MASTER

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Distillate Market Model Documentation Report

INTRODUCTION

Purpose of the Report

The purpose of this report is to define the objectives of the Distillate Market Model (DMM), describe its basic approach, and to provide detail on model functions. This report is intended as a reference document for model analysts, users, and the general public. Documentation of the model is in accordance with EIA's legal obligation to provide adequate documentation in support of its models (Public Law 94-385, Section 57(b)(2)).

Model Summary

The DMM performs a short-term (6- to 9-month) forecast of demand and retail price for distillate fuel oil in the national U.S. market; it also calculates the end-of-month stock level during the term of the forecast. The model is used to analyze certain market behavior assumptions or shocks and to determine the effect on retail market price, demand, and stock level.

Model Archival Citation

The Distillate Market Model (DMM) is archived on IBM-compatible micro-floppy disks and is available through the sponsoring office. The model contact is:

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Report Organization

The remainder of this report is organized in the following manner: (1) model purpose, (2) model rationale, (3) model structure, (4) properties of mathematical solution, (5) calibration and sensitivity analysis, (6) documentation of technical detail on model data and equations, and (7) appendices.

MODEL PURPOSE

Model Objectives

The DMM is to be used for policy analysis and general forecasting purposes and was developed for presentation at the State Heating Oil and Propane Program and the Winter Fuels conferences and also for the annual Distillate Fuel Oil Outlook article published in the Winter Fuels Report and the Petroleum Marketing Monthly. The model addresses very short-term monthly U.S. market responses at the national level. The model focuses on U.S. retail distillate demand and price and assesses market response to alternative scenarios and/or shocks, by providing very short-term (up to 9 months) forecasts of distillate demand, retail price, and end-of-month stock level. The model relies on the Short-Term Energy Outlook (STEO) mid-world oil price case to define a baseline and then uses assumptions on different possible market disturbances to assess market response on a monthly basis; the DMM differs substantially from the STEO because of a partial, rather than general, equilibrium approach to modelling petroleum product markets, because the DMM calculates a stock path rather than using an a priori choice, and because of the exclusive short-run focus of the DMM model. It has been used to forecast the effect of heating degree day and crude price changes on distillate prices and product supplied. The DMM also provides a framework to calculate stock levels from the forecasted demand and price variables.

Model Input/Output

The DMM uses both DOE and non-DOE data input sources. The non-DOE data came from two sources. Data Resources, Inc. (DRI) databases provided values, from the Bureau of Economic Analysis and the Bureau of Labor statistics, for general monthly national macroeconomic variables (including the industrial production index and the producer price index). The National Oceanic and Atmospheric Administration was the source for heating degree day information. The DOE historical data for crude oil prices, refinery variables, distillate demand, stock levels, and retail price came from EIA publications: the Petroleum Marketing Annual/Monthly (various issues) and the Petroleum Supply Annual/Monthly (various issues). All forecasts for future values of the independent variables used in the DMM came from EIA's Short-Term Integrated Forecasting System (Energy Information Administration, 1993).

Output from the DMM includes very short-term monthly forecasts of national demand, retail price, and stock levels of No. 2 distillate fuel oil.

Relationship to Other Models

The DMM interfaces directly with the Short-Term Integrated Forecasting System (STIFS) model by utilizing the mid-world oil price case forecast of distillate demand and retail price as the basis from which market perturbations will be analyzed. The model also takes projected values of No. 2 distillate fuel oil variables exogenously from STIFS: refinery production, field production, and net imports. Additionally, the model directly utilizes forecasts of certain macroeconomic and refinery variables from STIFS as inputs.

MODEL OVERVIEW AND RATIONALE

Fundamental Assumptions

The DMM is to be used to judge the effect of shocks or alternative behavior assumptions on the demand, price, and end-of-month stock level for retail No. 2 distillate fuel oil in the national economy. The theoretical basis for the model is the standard demand-supply approach used to determine the market effects of shifting demand and supply curves on a single product in an isolated market; it implicitly makes the assumption that all economic entities exhibit profit maximizing behavior. The model indirectly allows for feedback effects between price and demand over a monthly time frame. Although the model functions at a monthly frequency, conclusions are normally drawn from the model on a quarterly or semi-annual basis. The DMM uses recent historical market behavior as a pattern for predicting near-term future market responses.

The DMM is concerned with very short-term (i.e., 6- to 9-month) projections into the future. In order to make the analysis more tractable, a number of simplifying assumptions were made concerning the behavior of the distillate market; these include:

- Constant relative size of vehicle fleet using diesel fuel. Additionally, vehicle efficiency is assumed to be constant in the short-run due to the slow replacement of the current truck and automobile fleet.
- The No. 2 distillate fuel oil market is isolated from disturbances to other petroleum product markets. It is assumed that any significant interaction between the distillate market and other product markets (eg., gasoline, jet fuel, residual fuel, and other

petroleum products) would not occur within the timeframe of the forecast.

- Constant level of taxation. Taxes on No. 2 fuel oil and No. 2 diesel fuel have a direct effect on price and an indirect effect on demand. For the time frame of the forecast, it is assumed that any increased taxation will not cause serious market distortions and will be completely passed through to the retail level.
- The relative proportion of homes using No. 2 fuel oil for heating purposes remains constant. Additionally, furnace efficiency is assumed to be constant over the timeframe of the model projections.
- The spot purchases of No. 2 fuel oil by Non-Utility Generators will not distort the retail market. Most new cogeneration plants require Natural Gas as fuel; to reduce construction costs, these plants have minimal storage facilities for storing liquid heating fuels. During a prolonged cold spell, the natural gas service to these facilities may be interrupted, thus requiring a switch to No. 2 distillate as fuel.
- No change in refinery economic conditions. All scenarios were conducted under the assumption that refinery and production conditions do not radically change during the duration of the forecast. Net imports were also assumed to be exogenously determined.

The model makes no provision to distinguish between the types (e.g., diesel, heating fuel) or grade (e.g., low sulfur, high sulfur, dyed, etc.) of No. 2 distillate sold in the retail market.

The DMM allows market players to make pricing decisions based on historical price, demand, and stock patterns. The model assumes that market players make decisions on a monthly basis; although this may be somewhat of a long reference time frame, any analysis utilizing a more rapid decisionmaking process would be hampered by the lack of data availability at higher frequencies.

Alternative Approaches

The DMM is a time series model typical of a form used for the estimation of gasoline demand (see, for example, R. J. Sutherland, 1991). Cross-sectional models of end user purchasing behavior were not considered because of the need to forecast market adjustments to possible shocks for longer than a single time period. The STIFS model was not used because of the desire not to limit the effects of weather on heating oil demand to the Northeast section of the country and also to estimate total distillate demand in a single equation.

Prof. Tim Considine of Pennsylvania State University recently developed a short-term forecasting model for EIA (Task No. 92073, Contract No. DE-AC01-89-EI21003). That model was not used here for several reasons:

- The desire to model the distillate market as an isolated sector of the economy.
- The desire to avoid the problem of nonconvergence that can occur in multi-product models.
- The desire to estimate product supplied (demand) directly, rather than as an identity, in order to check the model's prediction of consumer behavior.
- The desire to focus on retail distillate prices rather than the wholesale prices contained in a production oriented model.

MODEL STRUCTURE

Flow Diagram

DISTILLATE ACTIVITY MARKET MODEL FLOW DIAGRAM

Solution of the DMM proceeds in a straightforward manner. The input variables are used as exogenous and predetermined variables for the independent estimation of demand and price. The model then algebraically calculates the projected stock level and other stock related variables used as inputs. The current period solution is printed and the model proceeds, if necessary, to the estimation for the next period.

List of Computations and Equations

The equation used by the model for the estimation of price is of the form:

PRICE = $\mathcal{F}$ (current and lagged crude price, lag of STOCKDIF, current and lagged heating degree variable, monthly dummy variables).

The actual estimated price equation is:

$$\begin{aligned} \text{PRICE}_t = & \alpha_0 + \alpha_{12} * \text{CRUDEPR}_t + \alpha_{13} * \text{CRUDEPR}_{t-1} + \alpha_{14} * \text{STOCKDIF}_{t-1} \\ & + \alpha_{15} * \text{HDDSPSQ}_t + \alpha_{16} * \text{HDDSPSQ}_{t-1} + \sum_{i=1}^{11} \alpha_i * \text{DUMMY}_i \end{aligned}$$

The equation used by the model for the estimation of demand (product supplied) is of the form:

DEMAND = $\mathcal{F}$ (business cycle variable, current and lagged heating degree days, trend, Kuwait war dummy variables, monthly dummy variables).

The actual estimated demand equation is:

$$\begin{aligned} \text{DEMAND}_t = & \beta_0 + \beta_{12} * \text{IPIDIF}_t + \beta_{13} * \text{HDD}_t + \beta_{14} * \text{HDD}_{t-1} + \sum_{i=1}^{11} \beta_i * \text{DUMMY}_i \\ & + \beta_{15} * \text{DOAUG90} + \beta_{16} * \text{DODEC90} + \beta_{17} * \text{TREND}_t \end{aligned}$$

where PRICE is the average No. 2 fuel oil price to residential customers deflated by the Producer Price Index.

 HDD is the mean deviation from normal heating degree days¹.

¹HDD_t = (HDDA_t - HDDN_t) / DAYS, where HDDA_t is the actual population weighted heating degree days for time period t and HDDN_t is the estimated 30 year average (1951 - 1980 basis) for each period.

$$\text{HDDSPSQ} = \begin{cases} \text{HDD}^2 & \text{if HDD} \geq 0 \\ 0 & \text{if HDD} < 0 \end{cases}$$

CRUDEPR is the average imported refiners acquisition cost of crude oil deflated by the Producer Price Index.

STOCKDIF is the deviation of the current stock level from the average of the previous 3 years.

TREND is a linear trend line.

DEMAND is the distillate product supplied.

IPIDIF is the deviation from a normalized industrial production index².

DUMMY_i are monthly dummy variables.

D0AUG90 are dummy variables for August, 1990, and December, 1990, respectively.

t is the subscript variable for monthly time series observations.

The inputs to the above equations are exogenous (i.e. STEO estimated) or previously calculated values for the variables. Direct output from these equations consist of 1-month-ahead forecasts of PRICE and DEMAND for total distillate fuel oil. The determination of the 1-month-ahead stock level from the forecasted level of demand is calculated by the following formulas:

$$\text{DELSTOCK}_t = (\text{PRIM_SUP}_t - \text{DEMAND}_t) * \text{DAYS}_t$$

$$\text{STOCK}_t = \text{STOCK}_{t-1} + \text{DELSTOCK}_t$$

$$\text{STOCKDIF}_t = \text{STOCK}_t - \text{STOCKAVG}_t$$

where PRIM_SUP is the sum of refinery output and net imports of distillate fuel oil (from STEO).

DAYS is the number of days in month t.

STOCKAVG is $(\text{STOCK}_{t-12} + \text{STOCK}_{t-24} + \text{STOCK}_{t-36}) / 3$

STOCK is the end-of-month stock level for total No. 2 distillate.

²IPIDIF_t = IPI_t - IPIN_t, where IPIN_t is the detrended industrial production index for the January, 1986, through December, 1994, time frame.

PROPERTIES OF MATHEMATICAL SOLUTION

Theoretical Considerations

The model is a standard demand-supply set of equations with no contemporaneous direct dependence between the demand and price equations. Any possible problem of simultaneous equations bias was addressed by formulating the model as a set of recursive equations with unidirectional indirect dependency among the dependent variables. The first endogenous variable, viz. demand, is determined only by exogenous variables; the second endogenous variable, viz. price, is determined by exogenous and predetermined variables. There is indirect feedback from the demand equation to the price equation through the lagged stock variable; the lack of a direct feedback from demand to price implies that a disturbance to the demand equation does not affect the price equation. Thus there is no contemporaneous correlation between the demand equation and price, so that Ordinary Least Square (OLS) estimate is unbiased (P. Kennedy, 1985).

Certain a priori restrictions were placed on the domain of a number of variables. These include:

- The lag-one autocorrelation parameter of the model has a domain between -1 and +1;
- The elasticity of demand is between 0 and -1; the elasticity of supply is greater than zero;
- The price, demand and stock level are finite and greater than zero.

Subject Matter Considerations

The original purpose of the DMM was to model the retail No. 2 fuel oil market at the national level. Data limitations required expanding the focus so as to include the market for total No. 2 distillate (i.e., heating fuel oil plus diesel fuel). The DMM assumes that market reactions are based on recent historical patterns and that any behavioral effects due to increased market segmentation as a result of the introduction of low sulfur and low aromatic diesel fuels will be incremental. While the annual incorporation of current data with historical trends may affect the DMM's responsiveness, minor structural changes in the market can be accommodated with modifications to the equations. The domain of the input variables is assumed to be that of the recent historical time series for the individual variables. Preliminary studies at the Petroleum Marketing Division have shown that equations with similar structure can also be used to describe the market functions within certain Petroleum Administration for Defense (PAD) Districts.

CALIBRATION AND SENSITIVITY ANALYSIS

Results of Calibration

Calibration of the model was performed using a comparison of the forecasts for demand, retail price and end-of-month stock level obtained by the DMM with those obtained by STIFS (third quarter, 1993 STEO) for the period June, 1993, through March, 1994. The following three tables illustrate the comparison values. It should be noted that the DMM end-of-month stock values for the first 2 months (i.e., June and July) reported in the tables were estimated from actual data³.

NO. 2 DISTILLATE OUTLOOK: DEMAND
Comparison of STEO and DMM Forecasts

DATE	STEO (MMbbl/d)	DMM (MMbbl/d)
Jun-93	2836	2855
Jul-93	2700	2717
Aug-93	2864	2812
Sep-93	2922	2885
Oct-93	3134	3103
Nov-93	3165	3119
Dec-93	3445	3466
Jan-94	3606	3523
Feb-94	3590	3534
Mar-94	3585	3461

³The tabulated values were estimated from a linear interpolation of weekly data published in the Weekly Petroleum Status Report, DOE/EIA-0208, various issues.

NO. 2 DISTILLATE OUTLOOK: STOCKS
Comparison of STEO and DMM Forecasts

DATE	STEO (MMbbl)	DMM (MMbbl)
Jun-93	106.2	109.1
Jul-93	117.1	120.4
Aug-93	121.6	126.5
Sep-93	127.5	133.5
Oct-93	130.5	137.4
Nov-93	137.0	145.3
Dec-93	136.5	144.1
Jan-94	130.0	140.2
Feb-94	117.0	128.7
Mar-94	101.7	117.3

NO. 2 DISTILLATE OUTLOOK: RETAIL PRICE
Comparison of STEO and DMM Forecasts

DATE	STEO (cents/gal)	DMM (cents/gal)
Jun-93	90.2	88.2
Jul-93	88.4	85.9
Aug-93	88.1	86.1
Sep-93	89.6	88.0
Oct-93	93.5	90.9
Nov-93	96.3	93.7
Dec-93	99.7	96.5
Jan-94	100.1	97.6
Feb-94	98.6	95.9
Mar-94	97.2	94.9

Another calibration was done by using the DMM to perform a dynamic ex post forecast of distillate price and demand for the previous heating season (i.e., 1992Q4 and 1993Q1). The results are shown in the next two tables, along with the actual values and the STIFS projections for the same time period. It can be seen that the accuracy of the DMM values compare favorably to those generated by STIFS.

NO. 2 DISTILLATE EX POST FORECAST: PRICE
Comparison of Model Predictions with Actual Values
(Cents per Gallon)

DATE	SERIES	ACTUAL	DMM	STEO
4th Quarter, 1992	Value	94.4	91.8	94.1
	Deviation from Actual		-2.6	-0.3
1st Quarter, 1993	Value	94.8	94.2	93.9
	Deviation from Actual		-0.6	-0.9

NO. 2 DISTILLATE EX POST FORECAST: DEMAND
Comparison of Model Predictions with Actual Values
(Million Barrels per Day)

DATE	SERIES	ACTUAL	DMM	STEO
4th Quarter, 1992	Value	3.10	3.21	3.26
	Deviation from Actual		+0.11	+0.16
1st Quarter, 1993	Value	3.30	3.44	3.54
	Deviation from Actual		+0.14	+0.21

Model Runs to Test Concordance with Intuition

The DMM underwent two tests to determine its correspondence with intuition and economic theory. This test was performed by increasing the severity of a prolonged cold snap during the heating season and was done in two parts: (1) the Cold Heating Season case, which increases the total mean heating degree days during the October through March season by 10 percent over the normal amount, and (2) the Cold Winter case, which takes the same number of increased mean heating degree days and apportions this amount just over the winter (i.e., January through March) months. Since one of the principal uses of No. 2 fuel oil is for residential and industrial heating, the results of this test should show that during the period of colder temperatures, demand for distillate will increase over and above that in the base case. The increased demand would create a larger demand/supply imbalance, thus putting additional upward pressure on prices, and would also result in larger stock drawdowns. This expected pattern of market behavior emulates that described in the EIA Service Report entitled "An Analysis of Heating Fuel Market Behavior, 1989-90", which provides an ex post analysis of a severe 1-month cold snap.

The following tables show the DMM's behavior under these scenarios and demonstrates the models' concordance with intuition. The model predicts that both the demand and retail price of distillate will rise, beginning in the first month of the beginning of the cold snap.

NO. 2 FUEL OIL SCENARIOS: DEMAND
Impact of Alternative Scenario Assumptions
(Thousand Barrels per Day)

DATE	BASE CASE	COLD HEATING SEASON	COLD WINTER
Aug-93	2812	2812	2812
Sep-93	2885	2885	2885
Oct-93	3103	3142	3103
Nov-93	3119	3206	3119
Dec-93	3466	3599	3466
Jan-94	3523	3679	3754
Feb-94	3534	3679	3777
Mar-94	3461	3572	3648

NO. 2 FUEL OIL SCENARIOS: RETAIL PRICE
Impact of Alternative Scenario Assumptions
(Cents per Gallon)

DATE	BASE CASE	COLD HEATING SEASON	COLD WINTER
Aug-93	86.1	86.1	86.1
Sep-93	88.0	88.0	88.0
Oct-93	90.9	91.1	90.9
Nov-93	93.7	94.6	93.7
Dec-93	96.5	99.0	96.5
Jan-94	97.6	101.8	103.4
Feb-94	95.9	100.5	106.9
Mar-94	94.9	98.7	103.2

NO. 2 FUEL OIL SCENARIOS: STOCK LEVEL
Impact of Alternative Scenario Assumptions
(Millions of Barrels)

DATE	BASE CASE	COLD HEATING SEASON	COLD WINTER
Aug-93	126.5	126.5	126.5
Sep-93	133.5	133.5	133.5
Oct-93	137.4	136.2	137.4
Nov-93	145.3	141.5	145.3
Dec-93	144.1	136.2	144.1
Jan-94	140.2	127.4	133.0
Feb-94	128.7	111.9	114.8
Mar-94	117.3	97.0	97.6

DOCUMENTATION OF TECHNICAL DETAIL ON MODEL DATA AND EQUATIONS

Validation of Input Data

Input variables that the DMM has in common with the STIFS were used with identical values.

Non-DOE Input Sources:

- Data Resources, Inc. (DRI) database, data from Bureau of Economic Analysis and Bureau of Labor Statistics.
 - Macroeconomic production and price index data.
- U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, Data Source DRD 964X.
 - Actual and normal statewide monthly heating degree day values.

DOE Data Input Sources:

Forms and Publications:

- Energy Information Administration, Petroleum Supply Annual, DOE/EIA-0340 and Petroleum Supply Monthly, DOE/EIA-0109, various issues.
 - No. 2 Distillate stocks and product supplied.
- Energy Information Administration, Petroleum Marketing Annual, DOE/EIA-0487 and Petroleum Marketing Monthly, DOE/EIA-0380, various issues.
 - Average imported crude oil refiner's acquisition costs, No.2 fuel oil prices to residential customers.

Models and Other:

● Energy Information Administration, Short-Term Integrated Forecasting System.

- Forecasts of economic and refinery variables.

Validation, Goodness-of-Fit of Equations Providing Parameter Estimates

The next table details the parameter estimates and a number of statistics related to the goodness-of-fit of the equations estimated by the DMM.

REGRESSION RESULTS

Dependent Variable is PRICE

SAMPLE RANGE: 1986.01 - 1993.05

Number of Observations: 89

Convergence achieved after four iterations

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT	Prob> T
C	45.497756	2.9950765	15.1908	0.0000
STOCKDIF(-1)	-6.143E-05	2.725E-05	-2.2549	0.0272
HDDSPSQ	0.1850852	0.0208315	8.8849	0.0000
HDDSPSQ(-1)	0.1831785	0.0219738	8.3362	0.0000
CRUDEPR	1.1098742	0.1524691	7.2793	0.0000
CRUDEPR(-1)	0.6629819	0.1537608	4.3118	0.0001
JAN	8.6722380	1.0102065	8.5846	0.0000
FEB	8.3931833	0.9752726	8.6060	0.0000
MAR	7.8248503	0.9257423	8.4525	0.0000
APR	6.1509881	0.8518563	7.2207	0.0000
MAY	4.0395809	0.7461252	5.4141	0.0000
JUN	1.8900819	0.5575943	3.3897	0.0011
AUG	0.0814093	0.5764404	0.1412	0.8881
SEP	1.4885528	0.7766028	1.9167	0.0593
OCT	2.8447527	0.9052433	3.1425	0.0024
NOV	4.5557712	0.9751640	4.6718	0.0000
DEC	6.9728389	1.0207939	6.8308	0.0000
AR(1)	0.9295744	0.0437259	21.2591	0.0000
R-squared		0.97362	Mean of dependent var	79.6016
Adjusted R-squared		0.96730	Sum of squared resid	157.515
S.E. of regression		1.48947	F-statistic	154.128
Durbin-Watson stat		1.56169	Prob(F-statistic)	0.00000

Dependent Variable is DEMAND
SAMPLE RANGE: 1986.01 - 1993.05
Number of Observations: 89

VARIABLE	COEFFICIENT	STD. ERROR	T-STAT	Prob> T
C	2621.3756	42.624147	61.4998	0.0000
IPIDIF	2697.9939	471.10898	5.7269	0.0000
HDD	45.352706	6.9123506	6.5611	0.0000
HDD(-1)	6.9906104	6.7522263	1.0353	0.3040
TREND	1.1094102	0.4431797	2.5033	0.0146
D0AUG90	418.11904	110.05244	3.7993	0.0003
D0DEC90	-471.86726	111.92963	-4.2157	0.0001
JAN	766.73046	55.002384	13.9399	0.0000
FEB	768.15699	55.555109	13.8269	0.0000
MAR	687.59673	54.156485	12.6965	0.0000
APR	326.27238	53.358360	6.1147	0.0000
MAY	162.69299	52.676103	3.0886	0.0029
JUN	143.59998	54.259416	2.6465	0.0100
AUG	89.529303	56.402450	1.5873	0.1169
SEP	154.61078	54.198330	2.8527	0.0057
OCT	366.06589	54.476738	6.7197	0.0000
NOV	377.16468	54.544196	6.9184	0.0000
DEC	716.88629	56.567173	12.6732	0.0000
R-squared	0.90116	Mean of dependent var		3027.42
Adjusted R-squared	0.87749	Sum of squared resid		289.550
S.E. of regression	101.345	F-statistic		38.0779
Durbin-Watson stat	1.94328	Prob(F-statistic)		0.00000

BIBLIOGRAPHY

- Energy Information Administration, Short-Term Integrated Forecasting System, 1993 Model Documentation Report, DOE/EIA-M041(93), Washington, DC., 1993.
- Energy Information Administration, An Analysis of Heating Fuel Market Behavior in 1989-90, Service Report, SR/OG/90-01, Washington, DC., 1993.
- P. Kennedy, A Guide To Econometrics, 2nd Edition, MIT Press, Cambridge, Massachusetts, 1985.
- R. J. Southerland, "An Analysis of Heating Fuel Prices During the Winter of 1989-90", Energy System and Policy, Vol. 15, pp. 161-180, 1991.

Model Abstract

Model Name: Distillate Market Model

Model Acronym: DMM

Model Description: The DMM performs a short-term (6- to 9-month) forecast of demand and price in the U.S. No. 2 fuel oil market. The model also calculates the end-of-month stock level. The model is used to analyze certain market behavior assumptions or market shocks and to determine their effect on market price, demand and stocks.

Last Model Update: September, 1993.

Part of Another Model: None.

Model Interfaces: None. The DMM uses inputs from STIFS, from which it obtains Economic and Refinery Data.

Sponsor:

- **Office:** Office of Oil and Gas
- **Division:** Petroleum Marketing Division
- **Branch:** Publications and Analysis, EI-432
- **Model Contact:** Charles Dale
- **Telephone:** (202) 586-1805.

Documentation: Energy Information Administration, Model Documentation of the Distillate Activity Market Model, DOE/EIA-M056, (Washington, DC, September, 1993).

Archive Media and Installation Guides: Archived on floppy disks, with internal documentation. Available from sponsoring office. Archive packages describing the use of the model in published applications may be obtained from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

Purpose: The Distillate Market Model was developed to provide support for the annual "Distillate Outlook" article published in the Winter Fuels Report and the Petroleum Marketing Monthly. The DMM assesses the market response to alternative market scenarios and/or shocks. The model relies on the STIFS mid-world oil price case for values of economic and refinery behavior variables to define a base-line and then uses assumptions on different possible market disturbances to assess their effects on a monthly basis. The DMM provides a framework to calculate stock levels from the estimated demand and price variables.

Energy System Described by Model: No. 2 distillate demand, retail prices and end-of-month stock levels.

Coverage:

- **Geographic:** National
- **Time Unit/Frequency:** Monthly
- **Products:** No. 2 Distillate Fuel Oil
- **Economic Sector:** Retail No. 2 Distillate Market.

Modeling Features:

- **Model Structure:** Multi-equation model
- **Modeling Technique:** Ordinary least squares, with correction for autocorrelation
- **Special Features:** None.

Non-DOE Input Sources:

- Data Resources, Inc. (DRI) database, data from Bureau of Economic Analysis and Bureau of Labor Statistics
 - Macroeconomic production, and price index variables
- U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, Data Source DRD 964X
 - Actual and normal statewide monthly heating degree day values.

DOE Data Input Sources:

Forms and Publications:

- Energy Information Administration, Petroleum Supply Annual, DOE/EIA-0340 and Petroleum Supply Monthly, DOE/EIA-0109
 - No. 2 distillate stocks and product supplied
- Energy Information Administration, Petroleum Marketing Annual, DOE/EIA-0487 and Petroleum Marketing Monthly, DOE/EIA-0380
 - Average imported crude oil refiner's acquisition costs, residential No. 2 fuel oil prices.

Models and Other:

- Energy Information Administration, Short-Term Integrated Forecasting System
 - Forecasts of economic and refinery variables.

General Output Descriptions: DMM is used to generate very short-term (up to 9 months), monthly forecasts of U.S. demand, price and stock levels of retail No. 2 distillate.

Computing Environment:

- **Hardware Used:** IBM-compatible personal computer
- **Operating System:** MS DOS
- **Software Used:** Micro-TSP, Version 7.01 or higher
- **Memory Requirements:** 640K
- **Storage Requirements:** 640K
- **Estimated Run Time:** 30 seconds calculation time on an 80386 PC operating under DOS 5
- **Special Features:** None.

Independent Expert Reviews: None.

Status of Evaluations by Sponsor: On-going. Annual revisions will be made based on needs of users.

References

- Energy Information Administration, Short-Term Integrated Forecasting System, 1993 Model Documentation Report, DOE/EIA-M041(93), Washington, DC., 1993.
- Energy Information Administration, An Analysis of Heating Fuel Market Behavior in 1989-90, Service Report, SR/OG/90-01, Washington, DC., 1990.
- R. J. Southerland, "An Analysis of Heating Fuel Prices During the Winter of 1989-90", Energy System and Policy, Vol. 15, pp. 161-180, 1991.

Model Cross Reference

<u>Equations</u> <u>(Pages 6-7)</u>	<u>Location in Code</u> <u>(Line Numbers)</u>
DEMAND	1-4
PRICE	5-8
DELSTOCK	9
STOCK	10
STOCKDEL	11

<u>Variable Name</u>	<u>Name in Code</u>	<u>Location in Code</u>
PRICE	PRICE	5
CRUDEPR	CRUDEPR	6
DEMAND	DEMAND	1, 9
HDD	HDD	1
HDDSPSQ	HDDSPSQ	5
IPIDIF	IPIDIF	1
TREND	TREND	1
DUMMY	JAN, MAR, etc.	2-4, 6-8
D0AUG90	D0AUG90	2
D0DEC90	D0DEC90	2
DELSTOCK	DELSTOCK	9, 10
STOCK	STOCK	10, 11
PRIM_SUP	PRIM_SUP	9
DAYS	DAYS	9
STOCKDIF	STOCKDIF	5, 11
STOCKAVG	STOCKAVG	11

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