

A Review of Fuel Marker Programs to Identify and Control Fraud

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ABSTRACT

Countries use excise tax to generate revenues to support and stimulate their economy. In addition, Governments often subsidise the cost of essential products. These programs for taxing fuel consumption and for providing subsidised fuel are themselves subject to fraud. In addition, companies also suffer as they not only lose legitimate sales, but fraud can occur from the illegal dumping of fuel by rogue traders which impacts both sales and fuel quality. Control programs often involving the use of advanced marker systems to identify and prevent fraud have been shown to be effective in controlling this fraud.

The Main Benefits of the Fiscal Control Programs where fuel trade plays a pivotal role in most countries are:

- Excise tax revenue can be increased (without raising taxes)
- Legal business is protected and this protects existing and enhances future foreign investment
- These programs cost a few percent of the revenues recovered

In this paper we review, by example, fuel control programs world-wide, to determine what is needed to make them successful. We have also examined the benefits which encourage a country to install a successful program.

INTRODUCTION

A Review of Fuel Control programs to Identify and Control Fraud

1. Introduction

Worldwide Trading Malpractice from smuggling, counterfeiting, theft and product diversion is estimated by groups such as the International Anticounterfeiting Coalition to cost over \$ 600 billion annually (5%-7% of World Trade) and is one of the biggest brakes on the

growth of companies and economies. This illegal trade occurs across most industrial sectors such as the petroleum, pharmaceutical, tobacco and agricultural sectors.

Focus on the Petroleum Sector In this paper, malpractice in the Petroleum sector will be reviewed with examples of how this can be controlled. In the Petroleum Sector there are basically 2 main sources of abuse:

- abuse arising from pricing differentials caused by either taxed or subsidised products
- abuse from trading pricing differentials.

Fiscal/Subsidy Fraud Countries need excise tax to generate wealth to support their economy. In addition, Governments also often subsidise the cost of essential products. These programs such as taxing fuel consumption and providing subsidised fuel are themselves subject to fraud. Control programs often involving the use of markers to identify and prevent fraud have been shown to be effective in controlling this fraud.

The Benefits of the Fiscal Control Programs - where fuel trade plays a pivotal role in most countries - are:

- tax revenue can be increased (without raising taxes)
- legal and legitimate jobs are protected
- legal business is protected and that protects existing and enhances future foreign investment
- Ultimately, increased tax revenue will lead to a higher GDP and an Improved quality of life

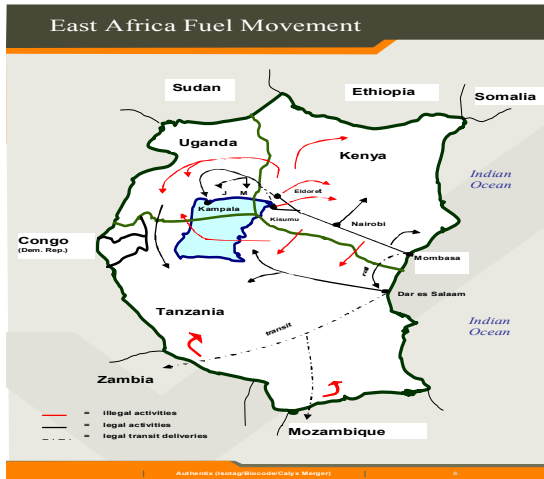
Trading Fraud can occur from the illegal dumping of fuel by one company onto another when there are price advantages due for example to fuel quality or transport costs. This - as well as fiscal fraud - will badly affect company sales and a marking program which identifies and controls this malpractice is clearly beneficial.

2. Examples of Fuel Fraud and Marking Programs

(a detailed example of Kenya and examples from around-the-world)

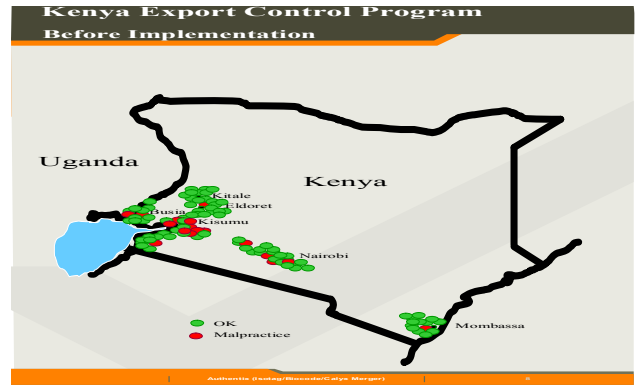
2.1 A Detailed Example Kenya

In East Africa (Kenya, Uganda and Tanzania), where the fuel economies are linked, programs are in place for marking and testing fuel in each of these countries to identify and control illegal activity such as smuggling, export dumping and adulteration. A typical example of the benefit to the country is Kenya.

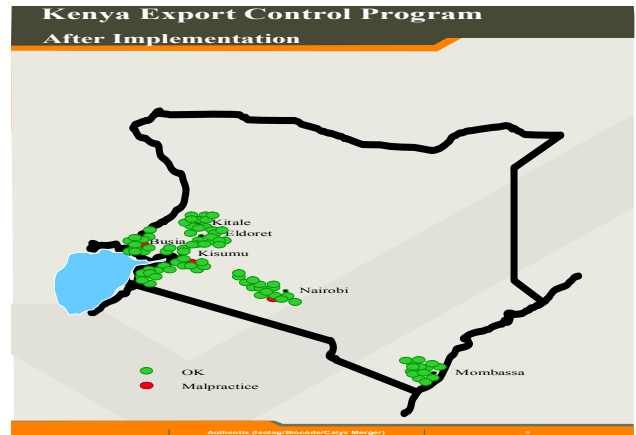


In Kenya tax has accounted for some 40% of the price of road fuel. However, when fuel is exported it is exported without tax and is therefore considerably cheaper than the pump price. This leads to the problem of tax free fuel designated for export being dumped illegally back into Kenya. To prevent this all zero taxed exported fuel (~600,000 kilolitres per annum) has been marked since October 1998. Fuel can then be tested at sites selling fuel to ensure that the export marker is not present. The Government along with the oil companies has also instituted other measures such as escorting tankers to the borders. A similar program is also in place to identify when kerosene is used illegally in road fuel. As the diagrams below show, the program has resulted in a significant reduction in illegal activity estimated to save the Kenyan Government annually some \$50 million in lost tax and the oil companies some \$ 75 million in sales (based on a \$ 50 oil barrel).

Illegal Sites before implementation (marked in red) where some 20% of sites are operating illegally



Reduction in Illegal Sites after implementation where < 2.5% of sites are operating illegally



2.2 A World-Wide Overview:

2.2.1 In America focus is primarily on:

- Franchise breaking where non-company fuel is illegally sold at company sites. This leads to both loss of sales and potential liability from selling poor quality fuel. In America, where the majors sell their fuel primarily through large wholesalers the problem can be severe. *In this case the Clients fuel is marked with a quantitative marker (often added through the additive package) and inspected to ensure their product is present and not replaced or diluted). Any discrepancy is dealt with through the dealer/multinational contract*
- Subsidy replacement, where subsidised product (e.g. agricultural diesel) is used illegally in other sectors. *In this case, a Yes/No marker is used and sites who should be using un-subsidised fuel are inspected to ensure that subsidised fuel is absent. If present, this is a legal offence which can be prosecuted through the courts.*

2.2.2 In South America focus is on a number of areas, for example:

In Guyana where the fuel is heavily taxed - the main problem occurs from smuggling from neighbouring

Countries. Here the Guyanese fuel is marked as it enters the Country with a quantitative marker and all retail sites are inspected to ensure that there has been no dilution of the quantitative marker with smuggled fuel where no tax has been paid.

In Brazil the main fiscal problem comes from illegally using subsidised product meant for remote areas in the main sector of the economy where un-subsidised product should be being used. In this case, a Yes/No marker is used and sites who should be using un-subsidised fuel are inspected to ensure that subsidised fuel is absent.

In Brazil, there are also significant problems with franchise breaking and rogue traders dumping fuel onto the sites of the company majors leading to problems of loss of sales and fuel quality. As with America, the Clients fuel is marked with a quantitative marker and inspected to ensure their product is present and not replaced or diluted. The oil companies who run these programs use them to gain a competitive advantage and advertise their activities as a commitment to providing their customers a quality product which has not been adulterated or substituted.

2.2.3 In Africa, the problems are diverse. Typical examples are:

In East Africa (Kenya, Uganda, Tanzania) where the fuel is heavily taxed and travels tax-free across the borders- the main problem occurs from smuggling from neighbouring Countries and the dumping of export fuel back into the Country of origin. A Yes/No marker is used to mark export fuel and a quantitative marker is used to mark road fuel. All retail sites are inspected for malpractice..

In South Africa, the most significant problem is the diversion of subsidised illuminating paraffin (kerosene) designated for lighting and heating for the poor into road fuel. In this case, a Yes/No marker is used and road fuel is inspected for the presence of marked illegal paraffin.

2.2.3 In Europe 2 problems pre-dominate

In Old Europe (France, UK, Spain etc.) subsidy replacement is the major problem where subsidised product (e.g. agricultural diesel) is used illegally in other sectors. In this case, a Yes/No marker is used and sites who should be using un-subsidised fuel are inspected to ensure that subsidised fuel is absent. If present, this is a legal offence which can be prosecuted through the courts.

In New Europe (Serbia, Romania etc. and much of the Former Soviet Union), the problem, as in East Africa comes from neighbouring Countries where the fuel is differentially taxed and travels tax-free across the borders- the main problem occurs from cross-border smuggling and the dumping of export fuel back into the

Country of origin. A Yes/No marker can be used to mark export fuel and a quantitative marker can be used to mark road fuel. All retail sites can be inspected for malpractice.

2.1.4 In Asia, the problems are Country Specific. For Example:

In India (the subject of a separate paper in the Conference) the most significant problem is the diversion of subsidised kerosene designated for lighting and heating for the poor into road fuel. In this case, a Yes/No marker is used and retail sites are inspected for the presence of illegal kerosene in the road fuel.

In Malaysia subsidised road fuel is illegally diverted into Industry. In this case, a Yes/No marker is used and industrial sites are inspected for the presence of illegal road fuel..

3. The Keys to a Successful Program:



3.1 Defining the Program: It is critical to define the programs objectives, operations and the penalties for illegal activity.

Strategic Marking Objectives

To Identify fuel that is illegal or has been adulterated

Demonstrating that action will be taken if illegal activity is detected

Operational

- Defining a suitable marker/test system
- Determining secure storage and distribution of the marker
- Determining how to mark the fuel or solvents

Measure for marker in market place

- Defining an appropriate sampling/inspection regime
- Defining a field test

- Defining the lab test for back-up

Controlling the Malpractice

- Penalise malpractice
- Certificate good practice

- Determine the criteria for success i.e. that legal fuel sales are going up and the number of sites where adulteration is occurring has been reduced

3.2 Integrated Management

The various elements of the operation can involve:

- controlled marking
- linking terminal deliveries to retail site receipts
- managing an active surveillance/testing program
- Providing data for management control/action on both an individual company basis and for the industry and Government as a whole.

For Success, this necessitates:

- Full coordinated operational control through Standard Operating Procedures
- Full operator training
- A management information system to back-up the operational activities
- Having a comprehensive data control system will ensure that:
 - Raw data from whatever source will be entered into a proscribed format
 - This will be used to prepare table/graphs
 - These will be use in turn to write reports
 - Data correlation
 - Being able to write specific reports

Chain of Evidence

It is critical that the full chain of evidence is maintained. It also essential to maximize the use of data by tracking parcels of product as well as confirming actual malpractice by field sampling and results. This information is used both for taking action against malpractice as well as to compare results of individual companies to the industry as a whole.

3.3 Choosing the Right Marker

3.3.1 Marking Strategy Depending on the nature of the problem, it will be important to determine the whether to mark the fuel that is being adulterated /replaced or the potential adulterant (or in the case of export dumping the export fuel). The arguments are summarised below. In general, quantitative marking is suitable when dilution is an issue, through for example smuggling and Yes/No marking when adulteration is an issue.

Marking Strategy		
Marking Approach	Positive	Draw backs
Mark All Road Fuel to 100%	All relevant fuel is marked and can be identified Laundering is not an issue	Level of detection is limited to 5-10% Theft and illegal use of the marker is a major issue
Mark Potential Adulterants	It is possible to detect very low levels of adulterant If solvents have been imported illegally they can be detected (they will have no marker)	This second option is valid only when it is possible to mark all product that is likely to be used illegally Some markers can be laundered

3.3.2 Marking Technology The main attributes of any marker system are summarised below

Idealised Marker Requirements The Marker System	
- Stable and Robust	
- Unique and protected by patents etc.	
- More than one marker to distinguish between neighbouring Countries	
- No effect on product specification	
- Works in all fuels (includes biofuels)	
- Detected at Low Levels and specific	
- Quick to test and confirmed in Lab	
- Can be identified after “laundering”	
- Will stand up in court (no mistakes)	

A number of different technologies have been used in the market place.

Traditional Dyes Marking programs originally relied on the relatively high levels of dyes, markers and inorganic tracers (generally greater than 20 ppm). Physical measurements (such as change in density or refractive index) have also been used.

Second Generation Dyes Tracing techniques were developed making use of covert chemicals. As with dyes relatively high levels of marker (generally greater than 20 ppm) are needed. The marker is normally analysed by a relatively simple chemical test which gives a colour (it is important that this is not confused with the colour of the fuel itself). The colour development is typical of a particular chemical and this, together with the relatively

high concentration used, means that it can be identified relatively quickly.

Isotope Technology relies on producing isotopes of different masses and measuring them with expensive sophisticated lab based instruments and highly trained technicians.

Infra Red /UV Direct Read Technologies A number of companies now offer machine read systems based on IR or UV tracers. This technology is easy to use, but there is a need to calibrate for different fuels.

Other Direct Read Technology There are a number of direct read technologies under development.

Immunoassay Technology (IAS) relies on marking with extremely low levels of marker (e.g. 100 ppb as opposed to the 20 ppm generally used for dyes). The marker is then detected by absorption onto an antibody column and analysed by a number of techniques including direct visual observation on the column, fluorometry and HPLC. Antibodies are very specific and one antibody will recognise only one marker chemical. This protects against false positives. The marker chemical is present at too low a concentration to be measured by any other technique. It is essential to have the antibody to extract and concentrate the marker. The security of the marker is therefore extremely high.

X-Ray Fluorescence, GCMS etc. Good technologies for quantitative detection which rely on lab or very large analytical equipment

The table1 compares the attributes of the various technologies.

To meet the requirements of any marker system there is the need for

- Accuracy coupled to on-site testing
- Marker security (the markers can not be imitated)
- Unequivocal identification of adulterants (making mistakes is costly)

In general, only a multi-layered marking system meets these requirements.

3.4 Needs for a Successful Program

Whereas, the marker system is critical, on its own it is not enough.

It is key to:

- Understand the Problem and have a Defined Program
- To have an Integrated Management System run by an Experienced Management Team
- An Appropriate and Excellent Marking Technology

- The Link between technology and integrated Management is illustrated below.



4. The Need for Marker Programs to Control Illegal Fuel Trade

4.1 World-wide Corruption Corruption and illegal activity is estimated to cost something over \$ 600 billion annually (5%-7% of World Trade) and is one of the biggest brakes on the growth of companies and economies. Often overlooked, but equally important are the abuse of subsidies for fuel and tax losses arising from smuggling.

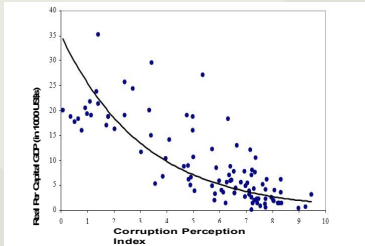
As has been shown in the previous section, effective programs can be put in place to control illegal practice and this quickly leads to recovered taxes and legal sales. This represents Growth without Taxation .

Recent Studies carried out by such groups who study and develop tools to combat corruption such as Accountability and Transparency International. What has been clearly shown is that there is a strong link between poor GDP and Corruption (Illegal Trading)

GDP Increases With Better Fiscal Transparency

In a 2001 International Monetary Fund paper entitled *Corruption, Growth, and Public Finances*, IMF research demonstrated that the more corrupt a country is, the lower its per capita GDP.

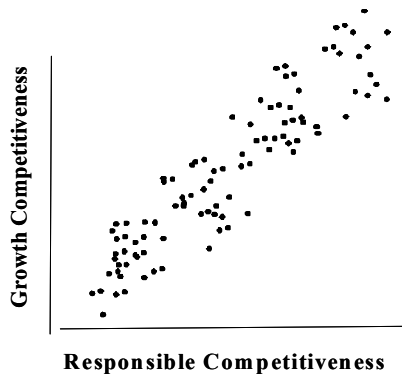
For many developing countries, taxes on fuel, tobacco and spirits generate significant portions of revenue. However, counterfeiting, smuggling, and diversion of these products can rob countries of billions in tax revenue and contribute to high levels of corruption.



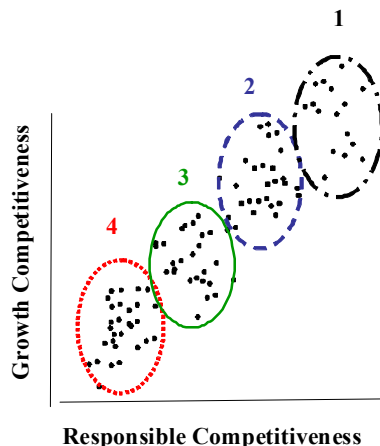
Authentix (Isotag/Biocoder/Calyx Merger)

52

4.2 Relating Fuel Fiscal Control Programs to Competitiveness. These Groups have also shown that there is a strong correlation between Growth Competitiveness with Responsible Competitiveness of ethics. This is shown figuratively below where the results of different Countries are compared.



The Countries can also be grouped and distinguished by their state of development as shown below



- 1 = Innovators = Enshrined in Law (UK, USA, Japan)
- 2 = Asserters = Responsibility and Brand (Malaysia, RSA, Spain)
- 3 = Compliers = Demonstrating Progress (India, Turkey, Poland)

- 4 = Starters = Implementation Difficult (China, Kenya, Nigeria)

What is interesting to note is that there are representative Countries in each Group that do have active control programs. There are also Countries in the same Group where fuel fraud is significant and there are no active programs. The factors that will affect responsible competitiveness and respective growth include

- Policy Drivers: which include controlling corruption by law
- Business Action: where overtly controlling trade brings (or preserves) profit
- Social Enablers: where being transparent is forced by the people of the Country who need the protection that controlled programs bring

Understanding how these factors will affect different Countries (which will vary from Group to Group) will help determine what is needed to encourage a Country to initiate and maintain a suitable fuel control program.

CONCLUSION

Having an integrated active program has distinct advantages. These programs will:

- Enable countries to increase tax revenues - without raising taxes
- Ensure subsidies go where they are needed
- Protect legal jobs
- Increase the degree of fiscal transparency within the Country's government
- Increase GDP which will effectively lead to an improved quality of life
- Maintain and enhance levels of foreign investment.
- Effective fuel marking programs will bring competitiveness and concomitant growth.

Focus on India: In the terms of the IFSL Conference (to be covered in detail in another paper to the Conference), India are to be congratulated for implementing a program to mark subsidised kerosene. This ensures both the kerosene gets where it is intended (to the poor) and that subsidies are not lost to unscrupulous agents.

Table 1 Petroleum Marker Technology Comparison

Technology	Use	
	For Measuring Dilution	For Measuring Adulteration
Immunoassay	<ul style="list-style-type: none"> • Accurate test • Can be done “on-site” or in the lab • High security • Works in all fuels 	<ul style="list-style-type: none"> • Measures very low levels of adulterants • Only marker recognised by the test • No mistakes
Covert Chemicals	<ul style="list-style-type: none"> • Easy test • Needs calibration on different fuels • Low level of security 	<ul style="list-style-type: none"> • Easy test • Can be imitated • Problems with false positives
Direct Read Technologies	<ul style="list-style-type: none"> • Very easy, quick test • Results may lack accuracy but are suitable for screening • Restricted number of markers 	<ul style="list-style-type: none"> • Instrument “noise” can lead to false positives • Should only be used in conjunction with a “Yes/No” marker
Isotopes	<ul style="list-style-type: none"> • Very accurate lab-based test which is slow and expensive • No field test 	<ul style="list-style-type: none"> • Not suitable as no field test available
GC X-Ray Diffraction	<ul style="list-style-type: none"> • Accurate • Needs large or lab-based instrumentation 	<ul style="list-style-type: none"> • Instrument “noise” can lead to false positives • Should only be used in conjunction with “Yes/No” marker