ANALYSIS OF SOUTH AFRICA'S PETROLEUM SECTOR – A PARTIAL INFORUM APPLICATION

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PREFACE

- The National Energy Regulator of South Africa (NERSA) is the regulatory authority established in terms of the National Energy Regulator Act, 2004.
- Plays a key role in the South African economy due to the fact that it regulates the energy sector.
- A priority of NERSA is the development and implementation of a suite of models for economic impact assessment of its regulatory decisions.
CONTENTS

• Background
• Modelling petroleum demand and supply
• Price elasticity of the demand for petroleum products
• Methodology
• Petrol Analysis
• Diesel Analysis
BACKGROUND TO SOUTH AFRICAN PETROLEUM SECTOR

• Inputs of petroleum products play an important part in transport and production activities of various other sectors of the economy.
• South Africa does not have its own economically extractable natural crude oil resources, so domestic prices for petroleum products are dependant on world price for crude oil.
RAW MATERIAL SOURCES FOR PETROLEUM PRODUCTS’ MANUFACTURING

67% of all petroleum products are crude oil based, the bulk of the remainder is used for coal and natural gas.
MODELLING PETROLEUM DEMAND AND SUPPLY

OVERALL DEMAND FOR PETROLEUM PRODUCTS ARE LINKED TO GENERAL ECONOMIC GROWTH
PETROLEUM GROWTH MODEL

• Suite of models were developed to optimize the demand and supply of petroleum.
• The model entertains the following aspects:
  • Petroleum supply and demand;
  • Impact of price elasticity on demand;
  • Anticipated South African sustainable economic growth and development;
  • Determine future sources of petroleum;
  • Derived petroleum tariffs; and
  • Impact on economic growth and inflation.
Development of the South African Petroleum Industry

Analyses, Models and Data

- Published and Internal SAPA Data Sources
- Integrated Multi Sector Dynamic Model - Projections (Inforum Model)
- Supply Coefficients for Use in Inforum Model
- Excel Spreadsheet to Calculate Implications on Tariff (long range marginal cost curve)
- 1) User Friendly Macro-economic Impact Model
   2) Leontief Input-Output Price Model
   3) Inforum Model

Petroleum Needs, Supply, Funding and Macro-economic Impact

- A. Current Petroleum Supply and Demand
- B. Anticipated South African Sustainable Economic Growth and Development
- C. Derived future petroleum demand
- D. Determine future sources of electricity supply (coal-to-liquid, refineries, etc.)
- E. Derived Tariffs
- F. Impact on economic growth; inflation and foreign and public debt situation

- Guidelines to ensure a healthy petroleum sector to support sustainable economic growth

Policy Questions and Issues

- Determine Sustainable Economic Growth Targets
- Consider Current and Future Role of Petroleum Intensive Users
- Incorporation of additional Refineries
- Technical Imperative
- Iterative Policy Decision Process to Optimize Economic Objectives
- Target
Annual economic growth rate trend = 2.8% per annum.

From 1989 to 2009 the demand for petroleum products increased by 2.3% on average per annum, while the economy registered annual growth of 2.8%.
PETROL AND DIESEL CONSUMPTION

Indices (2005 = 100)

- Petrol Consumption
- Diesel Consumption
PETROLEUM DEMAND TRENDS FROM 1988 TO 2009

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Petrol</td>
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- The demand for petrol grew much faster than that of diesel in the first period (1988 to 1999).
- Changed drastically in the period 1999 to 2009, where diesel grew at 4.3% per annum and petrol only at 0.4% per annum.
PRICE ELASTICITY OF THE DEMAND FOR PETROLEUM PRODUCTS

PRICE PLAYS AN IMPORTANT ROLE IN THE DEMAND FOR ALL PETROLEUM PRODUCTS
CRUDE OIL PRICE AND CONSUMPTION EFFECT OVER THE SHORT-TERM

Note: Excluding long term changes
METHODOLOGY

THE STRUCTURE OF THE THREE DEMAND FUNCTIONS USED FOR FORECASTING THE VARIOUS PETROLEUM PRODUCTS’ DEMANDS ARE SIMILAR.
DEMAND MOVEMENTS

• Three variables are used to explain the demand movements over time:
  1. The calculated demand vector was designed to present the historic domestic demand for the various petroleum products.
  2. Relative prices were used to calculate a variable to reflect price sensitivity (demand elasticity) in the regression analysis.
  3. Time was used in the regression analysis as a variable to explain the change in technology over time, which affects the usage of a specific petroleum product.
DEPENDANT VARIABLE IS THE ACTUAL VOLUME OF PETROL DEMAND WITH EXPLANATORY VARIABLES THE CALCULATED PETROL DEMAND INDICATOR, RELATIVE PRICES FOR PETROL AND RELATIVE PRICES FOR PETROL, LAGGED ONE PERIOD
### PETROL REGRESSION ANALYSIS

**Dependent variable:** Actual domestic petrol demand

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<th>Indicator</th>
<th>Reg-Coef</th>
<th>Elas</th>
<th>t-value</th>
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**RBSQ:** 0.8503
COMPARISON OF ACTUAL AND ESTIMATED DEMAND FOR PETROL
PETROL SCENARIO COMPARISON

**Standard Scenario**

- Estimated growth rate of domestic demand for petrol is around 3.8% p.a. (double the historic rate of 1.5% p.a.).
- Increased demand in petrol
  - As a result of more and more people buying cars as wealth increases.
  - If the price of petrol does not increase rapidly, petrol demand will follow the same trend.
- Low historic growth rate in petrol demand is the result of a relative high increase in petrol prices over the period.

**High Petrol Price Scenario**

- Lower growth rate in petrol demand due to the price effect
- Forecast for petrol drops from 3.8% p.a. to 2.5% p.a. if the petrol price changes drastically (from 8% to 10% p.a.)
PETROL CONSUMPTION AND REFINING CAPACITY REQUIRED

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**Standard Scenario - Future Petrol Demand and Supply**

- **Petrol Supply**
- **Petrol Demand**
- **Balance**

Litres millions

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<td>21500</td>
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<td>22500</td>
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The graph shows the projected demand and supply of petrol from 2009 to 2025, with a steady increase in demand and a slight decrease in supply, leading to a balancing point in the future.
THE REGRESSION EQUATIONS FOR FORECASTING DIESEL SALES ARE EXACTLY THE SAME AS WITH PETROL
## DIESEL REGRESSION ANALYSIS

<table>
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<tr>
<th>DIESEL</th>
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<td>RBSQ</td>
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**Dependent variable: Actual domestic diesel demand**

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<th>Reg-Coeff</th>
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<tr>
<td>Intercept</td>
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<td>Calculated Diesel Demand Indicator</td>
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<td>-2.03</td>
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</table>
COMPARISON OF ACTUAL AND ESTIMATED DEMAND FOR DIESEL
DIESEL SCENARIO COMPARISON

**Standard Scenario**
- Historic growth rate for diesel sales was 3.3% p.a.
- Projected growth rate is 3.7% p.a.
- Future growth in diesel demand will resemble the growth in the transport sector, which is forecasted at 2.9% p.a.

**High Diesel Price Scenario**
- Lower growth rate in diesel demand due to the price effect
- Forecast for diesel drops from 3.7% p.a. to 3.1% p.a. if the diesel price changes drastically (from 8% to 10% p.a.)
DIESEL CONSUMPTION AND REFINING CAPACITY REQUIRED

Standard Scenario - Future Diesel Demand and Supply

- Diesel Demand
- Diesel Supply
- Balance

Litres millions

The End