

Draft Final Report Sub Saharan Africa Refinery Project Volume II-B Refinery Study Appendices



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The World Bank
and
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OVERVIEW

This volume contains 4 appendices.

Appendix A: Demand Estimates, lays out the methodology by which the petroleum product demand projections for all the global regions in the WORLD® model were generated. It also lays out the model by which petroleum product demand projections for the individual SSA countries were developed. After the discussion of the model the Appendix includes population and GDP data for the SSA countries; projections of demand by petroleum product; and all the demand and supply projections for the various regions of the model.

Appendix B; WORLD® Model Assumptions, contains a number of modeling assumptions that were too detailed to include in the report.

Appendix C: WORLD® Model Runs, lists the eight cases that were modeled. The actual reports from the runs are in the accompanying Excel Workbook.

Appendix D: WORLD® Model, contains details on the global refining model that was used in this project.

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Overview**

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APPENDIX A: DEMAND ESTIMATES

OVERVIEW

The world demand and supply projections are based on the Energy Information Administration's (EIA) *Annual Energy Outlook 2009* (AEO2009) Early Release Reference Case¹. The projections are done in five-year intervals, with data for the historical year (2005) taken from the international tables for consumption² and production³ of petroleum from the EIA website. The consumption of petroleum products in Sub-Saharan Africa (SSA) is modeled separately at the country level on an annual basis. Figures in the AEO forecast, available by region as defined by the EIA, are allocated to WORLD® regions using data for the year 2007 from the international tables. This appendix addresses the details.

DEMAND

The AEO2009 Early Release contains a Reference Case projection of world petroleum consumption, available in EIA-defined regions. The EIA international table for petroleum consumption provides data by country on an annual basis for historical years. The AEO data (in EIA-defined regions) are allocated to WORLD® regions based on regional definitions. Data for 2005 is EIA historical data directly allocated to WORLD® regions. Future allocations are based on the most recent year in the historical data (2007), with AEO data as basis. China is the only instance of a one-to-one regional match and data is allocated accordingly. Three regions – the United States, Canada, and Sub-Saharan Africa – do not conform to the methodology described above. Tables detailing this process are provided in the back of the appendix under the heading **Allocation to WORLD® Regions**.

United States

The EIA region *United States* is allocated to five U.S. WORLD® regions, which correspond exactly to EIA's five Petroleum Administration for Defense Districts (PADDs). AEO2009 projects total petroleum consumption in the United States for the entire study period but by Census Division. The future consumption in the ten Census Divisions is first allocated to PADDs; the Census Divisions consumption split across two PADDs is allocated by using EIA historical consumption data by state for the year 2007. For example, the *East South Central* Census Division is split between PADDs II and III. Kentucky and Tennessee belong to PADD II and accounted for 60% of liquids consumption in *East South Central* in 2007; thus, 60% of the projected future consumption in *East South Central* is allocated to PADD II. Alabama and Mississippi accounted for remaining 40%, which is allocated to PADD III.

¹ Energy Information Administration – *Annual Energy Outlook 2009* Early Release Reference Case
Table 21. International Liquids Supply and Disposition Summary
http://www.eia.doe.gov/oiaf/aeo/excel/aeotab_21.xls
Release date: December 2008

² Energy Information Administration – *World Petroleum Consumption, Most Recent Annual Estimates, 1980-2007*
<http://www.eia.doe.gov/emeu/international/RecentPetroleumConsumptionBarrelsperDay.xls>
Table posted: December 22, 2008

³ Energy Information Administration – *World Production of Crude Oil, NGPL, and Other Liquids, Most Recent Annual Estimates, 1980-2007*
<http://www.eia.doe.gov/emeu/international/RecentCrudeNGPLOtherProduction.xls>
Table posted: October 23, 2008

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Appendix A: Demand Estimates

Canada

The EIA region *Canada* is allocated to two Canadian WORLD® regions, *Canada East* and *Canada West*, using sales by province data for the year 2007 from Statistics Canada.⁴ Since only historical data is available, the most recent year is used and the proportional shares are assumed to remain constant for all subsequent years. That is, 63.2% of the projected consumption in the EIA region *Canada* is assumed to take place in *Canada East*.

Greater Caribbean and Rest of South America

These two WORLD® regions correspond to three EIA regions: *Mexico* (which maps to *Greater Caribbean*), *Brazil* (which maps to *Rest of South America*) and *Other Central and South America* (which maps to both WORLD® regions). This third EIA region must be allocated using the same method as used for Canada in the preceding subsection. In the absence of a detailed regional forecast, EIA historical data are used to compute the proportions in which volumes in *Other Central and South America* are allocated to the two WORLD® regions.

Europe and Eurasia

Two EIA regions, *OECD Europe* and *Non-OECD Europe and Eurasia*, are mapped to five WORLD® regions, *Europe North*, *Europe South*, *Europe East*, *Caspian Region* and *Russia & Other FSU*. After classifying all countries in the EIA regions by OECD membership and WORLD® region, the allocation proportions are computed. Russia is broken out separately in the EIA projection, so its consumption volumes are allocated directly to *Russia & Other FSU* and are not considered in the allocation presented in the tables in the back of the appendix.

Asia Pacific

This is a very broad region geographically. On the EIA side, *OECD Asia* is subdivided into *Japan*, *South Korea* and *Australia/New Zealand*, and *Non-OECD Asia* is subdivided into *China*, *India* and *Rest of Non-OECD Asia*. *China* maps identically in the EIA and WORLD® models. *Japan* and *Australia/New Zealand* map to *Pacific Industrialized* in WORLD®, *South Korea* maps to *Pacific High Growth*, and *India* to *Other Asia*. *Rest of Non-OECD Asia* is allocated to *Pacific High Growth* and *Other Asia* using available 2007 consumption data from EIA.

Africa

The EIA region *Africa* corresponds to *North Africa/Eastern Mediterranean* and *Sub-Saharan Africa (SSA)* in WORLD®. Demand in the region is expected to consistently break roughly 45% to *North Africa* and 55% to *SSA* for the period through 2020⁵ and is allocated accordingly. *North Africa* in the WORLD® model includes some countries classified by the EIA as part of the *Middle East* (Israel, Lebanon, Syria) and *Non-OECD Europe and Central Asia* (Cyprus, Malta, Gibraltar). *Sub-Saharan Africa* is divided into three sub-regions: *West Africa*, *South Africa +*, and *East Africa*. *West Africa* is further sub-divided into *West*, *Nigeria +* and *West Central*. Similarly, *East Africa* consists of *South East*, *East Central* and *East – Red Sea*.

⁴ Statistics Canada, *Energy Statistics Handbook*, First quarter 2008, Table 5.4-1 “Petroleum products – Refined petroleum products, domestic sales by province – All products,” page 71.

<http://www.statcan.ca/english/freepub/57-601-XIE/57-601-XIE2008001.pdf>

Release date: July 16, 2008

⁵ International Energy Agency, *World Energy Outlook 2005*, Table 2.2 “World Oil Demand in the Reference Scenario,” page 83.

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Appendix A: Demand Estimates

Consumption in *Sub-Saharan Africa* is modeled as a function of GDP per capita, population, crude oil prices. The following data sources are used:

- Historical and forecasted GDP (billion 2007 U.S. dollars using market exchange rates) from the IMF⁶
- Historical and forecasted population (thousand persons) from the U.S. Census Bureau⁷
- Historical and forecasted crude oil prices (2007 U.S. dollars per barrel) from the EIA⁸

For modeling methodology see **Demand Model** section. For model output data see **Sub-Saharan Africa Detailed Product Demand Projections** at the back of the appendix.

SUPPLY

The AEO2009 Early Release contains a Reference Case projection of world petroleum production, again available in EIA-defined regions. The EIA international table for petroleum production provides data by country on an annual basis for historical years. An additional source is utilized in this case of supply: the proportions of production by major producing countries within an EIA-defined region from the older IEO 2008⁹ are applied to the AEO2009 regional forecasts; the use of these proportions are denoted in green in the allocation tables in the back of the appendix. The AEO data (in EIA-defined regions) are allocated to WORLD® regions based on regional definitions. Data for 2005 is EIA historical data directly allocated to WORLD® regions. Future allocations are based on the most recent year in the historical data (2007), with AEO data as basis. As is the case in demand, China is the only instance of a one-to-one regional match and data is allocated accordingly. Tables detailing this process are provided in the back of the appendix under the heading **Allocation to WORLD® Regions**.

United States

The United States is divided into five WORLD® regions that correspond exactly to the five PADDs. Historical data for the annual production of crude oil in the United States is also available by PADD.¹⁰ Volumes in the year 2005 are therefore allocated using actual proportions of regional production; the 2010, 2015 and 2020 volumes are allocated using proportions computed using 2007 production data.

Canada

The EIA region *Canada* is allocated to two Canadian WORLD® regions, *Canada East* and *Canada West*, using historical and forecasted volumes for the production of conventional liquids

⁶ International Monetary Fund, *World Economic Outlook Database*, October 2008.

<http://www.imf.org/external/pubs/ft/weo/2008/02/weodata/index.aspx>

⁷ U.S. Census Bureau, *International Data Base*. Data obtained on Aug 13, 2008.

<http://www.census.gov/ipc/www/idb/tables.html>

⁸ Energy Information Administration – Petroleum Navigator, Europe Brent Spot Price FOB for historical data; AEO 2009 Early Release Reference Case, Imported Low Sulfur Light Crude Price for future data points.

⁹ Energy Information Administration – *International Energy Outlook (IEO) 2008*, Table G5 “World Conventional Liquids Production by Region and Country, High Price Case, 1990–2030,” page 214-215, <http://www.eia.doe.gov/oiaf/ieo/pdf/ieopol.pdf>

¹⁰ Energy Information Administration, Petroleum Navigator, Crude Oil Production. http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbb1_a.htm

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from the Canadian Association of Petroleum Producers (CAPP)¹¹. The CAPP forecast is annual and goes out to the year 2020, so forecast-year-specific proportions can be obtained, as presented in back of the appendix.

Greater Caribbean and Rest of South America

EIA forecast of conventional liquids production is available for eight individual countries in these two WORLD® regions and an additional region (others) that encompasses the remainder the two WORLD® regions. Forecasted production in Mexico, Ecuador, Venezuela, Colombia and Trinidad & Tobago is allocated to *Greater Caribbean*; production in Brazil, Argentina and Peru goes to *Rest of South America*. As is done for the U.S., EIA historical data is used to map the remaining volume. Proportions computed based on 2005 volumes are used to allocate the remaining regional volume for the year 2005; those computed based on 2007 volumes are used for all subsequent periods.

Europe and Eurasia

Two EIA regions, *OECD Europe* and *Non-OECD Europe and Eurasia*, are mapped to five WORLD® regions, *Europe North*, *Europe South*, *Europe East*, *Caspian Region* and *Russia & Other FSU*. Most precisely, countries in *OECD Europe* fall under *Europe North*, *Europe South* and *Europe East*, while countries in *Non-OECD Europe and Eurasia* belong to *Europe East*, *Caspian Region* and *Russia & Other FSU*. Oil-producing countries in Europe and Eurasia are classified by OECD membership and WORLD® region. Countries that are broken out separately in the EIA projection for conventional liquids production are allocated directly to the applicable WORLD® regions. The remaining volumes in the two EIA regions are then separately allocated in proportion to estimated historical production. Proportions computed based on 2005 volumes are used to allocate the remaining regional volumes for the year 2005; those computed based on 2007 volumes are used for all subsequent periods.

Asia Pacific

OECD Asia in EIA, which consists of Japan, South Korea, Australia and New Zealand, maps exactly to *Pacific Industrialized* in WORLD® because South Korea is a non-oil producer in the projection for the entirety of the modeling period. (South Korea belongs to *Pacific High Growth* in WORLD®.) *China* in EIA maps directly to *China* in WORLD®. Among the separately broken-out Asian countries, Indonesia (*OPEC Asia*), Brunei, Malaysia, Thailand and Vietnam belong to *Pacific High Growth*, while volumes produced in India are allocated to *Rest of Asia*. Volumes in other oil-producing countries are allocated in proportion to estimated historical production.

Africa

Countries in Africa broken out in the EIA projection that map directly to WORLD® regions are: Algeria, Libya and Egypt (to *North Africa/Eastern Med*); Nigeria (*Nigeria +*); Chad, Congo Republic, Equatorial Guinea and Gabon (*West Central Africa*); Angola (*South Africa +*); and Sudan (*East Africa – Red Sea*). The remaining production on the continent comes from other oil-producing countries and is allocated in proportion to estimated historical production. Proportions computed based on 2005 volumes are used to allocate the remaining regional

¹¹ Canadian Association of Petroleum Producers, *2008 Canadian Crude Oil Forecast and Market Outlook*, Appendix B.1 “CAPP Canadian Crude Oil Production Forecast 2008–2020.”
http://www.capp.ca/default.asp?V_DOC_ID=1285

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volumes for the year 2005; those computed based on 2007 volumes are used for all subsequent periods.

The recently discovered and appraised Jubilee oil field off the coast of Ghana will produce 60,000 b/d of oil for the first phase of development and ultimately 120,000 b/d.¹² A conservative estimation of production from this oil field is added to the AEO-based projection, with 0.06 MMb/d beginning in 2013.

Tullow Oil discoveries in Uganda began in February 2006. As of December 2008, Uganda has a confirmed production capacity of 40,000 barrels per day¹³. To account for this confirmed capacity, 0.04 MMb/d is added to the AEO-based projection for 2010, 2015 and 2020.

Unconventional Liquids

The basis for the projection of unconventional liquids production is Table G6 in IEO 2008,¹⁴ which lists unconventional production by type for a non-comprehensive list of countries. Additional current and expected future production capacity for unconventional liquids identified by ICF research is added to the outlook. Of the two gas-to-liquids (GTL) projects in Qatar, Oryx GTL began production of 34,000 b/d in 2006 and Pearl GTL is expected to start up in two phases: 70,000 b/d first train in 2010 and 70,000 b/d second train in 2012. There is a 14,700 b/d GTL facility operated by Shell in Malaysia since 1993. There are two forthcoming coal-to-liquids (CTL) plants in China: one is expected to begin producing 22,000 b/d in the second half of 2008 and a larger 80,000 b/d facility is expected to start up in 2012. The central government of China has suspended all other CTL projects in the country, citing economic and environmental concerns.¹⁵

¹² *Oil & Gas Journal*, “Special Report: Ghana due first oil output in 2010 with Jubilee start-up,” May 26, 2008.
http://www.ogj.com/articles/print_screen.cfm?ARTICLE_ID=329653

¹³ *Sunday Monitor*, “Uganda could reap \$5billion annually from oil exploration.” December 8, 2008.
http://www.monitor.co.ug/artman/publish/business/Uganda_could_reap_5billion_annually_from_oil_exploration_76430.shtml

¹⁴ Energy Information Administration, *International Energy Outlook 2008*, Table G6 “World Unconventional Liquids Production by Region and Country, High Price Case, 1990–2030,” page 216.
<http://www.eia.doe.gov/oiaf/ieo/pdf/ieopol.pdf>

¹⁵ *China Daily*, “Is it the end of the line for coal-to-oil in China?” Oct 9, 2008.
http://www.chinadaily.com.cn/bizchina/2008-10/09/content_7090441.htm

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Appendix A: Demand Estimates

DEMAND MODEL

Data Processing and Integrating IEA Energy Balance Data with CITAC Data

The primary source of data for the demand model is provided by CITAC¹⁶, which provides total consumption from 2000 to 2007 for eight petroleum products and the IEA energy balances¹⁷, which provides data from 1992 to 2007. The IEA energy balances are used to extrapolate the CITAC data back to 1992.

The first step is to input the two energy sources and convert them to the same units which is petajoules (PJ). The IEA data is originally in thousand tons of oil equivalent (ktoe) and is converted to petajoules by multiplying by 0.041868. The CITAC data is in barrels per day and is converted to PJ by multiplying by 365 and dividing by 1000000 and then multiplying by the factor provided in the table below which is dependent upon the product.

	Conversion Factor (GJ/bbl)
Fuel	
LPG	4.037781
Gasoline	5.27444
Jet/Kerosene	5.656482
Gasoil	5.812771
Fuel Oil	6.061233
Bitumen	6.440953
Lubes	5.92382
Others	4.999981

This produces the following variables:

- $EU_IEA_{r',e,y}$ – energy consumption from the EIA data (PJ/year)
- $EU_CITAC_{r,f,v}$ – energy consumption from the CITAC data (PJ/year)
- e is the IEA energy sector/fuel
- f is the CITAC fuel
- r' is the IEA country/region
- r is the CITAC country

The second step is to map the IEA sector data to the extended CITAC fuel/sectors which is done using the mapping tables below and producing the variable $EU_IEA_{r',f,y}$.

¹⁶ CITAC Africa LLP is a UK-based, independent consultancy company focusing on the downstream African Energy market. <http://www.citac.com/>

¹⁷ International Energy Agency, *Energy Balances of Non-OECD Countries*, 2008 Edition.

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Mapping from IEA sector fuel use to CITAC fuel use

Series	Code	LPG	Gasoline	Jet/Kerosene	Gasoil	Fuel Oil	Bitumen	Lubes	Others
Total Final Consumption, Crude Oil	311								1
Total Final Consumption, Natural Gas Liquids	312								1
Total Final Consumption, Refinery Feedstocks	313								1
Total Final Consumption, Additives/Blending Components	314								1
Total Final Consumption, Other Hydrocarbons	315								1
Total Final Consumption, Refinery Gas	316								1
Total Final Consumption, Ethane	317								1
Total Final Consumption, Liquefied Petroleum Gases (LPG)	318	1							
Total Final Consumption, Motor Gasoline	319		1						
Total Final Consumption, Aviation Gasoline	320		1						
Total Final Consumption, Gasoline-type Jet Fuel	321			1					
Total Final Consumption, Kerosene-type Jet Fuel	322			1					
Total Final Consumption, Kerosene	323			1					
Total Final Consumption, Gas/Diesel Oil	324				1				
Total Final Consumption, Heavy Fuel Oil	325					1			
Total Final Consumption, Naphtha	326								1
Total Final Consumption, White Spirit & SBP	327								1
Total Final Consumption, Lubricants	328							1	
Total Final Consumption, Bitumen	329						1		
Total Final Consumption, Paraffin Waxes	330								1
Total Final Consumption, Petroleum Coke	331								1
Total Final Consumption, Non-specified Petroleum Products	332								1

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The mapped IEA data, $EU_IEA_{r',f,y}$, is not quite ready to use to extrapolate the CITAC data back to 1992 due to differences in the allocation of fuel use to fuel types between the two data sources and differences in total fuel use. The third step is to create an allocation to address these differences. This is first accomplished by calculating the average consumption from 2000 to 2007 for both EIA and CITAC data as follows:

- $FC_IEA_r = \sum_{f,y} EU_IEA_{r',f,y}$ where the IEA region r' is mapped to the CITAC country r and $\sum_{f,y} EU_IEA_{r',f,y} \neq 0$ and set to FCA_CITAC_r otherwise
- $FCA_CITAC_r = EU_CITAC_{r,f,v}$
- $FScl = FCA_CITAC_r / FC_IEA_r$

The mapping from IEA region r' to CITAC country r is required since the IEA data is not provided for all countries and the IEA region, Rest of Sub-Saharan Africa region is used in this case.

Once the scaling factor, $FScl$, is developed we then create a mapping for each region r from the CITAC data with the original fuels only to the CITAC fuel list as follows:

- $Map_{r,f,f} = FScl$ if $FScl * EU_IEA_{r',f,y} > EU_CITAC_{r,f,v}$
- $= EU_IEA_{r',f,y} / EU_CITAC_{r,f,v}$ otherwise
- $Left_{r,f} = Map_{r,f,f} - fScl$
- $Rem_{r,f} = FCA_CITAC_r - Map_{r,f,f} * FC_IEA_r$
- $Rem_r = \sum_f Rem_{r,f}$

Where the IEA region r' is mapped to the CITAC country r .

The remaining mapping is defined as

- $Map_{r,f,f'} = Left_{r,f} * Rem_{r,f} / Rem_r$

The final allocate of EIA demand used is as follows:

- $FA_{r,f,y} = \sum_{f'} Map_{r,f,f'} * EU_IEA_{r',f,y}$

The calculated values used in the model is then

- $FC_{r,f,y} = FA_{r,f,y} / FA_{r,f,y'} * EU_CITAC_{r,f,v}$

Where $y' = y$ if y is between 2000 and 2007 and $EU_CITAC_{r,f,v} < 0$ and $y' = 2000$ otherwise.

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Total Consumption of Petroleum Products

The demand model is constructed to first estimate the total consumption of petroleum products based on population, GDP, and crude oil prices. The total consumption of petroleum products is based upon CITAC data¹⁸ and the functional representation of consumption of petroleum products is given as follows:

$$TC_{c,y} = \alpha_c * G_{c,y}^\beta * P_{c,y}^\gamma * CP_y^\eta * Eff^{(y-1992)}$$

Where:

- c is the index of the country,
- y is the year (e.g., 1995),
- $HC_{c,y}$ is total historic consumption for the country c and year y ,
- $TC_{c,y}$ is total modeled consumption for the country c and year y ,
- $G_{c,y}$ is the GDP per capita for the country c and year y (\$2006/capita),
- $P_{c,y}$ is the population for the country c and year y (thousands),
- CP_y is the crude oil price for the year y (Europe Brent spot price FOB, \$2006/bbl),
- Eff is the annual improvement in energy intensity in the region (e.g., -0.005 is 0.5% reduction annually) ,
- α_c is the country intercept for the country c (ktoe per year),
- β is the income elasticity (against GDP per capita)
- γ is the population elasticity, and
- η is the price elasticity.

We selected the following factors to best fit the data combined with exogenous estimates of the key variables:

- EFF as -0.005 (-.5%)
- β as 0.9
- γ as 0.9
- η as -0.15.

and using these calculated α_c to minimize the sum of difference between the model ($TC_{c,y}$) and the historic data ($HC_{c,y}$) squared.

The values for α_c are provided below:

	Country Intercept
Angola	-7.2684
Cameroon	-7.4531
Côte d'Ivoire	-7.4846
Ethiopia	-7.0398
Gabon	-7.6445
Ghana	-6.5552
Kenya	-6.5886
Nigeria	-6.6164
Senegal	-6.6151

¹⁸ CITAC Africa LLC database

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South Africa	-6.8400
Sudan	-7.0667
Tanzania	-7.1598
Uganda	-7.3183
Zimbabwe	-6.2125
Benin	-7.6329
Burkina Faso	-7.2836
Congo, Democratic Republic of	-8.0570
Eritrea	-6.2651
Guinea	-6.4318
Madagascar	-6.9888
Mali	-7.0401
Mauritania	-6.4636
Mauritius	-6.5494
Mozambique	-7.0396
Namibia	-6.7738
Niger	-7.5571
Seychelles	-5.8679
Togo	-6.5550
Zambia	-7.5751
Botswana	-7.5003
Burundi	-7.2559
Cape Verde	-6.5306
Chad	-8.0336
Central African Republic	-8.1108
Comoros	-10.9504
Congo, Republic of	-8.2379
Djibouti	-7.0986
Equatorial Guinea	-8.2922
Gambia	-6.4732
Guinea-Bissau	-6.5882
Lesotho	-7.8194
Liberia	-5.7457
Malawi	-7.2286
Rwanda	-7.8333
São Tomé and Príncipe	-6.5536
Sierra Leone	-6.9453
Somalia	-7.5462
Swaziland	-7.3684

Consumption by Fuel Type

The consumption by fuel type is calculated by using the following model formulation:

- $MC_{c,f,y} = TC_{c,y} * FS_{c,f,y} / \sum_f FS_{c,f,y}$
- $FS_{c,f,y} = SI_{c,f,y} + SS_{c,f} * \log(GDP_{c,y})$

Where

- $MC_{c,f,y}$ is the consumption of fuel f in country c and year y (PJ)
- $TC_{c,y}$ is the total consumption of petroleum products (PJ, see section above)
- $FS_{c,f,y}$ is the fuel share for fuel f in country c and year y (fraction)

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- $SI_{c,f,y}$ is the country intercept for the fuel and region (fraction)
- $SS_{c,f}$ is the income elasticity for the share by country and fuel
- $GDP_{c,y}$ is the GDP per capita (\$2006/capita) for the country and year

The income elasticity is calculated using regression analysis where the value SS_f minimizes the following equation:

- $\sum_{c,y} [Shr_{c,f,y} - (A_f + SS_f * \log(GDP_{c,y}))]^2$
- $Shr_{c,f,y} = EU_CITAC_{c,f,y} / \sum_f EU_CITAC_{r,f,y}$

where

- SS_f is the regression slope
- A_f is the intercept
- $Shr_{c,f,y}$ is the share of total consumption for the fuel type f

The variable $SS_{c,f}$ is set to SS_f if $\sum_y EU_CITAC_{c,f,y}$ is non-zero and set to zero otherwise

The country intercept is calculated as follows:

- For y between 1992 and 2007
 - $SI_{c,f,y} = Shr_{c,f,y} - SS_{c,f} * \ln(GDP_{c,y})$
- For y > 2007
 - $SI_{c,f,y} = SI_{c,f,y-1} * 0.9 + SI_{c,f} * 0.1$
 - $SI_{c,f} = \sum_{1992 <= y <= 2007} [Shr_{c,f,y} - SS_{c,f} * \ln(GDP_{c,y})] / (2007 - 1992 + 1)$

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Country	Series	Unit	1992	1993	1994	1995	1996	1997	1998	1999
Angola	GDP, Constant Prices	Billion 2006 U.S. Dollar	19.52	14.84	15.03	17.29	20.75	21.89	21.89	22.60
Angola	Population	Thousand Person	8,742	8,966	9,172	9,419	9,651	9,856	10,039	10,215
Benin	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.58	2.73	2.78	2.95	3.08	3.26	3.39	3.57
Benin	Population	Thousand Person	5,010	5,250	5,488	5,647	5,820	6,006	6,202	6,407
Botswana	GDP, Constant Prices	Billion 2006 U.S. Dollar	5.23	5.34	5.53	5.77	6.10	6.70	7.42	7.96
Botswana	Population	Thousand Person	1,341	1,385	1,427	1,468	1,507	1,544	1,579	1,611
Burkina Faso	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.66	2.75	2.78	2.94	3.27	3.47	3.73	4.00
Burkina Faso	Population	Thousand Person	8,935	9,238	9,571	9,903	10,220	10,543	10,873	11,225
Burundi	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.02	0.96	0.92	0.85	0.78	0.78	0.82	0.81
Burundi	Population	Thousand Person	5,809	5,633	5,682	6,078	6,101	6,122	6,271	6,458
Cameroon	GDP, Constant Prices	Billion 2006 U.S. Dollar	11.79	11.42	11.14	11.50	12.08	12.70	13.34	13.92
Cameroon	Population	Thousand Person	12,575	12,920	13,264	13,603	13,945	14,290	14,638	14,989
Cape Verde	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.45	0.49	0.52	0.56	0.60	0.64	0.70	0.78
Cape Verde	Population	Thousand Person	361	367	373	378	383	388	393	397
Central African Republic	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.28	1.26	1.31	1.38	1.27	1.36	1.41	1.46
Central African Republic	Population	Thousand Person	3,267	3,368	3,467	3,544	3,619	3,700	3,783	3,863
Chad	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.70	2.64	2.79	2.77	2.82	2.98	3.19	3.17
Chad	Population	Thousand Person	6,263	6,379	6,497	6,770	7,051	7,262	7,479	7,709
Comoros	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.32	0.33	0.31	0.32	0.32	0.33	0.34	0.34
Comoros	Population	Thousand Person	455	468	482	497	512	528	544	561
DR Congo	GDP, Constant Prices	Billion 2006 U.S. Dollar	9.88	8.55	8.22	8.28	8.18	7.74	7.61	7.28
DR Congo	Population	Thousand Person	41,645	43,027	44,486	46,299	47,197	47,740	48,760	50,284
Congo Republic	GDP, Constant Prices	Billion 2006 U.S. Dollar	5.44	5.39	5.09	5.30	5.52	5.49	5.70	5.55
Congo Republic	Population	Thousand Person	2,409	2,488	2,569	2,649	2,730	2,801	2,878	2,971
Côte d'Ivoire	GDP, Constant Prices	Billion 2006 U.S. Dollar	12.64	12.61	14.07	14.86	16.06	16.98	17.74	18.06
Côte d'Ivoire	Population	Thousand Person	13,422	13,861	14,380	14,846	15,281	15,686	16,045	16,457
Djibouti	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.73	0.68	0.67	0.65	0.62	0.62	0.62	0.64
Djibouti	Population	Thousand Person	384	393	403	409	414	418	422	427
Equatorial Guinea	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.24	0.27	0.31	0.37	0.61	1.53	1.90	2.38
Equatorial Guinea	Population	Thousand Person	392	403	414	426	438	451	464	478
Eritrea	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.73	0.83	1.00	1.02	1.12	1.20	1.23	1.23
Eritrea	Population	Thousand Person	3,087	3,228	3,380	3,565	3,733	3,842	3,963	4,080
Ethiopia	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.65	7.53	7.80	8.27	9.36	9.69	9.30	9.86
Ethiopia	Population	Thousand Person	51,673	52,803	54,034	55,550	57,193	58,805	60,484	62,279
Gabon	GDP, Constant Prices	Billion 2006 U.S. Dollar	7.58	7.88	8.17	8.58	8.89	9.40	9.73	8.86
Gabon	Population	Thousand Person	986	1,013	1,041	1,069	1,098	1,127	1,157	1,196
Gambia, The	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.27	0.29	0.30	0.29	0.31	0.32	0.35	0.37
Gambia, The	Population	Thousand Person	1,025	1,066	1,108	1,150	1,193	1,236	1,279	1,323
Ghana	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.70	7.03	7.26	7.55	7.90	8.23	8.62	9.00
Ghana	Population	Thousand Person	16,302	16,814	17,310	17,712	18,092	18,477	18,885	19,305
Guinea	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.68	1.76	1.84	1.92	2.02	2.12	2.22	2.32
Guinea	Population	Thousand Person	6,801	6,989	7,209	7,446	7,702	7,791	7,907	8,154
Guinea-Bissau	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.30	0.31	0.32	0.33	0.35	0.37	0.27	0.29
Guinea-Bissau	Population	Thousand Person	1,051	1,084	1,117	1,143	1,166	1,194	1,222	1,250
Kenya	GDP, Constant Prices	Billion 2006 U.S. Dollar	14.93	14.92	15.30	15.95	16.59	16.63	17.18	17.59
Kenya	Population	Thousand Person	25,019	25,818	26,455	27,124	27,790	28,459	29,123	29,795
Lesotho	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.93	0.96	1.00	1.04	1.14	1.24	1.18	1.18
Lesotho	Population	Thousand Person	1,802	1,842	1,881	1,919	1,955	1,989	2,019	2,046
Liberia	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.41	0.43	0.42	0.42	0.43	0.47	0.52	0.56

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Country	Series	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Angola	GDP, Constant Prices	Billion 2006 U.S. Dollar	23.28	24.01	27.50	28.41	31.58	38.10	45.17	56.32	65.22	72.46	80.65
Angola	Population	Thousand Person	10,377	10,538	10,761	11,057	11,391	11,707	11,993	12,264	12,531	12,799	13,068
Benin	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.74	3.97	4.15	4.31	4.45	4.58	4.75	4.97	5.22	5.49	5.80
Benin	Population	Thousand Person	6,619	6,839	7,064	7,294	7,527	7,778	8,032	8,278	8,533	8,792	9,056
Botswana	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.63	9.04	9.52	10.12	10.79	11.29	11.68	12.38	12.96	13.50	14.10
Botswana	Population	Thousand Person	1,639	1,665	1,689	1,712	1,735	1,760	1,788	1,816	1,842	1,868	1,893
Burkina Faso	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.08	4.35	4.55	4.89	5.11	5.48	5.78	5.98	6.23	6.52	6.88
Burkina Faso	Population	Thousand Person	11,588	12,039	12,585	13,065	13,478	13,904	14,344	14,797	15,265	15,746	16,242
Burundi	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.80	0.82	0.86	0.85	0.89	0.90	0.94	0.97	1.02	1.06	1.11
Burundi	Population	Thousand Person	6,621	6,810	7,021	7,252	7,516	7,795	8,090	8,391	8,691	8,988	9,281
Cameroon	GDP, Constant Prices	Billion 2006 U.S. Dollar	14.50	15.16	15.76	16.40	17.01	17.40	17.96	18.57	19.29	20.06	20.95
Cameroon	Population	Thousand Person	15,343	15,707	16,094	16,489	16,873	17,261	17,658	18,060	18,468	18,879	19,294
Cape Verde	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.84	0.89	0.93	0.98	1.02	1.09	1.20	1.28	1.37	1.44	1.53
Cape Verde	Population	Thousand Person	402	405	409	413	416	419	422	424	427	429	432
Central African Republic	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.49	1.50	1.49	1.37	1.39	1.42	1.48	1.53	1.59	1.65	1.73
Central African Republic	Population	Thousand Person	3,940	3,998	4,053	4,118	4,178	4,244	4,311	4,377	4,444	4,511	4,579
Chad	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.14	3.51	3.81	4.37	5.83	6.30	6.31	6.35	6.45	6.63	6.83
Chad	Population	Thousand Person	7,943	8,179	8,436	8,746	9,098	9,401	9,649	9,886	10,111	10,329	10,543
Comoros	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.35	0.36	0.37	0.38	0.38	0.40	0.40	0.41	0.41	0.42	0.43
Comoros	Population	Thousand Person	579	596	615	633	652	672	691	711	732	752	773
DR Congo	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.78	6.64	6.87	7.26	7.75	8.36	8.82	9.38	10.38	11.25	12.58
DR Congo	Population	Thousand Person	51,849	53,497	55,200	56,886	58,630	60,474	62,376	64,390	66,515	68,693	70,916
Congo Republic	GDP, Constant Prices	Billion 2006 U.S. Dollar	5.97	6.20	6.48	6.53	6.76	7.28	7.74	7.63	8.32	8.94	9.81
Congo Republic	Population	Thousand Person	3,102	3,238	3,329	3,413	3,502	3,602	3,702	3,801	3,903	4,011	4,124
Côte d'Ivoire	GDP, Constant Prices	Billion 2006 U.S. Dollar	17.22	17.23	16.96	16.67	16.94	17.26	17.38	17.64	18.10	18.66	19.58
Côte d'Ivoire	Population	Thousand Person	16,885	17,311	17,688	18,068	18,504	18,921	19,327	19,747	20,180	20,617	21,059
Djibouti	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.64	0.65	0.67	0.69	0.71	0.73	0.77	0.81	0.86	0.90	0.95
Djibouti	Population	Thousand Person	431	438	447	457	467	477	487	496	506	516	526
Equatorial Guinea	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.82	4.60	5.49	6.26	8.64	9.48	9.60	11.66	12.53	13.10	13.65
Equatorial Guinea	Population	Thousand Person	491	506	521	536	551	567	583	600	616	633	651
Eritrea	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.08	1.17	1.21	1.18	1.19	1.22	1.21	1.23	1.24	1.27	1.32
Eritrea	Population	Thousand Person	4,197	4,338	4,505	4,700	4,907	5,070	5,214	5,358	5,502	5,647	5,793
Ethiopia	GDP, Constant Prices	Billion 2006 U.S. Dollar	10.45	11.25	11.39	10.99	12.07	13.60	15.17	16.85	18.33	19.43	20.85
Ethiopia	Population	Thousand Person	64,165	66,123	68,187	70,366	72,637	74,980	77,411	79,936	82,545	85,237	88,013
Gabon	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.69	8.88	8.85	9.07	9.17	9.44	9.56	10.07	10.44	10.88	11.32
Gabon	Population	Thousand Person	1,236	1,269	1,300	1,333	1,364	1,396	1,426	1,456	1,486	1,515	1,545
Gambia, The	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.39	0.41	0.40	0.42	0.45	0.48	0.51	0.54	0.57	0.59	0.63
Gambia, The	Population	Thousand Person	1,368	1,413	1,458	1,503	1,549	1,595	1,642	1,688	1,735	1,783	1,831
Ghana	GDP, Constant Prices	Billion 2006 U.S. Dollar	9.33	9.72	10.17	10.70	11.30	11.96	12.72	13.55	14.36	15.17	16.08
Ghana	Population	Thousand Person	19,736	20,177	20,639	21,111	21,572	22,026	22,479	22,931	23,383	23,832	24,279
Guinea	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.39	2.48	2.58	2.61	2.67	2.75	2.82	2.87	2.99	3.10	3.25
Guinea	Population	Thousand Person	8,350	8,417	8,520	8,756	8,972	9,154	9,346	9,569	9,807	10,058	10,324
Guinea-Bissau	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.31	0.31	0.29	0.29	0.29	0.30	0.31	0.32	0.33	0.33	0.35
Guinea-Bissau	Population	Thousand Person	1,279	1,306	1,333	1,360	1,387	1,414	1,443	1,473	1,503	1,534	1,565
Kenya	GDP, Constant Prices	Billion 2006 U.S. Dollar	17.70	18.54	18.59	19.11	19.99	21.17	22.52	24.12	24.91	25.83	27.36
Kenya	Population	Thousand Person	30,508	31,299	32,155	33,042	33,967	34,912	35,891	36,914	37,954	39,003	40,047
Lesotho	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.21	1.23	1.27	1.30	1.36	1.39	1.49	1.57	1.63	1.68	1.75
Lesotho	Population	Thousand Person	2,068	2,085	2,098	2,107	2,114	2,118	2,122	2,125	2,128	2,131	2,133
Liberia	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.72	0.74	0.77	0.53	0.54	0.57	0.61	0.67	0.73	0.78	0.85

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Country	Series	Unit	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Angola	GDP, Constant Prices	Billion 2006 U.S. Dollar	80.34	82.91	82.95	85.46	88.05	90.71	93.46	96.29	99.20	102.20
Angola	Population	Thousand Person	13,339	13,611	13,886	14,163	14,443	14,728	15,015	15,306	15,601	15,898
Benin	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.15	6.52	6.91	7.32	7.75	8.21	8.70	9.22	9.76	10.34
Benin	Population	Thousand Person	9,325	9,599	9,877	10,161	10,449	10,741	11,039	11,341	11,646	11,956
Botswana	GDP, Constant Prices	Billion 2006 U.S. Dollar	14.92	15.87	16.67	17.60	18.58	19.61	20.70	21.85	23.07	24.35
Botswana	Population	Thousand Person	1,918	1,941	1,964	1,986	2,007	2,027	2,046	2,064	2,082	2,098
Burkina Faso	GDP, Constant Prices	Billion 2006 U.S. Dollar	7.28	7.72	8.18	8.66	9.17	9.71	10.28	10.88	11.52	12.19
Burkina Faso	Population	Thousand Person	16,751	17,275	17,813	18,365	18,932	19,513	20,108	20,717	21,340	21,978
Burundi	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.17	1.23	1.30	1.37	1.44	1.51	1.59	1.68	1.76	1.86
Burundi	Population	Thousand Person	9,570	9,858	10,144	10,431	10,724	11,023	11,326	11,635	11,948	12,266
Cameroon	GDP, Constant Prices	Billion 2006 U.S. Dollar	22.06	23.22	24.45	25.70	27.02	28.40	29.85	31.38	32.98	34.67
Cameroon	Population	Thousand Person	19,711	20,130	20,549	20,969	21,387	21,805	22,223	22,641	23,057	23,471
Cape Verde	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.64	1.75	1.86	1.99	2.12	2.27	2.42	2.58	2.76	2.94
Cape Verde	Population	Thousand Person	434	436	438	440	442	444	446	447	449	450
Central African Republic	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.82	1.91	2.01	2.10	2.21	2.32	2.43	2.55	2.68	2.81
Central African Republic	Population	Thousand Person	4,646	4,713	4,780	4,847	4,912	4,977	5,041	5,104	5,165	5,225
Chad	GDP, Constant Prices	Billion 2006 U.S. Dollar	7.02	7.20	7.37	7.56	7.76	7.97	8.18	8.40	8.62	8.85
Chad	Population	Thousand Person	10,759	10,976	11,193	11,412	11,631	11,852	12,076	12,302	12,528	12,756
Comoros	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.44	0.46	0.48	0.50	0.52	0.54	0.56	0.58	0.60	0.62
Comoros	Population	Thousand Person	795	816	838	860	883	906	929	952	976	1,001
DR Congo	GDP, Constant Prices	Billion 2006 U.S. Dollar	13.77	14.92	16.01	17.48	19.08	20.83	22.74	24.83	27.10	29.59
DR Congo	Population	Thousand Person	73,180	75,483	77,829	80,219	82,657	85,147	87,689	90,281	92,920	95,605
Congo Republic	GDP, Constant Prices	Billion 2006 U.S. Dollar	9.92	10.09	10.23	10.54	10.86	11.19	11.53	11.88	12.24	12.61
Congo Republic	Population	Thousand Person	4,242	4,365	4,491	4,621	4,754	4,888	5,025	5,163	5,303	5,445
Côte d'Ivoire	GDP, Constant Prices	Billion 2006 U.S. Dollar	20.78	22.07	23.48	24.87	26.36	27.92	29.59	31.35	33.22	35.19
Côte d'Ivoire	Population	Thousand Person	21,504	21,952	22,401	22,849	23,295	23,740	24,185	24,627	25,067	25,504
Djibouti	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.03	1.11	1.18	1.27	1.36	1.46	1.57	1.68	1.81	1.94
Djibouti	Population	Thousand Person	536	546	556	566	576	586	596	606	617	627
Equatorial Guinea	GDP, Constant Prices	Billion 2006 U.S. Dollar	14.26	14.91	15.09	15.66	16.25	16.86	17.50	18.16	18.85	19.56
Equatorial Guinea	Population	Thousand Person	668	686	704	722	741	759	778	797	817	836
Eritrea	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.39	1.45	1.52	1.59	1.66	1.74	1.82	1.91	1.99	2.09
Eritrea	Population	Thousand Person	5,939	6,086	6,234	6,381	6,528	6,674	6,821	6,968	7,114	7,260
Ethiopia	GDP, Constant Prices	Billion 2006 U.S. Dollar	22.42	24.12	25.97	27.92	30.02	32.27	34.70	37.31	40.11	43.13
Ethiopia	Population	Thousand Person	90,874	93,816	96,838	99,943	103,134	106,412	109,777	113,230	116,776	120,420
Gabon	GDP, Constant Prices	Billion 2006 U.S. Dollar	11.55	11.77	11.95	12.22	12.50	12.78	13.07	13.37	13.68	13.99
Gabon	Population	Thousand Person	1,577	1,608	1,640	1,673	1,705	1,739	1,772	1,807	1,841	1,877
Gambia, The	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.66	0.70	0.74	0.78	0.83	0.87	0.92	0.97	1.03	1.09
Gambia, The	Population	Thousand Person	1,879	1,928	1,978	2,028	2,080	2,132	2,184	2,238	2,292	2,346
Ghana	GDP, Constant Prices	Billion 2006 U.S. Dollar	17.04	18.19	19.42	20.66	21.98	23.38	24.87	26.46	28.15	29.94
Ghana	Population	Thousand Person	24,724	25,167	25,608	26,044	26,475	26,902	27,325	27,745	28,159	28,567
Guinea	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.44	3.63	3.82	4.03	4.25	4.48	4.72	4.98	5.25	5.53
Guinea	Population	Thousand Person	10,601	10,885	11,176	11,474	11,780	12,093	12,414	12,742	13,077	13,420
Guinea-Bissau	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.47	0.48	0.50
Guinea-Bissau	Population	Thousand Person	1,597	1,629	1,661	1,693	1,726	1,759	1,792	1,826	1,859	1,893
Kenya	GDP, Constant Prices	Billion 2006 U.S. Dollar	29.14	31.04	33.06	35.18	37.43	39.82	42.37	45.08	47.96	51.03
Kenya	Population	Thousand Person	41,071	42,063	43,012	43,910	44,753	45,546	46,298	47,007	47,678	48,319
Lesotho	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.85	1.95	2.05	2.15	2.26	2.37	2.49	2.62	2.75	2.89
Lesotho	Population	Thousand Person	2,135	2,137	2,139	2,141	2,142	2,142	2,142	2,142	2,141	2,139
Liberia	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.97	1.10	1.23	1.38	1.55	1.73	1.95	2.18	2.45	2.75

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Liberia	Population	Thousand Person	1,913	1,990	1,974	1,975	2,026	2,201	2,456	2,599
Madagascar	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.75	3.82	3.82	3.89	3.97	4.12	4.28	4.48
Madagascar	Population	Thousand Person	12,357	12,737	13,128	13,532	13,948	14,377	14,817	15,271
Malawi	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.93	2.12	1.90	2.16	2.38	2.54	2.56	2.65
Malawi	Population	Thousand Person	10,294	10,475	10,296	10,224	10,459	10,735	11,011	11,286
Mali	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.22	3.35	3.47	3.55	3.81	4.01	4.35	4.48
Mali	Population	Thousand Person	8,418	8,594	8,776	8,966	9,165	9,373	9,589	9,814
Mauritania	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.56	1.65	1.60	1.75	1.86	1.78	1.83	1.95
Mauritania	Population	Thousand Person	2,119	2,205	2,279	2,342	2,389	2,445	2,515	2,591
Mauritius	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.36	3.70	3.88	4.06	4.07	4.22	4.58	4.79
Mauritius	Population	Thousand Person	1,085	1,099	1,111	1,123	1,135	1,148	1,161	1,173
Mozambique	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.35	2.55	2.71	2.77	3.18	3.53	3.95	4.28
Mozambique	Population	Thousand Person	13,180	13,691	14,781	15,765	16,298	16,760	17,220	17,677
Namibia	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.06	3.98	4.27	4.44	4.58	4.78	4.93	5.10
Namibia	Population	Thousand Person	1,553	1,595	1,638	1,681	1,724	1,766	1,807	1,847
Niger	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.27	2.31	2.40	2.24	2.35	2.37	2.67	2.69
Niger	Population	Thousand Person	8,393	8,631	8,880	9,139	9,404	9,666	9,935	10,221
Nigeria	GDP, Constant Prices	Billion 2006 U.S. Dollar	68.10	69.52	70.16	69.94	73.43	75.49	77.54	77.91
Nigeria	Population	Thousand Person	101,625	104,200	106,814	109,465	112,149	114,862	117,600	120,369
Rwanda	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.90	1.73	0.91	1.20	1.38	1.61	1.75	1.85
Rwanda	Population	Thousand Person	7,271	7,560	6,264	5,461	6,511	7,580	7,957	8,122
São Tomé and Príncipe	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08
São Tomé and Príncipe	Population	Thousand Person	126	129	133	137	141	146	150	155
Senegal	GDP, Constant Prices	Billion 2006 U.S. Dollar	5.54	5.61	5.61	5.91	6.03	6.21	6.58	7.00
Senegal	Population	Thousand Person	8,311	8,544	8,780	9,023	9,274	9,528	9,789	10,057
Seychelles	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.57	0.61	0.60	0.60	0.66	0.74	0.76	0.77
Seychelles	Population	Thousand Person	75	76	76	77	78	78	78	79
Sierra Leone	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.28	1.28	1.32	1.19	0.90	0.74	0.73	0.67
Sierra Leone	Population	Thousand Person	4,267	4,221	4,318	4,388	4,445	4,585	4,680	4,706
Somalia	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.50	1.49	1.53	1.57	1.61	1.65	1.70	1.75
Somalia	Population	Thousand Person	6,116	6,101	6,264	6,401	6,574	6,751	6,965	7,171
South Africa	GDP, Constant Prices	Billion 2006 U.S. Dollar	163.27	165.29	170.63	175.95	183.53	188.38	189.36	193.82
South Africa	Population	Thousand Person	40,091	40,941	41,662	42,228	42,794	43,354	43,962	44,526
Sudan	GDP, Constant Prices	Billion 2006 U.S. Dollar	17.85	18.95	18.95	18.95	18.95	20.95	21.85	22.53
Sudan	Population	Thousand Person	27,851	28,582	29,349	30,141	30,812	31,585	32,511	33,345
Swaziland	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.83	1.88	1.93	2.02	2.09	2.16	2.22	2.28
Swaziland	Population	Thousand Person	962	992	998	1,005	1,031	1,054	1,076	1,094
Tanzania	GDP, Constant Prices	Billion 2006 U.S. Dollar	7.37	7.46	7.57	7.84	8.20	8.49	8.80	9.12
Tanzania	Population	Thousand Person	26,767	27,697	28,798	29,753	30,392	31,093	31,951	32,808
Togo	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.78	1.49	1.70	1.82	1.95	2.03	1.98	2.03
Togo	Population	Thousand Person	3,748	3,726	3,750	3,966	4,158	4,321	4,455	4,583
Uganda	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.72	4.03	4.29	4.77	5.20	5.49	5.70	6.16
Uganda	Population	Thousand Person	18,729	19,424	20,128	20,690	21,249	21,861	22,502	23,228
Zambia	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.39	8.39	7.27	7.07	7.56	7.81	7.66	7.83
Zambia	Population	Thousand Person	8,445	8,671	8,892	9,102	9,306	9,529	9,750	9,967
Zimbabwe	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.21	6.34	6.71	6.72	7.37	7.47	7.48	7.21
Zimbabwe	Population	Thousand Person	10,720	10,976	11,086	11,159	11,317	11,469	11,607	11,733
Other Sub-Saharan Africa	GDP, Constant Prices	Billion 2006 U.S. Dollar	39.95	41.17	41.21	42.92	44.90	47.76	50.45	52.93
Other Sub-Saharan Africa	Population	Thousand Person	110,642	113,373	114,591	116,747	120,710	124,670	128,128	131,631

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Appendix A: Demand Estimates

Liberia	Population	Thousand Person	2,695	2,759	2,816	2,812	2,809	2,902	3,044	3,196	3,335	3,442	3,534
Madagascar	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.68	4.96	4.34	5.01	5.17	5.42	5.78	6.14	6.56	6.95	7.68
Madagascar	Population	Thousand Person	15,742	16,227	16,726	17,240	17,768	18,312	18,872	19,449	20,043	20,654	21,282
Malawi	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.68	2.56	2.61	2.72	2.86	2.92	3.16	3.43	3.70	3.94	4.25
Malawi	Population	Thousand Person	11,560	11,833	12,109	12,389	12,677	12,975	13,284	13,603	13,932	14,269	14,613
Mali	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.34	4.86	5.07	5.44	5.56	5.90	6.22	6.41	6.73	7.00	7.35
Mali	Population	Thousand Person	10,049	10,294	10,550	10,815	11,091	11,379	11,681	11,995	12,324	12,667	13,025
Mauritania	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.99	2.05	2.07	2.18	2.30	2.42	2.70	2.72	2.78	2.94	3.13
Mauritania	Population	Thousand Person	2,668	2,747	2,829	2,913	2,999	3,087	3,177	3,270	3,365	3,462	3,561
Mauritius	GDP, Constant Prices	Billion 2006 U.S. Dollar	5.14	5.35	5.43	5.64	5.91	6.09	6.31	6.65	6.98	7.25	7.63
Mauritius	Population	Thousand Person	1,186	1,198	1,210	1,221	1,232	1,243	1,253	1,264	1,274	1,284	1,294
Mozambique	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.35	4.88	5.33	5.68	6.12	6.64	7.21	7.72	8.18	8.70	9.25
Mozambique	Population	Thousand Person	18,125	18,559	18,979	19,383	19,773	20,154	20,530	20,906	21,285	21,669	22,061
Namibia	GDP, Constant Prices	Billion 2006 U.S. Dollar	5.28	5.40	5.76	5.97	6.36	6.66	6.92	7.18	7.44	7.67	8.02
Namibia	Population	Thousand Person	1,893	1,935	1,961	1,983	2,007	2,028	2,049	2,069	2,089	2,109	2,128
Niger	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.62	2.82	2.97	3.20	3.17	3.41	3.58	3.70	3.88	4.02	4.21
Niger	Population	Thousand Person	10,516	10,823	11,141	11,470	11,810	12,163	12,525	12,895	13,273	13,659	14,054
Nigeria	GDP, Constant Prices	Billion 2006 U.S. Dollar	82.05	88.75	107.55	118.66	131.22	138.30	146.89	156.44	166.29	175.94	186.85
Nigeria	Population	Thousand Person	123,179	126,014	128,864	131,728	134,605	137,495	140,398	143,312	146,255	149,229	152,217
Rwanda	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.00	2.17	2.41	2.41	2.54	2.72	2.87	3.04	3.28	3.45	3.64
Rwanda	Population	Thousand Person	8,278	8,467	8,686	8,897	9,128	9,378	9,638	9,908	10,186	10,473	10,769
São Tomé and Príncipe	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.09	0.09	0.10	0.10	0.11	0.12	0.12	0.13	0.14	0.15	0.15
São Tomé and Príncipe	Population	Thousand Person	160	165	170	176	182	188	194	200	206	213	219
Senegal	GDP, Constant Prices	Billion 2006 U.S. Dollar	7.22	7.55	7.60	8.11	8.59	9.07	9.28	9.70	10.14	10.62	11.24
Senegal	Population	Thousand Person	10,332	10,617	10,913	11,218	11,534	11,860	12,191	12,522	12,853	13,185	13,516
Seychelles	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.80	0.79	0.80	0.75	0.73	0.74	0.78	0.83	0.85	0.85	0.88
Seychelles	Population	Thousand Person	79	80	80	80	81	81	82	82	82	83	83
Sierra Leone	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.70	0.83	1.05	1.15	1.24	1.33	1.42	1.52	1.60	1.68	1.79
Sierra Leone	Population	Thousand Person	4,816	5,087	5,365	5,571	5,739	5,874	6,013	6,152	6,295	6,440	6,589
Somalia	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.81	1.86	1.93	2.00	2.07	2.14	2.21	2.27	2.34	2.40	2.47
Somalia	Population	Thousand Person	7,386	7,627	7,897	8,174	8,459	8,752	9,030	9,292	9,559	9,832	10,112
South Africa	GDP, Constant Prices	Billion 2006 U.S. Dollar	201.88	207.40	215.01	221.71	232.50	244.13	257.28	270.40	279.59	287.42	300.07
South Africa	Population	Thousand Person	45,064	45,576	46,077	46,567	47,033	47,483	47,926	48,367	48,783	49,052	49,109
Sudan	GDP, Constant Prices	Billion 2006 U.S. Dollar	24.42	25.92	27.31	29.27	30.76	32.71	36.40	40.08	44.21	47.74	51.61
Sudan	Population	Thousand Person	34,194	35,063	35,909	36,593	37,097	37,763	38,574	39,379	40,218	41,088	41,980
Swaziland	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.32	2.35	2.39	2.48	2.54	2.60	2.67	2.76	2.82	2.87	2.92
Swaziland	Population	Thousand Person	1,110	1,122	1,130	1,136	1,138	1,138	1,136	1,133	1,129	1,124	1,119
Tanzania	GDP, Constant Prices	Billion 2006 U.S. Dollar	9.57	10.14	10.87	11.61	12.52	13.45	14.35	15.37	16.48	17.51	18.74
Tanzania	Population	Thousand Person	33,712	34,567	35,383	36,199	36,990	37,771	38,569	39,384	40,213	41,049	41,893
Togo	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.01	1.96	1.96	2.06	2.11	2.13	2.22	2.27	2.29	2.35	2.42
Togo	Population	Thousand Person	4,712	4,843	4,977	5,115	5,255	5,400	5,549	5,702	5,859	6,020	6,185
Uganda	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.50	6.84	7.42	7.91	8.45	8.99	9.96	10.84	11.70	12.39	13.33
Uganda	Population	Thousand Person	23,956	24,690	25,470	26,322	27,234	28,199	29,207	30,263	31,368	32,370	33,399
Zambia	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.11	8.51	8.79	9.24	9.74	10.26	10.89	11.57	12.27	12.84	13.61
Zambia	Population	Thousand Person	10,205	10,440	10,633	10,800	10,962	11,115	11,288	11,477	11,670	11,863	12,057
Zimbabwe	GDP, Constant Prices	Billion 2006 U.S. Dollar	6.69	6.51	6.23	5.58	5.38	5.17	4.89	4.58	4.36	4.27	4.18
Zimbabwe	Population	Thousand Person	11,820	11,868	11,866	11,816	11,735	11,639	11,544	11,443	11,350	11,393	11,652
Other Sub-Saharan Africa	GDP, Constant Prices	Billion 2006 U.S. Dollar	54.83	59.36	62.07	65.93	71.94	76.07	80.00	85.41	90.07	94.12	99.38
Other Sub-Saharan Africa	Population	Thousand Person	135,178	138,927	142,963	147,175	151,456	155,778	160,189	164,752	169,442	174,109	178,885

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Liberia	Population	Thousand Person	3,618	3,693	3,769	3,846	3,923	4,001	4,080	4,161	4,242	4,324
Madagascar	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.34	8.83	9.37	10.09	10.86	11.69	12.59	13.55	14.59	15.70
Madagascar	Population	Thousand Person	21,926	22,586	23,260	23,948	24,651	25,368	26,099	26,844	27,602	28,374
Malawi	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.52	4.81	5.12	5.46	5.83	6.22	6.64	7.08	7.55	8.06
Malawi	Population	Thousand Person	14,964	15,320	15,681	16,048	16,418	16,792	17,169	17,549	17,930	18,313
Mali	GDP, Constant Prices	Billion 2006 U.S. Dollar	7.79	8.11	8.47	8.89	9.33	9.79	10.27	10.78	11.31	11.86
Mali	Population	Thousand Person	13,398	13,787	14,192	14,615	15,055	15,511	15,984	16,474	16,981	17,505
Mauritania	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.32	3.74	3.98	4.30	4.65	5.03	5.43	5.87	6.35	6.86
Mauritania	Population	Thousand Person	3,663	3,767	3,873	3,981	4,091	4,203	4,317	4,433	4,551	4,671
Mauritius	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.03	8.44	8.87	9.33	9.81	10.31	10.85	11.41	12.00	12.61
Mauritius	Population	Thousand Person	1,304	1,313	1,322	1,331	1,340	1,348	1,356	1,364	1,372	1,379
Mozambique	GDP, Constant Prices	Billion 2006 U.S. Dollar	9.86	10.50	11.18	11.90	12.67	13.50	14.37	15.30	16.29	17.35
Mozambique	Population	Thousand Person	22,463	22,874	23,295	23,726	24,166	24,615	25,072	25,536	26,006	26,480
Namibia	GDP, Constant Prices	Billion 2006 U.S. Dollar	8.40	8.80	9.20	9.63	10.09	10.56	11.05	11.57	12.11	12.68
Namibia	Population	Thousand Person	2,148	2,166	2,183	2,198	2,212	2,225	2,236	2,246	2,255	2,263
Niger	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.43	4.79	5.00	5.29	5.60	5.93	6.27	6.64	7.03	7.44
Niger	Population	Thousand Person	14,457	14,868	15,288	15,715	16,152	16,597	17,049	17,510	17,979	18,457
Nigeria	GDP, Constant Prices	Billion 2006 U.S. Dollar	200.63	215.46	230.60	246.91	264.38	283.09	303.12	324.56	347.52	372.11
Nigeria	Population	Thousand Person	155,216	158,223	161,236	164,253	167,271	170,291	173,311	176,330	179,342	182,344
Rwanda	GDP, Constant Prices	Billion 2006 U.S. Dollar	3.84	4.06	4.28	4.52	4.78	5.05	5.33	5.63	5.94	6.28
Rwanda	Population	Thousand Person	11,072	11,380	11,694	12,012	12,332	12,656	12,983	13,314	13,647	13,983
São Tomé and Príncipe	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.16	0.17	0.19	0.20	0.21	0.23	0.24	0.26	0.28	0.30
São Tomé and Príncipe	Population	Thousand Person	226	233	240	247	255	262	269	277	284	292
Senegal	GDP, Constant Prices	Billion 2006 U.S. Dollar	11.87	12.51	13.18	13.91	14.68	15.50	16.36	17.26	18.22	19.23
Senegal	Population	Thousand Person	13,849	14,185	14,523	14,864	15,207	15,552	15,898	16,246	16,596	16,946
Seychelles	GDP, Constant Prices	Billion 2006 U.S. Dollar	0.91	0.94	0.98	1.01	1.05	1.08	1.12	1.16	1.20	1.24
Seychelles	Population	Thousand Person	83	84	84	84	85	85	85	86	86	86
Sierra Leone	GDP, Constant Prices	Billion 2006 U.S. Dollar	1.91	2.03	2.17	2.31	2.46	2.62	2.79	2.97	3.16	3.37
Sierra Leone	Population	Thousand Person	6,740	6,895	7,053	7,214	7,377	7,544	7,713	7,885	8,060	8,237
Somalia	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.54	2.61	2.69	2.76	2.84	2.92	3.01	3.09	3.18	3.27
Somalia	Population	Thousand Person	10,400	10,693	10,992	11,296	11,607	11,925	12,250	12,582	12,923	13,272
South Africa	GDP, Constant Prices	Billion 2006 U.S. Dollar	314.49	330.14	346.64	363.33	380.82	399.15	418.37	438.51	459.62	481.75
South Africa	Population	Thousand Person	49,004	48,810	48,601	48,376	48,286	48,339	48,390	48,440	48,487	48,530
Sudan	GDP, Constant Prices	Billion 2006 U.S. Dollar	55.26	58.32	61.06	64.93	69.05	73.42	78.07	83.02	88.28	93.87
Sudan	Population	Thousand Person	42,898	43,843	44,812	45,803	46,813	47,840	48,877	49,924	50,979	52,041
Swaziland	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.99	3.07	3.15	3.22	3.30	3.37	3.45	3.54	3.62	3.71
Swaziland	Population	Thousand Person	1,113	1,107	1,102	1,096	1,090	1,084	1,078	1,071	1,063	1,056
Tanzania	GDP, Constant Prices	Billion 2006 U.S. Dollar	20.23	21.85	23.49	25.30	27.24	29.34	31.59	34.02	36.64	39.46
Tanzania	Population	Thousand Person	42,747	43,602	44,455	45,299	46,123	46,930	47,723	48,498	49,255	49,989
Togo	GDP, Constant Prices	Billion 2006 U.S. Dollar	2.52	2.62	2.73	2.83	2.94	3.05	3.17	3.29	3.42	3.55
Togo	Population	Thousand Person	6,354	6,526	6,701	6,880	7,061	7,244	7,430	7,618	7,808	8,000
Uganda	GDP, Constant Prices	Billion 2006 U.S. Dollar	14.40	15.55	16.48	17.72	19.05	20.49	22.03	23.68	25.46	27.38
Uganda	Population	Thousand Person	34,612	35,873	37,181	38,537	39,941	41,394	42,894	44,443	46,042	47,691
Zambia	GDP, Constant Prices	Billion 2006 U.S. Dollar	14.41	15.26	16.17	17.13	18.15	19.22	20.36	21.57	22.85	24.21
Zambia	Population	Thousand Person	12,251	12,443	12,635	12,826	13,017	13,206	13,395	13,581	13,766	13,948
Zimbabwe	GDP, Constant Prices	Billion 2006 U.S. Dollar	4.09	4.05	4.07	4.02	3.97	3.92	3.88	3.83	3.78	3.74
Zimbabwe	Population	Thousand Person	12,084	12,620	13,183	13,772	14,230	14,547	14,868	15,191	15,512	15,832
Other Sub-Saharan Africa	GDP, Constant Prices	Billion 2006 U.S. Dollar	105.12	111.20	116.44	122.97	129.90	137.26	145.07	153.38	162.21	171.60
Other Sub-Saharan Africa	Population	Thousand Person	183,929	189,098	194,390	199,808	205,355	211,030	216,831	222,757	228,806	234,978

Demand Estimates
Appendix A

World Petroleum Liquids Consumption by WORLD® Region, 2005-2020

(Million tonnes per year)

Region/Country	2005	2010	2015	2020	Average Annual Growth		
					2005-2010	2010-2015	2015-2020
Total World	4,470	4,616	4,770	5,057	0.6%	0.7%	1.2%
US East Coast	349	331	337	337	-1.0%	0.4%	0.0%
US Mid West	282	267	272	271	-1.1%	0.3%	-0.1%
US Gulf Coast	275	262	268	268	-1.0%	0.4%	0.0%
US Rocky Mountain	34	33	34	35	-0.7%	0.7%	0.3%
US West Coast	169	162	167	169	-0.8%	0.6%	0.2%
Canada East	79	77	76	77	-0.5%	-0.3%	0.4%
Canada West	46	45	44	45	-0.5%	-0.3%	0.4%
Greater Caribbean	219	251	257	273	2.7%	0.4%	1.2%
Rest of South America	184	210	215	228	2.7%	0.4%	1.2%
Europe North	535	516	494	488	-0.7%	-0.9%	-0.2%
Europe South	253	256	256	264	0.2%	0.0%	0.7%
Europe East	84	92	92	95	1.9%	0.0%	0.7%
Caspian Region	30	33	35	38	1.9%	0.9%	1.7%
Russia & Other FSU	192	205	210	222	1.4%	0.5%	1.1%
North Africa/Eastern Med	113	122	128	138	1.4%	1.1%	1.4%
Sub-Saharan Africa	70	84	97	120	3.7%	3.1%	4.3%
West Africa	28	32	39	49	3.2%	3.7%	4.8%
<i>West</i>	9	11	13	15	3.3%	3.0%	4.1%
<i>Nigeria +</i>	16	18	23	30	3.0%	4.6%	5.5%
<i>West Central</i>	3	3	4	4	3.5%	1.2%	2.7%
South Africa +	28	33	37	44	3.9%	2.2%	3.2%
East Africa	14	18	21	27	4.4%	3.7%	5.0%
<i>South East</i>	4	4	5	6	2.2%	3.0%	4.4%
<i>East Central</i>	5	7	8	10	5.0%	4.2%	5.3%
<i>East - Red Sea</i>	5	7	8	11	5.4%	3.8%	5.1%
Middle East	277	306	331	360	2.0%	1.6%	1.7%
Pacific Industrialized	342	305	289	286	-2.3%	-1.1%	-0.2%
Pacific High Growth	384	395	431	469	0.6%	1.8%	1.7%
China	357	454	499	603	4.9%	1.9%	3.9%
Rest of Asia	194	209	238	271	1.5%	2.7%	2.6%

Demand Estimates
Appendix A

World Petroleum Liquids Production by WORLD® Region, 2005-2020				
<i>(Million tonnes per year)</i>				
Region/Country	2005	2010	2015	2020
Total Conventional Production	4,339	4,375	4,416	4,602
Total Unconventional Production	133	260	369	457
Total Production	4,472	4,635	4,785	5,060
US East Coast	2	2	2	2
US Mid West	33	43	44	48
US Gulf Coast	212	261	265	287
US Rocky Mountain	26	33	34	37
US West Coast	119	128	130	141
<i>US Biofuels</i>	11	41	56	64
<i>US Coal-to-Liquids</i>	0	0	0	9
Canada East	21	18	10	5
Canada West	82	84	70	61
<i>Canada Oil Sands</i>	59	86	126	157
Greater Caribbean	424	317	285	287
Mexico	201	153	135	120
Ecuador	29	23	24	26
Venezuela	152	98	90	103
<i>Venezuela Extra Heavy Oil</i>	32	39	43	57
Colombia	28	27	16	17
Trinidad & Tobago	10	11	11	6
Other	5	6	9	16
Rest of South America	157	180	199	230
Brazil	106	132	155	184
<i>Brazil Biofuels</i>	11	13	24	38
Argentina	41	37	27	22
Peru	6	5	11	11
Other	4	5	7	12
Europe North	283	209	174	149
Denmark	20	15	10	6
Norway	158	122	99	90
United Kingdom	96	61	52	40
Other	8	12	12	13
<i>Europe North Biofuels</i>	3	8	9	10
Europe South	12	13	14	15
<i>Europe South Biofuels</i>	2	9	11	11
Europe East	4	13	10	11
<i>Europe East Biofuels</i>	1	1	1	2
Caspian Region	112	176	211	229
Russia & Other FSU	515	515	525	553
<i>Russia & Other FSU Biofuels</i>	1	1	1	1

Demand Estimates
Appendix A

World Petroleum Liquids Production by WORLD® Region, 2005-2020 (continued)				
<i>(Million tonnes per year)</i>				
Region/Country	2005	2010	2015	2020
North Africa/Eastern Med	245	261	277	285
Algeria	112	130	152	164
Libya	92	97	90	82
Egypt	37	30	31	35
Tunisia	4	4	4	4
Morocco	0	0	0	0
Sub-Saharan Africa	301	366	386	391
West Africa	204	197	218	220
West	0	1	4	4
Ghana	0	0	3	3
Mauritania	0	1	1	1
Nigeria +	140	134	150	149
Nigeria	140	134	150	149
West Central	64	62	63	67
Cameroon	4	4	4	4
Chad	9	10	10	10
Congo Republic	13	10	15	20
DR Congo	1	1	1	1
Cote d'Ivoire	2	2	2	2
Equatorial Guinea	20	25	21	20
Gabon	14	10	10	10
South Africa +	78	131	135	138
Angola	67	123	127	130
South Africa	11	8	8	8
<i>South Africa Coal-to-Liquids</i>	9	9	9	9
<i>South Africa Gas-to-Liquids</i>	0	4	4	5
East Africa	19	38	33	33
South East	0	0	0	0
DR Congo	0	0	0	0
East Central	0	2	2	2
Uganda	0	2	2	2
East - Red Sea	19	35	31	30
Sudan	19	35	31	30

Demand Estimates
Appendix A

World Petroleum Liquids Production by WORLD® Region, 2005-2020 (continued)				
<i>(Million tonnes per year)</i>				
Region/Country	2005	2010	2015	2020
Middle East	1,363	1,297	1,342	1,428
Iran	226	213	194	185
Iraq	101	104	103	154
Kuwait	142	135	143	142
Qatar	59	83	103	129
<i>Qatar Gas-to-Liquids</i>	0	3	8	8
Saudi Arabia	592	539	583	597
United Arab Emirates	151	150	143	148
Oman	42	36	38	38
Syria	26	21	19	16
Yemen	21	15	14	16
Bahrain	2	2	2	2
Jordan	0	0	0	0
Pacific Industrialized	31	51	50	50
Japan	1	7	8	8
Australia and New Zealand	30	44	42	42
Pacific High Growth	150	141	133	141
Indonesia	61	48	42	39
Brunei	11	11	10	11
Malaysia	40	32	31	39
<i>Malaysia Gas-to-Liquids</i>	1	1	1	1
Thailand	15	21	21	22
Vietnam	21	27	26	28
Other	2	2	2	2
China	193	200	188	188
<i>China Biofuels</i>	5	9	9	14
<i>China Coal-to-Liquids</i>	0	1	5	5
<i>China Methanol</i>	0	32	54	58
Rest of Asia	55	67	66	65
India	42	53	52	56
<i>India Biofuels</i>	0	4	9	9
Other	12	14	13	9

Demand Estimates Appendix A

Total Consumption, Petroleum

(Includes marine bunkers and final consumption; excludes refinery own use and distribution losses)

<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	9,229	9,270	9,889	9,818	10,836	10,841	11,111	11,430	11,817	12,139	12,580	13,075	13,615	14,148	14,738	15,361	3.5%	3.4%
Côte d'Ivoire	2,016	1,939	2,032	2,017	2,134	2,139	2,182	2,228	2,287	2,334	2,395	2,463	2,536	2,608	2,687	2,769	2.1%	2.4%
Ghana	2,367	2,433	2,619	2,627	2,920	2,932	3,004	3,097	3,220	3,315	3,443	3,587	3,743	3,898	4,069	4,250	4.0%	3.8%
Senegal	1,794	1,474	1,757	1,742	1,935	1,941	1,984	2,028	2,089	2,140	2,212	2,293	2,381	2,467	2,562	2,662	2.7%	3.3%
Burkina Faso	379	466	434	428	483	483	498	513	534	550	573	599	627	655	685	718	4.3%	4.0%
Cape Verde	275	345	372	373	420	420	434	447	465	480	500	524	549	574	602	631	5.7%	4.1%
Gambia, The	102	110	119	118	134	134	138	141	147	151	157	163	171	178	186	194	4.4%	3.9%
Guinea	617	602	611	603	674	668	686	704	727	746	773	803	837	869	906	944	2.9%	3.4%
Guinea-Bissau	62	64	68	67	74	73	73	74	76	77	78	80	83	85	87	90	2.5%	2.1%
Liberia	355	391	360	361	408	410	441	471	504	536	575	619	669	720	776	838	5.9%	6.7%
Mali	438	617	644	640	716	713	733	742	761	777	802	830	861	890	924	958	5.4%	3.1%
Mauritania	535	523	550	520	577	567	570	605	614	629	650	675	702	728	757	788	2.6%	2.8%
Sierra Leone	288	307	324	322	361	361	370	380	394	405	420	438	457	476	498	520	4.0%	3.7%
Nigeria +	15,614	14,829	15,705	15,795	17,999	18,123	18,882	19,696	20,674	21,533	22,656	23,876	25,214	26,563	28,061	29,659	4.4%	5.0%
Benin	363	378	392	388	437	435	445	456	472	484	502	522	544	565	589	613	3.6%	3.5%
Nigeria	14,549	13,819	14,678	14,793	16,881	17,018	17,756	18,544	19,490	20,325	21,410	22,586	23,877	25,180	26,627	28,171	4.5%	5.1%
Togo	545	487	461	441	487	477	481	486	496	501	511	524	538	550	565	579	0.4%	1.8%
Niger	156	144	174	173	194	194	199	209	215	223	233	244	256	267	281	294	4.3%	4.1%
West Central	2,795	2,844	3,012	2,989	3,333	3,325	3,350	3,377	3,419	3,459	3,534	3,624	3,723	3,817	3,923	4,034	2.5%	2.3%
Cameroon	1,033	1,032	1,087	1,070	1,194	1,183	1,209	1,238	1,279	1,309	1,353	1,403	1,458	1,510	1,569	1,630	3.1%	3.2%
DR Congo	253	203	229	231	259	264	270	274	278	284	294	305	317	328	341	354	2.3%	3.4%
Congo Republic	334	409	388	396	454	466	456	449	445	444	448	453	459	464	470	476	2.4%	1.6%
Gabon	730	743	819	808	889	878	870	861	856	852	854	858	864	867	872	878	1.2%	0.5%
Central African Republic	47	49	55	54	61	61	62	64	66	67	69	72	75	77	80	83	4.0%	3.2%
Chad	182	184	199	192	214	210	210	211	213	214	217	221	225	229	233	238	1.8%	1.4%
Equatorial Guinea	216	224	235	237	262	264	272	280	282	288	299	312	327	341	358	375	3.7%	3.7%

Demand Estimates Appendix A

Total Consumption, Petroleum (continued)																	% Δ p.a.	% Δ p.a.
(Includes marine bunkers and final consumption; excludes refinery own use and distribution losses)																		
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2005-2020	2007-2020
South Africa +	27,572	28,741	30,247	30,133	33,411	33,428	33,924	34,622	35,523	36,219	37,253	38,415	39,679	40,881	42,218	43,610	3.1%	2.9%
Angola	2,577	2,923	2,918	3,183	3,799	4,001	3,907	3,942	3,904	3,939	4,015	4,104	4,204	4,293	4,396	4,503	3.8%	3.4%
Botswana	630	676	741	734	823	815	836	864	890	914	947	986	1,028	1,068	1,114	1,162	4.2%	3.5%
Mozambique	130	134	147	148	169	172	178	185	194	202	212	223	236	248	262	277	5.2%	5.0%
Namibia	727	756	771	759	847	841	857	876	901	921	951	984	1,021	1,056	1,096	1,137	3.0%	3.0%
South Africa	23,218	23,873	25,214	24,866	27,285	27,124	27,667	28,275	29,146	29,752	30,630	31,609	32,671	33,684	34,808	35,978	3.0%	2.8%
Lesotho	65	142	152	149	165	162	164	167	171	173	177	183	188	193	199	205	8.0%	2.3%
Swaziland	201	208	271	262	287	277	276	275	276	275	277	280	283	285	289	292	2.5%	0.6%
São Tomé and Príncipe	23	27	32	32	36	36	37	39	41	42	44	47	49	52	54	57	6.2%	4.5%
South East	3,822	3,764	3,829	3,796	4,254	4,271	4,377	4,479	4,632	4,759	4,942	5,151	5,380	5,606	5,858	6,125	3.2%	3.7%
DR Congo	109	88	99	100	112	114	117	119	121	124	129	134	139	144	150	156	2.4%	3.6%
Mozambique	388	401	437	441	506	512	532	552	579	603	633	667	704	741	782	826	5.2%	5.0%
Zambia	427	431	512	515	583	588	606	626	652	675	704	738	775	811	851	893	5.0%	4.4%
Madagascar	566	546	579	584	666	695	732	755	787	824	872	926	986	1,046	1,113	1,184	5.0%	5.7%
Malawi	239	264	315	320	367	374	385	398	415	430	450	473	497	522	549	578	6.1%	4.8%
Mauritius	1,072	1,092	1,093	1,085	1,210	1,209	1,235	1,263	1,303	1,335	1,381	1,435	1,494	1,551	1,614	1,681	3.0%	3.4%
Seychelles	348	371	385	373	405	395	396	398	406	408	415	423	433	441	451	461	1.9%	1.4%
Comoros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.5%	7.9%
Zimbabwe	671	571	409	377	406	384	374	367	368	361	357	355	353	350	348	346	-4.3%	-1.3%
East Central	5,131	5,409	5,707	5,679	6,497	6,549	6,799	7,065	7,384	7,668	8,041	8,459	8,914	9,369	9,873	10,408	4.8%	4.7%
Kenya	2,894	3,262	3,387	3,323	3,716	3,733	3,861	3,998	4,178	4,325	4,522	4,743	4,984	5,222	5,486	5,764	4.7%	4.2%
Tanzania	1,363	1,243	1,302	1,322	1,510	1,532	1,604	1,682	1,771	1,854	1,959	2,077	2,205	2,335	2,479	2,632	4.5%	5.6%
Burundi	81	85	89	88	99	99	101	103	107	109	113	118	123	127	132	138	3.6%	3.4%
Rwanda	139	146	160	163	184	184	188	193	200	205	212	221	230	239	249	260	4.3%	3.8%
Uganda	654	673	769	783	988	1,003	1,045	1,089	1,128	1,174	1,233	1,300	1,372	1,446	1,527	1,614	6.2%	5.9%
East - Red Sea	5,405	5,164	5,806	5,995	6,900	7,025	7,299	7,523	7,795	8,078	8,454	8,875	9,334	9,789	10,292	10,824	4.7%	4.9%
Eritrea	208	160	165	162	181	182	190	195	204	210	219	229	240	250	261	273	1.8%	4.0%
Ethiopia	1,450	1,617	1,713	1,771	2,024	2,063	2,157	2,256	2,384	2,493	2,631	2,785	2,951	3,118	3,302	3,497	6.0%	5.6%
Sudan	3,488	3,126	3,659	3,797	4,398	4,487	4,653	4,766	4,893	5,053	5,271	5,517	5,785	6,050	6,343	6,653	4.4%	4.7%
Djibouti	110	113	125	125	140	140	146	152	159	165	173	182	192	202	213	225	4.9%	4.6%
Somalia	147	147	144	141	157	153	154	154	156	157	159	162	166	169	172	176	1.2%	1.5%
Total	69,566	70,019	74,195	74,205	83,230	83,563	85,741	88,192	91,244	93,856	97,460	101,475	105,859	110,172	114,963	120,021	3.7%	3.8%

**Demand Estimates
Appendix A**

Marine Bunkers, Gasoil																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	1,216	1,229	1,241	1,253	1,265	1,278	1,291	1,304	1,318	1,331	1,345	1,359	1,373	1,388	1,403	1,418	1.0%	1.0%
Côte d'Ivoire	485	490	494	499	504	509	515	520	525	530	535	541	546	552	557	563	1.0%	1.0%
Ghana	485	490	494	499	504	509	515	520	525	530	535	541	546	552	557	563	1.0%	1.0%
Senegal	242	245	247	250	252	255	257	260	262	265	268	270	273	276	279	281	1.0%	1.0%
Burkina Faso	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4%	7.4%
Gambia, The	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4%	7.4%
Guinea	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	6.4%	7.4%
Guinea-Bissau	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4%	7.4%
Liberia	1	1	1	1	1	1	1	1	2	2	2	2	2	3	3	3	6.4%	7.4%
Mali	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritania	1	2	1	1	1	1	2	2	2	2	2	2	3	3	3	4	6.4%	7.4%
Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	6.4%	7.4%
Nigeria +	111	98	100	100	102	104	105	107	109	111	113	115	118	120	123	126	0.9%	1.8%
Benin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria	109	97	98	98	101	102	104	105	107	109	111	114	116	119	122	125	0.9%	1.8%
Togo	2	1	2	1	2	2	2	2	2	2	2	2	2	2	2	2	-2.2%	0.5%
Niger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Central	74	108	99	98	97	97	97	97	97	97	98	99	101	102	104	106	2.4%	0.5%
Cameroon	11	43	35	34	33	32	32	32	33	33	33	33	33	33	33	33	7.5%	-0.5%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	52	54	54	54	55	55	54	53	52	51	51	50	49	48	47	47	-0.8%	-1.1%
Central African Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equatorial Guinea	10	11	10	10	9	10	11	12	12	13	15	17	19	21	24	26	6.4%	7.4%

Demand Estimates Appendix A

Marine Bunkers, Gasoil	(continued)																% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
South Africa +	329	354	364	376	384	396	414	433	454	470	486	500	514	528	541	555	3.5%	3.3%
Angola	24	24	24	25	25	25	26	28	29	31	32	34	35	37	39	41	3.6%	4.1%
Botswana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	3	9.8%	9.2%
Namibia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	304	328	339	350	357	369	386	403	422	437	451	464	476	488	499	510	3.5%	3.2%
Lesotho	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swaziland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
São Tomé and Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4%	7.4%
South East	11	12	12	12	12	13	15	16	17	18	20	22	25	27	30	32	7.3%	8.0%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	3	3	3	4	4	5	5	6	7	7	8	8	9	9	10	10	9.8%	9.2%
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Madagascar	3	3	3	2	2	2	3	3	3	3	4	4	5	5	6	6	6.4%	7.4%
Malawi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritius	6	6	6	5	5	5	6	7	7	7	8	9	10	12	13	14	6.4%	7.4%
Seychelles	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	6.4%	7.4%
Comoros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.4%	7.4%
Zimbabwe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	18	20	21	21	23	24	25	27	29	31	33	35	37	39	42	45	6.1%	5.9%
Kenya	17	19	19	19	19	20	20	21	22	23	24	25	26	27	29	30	3.8%	3.5%
Tanzania	1	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	19.0%	16.9%
Burundi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rwanda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uganda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East - Red Sea	8	10	13	17	19	23	26	28	31	34	37	40	43	46	49	53	13.8%	11.2%
Eritrea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethiopia	-	-	1	2	3	4	5	5	6	7	8	9	10	11	12	13	-	19.1%
Sudan	7	9	11	14	16	18	20	22	23	25	27	30	32	34	36	38	12.1%	9.8%
Djibouti	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	6.4%	7.4%
Somalia	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	6.4%	7.4%
Total	1,767	1,830	1,850	1,876	1,900	1,934	1,974	2,013	2,053	2,092	2,131	2,171	2,211	2,251	2,292	2,334	1.9%	1.8%

**Demand Estimates
Appendix A**

Marine Bunkers, Fuel Oil																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	566	572	577	582	587	593	600	607	613	619	627	634	642	650	658	667	1.1%	1.1%
Côte d'Ivoire	560	565	571	577	582	588	594	600	606	612	618	624	631	637	643	650	1.0%	1.0%
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burkina Faso	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cape Verde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.6%	8.2%
Gambia, The	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.6%	8.2%
Guinea	2	2	2	1	1	1	2	2	2	2	2	3	3	3	4	4	6.6%	8.2%
Guinea-Bissau	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6.6%	8.2%
Liberia	2	2	2	2	1	1	2	2	2	2	2	3	3	4	4	5	6.6%	8.2%
Mali	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritania	2	2	2	2	1	2	2	2	2	2	3	3	4	4	5	6	6.6%	8.2%
Sierra Leone	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	6.6%	8.2%
Nigeria +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Togo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Niger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Central	148	156	155	155	158	161	162	162	162	163	165	167	170	173	176	180	1.3%	1.2%
Cameroon	2	11	8	8	8	7	8	8	8	8	8	8	9	9	9	10	10.0%	1.1%
DR Congo	2	2	3	3	3	4	5	5	5	6	6	7	8	8	9	9	11.5%	10.7%
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	129	127	130	132	137	137	136	134	132	132	130	129	127	126	124	122	-0.4%	-0.5%
Central African Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equatorial Guinea	15	16	14	12	10	12	14	15	16	17	20	23	26	30	35	39	6.6%	8.2%

Demand Estimates Appendix A

Marine Bunkers, Fuel Oil	(continued)																% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
South Africa +	2,909	2,840	2,944	3,027	3,088	3,163	3,254	3,346	3,442	3,511	3,572	3,622	3,667	3,708	3,746	3,781	1.8%	1.9%
Angola	1	1	10	18	26	34	33	35	35	38	41	45	48	51	54	57	30.9%	14.5%
Botswana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	-	-	0	0	0	1	1	1	1	1	1	2	2	2	2	2	-	22.7%
Namibia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	2,908	2,839	2,934	3,008	3,061	3,128	3,220	3,310	3,407	3,472	3,529	3,575	3,617	3,656	3,690	3,722	1.7%	1.8%
Lesotho	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swaziland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
São Tomé and Príncipe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.6%	8.2%
South East	15	16	15	15	13	16	19	21	22	24	27	31	36	40	45	50	8.5%	9.7%
DR Congo	2	2	3	3	3	4	5	5	5	6	6	7	8	8	9	9	11.5%	10.7%
Mozambique	-	-	0	1	1	2	2	3	3	4	4	5	5	6	6	7	-	22.7%
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Madagascar	4	4	4	3	2	3	3	4	4	4	5	6	7	8	9	10	6.6%	8.2%
Malawi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritius	8	9	8	7	6	7	8	9	9	10	11	13	15	17	19	22	6.6%	8.2%
Seychelles	1	1	1	0	0	0	1	1	1	1	1	1	1	1	1	2	6.6%	8.2%
Comoros	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.6%	8.2%
Zimbabwe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	49	56	65	73	83	92	102	112	122	131	141	151	160	170	180	190	9.5%	8.6%
Kenya	24	27	34	39	45	51	57	63	69	75	81	87	93	99	105	110	10.7%	9.5%
Tanzania	25	29	31	35	38	41	45	49	52	56	60	64	67	71	75	80	8.1%	7.5%
Burundi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rwanda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uganda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East - Red Sea	1	1	19	35	48	62	75	88	101	113	124	135	146	156	165	174	41.4%	18.6%
Eritrea	-	-	2	3	4	6	7	8	9	10	11	12	13	14	14	15	-	18.3%
Ethiopia	-	-	16	31	43	55	68	79	91	102	112	122	131	140	149	157	-	19.0%
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Djibouti	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	6.6%	8.2%
Somalia	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	6.6%	8.2%
Total	3,688	3,641	3,774	3,887	3,976	4,067	4,212	4,335	4,462	4,562	4,656	4,740	4,820	4,897	4,971	5,042	2.1%	2.3%

Demand Estimates Appendix A

Final Consumption, LPG																		
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	363	357	388	375	415	408	413	422	434	443	457	474	493	512	534	557	2.9%	2.8%
Côte d'Ivoire	103	74	86	82	89	87	88	89	92	93	96	99	103	107	111	116	0.8%	2.3%
Ghana	70	89	103	100	110	108	108	110	113	115	118	123	127	132	138	144	4.9%	2.7%
Senegal	135	133	134	131	147	146	149	152	156	159	165	171	178	184	192	200	2.7%	3.1%
Burkina Faso	14	17	21	20	21	21	21	21	21	22	22	23	23	24	25	26	4.4%	1.8%
Cape Verde	2	2	3	3	4	5	5	6	6	7	7	8	9	10	10	11	12.2%	10.7%
Gambia, The	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	11.9%	13.3%
Guinea	3	3	3	3	3	3	4	4	4	4	5	5	5	6	6	6	4.1%	5.8%
Guinea-Bissau	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2.2%	1.1%
Liberia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mali	5	6	6	6	7	6	7	7	7	7	7	7	8	8	8	8	4.2%	2.6%
Mauritania	30	31	30	28	31	30	30	32	33	33	34	36	37	38	40	42	2.2%	2.4%
Sierra Leone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	70	87	92	97	115	121	132	145	159	172	188	207	227	248	271	297	10.1%	9.4%
Benin	6	7	8	8	8	8	8	8	8	8	8	8	8	9	9	9	2.4%	1.0%
Nigeria	61	76	80	86	103	109	121	133	147	160	176	194	214	235	257	282	10.8%	10.2%
Togo	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1.9%	-0.3%
Niger	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	5.7%	6.6%
West Central	72	78	82	80	88	87	87	87	88	88	90	91	94	96	98	101	2.3%	1.6%
Cameroon	44	47	50	47	52	50	50	50	51	52	53	54	56	58	59	61	2.3%	1.7%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	7	8	7	8	10	11	11	11	11	12	12	12	13	13	13	14	4.5%	5.2%
Gabon	21	22	25	24	27	26	26	25	25	24	24	25	25	25	25	25	1.1%	0.1%
Central African Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6.6%	7.1%
Chad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equatorial Guinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Demand Estimates Appendix A

Final Consumption, LPG	(continued)																% Δ p.a.	% Δ p.a.
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2005-2020	2007-2020
South Africa +	559	601	651	664	760	777	797	825	856	885	923	965	1,010	1,055	1,103	1,154	5.0%	4.5%
Angola	98	102	121	134	162	172	168	169	167	169	172	176	181	185	189	194	4.7%	3.7%
Botswana	15	16	20	20	23	23	23	24	25	26	27	29	30	32	33	35	5.7%	4.3%
Mozambique	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	5	4.2%	4.8%
Namibia	7	2	4	4	5	6	7	7	8	9	10	11	12	13	14	15	4.9%	11.6%
South Africa	426	469	491	491	553	559	581	606	637	662	694	729	766	803	844	887	5.0%	4.6%
Lesotho	5	5	7	7	8	8	9	9	9	10	10	10	11	11	12	12	6.6%	3.9%
Swaziland	5	5	5	5	6	6	6	6	6	6	6	6	6	7	7	7	1.8%	2.2%
São Tomé and Príncipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	85	91	97	96	107	106	109	111	115	118	122	128	133	139	146	153	4.0%	3.5%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	8	8	8	8	9	9	9	9	10	10	11	11	12	12	13	14	4.2%	4.8%
Zambia	3	5	8	8	9	8	8	8	9	9	9	9	10	10	11	11	9.3%	2.5%
Madagascar	7	8	7	7	8	9	9	10	10	11	12	13	14	15	16	17	6.7%	7.1%
Malawi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritius	56	59	63	63	70	70	72	74	76	78	81	84	88	92	96	100	3.9%	3.6%
Seychelles	2	3	3	3	3	3	3	4	4	4	4	4	4	4	5	5	5.9%	3.7%
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	10	9	8	7	8	7	7	6	6	6	6	6	6	5	5	5	-4.4%	-3.4%
East Central	58	78	90	86	94	93	95	98	102	105	110	116	122	129	137	146	6.3%	3.7%
Kenya	50	66	75	70	75	73	73	74	75	77	79	82	85	89	93	98	4.6%	2.0%
Tanzania	4	5	7	8	9	10	11	13	14	16	17	19	22	24	26	29	13.6%	11.8%
Burundi	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3.6%	3.4%
Rwanda	-	-	-	0	0	1	1	1	1	1	1	2	2	2	2	2	-	-
Uganda	4	6	7	7	8	8	9	9	10	10	11	11	12	13	14	15	10.1%	5.6%
East - Red Sea	112	197	206	207	232	230	232	232	233	236	242	250	259	269	280	291	6.6%	2.7%
Eritrea	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-2.0%	3.0%
Ethiopia	0	1	2	3	4	5	6	7	9	10	11	13	15	17	19	21	30.1%	19.6%
Sudan	110	195	203	203	227	224	225	224	223	225	230	236	243	251	259	269	6.2%	2.2%
Djibouti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Somalia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,320	1,490	1,607	1,605	1,812	1,823	1,865	1,920	1,965	2,047	2,133	2,231	2,339	2,447	2,569	2,699	4.9%	4.1%

**Demand Estimates
Appendix A**

Final Consumption, Gasoline																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	1,283	1,317	1,376	1,368	1,543	1,538	1,576	1,616	1,673	1,714	1,774	1,841	1,913	1,983	2,059	2,138	3.5%	3.4%
Côte d'Ivoire	99	101	117	117	133	134	139	144	151	156	162	169	177	184	192	200	4.8%	4.2%
Ghana	567	545	547	556	640	649	673	701	736	764	799	839	881	922	967	1,014	3.9%	4.9%
Senegal	108	107	107	105	117	115	115	116	117	118	120	122	125	127	129	131	1.3%	1.6%
Burkina Faso	100	125	151	146	161	157	159	160	164	166	170	175	180	186	192	199	4.7%	2.1%
Cape Verde	8	18	20	18	18	17	15	14	12	11	9	7	6	4	2	0	-22.7%	-31.2%
Gambia, The	40	43	45	42	46	43	43	42	42	42	42	42	42	43	44	44	0.7%	-0.1%
Guinea	126	118	118	116	130	128	131	133	137	140	144	149	154	159	165	171	2.0%	2.9%
Guinea-Bissau	10	10	12	11	12	12	12	12	12	11	12	12	12	12	12	12	1.3%	0.1%
Liberia	45	68	50	48	53	51	52	53	54	55	56	57	58	59	60	61	2.1%	1.6%
Mali	100	102	124	123	137	135	138	139	142	144	148	152	157	162	167	172	3.7%	2.5%
Mauritania	25	21	23	23	25	25	25	25	25	25	25	25	25	25	25	24	-0.3%	0.5%
Sierra Leone	54	58	61	62	71	72	75	78	81	84	88	92	96	100	105	109	4.8%	4.6%
Nigeria +	8,083	7,573	8,121	8,031	9,016	8,943	9,181	9,445	9,787	10,071	10,474	10,936	11,445	11,951	12,517	13,120	3.3%	3.8%
Benin	120	117	120	117	130	127	129	130	133	135	138	142	146	150	155	160	1.9%	2.2%
Nigeria	7,749	7,283	7,793	7,710	8,656	8,586	8,817	9,072	9,405	9,680	10,072	10,520	11,015	11,507	12,058	12,645	3.3%	3.8%
Togo	158	121	148	145	164	163	167	171	176	180	185	191	197	203	209	216	2.1%	2.9%
Niger	55	52	59	59	67	67	68	72	74	76	79	83	87	91	95	100	4.0%	4.1%
West Central	536	539	544	543	613	613	623	633	647	658	676	696	718	738	760	784	2.6%	2.9%
Cameroon	290	279	295	290	326	323	329	337	347	354	365	378	392	405	419	434	2.7%	3.0%
DR Congo	70	46	48	49	56	57	59	60	62	63	66	68	71	73	76	79	0.8%	3.9%
Congo Republic	73	105	87	88	100	102	100	99	98	98	99	100	101	102	104	105	2.5%	1.4%
Gabon	45	49	49	49	56	56	56	57	58	58	59	60	62	63	64	65	2.5%	2.2%
Central African Republic	11	12	13	13	14	14	14	14	15	15	15	16	16	17	17	18	3.2%	2.4%
Chad	16	16	17	18	21	21	23	23	24	25	26	27	28	29	30	31	4.6%	4.9%
Equatorial Guinea	31	33	35	36	41	40	41	42	43	44	45	46	48	49	51	52	3.5%	3.1%

Demand Estimates Appendix A

Final Consumption, Gasoline	(continued)																% Δ p.a.	% Δ p.a.
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2005-2020	2007-2020
South Africa +	9,565	9,751	10,061	9,943	11,105	11,022	11,208	11,426	11,744	11,963	12,310	12,708	13,140	13,546	13,998	14,467	2.8%	2.8%
Angola	376	411	463	464	516	505	475	458	440	426	418	413	409	404	402	400	0.4%	-1.1%
Botswana	308	318	335	333	374	370	380	392	403	413	428	444	462	479	497	516	3.5%	3.4%
Mozambique	19	21	23	23	25	25	25	25	26	26	27	27	28	29	30	31	3.3%	2.3%
Namibia	229	239	263	258	287	283	287	292	299	304	312	321	331	341	351	362	3.1%	2.5%
South Africa	8,517	8,604	8,817	8,707	9,727	9,666	9,866	10,083	10,398	10,614	10,942	11,315	11,719	12,099	12,521	12,957	2.8%	3.0%
Lesotho	25	65	67	65	71	68	69	69	70	70	71	72	74	75	77	78	7.8%	1.2%
Swaziland	85	89	88	88	99	98	99	100	102	103	104	106	108	110	111	113	1.9%	2.0%
São Tomé and Príncipe	4	5	6	6	7	7	7	7	7	8	8	8	9	9	9	10	5.6%	3.8%
South East	775	703	580	577	651	653	668	682	704	720	743	770	798	825	855	885	0.9%	3.3%
DR Congo	30	20	20	21	24	25	25	26	26	27	28	29	30	31	32	34	0.8%	3.9%
Mozambique	57	63	69	67	75	74	74	75	77	78	79	82	84	86	89	92	3.3%	2.3%
Zambia	110	91	115	115	130	130	134	137	142	146	151	158	164	170	177	185	3.5%	3.7%
Madagascar	85	75	79	82	97	102	108	114	120	126	134	143	152	161	171	182	5.2%	6.6%
Malawi	65	77	95	95	107	108	110	112	115	118	122	127	132	137	143	149	5.6%	3.5%
Mauritius	90	90	90	90	102	102	104	106	109	111	113	117	120	123	126	129	2.4%	2.8%
Seychelles	13	10	10	10	11	10	10	10	9	9	9	8	8	8	7	7	-4.2%	-3.1%
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	326	277	100	95	106	103	102	103	105	105	106	107	108	108	109	109	-7.0%	0.7%
East Central	934	885	911	915	1,040	1,048	1,086	1,125	1,171	1,211	1,263	1,322	1,384	1,445	1,512	1,581	3.6%	4.3%
Kenya	351	385	387	387	440	444	460	476	497	512	533	556	579	602	626	651	4.2%	4.1%
Tanzania	231	246	266	264	297	295	303	312	322	331	344	358	374	389	406	423	4.1%	3.7%
Burundi	25	26	28	27	30	29	29	29	30	30	31	31	32	33	34	35	2.3%	1.9%
Rwanda	75	78	85	82	89	85	83	82	82	81	81	82	83	84	85	87	1.0%	0.1%
Uganda	251	150	145	155	185	195	210	226	240	256	274	294	316	337	360	385	2.9%	7.8%
East - Red Sea	711	889	958	952	1,062	1,046	1,050	1,049	1,056	1,063	1,082	1,106	1,134	1,160	1,191	1,223	3.7%	1.9%
Eritrea	15	5	7	7	9	9	9	10	10	11	11	12	12	13	13	14	-0.6%	5.3%
Ethiopia	149	153	143	149	174	179	188	198	209	218	230	243	256	269	283	297	4.7%	5.8%
Sudan	542	726	802	789	873	851	847	836	831	828	836	847	861	873	890	907	3.5%	1.0%
Djibouti	4	4	5	5	5	5	5	5	5	5	4	4	4	4	4	3	-1.4%	-3.3%
Somalia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1.5%	1.7%
Total	21,886	21,657	22,551	22,329	25,032	24,863	25,391	25,976	26,782	27,400	28,323	29,378	30,533	31,648	32,892	34,198	3.0%	3.3%

Demand Estimates Appendix A

Final Consumption, Jet/Kerosene

<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	774	727	804	816	937	953	994	1,037	1,090	1,134	1,191	1,253	1,320	1,386	1,457	1,533	4.7%	5.1%
Côte d'Ivoire	84	80	80	80	90	92	96	100	106	110	116	122	128	135	142	150	3.9%	4.9%
Ghana	191	188	183	188	219	224	234	246	261	273	288	304	322	339	358	378	4.7%	5.7%
Senegal	206	107	188	188	214	217	224	231	240	248	258	270	282	295	308	322	3.0%	4.2%
Burkina Faso	40	39	33	34	40	42	45	48	51	54	57	61	65	69	73	77	4.5%	6.8%
Cape Verde	99	142	153	152	170	168	173	177	183	188	195	203	211	220	230	241	6.1%	3.5%
Gambia, The	20	21	25	23	24	23	22	22	21	21	21	21	21	21	21	21	0.2%	-1.3%
Guinea	27	18	22	22	24	24	25	26	27	28	29	30	32	33	34	36	2.0%	3.9%
Guinea-Bissau	10	10	11	10	11	11	11	10	11	10	11	11	11	11	11	11	0.9%	0.3%
Liberia	16	18	15	15	18	19	20	22	24	26	28	31	33	36	39	43	6.7%	8.5%
Mali	25	52	40	45	55	59	64	69	74	78	84	89	95	101	106	112	10.6%	8.2%
Mauritania	25	17	18	17	20	20	21	22	23	24	25	26	28	29	30	32	1.5%	4.6%
Sierra Leone	33	35	38	41	51	55	59	64	70	74	80	86	92	98	104	110	8.5%	8.7%
Nigeria +	1,939	2,023	2,115	2,155	2,488	2,533	2,664	2,802	2,963	3,107	3,288	3,488	3,706	3,924	4,163	4,417	5.6%	5.8%
Benin	91	104	109	107	120	119	122	124	128	131	136	141	146	152	158	164	4.0%	3.2%
Nigeria	1,727	1,786	1,878	1,928	2,237	2,287	2,416	2,550	2,707	2,847	3,022	3,214	3,423	3,633	3,863	4,107	5.9%	6.2%
Togo	100	118	112	105	113	108	107	106	107	106	107	108	110	111	113	115	0.9%	0.2%
Niger	20	15	16	16	18	19	19	20	21	22	23	25	26	27	29	30	2.9%	5.1%
West Central	459	430	449	455	520	527	538	549	562	574	592	612	634	654	677	700	2.8%	3.5%
Cameroon	169	164	166	167	190	191	198	205	214	221	231	241	252	263	275	287	3.6%	4.3%
DR Congo	57	48	50	53	61	64	67	69	72	74	78	82	86	90	94	99	3.7%	5.3%
Congo Republic	86	68	81	83	95	98	96	94	94	93	94	95	97	98	99	101	1.1%	1.6%
Gabon	83	84	78	81	95	97	100	102	105	107	109	112	115	118	121	124	2.7%	3.6%
Central African Republic	13	15	17	16	18	18	18	19	19	20	20	21	22	22	23	24	4.0%	2.8%
Chad	27	27	30	28	30	29	28	27	27	27	26	26	27	27	27	27	0.1%	-0.7%
Equatorial Guinea	25	25	27	27	31	31	31	32	32	32	33	34	35	36	38	39	3.0%	2.9%

Demand Estimates Appendix A

Final Consumption, Jet/Kerosene (continued)																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
South Africa +	2,997	3,115	3,095	3,114	3,533	3,568	3,636	3,730	3,840	3,933	4,065	4,214	4,374	4,526	4,693	4,866	3.3%	3.5%
Angola	523	551	407	470	590	648	657	685	698	722	751	783	815	845	876	908	3.7%	6.4%
Botswana	14	19	21	21	24	24	24	25	26	27	28	29	30	31	33	34	6.2%	3.6%
Mozambique	18	19	20	20	23	23	23	24	25	26	27	28	30	31	33	34	4.4%	4.2%
Namibia	56	59	50	50	57	58	60	62	64	66	69	72	75	78	81	85	2.8%	4.2%
South Africa	2,369	2,423	2,490	2,456	2,741	2,726	2,787	2,854	2,950	3,019	3,119	3,233	3,357	3,475	3,605	3,741	3.1%	3.2%
Lesotho	5	30	32	29	30	28	27	26	26	25	25	24	24	24	24	24	11.1%	-2.1%
Swaziland	7	7	67	59	60	53	49	45	42	39	36	34	32	31	29	28	9.7%	-6.5%
São Tomé and Príncipe	6	7	8	8	9	9	9	9	9	10	10	11	11	12	12	13	5.4%	3.7%
South East	578	553	625	621	698	701	719	735	760	781	811	844	881	917	957	999	3.7%	3.7%
DR Congo	24	21	22	23	26	27	29	30	31	32	33	35	37	39	40	42	3.7%	5.3%
Mozambique	54	56	60	60	68	68	70	72	75	77	81	85	89	93	98	103	4.4%	4.2%
Zambia	29	25	37	38	44	45	47	50	52	55	58	61	64	68	71	75	6.5%	5.6%
Madagascar	90	76	88	88	100	103	108	111	115	120	126	134	142	150	159	168	4.3%	5.2%
Malawi	38	34	30	32	38	41	44	47	50	53	57	61	65	69	74	78	4.9%	7.8%
Mauritius	252	257	306	303	337	335	340	347	356	364	375	388	402	416	431	448	3.9%	3.0%
Seychelles	32	34	36	35	38	37	37	38	39	39	40	41	42	42	43	44	2.3%	1.7%
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	59	50	47	44	47	44	43	42	42	41	41	41	41	40	40	40	-2.6%	-1.4%
East Central	1,177	1,205	1,242	1,244	1,415	1,437	1,503	1,572	1,654	1,727	1,820	1,923	2,035	2,146	2,269	2,399	4.9%	5.2%
Kenya	884	898	916	899	1,006	1,010	1,045	1,081	1,129	1,169	1,222	1,281	1,346	1,410	1,481	1,556	3.8%	4.2%
Tanzania	166	171	193	206	247	260	281	303	327	350	377	407	438	470	505	542	8.2%	8.3%
Burundi	15	16	16	16	18	18	19	19	20	21	22	22	23	24	25	26	3.9%	3.8%
Rwanda	13	14	15	16	20	21	22	24	26	27	29	31	33	35	37	39	7.7%	7.7%
Uganda	99	107	102	106	124	128	136	144	152	160	171	182	195	207	221	235	6.0%	6.6%
East - Red Sea	671	779	704	714	810	815	843	869	904	936	978	1,026	1,079	1,131	1,189	1,251	4.2%	4.5%
Eritrea	40	27	33	30	33	32	32	31	32	32	32	33	34	34	35	36	-0.6%	0.8%
Ethiopia	343	400	424	429	483	485	500	516	539	558	584	613	646	679	716	755	5.4%	4.5%
Sudan	186	249	138	147	174	181	191	199	207	217	228	241	255	268	283	298	3.2%	6.1%
Djibouti	58	59	64	64	71	71	74	76	80	82	86	91	95	100	105	111	4.4%	4.3%
Somalia	44	44	44	43	48	46	46	46	47	47	47	48	49	50	51	51	1.0%	1.1%
Total	8,595	8,832	9,035	9,119	10,402	10,534	10,896	11,294	11,774	12,191	12,745	13,361	14,028	14,683	15,406	16,165	4.3%	4.6%

**Demand Estimates
Appendix A**

Final Consumption, Gasoil

<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	3,538	3,676	3,966	3,903	4,377	4,363	4,478	4,628	4,807	4,958	5,168	5,407	5,670	5,931	6,224	6,536	4.2%	3.9%
Côte d'Ivoire	554	530	557	542	604	602	622	645	675	699	731	767	806	845	889	935	3.5%	4.1%
Ghana	944	1,001	1,172	1,163	1,310	1,305	1,333	1,376	1,435	1,480	1,543	1,616	1,696	1,776	1,867	1,963	5.0%	4.0%
Senegal	607	523	597	590	665	669	686	705	730	752	782	816	854	891	933	976	3.2%	3.9%
Burkina Faso	185	215	160	161	186	189	198	208	219	229	242	256	270	285	301	318	3.7%	5.4%
Cape Verde	102	122	133	136	156	159	167	175	185	194	206	218	232	245	260	276	6.9%	5.8%
Gambia, The	27	29	31	34	42	45	49	53	58	62	67	72	77	82	88	94	8.7%	9.0%
Guinea	187	188	194	192	216	215	222	229	238	245	255	267	279	292	305	320	3.7%	3.9%
Guinea-Bissau	41	42	44	43	49	48	49	50	52	53	54	56	58	60	62	64	3.0%	2.9%
Liberia	88	102	93	92	103	103	111	120	129	138	150	163	179	195	213	233	6.7%	7.3%
Mali	306	420	418	414	461	458	469	474	485	494	509	527	546	564	585	607	4.7%	2.9%
Mauritania	317	310	364	341	376	367	366	389	394	403	416	432	449	466	485	505	3.2%	2.5%
Sierra Leone	181	194	204	195	211	205	204	204	206	207	211	217	223	229	236	245	2.0%	1.4%
Nigeria +	4,322	4,216	4,525	4,571	5,232	5,294	5,560	5,849	6,187	6,498	6,895	7,342	7,833	8,336	8,895	9,496	5.4%	5.9%
Benin	80	89	92	95	111	115	121	128	136	142	151	160	170	179	189	200	6.4%	6.2%
Nigeria	4,039	3,940	4,227	4,278	4,904	4,968	5,225	5,503	5,830	6,130	6,513	6,943	7,416	7,901	8,441	9,022	5.5%	6.0%
Togo	131	119	120	112	122	118	118	118	120	120	122	125	127	130	133	136	0.3%	1.0%
Niger	72	67	87	85	95	94	95	100	102	105	110	114	120	125	131	138	4.4%	3.6%
West Central	1,243	1,321	1,468	1,440	1,602	1,581	1,576	1,574	1,580	1,588	1,614	1,647	1,686	1,722	1,766	1,812	2.5%	1.6%
Cameroon	396	392	438	428	478	471	481	492	508	520	538	558	581	603	629	655	3.4%	3.1%
DR Congo	107	96	111	109	120	121	122	122	122	124	128	132	136	141	146	151	2.4%	2.5%
Congo Republic	156	212	197	199	225	230	221	215	210	208	207	208	209	210	212	213	2.1%	0.6%
Gabon	316	348	430	413	454	439	427	417	409	402	400	399	400	400	401	403	1.6%	-0.5%
Central African Republic	20	20	22	22	25	25	26	27	28	29	30	31	33	34	36	37	4.3%	4.0%
Chad	114	115	122	117	129	126	125	125	125	125	127	128	131	132	135	137	1.2%	0.9%
Equatorial Guinea	134	138	148	151	171	170	173	177	177	180	185	190	196	202	209	215	3.2%	2.9%

Demand Estimates Appendix A

Final Consumption, Gasoil	(continued)																% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
South Africa +	9,137	9,923	11,074	10,965	12,249	12,228	12,339	12,571	12,871	13,128	13,531	13,995	14,510	15,010	15,575	16,172	3.9%	3.0%
Angola	1,159	1,347	1,513	1,666	2,003	2,123	2,062	2,078	2,049	2,064	2,102	2,147	2,197	2,243	2,296	2,351	4.8%	3.5%
Botswana	288	323	359	355	397	393	404	418	431	444	462	482	504	526	550	575	4.7%	3.7%
Mozambique	85	88	97	98	114	116	121	126	133	139	147	156	165	175	185	196	5.7%	5.6%
Namibia	397	414	427	420	468	465	476	487	502	514	532	553	575	597	622	647	3.3%	3.2%
South Africa	7,077	7,594	8,508	8,257	9,079	8,946	9,089	9,272	9,560	9,768	10,085	10,448	10,852	11,247	11,694	12,168	3.7%	2.8%
Lesotho	20	41	45	44	49	48	49	50	52	53	55	57	59	61	63	66	8.2%	2.9%
Swaziland	98	101	107	105	118	116	117	118	120	121	123	125	128	130	132	135	2.2%	1.8%
São Tomé and Príncipe	13	15	18	18	21	21	22	23	24	25	26	28	29	31	33	35	6.7%	5.1%
South East	1,785	1,807	1,937	1,918	2,151	2,161	2,218	2,270	2,351	2,421	2,520	2,633	2,759	2,884	3,024	3,174	3.9%	3.9%
DR Congo	45	40	47	46	51	51	51	51	52	52	54	55	57	59	61	64	2.4%	2.5%
Mozambique	254	263	289	293	339	345	361	377	398	416	439	465	493	521	552	586	5.7%	5.6%
Zambia	215	240	301	298	331	329	335	343	354	363	377	393	411	429	449	470	5.3%	3.5%
Madagascar	351	345	359	360	409	426	447	459	477	499	528	560	596	632	673	717	4.9%	5.5%
Malawi	112	129	165	167	190	193	198	203	211	219	229	240	253	265	279	295	6.7%	4.5%
Mauritius	351	351	306	310	353	358	372	386	405	420	440	463	487	511	537	564	3.2%	4.8%
Seychelles	242	256	266	258	280	273	275	277	283	286	291	298	305	312	319	327	2.0%	1.6%
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	215	183	205	187	199	186	178	173	172	166	163	160	158	155	153	151	-2.3%	-2.3%
East Central	1,920	2,213	2,534	2,483	2,762	2,751	2,831	2,922	3,033	3,136	3,279	3,443	3,627	3,814	4,024	4,251	5.4%	4.1%
Kenya	938	1,098	1,229	1,185	1,308	1,301	1,337	1,378	1,435	1,482	1,548	1,624	1,708	1,794	1,890	1,993	5.2%	3.8%
Tanzania	663	682	762	755	846	842	868	898	935	969	1,016	1,070	1,131	1,193	1,263	1,340	4.8%	4.4%
Burundi	30	32	33	34	39	39	41	43	45	47	50	52	55	58	61	64	5.1%	5.2%
Rwanda	38	40	45	49	59	62	66	71	76	80	85	91	96	102	108	115	7.6%	7.4%
Uganda	251	362	465	460	510	507	519	533	543	558	581	607	637	667	702	740	7.5%	3.6%
East - Red Sea	2,763	2,650	2,893	3,017	3,503	3,596	3,764	3,904	4,066	4,241	4,466	4,718	4,992	5,267	5,571	5,894	5.2%	5.6%
Eritrea	120	102	108	102	111	108	110	110	113	114	117	121	125	129	134	139	1.0%	1.9%
Ethiopia	767	870	941	964	1,095	1,109	1,155	1,204	1,269	1,325	1,399	1,481	1,572	1,665	1,768	1,878	6.2%	5.5%
Sudan	1,814	1,615	1,779	1,886	2,223	2,305	2,423	2,509	2,600	2,713	2,858	3,018	3,192	3,365	3,556	3,757	5.0%	5.9%
Djibouti	44	45	50	51	57	58	61	64	68	71	75	80	85	90	95	101	5.7%	5.6%
Somalia	18	18	15	15	16	16	16	16	17	17	17	17	18	18	19	19	0.4%	1.8%
Total	24,708	25,807	28,397	28,297	31,876	31,975	32,766	33,718	34,896	35,969	37,472	39,184	41,076	42,964	45,079	47,336	4.4%	4.0%

Demand Estimates Appendix A

Final Consumption, Fuel Oil																		
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	1,309	1,228	1,405	1,385	1,553	1,543	1,585	1,633	1,689	1,736	1,802	1,878	1,961	2,042	2,132	2,227	3.6%	3.6%
Côte d'Ivoire	94	68	93	89	97	95	95	96	98	99	101	103	106	109	111	114	1.3%	1.6%
Ghana	51	58	58	56	62	60	59	58	58	57	56	55	54	53	51	50	-0.2%	-1.2%
Senegal	469	341	459	452	508	506	516	526	541	553	572	592	615	637	661	687	2.6%	3.1%
Burkina Faso	33	62	69	66	73	71	71	72	73	74	75	77	79	81	84	87	6.6%	1.8%
Cape Verde	65	60	63	63	71	71	73	75	78	80	83	87	91	94	98	102	3.1%	3.8%
Gambia, The	15	16	18	18	21	21	22	23	24	25	26	27	28	29	31	32	5.2%	4.6%
Guinea	260	260	260	256	285	282	289	296	305	312	322	334	347	360	374	389	2.7%	3.2%
Guinea-Bissau	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liberia	202	200	200	203	232	235	254	273	294	313	337	364	393	423	457	493	6.1%	7.2%
Mali	2	36	54	52	57	55	54	54	54	53	54	54	55	56	57	58	23.3%	0.5%
Mauritania	100	107	111	106	119	117	119	126	128	131	135	140	146	151	156	162	3.3%	3.0%
Sierra Leone	19	20	21	23	28	29	32	34	36	38	41	43	46	49	51	54	7.3%	7.5%
Nigeria +	745	486	381	457	598	669	751	832	918	994	1,079	1,130	1,183	1,239	1,297	1,359	4.1%	10.3%
Benin	48	45	47	45	50	49	49	50	50	51	52	53	55	56	57	59	1.4%	1.8%
Nigeria	546	313	251	330	456	529	609	688	770	844	926	972	1,020	1,071	1,125	1,181	5.3%	12.7%
Togo	143	118	73	70	78	77	78	80	81	83	85	87	89	91	94	96	-2.6%	2.2%
Niger	8	9	11	11	13	14	14	15	16	16	17	18	19	20	21	22	7.1%	5.6%
West Central	212	157	163	165	189	190	194	198	202	206	210	216	221	226	231	236	0.7%	2.9%
Cameroon	83	56	54	52	58	56	56	56	56	57	57	58	59	59	60	61	-2.0%	1.0%
DR Congo	13	7	14	13	14	13	13	12	12	12	11	11	11	11	10	10	-2.0%	-2.5%
Congo Republic	8	10	14	16	20	23	24	26	28	29	31	32	34	35	37	38	11.3%	8.2%
Gabon	80	56	49	51	60	61	63	65	67	68	70	72	74	76	78	80	0.0%	3.9%
Central African Republic	2	2	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4.1%	1.9%
Chad	26	26	30	30	34	34	35	35	36	37	38	39	40	41	42	43	3.5%	2.8%
Equatorial Guinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Demand Estimates Appendix A

Final Consumption, Fuel Oil	(continued)																% Δ p.a.	% Δ p.a.
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2005-2020	2007-2020
South Africa +	708	711	567	556	620	600	593	582	575	559	549	541	531	517	503	488	-2.5%	-1.1%
Angola	168	196	68	70	83	85	91	95	101	105	109	114	119	123	127	131	-1.6%	5.2%
Botswana	5	1	5	5	6	5	5	4	4	3	3	2	1	0	1	2	-4.8%	-5.7%
Mozambique	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-100.0%	-
Namibia	34	36	22	22	24	23	22	22	22	22	21	21	21	21	20	20	-3.6%	-1.0%
South Africa	488	475	469	456	501	479	465	448	433	413	397	383	368	349	329	307	-3.1%	-3.2%
Lesotho	10	1	1	4	6	8	10	12	14	16	17	19	21	22	24	25	6.3%	27.4%
Swaziland	0	1	1	0	0	0	0	1	1	1	1	2	2	2	2	3	12.1%	12.1%
São Tomé and Príncipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	521	534	517	513	574	573	585	597	615	629	650	673	698	721	748	775	2.7%	3.2%
DR Congo	6	3	6	6	6	6	6	5	5	5	5	5	5	5	4	4	-2.0%	-2.5%
Mozambique	7	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-100.0%	-
Zambia	53	54	35	41	52	58	64	70	77	84	90	98	105	113	121	128	6.0%	10.5%
Madagascar	28	35	40	41	48	50	53	55	58	60	64	67	71	75	79	84	7.6%	5.8%
Malawi	20	20	20	21	26	27	29	30	32	34	36	38	41	43	45	48	6.0%	7.0%
Mauritius	309	319	314	307	338	331	333	336	342	345	353	361	372	381	392	404	1.8%	1.9%
Seychelles	58	67	70	67	72	70	69	69	70	70	70	71	72	73	74	75	1.7%	0.6%
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	40	34	32	30	33	31	31	31	32	31	32	32	32	32	32	32	-1.4%	0.1%
East Central	920	885	776	787	1,002	1,025	1,073	1,122	1,181	1,231	1,293	1,361	1,433	1,503	1,580	1,659	4.0%	6.0%
Kenya	586	712	674	671	762	772	804	837	878	912	956	1,005	1,056	1,107	1,162	1,219	5.0%	4.7%
Tanzania	272	110	42	52	70	79	91	102	114	125	137	150	163	176	190	204	-1.9%	12.9%
Burundi	10	10	11	10	11	11	10	10	10	10	10	10	10	10	10	11	0.4%	-0.3%
Rwanda	13	14	15	14	16	15	14	14	14	14	14	14	14	14	14	14	0.6%	-0.4%
Uganda	39	38	34	39	144	148	153	159	164	170	176	182	189	196	203	211	11.9%	15.0%
East - Red Sea	954	424	539	579	694	729	779	823	872	918	974	1,033	1,096	1,156	1,222	1,289	2.0%	6.9%
Eritrea	30	23	13	17	23	26	30	34	38	41	45	49	54	58	62	66	5.4%	13.4%
Ethiopia	167	168	162	166	190	193	200	208	219	227	238	251	264	277	291	306	4.1%	5.0%
Sudan	693	168	299	333	411	441	478	510	543	577	616	658	701	744	789	835	1.3%	8.2%
Djibouti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Somalia	65	65	65	64	71	70	70	71	72	72	74	75	77	78	80	82	1.5%	1.8%
Total	5,370	4,423	4,348	4,442	5,230	5,329	5,560	5,787	6,051	6,273	6,558	6,831	7,122	7,404	7,713	8,033	2.7%	4.8%

Demand Estimates Appendix A

Final Consumption, Bitumen																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	92	93	63	65	76	78	82	87	92	96	101	107	113	119	126	133	2.5%	5.9%
Côte d'Ivoire	8	7	9	8	9	8	8	8	8	8	8	8	8	8	9	9	0.8%	0.1%
Ghana	35	36	36	37	43	45	47	50	53	55	59	62	66	70	74	78	5.6%	6.2%
Senegal	11	11	11	12	14	14	15	16	17	18	19	20	22	23	24	25	5.9%	6.8%
Burkina Faso	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cape Verde	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gambia, The	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guinea	7	7	7	7	7	7	7	7	7	7	7	7	7	7	8	8	1.2%	0.8%
Guinea-Bissau	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liberia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mali	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritania	32	32	1	2	3	4	5	6	7	7	8	9	10	11	12	13	-6.1%	22.1%
Sierra Leone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	180	176	180	180	204	205	212	220	230	239	250	263	277	291	307	323	4.0%	4.6%
Benin	13	11	12	11	12	12	12	12	12	12	12	13	13	13	14	14	0.5%	1.3%
Nigeria	162	162	167	167	190	190	197	205	214	222	233	245	259	272	287	302	4.2%	4.7%
Togo	5	3	1	1	2	2	3	3	4	4	5	5	6	6	6	7	1.6%	19.5%
Niger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Central	16	17	13	15	19	21	23	25	27	28	30	32	34	36	38	40	6.2%	8.9%
Cameroon	10	10	10	11	14	14	16	17	18	19	21	22	24	25	26	28	7.0%	8.1%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	5	6	2	2	3	4	4	4	4	4	5	5	5	5	6	6	0.9%	8.5%
Gabon	1	1	1	2	2	3	3	4	4	4	5	5	5	6	6	6	12.4%	14.4%
Central African Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equatorial Guinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Demand Estimates Appendix A

Final Consumption, Bitumen	(continued)																% Δ p.a.	% Δ p.a.
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2005-2020	2007-2020
South Africa +	355	370	408	399	441	435	436	440	447	452	462	474	487	500	515	531	2.7%	2.0%
Angola	20	25	43	43	48	47	44	42	39	37	36	35	35	34	33	33	3.3%	-1.9%
Botswana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Namibia	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3.6%	4.2%
South Africa	329	339	360	351	387	381	386	391	401	408	418	431	445	458	473	489	2.7%	2.4%
Lesotho	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swaziland	5	5	4	4	5	5	5	5	6	6	6	6	6	7	7	7	2.0%	4.0%
São Tomé and Príncipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-11.9%	33.0%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-11.9%	33.0%
Madagascar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malawi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seychelles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	18	19	28	28	32	32	34	35	37	38	40	42	45	47	50	52	7.4%	4.9%
Kenya	13	16	18	18	21	21	22	23	25	26	27	29	31	32	34	36	7.2%	5.4%
Tanzania	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burundi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rwanda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uganda	5	3	10	10	11	11	11	12	12	12	13	14	14	15	16	16	7.7%	3.9%
East - Red Sea	25	22	23	23	25	25	26	27	27	28	29	30	31	32	34	35	2.3%	3.4%
Eritrea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethiopia	7	4	4	5	6	6	7	8	8	9	10	11	11	12	13	14	5.2%	9.5%
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Djibouti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Somalia	18	18	18	18	20	19	19	19	19	19	19	20	20	20	20	21	0.9%	1.0%
Total	689	699	715	710	796	796	813	833	860	882	913	949	988	1,026	1,069	1,114	3.3%	3.5%

Demand Estimates Appendix A

Final Consumption, Lubricants																		
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	63	54	51	55	66	70	75	80	86	91	98	104	111	118	125	133	5.0%	7.6%
Côte d'Ivoire	10	9	9	9	11	11	12	12	13	14	15	15	16	17	18	19	4.7%	6.0%
Ghana	25	26	26	27	32	33	35	37	40	42	44	47	50	53	56	59	6.0%	6.7%
Senegal	14	5	11	13	16	17	18	20	21	23	24	26	28	30	32	34	5.9%	8.6%
Burkina Faso	8	8	-	1	2	3	4	4	5	6	7	8	9	9	10	11	2.3%	-
Cape Verde	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gambia, The	-	-	-	0	0	0	0	0	0	0	0	1	1	1	1	1	-	-
Guinea	5	5	5	5	6	5	6	6	6	6	6	6	6	7	7	7	2.1%	2.4%
Guinea-Bissau	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-
Liberia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mali	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritania	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	-2.3%	22.6%
Sierra Leone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	163	169	191	203	243	256	276	297	320	342	367	395	424	454	486	520	8.0%	8.0%
Benin	4	4	4	4	5	5	5	5	5	5	5	6	6	6	6	6	3.0%	2.8%
Nigeria	156	161	183	196	235	247	267	288	311	332	357	384	413	442	474	507	8.2%	8.1%
Togo	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	2.5%	2.6%
Niger	-	-	-	0	0	1	1	1	1	1	1	1	2	2	2	2	-	-
West Central	22	23	23	23	27	27	28	29	30	31	32	34	35	37	38	40	3.9%	4.4%
Cameroon	16	16	16	15	17	17	18	18	19	19	20	21	22	22	23	24	3.0%	3.4%
DR Congo	4	4	4	4	4	4	4	4	5	5	5	5	5	5	6	6	3.3%	3.8%
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	2	2	2	3	4	4	4	5	5	5	5	6	6	6	6	7	7.2%	8.3%
Central African Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equatorial Guinea	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	9.5%	8.0%

Demand Estimates Appendix A

Final Consumption, Lubricants (continued)																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
South Africa +	290	292	293	292	330	331	341	351	365	376	390	406	423	439	457	475	3.3%	3.8%
Angola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Botswana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	3	3	3	3	3	3	3	3	4	4	4	4	4	4	5	5	4.2%	4.1%
Namibia	2	4	4	4	4	4	5	5	5	5	5	5	5	6	6	6	7.4%	3.2%
South Africa	286	286	286	285	322	323	333	343	357	367	381	397	413	429	446	464	3.3%	3.8%
Lesotho	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swaziland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
São Tomé and Príncipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	49	47	46	44	48	46	46	46	47	48	49	50	51	53	55	57	1.0%	1.6%
DR Congo	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3.3%	3.8%
Mozambique	8	8	9	9	10	10	10	10	11	11	11	12	13	13	14	15	4.2%	4.1%
Zambia	15	16	16	15	17	17	17	17	18	18	19	19	20	21	22	22	2.7%	2.8%
Madagascar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malawi	4	4	4	4	5	5	6	6	6	6	7	7	7	8	8	9	5.8%	5.3%
Mauritius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seychelles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	21	18	16	14	14	13	12	11	11	10	10	10	9	9	9	9	-5.8%	-4.6%
East Central	34	42	35	35	40	41	43	46	48	50	53	56	60	63	66	70	5.0%	5.6%
Kenya	28	36	30	30	34	34	36	38	40	41	43	46	48	51	53	56	4.7%	5.0%
Tanzania	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burundi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rwanda	-	-	-	0	0	1	1	1	1	1	2	2	2	2	2	3	-	-
Uganda	6	7	5	5	6	6	6	7	7	8	8	9	9	10	11	11	4.8%	7.1%
East - Red Sea	46	66	62	64	75	77	80	83	87	91	96	101	106	112	118	125	6.8%	5.6%
Eritrea	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-0.6%	0.7%
Ethiopia	18	20	19	20	24	25	26	28	30	32	34	36	39	41	44	47	6.5%	7.2%
Sudan	24	40	36	38	44	45	47	49	50	52	55	57	60	63	66	69	7.3%	5.1%
Djibouti	3	4	5	5	6	5	5	6	6	6	6	6	6	7	7	7	5.8%	2.6%
Somalia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	669	693	700	716	828	847	889	933	985	1,029	1,065	1,146	1,211	1,275	1,346	1,419	5.1%	5.6%

Demand Estimates Appendix A

Final Consumption, Other Petroleum Products																		
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
West	24	16	18	16	17	17	17	17	17	17	17	18	18	19	20	20	-0.9%	1.1%
Côte d'Ivoire	21	14	16	14	15	14	14	13	13	13	13	13	14	14	14	15	-2.6%	-0.5%
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	2	2	2	2	3	3	3	3	3	4	4	4	5	5	5	6	7.4%	8.1%
Burkina Faso	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cape Verde	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gambia, The	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Guinea-Bissau	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liberia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mali	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritania	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sierra Leone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	4.8%	-
Benin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Togo	0	-	-	0	0	0	0	0	0	0	0	0	0	0	0	0	4.8%	-
Niger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Central	12	16	16	16	19	20	22	23	25	26	27	29	31	33	35	37	7.4%	6.8%
Cameroon	12	16	16	16	19	20	22	23	25	26	27	29	31	33	35	37	7.4%	6.8%
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central African Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chad	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equatorial Guinea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Demand Estimates Appendix A

Final Consumption, Other Petroleum Products	(continued)																% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
South Africa +	722	784	790	797	902	910	906	918	928	941	964	992	1,022	1,052	1,085	1,121	3.0%	2.7%
Angola	208	267	270	292	347	363	351	352	346	347	352	358	365	372	379	387	4.2%	2.8%
Botswana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Namibia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	515	517	520	505	555	547	555	565	582	594	612	634	657	680	706	733	2.4%	2.7%
Lesotho	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Swaziland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
São Tomé and Príncipe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DR Congo	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mozambique	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Madagascar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Malawi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mauritius	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Seychelles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Comoros	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zimbabwe	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	3	6	5	5	6	6	6	7	8	8	9	10	11	12	14	15	11.0%	8.5%
Kenya	3	6	5	5	6	6	6	7	8	8	9	10	11	12	14	15	11.0%	8.5%
Tanzania	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Burundi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rwanda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uganda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East - Red Sea	114	126	390	387	431	423	423	419	418	419	426	436	448	459	473	489	10.2%	1.8%
Eritrea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethiopia	0	0	0	1	1	2	2	3	4	4	5	6	7	7	8	9	25.6%	55.9%
Sudan	113	126	390	387	430	421	421	417	414	415	421	430	441	452	465	479	10.1%	1.6%
Djibouti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Somalia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	875	947	1,218	1,222	1,375	1,375	1,374	1,383	1,395	1,412	1,445	1,485	1,530	1,575	1,626	1,681	4.4%	2.5%

**Demand Estimates
Appendix A**

Refinery Own Use, Crude Oil																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Côte d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cameroon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa +	62	65	83	100	120	140	145	155	160	174	189	205	221	239	257	277	10.5%	9.7%
Angola	62	65	83	100	120	140	145	155	160	174	189	205	221	239	257	277	10.5%	9.7%
South Africa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	74	84	91	94	103	111	121	130	141	152	164	178	192	207	224	242	8.2%	7.8%
Kenya	74	84	91	94	103	111	121	130	141	152	164	178	192	207	224	242	8.2%	7.8%
East - Red Sea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	136	149	174	194	223	251	265	285	301	326	353	382	413	446	481	519	9.3%	8.8%

**Demand Estimates
Appendix A**

<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
Refinery Own Use, Refinery Gas																		
West	126	89	96	102	112	122	133	145	159	173	187	203	220	238	258	279	5.4%	8.6%
Côte d'Ivoire	42	42	43	44	47	50	53	57	61	66	70	75	80	86	92	98	5.8%	6.6%
Ghana	78	39	44	49	56	62	68	76	84	92	101	111	121	132	144	157	4.8%	10.2%
Senegal	7	8	8	9	10	11	11	12	13	14	16	17	18	20	22	24	8.9%	8.3%
Nigeria +	248	88	115	142	179	216	256	300	346	398	455	517	585	660	741	831	8.4%	16.5%
Nigeria	248	88	115	142	179	216	256	300	346	398	455	517	585	660	741	831	8.4%	16.5%
West Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cameroon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa +	1,665	1,710	1,816	1,885	2,009	2,135	2,271	2,426	2,588	2,758	2,935	3,122	3,316	3,531	3,755	3,995	6.0%	6.3%
Angola	44	47	63	78	95	113	117	125	129	142	155	168	183	198	215	233	11.7%	10.6%
South Africa	1,621	1,663	1,753	1,808	1,914	2,023	2,154	2,301	2,459	2,616	2,781	2,953	3,134	3,332	3,540	3,763	5.8%	6.0%
South East	25	26	28	29	31	33	35	37	40	43	45	48	52	55	59	63	6.3%	6.5%
Zambia	25	26	28	29	31	33	35	37	40	43	45	48	52	55	59	63	6.3%	6.5%
East Central	69	68	75	78	86	93	102	111	121	131	143	155	169	184	200	217	7.9%	8.6%
Kenya	69	68	75	78	86	93	102	111	121	131	143	155	169	184	200	217	7.9%	8.6%
East - Red Sea	3	3	6	8	10	13	16	18	21	24	27	31	36	40	45	51	21.7%	18.3%
Sudan	3	3	6	8	10	13	16	18	21	24	27	31	36	40	45	51	21.7%	18.3%
Total	2,137	1,985	2,134	2,243	2,427	2,613	2,813	3,038	3,274	3,526	3,793	4,077	4,377	4,708	5,059	5,437	6.4%	7.5%

**Demand Estimates
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Refinery Own Use, LPG																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Côte d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	18	2	3	4	6	7	9	10	12	14	16	18	21	23	26	29	3.3%	18.1%
Nigeria	18	2	3	4	6	7	9	10	12	14	16	18	21	23	26	29	3.3%	18.1%
West Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cameroon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kenya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East - Red Sea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	18	2	3	4	6	7	9	10	12	14	16	18	21	23	26	29	3.3%	18.1%

**Demand Estimates
Appendix A**

Refinery Own Use, Gasoil																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Côte d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	16	17	20	23	27	31	36	41	46	51	58	64	71	79	88	97	12.9%	13.1%
Nigeria	16	17	20	23	27	31	36	41	46	51	58	64	71	79	88	97	12.9%	13.1%
West Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cameroon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kenya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East - Red Sea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	16	17	20	23	27	31	36	41	46	51	58	64	71	79	88	97	12.9%	13.1%

**Demand Estimates
Appendix A**

Refinery Own Use, Fuel Oil																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	14	16	23	29	37	45	53	62	71	80	90	100	110	121	133	145	16.8%	15.2%
Côte d'Ivoire	14	16	23	29	37	45	53	62	71	80	90	100	110	121	133	145	16.8%	15.2%
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	363	170	198	225	264	303	345	389	436	489	547	609	676	751	831	918	6.4%	12.5%
Nigeria	363	170	198	225	264	303	345	389	436	489	547	609	676	751	831	918	6.4%	12.5%
West Central	-	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	-	4.9%
Cameroon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Congo Republic	-	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	-	4.9%
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa +	-	-	8	16	25	34	43	54	65	76	87	99	111	124	138	153	-	24.9%
Angola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	-	-	8	16	25	34	43	54	65	76	87	99	111	124	138	153	-	24.9%
South East	9	9	10	11	12	14	15	16	18	19	21	22	24	26	28	30	8.6%	8.8%
Zambia	9	9	10	11	12	14	15	16	18	19	21	22	24	26	28	30	8.6%	8.8%
East Central	26	25	28	29	33	36	39	42	46	50	54	59	64	70	76	82	8.0%	8.6%
Kenya	26	25	28	29	33	36	39	42	46	50	54	59	64	70	76	82	8.0%	8.6%
East - Red Sea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	411	222	268	312	372	432	496	565	637	716	800	891	988	1,094	1,207	1,330	8.1%	13.1%

**Demand Estimates
Appendix A**

Refinery Own Use, Other Petroleum Products																	% Δ p.a. 2005-2020	% Δ p.a. 2007-2020
<i>(Thousand tonnes per year)</i>	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
West	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Côte d'Ivoire	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Senegal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nigeria	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
West Central	-	31	29	27	26	25	24	23	23	22	21	20	20	19	19	18	-	-3.5%
Cameroon	-	31	29	27	26	25	24	23	23	22	21	20	20	19	19	18	-	-3.5%
Congo Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gabon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa +	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angola	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South Africa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
South East	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zambia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Central	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kenya	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East - Red Sea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sudan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	31	29	27	26	25	24	23	23	22	21	20	20	19	19	18	-	-3.5%

Demand Estimates
Appendix A

EIA, Petroleum Consumption, Annual (Thousand barrels per day)

Central and South America

		<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Antigua and Barbuda	Greater Caribbean	3.50	3.51	3.53	3.74	4.04	4.40	4.51	4.60			
Argentina	Rest of South America	510.93	474.39	438.30	449.99	471.79	483.01	535.00	580.00			
Aruba	Greater Caribbean	6.51	6.53	6.53	6.98	7.06	7.25	7.30	7.40			
Bahamas, The	Greater Caribbean	22.22	21.84	22.26	26.60	26.96	30.73	31.30	32.00			
Barbados	Greater Caribbean	10.82	10.37	10.37	10.57	7.10	9.83	9.60	9.40			
Belize	Greater Caribbean	4.71	6.26	6.01	6.29	6.75	7.12	7.30	7.40			
Bermuda	Greater Caribbean	3.66	3.63	3.67	3.98	4.25	4.50	4.60	4.70			
Bolivia	Rest of South America	48.10	46.74	46.72	46.26	49.62	50.80	55.60	59.00			
Cayman Islands	Greater Caribbean	2.39	2.41	2.41	2.50	2.70	2.82	2.90	3.00			
Chile	Rest of South America	235.90	232.49	233.96	235.77	244.63	259.86	266.00	272.00			
Colombia	Greater Caribbean	277.49	271.18	261.20	265.36	267.52	270.71	281.00	289.00			
Costa Rica	Greater Caribbean	36.28	37.59	39.66	41.92	41.56	40.61	42.00	44.00			
Cuba	Greater Caribbean	195.00	203.60	201.51	204.85	201.22	175.31	175.70	180.00			
Dominica	Greater Caribbean	0.59	0.75	0.82	0.88	0.77	0.67	0.71	0.80			
Dominican Republic	Greater Caribbean	110.06	113.95	116.15	115.28	114.07	115.41	116.50	118.00			
Ecuador	Greater Caribbean	130.54	139.97	141.73	146.06	151.90	159.41	165.00	171.00			
El Salvador	Greater Caribbean	38.06	39.41	39.01	42.36	41.93	43.36	43.80	44.20			
Falkland Islands (Islas Malvinas)	Greater Caribbean	0.19	0.19	0.21	0.21	0.23	0.25	0.26	0.27			
French Guiana	Greater Caribbean	6.34	6.35	6.53	6.81	6.62	6.89	7.00	7.10			
Grenada	Greater Caribbean	0.96	1.61	1.74	1.76	1.78	1.82	2.00	2.20			
Guadeloupe	Greater Caribbean	12.43	12.66	12.88	13.39	13.72	14.41	14.60	14.80			
Guatemala	Greater Caribbean	59.29	65.90	64.56	64.98	67.57	70.29	71.40	72.00			
Guyana	Greater Caribbean	10.81	11.10	11.27	11.08	10.07	10.99	10.70	10.50			
Haiti	Greater Caribbean	10.33	11.23	11.60	11.55	11.84	11.98	12.20	12.40			
Honduras	Greater Caribbean	28.11	33.00	36.34	36.54	41.85	44.09	46.10	47.50			
Jamaica	Greater Caribbean	65.64	66.20	67.78	70.43	71.33	68.97	74.30	77.20			
Martinique	Greater Caribbean	13.35	13.46	13.67	14.24	14.67	15.52	15.70	16.00			
Montserrat	Greater Caribbean	0.37	0.37	0.37	0.42	0.46	0.48	0.50	0.53			
Netherlands Antilles	Greater Caribbean	70.96	71.86	70.51	65.76	66.39	69.94	70.50	71.00			
Nicaragua	Greater Caribbean	24.02	25.58	25.42	25.64	27.17	28.60	27.40	27.80			
Panama	Greater Caribbean	77.38	80.28	76.59	77.57	88.03	84.30	88.20	92.00			
Paraguay	Rest of South America	25.10	24.06	25.05	26.02	26.09	25.81	26.30	27.50			
Peru	Rest of South America	156.79	153.87	152.34	154.22	161.96	157.73	157.60	160.00			
Saint Kitts and Nevis	Greater Caribbean	0.70	0.70	0.70	0.79	0.87	0.92	0.94	0.98			
Saint Lucia	Greater Caribbean	2.33	2.44	2.49	2.74	2.68	2.63	2.68	2.80			
Saint Vincent/Grenadines	Greater Caribbean	1.21	1.23	1.31	1.38	1.47	1.46	1.50	1.60			
Suriname	Greater Caribbean	10.33	10.88	11.46	11.73	12.22	12.58	12.80	13.20			
Trinidad and Tobago	Greater Caribbean	24.68	29.00	28.31	31.34	32.45	34.94	36.20	37.80			
Turks and Caicos Islands	Greater Caribbean	--	0.11	0.08	0.08	0.08	0.08	0.09	0.09			
Uruguay	Rest of South America	43.18	34.11	37.04	36.69	38.47	40.14	40.20	42.00			
Venezuela	Greater Caribbean	499.71	544.47	570.67	540.64	552.85	583.15	645.00	710.00			
Virgin Islands, British	Greater Caribbean	0.41	0.41	0.41	0.48	0.60	0.65	0.67	0.70			
		2,781.36	2,815.70	2,803.17	2,815.86	2,895.33	2,954.44	3,113.66	3,274.47			
	Greater Caribbean	63.3%	65.7%	66.7%	66.3%	65.7%	65.6%	65.3%	65.2%	65.2%	65.2%	65.2%
	Rest of South America	36.7%	34.3%	33.3%	33.7%	34.3%	34.4%	34.7%	34.8%	34.8%	34.8%	34.8%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Consumption, Annual (Thousand barrels per day)

OECD Europe

		<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Austria	Europe North	248.95	265.44	274.22	290.77	292.16	297.90	302.22	289.38			
Belgium	Europe North	606.32	609.07	617.27	654.55	656.54	659.81	638.34	628.47			
Czech Republic	Europe East	169.81	178.75	176.00	187.57	205.90	213.17	211.51	207.35			
Denmark	Europe North	210.00	213.41	197.16	188.27	185.33	183.46	190.48	190.61			
Faroe Islands	Europe North	4.46	4.46	4.49	4.53	4.58	4.64	4.68	4.70			
Finland	Europe North	200.31	199.61	210.01	220.99	218.98	217.11	223.11	228.17			
France	Europe North / South	1,998.58	2,052.16	1,983.25	1,999.05	2,006.57	1,988.65	1,981.18	1,949.95			
Germany	Europe North	2,771.85	2,814.62	2,721.64	2,678.72	2,665.48	2,647.12	2,691.81	2,456.00			
Greece	Europe South	399.21	405.73	408.39	428.73	419.76	423.88	444.10	441.39			
Hungary	Europe East	143.25	138.16	140.39	135.22	136.20	154.76	163.15	162.81			
Iceland	Europe North	18.23	17.49	18.05	18.31	19.03	19.34	20.08	21.12			
Ireland	Europe North	169.98	182.43	179.41	176.24	181.75	191.68	201.22	200.88			
Italy	Europe South	1,853.77	1,832.44	1,870.13	1,873.27	1,793.87	1,754.83	1,742.58	1,701.74			
Luxembourg	Europe North	47.55	50.62	51.69	55.72	61.16	63.80	61.33	60.64			
Netherlands	Europe North	854.52	893.65	898.32	918.64	947.87	1,021.38	999.48	984.24			
Norway	Europe North	211.96	217.61	215.88	227.55	214.15	213.68	229.05	224.55			
Poland	Europe East	411.26	404.69	406.48	431.06	458.54	471.68	502.53	523.98			
Portugal	Europe South	332.66	333.81	343.18	325.92	327.91	336.82	295.72	300.96			
Slovakia	Europe East	66.77	71.67	80.07	74.94	74.57	78.49	78.60	82.86			
Spain	Europe South	1,433.20	1,492.35	1,504.53	1,542.38	1,571.45	1,607.26	1,588.18	1,611.04			
Sweden	Europe North	361.99	369.00	372.59	369.01	368.39	359.57	354.47	353.68			
Switzerland	Europe North	274.03	276.90	267.58	269.89	269.58	271.31	270.52	244.91			
United Kingdom	Europe North	1,765.44	1,746.99	1,738.64	1,758.76	1,785.40	1,833.92	1,812.01	1,740.48			
		14,554.08	14,771.06	14,679.37	14,830.10	14,865.17	15,014.26	15,006.35	14,609.92			
	Europe North	60.1%	60.2%	59.7%	59.6%	59.7%	59.8%	59.9%	58.9%	58.9%	58.9%	58.9%
	Europe South	34.5%	34.5%	34.9%	34.9%	34.4%	34.1%	33.7%	34.4%	34.4%	34.4%	34.4%
	Europe East	5.4%	5.4%	5.5%	5.6%	5.9%	6.1%	6.4%	6.7%	6.7%	6.7%	6.7%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Demand Estimates
Appendix A

EIA, Petroleum Consumption, Annual (Thousand barrels per day)

Non-OECD Europe and Central Asia

		<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Albania	Europe East	21.04	22.68	24.28	27.40	28.83	31.20	31.40	31.80			
Bosnia and Herzegovina	Europe East	19.23	19.28	20.13	21.77	24.94	26.05	26.80	27.50			
Bulgaria	Europe East	99.88	101.31	105.73	102.21	104.45	113.90	119.40	121.00			
Croatia	Europe East	85.54	85.54	89.49	91.34	95.50	95.76	99.00	103.00			
Former Serbia and Montenegro	Europe East	62.48	81.94	83.82	84.67	85.08	86.09	88.30	91.00			
Macedonia	Europe East	22.07	18.48	20.17	19.80	19.65	19.89	20.30	21.00			
Romania	Europe East	224.24	228.91	232.28	219.61	225.09	221.88	215.00	219.00			
Slovenia	Europe East	52.28	52.02	51.04	52.00	52.62	55.03	58.00	60.00			
Cyprus	North Africa/Eastern Med	47.50	51.63	50.88	51.60	54.54	55.51	56.20	57.00			
Gibraltar	North Africa/Eastern Med	41.09	22.68	23.07	23.67	24.35	25.05	25.60	26.10			
Malta	North Africa/Eastern Med	18.16	15.06	18.05	17.98	18.21	18.91	19.10	19.00			
Armenia	Caspian Region	35.21	37.09	38.64	39.91	41.24	44.40	45.40	46.00			
Azerbaijan	Caspian Region	136.89	119.89	110.35	110.78	112.60	128.35	120.00	115.00			
Belarus	Russia & Other FSU	139.77	130.33	123.44	142.83	158.46	171.30	168.00	173.00			
Estonia	Russia & Other FSU	22.93	23.54	23.52	24.36	27.74	28.48	28.80	28.00			
Georgia	Caspian Region	15.84	12.67	12.29	12.44	12.97	15.04	14.50	14.00			
Kazakhstan	Caspian Region	194.75	210.45	217.16	206.98	221.25	228.98	234.20	231.00			
Kyrgyzstan	Caspian Region	10.57	9.25	10.09	9.57	12.23	13.70	13.90	14.00			
Latvia	Russia & Other FSU	28.86	29.75	28.23	29.82	32.63	35.43	36.50	37.20			
Lithuania	Russia & Other FSU	56.53	54.64	53.04	51.56	55.07	68.35	69.00	70.00			
Moldova	Russia & Other FSU	9.58	10.56	11.98	12.91	14.30	14.62	15.00	16.00			
Tajikistan	Caspian Region	23.33	24.96	25.45	27.49	29.49	31.75	33.00	34.00			
Turkmenistan	Caspian Region	62.36	74.15	78.46	86.78	94.55	95.59	99.20	103.00			
Ukraine	Russia & Other FSU	260.14	304.46	308.03	322.46	325.34	352.42	343.00	351.00			
Uzbekistan	Caspian Region	146.09	148.26	151.36	150.47	152.11	145.26	147.00	148.00			
		1,836.35	1,889.49	1,910.98	1,940.40	2,023.25	2,122.94	2,126.60	2,156.60			
	Europe East	32.0%	32.3%	32.8%	31.9%	31.4%	30.6%	31.0%	31.3%	31.3%	31.3%	31.3%
	Caspian Region	34.0%	33.7%	33.7%	33.2%	33.4%	33.1%	33.3%	32.7%	32.7%	32.7%	32.7%
	Russia & Other FSU	28.2%	29.3%	28.7%	30.1%	30.3%	31.6%	31.0%	31.3%	31.3%	31.3%	31.3%
	North Africa/Eastern Med	5.8%	4.7%	4.8%	4.8%	4.8%	4.7%	4.7%	4.7%	4.7%	4.7%	4.7%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Consumption, Annual (Thousand barrels per day)

Middle East

		<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Bahrain	Middle East	23.29	23.98	23.92	25.95	29.09	30.52	33.20	36.00			
Iran	Middle East	1,248.32	1,285.32	1,350.35	1,425.65	1,488.52	1,556.44	1,655.00	1,708.00			
Iraq	Middle East	462.32	489.08	497.37	457.38	502.66	541.03	564.00	596.00			
Jordan	Middle East	101.08	98.84	103.33	106.43	106.98	112.43	107.30	106.00			
Kuwait	Middle East	264.42	275.18	285.16	297.83	305.32	329.94	316.00	325.00			
Oman	Middle East	52.54	54.72	57.23	58.43	63.91	72.06	72.80	76.00			
Qatar	Middle East	48.17	54.48	62.25	71.88	82.85	86.08	102.00	115.00			
Saudi Arabia	Middle East	1,537.10	1,606.30	1,676.25	1,774.59	1,884.41	1,963.64	2,070.00	2,210.00			
United Arab Emirates	Middle East	330.48	324.65	334.63	333.01	351.14	374.23	413.00	441.00			
Yemen	Middle East	96.62	102.45	112.31	121.49	123.28	128.18	133.40	141.00			
Turkey	Europe South	666.88	618.62	657.73	644.97	661.37	659.33	677.62	690.55			
Israel	North Africa/Eastern Med	255.36	273.36	246.46	251.99	241.35	257.53	242.00	235.00			
Lebanon	North Africa/Eastern Med	105.53	101.32	101.92	104.49	102.29	97.45	92.60	94.00			
Syria	North Africa/Eastern Med	255.52	253.73	256.08	257.10	257.62	258.65	264.00	269.00			
		5,447.63	5,562.04	5,764.98	5,931.20	6,200.79	6,467.52	6,742.92	7,042.55			
	Middle East	76.4%	77.6%	78.1%	78.8%	79.6%	80.3%	81.1%	81.7%	81.7%	81.7%	81.7%
	Europe South	12.2%	11.1%	11.4%	10.9%	10.7%	10.2%	10.0%	9.8%	9.8%	9.8%	9.8%
	North Africa/Eastern Med	11.3%	11.3%	10.5%	10.3%	9.7%	9.5%	8.9%	8.5%	8.5%	8.5%	8.5%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Demand Estimates
Appendix A

EIA, Petroleum Consumption, Annual (Thousand barrels per day)												
Other Asia		<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Afghanistan	Rest of Asia	4.72	4.69	4.79	3.81	4.12	4.44	4.65	4.70			
American Samoa	Rest of Asia	3.74	3.75	3.82	3.82	3.81	4.07	4.09	4.10			
Bangladesh	Rest of Asia	68.80	81.25	82.77	83.87	84.64	86.76	88.00	91.00			
Bhutan	Rest of Asia	0.98	1.05	1.09	1.13	1.14	1.15	1.20	1.25			
Brunei	Pacific High Growth	12.05	11.59	11.47	12.94	12.95	14.03	14.60	15.00			
Burma (Myanmar)	Rest of Asia	36.75	33.65	34.52	35.97	40.29	42.99	41.00	40.00			
Cambodia	Rest of Asia	3.52	3.58	3.60	3.68	3.59	3.62	4.20	4.40			
Cook Islands	Rest of Asia	0.39	0.39	0.39	0.39	0.43	0.48	0.48	0.49			
Fiji	Rest of Asia	5.39	5.41	8.22	10.26	8.60	8.06	8.80	9.60			
French Polynesia	Rest of Asia	4.58	4.59	4.82	5.73	5.68	6.27	6.30	6.40			
Guam	Rest of Asia	18.58	20.21	13.66	15.40	12.13	13.53	11.65	11.02			
Hong Kong	Pacific High Growth	244.92	245.38	272.63	276.58	318.15	331.30	349.00	366.00			
Indonesia	Pacific High Growth	1,036.70	1,077.00	1,125.65	1,142.67	1,232.57	1,279.15	1,207.80	1,179.00			
Korea, North	Rest of Asia	25.38	22.51	24.53	24.52	24.02	18.62	16.50	16.20			
Laos	Rest of Asia	2.73	2.74	2.85	2.94	2.90	3.04	3.10	3.20			
Macau	Rest of Asia	10.12	10.73	11.73	12.26	15.03	12.86	14.80	15.30			
Malaysia	Pacific High Growth	465.02	475.10	462.75	479.86	508.04	521.85	520.00	547.00			
Maldives	Rest of Asia	3.14	3.37	6.19	6.96	4.87	3.89	4.70	5.50			
Mongolia	Rest of Asia	8.50	9.86	10.67	10.35	12.28	12.63	13.20	14.00			
Nauru	Rest of Asia	0.96	0.97	1.01	1.01	1.02	1.05	1.08	1.10			
Nepal	Rest of Asia	14.90	15.26	15.51	15.67	16.15	16.72	16.90	17.20			
New Caledonia	Rest of Asia	8.59	8.61	10.02	10.02	11.37	11.42	11.50	12.00			
Pakistan	Rest of Asia	365.01	360.12	355.89	336.60	326.85	336.19	359.00	390.00			
Papua New Guinea	Rest of Asia	14.94	14.98	22.04	25.18	25.02	25.08	27.20	29.50			
Philippines	Pacific High Growth	352.77	346.85	337.75	332.61	337.22	340.79	318.30	322.00			
Samoa	Rest of Asia	0.97	0.97	1.02	1.02	1.06	1.13	1.15	1.17			
Singapore	Pacific High Growth	660.30	707.56	698.04	668.30	745.66	808.58	857.00	916.00			
Solomon Islands	Rest of Asia	1.21	1.21	1.25	1.25	1.30	1.43	1.44	1.46			
Sri Lanka	Rest of Asia	74.60	73.38	76.41	78.27	80.99	87.11	84.60	86.00			
Taiwan	Pacific High Growth	865.30	881.72	893.74	929.90	948.02	939.49	947.00	979.00			
Thailand	Pacific High Growth	724.94	701.61	763.27	832.32	915.47	930.89	941.00	952.00			
Tonga	Rest of Asia	0.92	0.88	0.78	0.78	0.84	1.03	1.10	1.20			
U.S. Pacific Islands	Rest of Asia	2.01	2.01	2.01	2.01	2.01	2.01	2.02	2.03			
Vietnam	Pacific High Growth	175.71	178.57	192.90	214.62	238.37	244.59	255.00	270.00			
Wake Island	Rest of Asia	8.98	9.00	9.16	9.16	9.13	9.09	9.30	9.40			
		5,228.12	5,320.58	5,466.93	5,591.85	5,955.71	6,125.33	6,147.66	6,324.22			
	Pacific High Growth	86.8%	86.9%	87.0%	87.4%	88.3%	88.3%	88.0%	87.7%	87.7%	87.7%	87.7%
	Rest of Asia	13.2%	13.1%	13.0%	12.6%	11.7%	11.7%	12.0%	12.3%	12.3%	12.3%	12.3%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

Statistics Canada, Petroleum Consumption, Annual (Thousand cubic meters)

	<u>2007</u>
Atlantic Provinces	9,833
Quebec	22,307
Ontario	33,226
Manitoba	3,089
Saskatchewan	4,889
Alberta	17,898
British Columbia	11,524
Yukon Territory	129
Northwest Territories	537
Total	103,432
Canada East	63.2%
Canada West	36.8%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels)						
United States						
	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>2007</u>
PADD 1	7,458	7,170	6,941	8,299	8,062	7,703
PADD 2	164,635	161,360	159,309	161,587	167,298	171,521
PADD 3	1,174,305	1,162,869	1,103,743	1,023,499	1,035,904	1,032,088
PADD 4	102,982	105,931	113,069	123,956	130,466	131,716
PADD 5	647,745	636,123	600,239	572,765	520,529	505,423
Total	2,097,125	2,073,453	1,983,301	1,890,106	1,862,259	1,848,451
PADD 1	0.4%	0.3%	0.3%	0.4%	0.4%	0.4%
PADD 2	7.9%	7.8%	8.0%	8.5%	9.0%	9.3%
PADD 3	56.0%	56.1%	55.7%	54.2%	55.6%	55.8%
PADD 4	4.9%	5.1%	5.7%	6.6%	7.0%	7.1%
PADD 5	30.9%	30.7%	30.3%	30.3%	28.0%	27.3%

CAPP, Petroleum Production, Annual (Thousand barrels per day)					
Canada					
	<u>2005</u>	<u>2007</u>	<u>2010</u>	<u>2015</u>	<u>2020</u>
Canada East	305	369	235	140	75
Canada West	1,213	1,182	1,112	984	860
<i>Oil sands</i>	975	1,202	1,619	2,769	3,539
Total	1,518	1,551	1,347	1,124	935
Canada East	20.1%	23.8%	17.4%	12.5%	8.0%
Canada West	79.9%	76.2%	82.6%	87.5%	92.0%
<i>Oil sands as percentage of total conventional</i>	64.2%	77.5%	120.2%	246.3%	378.6%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels per day)												
Non-OPEC Africa		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Cameroon	SSA - West Central	84.82	76.65	69.82	67.00	65.99	82.32	86.40	82.83			
Chad	SSA - West Central	0.00	0.00	0.00	36.07	170.59	176.66	157.92	144.20			
Congo (Brazzaville)	SSA - West Central	292.13	266.61	260.21	255.84	243.25	236.21	247.65	214.17			
Congo (Kinshasa)	SSA - West Central / South East	26.00	24.00	22.67	22.00	21.08	19.75	20.00	22.16			
Cote d'Ivoire (IvoryCoast)	SSA - West Central	11.50	11.00	12.00	19.00	26.00	39.00	62.00	52.00			
Egypt	North Africa/Eastern Med	803.44	758.40	750.99	749.65	708.13	696.18	675.17	672.03			
Equatorial Guinea	SSA - West Central	167.50	181.44	212.56	206.47	368.21	375.48	362.87	368.53			
Gabon	SSA - West Central	315.00	270.00	251.20	241.42	239.05	266.32	237.22	244.22			
Ghana	SSA - West	7.00	7.00	7.00	7.00	7.00	6.00	6.00	6.00			
Mauritania	SSA - West	0.00	0.00	0.00	0.00	0.00	0.00	30.62	14.99			
Morocco	North Africa/Eastern Med	5.30	5.40	5.26	5.20	5.20	5.50	5.50	5.50			
South Africa	SSA - South Africa +	188.70	196.33	197.96	191.24	217.03	200.40	187.16	182.06			
Sudan	SSA - Red Sea	186.00	209.13	238.77	269.74	342.51	350.00	378.11	463.77			
Tunisia	North Africa/Eastern Med	80.73	72.63	78.80	77.61	81.76	77.00	78.44	86.30			
		2,168.12	2,078.58	2,107.23	2,148.23	2,495.81	2,530.81	2,535.05	2,558.76			
	North Africa/Eastern Med	41.0%	40.2%	39.6%	38.8%	31.9%	30.8%	29.9%	29.9%	24.3%	25.2%	26.9%
	SSA - West	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	1.4%	0.8%	0.7%	0.7%	0.6%
	SSA - West Central	41.0%	39.6%	39.0%	39.2%	45.2%	47.0%	46.1%	43.8%	44.0%	45.7%	46.0%
	SSA - South Africa +	8.7%	9.4%	9.4%	8.9%	8.7%	7.9%	7.4%	7.1%	5.8%	6.0%	5.6%
	SSA - South East	0.4%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.3%	0.2%	0.2%	0.2%
	SSA - Red Sea	8.6%	10.1%	11.3%	12.6%	13.7%	13.8%	14.9%	18.1%	25.0%	22.2%	20.7%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Cameroon	SSA - West Central	3.9%	3.7%	3.3%	3.1%	2.6%	3.3%	3.4%	3.2%	2.6%	2.7%	2.5%
Chad	SSA - West Central	0.0%	0.0%	0.0%	1.7%	6.8%	7.0%	6.2%	5.6%	7.1%	7.4%	6.9%
Congo Republic	SSA - West Central	13.5%	12.8%	12.3%	11.9%	9.7%	9.3%	9.8%	8.4%	7.1%	11.1%	13.8%
DR Congo	SSA - West Central / South East	1.2%	1.2%	1.1%	1.0%	0.8%	0.8%	0.8%	0.9%	0.7%	0.7%	0.7%
Cote d'Ivoire	SSA - West Central	0.5%	0.5%	0.6%	0.9%	1.0%	1.5%	2.4%	2.0%	1.6%	1.7%	1.6%
Egypt	North Africa/Eastern Med	37.1%	36.5%	35.6%	34.9%	28.4%	27.5%	26.6%	26.3%	21.4%	22.2%	24.1%
Equatorial Guinea	SSA - West Central	7.7%	8.7%	10.1%	9.6%	14.8%	14.8%	14.3%	14.4%	17.9%	14.8%	13.8%
Gabon	SSA - West Central	14.5%	13.0%	11.9%	11.2%	9.6%	10.5%	9.4%	9.5%	7.1%	7.4%	6.9%
Ghana	SSA - West	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Mauritania	SSA - West	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	0.6%	0.5%	0.5%	0.5%
Morocco	North Africa/Eastern Med	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
South Africa	SSA - South Africa +	8.7%	9.4%	9.4%	8.9%	8.7%	7.9%	7.4%	7.1%	5.8%	6.0%	5.6%
Sudan	SSA - Red Sea	8.6%	10.1%	11.3%	12.6%	13.7%	13.8%	14.9%	18.1%	25.0%	22.2%	20.7%
Tunisia	North Africa/Eastern Med	3.7%	3.5%	3.7%	3.6%	3.3%	3.0%	3.1%	3.4%	2.7%	2.8%	2.6%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels per day)												
OPEC West Africa		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Angola	SSA - South Africa +	746.40	742.38	896.37	902.55	1,054.72	1,260.79	1,435.28	1,768.97			
Nigeria	SSA - Nigeria +	2,165.00	2,256.16	2,117.86	2,275.00	2,328.96	2,627.44	2,439.86	2,349.64			
		2,911.40	2,998.54	3,014.23	3,177.55	3,383.68	3,888.23	3,875.15	4,118.61			
Angola	SSA - South Africa +	25.6%	24.8%	29.7%	28.4%	31.2%	32.4%	37.0%	43.0%	48.0%	45.8%	46.7%
Nigeria	SSA - Nigeria +	74.4%	75.2%	70.3%	71.6%	68.8%	67.6%	63.0%	57.0%	52.0%	54.2%	53.3%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

EIA, Petroleum Production, Annual (Thousand barrels per day)												
OPEC North Africa		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Algeria	North Africa/Eastern Med	1,483.91	1,560.00	1,575.98	1,891.04	1,968.78	2,092.32	2,124.00	2,175.40			
Libya	North Africa/Eastern Med	1,470.03	1,428.55	1,383.52	1,485.52	1,583.22	1,721.92	1,809.64	1,845.55			
		2,953.93	2,988.55	2,959.50	3,376.56	3,551.99	3,814.23	3,933.64	4,020.95			
Algeria	North Africa/Eastern Med	50.2%	52.2%	53.3%	56.0%	55.4%	54.9%	54.0%	54.1%	57.4%	62.8%	66.7%
Libya	North Africa/Eastern Med	49.8%	47.8%	46.7%	44.0%	44.6%	45.1%	46.0%	45.9%	42.6%	37.2%	33.3%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
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EIA, Petroleum Production, Annual (Thousand barrels per day)		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
OPEC Middle East												
Iran	Middle East	3,771.30	3,803.70	3,530.50	3,837.79	4,106.43	4,240.29	4,150.40	4,035.55			
Iraq	Middle East	2,585.68	2,410.00	2,043.00	1,320.79	2,026.47	1,892.66	2,013.60	2,099.74			
Kuwait	Middle East	2,193.50	2,117.02	2,019.16	2,259.75	2,505.70	2,659.18	2,665.34	2,603.51			
Qatar	Middle East	870.20	864.15	839.11	916.07	1,032.54	1,100.00	1,130.97	1,114.41			
Saudi Arabia	Middle East	9,471.80	9,152.10	8,809.40	10,075.00	10,490.82	11,090.14	10,659.33	10,241.51			
United Arab Emirates	Middle East	2,567.83	2,495.00	2,381.99	2,658.14	2,757.36	2,835.42	2,935.70	2,938.32			
		21,460.31	20,841.96	19,623.16	21,067.53	22,919.32	23,817.68	23,555.34	23,033.03			
Iran	Middle East	17.6%	18.3%	18.0%	18.2%	17.9%	17.8%	17.6%	17.5%	17.4%	15.3%	13.6%
Iraq	Middle East	12.0%	11.6%	10.4%	6.3%	8.8%	7.9%	8.5%	9.1%	8.5%	8.1%	11.4%
Kuwait	Middle East	10.2%	10.2%	10.3%	10.7%	10.9%	11.2%	11.3%	11.3%	11.0%	11.3%	10.5%
Qatar	Middle East	4.1%	4.1%	4.3%	4.3%	4.5%	4.6%	4.8%	4.8%	6.8%	8.1%	9.5%
Saudi Arabia	Middle East	44.1%	43.9%	44.9%	47.8%	45.8%	46.6%	45.3%	44.5%	44.1%	45.9%	44.1%
United Arab Emirates	Middle East	12.0%	12.0%	12.1%	12.6%	12.0%	11.9%	12.5%	12.8%	12.3%	11.3%	10.9%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

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EIA, Petroleum Production, Annual (Thousand barrels per day)												
Non-OPEC Middle East		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Bahrain	Middle East	48.37	47.30	47.26	47.63	48.00	45.00	46.00	46.00			
Israel	North Africa/Eastern Med	0.08	0.08	0.10	0.06	0.08	0.10	0.10	0.10			
Jordan	Middle East	0.04	0.04	0.02	0.02	0.02	0.02	0.02	0.02			
Oman	Middle East	974.00	917.00	901.72	825.30	756.46	782.30	745.65	716.42			
Syria	North Africa/Eastern Med	550.83	517.94	525.23	513.98	491.06	482.04	451.80	436.21			
Yemen	Middle East	437.76	440.87	439.35	429.40	404.38	400.15	374.91	318.69			
Turkey	Europe South	52.68	48.00	46.67	45.17	42.42	43.67	42.16	41.00			
		2,063.75	1,971.23	1,960.36	1,861.56	1,742.41	1,753.28	1,660.64	1,558.44			
	Middle East	70.8%	71.3%	70.8%	70.0%	69.4%	70.0%	70.2%	69.4%	70.4%	72.3%	75.7%
	North Africa/Eastern Med	26.7%	26.3%	26.8%	27.6%	28.2%	27.5%	27.2%	28.0%	27.0%	25.3%	21.9%
	Europe South	2.6%	2.4%	2.4%	2.4%	2.4%	2.5%	2.5%	2.6%	2.5%	2.4%	2.4%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Bahrain	Middle East	2.3%	2.4%	2.4%	2.6%	2.8%	2.6%	2.8%	3.0%	2.9%	2.7%	2.7%
Israel	North Africa/Eastern Med	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Jordan	Middle East	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Oman	Middle East	47.2%	46.5%	46.0%	44.3%	43.4%	44.6%	44.9%	46.0%	47.3%	50.6%	51.1%
Syria	North Africa/Eastern Med	26.7%	26.3%	26.8%	27.6%	28.2%	27.5%	27.2%	28.0%	27.0%	25.3%	21.9%
Yemen	Middle East	21.2%	22.4%	22.4%	23.1%	23.2%	22.8%	22.6%	20.4%	20.3%	19.0%	21.9%
Turkey	Europe South	2.6%	2.4%	2.4%	2.4%	2.4%	2.5%	2.5%	2.6%	2.5%	2.4%	2.4%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels per day)												
Non-OPEC Central and South America		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Argentina	Rest of South America	809.14	850.40	840.15	840.11	797.08	773.65	774.43	762.78			
Barbados	Greater Caribbean	1.53	1.27	1.00	1.00	1.00	1.00	1.03	1.11			
Belize	Greater Caribbean	0.00	0.00	0.00	0.00	0.00	0.00	2.26	3.00			
Bolivia	Rest of South America	39.39	43.87	46.20	41.71	60.01	61.35	59.66	60.46			
Chile	Rest of South America	10.85	11.70	11.31	11.37	10.59	10.25	8.40	6.44			
Colombia	Greater Caribbean	694.28	626.62	578.94	544.55	532.76	529.79	534.95	533.66			
Cuba	Greater Caribbean	42.00	50.00	47.30	55.17	57.93	52.27	51.64	51.73			
Guatemala	Greater Caribbean	20.68	21.08	17.99	21.99	19.81	17.15	20.14	15.82			
Peru	Rest of South America	99.49	97.06	96.87	92.35	94.12	111.29	115.58	113.87			
Suriname	Greater Caribbean	10.00	10.00	10.00	10.00	10.00	10.00	11.60	13.54			
Trinidad and Tobago	Greater Caribbean	146.45	139.10	152.06	182.55	164.94	181.87	191.17	164.25			
		1,873.81	1,851.09	1,801.81	1,800.80	1,748.24	1,748.63	1,770.87	1,726.65			
	Greater Caribbean	48.8%	45.8%	44.8%	45.3%	45.0%	45.3%	45.9%	45.4%	47.8%	44.5%	45.3%
	Rest of South America	51.2%	54.2%	55.2%	54.7%	55.0%	54.7%	54.1%	54.6%	52.2%	55.5%	54.7%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Argentina	Rest of South America	43.2%	45.9%	46.6%	46.7%	45.6%	44.2%	43.7%	44.2%	41.2%	33.3%	26.7%
Barbados	Greater Caribbean	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%
Belize	Greater Caribbean	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.2%	0.4%	0.7%
Bolivia	Rest of South America	2.1%	2.4%	2.6%	2.3%	3.4%	3.5%	3.4%	3.5%	4.7%	8.0%	13.3%
Chile	Rest of South America	0.6%	0.6%	0.6%	0.6%	0.6%	0.6%	0.5%	0.4%	0.5%	0.8%	1.4%
Colombia	Greater Caribbean	37.1%	33.9%	32.1%	30.2%	30.5%	30.3%	30.2%	30.9%	29.4%	20.0%	20.0%
Cuba	Greater Caribbean	2.2%	2.7%	2.6%	3.1%	3.3%	3.0%	2.9%	3.0%	4.0%	6.8%	11.3%
Guatemala	Greater Caribbean	1.1%	1.1%	1.0%	1.2%	1.1%	1.0%	1.1%	0.9%	1.2%	2.1%	3.5%
Peru	Rest of South America	5.3%	5.2%	5.4%	5.1%	5.4%	6.4%	6.5%	6.6%	5.9%	13.3%	13.3%
Suriname	Greater Caribbean	0.5%	0.5%	0.6%	0.6%	0.6%	0.6%	0.7%	0.8%	1.0%	1.8%	3.0%
Trinidad and Tobago	Greater Caribbean	7.8%	7.5%	8.4%	10.1%	9.4%	10.4%	10.8%	9.5%	11.8%	13.3%	6.7%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels per day)		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
OECD Europe												
Austria	Europe North	20.00	20.67	21.66	20.92	21.08	18.82	19.75	20.42			
Czech Republic	Europe East	6.10	7.42	7.50	9.00	11.09	12.01	7.66	7.50			
Denmark	Europe North	362.93	346.20	370.76	375.05	389.15	377.15	342.00	311.56			
France	Europe North / South	36.00	34.92	33.91	29.38	28.33	24.34	22.50	20.84			
Germany	Europe North	82.82	78.86	81.86	80.30	83.90	73.93	83.55	80.33			
Greece	Europe South	5.65	5.79	4.06	3.31	3.14	2.67	1.84	1.25			
Hungary	Europe East	46.57	45.72	38.35	40.90	42.86	37.17	33.82	27.56			
Italy	Europe South	93.50	79.46	85.36	95.85	112.17	124.61	124.34	126.37			
Netherlands	Europe North	54.58	46.20	65.15	64.95	61.04	49.74	41.32	54.30			
Norway	Europe North	3,345.68	3,414.57	3,333.89	3,264.03	3,188.56	2,968.47	2,776.79	2,555.63			
Poland	Europe East	12.90	17.18	16.74	16.30	28.74	24.63	29.49	29.50			
Portugal	Europe South	0.00	0.00	0.00	0.00	0.00	0.00	1.00	2.25			
Slovakia	Europe East	1.00	1.00	1.00	1.26	5.67	8.93	10.00	8.85			
Spain	Europe South	4.75	7.10	6.41	6.60	6.00	3.09	2.99	2.75			
Turkey	Europe South	52.68	48.00	46.67	45.17	42.42	43.67	42.16	41.00			
United Kingdom	Europe North	2,507.76	2,540.70	2,503.22	2,334.37	2,017.46	1,805.09	1,632.49	1,633.64			
		6,632.92	6,693.80	6,616.54	6,387.37	6,041.60	5,574.30	5,171.72	4,923.74			
	Europe North	96.4%	96.6%	96.6%	96.4%	95.6%	95.2%	94.9%	94.8%	91.9%	90.1%	87.8%
	Europe South	2.6%	2.4%	2.4%	2.6%	2.9%	3.3%	3.5%	3.7%	5.8%	7.1%	8.7%
	Europe East	1.0%	1.1%	1.0%	1.1%	1.5%	1.5%	1.6%	1.5%	2.3%	2.8%	3.5%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Austria	Europe North	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.4%	0.4%	0.6%	0.8%	1.0%
Czech Republic	Europe East	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	0.1%	0.2%	0.2%	0.3%	0.4%
Denmark	Europe North	5.5%	5.2%	5.6%	5.9%	6.4%	6.8%	6.6%	6.3%	6.7%	5.4%	3.3%
France	Europe North / South	0.5%	0.5%	0.5%	0.5%	0.5%	0.4%	0.4%	0.4%	0.7%	0.8%	1.0%
Germany	Europe North	1.2%	1.2%	1.2%	1.3%	1.4%	1.3%	1.6%	1.6%	2.5%	3.1%	3.8%
Greece	Europe South	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%
Hungary	Europe East	0.7%	0.7%	0.6%	0.6%	0.7%	0.7%	0.7%	0.6%	0.9%	1.1%	1.3%
Italy	Europe South	1.4%	1.2%	1.3%	1.5%	1.9%	2.2%	2.4%	2.6%	4.0%	4.8%	6.0%
Netherlands	Europe North	0.8%	0.7%	1.0%	1.0%	1.0%	0.9%	0.8%	1.1%	1.7%	2.1%	2.6%
Norway	Europe North	50.4%	51.0%	50.4%	51.1%	52.8%	53.3%	53.7%	51.9%	53.3%	51.4%	53.3%
Poland	Europe East	0.2%	0.3%	0.3%	0.3%	0.5%	0.4%	0.6%	0.6%	0.9%	1.1%	1.4%
Portugal	Europe South	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Slovakia	Europe East	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.2%	0.2%	0.3%	0.3%	0.4%
Spain	Europe South	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Turkey	Europe South	0.8%	0.7%	0.7%	0.7%	0.7%	0.8%	0.8%	0.8%	1.3%	1.6%	1.9%
United Kingdom	Europe North	37.8%	38.0%	37.8%	36.5%	33.4%	32.4%	31.6%	33.2%	26.7%	27.0%	23.3%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels per day)												
Non-OECD Europe and Central Asia		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Albania	Europe East	5.66	5.95	6.36	6.72	6.69	7.00	7.74	6.42			
Bulgaria	Europe East	0.85	0.60	0.74	0.60	1.00	1.00	1.00	1.00			
Croatia	Europe East	30.34	28.56	27.40	27.28	25.25	23.66	21.75	20.09			
Romania	Europe East	128.42	131.21	130.71	123.96	121.25	112.31	103.46	102.03			
Serbia	Europe East	16.00	15.00	14.00	13.50	13.00	12.16	11.00	10.00			
Slovenia	Europe East	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01			
Azerbaijan	Caspian Region	286.04	307.17	313.86	323.75	315.43	438.77	645.52	846.83			
Belarus	Russia & Other FSU	37.00	37.00	36.51	36.40	36.33	35.00	35.00	35.00			
Estonia	Russia & Other FSU	4.75	0.00	5.50	6.10	6.56	6.90	7.28	7.40			
Georgia	Caspian Region	2.00	2.00	1.48	2.80	2.00	2.00	1.00	1.00			
Kazakhstan	Caspian Region	725.00	834.86	964.19	1,058.71	1,241.25	1,333.28	1,383.33	1,440.34			
Kyrgyzstan	Caspian Region	2.00	2.00	1.52	1.38	1.40	2.00	2.00	1.00			
Lithuania	Russia & Other FSU	5.98	9.56	8.84	7.76	6.11	4.39	3.67	3.09			
Tajikistan	Caspian Region	0.39	0.33	0.31	0.35	0.25	0.28	0.30	0.28			
Turkmenistan	Caspian Region	157.17	167.00	191.57	199.36	213.08	195.81	176.47	179.55			
Ukraine	Russia & Other FSU	88.33	86.49	84.41	89.50	93.37	99.50	102.59	101.50			
Uzbekistan	Caspian Region	151.34	154.00	151.95	155.04	141.00	123.90	106.98	98.25			
		1,641.29	1,781.74	1,939.36	2,053.23	2,223.97	2,397.96	2,609.11	2,853.79			
	Europe East	11.0%	10.2%	9.2%	8.4%	7.5%	6.5%	5.6%	4.9%	3.8%	2.2%	2.2%
	Caspian Region	80.7%	82.4%	83.8%	84.8%	86.1%	87.4%	88.8%	90.0%	92.2%	95.4%	95.4%
	Russia & Other FSU	8.3%	7.5%	7.0%	6.8%	6.4%	6.1%	5.7%	5.2%	4.0%	2.4%	2.4%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Albania	Europe East	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.2%	0.1%	0.1%
Bulgaria	Europe East	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Croatia	Europe East	1.8%	1.6%	1.4%	1.3%	1.1%	1.0%	0.8%	0.7%	0.5%	0.3%	0.3%
Romania	Europe East	7.8%	7.4%	6.7%	6.0%	5.5%	4.7%	4.0%	3.6%	2.8%	1.6%	1.6%
Serbia	Europe East	1.0%	0.8%	0.7%	0.7%	0.6%	0.5%	0.4%	0.4%	0.3%	0.2%	0.2%
Slovenia	Europe East	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Azerbaijan	Caspian Region	17.4%	17.2%	16.2%	15.8%	14.2%	18.3%	24.7%	29.7%	34.2%	27.9%	25.6%
Belarus	Russia & Other FSU	2.3%	2.1%	1.9%	1.8%	1.6%	1.5%	1.3%	1.2%	1.0%	0.6%	0.6%
Estonia	Russia & Other FSU	0.3%	0.0%	0.3%	0.3%	0.3%	0.3%	0.3%	0.3%	0.2%	0.1%	0.1%
Georgia	Caspian Region	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Kazakhstan	Caspian Region	44.2%	46.9%	49.7%	51.6%	55.8%	55.6%	53.0%	50.5%	50.0%	58.1%	60.5%
Kyrgyzstan	Caspian Region	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
Lithuania	Russia & Other FSU	0.4%	0.5%	0.5%	0.4%	0.3%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%
Tajikistan	Caspian Region	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Turkmenistan	Caspian Region	9.6%	9.4%	9.9%	9.7%	9.6%	8.2%	6.8%	6.3%	5.3%	7.0%	7.0%
Ukraine	Russia & Other FSU	5.4%	4.9%	4.4%	4.4%	4.2%	4.1%	3.9%	3.6%	2.8%	1.6%	1.6%
Uzbekistan	Caspian Region	9.2%	8.6%	7.8%	7.6%	6.3%	5.2%	4.1%	3.4%	2.6%	2.3%	2.3%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

**Demand Estimates
Appendix A**

EIA, Petroleum Production, Annual (Thousand barrels per day)		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Other Asia												
Bangladesh	Rest of Asia	2.70	3.58	6.30	6.30	6.20	6.20	6.20	6.20			
Brunei	Pacific High Growth	215.00	217.23	189.00	195.94	204.17	213.36	221.64	180.28			
Burma (Myanmar)	Rest of Asia	12.26	10.17	15.20	15.17	20.15	20.19	23.20	21.36			
India	Rest of Asia	736.34	742.40	779.75	782.03	811.42	794.66	813.68	840.61			
Indonesia	Pacific High Growth	1,518.38	1,421.62	1,329.03	1,232.97	1,168.64	1,135.15	1,087.55	1,028.96			
Korea, South	Pacific High Growth	13.00	12.00	11.00	10.00	9.00	10.00	11.00	13.92			
Malaysia	Pacific High Growth	763.03	741.21	785.46	830.86	850.35	740.37	717.91	691.51			
Pakistan	Rest of Asia	58.02	64.61	69.04	64.93	67.00	68.63	68.67	69.08			
Papua New Guinea	Rest of Asia	70.06	67.50	55.15	50.49	45.58	40.28	44.39	41.99			
Philippines	Pacific High Growth	1.14	8.46	9.85	13.78	25.00	25.00	25.00	24.62			
Taiwan	Pacific High Growth	1.04	1.10	0.98	0.97	0.83	0.83	0.83	0.83			
Thailand	Pacific High Growth	169.66	173.76	192.16	241.20	237.82	290.25	313.79	327.88			
Timor-Leste (East Timor)	Rest of Asia	--	--	--	0.00	51.91	94.42	100.90	78.48			
Vietnam	Pacific High Growth	316.00	356.75	339.59	352.51	403.29	390.99	361.90	350.65			
		3,876.63	3,820.37	3,782.52	3,797.14	3,901.36	3,830.33	3,796.66	3,676.36			
	Pacific High Growth	77.3%	76.7%	75.5%	75.8%	74.3%	73.3%	72.2%	71.2%	67.8%	67.0%	68.4%
	Rest of Asia	22.7%	23.3%	24.5%	24.2%	25.7%	26.7%	27.8%	28.8%	32.2%	33.0%	31.6%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		2000	2001	2002	2003	2004	2005	2006	2007	2010	2015	2020
Bangladesh	Rest of Asia	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.1%
Brunei	Pacific High Growth	5.5%	5.7%	5.0%	5.2%	5.2%	5.6%	5.8%	4.9%	5.1%	5.3%	5.4%
Burma (Myanmar)	Rest of Asia	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.6%	0.6%	0.7%	0.5%
India	Rest of Asia	19.0%	19.4%	20.6%	20.6%	20.8%	20.7%	21.4%	22.9%	25.6%	26.3%	27.0%
Indonesia	Pacific High Growth	39.2%	37.2%	35.1%	32.5%	30.0%	29.6%	28.6%	28.0%	23.1%	21.1%	18.9%
Korea, South	Pacific High Growth	0.3%	0.3%	0.3%	0.3%	0.2%	0.3%	0.3%	0.4%	0.4%	0.4%	0.3%
Malaysia	Pacific High Growth	19.7%	19.4%	20.8%	21.9%	21.8%	19.3%	18.9%	18.8%	15.4%	15.8%	18.9%
Pakistan	Rest of Asia	1.5%	1.7%	1.8%	1.7%	1.7%	1.8%	1.8%	1.9%	2.1%	2.1%	1.5%
Papua New Guinea	Rest of Asia	1.8%	1.8%	1.5%	1.3%	1.2%	1.1%	1.2%	1.1%	1.3%	1.3%	0.9%
Philippines	Pacific High Growth	0.0%	0.2%	0.3%	0.4%	0.6%	0.7%	0.7%	0.7%	0.7%	0.8%	0.5%
Taiwan	Pacific High Growth	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Thailand	Pacific High Growth	4.4%	4.5%	5.1%	6.4%	6.1%	7.6%	8.3%	8.9%	10.3%	10.5%	10.8%
Timor-Leste (East Timor)	Rest of Asia	0.0%	0.0%	0.0%	0.0%	1.3%	2.5%	2.7%	2.1%	2.4%	2.4%	1.7%
Vietnam	Pacific High Growth	8.2%	9.3%	9.0%	9.3%	10.3%	10.2%	9.5%	9.5%	12.8%	13.2%	13.5%
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

APPENDIX B: WORLD® MODEL ASSUMPTIONS

This appendix contains certain assumptions that were not included in the main report. These assumptions are critical to the correct working of the model but are not necessarily relevant to the SSA refining sector discussion so they were included in this appendix.

Global Product Demand Mix & Quality

The WORLD® “starting point” already included developments which will be critical for setting future refining economics and product supply costs / prices in Africa and elsewhere. These include: the global trend to light products which will continue to leave residual fuel as a low revenue stream, the trend in Europe and elsewhere to distillates (notably diesel) with its higher growth rates than gasoline and hence impacts on relative gasoline/jet-kero/diesel economics, the impacts of growing biofuel supplies, and the effects of broadly tightening quality on gasoline and diesel and also of marine fuels regulations. The existing product specifications, including carbon taxes where applicable (e.g. the European Union’s ETs), that exist in different regions are modeled as are product specifications that are required by law or regulation but have not yet been implemented (e.g., off road diesel in the United States). Biofuels mandates have also been factored in, following the EIA AEO2009 projections with limited adjustments.

Broadly the trends incorporated in WORLD for gasoline and diesel are for completion of OECD ultra-low sulfur programs by 2011/2012 and for non-OECD regions to progressively move towards first low sulfur (500 – 100 ppm) and then ultra-low sulfur (50 – 10 ppm) levels, generally following the Euro II/IV/V standards. The net effect is that projected gasoline and diesel sulfur levels will be below 150 and 500 ppm respectively by 2020 in essentially all non-OECD regions.

Arguably, the main “new” global trend in product quality stems from efforts to restrict pollution from marine vessels. The Protocol of 1997 adopted by the International Maritime Organization (IMO) included Annex VI of MARPOL¹⁹ which entered into force in May of 2005 and sets limits on SO_x and NO_x emissions from ship exhausts. In October 2008, the IMO Marine Environment Protection Committee (MEPC) adopted amendments to the regulations under Annex VI to further reduce emissions (for ratification July 2009). The amendments enter into force in 2010. Under them, the global sulfur cap for bunkers will be reduced to 3.5 %S starting 1 January 2012 and then reduced to 0.50 %S effective on 1 January 2020. Limits on bunkers in Emission Control Areas (ECA’s) are reduced to 1.00 %S on 1 March 2010 (from 1.5%) and further reduced to 0.10 %S effective 1 January 2015. The IMO will conduct a study in 2018 to confirm whether the global 0.5%S standard will in fact be mandated for 2020 or delayed to no later than 2025.

What the impact will be will partially depend on advances in ship scrubbing technology. However, the net effect will likely be a substantial impact on the market for heavy fuel oil used as bunkers and also on marine and land use distillates markets. Barring widespread use of scrubbing, the 0.1%S ECA standard applicable in 2015 will require all affected fuel volumes to be marine distillate (MGO or MDO) not IFO. Again, barring widespread scrubbing, the global switch to 0.5%S bunkers in 2020/25 will also require distillate. EnSys was heavily involved in

¹⁹ International Convention for the Prevention of Pollution from Ships.

World® Model Assumptions Appendix B

refining studies leading up to the IMO decision and it is plain that full conversion from IFO to distillate would lead to very substantial incremental refining investments and to major impacts on the supply costs of heavy fuels, marine and other distillates. Crude price differentials would also be impacted.

The issue for the SSA refining study was what marine fuels scenario to assume. Drawing on other study work undertaken for the U.S. EPA *et al*, the basis adopted for this study was as follows:

2010

- No additional ECA's in force beyond the two in existence today in Northern Europe (Baltic and North Sea) plus the EU 0.1% S marine diesel rule
- ECA standard of 1.0% S applies
- Global limit of 3.5% S applies. (In practice this is projected to have little impact as current global average IFO sulfur level is around 2.7% S and few IFO lots are sampled at levels above 3.5% S.)

2015

- The United States and Canada have introduced ECA's but no other regions have done so
- New 0.1% sulfur standard applies in ECA's and is met entirely by using low sulfur marine distillate fuel (no use of scrubbing)

2020

- Global 0.5% sulfur standard is assumed deferred to beyond 2020 and/or it is assumed that scrubbing has become proven
- There are additional ECA's in force, i.e. a gradual increase in the proportion of low sulfur marine distillate.

The 2020 scenario was selected as ICF/EnSys knows from experience that a total conversion from IFO to marine distillate would dominate all other product grade mix and quality developments and hence bias the study results. At a future date, and depending on how the IMO Annex VI situation evolves, it may be appropriate to revisit the analysis.

Global and SSA Costs

Significant cost inputs include regional **prices for natural gas** as supplementary refinery fuel and hydrogen feedstock and the price of fuel grade coke. In part based on EIA projections, natural gas prices by region were projected to broadly maintain their current ratios to crude oil price. Based on review with CITAC, the selected few SSA refineries with access to natural gas were identified. Based on "opportunity cost" considerations, associated natural gas prices were estimated at levels well below Btu parity with crude.

Prices for **petroleum coke** have little direct impact on SSA refineries today as they possess little coking capacity. However, coke prices are important in the global context as they have an impact on the attractiveness of coking. In the WORLD® model, coking unit throughputs are not fixed and so fuel grade coke production is allowed to float at an input price. In this study, coke prices were projected to move up moderately over time, reflecting in part the projected rising crude prices but also relatively flat coal prices, which are important in driving coke price.

World® Model Assumptions Appendix B

Sub Saharan Africa Assumptions

SSA refinery sub-groups used in the analysis were those that were agreed on in the project Kick off meeting and the Steering Committee meeting, and as shown in Exhibit 4. At those meetings, a series of refinery projects was also listed, as shown in Exhibit 5. However, with the exception of one small project, none of those is currently under construction. To be consistent with the approach used across global regions of adding into the capacity base only projects known to be under construction, no SSA projects were therefore added into the capacity base. WORLD® results, and the SSA and other capacity expansions contained therein, thus provided a reference against which to compare the projects currently listed for SSA refineries.

SSA Refinery Assumptions

A series of premises was applied to define the SS African refineries as closely as possible.

None of the listed SSA projects was under construction as so, as previously explained, none was added into the WORLD® refinery projects database²⁰. In the three “new” refining groups, the option was left open for the model to elect to add further capacity. Since the Sonangol Lobito refinery is the furthest advanced among a number of potential Africa South regional projects, the WORLD® model Africa South “new” slot was established as most likely processing Angolan crude oil. (No configuration details were pre-set in any of the “new” slots as the model selects a capacity and configuration.) No defined projects were assigned to Africa West “new”. The Africa East “new” slot was used to reflect the potential Uganda refinery to process Mputa crude.

Based on ICF/EnSys experience that, in less efficient refineries, the secondary units often have even higher days off line than the main distillation unit, and on guidance from CITAC, the effective capacities on secondary units were assessed separate from those for crude distillation²¹.

The information was used to establish realistic refinery capabilities for the modeling and also to determine which “lower capability” refineries do or do not have the potential to be brought up to nameplate capacity through revamp projects. Such revamp projects would provide a lower cost step for improving capacity before launching into full cost major new units or complete new refineries and are thus an important consideration.

The WORLD® model contains a detailed build-up of refinery capital costs by process unit. WORLD® process unit capital costs are basis year 2000, U.S. Gulf Coast. To adjust to future horizons, it is first necessary to consider general, global escalation versus 2000 in the costs of construction. 2008 costs were reported as having escalated by a factor of 1.75 relative to 2000. Based on early 2009 announcements, for instance on the Coega project, cost levels have declined versus their 2008 peak. Thus for the case study horizons, a decline and then gradual re-escalation in costs was assumed. Specific factors versus 2000 were: for 2010, 1.4, for 2105, 1.6 and for 2020 1.8.

The study was undertaken on the basis that the majority of the SSA refineries do not have access to natural gas. With regard to the potential “new” refineries, it was assumed a new Africa West major refinery would have access and that the premised new Africa East refinery in Uganda would not. None of the potential Africa South major new refinery projects were assumed would have access to natural gas.

²⁰ A new refinery potentially under construction in Chad (with Chinese support) was noted but its status was considered too unclear for it to be added as a firm project into the capacity base; similarly a refinery project recently listed in Niger .

²¹ Historical, refinery-by-refinery process throughput data were requested but not obtained.

World® Model Assumptions Appendix B

Refineries with access to natural gas have the option to use it as both supplementary fuel and as feedstock for hydrogen generation. Refineries with no access must use internal refinery streams for both. Refinery fuel then comprises still gas supplemented by residual fuel plus potential limited amounts of additional streams such as LPG. Hydrogen generation – where needed beyond hydrogen produced via catalytic reforming – must be produced using naphtha and/or LPG feed streams.

Steam generation was taken as internal to the refineries in all cases, thus the associated fuel consumed is an element in total refinery fuel consumption. Recognizing that some SSA refineries may indeed have internal power generation facilities, all SSA refineries were modeled as purchasing electricity. Therefore, refinery fuel consumption as reported, does not include any allowance for power generation.

Overall, refinery fuel consumption is driven by the types of crude oil processed and the associated operations on crude distillation, secondary and supporting units. Factors were used in WORLD® to reflect actual levels of efficiency in use of fuel, thereby impacting the total “refinery fuel and loss” figure. The intent was to bring “refinery fuel and loss” figures close to the actual levels indicated based on CITAC and published data.

APPENDIX C: WORLD® MODEL RUNS

Eight cases were run to examine various options for this study. The exhibit below summarizes the cases. All eight cases are discussed in the report. Since it proved impossible to incorporate all the output either into the report or this appendix there is an attached Excel workbook that incorporates all of the SSA runs. Each sheet is labeled with the case number and they are in the order that appears in the exhibit.

Exhibit C-1: Modeling Case Descriptions

Case Description	Case No.	2010	2015	Economic Conditions in SSA	2015/2020 AFRI-Current	2015/2020 AFRI-4
2010 Base Case	210	X			X	
2015 Open Market Case. SSA Refineries in open competition	215		X	Unfavorable	X	
2015 Open Market Case. SSA Refineries in open competition	216		X	Unfavorable		X
2020 Base Case: SSA Refineries kept running:	224			Favorable	X	
2020 Base Case – SSA Refineries kept running:	220			Favorable		X
2020 Open Market Case: SSA Refineries in open competition:	221			Favorable	X	
2020 Open Market Case: SSA Refineries in open competition:	222			Favorable		X
2020 Open Market Case: SSA Refineries in open competition:	223			Unfavorable		X

World® Model Runs
Appendix C

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page

APPENDIX D: WORLD® MODEL

DETAILS OF THE WORLD® MODEL

OVERVIEW

Increasing interest is being shown in the EnSys **WORLD®** modelling system by private sector and government entities, viewing **WORLD®** as a unique means to address petroleum industry developments and issues at the national, regional and global levels. This document provides an overview of **WORLD®** features, applications and systems aspects.

Section 1 Highlights key **WORLD®** features.

Section 2 Gives a brief background to the evolution of **WORLD®**, illustrates actual applications and potential analytical scope.

Section 3 Overviews **WORLD®**'s regional formulation capabilities.

Section 4 Itemizes the types of data and assumptions underlying a **WORLD®** case and the types of results output.

Section 5 Provides a systems overview of **WORLD®**, outlining the data and program sub-systems that make up the full modelling system and briefly indicating model size and performance statistics.

Supporting Appendices

Provide details on, respectively:

- I** **WORLD®** regional and sub-regional make-up
- II** **WORLD®** process units and key operating modes
- III** **WORLD®** finished products and blend qualities
- IV** Acronyms and abbreviations

1. WORLD® KEY FEATURES

The features of the *World Oil Refining Logistics and Demand model* ("WORLD®") distinguish it in its ability to address complex future and present-day issues.

Model

- ❖ Linear programming modelling system.
- ❖ Simulates the activities and economics of the world regional petroleum industry against short, medium or long term horizons.
- ❖ Integrates and captures the interactions between:
 - crude supply
 - non-crude supply
 - refining operations – including CO2 emissions
 - refining investment
 - transportation of crude oils, products and intermediates
 - product blending/quality
 - product demand
 - market economics and pricing.

Regional Formulation

- ❖ Discrete representation of the world's major regions.
- ❖ Data-driven redefinition of model regions.
- ❖ Facility to sub-divide regions by refinery category, e.g. small, simple versus large, complex, even represent individual refineries
- ❖ Facility to independently model single regions, prototypical or individual refineries.

Crude Oils

- ❖ Representation of over 200 world crude oils.

Refining Technology

- ❖ Detailed, tested, state-of-the-art representation of fifty-plus refinery processes.
- ❖ Advanced representation of processes for reformulated, ultra-low sulfur/aromatics and military fuels.

Gas/NGLs, GTLs, CTL's, Oxygenates and Petrochemicals

- ❖ Integrated representation of:
 - Gas/NGLs inputs to petroleum sector.
 - Merchant oxygenates production (separate from in-refinery production.)
 - GTL gas-to-liquids merchant processes and CTL coal-to-liquids.
 - Facility to integrate petrochemical operations and their inter-actions with refining.

Product Formulation and Demand

- ❖ Detailed breakout of major, minor and military petroleum products and demands.
- ❖ 30+ discrete products normally simulated.

- ❖ Detailed representation of reformulated as well as conventional fuels including RFG and ultra-low-sulfur diesel, also RBOBs/ethanol blends
- ❖ Optional detailed representation of military fuels.
- ❖ Rich array of available product specifications for conventional, reformulated, and military/experimental fuels with user control over activation.
- ❖ Facility to represent tranches of demand, hence supply and demand "curves" for demands and, in sub-global models, imports and exports.

Transportation

- ❖ Comprehensive inter-regional transportation of crude oils, products and intermediates.
- ❖ Multiple tanker types and costs.
- ❖ Import tariffs.
- ❖ Capacitated pipeline movements.
- ❖ Minor transportation modes.
- ❖ Multi-mode movements.

Industry Structure and Investment

- ❖ Advanced refinery process capacity investment feature.
- ❖ Regional differentiation of refining costs.
- ❖ Effect of environmental regulations on capital and operating costs.
- ❖ Impact of economies of scale.

Refining Energy Intensity & Emissions

- ❖ Computation and reporting of refinery fuel consumptions and related CO2 emissions.

Data and Case Management

- ❖ Supporting detailed databases:
 - crude and non-crude supply
 - refinery capacity and construction
 - transportation
 - product quality
 - product demand
 - facilitate adaptation to new studies and model formulations.
 - ❖ Databases are designed to work from major data sources, e.g. EIA
 - ❖ Ability to set sub-regional demand growth rates by product type to user-selected future horizons.

System Performance and Flexibility

- ❖ Advanced matrix generation and report writing code enables virtually all model changes to be data-driven.
- ❖ Complete system runs routinely on Pentium PCs (using barrier method optimizers; XpressMP or CPLEX.)

Documentation and Training

- ❖ Comprehensive model user documentation.
- ❖ Training and seminars.

User Interfaces

- ❖ All refinery technology data are held in a single Excel workbook database with all process vectors weight and sulfur balanced
- ❖ All case input data are held in a set of inter-linked Excel workbooks, making for easier case management and reduced input errors: master, supply/demand/quality, capacity & construction, transport
- ❖ Input data and solution results are brought into a single Excel report workbook which details all major results, both globally and by region, including:
 - ❖ Supply/demand balances
 - ❖ Crude and product inter-regional movements
 - ❖ Pipeline and other transport mode utilizations /expansions
 - ❖ Refinery utilizations, capacity additions and investments
 - ❖ Crude and product prices and differentials (note the marker crude price is input)
 - ❖ Cracking / refining margins
 - ❖ Global supply / demand volume and weight balance cross-checks

2. WORLD® MODEL EVOLUTION AND APPLICATION

EVOLUTION

Assessment of issues surrounding the future of global refining can only be taken so far by static or simplified analyses. The world petroleum industry is technically complex, has the economic attributes of a co-product industry, and its different aspects and regions are highly inter-related. It contains considerable ability to adjust to changed circumstances. Finally, it is faced today by major challenges presented by environmental, product quality, conservation, substitution, supply/demand and technology/cost developments.

The **WORLD®** model was designed to bring all of the key elements of the world petroleum industry together into one simulation tool, with the specific goal that it realistically address departures from present day "Business As Usual" and do so across a wide range of time-frames.

WORLD® was developed by a team of international petroleum consultants with many years' experience in oil industry management, planning, systems, and in analysis of issues, developments and projects. Key to **WORLD®**'s evolution have been associations and assignments with: Queen Mary College London, OPEC, NASA, Oak Ridge/U.S. Navy, U.S. Energy Information Administration, U.S. EPA, U.S. Department of Energy Offices of Strategic Petroleum Reserve, Energy Emergencies, Policy, American Petroleum Institute, International Maritime Organisation, with private oil companies including ConocoPhillips, Marathon, BP and Shell. In 1992, **WORLD®** was adopted by the U.S. Energy Information Administration as its primary global petroleum analytical tool and in 2000 by the OPEC Secretariat.

CURRENT AND PAST APPLICATIONS

Developed and proven over the last twenty years, **WORLD®** offers broad analytical scope in its global, regional and single refinery forms, for instance,

- ❖ EIA employs **WORLD®** as a key component of each Annual and International Energy Outlook cycle, projecting alternative BAU scenarios out to 2025.
- ❖ EIA has also applied **WORLD®** successfully to policy analyses including Alaskan crude exportation, gasoline Btu tax and anti-dumping disputes
- ❖ EnSys' applications of **WORLD®** have included:
 - evaluation of impacts on regional and global refining and crude oil trading of supply, product, regulatory and technology developments through 2020. Includes projections for refining investments by region, worldwide
 - assessment of the medium term impacts 2010 and 2015 of different rates of oil demand growth and implementation of refinery projects
 - assessment of impacts of potential short term oil supply disruptions on 2003 oil markets, changes in refining / oil trade / import patterns through 2010 and 2015, hence import dependencies and implications for crude types needed for expansion of the US Strategic Petroleum Reserve

- evaluation of the economics of GTL liquids as petroleum feed/blend stocks based on potential GTL projects
- projection through 2020 of the impacts on refining investments and economics of high oil prices leading to high growth rates in non-crude oils and synthetic crude oils supply streams allied with reductions in demand growth
- assessment of the detailed US refining impacts (investments, product switching, market shares, exports, imports, supply and market pricing) of ultra-low sulfur gasoline and diesel (including prospectively off-road diesel) set in a global context of movements in Europe and elsewhere to ultra-low standards and using latest projections on available refinery process technologies and economics. Study horizons include: 2006, 2010, 2015 and 2020
- analysis of the world-wide crude oil market and refining impacts of growing Caspian crude production with emphasis also on the effects of alternative Caspian crude export routes; also impacts of variability in projected Russian crude oil production to 2015
- sensitivity of year 2010 and 2015 global GTL and refining investments to reductions in GTL capital costs from their current level of approximately \$22,500/bbl/day
- impacts on US Gulf Coast (PADDIII) refining of ultra low sulfur gasoline and then diesel regulations. Emphasis on desulfurization investments and ULS diesel production costs at different sulfur specifications (50 – 8 ppm) and different levels of phase-in (0%, 25%, 50%, 75%, 100%). Phase-in results formed the basis of an Argonne/DOE report on phase-in economic benefits
- global "business as usual" outlook for 2010 taking account of changes in crude supply and product demand and three different scenarios of tightening in product quality. Emphasis on related requirements for new and revamp process investments for upgrading and desulfurization
- effect on US, OECD and global refining activity, investment and trade of applying carbon taxes to refinery fuels and petroleum products in OECD regions
- impacts of US and overseas fuels reformulation and refinery environmental regulation on year 2000 regional refining investments, utilizations, import/export trade patterns and US energy security
- cost impacts of low sulfur gasoline and of potential US diesel reformulation to close to Swedish standards, including effects of newly evolving refinery technologies
- price impacts on tight world markets of early SPR drawdown at the time of the Iraqi invasion of Kuwait
- effects on markets of large ramp-up in jet fuel demand at the onset of Operation Desert Storm against various "what if" scenarios including refinery outages and disruption of key tanker arteries
- calibration to first quarter 2000 world market/supply conditions leading in to simulation of the impacts of hypothetical major supply disruptions and SPR drawdowns. Emphasis

on the market pricing and related economic impacts of sweet versus sour SPR crude draw mix

- ❖ Private sector clients have applied **WORLD®** to assessments of:
 - longer term strategic investment opportunities
 - shorter to medium term refining tightness and margins, based on the balance of known capacity additions with demand growth and crude slate
 - support of shorter to medium term trading decisions
 - assessment of European 2005 gasoline and diesel fuel regulations.

POTENTIAL APPLICATIONS

Interest in **WORLD®** among the private sector is growing. EnSys is experiencing a shift in **WORLD®** use toward a mix of corporate/market and policy issues. Areas of active interest include:

- ❖ impacts on US and world regional refining and trade of the trend to ever lower sulfur fuels
- ❖ new developments in Caribbean and Atlantic basin crude production, including Canada, Venezuela, Colombia, West Africa and US Gulf Coast deep offshore, and their implications for future crude trading patterns and refinery economics, especially in the US Gulf Coast, US Northeast and Europe
- ❖ impacts of developments in supplies of “non-crudes”, notably NGL’s, condensates, GTI/CTL and biofuels
- ❖ impacts of new refining technologies processes and additives on future refining configurations, economics and markets
- ❖ implications of growing inter and intra regional crude and product trade for tanker supply / demand and freight rates, recognizing tanker scrapping and replacement costs
- ❖ impacts of GHG / climate change regulatory and market driven developments

Analytical Flexibility

WORLD® is a modelling system – not a single model. Using it, different model formulations can be developed, e.g. to give more detailed representation of a given world region (for instance, Northern Europe or Asia-Pacific) or of given refinery classes (for example, U.S. refineries that are focussed on heavy crude oils or are high-cost producers of diesel fuels).

These options and other built-in features lead to a wide range of analytical flexibility e.g. for:

- ❖ Model variants that focus in detail on **one region or nation** but maintain a full global accounting
- ❖ Analysis of outlooks for or impacts on **different types of refineries**
- ❖ Rigorous simulation of **refinery emissions** and loss, control technologies and costs.
- ❖ **Impacts** of new refining process technologies.
- ❖ **Cogeneration** options
- ❖ Simulation of **global industry GHG (CO₂) emissions from production, transport, processing and consumption** under different scenarios.

3. REGIONAL FORMULATION CAPABILITIES

The **WORLD®** system was explicitly designed to permit flexibility in regional formulation and disaggregation. The regional composition of **WORLD®** is data driven, that is, regional make-up can be modified solely by altering data tables without alteration of code.

In the **WORLD®** model, crude supply/ product demand and refining regions are decoupled, i.e. they may be defined separately from each other. In the usual global formulation however, these regions are set up as coincident.

The current **WORLD®** formulations include a US-oriented variant and two “general” global formulations comprising respectively 18 and 23 regions. **WORLD®** data are held at country/sub-country and regional levels. This facilitates regional reformulation, e.g. to focus on a specific part of the world or country.

Any region may be disaggregated by refinery sub-group, e.g. to distinguish large, complex from small, simple refineries, identify logistics sub-groups, or even single refineries.²²

APPENDIX I details current **WORLD®** regional formulations.

²² This is possible since EnSys maintains capacity data at the individual refinery level, enabling a high degree of flexibility in aggregation.

4. MODEL INPUT REQUIREMENTS AND OUTPUT RESULTS

WORLD® INPUTS (CASE ASSUMPTIONS)

The **WORLD®** model is a linear programming model which simulates the operation of the world regional petroleum industry based on user-specified assumptions regarding the time horizon and scenario of interest. For a complete **WORLD®** case, the following are the main input assumptions to be specified by the user:

Feedstocks

- ❖ Crude supply by nation by crude type (including SPR crude oils in SPR draw cases.)
- ❖ FOB price of the balancing marker crude whose input is allowed to float
- ❖ Fixed availabilities of non-crude inputs to the refining supply system, notably NGLs, ethanol/biodiesel, synthetic petroleum fuels (GTL's, CTL's), returns from the petrochemicals sector such as steam cracker gasoline.
- ❖ Base available regional capacities for production of "merchant" MTBE and other ethers; also GTL liquids.
- ❖ Regional "major industrial user" prices for methanol²³, natural gas, purchased electricity.
- ❖ For regions where remote ("stranded") gas is considered a feedstock for GTLs, remote gas prices.
- ❖ Amounts of crude-based streams, notably resid, allowed to refinery fuel²⁴.
- ❖ Amounts of crude oils used for direct consumption.

Products

- ❖ Demands for generally around 28 petroleum products by region, essentially all fixed except for elemental sulfur and fuel grade coke which are priced and treated as by-products.
- ❖ Key qualities of all major products²⁵.

Refining

- ❖ Base "nameplate" capacities of some 50 process unit types covering primary processing (distillation), secondary processing, yield and quality upgrading, ancillary units (hydrogen production, sulfur recovery, utilities generation) representing established technologies, and new technologies centred mainly on reformulated fuels production.
- ❖ For each unit in each region, estimated effective availability factor reflecting such factors as short or long run utilization rates, refinery practice of double training key units such as sulfur recovery, poorer operating practices in some world regions, or effects of scheduled shutdowns in a short-term seasonal case.
- ❖ For each regional refinery, controls on operations of major units, e.g. severity, feed composition.

²³ The price of methanol in **WORLD®** is a function of the region and the regional price for natural gas.

²⁴ Operating with no constraints on the composition of the refinery fuel pool allows an unrealistically large flexibility for disposition of residual fuel. Consequently, residual fuel and other crude-based inputs are set based on historical data and likely trends with total fuel consumption balancing on process gas plus purchased natural gas.

²⁵ **WORLD®** incorporates both base grades of each product with standard qualities and the capability to input and track quality differences between world regions. Quality variation is tracked firstly by establishing regional splits between different base grades of the major products, e.g. gasoline (4 conventional and 1 reformulated grade), middle distillates (4 grades), residual fuels (4 grades). Gasolines are differentiated principally on octane (lead-free basis) sulfur and volatility, distillates and residual fuels on sulfur and viscosity/pour point. Further regional differences within major grades can then be entered; the impacts of these differences on blend pool qualities are tracked and accounted for in the model.

- ❖ For cases with refinery investment option:
 - refinery and merchant process unit base capital and fixed operating costs (generally US Gulf Coast basis) and rate of capital cost improvement over time
 - factors to represent capital cost/location factor and capital recovery factor (cost of capital)²⁶ in each region.
- ❖ Limits on capacity additions in the form of revamping, de-bottlenecking and major new unit investments, e.g. not allowing any net increase in US PADD 1 distillation capacity. (**WORLD®** allows all three modes of capacity expansion under user control.)
 - for debottlenecking and revamping, capital costs as factors of new unit costs
- ❖ Differences in regional environmental costs can also be accounted for.

Transportation

- ❖ Allowed inter-regional movements for each crude and each product; this in part to control the number of transportation options by eliminating extremely unlikely or essentially duplicate routings and in part to prevent movements that are not allowed for political reasons, no Iranian imports to U.S.,
- ❖ Marine transportation cost for each crude, product and shipped inter-refinery intermediate stream, based generally on WorldScale rates and percentages depending on tanker class for the route.
- ❖ Related import duty, lightering, canal or other tariffs
- ❖ Optional differentiation of tankers by class with fleet capacity limits
- ❖ Transportation capacity limits and tariffs on major inter-regional pipelines
- ❖ Multi-mode transport movements that encompass a combination of modes e.g. pipeline-tanker-pipeline
- ❖ Selection of pipelines where expansion allowed and associated projected tariff increase – if any

General

- ❖ Selected limitations on individual activities, e.g. requiring certain minimum volumes of FCC feedstocks to move into the U.S. to reflect the existence of several refineries for whom this is their primary feedstock, a "micro" factor that in the aggregated model would otherwise be subsumed.

Underlying Premises

- ❖ The case inputs above define the present-day or future scenario to be simulated. Development of future horizon cases in particular requires careful consideration of the uncertainties underlying projections and thus how the parameters that influence the industry could evolve. For instance, the following are among key basic factors influencing any current forward-looking study:
 - The overall assessment and outlook for global oil price / gas price / supply / demand balance.
 - Crude production outlook including balance of future OPEC versus non-OPEC production.
 - Specific country crude production and mix.
 - Product demand growth rates, absolute and relative.
 - Extent of new gas distribution projects and their influence on regional substitution of residual and heating oil demands.
 - Evolution of gasoline, distillates and residual fuel qualities by region, especially based on mandates for clean and reformulated fuels.

²⁶ *Capital recovery factor may be directly input or may be calculated from the cost of capital, tax region, economic life, and depreciation schedule.*

- Potential substitution of petroleum products by alternative fuels.
- Rate of spread of advanced fuels regulations, in both OECD and non-OECD regions
- Availability of new refining technologies and their costs.
- Evolution of regional capital cost location factors for process unit investments depending on the effects of environmental legislation.
- Forecast transportation routes, modes, capacities and rates.

While certain of these parameters will often have been set by the world regional supply/demand forecast used for a particular study, numerous parameters ranging from details of non-OPEC regional growth rates for individual products to specific refining assumptions have to be derived from ancillary sources and/or by analyst judgement.

Given the above inputs, the **WORLD®** model simulates the operations, technology and economics of the world regional industry, using all the available options – crude shipping, refinery processing, investment (when allowed), blending, intermediates and product shipping – to satisfy the specific product demands feasibly and optimally (i.e. at minimum global cost); this while respecting all the constraints on the system, notably supply limits, shipping limits, process capacity and operational limits, product blending specifications, regional product demands.

WORLD® OUTPUTS

The outputs from a simulation can be categorized into two groups:

I Physical Information

- ❖ Marginal and total crude oils and non-crude oils supply/usage volumes
- ❖ Generation and consumption of utilities and variable non-crude feedstocks (methanol for refinery and merchant [MTBE] use, natural gas for refinery use and as merchant GTL feedstock.)
- ❖ Crude, non-crude oils, products and intermediates movements, i.e. trading volumes.
- ❖ Refinery and "merchant" process unit capacity additions (when allowed) in every region through revamping, debottlenecking and major new unit investments.
- ❖ Process unit operations, regional refining and merchant plant throughputs and utilizations.
- ❖ Blending activities and blend compositions.
- ❖ Product demands (sales), generally fixed except for coke and sulfur.

II Refining and Market Economic Information

- ❖ Marginal costs on every crude where there is an active movement into the region. These equate to FOB prices at port of origin and to CIF prices at port of delivery.
- ❖ Finished product marginal costs (equating to open market prices) in every region²⁷.
- ❖ Values of intermediate streams in every regional refinery.
- ❖ Economic rents (expansion incentives) on process units at their capacity limit (either where investment is not activated as in a short term analysis or where allowed active investment is limited and at its maximum.)
- ❖ Costs (relaxation incentives) on limiting product specifications.

²⁷ Note that the only prices input are generally those for (a) the marginal crude, (b) variable non-crudes (gas and methanol), (c) minor refined products (sulfur and fuel grade coke). All other crude, non-crude product prices are derived as outputs. These output prices are affected principally by (a) the level of the input marker crude price and (b) the slackness or tightness in refinery upgrading capacity relative to light versus heavy product demand

- ❖ Costs (relaxation incentives) on other imposed constraints, e.g. process unit operations, specific movements.
- ❖ Costs of investments in new capacity (when allowed.)
- ❖ Refining margins.

Comparing these outputs across cases, it is possible to identify the physical, market and regional economic effects on producers, refiners, shippers and consumers of changes in the world petroleum supply situation – whether changes in BAU assumptions or the effects of a disruption.

Overall, the **WORLD®** model:

- ❖ Reflects and simulates the effects of the economic cost/profit forces driving industry activities. Realistically simulates the refining operations and economics of the world's regions.
- ❖ *(Because it contains detailed refining matrices.)*
- ❖ Ensures a feasible solution to meeting world regional demands identifying material balance flows across regions and globally.
- ❖ *(Provided input assumptions allow a feasible solution.)*

*(Since the majority of crude and product trading today is related to open market prices, and also because virtually all refiners run and optimize their refineries based on market economics using LP models fundamentally similar to the **WORLD®** model.)*

- ❖ Provides an integrated simulation which generates internally consistent physical/trade flows, refining, market, regional economics and interactions.

In its global formulation, the **WORLD®** model simulates regional effects. Insights at the level of individual countries or refinery types can be obtained where the model has been appropriately disaggregated. For instance, the US-oriented version not only models the USA in the form of the five PADD regions (plus Canada split into East and West) but, within each PADD, breaks the total regional refining capacity into sub-groups by refinery type.

APPENDIX I: WORLD® REGIONS AND FORMULATIONS

Balanced Global	Expanded Global	US Detailed
18 regions 1 refinery group per region	23 regions 1 refinery group per region	14 regions 18 US refinery groups 9 non US refinery groups
US East Coast (PADD1)	US East Coast (PADD1)	US East Coast (PADD1) **(2)
	US Mid West (PADD2)	US Mid West (PADD2) **(3)
US Gulf Coast, Interior, Eastern Canada	US Gulf Coast (PADD3)	US Gulf Coast (PADD3) **(7)
	US Rocky Mountain (PADD4)	US Rocky Mountain (PADD4) **(1)
US West Coast, Western Canada	US West Coast (PADD5)	US West Coast (PADD5) **(3)
	Canada East	Canada East (1)
	Canada West	Canada West (1)
	Mexico	
Greater Caribbean	Greater Caribbean	Greater Caribbean (2 one being PADD6)
South America	South America	
Africa North & Eastern Med	Africa North & Eastern Med	
Africa West	Africa Rest	
Africa East/South		
Europe North	Europe North West	Europe / Med (1)
Europe South	Europe South	
Europe East	Europe East	Europe East (1)
Russia/FSU	Russia/FSU	Russia/FSU/Caspian (1)
Caspian	Caspian	
Middle East	Middle East	Middle East (1)
Pacific Industrialized	Japan	
Pacific Newly Industrializing	India	
China	China	China (1)
Rest of Asia	North East Asia	Pacific/Rest of World (1)
	South East Asia	
		** multiple refining groups per region

APPENDIX II: WORLD® PROCESS UNITS AND ADVANCED OPERATING MODES

PRIMARY DISTILLATION UNITS

crude oil atmospheric distillation

- ❖ standard base cutting scheme, heavy kero (500-550⁰F) and heavy distillate (650-690⁰F) trim streams

vacuum distillation

CRACKING AND DESULFURIZATION/HYDROTREATING UNITS

delayed coker

fluid coker

flexi coker

visbreaker/thermal cracker

fluid cat cracker

- ❖ vacuum gasoil (hydro-fined and non-hydrofined), distillate, low sulfur/desulfurized atmospheric resid and potential medium/high sulfur atmospheric resid cracking
- ❖ conversions 65 to 85%
- ❖ ZSM high octane/high light olefins modes
- ❖ low olefin mode
- ❖ correlation of product sulfur levels with feed sulfur
- ❖ FCC SOX emissions scrubber unit.

hydrocracker - with full and mild hydro-cracking variants

- ❖ Gasoil conventional
- ❖ Gasoil ultra low sulphur
- ❖ Gasoil MAK
- ❖ Gasoil mild hydro-cracking
- ❖ Resid

naphtha hydrocracker

naphtha hydrotreater

- ❖ Merox sweetening
- ❖ conventional hydrotreating

FCC gasoline advanced hydrotreating processes (CDTech, OCTGAIN)

FCC gasoline deep desulfurization via sulphur oxidation (Phillips S Zorb)

distillate desulfurization

- ❖ Merox sweetening
- ❖ conventional hydro-treating
- ❖ current and forward technologies for ultra low sulfur deep desulfurization/ de-aromatization, including to sub 10 ppm sulfur

deep desulfurization via sulphur oxidation (Phillips S Zorb)

- ❖ bio-desulfurization

FCC feed hydrofiner/gas oil desulfurization

- ❖ mild hydro-cracking modes

residuum desulfurizers - atmospheric and vacuum resid units

lube and wax units

EXTRACTION AND DISTILLATE UNITS

solvent deasphalting
middle distillate furfural extraction
middle distillate gas oil dewaxing

jet fraction end point recut (470°F)

high density jet fuel pre-fractionation
high density jet fuel hydrofining

LIGHT ENDS AND GASOLINE UNITS

- ❖ catalytic reforming
- ❖ discrete units for:
 - high pressure (semi regen)
 - low pressure (cyclic/semi regen)
 - low pressure continuous reforming
- ❖ severities (low pressure/continuous) from 90 to 105
- ❖ heavy (250-325 °F), light (175-250 °F) and very light naphtha (158-175 °F) feedstocks
- ❖ FC heavy gasoline, coker heavy naphtha and hydro-cracker heavy naphtha reforming
- ❖ high octane catalyst mode (UOP R-62 type)
- ❖ very low pressure (low benzene) operation

reformer feed fractionation
reformate splitter
naphtha splitter
butanes/butenes splitter
FCC gasoline fractionation
coker naphtha fractionation
natural gasoline fractionation
cryogenic ethylene fractionation

thermal cracker ethane/propane/butane feed
thermal cracker naphtha feed
thermal cracker vacuum gas oil feed

ethane/propane/butanes/pentane dehydrogenation
ethylene to 1-butene dimerization
n-pentene/n-hexene hydrogenation
butane isomerization
pentane/hexane isomerization
total recycle pentane/hexane isomerization
alkylation feed butylene isomerization/treating

alkylation unit

- ❖ ethylene, propylene, butylenes, amylene alkylation

polymerization unit
dimersol unit
benzene alkylation (UOP Alkymax)
cyclar unit
aromatics recovery

- ❖ benzene and heavier aromatics extraction

MTBE/TAME/THME/ETBE/TAEE/THEE (etherol) UNITS

DIPE (propylene ether) unit

Iso-Octane

UTILITIES/ANCILLARY UNITS

hydrogen generation - steam reforming
hydrogen generation - partial oxidation
hydrogen purification

hydrogen to refinery fuel
light ends to refinery fuel
refinery evaporation loss

refinery fuel pool "plant"
steam generation
power generation
H₂S and sulfur recovery

STREAM DISPOSITIONS

stream transfers/combination control
blend component disposition control

OXYGENATES REPRESENTED

MTBE, ETBE, TAME, THEE, TBA, Oxinol, Ethanol (splash and full blend) Methanol, DIPE

ADDITIVES REPRESENTED

TEL/TML²⁸

MMT

diesel ignition improver
diesel pour point depressant
specialty jet fuel additives

MERCHANT UNITS

MTBE

Iso-Octane

Butane isomerization

Iso-butane dehydrogenation

²⁸ **WORLD® Model** incorporates leaded gasoline but is generally run with gasoline grades reduced to equivalent lead-free basis.

GTL (Shell SMDS, SASOL)

Supporting utilities units

APPENDIX III: WORLD® PRODUCTS & BLEND PROPERTIES

GASOLINES	RESIDUAL FUEL OILS
<p>Conventional (environmentally unregulated)</p> <ul style="list-style-type: none"> • premium (US grade) • regular (US grade) • regular (foreign grade) • local/low octane grade <p>• aviation gasoline</p> <p>Conventional/low/ultra low sulfur (environmentally "baseline" regulated)</p> <ul style="list-style-type: none"> • premium • regular <p>Oxygenated</p> <ul style="list-style-type: none"> • premium • regular <p>Reformulated¹ Federal – MTBE and Ethanol/RBOB</p> <ul style="list-style-type: none"> • premium • regular <p>CARB/CARBOB</p> <ul style="list-style-type: none"> • premium • regular 	<ul style="list-style-type: none"> • < 0.3% sulfur • 0.3 - 1.0% sulfur • 1.0 - 3.0% sulfur • bunkers (IFO 180, IFO 380) at alternative sulphur levels <p>LUBES AND WAXES</p> <p>PETROLEUM COKE</p> <ul style="list-style-type: none"> • low sulfur • high sulfur <p>ASPHALT</p> <p>OTHER</p> <ul style="list-style-type: none"> • petrochemicals naphtha • special naphthas • petrochemical gasoil • aromatics (total BTX/benzene/heavy) • process gas • sulfur <p>LPG</p> <ul style="list-style-type: none"> • mixed or individual streams
<p>LIGHT DISTILLATES</p> <ul style="list-style-type: none"> • Jet A/A1 • JP8 • JP5 • JP4 • kerosene • No 1 diesel <p>MIDDLE DISTILLATES</p> <ul style="list-style-type: none"> • No2 heating oil • No2 HS, LS, ULS, ULSA diesel fuels • off-road diesels • marine diesel • military diesel grades <p>Additional product types or grades can readily be formulated either as specification or recipe blends.</p>	

I. Summer/Winter distinctions.

GASOLINE AND DISTILLATE/RESIDUAL BLENDING PROPERTIES

GASOLINES

research octane	oxygen content (wt%)
motor octane	methanol content
road octane (R+M/2)	aromatics content
lead ²⁹	butane content
benzene content	
MMT (incorporating non linear effect)	total/light olefins content
atmospheric (hydroxyl) reactivity	bromine number
RVP	sulfur (ppm)
vapor lock index	gravity
evaporative index	
distillation:	
percent @ 212	EPA Complex Model ³⁰
257	
356 ⁰ F	

DISTILLATES/RESIDUALS/NAPHTHAS

flash point (index)	aromatics content
freeze point (index)	paraffins content
pour point (index)	naphthenes content
cetane (index)*	
luminometer no. (index)	viscosity @ 122, 104, 100
diesel ignition improver (with non-linear effect)	-4, -3, -40 ⁰ F
sulphur	carbon residue
RVP	hydrogen content
distillation:	net heat of combustion
percent @ 392 400 440 465 ⁰ F	static surface tension
dynamic surface tension	

²⁹ **WORLD®** incorporates lead blending but is generally run with gasolines reduced to an equivalent lead-free basis.

³⁰ Total VOC's, NOx and toxics can be directly represented via proprietary EnSys linearized formulation of the EPA Complex Model.

APPENDIX IV: ACRONYMS AND ABBREVIATIONS

AEO	Annual Energy Outlook
API	American Petroleum Institute
BAU	Business as Usual
BTU	British Thermal Unit
BPD	Barrels Per Day
BPCD	Barrels per Calendar Day
BPSD	Barrels per Stream Day
CARB	California Air Resources Board
DOE	Department of Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency
IEA	International Energy Agency
IEO	International Energy Outlook
LPG	Liquefied Petroleum Gas
MBD	Thousand Barrels Per Day
MMBPD	Million Barrels Per Day
NGL	Natural Gas Liquid
NIPER	National Institute for Petroleum and Energy Research
NPC	National Petroleum Council
NPRA	National Petrochemical Refiners Association
WORLD®	World Oil Refining Logistics Demand (model)