Pennsylvania and elsewhere.

III. The Proposed Reduction in Sulfur Content Of Home Heating Oil To 15 ppm In 2012 Is Not Clearly Needed

A. The Reduction To 15 PPM Exceeds Requirements of Federal Law And A Cost-Benefit Analysis Is Needed For This Step

There was no analysis in the proposal of the cost benefit reducing sulfur to some level other than 15 ppm. Hess and HOVENSA do not believe that the reduction to 15 ppm can be justified at this time and that 500 or 1000 ppm is a more supportable standard.

1. The proposed reduction of sulfur content in heating oil to 15 ppm is the most restrictive standard for heating oil in entire world

The International Fuels Quality Center (an affiliate of Hart Energy) is the leading expert organization on worldwide fuel standards. Hess and HOVENSA retained IFQC to review international standards for No. 2 Fuel Oil. A table from their report summarizes the findings:

Global Heating Oil Specifications

European Union	Gas Oil	1000	
Germany	High Efficiency Furnaces	50	1
Canada	Heating Fuel Oil	5000	
Canada/Provinces	Kerosene	2000	
Russia	Gas Oil	5000	2
Japan	Fuel A	20000	3
Japan	Kerosene	5000	
South Korea	Distillate-Kerosene	1000	4

1. *Special Fuel with tax incentives*
2. *Higher sulfur specifications in some areas*
3. *Commercial/industrial versus residential*
4. *Heating and cooking applications*

IFQC did not identify any other countries with heating oil limitations. The European Union has the lowest sulfur specification, which was lowered from 2000 ppm to 1000 ppm in 2008. See, EU Dir. 1999/32/EC (attached) which specified a 1000 ppm S standard for "gasoil" which is essentially No. 2 fuel oil. It is noteworthy that liquid fuels[12] have about a 20% share of the heating market in the EU. *See*, European Heating Oil Association, powerpoint presentation, 2/7/2007. Canada is expected to follow suit. There is a special 50 ppm grade in Germany offered for high efficiency burners under a voluntary agreement with refiners (Low Sulfur EL Type Fuel Oil, meeting a German engineering standard DIN 51603-1), but it is not mandated and its use is encouraged through subsidies. Only New Jersey, which has adopted by regulation15 ppm S heating oil in 2016 and New York, which legislatively mandated 15 ppm in 2012 have similarly low standards.

We note that a 500 ppm standard is very similar to the US standard of 400 ppm S for No. 1 fuel oil (kerosene). Because K-1 is typically used in indoor space heaters, this

[12] Some countries may use No. 1 fuel oil instead of No. 2 fuel oil, which may have different specifications and characteristics and different equipment uses.

indicates that the sulfur specification would have to have been set to a conservative level for operability and air quality purposes.

This also appears to be the case for the residual fuel proposal of .5%S. The EU standard is 1% S. Again, Canada is expected to follow suit. Refiners do not make extremely low sulfur residual fuels unless it is otherwise economic to run very low sulfur crude oil because refiners lose money on the fuel. Thus, refiners will not invest to meet a lower No. 6 Oil specification. Moreover, residual fuel oil use has declined steeply as noted above and does not appear to represent a control measure that would be effective in PM 2.5 attainment, particularly in the long run. Hess believes that the standards for residual fuel have very limited information supporting them and that additional review is warranted for feasibility and cost.[13]

2. The product cost of the reduction from 500 ppm to 15 ppm is estimated by EPA to be much higher than the reduction to 500 ppm for much less sulfur reduction.

EPA's May 2004 Regulatory Impact Analysis for the offroad diesel rule (the Offroad RIA) reports that the cost of going to 500 ppm was about 2 cents or so but that the next step to 15 ppm was an additional ~ 5 cents per gallon. The main reason for the higher cost of the reduction to 15 ppm is the difficulty of removing the last few S molecules from feedstocks that are very hard to treat. Most of the easier to treat feedstocks were converted for the road diesel rule in 2006, leaving behind harder to treat distillate fractions. *Final Regulatory Analysis, Control of Emissions from Nonroad Diesel Engines.* Office of Transportation and Air Quality. EPA420-R-04-007, May 2004, Chapter 8. Based on EPA's estimate and sales of 891 million gallons of No. 2 Oil in Pennsylvania in 2008 report by EIA, the reduction from 2000 ppm to 500 ppm would cost about $18 MM to achieve a 75% reduction in sulfur content. *Fuel Oil and Kerosene Sales 2008,* US Energy Information Administration DOE/EIA-0535(08). The reduction 500 ppm to 15 ppm would cost about $45 million dollars per year to achieve an additional 24% reduction.[14]

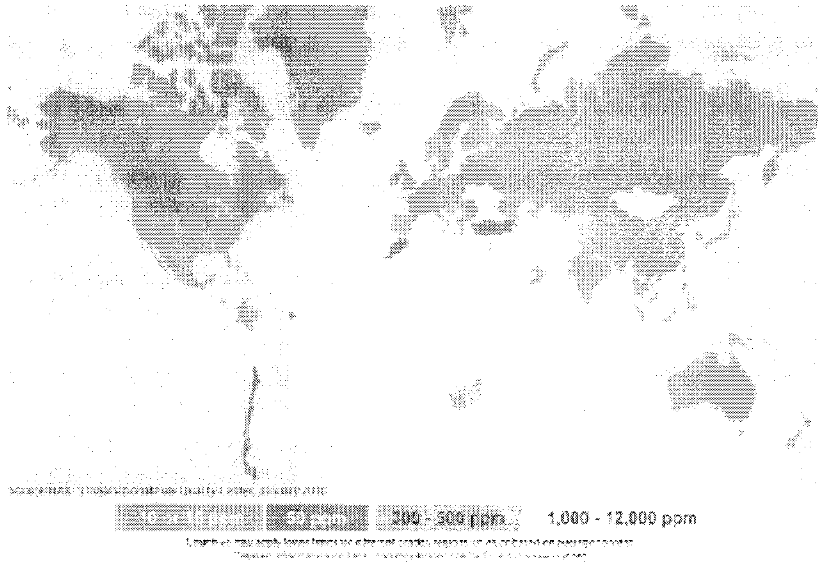
3. A product specification of 500 ppm is less likely to result in price spikes because there are more additional sources of supply.

At 15 ppm S, heating oil is competition with the road diesel market for supply. In those countries with a low sulfur road diesel standard in place, a separate and higher heating oil sulfur specification applies, as discussed above. It is also at or very close to lowest sulfur specification worldwide for light distillates. The map below, prepared by IFQC, shows worldwide sulfur specifications:

[13] NESCAUM has, on several occasions, stated that a subpanel would be convened to review these standards, but did not do so.

[14] As noted elsewhere, the actual capital cost of desulfurizing facilities is quite high.

Figure 2: Maximum Allowable Sulfur in On-Road Diesel Worldwide



Thus, implementing a 15 ppm sulfur for heating oil drastically limits worldwide sources of supply, with two predictable effects, higher long term prices and much more limited ability to obtain supply quickly in the case of a cold winter. In the winter of 1999-2000, runouts were avoided by imports of higher sulfur material mostly from Russia and Eastern Europe. See, *The Northeast Heating Fuel Market, Assessment and Options*, EIA, May 2000. Likewise, during recent Gulf Coast hurricanes that disrupted product pipeline operations, the 15 ppm diesel standard caused substantial hardship, including fistfights over supply, because of the limited options for supply. Approximately 26 additional countries can provide supply at a 500 ppm standard, including major refining centers in Singapore, India, China, Venezuela, South Africa and others. Moreover, 400 ppm S kerosene can also be used as a blendstock to enhance No. 2 heating oil supplies with a 500 ppm standard. Thus, 500 ppm S heating oil allows for a much greater diversity of supply, which can reduce long term costs and supply disruption risks. Even at 50 ppm, there are a more limited number of supply options. It is important to note that in the case of a supply disruption, the shortage that results will not only affect heating oil, but road diesel, making such disruptions even more costly at 15 ppm or even 15 ppm.

Hess and HOVENSA do not believe that the provisions in the Fuel Sulfur Rule for temporarily allowing higher sulfur material will be effective and do not represent good policy. The proposal allows 500 ppm material to be used if:
"(A) The Department determines that an insufficient quantity of compliant commercial fuel oil is reasonably available in the subject air basins."
First, by the time PADEP acts to allow the higher sulfur material into the marketplace, it is already too late. That is because very little 500 ppm material is made in the United States (the percentage has dropped virtually every year since the 2006 effective date of the ULSD rules) and it will have to be imported, taking a week or more to arrive in the

Pennsylvania marketplace. Second, it is exceptionally rare for actual product runouts to occur such that the PADEP could declare that insufficient product is available. What actually happens (as it should in a market based system) is that the supply –demand balance tightens, raising the price of a fuel in relatively short supply in an area. This higher price, which can be $1 or $2 dollars more per gallon in more severe winter supply disruption periods, will attract sufficient supply, but at the much higher price. The result is that the consumer will end up paying the higher price. Third, such waivers typically cause post waiver dislocations, particularly with the language proposed by PADEP to limit as much as possible the period of the waiver. This happens because a supplier gets "stuck" with a tank full of material that cannot then be sold in Pennsylvania because it exceeds the sulfur spec of 15 ppm. It takes only a relatively small heel of 500 ppm material to render an entire tank non-compliant with the 15 ppm standard. Finally, allowing extra volumes of higher sulfur product into the marketplace at the discretion of the PADEP undermines the decisions of refiners that do make investments to produce additional supplies of ULSD for the heating oil market. For this reason alone, NESCAUM and others have not typically included waiver provisions of the type seen in this rule.

4. The reduction from 500 ppm to 15 ppm will not bring any additional economic benefits to consumers.

The benefits cited in the preamble and by NESCAUM are based on a study by NYSERDA and Brookhaven National Labs, which was partially funded by a New York State heating oil dealer group. *Low Sulfur Home Heating Oil Demonstration Project Summary Report,* Batey and McDonald, Brookhaven National Laboratory, June 2005 (the "BNL Study"). This study considered and evaluated the benefits of 500 ppm heating oil vs. 2000 ppm and higher heating oil, not 15 ppm heating oil:

> "Potential cost savings for the nation and New York State that would be attributed to using low sulfur (0.05%) fuel oil can be evaluated based on Figure 6-2a and 6-2b that follow. It shows the calculated reduction in vacuum cleaning costs for different hourly service rates."

The BNL Study posited that the lower sulfur level would reduce cleaning intervals from annually to approximately once every five years and, to a very limited extent, improve heat transfer in the boiler. Reducing the sulfur content from 500 ppm to 15 ppm would have very little, if any, positive effect on equipment costs, because it is not plausible to assume that cleaning intervals would rise to 10 or 20 years at this lower sulfur level.

Figure 6-2a from the BNL Study bears this out, because the savings curve flattens out at lower sulfur levels:

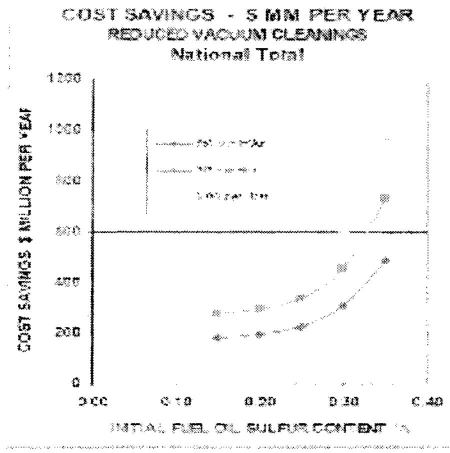


Figure 6-2a

Moreover, the BNL Study questioned whether these savings would actually materialize because service providers and customers are accustomed to annual cleanings, have to implement a new visual inspection and because fire codes and manufacturers warranties may continue to require annual cleaning. BNL Study, pages 51 to 53.

<u>5. There is no technology driver that requires a mandated level of 15 ppm S heating oil for all boilers.</u>

<u>a. Background</u>

The reason that EPA chose 15 ppm for diesel was because of catalyst poisoning by sulfur (similar to the reason lead was phased out in gasoline) which would disable advanced emissions controls on new vehicles and other mobile sources:

> "During the past 15 years, however, more development effort has been put into catalytic exhaust emission-control devices for diesel engines, particularly in the area of particulate matter PM) control. Those developments, and recent developments in diesel NOx exhaust emission control devices, make the widespread commercial use of highly efficient diesel exhaust emission controls feasible. EPA has recently set new emission standards for diesel engines installed in highway vehicles based on the emission-reduction potential of these devices. These devices will also make possible a level of emission control for nonroad diesel engines that is similar to that attained by gasoline catalyst systems. However, without the same ultra-low-sulfur diesel fuel that will be used by highway engines, these technologies cannot be implemented." Offroad RIA, p ES-4 and ES-5.

Importantly, at the time EPA adopted its onroad and offroad diesel rules, 15 ppm diesel fuel barely existed in the United States. To ensure a source of supply of fuel for these new vehicles, EPA had to mandate that refiners make diesel fuel that met the 15 ppm standard.

b. High Efficiency Energy Star boilers do not require 15 ppm sulfur heating oil.

The preamble to the Fuel Sulfur Rule and some proponents of this initiative cite more efficient "condensing boilers" as a reason for the 15 ppm standard. These boilers can (but do not always achieve) efficiencies in the 93% range vs. approximately 85 to 89% for high efficiency boilers. But there are already ultra high efficiency condensing boilers that operate on existing 2000 ppm S fuel, such as the Monitor FCX or Peerless Pinnacle. See, e.g. http://www.peerlessboilers.com/Products/ResidentialBoilers/PeerlessPinnacleOil/tabid/115/Default.aspx# The reason that this is the case is a matter of simple engineering. The limitation on sulfur in condensing boilers is almost entirely related to potential corrosion in the boilers from sulfuric acid forming in the flue gas.[15] Thus, as opposed to catalyst poisoning, which is unavoidable, corrosion can be dealt with by proper metallurgy and design, as it has been in efficient industrial boiler applications for many years. Indeed, Peerless is sufficiently confident of the quality of its product using conventional fuel oil that Peerless offers a twelve year warranty on the heat exchanger for this boiler.

And there are many more oil boilers that can meet the 85% standard that achieves an Energy Star rating from EPA. See, "EPA ENERGY STAR® Boiler Product List", Attachment 1 to this letter, which lists 285 boilers currently using heating oil that are Energy Star performers. A good example is the Buderus line of boilers, such as the 125BE which achieves efficiencies in the 89% range. The 125BE specifies "#2 Fuel Oil ASTM D396-05 Type 2." This specification is for 500 ppm S No. 2 fuel oil, not 15 ppm. See, summary of ASTM D396-05, attachment 2.[16] Other Buderus high efficiency boilers do not appear to even require 500 ppm S. See, e.g. *Installation and maintenance instructions, Oil and gas fired boilers, Logano G215US.* Buderus also provides a 10 year heat exchanger warranty. See, *Limited Warranty for Buderus Residential Cast Iron Water Boilers.* The same is true of many other highly efficient Energy Star boilers. Representative manufacturer information can be provided upon request. It is also the case that both Ireland and the United Kingdom mandate that new boilers reach high efficiency levels, in the vicinity of 86%. Neither country imposes 15 or 50 ppm S standards on No. 2 fuel oil. Thus, it is plainly evident that energy efficiency does not require 15 ppm or even 50 ppm sulfur No. 2 fuel oil and the "gain" in efficiency is truly negligible in doing so.

c. There is no need for a mandate for 15 ppm or 50 ppm S because this fuel is already available to consumers who want or need it.

Critically, as opposed to EPA's action in the road diesel rule to mandate 15 ppm material which was not present in the marketplace and was needed as a technology enabler, ULSD already exists in the marketplace. For those condensing boilers where the manufacturer recommends ultra low sulfur fuel (e.g. Viessmann, which recommends 50 ppm S fuel),

[15] Even with natural gas, the condensate from condensing boilers is low in pH requiring high quality alloys and water treatment. http://en.wikipedia.org/wiki/Condensing_boiler

[16] ASTM standards are copywrited, so that the actual standard cannot be attached. However, the author has reviewed the actual D-396 standard, which is as stated in this letter.

the product needed to operate these boilers is already available to consumers, so that a mandated ULSD sulfur level for heating oil is not needed even if PADEP concluded that enabling the minor efficiency gain was warranted. This is particularly the case since boiler fleets turn over only over a very long periods—20[17] years is typical and manufacturer guarantees are 10 or more years—so that the amount of USLD needed for these boilers can ramp up over time on an as needed basis. A manufacturer can easily place a label on equipment with the specification of the oil or other fuel it needs, a practice already in use in Pennsylvania and elsewhere, including internationally. For example, the Buderus 125E noted above has a decal that is placed on the boiler and, presumably, the oil heating dealer who sold the customer the equipment will be able to guide the customer in the use of proper fuels.

It is important to note that the BNL Study, commissioned by a heating oil dealer consortium, supported a voluntary approach:

> **"Product Availability**
> The low sulfur (0.05%) oil used in this study is the same fuel that is mandated by the Federal Government for on-highway use for motor vehicles. Its use in homes is voluntary. Adequate supply for use in homes is expected as the number of homes increases steadily. However, a supply concern exists regarding mandated use of low sulfur fuel by some state environmental departments. This could cause a shortage in supplies locally and create a situation where the price of low sulfur oil rises suddenly in response to the surge in demand relative to supply. This would have a very negative impact on consumers and oil heat marketers. It would be similar to the "boutique specification gasoline" required in some states that creates serious price spikes due lo local shortages of certain gasoline blends. We strongly encourage voluntary participation in the low sulfur heating oil program, which is fully supported by national oil heat associations. State mandates must not be enacted until normal market forces expand the use of low sulfur heating oil without mandates that could cause price instability and supply shortages." BNL Study, p. 50-51.

d. Condensing boilers have some serious drawbacks and do not work in all applications.

Even these higher efficiency boilers have their detractors, based on a variety of real world factors, such as much higher boiler cost (generally 30-40% higher) and higher maintenance costs, as these quotes from Wikipedia indicate[18]:

> "Condensing boilers have a reputation for being less reliable, requiring professional installation and regular service, and may suffer because installers and plumbers may not understand their operation."
> "Condensing boilers are up to 50% more expensive to buy and install than conventional types in the UK and the US."
> http://en.wikipedia.org/wiki/Condensing_boiler

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[17] This problem is so significant even in Europe that the UK government recently announced a boiler scrappage scheme to try to get people with very old boilers with ~70% efficiency or less to upgrade. http://www.oftec.org/BoilerScrappageScheme.asp

[18] The Wikipedia notes are consistent with web blogs on this subject, in the author's opinion.

They are often unable to achieve the reported efficiencies, for a variety of real world reasons. One of the key reasons is condensing boilers are reported to be most efficient at lower water temperatures, as this material from Condensingboiler.org demonstrates:

"It is only possible for a condensing boiler to work to these very high efficiencies if the flow and return pipework is also kept below 55°C The flow & return temperatures need to be maintained for the heat transference to occur from the flue to the water (i.e. heat transference goes from hotter to cooler materials).

Many people are installing condensing boilers in homes which are fitted with radiators and a primary flow and return to the hot water. Some of these people may be under the impression they are getting more for their money unfortunately as stated above, low flow and return connections are essential, therefore they are not making the vast savings they are led to expect. For a central heating system to work with radiators and hot water cylinders the flow temperatures need to be around 82°C, so in fact the installer has put in an expensive condensing boiler which gives only slightly improved efficiency over the more traditional boiler. The appliance basically only works in its condensing mode during initial heat-up.
To achieve a system which will function in its condensing mode the installer needs to consider a suitable system of radiant heating." http://www.condensingboiler.org.uk/

The effect of this low temperature output of condensing boilers is to require the complete replacement of a consumer's ENTIRE heating system in many cases to maintain adequate home comfort temperatures. This will be a particular difficulty in Pennsylvania, which has many radiator and baseboard hot water heating systems and many steam systems, which cannot be converted to condensing mode. Additionally, condensing boilers also normally cannot be vented through a chimney because of the low flue gas temperature, they must be side vented which may not comply with codes in some areas or be feasible. Other problems are noted by Sustainable Energy Ireland:

> It is sometimes more difficult to install a condensing boiler as a replacement to a non-condensing boiler because:
> • The flue gases discharged from the flue terminal are cooler and less buoyant, and usually form a visible 'plume'. They may cause wetting of surfaces too close to the terminal, or nuisance to neighboring property, or to people passing nearby.
> • An existing flue designed for a non-condensing boiler is unsuitable for a condensing boiler (and vice versa), and the flue for a condensing boiler must not be shared with any noncondensing appliance.
> • A liquid condensate forms within the boiler, and must be discharged to a suitable drain or soak away.

This partially influenced the choice of an 86% efficiency standard that did not compel condensing boilers. It should be clear from the foregoing that even if all condensing boilers required 15 ppm or 50 ppm S material –and they do not—it would not be a reason to mandate this standard because they may not work in many applications in Pennsylvania

<u>e. EPA's area source boiler NESHAPS rule could effectively eliminate new oil fired boilers, so that upgrades to theoretically more efficient technology would be irrelevant.</u>

On June 4, 2010, EPA proposed an area source NESHAPS rule that would impose extremely low PM and CO standards on new oil fired boilers, but would not affect gas fired boilers. The Oilheat Manufacturers Association recently commented that these standards cannot be met by any existing or new equipment made by OMA members and stated as follows:

> "We believe that setting a much more stringent standard for new or reconstructed boilers will discourage use and introduction of more efficient and less polluting boilers and encourage "band aid" fixes to avoid the more restrictive standards." EPA-HQ-OAR-2006-0790-2249."

This action, which may very well be adopted by EPA, would eliminate any theoretical or potential energy savings in oil fired boilers from use of lower sulfur fuels.

6. A 15 ppm standard will cause high quality distillate to be downgraded to much less valuable products.

A 15 ppm standard "strands" high quality and expensive distillate that has gone slightly offspec. Pipeline interfaces between higher sulfur products like jet fuel or kerosene and ULSD would no longer be able to be marketed as a high value fuel, and would have to be downgraded to much lower value fuel. This same issue exists when the near zero sulfur product at a refinery exceeds the pipeline standard of 7-10 ppm because of minor technical issues or catalyst life problems.

7. A 15 ppm or 50 ppm standard imposes unnecessary burdens and costs on business and consumers.

As discussed extensively above, there is no reason whatsoever to mandate 15 or 50 ppm material, because consumers who want or need it can already buy that fuel. It should be the responsibility of the heating oil dealer community to market this fuel to their customers, not the obligation of Pennsylvania to mandate it to achieve the business aims of those dealers. To mandate the additional step below 500 ppm is tremendously costly in capital expense to refiners who currently produce heating oil, because of the difficulty of removing the sulfur from the distillate streams used to blend heating oil. The technical difficulty of this step is unequivocally documented in the Offroad RIA, cited above. A typical 15 ppm distillate desulfurization project for many refiners for current heating oil streams will cost >$200MM. A 500 ppm standard can significantly reduce the cost of the capital investment needed, depending on refinery configuration, because hydrogen plant and distillate desulfurizer reaction vessels can be significantly smaller in size. HOVENSA preliminarily estimates the project cost to be approximately 50% less (>$100 to $150MM savings) for a 500 ppm product specification.

The refinery operating costs are also significantly less with a 500 ppm standard than a 15 ppm standard because of three major factors

- Longer catalyst life
- Lower hydrogen consumption
- Product downgrade capability

- Higher lost economic opportunity because of shutdowns for catalyst change outs.

Collectively, the cost savings at HOVENSA are estimated to be $10MM/annually.

Even a 50 ppm standard would impose a lesser burden than a 15 ppm standard. While it would not reduce the capital expenditure needed to produce the fuel, it would reduce refinery operating expenses and waste generation significantly because catalyst used to assist in desulfurization would have to be changed much less frequently. The technical reason for this is essentially the same reason that S poisons catalyst in newer vehicles—the more severe refining causes catalysts to be deactivated more quickly by operating conditions, Sulfur and other impurities. Annual catalyst change is needed in many cases for ULSD production. We estimate that 50 ppm would require a catalyst change every 2 or 3 years, for an annual savings at HOVENSA of $2MM per year. Port Reading would see savings of about 1/3 to ½ of this amount. As discussed below, the product downgrade capability also reduces operating costs from downgrading valuable distillates to a much less valuable product.

8. Lowering the standard below 500 ppm would have unintended negative environmental consequences.

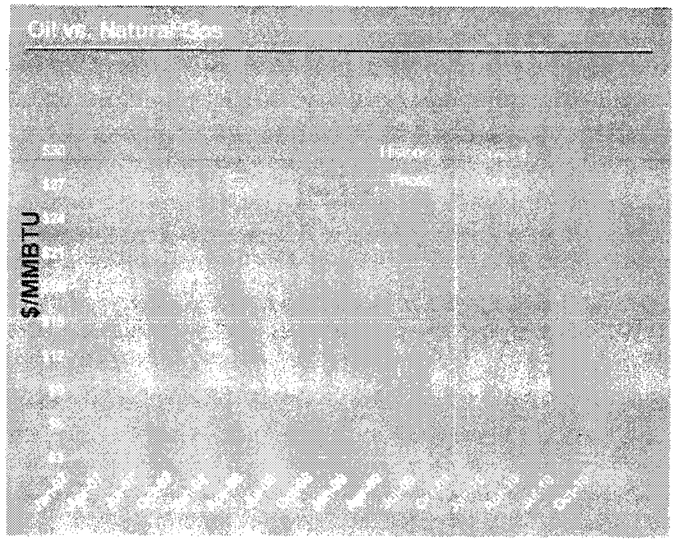
As noted above, Hess and HOVENSA believe that the benefits of this rule are offset by negative consequences, and that the rule should be viewed as increasing GHG emissions. If Port Reading were to install the processes need to desulfurize distillate production to meet a 15 ppm standard, Port Reading has calculated an annual increase of 378,000,000 pounds per year of CO_2. HOVENSA calculated an increase of 803,000,000 lbs of CO_2 annually to install hydrodesulfurization facilities needed to comply with the Fuel Sulfur Rule.[19] Other refiners currently making home heating oil would have to install similar desulfurization facilities to meet this standard and would experience a similar CO_2 increase.[20]

It has been suggested that the roll out of condensing boilers would "quickly" offset these increases. This view is not correct. First, condensing and high efficiency boilers can already operate on 2000 ppm or 500 ppm S heating oil. It is not necessary to lower sulfur below 500 ppm to achieve efficiency gains. Even more important is that this assumes that the only choice a consumer has when replacing a boiler with a more efficient model is to use fuel oil. Pennsylvania has an excellent infrastructure of natural gas pipelines, which should expand with development of the Marcellus Shale resources and the vast

[19] Assumes full operation for 365 days

[20] This assumes a similar feedstock, such as LCO, which is hydrogen intensive to treat.

majority of customers can choose to use natural gas instead of fuel oil. Consequently, most current heating oil customers can utilize any condensing boiler made simply by switching to natural gas. Natural gas has been cheaper, as the adjacent graph illustrates. It is also perceived to be a more convenient fuel to use than heating oil.



The result has been that the bulk of customers faced with a choice of choosing natural gas or heating oil choose to use natural gas. This is apparent from the Pennsylvania fuel oil sales reported by EIA over the last several decades, reprinted above, showing drastic demand declines at the residential level. Thus, Hess and HOVENSA do not believe that any gain in efficiency can be credited to 15 or 50 ppm heating oil.

Second, as discussed above, the efficiency gains from boilers designed to operate at 50 ppm are insignificant and, in many cases, will not materialize. For example, US EPA reports that increasing industrial boiler thermal efficiency from 86% (achievable by many current boilers) to 92% (theoretical condensing boiler performance) would reduce the emissions from 85.1 to 79.5 Kg CO2/MMBTU output. *Climate Leaders Greenhouse Gas Inventory Protocol Offset Project Methodology for Project Type: Industrial Boiler Efficiency,* Appendix II, USEPA August, 2008. Using these emissions factors and considering that the average residential user consumes approximately 730 gallons of heating oil annually[21] (which has a heating value of about 140,000 Btu per gallon), this efficiency increase would lower CO2 emissions by approximately 1000 pounds per home annually.[22] It should be obvious that the increased CO2 emissions from Port Reading alone would exceed any gain in efficiency attributed to 15/50 ppm heating oil on the theory (with which Hess and HOVENSA do not agree) that it allows use of a wider range of condensing boilers.

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[21] Residential Energy Consumption Survey, US EIA, 1997.

[22] Secondary checks using standard CO2 emissions factors and emissions estimating tools yields a similar number.

Finally, we note that this rule cannot take credit for emissions reductions for those boilers that do need to use 15/50 ppm heating oil, because that fuel is already available and should be projected to be available for the limited number of boilers requiring this fuel, particularly given the likelihood that many of these customers will simply switch to natural gas. In effect, a reduction to 15 or 50 ppm S by Pennsylvania will require that the vast majority of fuel oil consumers utilize a fuel they do not need, will cost them more, and will increase emissions overall for some pollutants.

Hess and HOVENSA appreciate the opportunity to comment on this rule and look forward to continuing to work with Pennsylvania to achieve cleaner air quality in a cost effective fashion.

Very truly yours,

Christopher S. Colman

CSC:km

Oil fired Energy Star boilers highlighted in yellow for emphasis

Attachment 1--EPA Energy Star Boiler List

Boilers Product List

List Current as of January 02, 2009

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Ambassador	Axia 20E	Water	Gas	86.9	Axia 20E
Ambassador	Axia 29E	Water	Gas	85.7	Axia 29E
Ambassador	BMS 10/20	Water	Gas	88.2	BMS 10/20
American Standard	APFWF	Water	Oil	85.5-86.7	All models beginning with APFWF
Baxi	Luna	Water	Gas	85.5	Luna 1.31 Comfort
Baxi	Luna	Water	Gas	85.5	Luna 310 Comfort
Baxi	Luna	Water	Gas	92.5	Luna HT 1.100
Baxi	Luna HT	Water	Gas	92.5	Luna HT 1.330
Baxi	Luna HT	Water	Gas	92.5	Luna HT 1.450
Baxi	Luna HT	Water	Gas	92.5	Luna HT 1.650
Baxi	Luna HT	Water	Gas	92.5	Luna HT 330
Baxi	Luna HT	Water	Gas	92.5	Luna HT 380
Baxi	Luna Wall Hung Boiler		Gas	85.5	Luna 131 Fi
Baxi	Luna Wall Hung Boiler		Gas	85.5	Luna 310 Fi
BIASI, SpA	B10 Series	Water		85.0-85.8	B3-B9
BIASI, SpA	BIASI SG	Water		85.1-87.8	SG2-SG6
Buderus	G115	Water	Oil	86.0-86.8	G115/21, /28, /34
Buderus	G115WS	Water	Oil	86.0	G115WS/5
Buderus	G115WS	Water	Oil	86.5	G115WS/3
Buderus	G115WS	Water	Oil	86.8	G115WS/4
Buderus	G124x	Water	Gas	85	G124x/DI/18, /25, /32
Buderus	G125BE	Water	Oil	89.05	G125BE/34

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Buderus	G125BE	Water	Oil	89.42	G125BE/28
Buderus	G125BE	Water	Oil	89.75	G125BE/21
Buderus	G215	Water	Oil	86.0-86.3	G215/3, /4, /5, /6 models
Buderus	G215	Water	Oil	86.7	G215/7
Buderus	GA124	Water	Gas	85.0-85.2	GA124/17, /23, 30
Buderus	GA244	Water	Gas	85	GA244 - models 37,44
Buderus	GB125BE	Water	Oil	93.4	GB125BE/22
Buderus	GB125BE	Water	Oil	93.4	GB125BE/30
Buderus	GB125BE	Water	Oil	93.4	GB125BE/35
Buderus	GB142	Water	Gas	94.1	GB142/30
Buderus	GB142	Water	Gas	95.4	GB142/24
Buderus	GB142	Water	Gas	95.4	GB142/45
Buderus	GB142	Water	Gas	95.5	GB142/60
Buderus	GB162	Water	Gas	93.9	GB162/80
Burnham Hydronics	Alpine		Nat. & LP Gas	95.0	ALP080, ALP105, ALP150, ALP210 & ALP285
Burnham Hydronics	CHG	Water	Nat/LP Gas	93.1	CHG150
Burnham Hydronics	CHG	Water	Nat/LP Gas	94.2	CHG225
Burnham Hydronics	FCM	Water	Gas	94.5-95.4	FCM070, FCM090, FCM120
Burnham Hydronics	LE, LEDV Series	Water	Oil	86.7	LE-1, LEDV-1
Burnham Hydronics	MegaSteam	Steam	Oil	86.0	MST288, MST396, MST513, MST629
Burnham Hydronics	MPO	Water	Oil	87	MPO115
Burnham Hydronics	MPO	Water	Oil	87	MPO84, MPO147, MPO189, MPO231

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Burnham Hydronics	MPODV	Water	Oil	87	MPO84DV, MPO147DV, MPO189DV, MPO231DV
Burnham Hydronics	PVG	Water	Nat/LP Gas	85-85.5	PVG3, PVG4, PVG5, PVG6, PVG7
Burnham Hydronics	Revolution	Water	Gas	87-88	RV3, RV4, RV5, RV6, RV7
Burnham Hydronics	SCG	Water	Nat/LP Gas	85-85.5	SCG3, SCG4, SCG5, SCG6, SCG7
Burnham Hydronics	V8	Steam	Oil	85.1-85.7	V83S, V84S, V85S, V86S
Burnham Hydronics	V8	Water	Oil	85-86.3	V83W, V84W, V85W, V86W, V87W
Clean Burn Inc.	Coil Tube Boiler	Water	Oil	86.48	CB-200-CTB
Climate Energy	CE95M	Water	Gas	95.0	All models beginning with CE95M
Columbia Boiler Company	Casco Bay CBX	Water	Oil	85.5	CBX 125WC, CBX 125WC-DV
Columbia Boiler Company	Casco Bay CBX	Water	Oil	86.0	CBX 110WC, CBX 110WC-DV
Columbia Boiler Company	Casco Bay CBX	Water	Oil	86.5	CBX 100WC, CBX 100WC-DV
Columbia Boiler Company	Casco Bay CBX	Water	Oil	87	CBX 90WC, CBX 90WC-DV
Columbia Boiler Company	Emerald Series	Water	Oil	85.0	EM 3125
Columbia Boiler Company	Emerald Series	Water	Oil	85.5	EM 3100
Columbia Boiler Company	LV and LV-DV Series	Water	Oil	85.2	LV-75, LV-75 DV
Columbia Boiler Company	LV & LVD Series	Water	Oil	85.0	LV-125, LVD-125
Columbia Boiler Company	LV Series	Water	Oil	85.0	LV 125
Columbia Boiler Company	Solara Series	Water	Oil	85.0	SL7175
Columbia Boiler Company	Solaia Series	Water	Oil	85.5	SL375

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Columbia Boiler Company	Solaia Series	Water	Oil	86.5	SL4100
Columbia Boiler Company	Solaia Series	Water	Oil	86.9	SL5125
Columbia Boiler Company	Solaia Series	Water	Oil	86.9	SL6150
Columbia Boiler Company	WB-II Series	Water	Oil	86.0	WB 165
Columbia Boiler Company	WB-II Series	Water	Oil	85.6	WB 175
Columbia Boiler Company	WB Series	Water	Oil	85.0	WB 125
Columbia Boiler Company	WB Series	Water	Oil	85.1	WB 90, WB 90 DV
Columbia Boiler Company	WB & WB-DV Series	Water	Oil	85.0	WB-125, WB-125 DV
Conematic Heating Systems Inc.	Boilers	Water	Natural Gas	90	CM-1
Conematic Heating Systems Inc.	Boilers	Water	Natural Gas	90	CM-RU
Conematic Heating Systems Inc.	Hydronic Boiler & Demand Water Heater	Water	Natural Gas	90	CM-1
Conematic Heating Systems Inc.	Hydronic Boiler Radiant Unit	Water	Natural Gas	90	CM-RU
Crown Boiler Co.	Bimini	Water	Gas	93.1 - 94.2	BWC150, BWC225
Crown Boiler Co.	Cabo II	Water	Gas	85.1 - 85.3	CWD060, CWD083, CWD110, CWD138, CWD165, CWD193, CWD220, CWD245
Crown Boiler Co.	Freeport	Water	Oil	86.1-87.6	CT-3, CT-4, CT-5, CT-6, CT-7
Crown Boiler Co.	Tobago	Water	Oil	85.8-86.1	TW2-065, TW2-075, TW2-090, TW2-120
Dexter Boilers	Boilers	Water	Oil	86.3	25
Dexter Boilers	Boilers	Water	Oil	86.6	20

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Dunkirk Boilers	Empire Series	Steam	Oil	85.0	ESC365, ESC4100
Dunkirk Boilers	Empire Series	Water	Oil	85.2 - 86.5	3EW.65T, 3EW.75T, 3EW.65Z, 3EW.75Z
Dunkirk Boilers	Empire Series	Water	Oil	85.2 - 86.5	4EW1.25T, 4EW1.50T, 4EW1.25Z, 4EW1.50Z
Dunkirk Boilers	Empire Series	Water	Oil	85.2 - 86.5	4EW.90T, 4EW.90Z
Dunkirk Boilers	Empire Series	Water	Oil	85.2-86.5	5EW1.20T, 5EW1.20Z
Dunkirk Boilers	EV Series	Water	Gas	85	DPFG-3T, 4T, 5T, 6T, 8T
Dunkirk Boilers	EV Series	Water	Oil	87.4 - 87.6	All models ending in UDES or DES
Dunkirk Boilers	EV Series	Water	Oil	87.4 - 87.6	DFPO-3T, 4T, 5T, 6T, 8T
Dunkirk Boilers	EXCEL & IOR	Water	Oil	85.8-86.5	4EXA075
Dunkirk Boilers	EXCEL & IOR	Water	Oil	85.8-86.5	5EXA100
Dunkirk Boilers	EXCEL & IOR	Water	Oil	85.8-86.5	6EXA130
Dunkirk Boilers	EXCEL & IOR	Water	Oil	85.8-86.5	7EXA165
Dunkirk Boilers	Quantum	Water	Gas	95	Q95M 200
Dunkirk Boilers	Quantum 90-200	Water	Gas	90	Q90 -125, 150, 175, 200
Dunkirk Boilers	Quantum 90 Series	Water	Gas	90	Q-90-50, -75, 100
Dunkirk Boilers	Quantum Leap (QL) Series	Water	Gas	95	QL-100
ECR International	Freewatt	Water	Gas	95.0	Models beginning with FW95M
EFM	PK 400 Series	Water	Oil	85.1	0.50 GPH
EFM	PK 440 Series	Water	Oil	85.2	1.10 GPH
EFM	PK 440 Series	Water	Oil	85.5	1.00 GPH
EFM	PK 440 Series	Water	Oil	85.8	0.85 GPH
EFM	PK 450 Series	Water	Oil	86.2	0.85 GPH
EFM	SPK 600 Series	Water	Oil	85.4	1.35 GPH

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
EFM	SPK 600 Series	Water	Oil	85.6	1.25 GPH
EFM	SPK 600 Series	Water	Oil	85.7	1.10 GPH
EFM	VT 1000 Series	Water	Oil	85.2	1.10 GPH
EFM	VT 700 Series	Water	Oil	85.1	0.65 GPH
Embassy	Ambassador	Water	Gas		Onex
Energy Kinetics	System 2000	Water	Gas	85-86	EK-1, EK-1-DV, EK-2, EK-2-DV
Energy Kinetics	System 2000	Water	Oil	86.2-87.5	EK-1, EK-1-DV, EK-2, EK-2-DV
Energy Kinetics	System 2000	Water	Propane	86-88	EK-1, EK-1-DV, EK-2, EK-2-DV
Excel	JS	Water	Gas	86	All series beginning with JS
Hamilton Engineering	EVO micro	Water	Gas	93.7	All models beginning with HWD - 129, 179, 199ASME, 299ASME
Hamilton Engineering	EVO micro	Water	Gas	93.7%	All models beginning with HWH - 129, 129.8, 179, 179.8, 199, 199ASME, 299, 299ASME
Heat Transfer Products, Inc.	Gas Fired Condensing Boiler	Water	Gas	95.1	Munchkin 140M
Heat Transfer Products, Inc.	Gas Fired Condensing Boiler	Water	Gas	95.1	Munchkin 199M
Heat Transfer Products, Inc.	Gas Fired Condensing Boiler	Water	Gas	95.1	Munchkin 80M
Heat Transfer Products, Inc.	Gas Fired Condensing Boiler	Water	Gas	95.1	Munchkin T50M
Heat Transfer Products, Inc.	Gas Fired Condensing Boiler	Water	Gas	95.1	Munchkin T80M
Heat Transfer Products, Inc.	Munchkin	Water	Gas	.93	Munchkin Contender MC 50
Heat Transfer Products, Inc.	Munchkin	Water	Gas	.93	Munchkin Contender MC 80

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Heat Transfer Products, Inc.	Munchkin	Water	Gas	93	Munchkin Contender MC 120
Heat Transfer Products, Inc.	Munchkin	Water	Gas	93	Munchkin Contender MC 99
Hydrotherm	KN	Water	Gas	92.7	KN-2
Hydrotherm	PB Series	Steam	Oil	85.1-86.2	PB-S-3(T)
Hydrotherm	PB Series	Steam	Oil	85.1-86.2	PB-S-4(T)
Hydrotherm	PB Series	Steam	Oil	85.1-86.2	PB-S-5(T)
Hydrotherm	PB Series	Steam	Oil	85.1-86.2	PB-S-6(T)
Hydrotherm	PB Series	Water	Oil	85.1-86.2	PB-W-3(T)
Hydrotherm	PB Series	Water	Oil	85.1-86.2	PB-W-4(T)
Hydrotherm	PB Series	Water	Oil	85.1-86.2	PB-W-5(T)
Hydrotherm	PB Series	Water	Oil	85.1-86.2	PB-W-6(T)
Hydrotherm Boilers	GX Series	Water	Gas	92.7	GX-150
Hydrotherm Boilers	GX Series	Water	Gas	92.7	GX-200
Hydrotherm Boilers	PB Series	Steam	Oil	85.1-86.2	PB-S-3(T), PB-S-4(T), PB-S-5(T), PB-S-6(T)
Hydrotherm Boilers	PB Series	Water	Oil	85.1-86.2	PB-W-3(T), PB-W-4(T), PB-W-5(T), PB-W-6(T)
Hydrotherm Boilers	Pulse	Water	Gas	90.3-90.6	AM-100, AM-150, AM-300
Hydrotherm Boilers	Sabre Series	Water	Gas	86.0-86.5	FX-70, FX-105, FX-140, FX-175, FX-200
LAARS Heating Systems Company	9600 CB	Water	Gas	88.6	CB-M2
LAARS Heating Systems Company	Endurance	Water	Gas	85.5	ED
LAARS Heating Systems Company	Mascot	Water	Gas	92.5	HT
LAARS Heating Systems Company	Neotherm	Water	Gas	95.6	NT

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
LAARS Heating Systems Company	Pennant	Water	Gas	85.5	PNCH
LAARS Heating Systems Company	Summit	Water	Gas	90.5	SMB
Lochinvar	Knight	Water	Gas	95.3	KBL080
Lochinvar	Knight	Water	Gas	95.3	KBN080
Lochinvar	Knight	Water	Gas	95.4	KBL105
Lochinvar	Knight	Water	Gas	95.4	KBN105
Lochinvar	Knight	Water	Gas	95.5	KBL150
Lochinvar	Knight	Water	Gas	95.5	KBN150
Lochinvar	Knight	Water	Gas	95.7	KBL210
Lochinvar	Knight	Water	Gas	95.7	KBN210
Lochinvar	Knight	Water	Gas	96	KBL285
Lochinvar	Knight	Water	Gas	96	KBN285
Lochinvar	Knight Wall Mount	Water	Gas	95.3	WBL050
Lochinvar	Knight Wall Mount	Water	Gas	95.3	WBL080
Lochinvar	Knight Wall Mount	Water	Gas	95.3	WBN050
Lochinvar	Knight Wall Mount	Water	Gas	95.3	WBN080
Lochinvar	Knight Wall Mount	Water	Gas	95.4	WBL105
Lochinvar	Knight Wall Mount	Water	Gas	95.4	WBN105
Lochinvar	Knight Wall Mount	Water	Gas	95.5	WBL150
Lochinvar	Knight Wall Mount	Water	Gas	95.5	WBN150
Lochinvar	Knight Wall Mount	Water	Gas	95.7	WBL210
Lochinvar	Knight Wall Mount	Water	Gas	95.7	WBN210
Mestek	i Series	Water	Gas	92.7	200i

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Monitor Products, Inc	Fully Condensing Boilers	Water	Oil	92.97	FCX fully condensing boiler
Monitor Products, Inc	MZ-Wall Hung Condensing Boiler	Water	Gas	95	MZ 40C, MZ 25S, MZ 25C
Newmac		Water	Oil	85.0	NBR-120
Newmac		Water	Oil	85.0	NBR-122
Newmac		Water	Oil	85.0	NBR-126
Newmac		Water	Oil	85.0	NBR-140
Newmac		Water	Oil	85.0	NBR2-120
Newmac		Water	Oil	85.0	NBR2-122
Newmac		Water	Oil	85.0	NBR2-126
Newmac		Water	Oil	85.0	NBR2-140
Newmac		Water	Oil	85.0	NBR2-140V
Newmac		Water	Oil	85.1	NBR-127
Newmac		Water	Oil	85.1	NBR2-127
Newmac		Water	Oil	85.2	NBR-113
Newmac		Water	Oil	85.2	NBR2-113
Newmac		Water	Oil	85.3	NBR-122V
Newmac		Water	Oil	85.3	NBR2-122V
Newmac		Water	Oil	85.4	NBR-109
Newmac		Water	Oil	85.4	NBR-111
Newmac		Water	Oil	85.4	NBR-126V
Newmac		Water	Oil	85.4	NBR2-109
Newmac		Water	Oil	85.4	NBR2-111
Newmac		Water	Oil	85.4	NBR2-126V
Newmac		Water	Oil	85.5	NBR-120V

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Newmac		Water	Oil	85.5	NBR-140V
Newmac		Water	Oil	85.5	NBR2-120V
Newmac		Water	Oil	86.2	NBR-109V
Newmac		Water	Oil	86.2	NBR2-109V
Newmac		Water	Oil	86.3	NBR-100
Newmac		Water	Oil	86.3	NBR-111V
Newmac		Water	Oil	86.3	NBR2-100
Newmac		Water	Oil	86.3	NBR2-111V
Newmac		Water	Oil	86.4	NBR2-96
Newmac		Water	Oil	86.4	NBR-96
Newmac		Water	Oil	86.6	NBR2-90
Newmac		Water	Oil	86.6	NBR2-98
Newmac		Water	Oil	86.6	NBR-90
Newmac		Water	Oil	86.6	NBR-98
Newmac		Water	Oil	86.7	NBR2-91
Newmac		Water	Oil	86.7	NBR-91
Newmac		Water	Oil	87.2	NBR2-96V
Newmac		Water	Oil	87.2	NBR-96V
Newmac		Water	Oil	87.4	NBR2-90V
Newmac		Water	Oil	87.4	NBR2-98V
Newmac		Water	Oil	87.4	NBR-90V
Newmac		Water	Oil	87.4	NBR-98V
New Yorker Boiler Co	CL Series	Water	Oil	85.1	CL3-105
New Yorker Boiler Co	CL Series	Water	Oil	85.7	CL5-168

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New Yorker Boiler Co	CL Series	Water	Oil	85.8	CL4-126
New Yorker Boiler Co	CL Series	Water	Oil	86.0	CL3-091
New Yorker Boiler Co	FR-122-W	Water	Oil	85.1	FR-122-W
New Yorker Boiler Co	FR-147-W	Water	Oil	86.7	FR-147-W
New Yorker Boiler Co	FR-173-W	Water	Oil	85.9	FR-173-W
New Yorker Boiler Co	FR-205-W	Water	Oil	86	FR-205-W
New Yorker Boiler Co	FR-232-W	Water	Oil	85.1	FR-232-W
New Yorker Boiler Co	FR-98-W	Water	Oil	86.4	FR-98-W
New Yorker Boiler Co	FR-HGS	Water	Oil	87.8	FR-HGS
New Yorker Boiler Co	FR-HGS II	Water	Oil	85	FR-HGS II
New Yorker Boiler Company, Inc.	MicroTEK3	Water	Oil	86.7	MicroTEK3-1
New Yorker Boiler Company, Inc.	MicroTEK3DV	Water	Oil	86.7	MicroTEK3DV-1
Noritz	841 Series	Water	Gas		N-0841MC-DV (LP)
Noritz	841 Series	Water	Gas		N-0841MC-DV (NG)
Noritz	841 Series	Water	Gas		N-0841MC (LP)
Noritz	841 Series	Water	Gas		N-0841MC (N6)
Northshore Welding	Rayes Boiler	Steam	Gas	85	S4 (Gas, Steam)
Northshore Welding	Rayes Boiler	Steam	Gas	85	S6 (Gas, Steam)
Northshore Welding	Rayes Boiler	Steam	Oil	85	S4 (Oil, Steam)
Northshore Welding	Rayes Boiler	Steam	Oil	85	S6 (Oil, Steam)
Northshore Welding	Rayes Boiler	Water	Gas	85	S4 (Gas, Water)
Northshore Welding	Rayes Boiler	Water	Gas	85	S6 (Gas, Water)
Northshore Welding	Rayes Boiler	Water	Oil	85	S4 (Oil, Water)
Northshore Welding	Rayes Boiler	Water	Oil	85	S6 (Oil, Water)

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Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
NTI	Caprice	Water	Oil	85.1	C340
NTI	Caprice	Water	Oil	85.2	C305
NTI	Caprice	Water	Oil	85.5	C250
NTI	Caprice	Water	Oil	85.7	C275
NTI	Caprice	Water	Oil	85.8	C105
NTI	Caprice	Water	Oil	86.2	C125
NTI	Caprice	Water	Oil	86.8	C230
NTI	Caprice	Water	Oil	86.9	C85
NTI	Caprice	Water	Oil	87	C95
NTI	Caprice	Water	Oil	87.6	C220
NTI	Matrix	Water	Gas	92.7	M100
NTI	Odyssey	Water	Oil	85	CT120
NTI	Odyssey	Water	Oil	85	CT250
NTI	Odyssey	Water	Oil	85.2	CT150
NTI	Odyssey	Water	Oil	85.6	CT230
NTI	Odyssey	Water	Oil	85.8	CT215
NTI	Trinity	Water	Gas	92.7	Ti 100
NTI	Trinity	Water	Gas	92.7	Ti150
NTI	Trinity	Water	Gas	92.7	Ti150c
NTI	Trinity	Water	Gas	92.7	Ti200
NTI	Trinity	Water	Gas	92.7	Ti200c
NTI	Triton	Water	Oil	85	VS100
NTI	Triton	Water	Oil	85	VS90
NTI	Triton	Water	Oil	86.7	VS80

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OMEGA COMFORT	JLG	Water	Gas	86	JLG-28
OMEGA COMFORT	OME	Water	Gas	87	OME620D
OMEGA COMFORT	TEK	Water	Gas	87	TEK 3
Peerless (P.B. Heat)	EC/ECT	Steam	Oil	85.1	EC/ECT-04- 1.25 gph
Peerless (P.B. Heat)	EC/ECT	Steam	Oil	85.4	EC/ECT-03- .75 gph
Peerless (P.B. Heat)	EC/ECT	Steam	Oil	85.6	EC/ECT-05- 1.75 gph
Peerless (P.B. Heat)	EC/ECT	Water	Oil	85.2	EC/ECT-04- 1.50 gph
Peerless (P.B. Heat)	EC/ECT	Water	Oil	85.2	EC/ECT-05- 2.00 gph
Peerless (P.B. Heat)	EC/ECT	Water	Oil	85.3	EC/ECT-03- 1.00 gph
Peerless (P.B. Heat)	EC/ECT	Water	Oil	86.1	EC/ECT-04- 1.25 gph
Peerless (P.B. Heat)	EC/ECT	Water	Oil	86.2	EC/ECT-05- 1.75 gph
Peerless (P.B. Heat)	EC/ECT	Water	Oil	86.6	EC/ECT-03- .75 gph
Peerless (P.B. Heat)	PDE	Water	Gas	85	PDE-03, PDE-04, PDE-05
Peerless (P.B. Heat)	Peerless Pinnacle Oil	Water	Oil	91.3	PO-84
Peerless (P.B. Heat)	Peerless Pinnacle Oil	Water	Oil	91.7	PO-70
Peerless (P.B. Heat)	Peerless Pinnacle Oil	Water	Oil	91.8	PO-84A
Peerless (P.B. Heat)	Peerless Pinnacle Oil	Water	Oil	92	PO-70A
Peerless (P.B. Heat)	Peerless Series PSC II	Water	Gas	85	PSCII-04-WPC
Peerless (P.B. Heat)	Peerless Series PSC II	Water	Gas	85	PSCII-05-WPC
Peerless (P.B. Heat)	Peerless Series PSC II	Water	Gas	85.1	PSCII-06-WPC
Peerless (P.B. Heat)	Peerless Series PSC II	Water	Gas	86	PSCII-03-WPC
Peerless (P.B. Heat)	Pinnacle	Water	Gas	95.1	PI-80, PI-140, PI-199
Peerless (P.B. Heat)	Pinnacle	Water	Gas	95.1	PI-T50, PI-T80
Peerless (P.B. Heat)	PRO Series	Water	Oil	85.2	PRO-04-100

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Peerless (P.B. Heat)	PRO Series	Water	Oil	85.2	PRO-05-125
Peerless (P.B. Heat)	PRO Series	Water	Oil	85.4	PRO-03-060
Peerless (P.B. Heat)	PRO Series	Water	Oil	86.4	PRO-04-080
Peerless (P.B. Heat)	PRO Series	Water	Oil	86.5	PRO-05-100
Peerless (P.B. Heat)	PureFire	Water	Gas	95.0	PF-50
Peerless (P.B. Heat)	PureFire	Water	Gas	95.2	PF-80
Peerless (P.B. Heat)	PureFire	Water	Gas	95.3	PF-140
Peerless (P.B. Heat)	PureFire	Water	Gas	95.8	PF-110
Peerless (P.B. Heat)	WBV	Steam	Oil	85.3	WBV-04-1.25gph
Peerless (P.B. Heat)	WBV	Water	Oil	85.0	WBV-03-1.05 gph
Peerless (P.B. Heat)	WBV	Water	Oil	85.1	WBV-04-1.5 gph
Peerless (P.B. Heat)	WBV	Water	Oil	85.4	WBV-04-1.25gph
Peerless (P.B. Heat)	WBV	Water	Oil	86.2	WBV-03-.85gph
Peerless (P.B. Heat)	WBV	Water	Oil	87	WBV-04-.95 gph
Peerless (P.B. Heat)	WBV	Water	Oil	87.5	WBV-03-.60 gph
Peerless (P.B. Heat)	WV	Water	Oil	85.0	WV-05-1.95 gph
Peerless (P.B. Heat)	WV	Water	Oil	85.5	WV-05-1.75gph
Peerless (P.B. Heat)	WV-DV	Water	Oil	85.9	WV-DV-03-WPC-.85gph
Peerless (P.B. Heat)	WV-DV	Water	Oil	85.9	WV-DV-03-WPCT-.85gph
Peerless (P.B. Heat)	WV-DV	Water	Oil	86	WV-DV-04 WPC 1.30gph
Peerless (P.B. Heat)	WV-DV	Water	Oil	86.7	WV-DV-03 WPC-.75gph
Peerless (P.B. Heat)	WV-DV	Water	Oil	86.7	WV-DV-03 WPCT-.75gph
Peerless (P.B. Heat)	WV-DV	Water	Oil	86.7	WV-DV-04 WPC 1.15gph
Pennco	Keystone Series	Steam	Oil	85.0	KSC365, KSC4100

EPA ENERGY STAR® Boiler Product List

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Pennco	Keystone Series	Water	Oil	85.1	4K1.50
Pennco	Keystone Series	Water	Oil	85.6	3K0.75
Pennco	Keystone Series	Water	Oil	85.9	4K1.25
Pennco	Keystone Series	Water	Oil	86	4K0.90
Pennco	Keystone Series	Water	Oil	86.1	3K0.60
Pennco	Keystone Series	Water	Oil	86.1	5K1.20
Pensotti	Blueline	Water	Oil	86.5	BL3- 50 HE
Pensotti	Blueline	Water	Oil	86.5	BL4-75 HE
Pensotti	BlueLine	Water	Oil	86.5	BL5-95
Pensotti	BlueLine	Water	Oil	86.5	BL6-120 HE
Pensotti	BlueLine	Water	Oil	86.5	BL7-140HE
Pensotti	Heatline	Water	Oil	85.1	DK2-3
Pensotti	Heatline	Water	Oil	85.6	DK2-5
Pensotti	Heatline	Water	Oil	86.4	DK2-4
Pensotti	Heatline	Water	Oil	86.7	DK2-6
Pensotti	Heatline	Water	Oil	86.9	DK2-7
Pensotti	Heatline	Water	Oil	87.1	DK2-7
Pure Pro	Trio	Water	Oil	85.0	P3, P3D
Pure Pro	Trio	Water	Oil	85.0	P7
Pure Pro	Trio	Water	Oil	86.1	P4, P5D
Pure Pro	Trio	Water	Oil	86.4	P6
Pure Pro	Trio	Water	Oil	86.5	P5, P5D
Quietside	QVM8-OL	Water	Oil	85	QVM8-085/120/150 OL
Quietside	QVM-9	Water	Gas	90	QVM9-090/125/150

EPA ENERGY STAR® Boiler Product List

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Slant/Fin Corporation	Bobcat	Water	Gas	93	B-120A
Slant/Fin Corporation	Bobcat	Water	Gas	93	B-200A
Slant/Fin Corporation	Bobcat	Water	Gas	93.0	B-120
Slant/Fin Corporation	Bobcat	Water	Gas	93.0	B-200
Slant/Fin Corporation	Eutectic	Water	Oil	86.5	EC-25,26
Slant/Fin Corporation	Eutectic	Water	Oil	87.0	EC-13,14,15,16
Slant/Fin Corporation	Eutectic	Water	Oil	87.0	EC-13DV,14DV,15,DV,16DV
Slant/Fin Corporation	Intrepid	Water	Oil	86	TR-30H,40H,50H
Slant/Fin Corporation	Intrepid (LDV)	Water	Oil	86.2	TRDV-30-1.10
Slant/Fin Corporation	Intrepid (LDV)	Water	Oil	87.2	TRDV-30-0.85
Slant/Fin Corporation	Intrepid (LDV)	Water	Oil	87.5	TRDV-30-1.00
Slant/Fin Corporation	Liberty	Water	Oil	86.0	LD-30H
Slant/Fin Corporation	Liberty	Water	Oil	86.0	LD-40H
Slant/Fin Corporation	Liberty	Water	Oil	86.0	LD-50H
Slant/Fin Corporation	Lynx	Water	Gas	94.0	LX-85
Slant/Fin Corporation	Lynx	Water	Gas	95.0	LX-85A
Slant/Fin Corporation	Victory	Water	Gas	85.1	VSPH-180
Slant/Fin Corporation	Victory	Water	Gas	85.2	VSPH-150
Slant/Fin Corporation	Victory	Water	Gas	85.5	VSPH-120
Slant/Fin Corporation	Victory	Water	Gas	85.7	VSPH-90
Slant/Fin Corporation	Victory	Water	Gas	86.1	VSPH-60
Slant/Fin Corporation	XL-2000	Water	Oil	86.0	XL-30H
Slant/Fin Corporation	XL-2000	Water	Oil	86.0	XL-40H
Slant/Fin Corporation	XL-2000			85.0	XL-30, XL-40, XL-50

EPA ENERGY STAR® Boiler Product List

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Smith	GC Series	Water	Gas		GC160
Smith Boilers	8 series	Steam	Oil	85.1-86.2	8-S-3(T)
Smith Boilers	8 series	Steam	Oil	85.1-86.2	8-S-4(T)
Smith Boilers	8 series	Steam	Oil	85.1-86.2	8-S-5(T)
Smith Boilers	8 series	Steam	Oil	85.1-86.2	8-S-6(T)
Smith Boilers	8 series	Water	Oil	85.1-86.2	8-W-3(T)
Smith Boilers	8 series	Water	Oil	85.1-86.2	8-W-4(T)
Smith Boilers	8 series	Water	Oil	85.1-86.2	8-W-5(T)
Smith Boilers	8 series	Water	Oil	85.1-86.2	8-W-6(T)
Smith Cast Iron Boilers	8 Series	Water	Oil	85.1-86.2	8-W-3(T), 8-W-4(T), 8-W-5(T), 8-W-6(T)
Smith Cast Iron Boilers	GT Series	Water	Gas	92.7	GT-150, GT-200
Smith Cast Iron Boilers	Lexington Series			86.0-86.5	GS110-3 through GS110-7
Thermo-Dynamics Boiler Company	CWL Series	Water	Oil	85	CWL-85, CWL-85 DV
Thermo-Dynamics Boiler Company	HT & HT-DV Series	Water	Oil	85.1	HT 90, HT 90 DV
Thermo-Dynamics Boiler Company	HT & HT-DV Series	Water	Oil	85.0	HT-125, HT-125 DV
Thermo-Dynamics Boiler Company	HT-II Series	Water	Oil	85.6	HT-175
Thermo-Dynamics Boiler Company	HT-II Series	Water	Oil	86.0	HT-165
Thermo-Dynamics Boiler Company	LM & LM-DV Series	Water	Oil	85.0	LM-125
Thermo-Dynamics Boiler Company	LM & LM-DV Series	Water	Oil	85.2	LM-75, LM-75 DV
Thermo-Dynamics Boiler Company	SPK 600 Series	Water	Oil	85.4	1.35 GPH
Thermo-Dynamics Boiler Company	SPK 600 Series	Water	Oil	85.6	1.25 GPH

EPA ENERGY STAR® Boiler Product List

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Thermo-Dynamics Boiler Company	SPK 600 Series	Water	Oil	85.7	1.10 GPH
Thermo-Dynamics Boiler Company	S Series	Water	Oil	85.1	STR-110
Thermo-Dynamics Boiler Company	S Series	Water	Oil	85.2	STR-85
Thermo-Dynamics Boiler Company	S Series	Water	Oil	85.4	STR-100
Thermo-Dynamics Boiler Company	TDX Series	Water	Oil	85.5	TDX 125WC, TDX 125WC-DV
Thermo-Dynamics Boiler Company	TDX Series	Water	Oil	86.0	TDX 110WC, TDX 110WC-DV
Thermo-Dynamics Boiler Company	TDX Series	Water	Oil	86.5	TDX 100WC, TDX 100WC-DV
Thermo-Dynamics Boiler Company	TDX Series	Water	Oil	87	TDX 90WC, TDX 90WC-DV
Toyctomi	Oil Miser	Water	Oil	86.5	OM-180
Trane	TPFWF	Water	Oil	85.5-86.7	All models beginning with TPFWF
Triangle Tube	Delta	Water	Gas	85.2-86.0	PG PLUS-25, 30, 35, 40, 45, 150, 199
Triangle Tube	Prestige	Water	Gas	95	Excellence 110
Triangle Tube	Prestige	Water	Gas	95	Excellence 110P
Triangle Tube	Prestige	Water	Gas	95	Solo 110
Triangle Tube	Prestige	Water	Gas	95	Solo 110P
Triangle Tube	Prestige	Water	Gas	95	Solo 175
Triangle Tube	Prestige	Water	Gas	95	Solo 250
Triangle Tube	Prestige	Water	Gas	95.0	Solo 60
Ultimate	Ultimate Products	Water	Gas	85	PFG-3T, 4T, 5T, 6T, 8T
Ultimate	Ultimate Products	Water	Oil	87.4-87.6	PFO-3,4,5,7,9 and PF03T, 4T, 5T, 6T, 8T
Utica Boilers	BC-Series	Water	Oil	86	BC-3D, BC-4D

EPA ENERGY STAR® Boiler Product List

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Utica Boilers	Starfire III Series	Steam	Oil	85.0	SFE365S
Utica Boilers	Starfire III Series	Steam	Oil	85.0	SFE4100S
Utica Boilers	Star Fire III Series	Water	Oil	86	SFH 365W, 4100W, 5125W, 6150W
Utica Boilers	TRIFIRE	Water	Oil	85.8-86.5	4TRA075
Utica Boilers	TRIFIRE	Water	Oil	85.8-86.5	5TRA100
Utica Boilers	TRIFIRE	Water	Oil	85.8-86.5	6TRA130
Utica Boilers	TRIFIRE	Water	Oil	85.8-86.5	7TRA165
Utica Boilers	UB	Water	Gas	95	UB95M 200
Utica Boilers	UB90-100	Water	Gas	90	UB90-50, UB90-75, UB90-100
Utica Boilers	UB90-200	Water	Gas	90	UB90-125, 150, 175, 200
Utica Boilers	USC-Series	Water	Gas	87	USC-3, 4, 5
Utica Heating	Keystone Water	Water	Oil	85.1	UH4KW1.50
Utica Heating	Keystone Water	Water	Oil	85.6	UH3KW0.75
Utica Heating	Keystone Water	Water	Oil	85.9	UH4KW1.25
Utica Heating	Keystone Water	Water	Oil	86	UH4KW0.90
Utica Heating	Keystone Water	Water	Oil	86.1	UH3KW0.60
Viessmann	Vitodens 100	Water	Gas	95.1	WB1 8-24 through WB1 8-30
Viessmann	Vitodens 200	Water	Gas	94.2	WB26-24 through WB215-60
Viessmann	Vitodens 200	Water	Gas	95.2	WB2 6-24 through WB2 15-60
Viessmann	Vitogas 100	Water	Gas	85.4 - 85.	GS1-22 through GS1-60
Viessmann	Vitola 200	Water	Oil	87.1 - 87.	VB2-18 through VB2-63
Viessmann	Vitorond 100	Water	Oil	86.9	VR1-22 through VRI-63
Viessmann	Vitorond 200	Water	Oil	86.7 - 88.	VR2-18 through VR2-63

EPA ENERGY STAR® Boiler Product List

Oil fired Energy Star boilers highlighted in yellow for emphasis

Brand Name	Model Name	Boiler Type	Fuel Type	AFUE Rating	Model Number
Weil-McLain	CGS	Water	Gas	85.3	CGs-3
Weil-McLain	GV	Water	Gas	87.0	GV-6
Weil-McLain	GV	Water	Gas	87.2	GV-5
Weil-McLain	GV	Water	Gas	87.3	GV-4
Weil-McLain	GV	Water	Gas	87.5	GV-3
Weil-McLain	Ultra	Water	Gas	92.0	Ultra 105
Weil-McLain	Ultra	Water	Gas	92.8	Ultra 230
Weil-McLain	Ultra	Water	Gas	93.0	Ultra 155
Weil-McLain	Ultra	Water	Gas	93.0	Ultra 80
Weil-McLain	Ultra Oil	Water	Oil	86.2	UO-4, 1.20GPH
Weil-McLain	Ultra Oil	Water	Oil	86.5	UO-3, 1.0GPH
Weil-McLain	Ultra Oil	Water	Oil	86.5	UO-3, .80GPH
Weil-McLain	Ultra Oil	Water	Oil	86.5	UO-5, 1.40GPH
Weil-McLain	WGO	Water	Oil	85.0	WGO-4
Weil-McLain	WGO	Water	Oil	85.0	WGO-5
Weil-McLain	WGO	Water	Oil	85.0	WGO-6
Weil-McLain	WGO	Water	Oil	85.0	WGO-7
Weil-McLain	WGO	Water	Oil	85.3	WGO-3
Weil-McLain	WGO	Water	Oil	86.4	WGO-2
Weil-McLain	WTGO	Water	Oil	85.0	WTGO-4
Weil-McLain	WTGO	Water	Oil	85.0	WTGO-5
Weil-McLain	WTGO	Water	Oil	85.0	WTGO-6
Weil-McLain	WTGO	Water	Oil	85.0	WTGO-7
Weil-McLain	WTGO	Water	Oil	85.3	WTGO-3

EPA ENERGY STAR® Boiler Product List

Attachment 2 ASTM D396-05

EXHIBIT 1

D396-05 STANDARD SPECIFICATION FOR FUEL OILS

Document: ASTM D396-05

Title: Standard Specification for Fuel Oils

Abstract: 1.1 This specification (Note 1) covers grades of fuel oil intended for use in various types of fuel-oil-burning equipment under various climatic and operating conditions. These grades are described as follows:

1.1.1 Grades No. 1 S5000, No. 1 S500, No. 2 S5000, and No. 2 S500 are middle distillate fuels for use in domestic and small industrial burners. Grades No. 1 S5000 and No. 1 S500 are particularly adapted to vaporizing type burners or where storage conditions require low pour point fuel.

1.1.2 Grades No. 4 (Light) and No. 4 are heavy distillate fuels or middle distillate residual fuel blends used in commercial industrial burners equipped for this viscosity range.

1.1.3 Grades No. 5 (Light), No. 5 (Heavy), and No. 6 are residual fuels of increasing viscosity and boiling range, used in industrial burners. Preheating is usually required for handling and proper atomization.

Note 1—For information on the significance of the terminology and test methods used in this specification, see Appendix X1.

Note 2—A more detailed description of the grades of fuel oils is given in X1.3.

1.2 This specification is for the use of purchasing agencies in formulating specifications to be included in contracts for purchases of fuel oils and for the guidance of consumers of fuel oils in the selection of the grades most suitable for their needs.

1.3 Nothing in this specification shall preclude observance of federal, state, or local regulations which can be more restrictive.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

Note 3—The generation and dissipation of static electricity can create problems in the handling of distillate burner fuel oils. For more information on the subject, see Guide D 4865.

Normative References: No normative references available

File Size: 0 kB

Price: $34.00

Attachment 3 EU Heating Oil Directive

COUNCIL DIRECTIVE 1999/32/EC

of 26 April 1999

relating to a reduction in the sulphur content of certain liquid fuels and amending Directive 93/12/EEC

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 130s(1) thereof,

Having regard to the proposal from the Commission (1),

Having regard to the opinion of the Economic and Social Committee (2),

Acting in accordance with the procedure laid down in Article 189c of the Treaty (3),

(1) Whereas the objectives and principles of the Community's environmental policy as set out in the action programmes on the environment and in particular the Fifth Environmental Action Programme (4) on the basis of principles enshrined in Article 130r of the Treaty aim in particular to ensure the effective protection of all people from the recognised risks from sulphur dioxide emissions and to protect the environment by preventing sulphur deposition exceeding critical loads and levels;

(2) Whereas Article 129 of the Treaty provides that health protection requirements are to form a constituent part of the Community's other policies; whereas Article 3(o) of the Treaty also provides that the activities of the Community should include a contribution to the attainment of a high level of health protection;

(3) Whereas emissions of sulphur dioxide contribute significantly to the problem of acidification in the Community; whereas sulphur dioxide also has a direct effect on human health and on the environment;

(4) Whereas acidification and atmospheric sulphur dioxide damage sensitive ecosystems, reduce biodiversity and reduce amenity value as well as detrimentally affecting crop production and the growth of forests; whereas acid rain falling in cities may cause significant damage to buildings and the architectural heritage; whereas sulphur dioxide pollution may also have a significant effect upon human health, particularly among those sectors of the population suffering from respiratory diseases;

(5) Whereas acidification is a transboundary phenomenon requiring Community as well as national or local solutions;

(6) Whereas emissions of sulphur dioxide contribute to the formation of particulate matter in the atmosphere;

(7) Whereas the Community and the individual Member States are Contracting Parties to the UN-ECE Convention on Long-Range Transboundary Air Pollution; whereas the second UN-ECE Protocol on transboundary pollution by sulphur dioxide foresees that the Contracting Parties should reduce sulphur dioxide emissions in line with or beyond the 30 % reduction specified in the first Protocol and whereas the second UN-ECE Protocol is based on the premise that critical loads and levels will continue to be exceeded in some sensitive areas; whereas further measures to reduce sulphur dioxide emissions will still be required if the objectives in the Fifth Environmental Action Programme are to be respected; whereas the Contracting Parties should therefore make further significant reductions in emissions of sulphur dioxide;

(8) Whereas sulphur which is naturally present in small quantities in oil and coal has for decades been recognised as the dominant source of sulphur dioxide emissions which are one of the main causes of 'acid rain' and one of the major causes of the air pollution experienced in many urban and industrial areas;

(9) Whereas the Commission has recently published a communication on a cost-effective strategy to combat acidification in the Community; whereas the control of sulphur dioxide emissions originating from the combustion of certain liquid fuels was identified as being an integral component of this cost-effective strategy; whereas the Community recognises the need for measures regarding all other fuels;

(10) Whereas studies have shown that benefits from reducing sulphur emissions by reductions in the sulphur content of fuels will often be considerably greater than the estimated costs to industry in this Directive and whereas the technology exists and is well established for reducing the sulphur level of liquid fuels;

(1) OJ C 190, 21.6.1997, p. 9, and OJ C 259, 18.8.1998, p. 5.
(2) OJ C 355, 21.11.1997, p. 1.
(3) Opinion of the European Parliament of 13 May 1998 (OJ C 167, 1.6.1998, p. 111), Council Common Position of 6 October 1998 (OJ C 364, 25.11.1998, p. 20) and Decision of the European Parliament of 9 February 1999 (not yet published in the Official Journal).
(4) OJ C 138, 17.5.1993, p. 5.

Attachment 3 EU Heating Oil Directive

(11) Whereas, in conformity with the principle of subsidiarity and the principle of proportionality referred to in Article 3b of the Treaty, the objective of reducing the emissions of sulphur dioxide arising from the combustion of certain types of liquid fuels cannot be achieved effectively by Member States acting individually; whereas unconcerted action offers no guarantee of achieving the desired objective, is potentially counter-productive and will result in considerable uncertainty in the market for the fuel products affected; whereas in view of the need to reduce sulphur dioxide emissions across the Community, it is therefore more effective to take action at the level of the Community; whereas this Directive limits itself to the minimum requirements necessary to achieve the desired objective;

(12) Whereas in Council Directive 93/12/EEC of 23 March 1993 relating to the sulphur content of certain liquid fuels (1) the Commission was asked to submit to the Council a proposal prescribing lower limits for the sulphur content in gas oil and new limits for aviation kerosene; whereas it would be appropriate to lay down limits for the sulphur content of other liquid fuels, in particular heavy fuel oils, bunker fuel oils, marine gas oils and gas oils, on the basis of cost effectiveness studies;

(13) Whereas, in accordance with Article 130t of the Treaty, this Directive should not prevent any Member State from maintaining or introducing more stringent protective measures; whereas such measures must be compatible with the Treaty and should be notified to the Commission;

(14) Whereas a Member State, before introducing new, more stringent protective measures, should notify the draft measures to the Commission in accordance with Council Directive 83/189/EEC of 28 March 1983 laying down a procedure for the provision of information in the field of technical standards and regulations (2);

(15) Whereas, with regard to the limit on the sulphur content of heavy fuel oil, it is appropriate to provide for derogations in Member States and regions where the environmental conditions allow;

(16) Whereas, with regard to the limit on the sulphur content of heavy fuel oil, it is also appropriate to provide for derogations for their use in combustion plants which comply with the emission limit values laid down in Council Directive 88/609/EEC of 24 November 1988 (3) on the limitation of emissions of certain pollutants into the air from large combustion plants; whereas in the light of the forthcoming revision of Directive 88/609/EEC, it may be necessary to review and, if appropriate, to revise certain provisions of this Directive;

(17) Whereas for refinery combustion plants excluded from the scope of Article 3(3)(c) of this Directive the emissions of sulphur dioxide averaged over such plants should not exceed the limits set out in Directive 88/609/EEC or any future revision of that Directive; whereas, in the application of this Directive, Member States should bear in mind that substitution by fuels other than those pursuant to Article 2 should not produce an increase in emissions of acidifying pollutants;

(18) Whereas a limit value of 0,2 % for the sulphur content of gas oils has already been established pursuant to Directive 93/12/EEC; whereas that limit value should be changed to 0,1 % until 1 January 2008;

(19) Whereas, in accordance with the 1994 Act of Accession, Austria and Finland have a derogation for a period of four years from the date of accession regarding the provisions in Directive 93/12/EEC concerning the sulphur content of gas oil;

(20) Whereas the limit values of 0.2 % (from the year 2000) and of 0.1 % (from the year 2008) for the sulphur content of gas oils intended for marine use in sea-going ships may present technical and economic problems for Greece throughout its territory, for Spain with regard to the Canary Islands, for France with regard to the French Overseas Departments, and for Portugal with regard to the archipelagoes of Madeira and Azores; whereas a derogation for Greece, the Canary Islands, the French Overseas Departments and the Archipelagoes of Madeira and Azores should not have a negative effect upon the market in gas oil intended for marine use and given that exports of gas oil for marine use from Greece, the Canary Islands, the French Overseas Departments and the Archipelagoes of Madeira and Azores to other Member States should satisfy the requirements in force in the importing Member State; whereas Greece, the Canary Islands, the French Overseas Departments and the Archipelagoes of Madeira and Azores should therefore be afforded a derogation from the limit values of sulphur by weight for gas oil used for marine purposes;

(1) OJ L 74, 27.3.1993, p. 81.
(2) OJ L 109, 26.4.1983, p. 8. Directive as last amended by Commission Decision 96/139/EC (OJ L 32, 10.2.1996, p. 31).
(3) OJ L 336, 7.12.1988, p. 1. Directive as last amended by Directive 94/66/EC (OJ L 337, 24.12.1994, p. 83).

Attachment 3 EU Heating Oil Directive

(21) Whereas sulphur emissions from shipping due to the combustion of bunker fuels with a high sulphur content contribute to sulphur dioxide pollution and problems of acidification; whereas the Community will be advocating more effective protection of areas sensitive to SO_x emissions and a reduction in the normal limit value for bunker fuel oil (from the present 4,5 %) at the continuing and future negotiations on the MARPOL Convention within the International Maritime Organisation (IMO); whereas the Community initiatives to have the North Sea/Channel declared a special low SO_x emission control area should be continued;

(22) Whereas more profound research into the effects of acidification on ecosystems and the human body is needed; whereas the Community is assisting such research under the Fifth Framework Research Programme (1);

(23) Whereas in the case of a disruption in the supply of crude oil, petroleum products or other hydrocarbons, the Commission may authorise application of a higher limit within a Member State's territory;

(24) Whereas Member States should establish the appropriate mechanisms for monitoring compliance with the provisions of this Directive; whereas reports on the sulphur content of liquid fuels should be submitted to the Commission;

(25) Whereas, for reasons of clarity, it will be necessary to amend Directive 93/12/EEC,

HAS ADOPTED THIS DIRECTIVE:

Article 1

Purpose and scope

1. The purpose of this Directive is to reduce the emissions of sulphur dioxide resulting from the combustion of certain types of liquid fuels and thereby to reduce the harmful effects of such emissions on man and the environment.

2. Reductions in the emissions of sulphur dioxide resulting from the combustion of certain petroleum-derived liquid fuels shall be achieved by imposing limits on the sulphur content of such fuels as a condition for their use within the territory of the Member States.

The limitations on the sulphur content of certain petroleum-derived liquid fuels as laid down in this Directive shall not, however, apply to:

(a) — petroleum derived liquid fuels used by seagoing ships, except those fuels falling within the definition in Article 2(3),

— marine gas oil used by ships crossing a frontier between a third country and a Member State;

(b) fuels intended for processing prior to final combustion;

(c) fuels to be processed in the refining industry.

Article 2

Definitions

For the purpose of this Directive:

1. *heavy fuel oil* means:

— any petroleum-derived liquid fuel falling within CN code 2710 00 71 to 2710 00 78, or

— any petroleum-derived liquid fuel, other than gas oil as defined in points 2 and 3, which, by reason of its distillation limits, falls within the category of heavy oils intended for use as fuel and of which less than 65 % by volume (including losses) distils at 250 °C by the ASTM D86 method. If the distillation cannot be determined by the ASTM D86 method, the petroleum product is likewise categorised as a heavy fuel oil;

2. *gas oil* means:

— any petroleum-derived liquid fuel falling within CN code 2710 00 67 or 2710 00 68, or

— any petroleum-derived liquid fuel which, by reason of its distillation limits, falls within the category of middle distillates intended for use as fuel and of which at least 85 % by volume (including losses) distils at 350 °C by the ASTM D86 method.

Diesel fuels as defined in Article 2(2) of Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC (2) are excluded from this definition. Fuels used in non-road mobile machinery and agricultural tractors are also excluded from this definition;

3. *marine gas oil* means fuels intended for marine use which meet the definition in point 2 or which have a viscosity or density falling within the ranges of viscosity or density defined for marine distillates in Table I of ISO 8217 (1996);

(1) OJ L 26, 1.2.1999, p. 1.

(2) OJ L 350, 28.12.1998, p. 58.

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4. *ASTM method* means the methods laid down by the American Society for Testing and Materials in the 1976 edition of standard definitions and specifications for petroleum and lubricating products;

5. *combustion plant* means any technical apparatus in which fuels are oxidised in order to use the heat generated;

6. *critical load* means a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on sensitive elements of the environment do not occur according to current knowledge.

Article 3

Maximum sulphur content of heavy fuel oil

1. Member States shall take all necessary steps to ensure that as from 1 January 2003 within their territory heavy fuel oils are not used if their sulphur content exceeds 1,00 % by mass.

2. Provided that the air quality standards for sulphur dioxide laid down in Directive 80/779/EEC (¹) or in any Community legislation which repeals and replaces these standards and other relevant Community provisions are respected and the emissions do not contribute to critical loads being exceeded in any Member State, a Member State may authorise heavy fuel oils with a sulphur content of between 1,00 and 3,00 % by mass to be used in part or the whole of its territory. Such authorisation shall apply only while emissions from a Member State do not contribute to critical loads being exceeded in any Member State.

3. (i) Subject to appropriate monitoring of emissions by competent authorities paragraphs 1 and 2 shall not apply to heavy fuel oils used:

(a) in combustion plants which fall within the scope of Directive 88/609/EEC, which are considered new plants in accordance with the definition given in Article 2(9) of that Directive and which comply with the sulphur dioxide emission limits for such plants set out in Article 4 of and Annex IV to that Directive;

(b) in other combustion plants, which do not fall under the scope of (a), where the emissions of sulphur dioxide from the plant are less than or equal to 1 700 mg/Nm³ at an oxygen content in the flue gas of 3 % by volume on a dry basis;

(c) for combustion in refineries, where the monthly average of emissions of sulphur dioxide averaged over all plants in the refinery, excluding combustion plants which fall under the scope of (a), irrespective of the type of fuel or fuel combination used, are within a limit to be set by each Member State which shall not exceed 1 700 mg/Nm³.

(ii) Member States shall take the necessary measures to ensure that any combustion plant using heavy fuel oil with a sulphur concentration greater than that referred to in paragraph 1 shall not be operated without a permit issued by a competent authority, which specifies the emission limits.

4. The provisions of paragraph 3 shall be reviewed and, if appropriate, revised in the light of any future revision of Directive 88/609/EEC.

5. If a Member State avails itself of the possibilities referred to in paragraph 2, it shall at least 12 months beforehand inform the Commission and the public. The Commission shall be given sufficient information to assess whether the criteria mentioned in paragraph 2 are met. The Commission shall inform the other Member States.

Within six months of the date on which it receives the information from the Member State, the Commission shall examine the measures envisaged and, in accordance with the procedure set out in Article 9, take a decision which it shall communicate to the Member States. This decision shall be reviewed every eight years on the basis of information to be provided to the Commission by the Member States concerned in accordance with the procedure set out in Article 9.

Article 4

Maximum sulphur content in gas oil

1. Member States shall take all necessary steps to ensure that gas oils, including marine gas oils, are not used within their territory as from:

— 1 July 2000 if their sulphur content exceeds 0,20 % by mass,

— 1 January 2008 if their sulphur content exceeds 0,10 % by mass.

2. By way of derogation from paragraph 1, Spain, for the Canary Islands, France, for the French Overseas Departments, Greece, for the whole or part of its territory, and Portugal, for the archipelagoes of Madeira and Azores may authorise the use of gas oils for marine use with a sulphur content in excess of the limits set out in paragraph 1.

(¹) OJ L 229, 30.8.1980, p. 30. Directive as last amended by Directive 91/692/EEC (OJ L 377, 31.12.1991, p. 48).

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3. Provided that the air quality standards for sulphur dioxide laid down in Directive 80/779/EEC or in any Community legislation which repeals and replaces these standards and other relevant Community provisions are respected and the emissions do not contribute to critical loads being exceeded in any Member State, a Member State may authorise gas oil with a sulphur content between 0,10 and 0,20 % by mass to be used in part or the whole of its territory. Such authorisation shall apply only while emissions from a Member State do not contribute to critical loads being exceeded in any Member State and shall not extend beyond 1 January 2013.

4. If a Member State avails itself of the possibilities referred to in paragraph 3, it shall, at least 12 months beforehand, inform the Commission and the public. The Commission shall be given sufficient information to assess whether the criteria mentioned in paragraph 3 are met. The Commission shall inform the other Member States.

Within six months of the date on which it receives the information from the Member State, the Commission shall examine the measures envisaged and, in accordance with the procedure set out in Article 9, take a decision which it shall communicate to the Member States.

Article 5

Change in the supply of fuels

If, as a result of a sudden change in the supply of crude oil, petroleum products or other hydrocarbons, it becomes difficult for a Member State to apply the limits on the maximum sulphur content referred to in Articles 3 and 4, that Member State shall inform the Commission thereof. The Commission may authorise a higher limit to be applicable within the territory of that Member State for a period not exceeding six months; it shall notify its decision to the Council and the Member States. Any Member State may refer that decision to the Council within one month. The Council, acting by a qualified majority, may adopt a different decision within two months.

Article 6

Sampling and analysis

1. Member States shall take all necessary measures to check by sampling that the sulphur content of fuels used complies with Articles 3 and 4. The sampling shall commence within six months of the date on which the relevant limit for maximum sulphur content in the fuel comes into force. It shall be carried out with sufficient frequency and in such a way that the samples are representative of the fuel examined.

2. The reference method adopted for determining the sulphur content shall be that defined by:

(a) ISO method 8754 (1992) and PrEN ISO 14596 for heavy fuel oil and marine gas oil;

(b) EN method 24260 (1987), ISO 8754 (1992) and PrEN ISO 14596 for gas oil.

The arbitration method will be PrEN ISO 14596. The statistical interpretation of the verification of the sulphur content of the gas oils used shall be carried out in accordance with ISO standard 4259 (1992).

Article 7

Reporting and review

1. On the basis of the results of the sampling and analysis carried out in accordance with Article 6, Member States shall by 30 June of each year supply the Commission with a short report on the sulphur content of the liquid fuels falling within the scope of this Directive and used within their territory during the preceding calendar year. This report shall include a summary of derogations granted pursuant to Article 3(3).

2. On the basis *inter alia* of the annual reports submitted in accordance with paragraph 1 and the observed trends in air quality and acidification, the Commission shall, by 31 December 2006, submit a report to the European Parliament and to the Council. The Commission may submit with its report proposals aimed at revising this Directive and in particular the limit values laid down for each fuel category and the exceptions and derogations provided for in Article 3(2) and (3), and Article 4(2) and (3).

3. The Commission shall consider which measures could be taken to reduce the contribution to acidification of the combustion of marine fuels other than those specified in Article 2(3) and, if appropriate, make a proposal by the end of 2000.

Article 8

Amendments to Directive 93/12/EEC

1. Directive 93/12/EEC is amended as follows:

(a) in Article 1, paragraph 1(a) and paragraph 2 are deleted;

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(b) in Article 2, the first subparagraph of paragraph 2 and paragraph 3 are deleted;

(c) Articles 3 and 4 are deleted.

2. Paragraph 1 shall apply as from 1 July 2000.

Article 9

Advisory Committee

The Commission shall be assisted by a committee of an advisory nature composed of the representatives of the Member States and chaired by the representative of the Commission.

The representative of the Commission shall submit to the committee a draft of the measures to be taken. The committee shall deliver its opinion on the draft, within a time limit which the chairman may lay down according to the urgency of the matter, if necessary by taking a vote.

The opinion shall be recorded in the minutes; in addition, each Member State shall have the right to ask to have its position recorded in the minutes.

The Commission shall take the utmost account of the opinion delivered by the committee. It shall inform the committee of the manner in which its opinion has been taken into account.

Article 10

Transposition

Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 1 July 2000. They shall immediately inform the Commission thereof.

When Member States adopt these provisions, these shall contain a reference to this Directive or shall be accompanied by such reference at the time of their official publication. The procedure for such reference shall be adopted by Member States.

Member States shall communicate to the Commission the text of the provisions of national law which they adopt in the field covered by this Directive.

Article 11

Penalties

Member States shall determine the penalties applicable to breaches of the national provisions adopted pursuant to this Directive. The penalties determined must be effective, proportionate and dissuasive.

Article 12

Entry into force

This Directive shall enter into force on the day of its publication in the *Official Journal of the European Communities*.

Article 13

Addressees

This Directive is addressed to the Member States.

Done at Luxembourg, 26 April 1999.

For the Council

The President

J. FISCHER

ULTRA LOW SULFUR HEATING OIL ASSESSMENT

Hart Energy Consulting
1616 S. Voss, suite 1000
Houston, Texas 77057, USA

Terry Higgins, Director, Refining and Special Projects
thiggins@hartenergy.com
+1 703-891-4815 (fax) +1 703-891-4880

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ULTRA LOW SULFUR HEATING OIL ASSESSMENT

I. Executive Summary

There have been a number of initiatives aimed at reducing the sulfur content of heating oil in the U.S. Northeast market. The Mid-Atlantic/Northeast Visibility Union (Mane-VU) has developed a position calling for 500 ppm sulfur for the inner zone States by 2012, reducing to 15 ppm by 2016. For the outer zone states, the position calls for 500 ppm in 2014 and 15 ppm in 2018. New Jersey has proposed regulations calling for 500 ppm heating oil in 2014 dropping to 15 ppm in 2016.

More recent legislative initiatives in New York and New Jersey call for a reduction in heating oil sulfur content to 15 ppm as early as 2011. The objective of this project and report is to provide an assessment of the impact on supply capability and prices of a 15 ppm heating oil requirement in New York and New Jersey in 2011.

A. Summary of Results

- Middle distillate will be the highest growth product globally. The global shift to distillate and specifically to lower sulfur distillates will place pressure on refining supply and yield capability and market price differentials.
- U.S. East Coast and Gulf Coast refineries supply close to 80% of the New York and New Jersey heating oil market and a similar share of the total PADD 1 market. Canada and Virgin Islands provide most of the remainder.
- Other traditional marginal heating oil suppliers to the East Coast (Russia and Venezuela) have left the market with the implementation of Federal low sulfur non-road diesel. These sources would not be able to produce a 15 ppm sulfur product.
- NJ and NY together represent 34% of the East Coast heating oil market.
- Ultra low sulfur diesel requirements (<15 ppm) in North American and European markets will increase significantly by 2011 (1.3 million barrels per day of demand - 21% increase). Ultra low sulfur distillate will represent close to 70% of total distillate demand in these markets, without any requirements for 15 ppm sulfur heating oil.
- The North American and European ultra low sulfur distillate markets will expand further through 2015, with ultra low sulfur demand increasing to 72% of the market.
- The U.S. market will be faced with additional requirements for 15 ppm diesel between now and 2012 as part of EPA's on-road and non-road diesel regulations.
- Low sulfur international marine bunker fuel requirements will place additional strain of the East Coast distillate market in 2015.
- U.S. East Coast refineries, which supply about 69% of the New York and New Jersey heating oil market, will not have capability to expand ultra low sulfur distillate production for this market without sufficient lead time for investment in desulfurization facilities.
- Refiners have announced plans to shut down two East Coast refineries with a total crude distillation capacity of 360 thousand barrels per day and distillate desulfurization capacity of 98

thousand barrels per day. The capacity loss will further limit capability of East Coast refiners to supply ultra low sulfur distillate.

- Likewise, Canadian and Virgin Island refineries, which supply about 18% of the New York and New Jersey heating oil market, will not have capability to expand ultra low sulfur distillate production for this market by 2011.
- Shell has announced plans to shut down its Montreal refinery with a crude distillation capacity of 121 thousand barrels per day and distillate desulfurization capacity of 40 thousand barrels per day.
- No significant ultra low sulfur supply capability is available from other import sources.
- The Gulf Coast refineries, which supply about 10% of the New York and New Jersey heating oil market, will likely have some capability to supply additional ultra low sulfur product. In view of expanding ultra low sulfur distillate requirements for the scheduled EPA on-road and non-road diesel regulations, their capability will fall well short of that required to cover the new requirements for the New York and New Jersey heating oil market.
- To the extent that Gulf Coast refiners can produce additional ultra low sulfur distillate beyond scheduled requirements, there are logistic constraints. Limited pipeline capability exists to expand heating oil shipments from Gulf Coast refineries to the New York and New Jersey market. Water shipments require Jones Act vessels, adding to the logistic constraints as well as transportation costs.
- Production of ultra low sulfur heating oil will cost 5 to 9 cents per gallon above high sulfur diesel.
- Given the tight market outlook, higher market premiums, 20 to 30 cents per gallon, are expected to prevail if heating oil sulfur is significantly reduced, until additional desulfurization capacity can be brought on line.
- With ultra low sulfur heating oil requirements, the market will have limited capability to respond to a cold weather surge in demand. A spike in demand would result in highly volatile markets with heating oil premiums reflecting market shortage conditions: 30 to 60 cents per gallon.

II. Current and Projected Future Distillate Markets

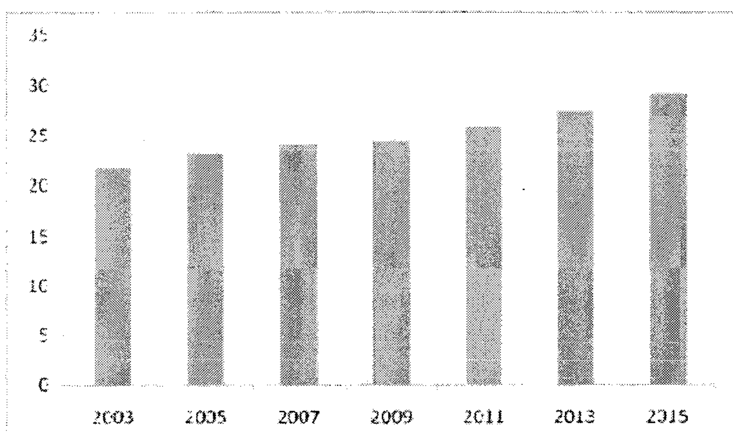
A. Global Distillate Market

The global distillate market is made up of transportation diesel fuels (on-road and non-road) and heating oil. On-road diesel represents 56% of the market and traditionally has been subject to more stringent sulfur content standards than other distillates. Other transportation diesel represents 16% of the market with the remaining 28% made up of heating oil. Future sulfur reduction initiatives will focus on the other transportation fuels and then eventually on heating oil.

Distillate has been the highest growth petroleum product category in the recent past and is expected to be so during the next decade. Global distillate demand grew at a rate of 2.9% annually between 2003 and 2008. Demand declined during 2009 as a result of the global recession. Distillate demand is very sensitive to economic growth and is expected to rebound strongly with economic turnaround.

Between 2009 and 2015 distillate demand is projected to increase by 2.9% annually (Figure II.1). Demand will largely be driven by high growth in developing countries such as China (5.8% annual growth in distillate demand, India (4.5% growth) and the Middle East (4.5% growth). In the Americas, Brazilian distillate demand will grow by nearly 3% annually while their on-road diesel will increase 4.8% per year. A rebound in the economy will return the U.S. diesel market to strong growth (over 2.2% per year) as well.

Figure II.1: Global Distillate Demand
Million Barrels per Day

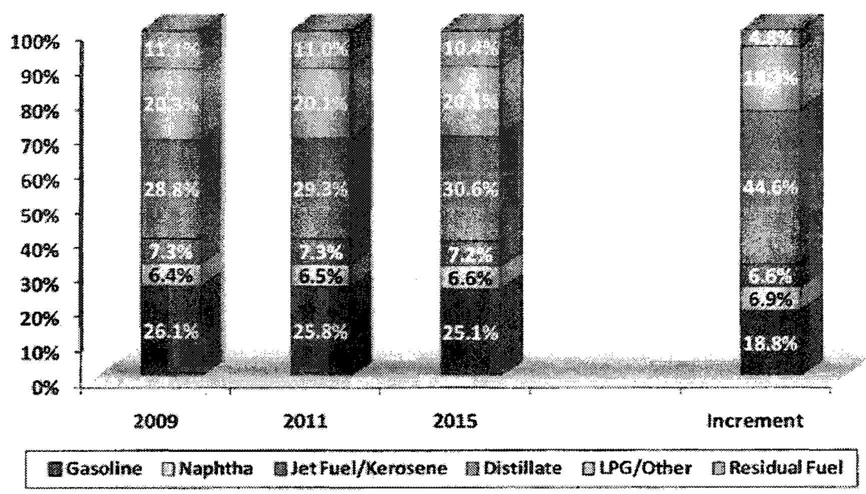


Source: Hart Energy Consulting

Distillate will continue to be the highest growth petroleum product category and, as such, will be the primary driver of markets, refining requirements and price/margins. Figure II.2 illustrates the predominant role of distillate in the future and current market. The three bars on the left show refined products' share of the market between 2009 and 2015. The right bar shows the market shares of incremental product in the market. The distillate market share will grow from 28.8% in 2009 to 30.6% in 2015. In terms of incremental product, distillate will account for almost 45% of petroleum product needs over the period.

In addition to the strong growth in demand, distillate fuel quality requirements will continue to have impacts on the future distillate market: supply, demand and pricing. The major industrialized countries are in the final phases of implementing ultra low sulfur standards for on-road diesel fuel and are following with an extension of the standards to non-road diesel. Other regions of the world are also initiating low sulfur programs, progressing along varying schedules.

Figure II.2: Global Refined Product Market Share



Source: Hart Energy Consulting

Table II.1 summarizes global distillate demand by product sulfur content for 2009, 2011 and 2015. Global distillate demand will increase by 1.4 million barrels per day by 2011 and 4.7 million barrels per day by 2015. There will also be a large shift to ultra low sulfur product. The demand for ultra low sulfur (15 ppm and lower) will increase 1.5 million barrels per day between 2009 and 2011 and an additional 2.2 million barrels per day between 2011 and 2015 (20% and 25% increase in demand 2009 to 2011 and 2011 to 2015, respectively).

Table II.1: Global Distillate Demand by Sulfur Content: 2009, 2011, 2015
Million Barrels per Day

Distillate Demand	2009	2011	2015
<15 ppm	7.42	8.88	11.09
>15 to <50 ppm	0.34	0.45	1.75
>50 to <500 ppm[1]	3.74	4.08	5.41
>500 ppm	12.92	12.43	10.85
Total Distillate	24.42	25.84	29.10
[1] *Majority is 500 ppm grade with some 350 ppm*			

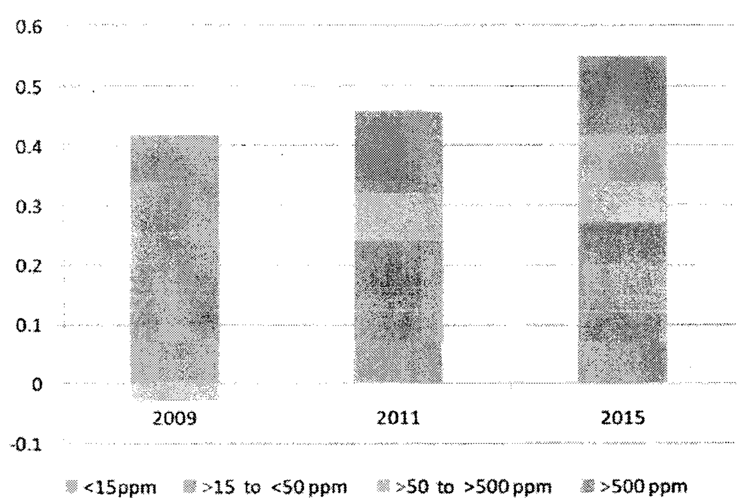
Source: Hart Energy Consulting

Global trade in distillate product primarily involves shipments within the Atlantic Basin: product to the European market and North America-Latin America trade. Europe is a large importer of distillate (13% of supply is imported) from CIS, Middle East and recently some from North America. North America is a net exporter of distillate to Latin America, with some product imported to the East Coast and the Gulf Coast exporting product.

The European/North American markets make up a majority of the global demand for ultra low sulfur distillate. Their demand for ultra low sulfur diesel will increase 1.3 million barrels per day or 21% between 2009 and 2011, as a result of growing on-road diesel demand and scheduled non-road ultra low sulfur requirements. Combined, these markets are short of distillate (net of European imports and North American exports) and the shortfall is projected to grow over time. Europe's distillate deficit will expand as the transportation market continues to shift to passenger diesels.

Figure II.3 shows the market shortfall (net import requirement) for the combined European and North American market with a breakdown by product sulfur content. The import requirement will increase by 0.16 million barrels per day, or 40% between 2009 and 2015. The projections also show an increasing shortfall (import requirement) of ultra low sulfur distillate. Imports of 15 ppm sulfur and lower diesel will increase by more than 40% between 2009 and 2011 and an additional 40% through 2015.

Figure II.3: Europe/North America Distillate Shortfall (Net Import Requirement)
Million Barrels per Day



Source: Hart Energy Consulting

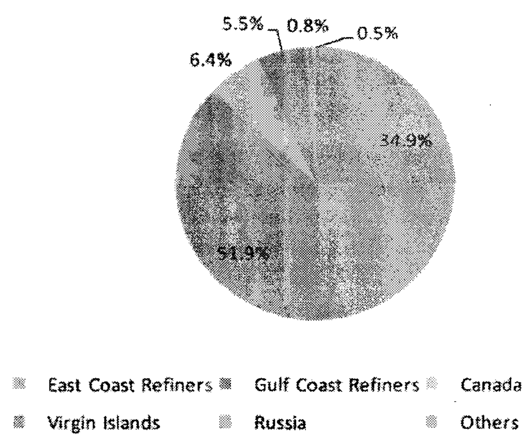
Summary

- Distillate will be the largest growth petroleum product market.
- Distillate product will be the primary petroleum market driver.
- Low sulfur distillate requirements will expand aggressively from 2009 to 2011, and 2011 to 2015.
- The Atlantic Basin market will become increasingly reliant on other global regions for distillate product and as well specifically for ultra low sulfur product.

B. U.S. East Coast (PADD 1) Distillate Market

Figure II.4 shows the breakdown of PADD 1 distillate and heating oil by supply source. Table II.2 provides a summary of distillate supply in PADD 1 with a breakdown diesel fuel and heating oil by sulfur content. Table II.2 balances are based on average supply and demand over the past three years and current distillate sulfur requirements.

Figure II.4: PADD 1 Distillate Supply Sources



Source: Energy Information Administration and Hart Energy Consulting

About 35% of PADD 1 distillate and 40% of heating oil is supplied by U.S. East Coast refineries. U.S. Gulf Coast refineries provide 52% of distillate and 44% of heating oil. The Virgin Islands and Eastern Canada refineries make up 12% of distillate and heating oil.

Other imports contribute little to PADD 1 distillate or heating oil supply. There is a small net export of total distillate product. For heating oil, the imports other than those from Canada and Virgin Islands account for 4% of PADD 1 supply.

About 57% of the PADD 1 distillate market is ultra low sulfur (<15 ppm sulfur) and 10% is 500 ppm grade. The remainder (largely made up of the heating oil portion) is high sulfur, above 500 ppm.

The heating oil market is seasonal versus a relatively constant market for other diesel fuel. During the peak winter season, peak demand is met from inventory draw and increased volume from East and Gulf coast refineries and imports. The graphs in the appendix to this section show the patterns of supply over the year. On average the source of peak supply for the region is:

- 30%-50% Inventory draw
- 30%-40% Gulf Coast refineries
- 10%-15% East Coast refineries
- 10%-15% Imports.

In the past (pre 2007) heating oil imports provided most of the incremental supply during periods of peak demand. A large portion of this was from Venezuela and Russia, which do not have low sulfur distillate production capability and are not likely to for some time. When portions of the PADD 1 market converted to low sulfur, these supply sources were displaced. In the event of a surge in heating oil demand, Venezuela and Russia could probably supply additional high sulfur heating oil. However, if low sulfur supplies were required, Venezuela and Russia would not be capable of supplying the market. This is generally true for most other world spot market suppliers in the near term as well.

Table II.2: PADD 1 Distillate Supply
Thousand Barrels per Day

	<15	15-500	500+	Total
On Road Diesel				
East Coast Refiners	234	5	0	239
Gulf Coast Refiners	348	6	0	354
Canada	66	0	0	66
Virgin Islands	35	0	0	35
Venezuela	0	0	0	0
Russia	0	0	0	0
Other Imports	2	0	0	2
Total	686	11	0	697
Other Diesel				
East Coast Refiners	11	35	8	54
Gulf Coast Refiners	16	116	8	140
Canada	5	-5	0	0
Virgin Islands	3	4	0	6
Venezuela	0	0	0	1
Russia	0	0	0	0
Other Imports	0	-34	0	-34
Total	35	116	16	167
Heating Oil				
East Coast Refiners	0	0	157	157
Gulf Coast Refiners	0	0	174	174
Canada	0	0	18	18
Virgin Islands	0	0	30	30
Venezuela	0	0	5	5
Russia	0	0	10	10
Other Imports	0	0	3	3
Total	0	0	397	397
Total				
East Coast Refiners	245	40	165	450
Gulf Coast Refiners	364	122	182	668
Canada	70	-5	18	83
Virgin Islands	38	4	30	71
Venezuela	1	0	5	6
Russia	0	0	10	10
Other Imports	3	-34	3	-28
Total	721	127	413	1261

Source: Energy Information Administration and Hart Energy Consulting

Summary

- U.S. East Coast and Gulf Coast supply close to 87% of total distillate supply and 84% of heating oil supply for PADD 1.
- Canada and Virgin Islands provide most of the remainder.
- Beyond inventory supply, U.S. refiners provide 40% to 55% of incremental heating oil supply during peak winter season demand.
- Imports (predominantly from Canada and Virgin Islands) make up the remaining peak demand requirements.
- Traditional marginal heating oil suppliers (Venezuela and Russia) no longer provide significant quantities of heating oil to the market and are not able to make up incremental needs for low sulfur product.

B. New York and New Jersey Market Distillate Market

New York and New Jersey represent 23% of the total PADD 1 distillate market and about 34% of the heating oil market. The total heating oil market represents about 134 thousand barrels per day.

Table II.3 provides an estimate of distillate supply to the New Jersey and New York markets with a breakdown diesel fuel and heating oil by sulfur content. U.S. refineries supply 82% of NY/NJ distillate and 79% of the heating oil. Although data is not available on the allocation between East Coast and Gulf Coast refineries, it is estimated that East Coast refiners supply 69% and Gulf Coast refiners 10% of the heating oil market. The Virgin Islands provides 16% of the market and Canada 2%.

The demand for ultra low sulfur (<15 ppm) diesel represents 48% of total distillate supply and high sulfur heating oil demand makes up 47% of the total distillate market. Implementing an ultra low sulfur requirement on heating oil in these markets would nearly double the requirement for ultra low sulfur product and requiring over 93% of the NY/NJ distillate market be supplied with ultra low sulfur product.

Summary

- New York and New Jersey represent 34% of the East Coast heating oil market.
- Nearly 82% of the New York and New Jersey distillate market is supplied by U.S. refiners: 67% by East Coast refiners and 15% from Gulf Coast refiners.
- The demand for ultra low sulfur (<15 ppm) diesel in the New York and New Jersey markets represents 48% of total distillate supply and high sulfur heating oil demand makes up 47% of the total distillate market.
- Implementing an ultra low sulfur requirement on heating oil in the New York/New Jersey market would double the requirement for ultra low sulfur product. Nearly 93% of the distillate market would require <15 ppm product.

Table II.3: New York and New Jersey Distillate Supply
Thousand Barrels per Day

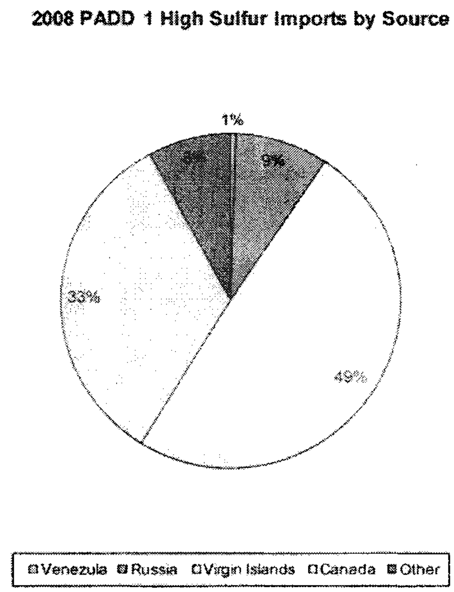
	<15	15-500	500+	Total
On Road Diesel				
East Coast Refiners	89	2	0	91
Gulf Coast Refiners	22	0	0	22
Canada	8	0	0	8
Virgin Islands	10	0	0	10
Venezuela	0	0	0	0
Russia	0	0	0	0
Other Imports	2	0	0	2
Total	131	2	0	133
Other Diesel				
East Coast Refiners	4	6	2	12
Gulf Coast Refiners	2	2	2	6
Canada	0	0	0	0
Virgin Islands	0	1	0	1
Venezuela	0	0	0	0
Russia	0	0	0	0
Other Imports	0	2	0	2
Total	6	11	4	21
Heating Oil				
East Coast Refiners	0	0	92	92
Gulf Coast Refiners	0	0	14	14
Canada	0	0	3	3
Virgin Islands	0	0	21	21
Venezuela	0	0	1	1
Russia	0	0	2	2
Other Imports	0	0	1	1
Total	0	0	134	134
Total				
East Coast Refiners	93	7	94	194
Gulf Coast Refiners	23	2	16	42
Canada	8	0	3	11
Virgin Islands	10	1	21	32
Venezuela	0	0	1	1
Russia	0	0	2	2
Other Imports	2	2	1	5
Total	137	13	138	288

Source: Energy Information Administration and Hart Energy Consulting

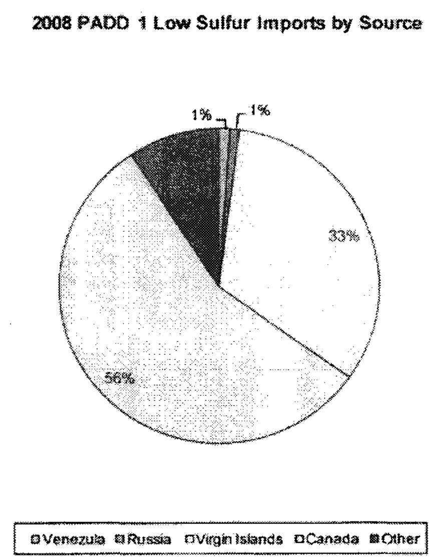
C. Section II Appendix

Little heating oil or diesel is supplied form imports other than Canada and Virgin Islands.

Figure II.5: PADD 1 Distillate Imports by Source

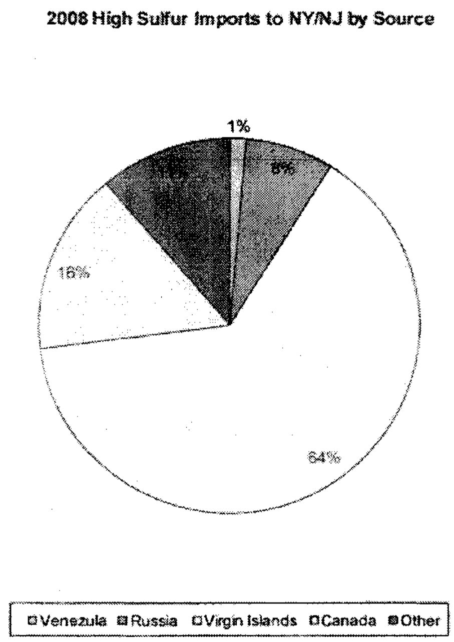


Source: Energy Information Administration

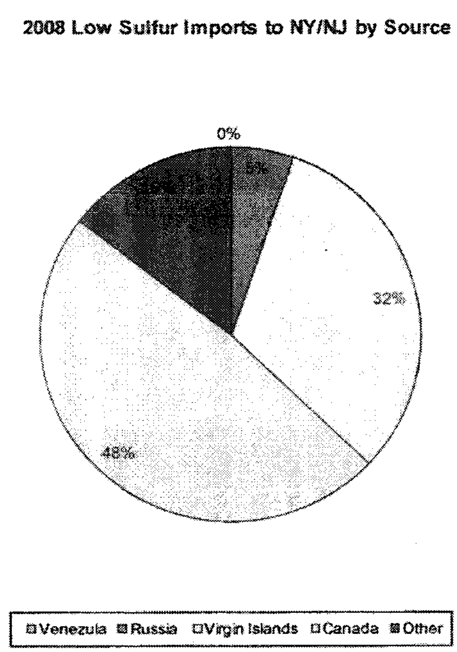


Source: Energy Information Administration

Figure II.6: NY/NJ Distillate Imports by Source



Source: Energy Information Administration



Source: Energy Information Administration

Imports have played a decreasing role in the NY/NJ market coinciding with reductions in the high sulfur off-road distillate market. Peak seasonal winter supplies from imports have declined significantly.

Table II.4: NY/NJ Annual/ Seasonal Heating Oil Import Trends: 2006-08

2006	Winter Months 000 Barrels	Summer Months 000 Barrels	Difference 000 Barrels	Difference 000 Barrels/Day
Venezula	9,140	6,993	2,147	11.8
Virgin Islands	8,895	8,091	804	4.4
Canada	7,126	4,552	2,574	14.1
Russia	4,825	1,536	3,289	18.1
Other	4,947	2,242	2,705	14.9
PADD 1 Total	**34,933**	**23,414**	**11,519**	**63.3**
2007				
Venezula	2,118	1,940	178	1.0
Virgin Islands	9,896	5,312	4,584	25.2
Canada	4,397	3,052	1,345	7.4
Russia	2,289	3,377	-1,088	-6.0
Other	1,032	2,083	-1,051	-5.8
PADD 1 Total	**19,732**	**15,764**	**3,968**	**21.8**
2008				
Venezula	97	0	97	0.5
Virgin Islands	5,659	4,732	927	5.1
Canada	3,948	3,038	910	5.0
Russia	1,346	527	819	4.5
Other	1,328	350	978	5.4
PADD 1 Total	**12,378**	**8,647**	**3,731**	**20.5**

Source: Energy Information Administration

III. Assessment of Ultra Low Sulfur Supply Capability

A. Ultra Low Sulfur Distillate Requirements

On-road ultra low sulfur diesel regulations in the U.S. are in the final stages of implementation. Currently 80% of on-road diesel production must be below 15 ppm sulfur and the remainder below 500 ppm. (Because of logistics and other market limitations, it is estimated that over 90% of on-road diesel currently meets the 15 ppm standard). In 2010, the requirement will expand to cover 100% of on-road diesel. Table III.1 shows the schedule for implementation of on-road and non-road diesel standards in the U.S.

Table III.1: U.S. On-Road and Non-Road Diesel Fuel Standards
Thousand Barrels per Day

Covered Fuel	2006	2007	2008	2009	2010	2011	2012	2013	2014
On-Road Diesel	80% <15 ppm 20% <500 ppm				<15 ppm				
Non-Road Diesel	<500 ppm				<15 ppm				
Locomotive and Marine	<500 ppm						<15 ppm		
Small Refiner Non-Road	High Sulfur				<500 ppm				<15 ppm

Notes:
- In the initial year of a new standard, implementation for refiners/importers begins in June 1 .
- Small refiner exemption schedule not expacted to have significant impact on East Coast market.

Source: U.S. Environmental Protection Agency

Non-road diesel is currently limited to 500 ppm sulfur, but the limit for a majority of the market will drop to 15 ppm in 2010 (June for non-road diesel refinery production and imports, and October for marketing). Rail and marine diesel limits will remain at 500 ppm until 2012.

Most of the European on-road diesel market (all EU members and many of those planning to join the EU) is at 10 ppm sulfur or less. In 2011, Europe will require the non-road diesel market to meet the 10 ppm standard as well. The current limit on heating oil is 1000 ppm although a few countries have initiated programs to introduce a low sulfur grade. Germany has the 1000 heating oil specification but also introduced a 50 ppm grade to reduce sulfur emissions and conform to the introduction of new burner technology. Germany used tax incentives to encourage market penetration of the 50 ppm fuel.

Table III.2 summarizes the North American and European distillate market in terms of sulfur content for 2009, 2011 and 2015. Requirements for ultra low sulfur diesel (15 ppm and less) in the Atlantic Basin market will increase by 1.3 million barrels per day between 2009 and 2011 and another 1.3 million barrels per day from 2011 and 2015. The near term requirements will continue to strain refinery ultra low sulfur production capability. Ultra low sulfur distillate, which represented 59 % of the market in 2009, will grow to 69% of the market by 2011 and 72% by 2015 (Figure III.1).

In addition to ultra low sulfur requirements, The U.S. (jointly with Canada) has recently applied for an Emission Control Area (ECA) designation of its coastal waters under the IMO organization. If approved, the ECA designation will require international vessels operating for up to 200 nautical miles offshore to comply with fuel quality and emission standards established by the IMO. Approval is expected this year. The Marine Environmental Protection Committee approved the proposal in principle in July 2009. If approved as expected in March 2010, the ECA designation would become effective around August of 2012.

The ECA designation would initially limit marine bunker to 10,000 ppm and lower this to 1000 ppm in 2015. The 1000 ppm standard will likely result in a shift from residual to distillate bunker, placing additional strain on the distillate market.

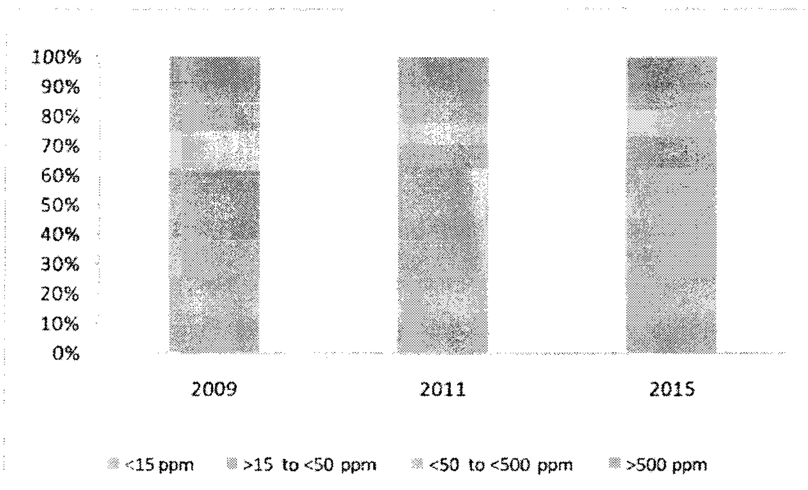
Table III.2: North America and European Distillate Market
Million Barrels per Day

	2009	2011	2015
North America			
<15 ppm	2.30	3.06	3.60
>15 to <50 ppm	0.00	0.00	0.00
<50 to <500 ppm [1]	0.67	0.14	0.21
>500 ppm	1.23	1.16	1.27
Total Distillate	4.20	4.36	5.08
Europe			
<15 ppm	4.04	4.59	5.28
>15 to <50 ppm	0.22	0.13	0.12
<50 to <500 ppm [1]	0.75	0.67	0.84
>500 ppm	1.48	1.28	0.95
Total Distillate	6.49	6.67	7.19
Total			
<15 ppm	6.34	7.65	8.88
>15 to <50 ppm	0.22	0.13	0.12
<50 to <500 ppm	1.42	0.81	1.05
>500 ppm	2.71	2.44	2.22
Total Distillate	10.69	11.03	12.27

[1] Primarily 500 ppm grade with some 350 ppm grade

Source: Hart Energy Consulting

Figure III.1: North America and European Distillate Market Share
Percent



Source: Hart Energy Consulting

Summary

- Ultra low sulfur distillate requirements in North American and European markets will increase significantly by 2011 (1.3 million barrels per day of demand, a (21% increase). Ultra low sulfur distillate will represent 69% of demand in these markets in 2011.
- The near term requirements will continue to strain refinery ultra low sulfur production capability.
- The North American and European ultra low sulfur distillate markets will expand further through 2015, with ultra low sulfur demand increasing to 72% of the market.
- Low sulfur international marine bunker fuel requirements will place additional strain of the East Coast distillate market.

B. Ultra Low Sulfur Distillate Supply

U.S. East Coast refineries supply about 69% of the New York and New Jersey heating oil market and 40% of the U.S. PADD 1 heating oil market. With the current economic downturn these refineries have some spare capacity. However, with the anticipated economic recovery and need to expand ultra low sulfur distillate production for the non-road diesel market, East Coast refineries will not have capacity to produce additional ultra low sulfur distillate for the heating oil market by 2011. Refinery shut downs and lower crude oil throughput to refineries will further limit the ability of East Coast refineries to produce ultra low sulfur heating oil.

A 15 ppm New York-New Jersey heating oil standard would require that over 80% of East Coast refinery distillate production be ultra low sulfur. This is not feasible without time to invest in new refinery desulfurization facilities.

Between 2004 and 2009, East Coast refiners expanded distillate desulfurization capacity by approximately 80 thousand barrels per day in order to meet low sulfur diesel requirements. Refiners also revamped existing capacity to achieve greater sulfur removal. Ultra low sulfur heating oil production in East Coast refineries would require further expansion and construction of new desulfurization, particularly so because a portion of refinery distillate currently blended to heating oil is not desulfurized at all. There are currently no announced desulfurization projects for East Coast refiners that would allow for additional production of lower sulfur distillate.

Refiners have announced shutdown of two East Coast refineries, Sunoco in New Jersey and Valero in Delaware (360 thousand barrels per day of crude processing capacity). The owners state that production will be shifted to their other East Coast refineries. The refineries being shut down have a combined distillate desulfurization of 98 thousand barrels per day. With this lost capacity it will be difficult to maintain current ultra low sulfur production capability and certainly not feasible to expand production.

Other East Coast refiners have announced initiatives to rationalize assets in view of the poor refinery economic climate. Valero has announced that it is considering sale of its New Jersey refinery and ConocoPhillips has announced its intention to sell $10 billion of assets over the next two years.

With sufficient lead time to invest in and modify desulfurization capacity, East Coast refiners could eventually supply additional ultra low sulfur distillate.

Canadian and Virgin Island refineries supply about 18% of the New York and New Jersey heating oil market. Neither of these sources have capability to provide substantial volume of additional ultra low sulfur heating oil by 2011. Shell has announced shut down of its Montreal refinery, 121 thousand barrels per day of crude distillation capacity and 40 thousand barrels per day of distillate desulfurization.

With sufficient lead time to invest in and modify desulfurization capacity, Canadian and Virgin Islands refiners could eventually supply additional ultra low sulfur distillate.

Other foreign refineries provide about 3% of the New York and New Jersey heating oil market. Other foreign sources historically provided a greater share of U.S. heating supply and a large portion of incremental product during peak winter demand periods. However, with the implementation of lower sulfur requirements for non road diesel, these sources have left the market.

Most of the past imports from non-Canadian and Virgin Island refiners came from Russia and Venezuela. Neither of these sources are likely to have, or will likely have in the near future, capability to produce ultra low sulfur distillate for the East Coast market. Russia has plans to expand ultra low sulfur distillate production capability, but any expansion in supply will likely serve the European market.

U.S. Gulf Coast refineries supply about 10% of the New York and New Jersey heating oil market. With the current economic downturn these refineries have some spare capacity, but a major portion of their spare capacity will be absorbed by anticipated economic recovery in the diesel market and need to expand ultra low sulfur distillate production for the non-road diesel market increase and on-road diesel which must be 100% 15 ppm in 2010.

There is refinery expansion activity underway in Gulf Coast refineries that will increase ultra low sulfur distillate production capability. One of the larger projects, Marathon in Louisiana, is in the initial stages of start up and its expansion project is in part focused on ultra low sulfur distillate production. The expansion will add ultra low sulfur distillate supply capability in the Gulf Coast. The output from the Marathon expansion project and other capacity additions in the Gulf Coast will not necessarily provide sufficient capability to meet demand of additional East Coast heating oil demand. North America in aggregate will require nearly 760 thousand barrels per day incremental ultra low sulfur distillate (32% increase) to meet scheduled requirements for on-road and non-road diesel between 2009 and 2011 (Table III.2).

Furthermore, the Gulf Coast is not the major supplier to the New York and New Jersey heating oil market. Some additional ultra low sulfur distillate production capability may be available beyond that required for the new off-non diesel regulations. However, total supply capability is likely to fall well short of the 134 thousand barrels per day New York and New Jersey heating oil market. Ultra low sulfur heating oil requirements for the New York-New Jersey market will represent an 18% increase demand for ultra low sulfur distillate over the planned North American on-road and non-road diesel requirement. Refiners have not planned for this magnitude increase in ultra low sulfur production requirements.

To the extent that Gulf Coast refiners can produce additional ultra low sulfur distillate beyond scheduled requirements, there are logistic constraints. There is limited capability to increase pipeline shipments of heating oil from the Gulf Coast. Water shipments will require Jones Act vessels, further constraining logistics and increasing costs.

Summary

- U.S. East Coast refineries, which supply about 69% of the New York and New Jersey heating oil market, will not have capability to expand ultra low sulfur distillate production for this market.
- Canadian and Virgin Island refineries, which supply about 18% of the New York and New Jersey heating oil market, will not have capability to expand ultra low sulfur distillate production for this market.
- No significant ultra low sulfur supply capability is available from other import sources.
- The Gulf Coast refineries, which supply about 10% of the New York and New Jersey heating oil market, will likely have some capability to supply additional ultra low sulfur product. In view of expanding ultra low sulfur distillate requirements for the scheduled on-road and non-road diesel regulations, their capability will fall well short of that required to cover the new requirements for the New York and New Jersey heating oil market.
- With sufficient lead time to invest in and modify desulfurization capacity, East Coast distillate suppliers could eventually provide the required additional ultra low sulfur distillate to cover a switch to ultra low sulfur heating oil.

IV. Low Sulfur Distillate Cost and Price Implications

A. Desulfurization Cost

Production of low sulfur diesel involves desulfurization of some or all of the refinery components blended into the low sulfur product. The marginal cost of production of the low sulfur diesel equals the desulfurization operating costs (fuel, hydrogen, catalysts, etc), the opportunity cost resulting from small yield shifts from diesel to LPG and the capital charge for desulfurization capacity.

As low sulfur targets are reduced, a greater portion of the refinery blend streams requires desulfurization and the severity of desulfurization must be increased. For example, in the production of 2000 to 3000 ppm U.S. high sulfur diesel and heating oil, approximately 40 to 50 percent of the blend components are desulfurized. For 500 ppm fuel, 80 to 85 percent of the blend streams are desulfurized and for <15 ppm diesel, all the components must be desulfurized. All else being the same, the low sulfur production costs would increase for lower sulfur product according to the portion desulfurized.

Lower sulfur requirements generally also require more severe operation to lower the sulfur content of the desulfurized blend component. Lower sulfur product is achieved through a combination of higher temperature (via fuel), greater hydrogen use, greater catalyst use, larger yield penalties, and higher pressures and larger equipment (higher capital costs). The cost of higher sulfur operations over a range of sulfur targets is not linear. As sulfur is reduced, the marginal cost of removal per unit of sulfur increases. The cost of producing 60 ppm sulfur versus 100 ppm is significantly lower than the cost of a 10 ppm target versus 50 ppm.

Note that a large portion of the operating costs is directly related to energy cost (fuel, hydrogen and yield) and therefore will increase with increasing crude cost.

Desulfurization operating and capital costs are also dependent on the refinery streams being desulfurized. Very high sulfur cracked streams are more difficult and costly to desulfurize to a given target than virgin (typical diesel) feeds. Many of the more difficult to treat refinery streams have historically been blended to heating oil and other higher sulfur products without desulfurization or after mild desulfurization. Therefore, as heating oil and other higher sulfur diesels are added to the low sulfur pool, the desulfurization step can be more difficult and costly.

Capital costs of ultra low sulfur desulfurization will also be influenced by the type of refinery processes, and in particular distillate desulfurization, available. In certain cases ultra low sulfur desulfurization can be achieved by modifying existing equipment (additional reactors, catalyst, hydrogen systems, etc). The cost of a revamp can be significantly lower than new capacity. For the first phase of U.S. diesel regulations, EPA estimated that about 80 percent of desulfurization would involve revamps and the capital costs for the revamps would be about 50 percent of the cost of a new unit.

Table IV.1 provides estimates of the cost of low sulfur distillates of varying sulfur levels. The wide range of costs reflects the possible use of the revamp option for ultra low sulfur production. For the 50 ppm and <15 ppm figures, the low end of the range represents the desulfurization cost for revamping an existing desulfurization unit for more severe operation (not included for 500 ppm).

Table IV.1: Cost of Low Sulfur Distillate
Cents per Gallon

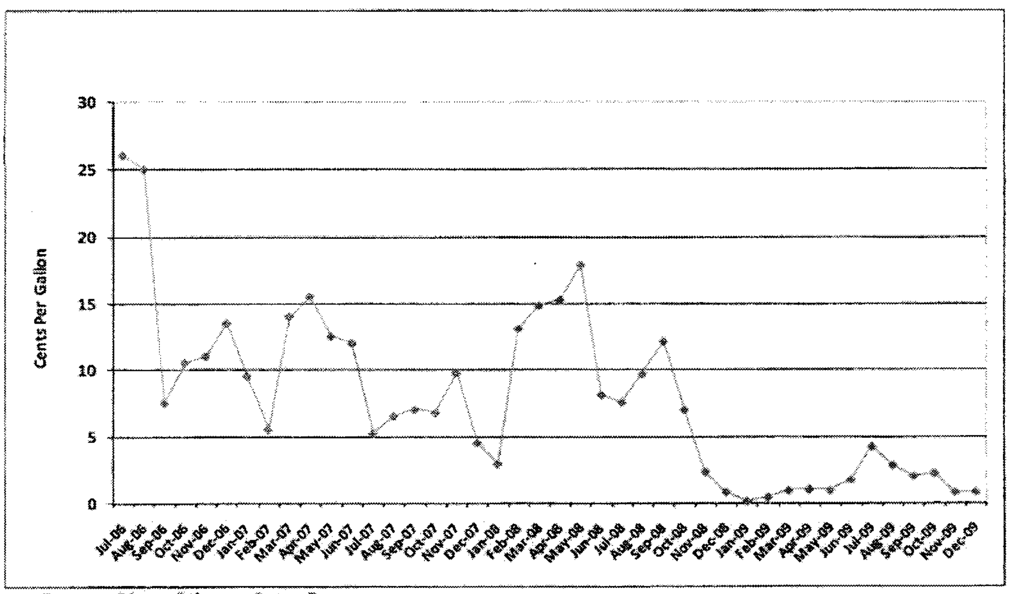
	500 ppm	50 ppm	<15 ppm
Capital Charge	2.2-2.8	1.3-3.0	1.5-3.2
Operating Cost	3.2-4.0	2.5-4.6	3.1-5.7
Total	5.4-6.8	3.8-7.6	4.6-8.9

B. Ultra Low Sulfur Distillate Price Implications

The market price of low versus higher sulfur distillates is a function of the production cost differential and market supply and demand. With adequate desulfurization capacity available, the market differential will tend to reflect the marginal operation cost differential. With a shortage or tightness in desulfurization capacity the market will reflect a premium equal at least to the operating costs plus capital charge. The premium can be greater in a tighter market.

Figure IV.1 provides price differentials for U.S. high sulfur distillate versus ultra low sulfur diesel. During initial implementation of ultra low sulfur diesel, the differentials reflected high premiums, above capital charge premiums. The premiums have since declined closer to operating plus capital charge.

Figure IV.1: NYH ULS Diesel-No2 Distillate Price Differential
Cents per gallon



Source: Platts Oilgram Price Report

Price differentials will continue to reflect a minimum premium of at least capital and operating costs. As long as ultra low sulfur programs are expanding and capital investment is required, the markets will justify full capital charge premiums. Markets are projected to tighten through 2012 as the economy recovers, diesel demand rebounds and the sulfur limit for non-road diesel is lowered. Therefore some volatility in premiums (and high premiums) can be expected.

Adding an ultra low sulfur requirement to New York and New Jersey heating oil in 2011 would severely strain supply capability. The requirement would increase ultra low sulfur demand in the entire PADD 1 market by 19%. The resulting tight market conditions would reflect conditions comparable to the ULSD implementation period with market premiums in the 20 to 30 cents per gallon range. The tight market and premiums would be expected to prevail until additional capacity could be brought on line.

With ultra low sulfur heating oil requirements, the market would not have capability to respond to a cold weather surge in demand. As noted in the previous section, the primary East Coast distillate suppliers have limited or no capability to expand production of ultra low sulfur distillate. No additional supply from imports can be expected. A spike in demand would result in highly volatile markets with heating oil premiums reflecting market shortage conditions.

Figure IV.2 shows gasoline and diesel margins (versus crude oil) from 2005 through 2009. The trends reflect market behavior through some volatile tight market situations. The rise sharp rise in margins in the fall of 2005 reflected shortages related to hurricane Katrina and the gasoline peak in the spring of 2006 corresponded to short term market tightness related to the removal of MTBE from gasoline. Other peaks occurred during periods of high refinery utilization (tight markets) during the summers of 2007 and 2008. The historic tight markets resulted in gasoline or diesel margin increases of 30 to 60 cents per gallon.

Figure IV.2: NYH LS Diesel Margin and Gasoline Margin
Cents per gallon

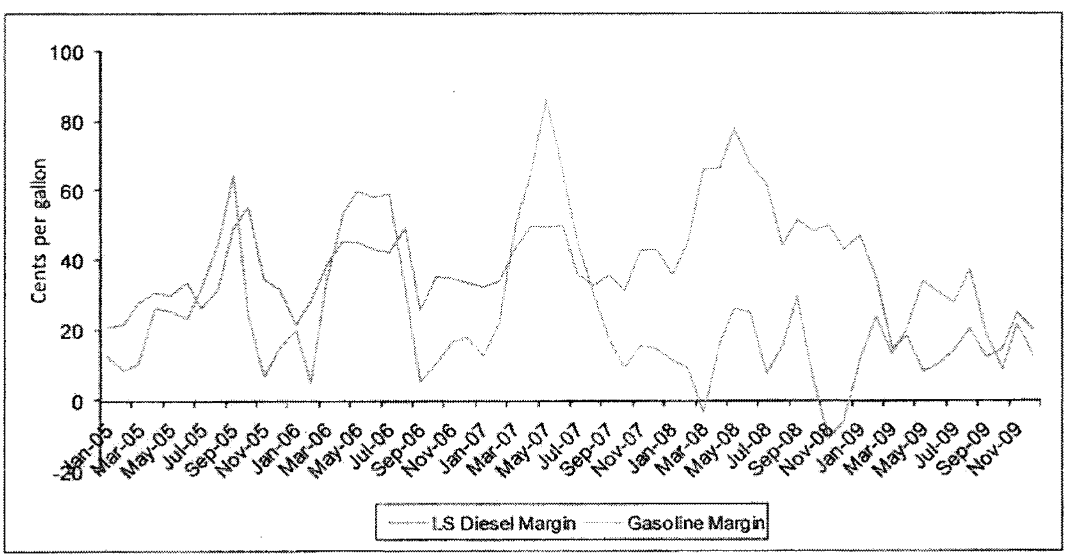
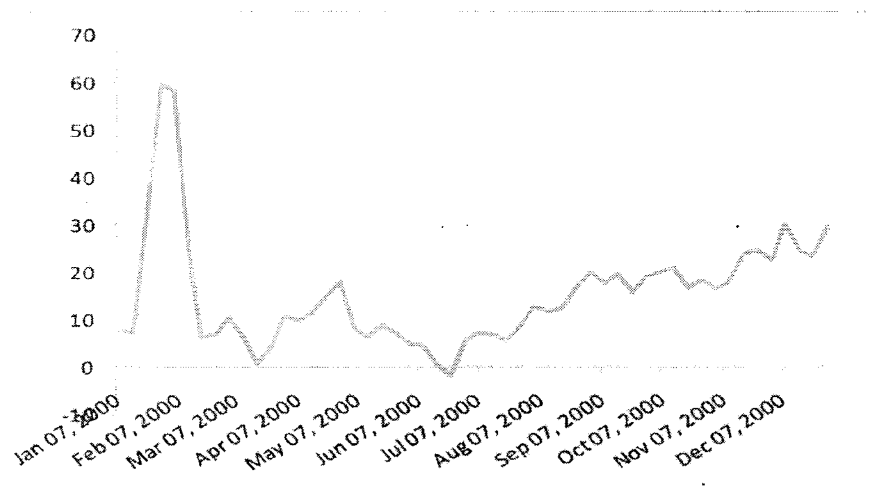


Figure IV.3 provides another example of the market premium responding to a shortage situation. The data show heating oil- crude oil margins for 2000 with margins responding to the winter supply short conditions early in the year. Again, the market responded to the shortage with premiums increasing by about 50 cents per gallon.

Figure IV.3: NYH Heating Oil-Crude (WTI) Margin: 2000
Cents per gallon



With limited sources of ultra low distillate to supply peak requirements, the market would respond to a surge in demand as a significant market shortage. Ultra low sulfur heating oil premiums can be expected comparable to past market performance, 30 to 60 cents per gallon.

Summary

- Production of ultra low sulfur heating oil will cost 5 to 9 cents per gallon above high sulfur diesel.
- Given the tight market outlook, higher market premiums, 20 to 30 cents per gallon, should be expected to prevail until additional desulfurization capacity can be brought on line.
- With ultra low sulfur heating oil requirements for NY and NJ, the market would not have capability to respond to a cold weather surge in demand. A spike in demand will result in highly volatile markets with heating oil premiums reflecting market shortage conditions: 30 to 60 cents per gallon.