

MARKET BASELINE STUDY ON LOW SULPHUR FUELS

ON BEHALF OF THE ICCT AND UNEP

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**CLIMATE &
CLEAN AIR
COALITION**
TO REDUCE SHORT-LIVED
CLIMATE POLLUTANTS

MAY 2014

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ACRONYMS

BBL/d	Barrels of oil per day
CCAC	Climate and Clean Air Coalition
GFEI	Global Fuel Economy Initiative
HDDI	Heavy Duty Diesel Initiative
HDV	Heavy duty vehicles
ICCT	International Council on Clean Transportation
LDV	Light duty vehicles
OECD	Organisation for Economic Co-operation and Development
ppm	Parts per million
UNEP	United Nations Environment Programme

MARKET STUDY ON LOW SULPHUR FUELS

PURPOSE

Over the past couple of decades, there has been a trend towards lower sulphur automotive fuels and cleaner, more efficient vehicles and vehicle emission standards. However, there are still countries and entire regions that use high sulphur fuels, which negatively impact on public health (through fine particulate matter) and climate (black carbon emissions). In addition, high sulphur fuels prevent the introduction of cleaner, more efficient vehicles by limiting emission control technologies.

ICCT is part of the Climate and Clean Air Coalition (CCAC) Heavy Duty Diesel Initiative (HDDI). Other partners are UNEP, the US Government and the Canadian Government. As part of the HDDI, ICCT and UNEP are working together to prepare a global sulphur strategy to promote a global move to low sulphur fuels. This report will contribute to the development of this strategy. In addition to this market study ICCT and UNEP are also in the process of preparing a global refineries report and a set of country case studies – all three will be key pillars contributing to the development of the global sulphur strategy.

This market baseline study provides a global overview of auto fuel (both crude and refined) and vehicle markets in various sub-regions where higher sulphur fuels (in particular, diesel fuel) are still in use (fuels above 50 ppm). The narrative lays out insights from a global survey that mapped out the fuel quality in countries, the quantities of oil traded and produced, and the vehicle fleet in use (both new and used, imported and produced locally).

When combined with the findings of the parallel refinery investment study, it will inform the development of a global strategy for the reduction of sulphur levels in auto fuels and the use of cleaner, more efficient diesel technologies to lower particle matter emissions and black carbon worldwide.

The market baseline study is split into regions and sub-regions. Annex 1 lists the countries per region / sub-region that were surveyed. Tables with details of diesel and vehicle standards and markets per region are presented in Annex 2 (Africa), Annex 3 (Middle East), Annex 4 (Latin America), Annex 5 (Eastern Europe and the Caucasus) and Annex 6 (Asia). References are listed in Annex 7.

METHODOLOGY

The data acquisition aspect of this study used a variety of online sources, in addition to drawing on the expertise and experience of UNEP Transport Unit staff working within the regions on improving fuel quality and vehicle emission standards.

Values for petroleum production, consumption, quality and trade were found for most countries in Latin America, the Caribbean, Africa, Eastern Europe and the Caucasus, the Middle East and Asia (see Annex 1 for a list of countries per sub-region used).

The resulting fuel flow data (both crude and refined) was used to generate regional maps. The purpose of the maps is to illustrate the major trade patterns and flows within and between regions, as well as highlight key countries in each sub-region. This visual presentation of quantity and quality of fuel flow allows the viewer to identify ‘hot spots’ or major fuel players in regions and sub regions, along with a clearer understanding of opportunities to support and promote cleaner fuels introduction.

With respect to vehicles: finding detailed import / export values for every country was not possible within the limitations of this study, with particular difficulty when it came to differentiating between new and second-hand vehicle sales in developing markets. This data is very hard to obtain. The

vehicle tables in the annexes do provide what could be used as a proxy: the monetary value of vehicle products imported and exported.

For a small group of countries, 2008 data was found for *new motor vehicle sales*¹ (new within the country; the statistics do include both new and used vehicles). More recent sales data was found for a few select countries. Other important parameters are the *motorisation rates*²³ of countries, combined with vehicle standards. These are provided for most countries. This information is listed in the vehicle tables in Annex 2 through 6.

There were a few assumptions used in the research and when preparing the regional tables and maps, along with a few important disclaimers to note:

- The maps show the quality of fuel being imported / exported; to determine the actual quality being imported by a country was not always possible. In cases where the actual sulphur level was unknown, the national standard was used. This is a rather problematic assumption, as the actual sulphur levels will often differ from the standard (which is the maximum level allowed), particularly when a country is importing from a source with low sulphur fuel. This difference between actual and maximum means that the fuel being used is at times a better quality than the standard. However, the maps indicate the standard, unless information was found regarding actual fuel quality, in which case this value was used.
- The study on refineries will help to clarify some of the confusion created by the above assumption as it will provide information about actual fuel quality being produced. For example: India has a national standard of 350ppm, but this study assumes it is exporting dirtier fuel to African countries, because of the lower fuel quality standard in the importing countries. However if the refinery study shows that all Indian refineries are producing 350ppm or better, then the maps would have to be revised to indicate that the importing African countries are receiving 350ppm fuel quality.
- Countries regularly change where they import from / export to, depending on price, availability, demand, products required, sanctions, conflict, economics, politics, refinery shutdowns etc. The maps make the trade relations and flows look very static as they are a snapshot in time; however this is not the case on an ongoing basis. For the sake of analysis, data between 2010-2013 was used.
- An attempt was made to include all the countries that have had trade connections with each other between 2010 and 2013, in order to show all observed trade links in that timeframe; but in any one given month, the actual trade flows might be different.
- In addition, the values of the flows shift regularly as well, for some of the same reasons as mentioned above. The maps might provide an impression that a certain country always produces the same amount every day or exports the same amount. In reality, these maps are snapshots of average trade flows and relations and should be understood as such.
- Since it was not practical to find one source or one time period with all the data required, data comes from various sources and in some cases different years, spanning 2010 to 2013 (and a few data points from early 2014). Given that the aim of the study is to map and analyze the relative magnitude of flows rather than specific and exact values, it was decided that this approach was acceptable for the purpose of this study.
- Because of the range of data sources and years used, the values do not add up perfectly for many of the countries (ie: production + imports ≠ consumption + exports), but the differences are, for the most part, minimal and, given the purpose of the study, are acceptable for the development of sound analysis and recommendations on sulphur reductions and trends.

1 Compilation of Foreign Motor Vehicle Import Requirements, 2011 (<http://www.ita.doc.gov/auto>)

2 Motorisation rate is the number of vehicles per 1,000 people in a country

3 2010 World Bank & OICA 2011 data. Includes cars, buses, freight vehicles, but not 2-wheelers. However, the growth rates in some countries have altered significantly the motorization rate in the past few years, so the value listed will not be as accurate in those cases.

- The maps do not provide exact numbers, but rather indicate ranges of fuel flow volumes to give a sense of the relative magnitude and importance of trade. As the data comes from various sources and spans three years, the use of ranges avoids the impression of a precise flow volume, which was not possible to achieve given the limitations outlined above.
- For vehicles: As it was not possible to find one source and/or one time period with all the data required, data comes from various sources and in some cases different years. No pre-2010 data was used, with one exception, which is noted in the tables where applicable.
- Because of the range of data sources and years used, the values should be viewed as an indication, not as absolute.
- Unless indicated otherwise, fuel quality discussed throughout this report is for diesel fuel only; this applies to fuel (ie diesel) quality standards, sulphur levels (in parts per million, ppm, for diesel) and actual, in-use fuel (ie diesel) quality.
- However refinery capacity and trade volumes indicated on maps and in text include all fuel products (unless otherwise specified), as disaggregated values for different fuels were not readily available.

The study focused on countries with developing and transitioning economies; North America, Australia and Western Europe were therefore not included directly. They are only mentioned when they provide fuels and vehicles to a developing region, or are the destination market for fuels and vehicles from other regions.

Regions were divided into sub-regions, primarily based on how existing markets are organised. The market-based sub-regions focused on in this study are: East Africa, Central Africa, North Africa, Southern Africa, West Africa, Middle East, Central America & the Caribbean, South America, Eastern Europe & the Caucasus, Central Asia, South Asia, North Asia and South-East Asia (see Annex 1 for countries per sub-region). For each sub-region, there is a narrative and a map. Tables are provided in Annexes 2 to 6, along with the breakdown of countries within each region.

Six vehicle case studies were developed in-depth. These were countries where studies had been conducted for the Global Fuel Economy Initiative and thus have detailed fleet data available, namely Chile, Ethiopia, Kenya, Georgia, Indonesia and Vietnam.

GLOBAL OUTLOOK

In 2012, the world consumed 88.9 million barrels of oil per day. While OECD⁴ consumption declined by 1.3% that year, consumption grew by 3.3% outside the OECD. This trend looks likely to continue. In 2009, for example, Asia overtook North America as the world's largest petroleum-consuming region, with consumption increasing by 4.4 million BBL/d between 2008 and 2012.

Most OECD countries are now at ultra-low sulphur fuels (i.e. 10 – 15ppm sulphur levels). Non-OECD countries, however, have varying standards in place, with many at 500ppm or above for automotive diesel fuels, as can be seen in Figure 1. Given that these are the countries experiencing increased fuel consumption and rapidly growing vehicle fleets, it is imperative that these countries move to cleaner fuel standards for health and climate reasons.

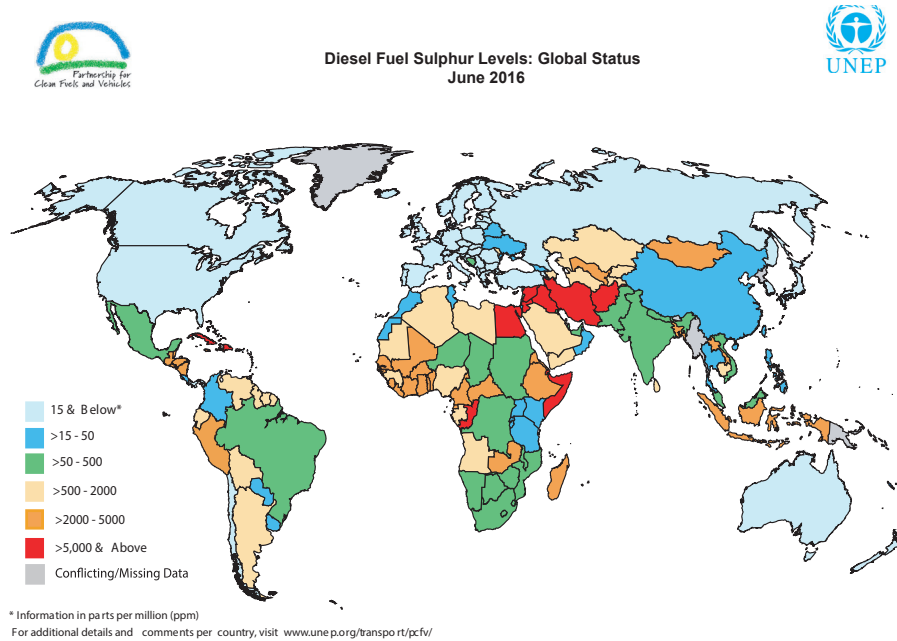


Figure 1: Global Status for Sulphur Levels in Diesel Fuel Updated June 2016

The growing demand for vehicles in developing and transitional economies requires a similar and complementary response for vehicle standards (both light duty and heavy duty). However cleaner, more efficient vehicles, which are helping the OECD countries to lower fuel consumption levels and improve air quality, require cleaner fuels to enable emission control technologies.

In addition to the required fuel and vehicle standards, the importance of the second-hand vehicle trade must be analysed and accounted for in global strategies, particularly for the non-OECD countries. In some countries, particularly in Africa, most vehicle imports are second hand vehicles. However, this in itself isn't necessarily detrimental to the cleaner fuels and vehicles agenda, as long as strict age limits, emission standards, good compliance and enforcement mechanisms are in place, combined with clean fuels. In Kenya, for example, there is an age limit on used imports; most of these used vehicles come from Japan, which has strict emission standards. In this case, the newer, second hand vehicles are relatively clean. However, in cases where there are no or very low standards on vehicle emissions, or poor regulation of second hand imports, there is a risk of dumping of 'dirty vehicles'.

Figure 2 indicates developing and transitional countries that have some sort of limit or a complete ban on the importation of used vehicles. Africa, Asia and the Middle East are lagging in terms of legislation on importation of used vehicles, thus potentially receiving vehicles that would have been scrapped in other countries.

IMPORT RESTRICTIONS

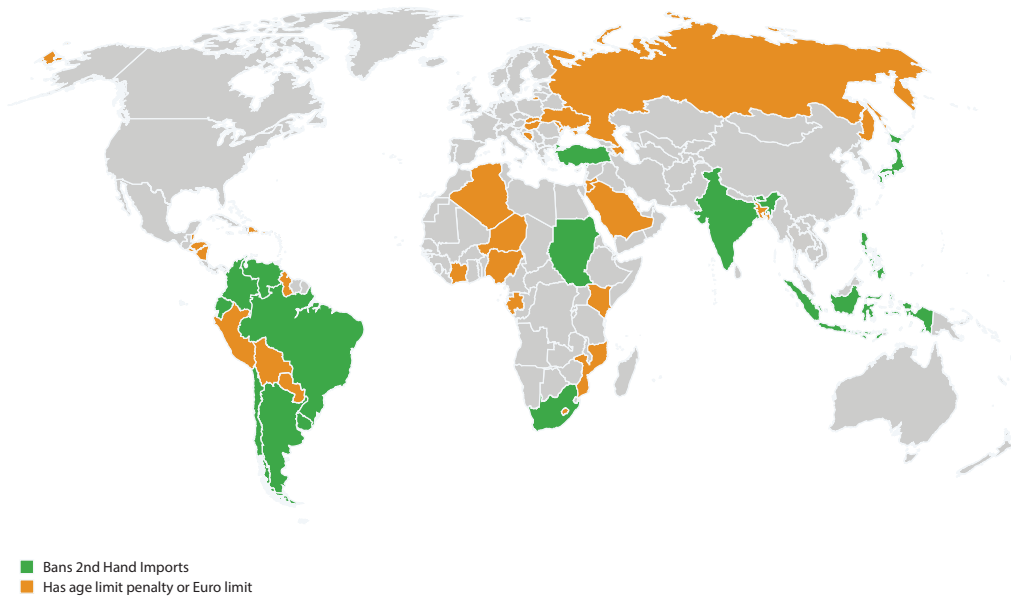
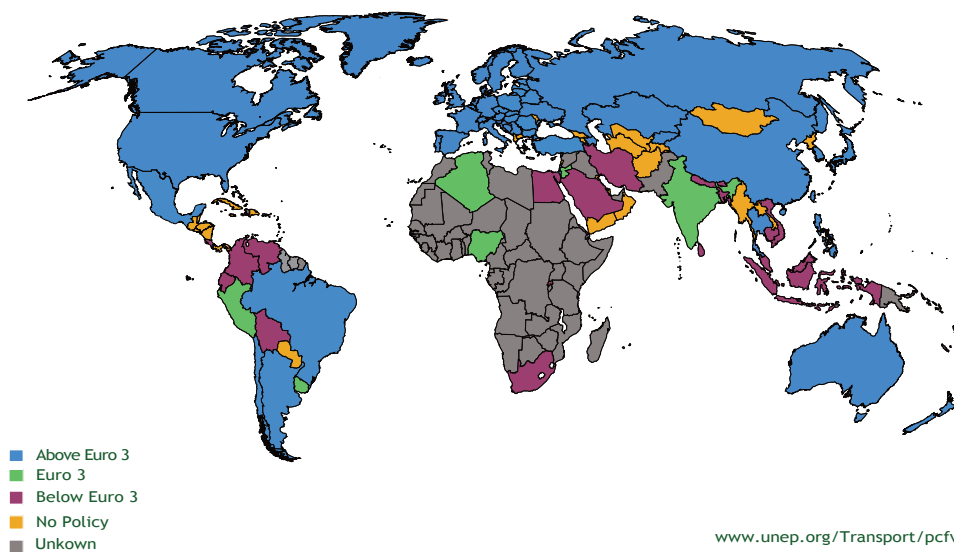


Figure 2: Import Restrictions on Used Vehicles in Developing and Transitional Countries Updated June 2016

Non-OECD countries will be seeing significant growth in vehicle stocks, both new and used. These vehicles should ideally be operated within the same, or similar, emissions control regimes as OECD countries, and with similar safeguards to protect these countries from becoming the dumping ground for obsolete technology. Figure 3⁵ provides an overview of vehicle emission standards in developing and transitional countries. For these countries to utilize the best available vehicle technology, clean fuels need to be available.



Vehicle Emissions Standards
June 2016



www.unep.org/Transport/pcfV

Figure 3: Vehicle Emission Standards in Developing & Transitional Countries Updated June 2016

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5 This map is a work in progress

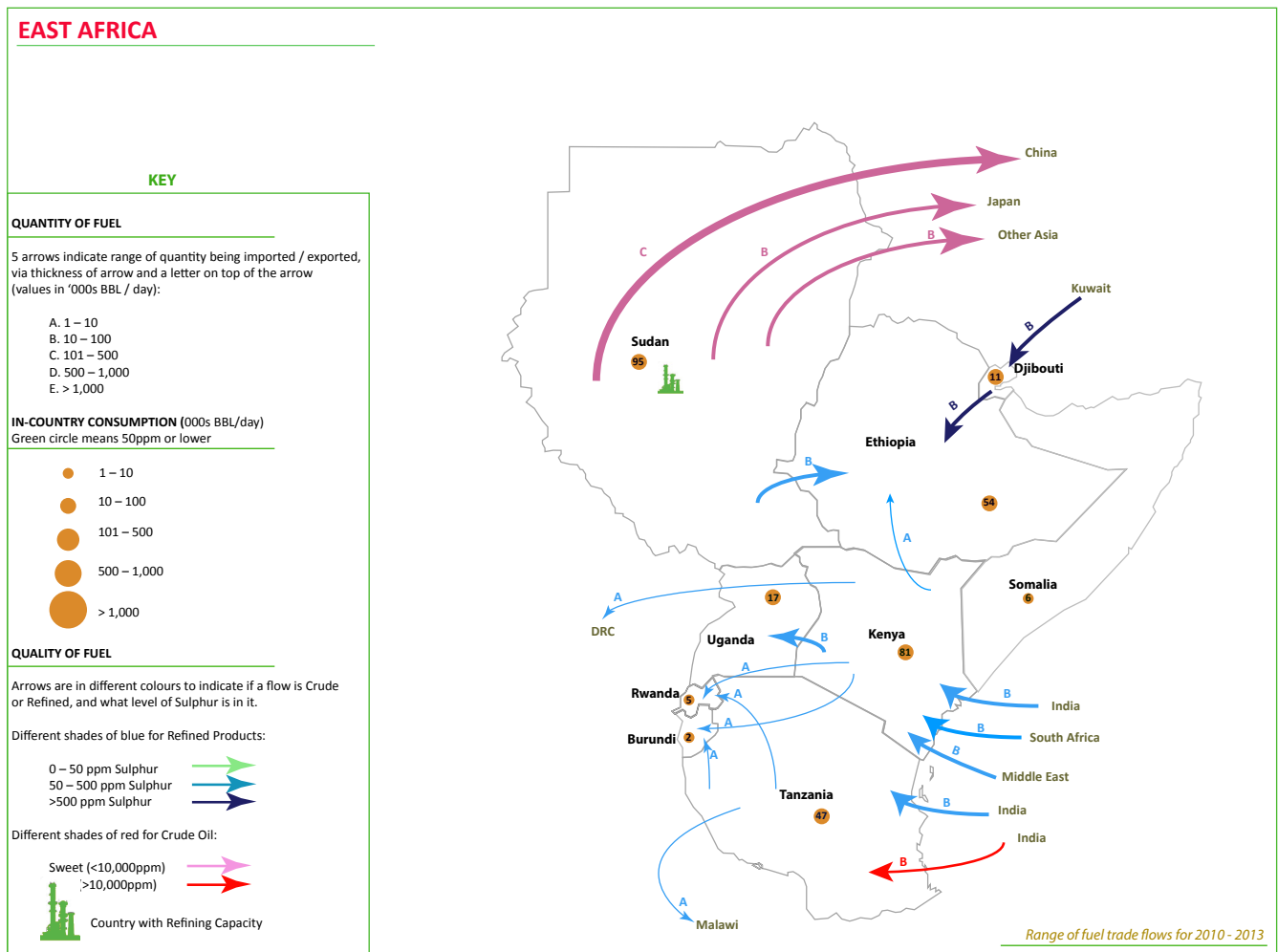


Figure 4: East Africa Fuel Flows

To date, Sudan and Uganda are the only countries in East Africa that have commercial oil fields (although current conflicts in Sudan have impacted on production levels). This may change over the coming years as other countries find oil reserves. Most of Sudan's sweet crude is exported to Asia.

Apart from in Sudan, there are no functioning refineries in the sub-region (Kenya's Mombasa facilities were closed in 2013). Ethiopia, which has the poorest sulphur standard levels for diesel at 5000ppm (see Table 1, Annex 2), is planning on constructing a refinery, as is Uganda in the next few years, in anticipation of the commercial development of its oil fields.

Kenya acts as a major conduit for petroleum products to its neighbours due to its port capacity in Mombasa; most products entering the region come through it. To a much lesser extent, Tanzania does supply some to its neighbours as well (for example, Uganda and Burundi in particular have sought to have a second supply, so as not to be as reliant on Kenya). From 2011, Kenya and Tanzania have been importing 500ppm fuels, with the Kenya refinery producing in addition on average 7,000ppm diesel fuel for local consumption. Since the closure of Kenya's refinery in 2013, the country has been supplied solely from imported 500ppm fuel.

⁶ Please note the limitations of this study: while the map makes trade relations and flows look very static, this isn't the case; in any one given month, the actual market might be different; data comes from various sources over a period of a few years (mainly 2010 to 2013); for these reasons, values do not add up perfectly (ie: production + imports ≠ consumption + exports); the focus is on the relative magnitude of trade.

The East African region in December 2013 gazetted harmonised low sulphur diesel standards (50ppm) to be effected from 1 January 2015. Hence at the beginning of next year, all the East African countries namely Kenya, Uganda, Tanzania, Rwanda, and Burundi are set to move to 50 ppm standards. Refined fuel products come chiefly from the Middle East, India and South Africa. Little information was available for Somalia, apart from its consumption level.

VEHICLES: With respect to vehicles, only Kenya and Sudan have import age restrictions on second hand vehicles (8 years and banned, respectively).

When comparing fuel and vehicle standards (Tables 1 and 2, Annex 2), it becomes clear that by the end of 2014, when the sub-region moves to 50ppm fuels, all these countries will be able to adopt Euro 4 vehicle emission standards to match with the low sulphur fuels.

Through analysis of the Global Fuel Economy Initiative (GFEI), two case studies in Africa were developed by Kenya and Ethiopia (Final Report on Pilot Global Fuel Economy Initiative Study in Ethiopia. Addis Ababa Institute of Technology, 2012 and Vehicle Inventory Report for GFEI Project, University of Nairobi Enterprise Services, December 2013.).

Kenya⁷ :

- 1) The cumulative vehicles registered could increase to approximately 5 million by 2030 (518,025 new registrations that year) if current trends continue. This would result in three times more cars by 2030 than were on the road in 2010. The overall trend is increased vehicle sales each successive year.
- 2) 80% of vehicles come from Japan, mostly as second-hand car sales.
- 3) Registration of second-hand vehicles was about 100 times higher than new vehicles: for light duty vehicles (LDV) in 2012, there were 109,260 used versus 1,212 new vehicles registered.
- 4) Since 2010, the average fuel consumption of vehicles purchased increased. This may be due to an increase in the average size of vehicles purchased. Kenya does not have a policy in place that promotes the importation of more fuel efficient vehicles but a project is underway that is reviewing this and that is expected to make recommendations for the introduction of such a policy.
- 5) The majority of new registrations in 2010 – 2012 were vehicles that were around 8 years old (the age limit for second-hand imports). This preference for older vehicles is encouraged by the tax structure applied to imports, with decreasing taxes for older vehicles.

According to the Kenya Motor Industry Association: 30% of all vehicles operating in Kenya are more than 15 years old; 70% of all vehicles are at least 10 years old; and the average age of LDV's is about 15 years, double the world norm.

While the emphasis on importation of second-hand vehicles will ensure a higher average fleet age, the ex-Japan vehicles meet at least Euro 4 LDV emission standard and are usually in very good condition. If clean fuels were available, this would protect the emission control devices, thus maximising the benefits of a higher standard vehicle.

⁷ Based on Vehicle Inventory Report for GFEI Project, Kenya (2013)

Ethiopia⁸ :

- 1) There are 325,000 vehicles in-country, with a 10% annual growth rate.
- 2) Most vehicles are older than 15 years, resulting in high fuel consumption and emissions.
- 3) There are no legally established ambient air quality standards or vehicular emission standards.
- 4) The excise tax is dependent on cylinder volume, thus penalising vehicles that consume more fuel per km and therefor acting indirectly in promoting fuel economy and lower emissions. However, like Kenya, the tax structure discourages new vehicle purchases, and there are no incentives for new technologies (hybrid, electric etc).
- 5) Environmental criteria are recognised under certain laws in terms of annual vehicle inspection, but these lack details for their enforcement.
- 6) While vehicles sales have increased notably over the last several years, the rate of growth for used vehicles is higher. In 2010, there were 4,335 new versus 10,596 used vehicles imported into Ethiopia, mostly from Japan (Toyota alone accounted for 80% of imported vehicles in 2010).
- 7) Most of the newly registered second-hand vehicles are in the 1 – 5 year old range; this provides a similar opportunity as found in Kenya, as the newer ex-Japan used vehicles will have at least Euro 4 emission standard and thus would provide an increased emission benefit if combined with low sulphur fuels.
- 8) In 2008, the number of diesel engines surpassed petrol, a trend that continues and will cause a disproportionate increase in emissions due to a combination of high sulphur fuels and damaged emission control devices.
- 9) For light duty vehicles, average fuel economy has improved, however many of the gasoline vehicles' catalytic converters have been removed, as there are no regulations regarding their use. Similarly for diesel vehicles, emission control technologies are sometimes removed due to lack of regulation and high sulphur diesel.

Ethiopia's vehicle fleet is an old one. However, heavy-duty trucks and buses are an interesting exception, particularly in Addis Ababa: more than 70% of the HDV were manufactured after 2000 (and most of those in the 2005 – 2009 years); many of them have retained their original emission controlling technology (diesel oxidation catalyst and / or diesel particulate filter).

Outside of the capital, the fleet is older with less use of emission controlling technology. Again, the heavy-duty truck and bus fleets still tend to be relatively new and many retain their emission control devices. However, with the use of high sulphur fuel, these devices are damaged or rendered inoperable.

The GFEI report (Final Report on Pilot Global Fuel Economy Initiative Study in Ethiopia. Addis Ababa Institute of Technology, 2012) recommended the adoption of Euro 3 vehicle emission standards in 2015 and Euro 4 by 2017, with concomitant lowering of sulphur levels to 50ppm.

⁸ Based on Final Report on Pilot Global Fuel Economy Initiative Study in Ethiopia (2012)

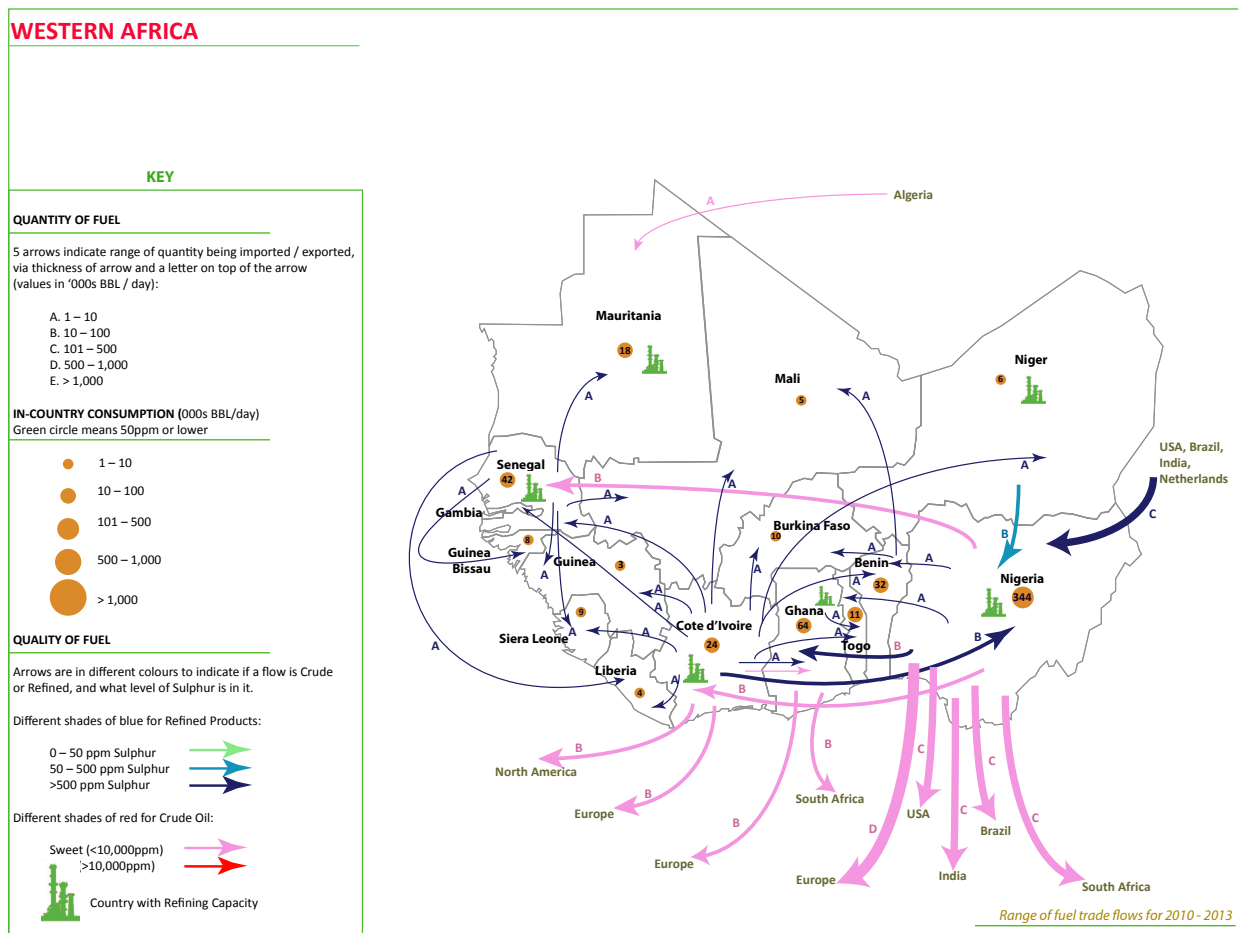


Figure 5: West Africa Fuel Flows

West Africa has little trade interaction with other African sub-regions, apart from a small volume of sweet crude exported to Cameroon and some sweet crude sales to South Africa. As a whole, it is fairly self-sufficient; however Nigeria, the largest consumer of petroleum by a significant margin, does import refined products from outside the region as well as high sulphur crude for its own consumption (see Table 3, Annex 2).

The three main producers in West Africa – Cote d’Ivoire, Nigeria and Ghana – export most of their sweet crude out of the sub-region to Europe, USA, India, Brazil and South Africa. Niger has a small level of production, most of which is exported as refined product to Nigeria.

While production does fluctuate due to internal conflict and political unrest, Nigeria is by far the largest producer and supplies the bulk of West Africa’s crude.

While Nigeria is a significant producer on the global market, Cote d’Ivoire has a more critical role as a local refining hub. It produces some sweet crude, most of which it exports to North America and Europe. It then imports more crude from Nigeria, which it refines for its own market and exports as high sulphur fuels to twelve of its neighbours (Mali, Burkina Faso, Liberia, Sierra Leone, Guinea, Senegal, Ghana, Togo, The Gambia, Benin and Nigeria).

Although smaller in scale and influence, Senegal also acts as a refining hub, by importing Nigerian crude, refining it for internal use and export and exporting to five of its neighbours (Liberia, Guinea Bissau, Guinea, Sierra Leone and Mali).

Sulphur levels tend to be high across the sub-region, with standards ranging from 1,000 to 5,000ppm. Only Niger has lower than 500ppm diesel quality from the country's refinery production, and could consider lowering its national standard from 2000ppm to at least 500ppm. There is little indication of change in the region, with the notable exception of Cote d'Ivoire, the main supplier of refined products in West Africa. The country has set 2017 as the year to implement 50ppm for diesel. If this happens, it could provide an opportunity to improve standards on fuel quality for all neighbouring countries.

Nigeria's refineries need upgrading, and there are discussions about building the largest refinery in Africa. The government has prepared 50ppm standards but has not adopted them. While the import standard for diesel is 3,000ppm, their own refinery produces 1,000ppm sulphur fuel. It is conceivable that they could improve the import standard, since much of their imported fuel comes from low sulphur countries (although occasionally they do import higher sulphur fuel from Central Asia); indeed, it is conceivable that some of the imported products are already low in sulphur. By bringing in cleaner fuel, the government and national distributors could improve significantly the overall quality of fuels in Nigeria, either by sending the cleaner fuels to larger urban centres or by mixing with their own refined products. Since three quarters of the oil products consumed are imported, a cleaner import standard would have a significant impact not only within the country, but also in the sub-region.

Although Nigeria doesn't directly supply a lot of refined products in the sub-region, its high sulphur fuel standard has an impact nonetheless on Benin, Mali, Burkina Faso, Togo and Ghana. The ships that bring in refined products for Nigeria also supply other importing countries. Given that Nigeria is a considerably larger consumer than its neighbours, its standard defines what will be delivered to the area. Benin for example has fuel storage capacity, and therefore supplies some refined products to Mali and Burkina Faso, purchased from the same source that Nigeria imports from.

VEHICLES: In the West Africa region, only Nigeria has introduced a national vehicle emissions standard – Euro 2 for light duty vehicles – and plans to introduce Euro 3 vehicle standards by 2015; however the country doesn't have the matching fuel.

The following countries have age-related restrictions on second hand vehicles: Cote d'Ivoire (anything older than 10 years is fined on import and annually); Ghana (a penalty is applied to vehicles older than 5 years); and Niger (no vehicle older than 5 years). Nigeria bans anything older than 15 years, which isn't a particularly meaningful limit.

When comparing fuel and vehicle standards (Tables 3 and 4, Annex 2), Niger has the possibility of going to Euro 3 vehicle emission standards, based on current fuel quality. If Cote d'Ivoire does implement a 50ppm standard, this would provide an opportunity for the sub-region to also tighten vehicle emission standards.

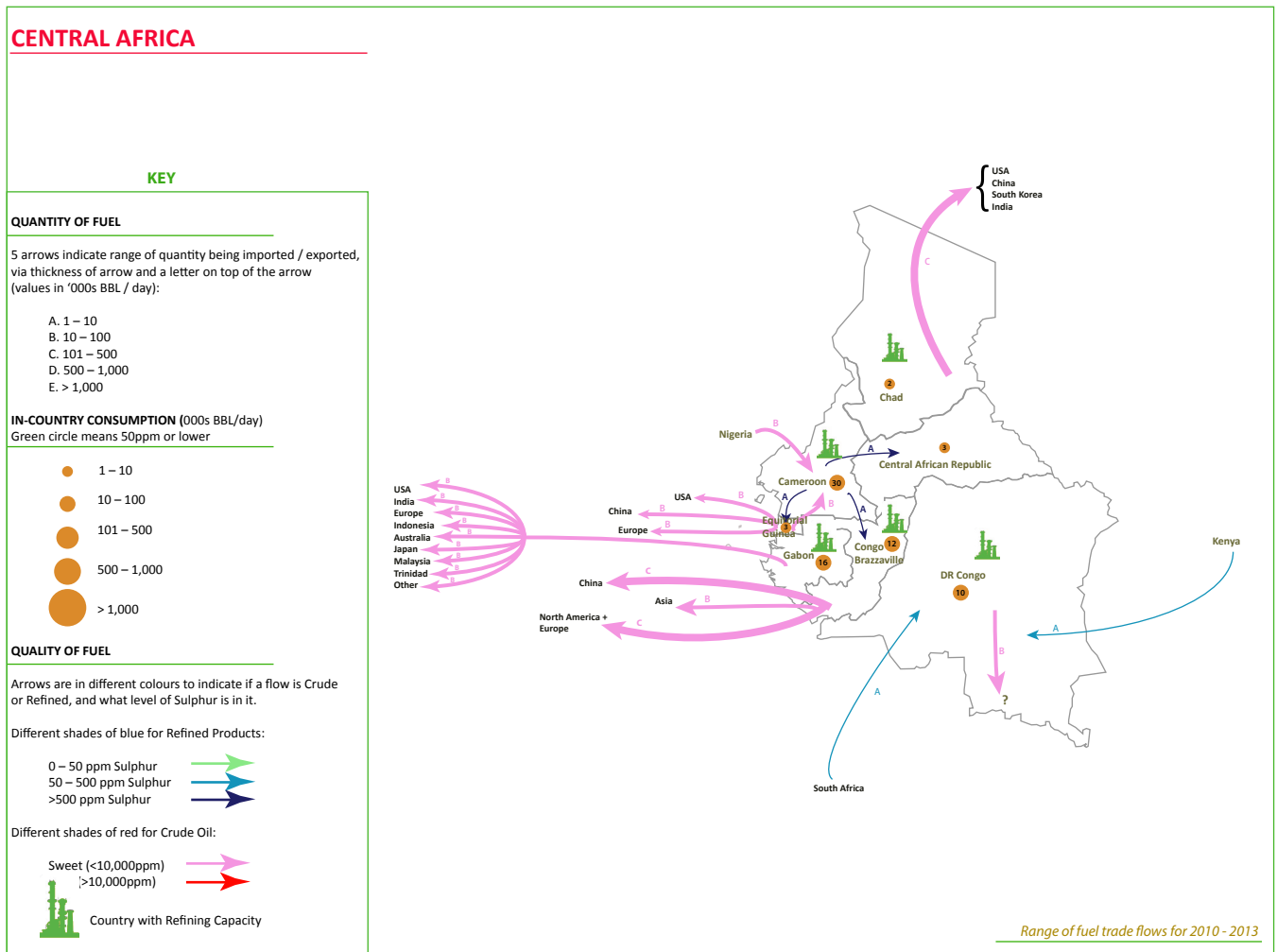


Figure 6: Central Africa Fuel Flows

Similarly to West Africa, Central Africa is a net exporter of sweet crude. Most exports are destined for the international market, especially USA, Europe, China and India. Apart from Central African Republic (which imports crude from Cameroon), all the countries are producers, led by Chad, Congo-Brazzaville, Gabon and Equatorial Guinea. DRC Congo and Cameroon are smaller producers.

Unlike West Africa, the movement of fuel between countries in the sub-region is very modest. While no one country stands out as an important local hub in the way Cote d'Ivoire does, Cameroon has some significance as it acts as a transit corridor for fuel being exported out of neighbouring countries via the Chad-Cameroon pipeline. It supplies refined products to two of its immediate neighbours: Congo-Brazzaville and Equatorial Guinea. DRC relies on Kenya and South Africa for its refined products, and could therefore implement a fuel quality standard of 500ppm sulphur (South Africa's current standard), moving to 50ppm by 2017.

Sulphur levels tend to be high across the sub-region, with standards set from 1,000 to 8,000ppm and little indication of change. Fuel in some of the countries has lower sulphur levels than the standard, but there are no low sulphur fuels, apart from Chad, which has the lowest sulphur levels, typically at 166ppm for diesel and 35ppm in petrol.

VEHICLES: Gabon is the only country with any restrictions on second hand vehicle importation, with a maximum age of 4 years. There are no vehicle emission standards within the sub-region.

When comparing fuel and vehicle standards (Tables 5 and 6, Annex 2), Chad has the possibility of going to Euro 3 vehicle emission standards, based on current fuel quality. DRC Congo could potentially as well, since its fuel is imported from Kenya and South Africa.

SOUTHERN AFRICA

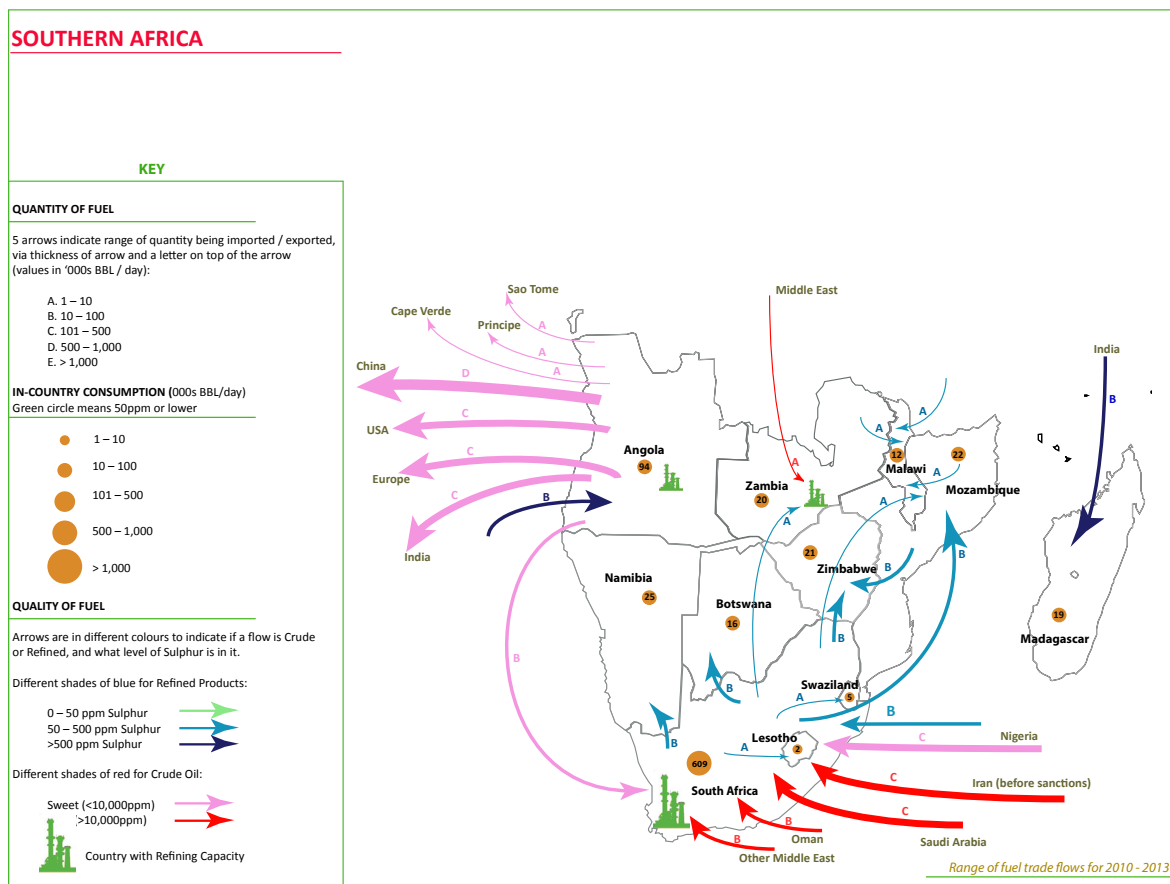


Figure 7: Southern Africa Fuel Flows

The only major producer in the region is Angola. Currently, the country exports most of its sweet crude out of the region, with the remainder going to South Africa, and imports refined products. Angola is constructing a new refinery that is scheduled to come online by 2017. The refinery will process Angola's crude oil into refined products that meet European and American specifications; these will be sold to domestic and international markets, including Europe and the USA. Assuming Angola does in fact consume the cleaner products from the new refinery (as opposed to exporting all the clean fuel and importing cheaper fuel), it will benefit from access to (ultra) low Sulphur gasoline and diesel.

While Angola is the major producer in the sub-region, it's South Africa that is for now a primary hub with the third largest refinery system in Africa (after Algeria and Egypt). It imports 95% of its crude oil requirements, but most of its products are refined in the country; it only imports products if there is an internal shortfall. South Africa is a key supplier of refined products to eight of its neighbours. It has embarked on an ambitious plan to upgrade existing refineries and to build a 300,000bbl/d refinery, all of which should meet a 10ppm sulphur standard by 2020. Once South Africa moves to low sulphur fuels, this could impact fuel quality in Botswana, Lesotho, Namibia, Swaziland, Mozambique, Zambia, Zimbabwe and Malawi, and these countries could consider tightening their import standards accordingly.

Mozambique is a second hub, as it imports and then re-exports to Malawi and Zimbabwe (similar to Kenya).

Madagascar is outside the sub-region's fuel trade as it imports refined products from India. However it has a high sulphur level standard that doesn't reflect the quality that India produces; either India is exporting high sulphur fuel to Madagascar, or Madagascar could improve its standard to match what it currently imports. Indeed, there are plans to improve the diesel fuel specifications to 500ppm. Mauritius is the only country in the sub-region that has attained 50 ppm diesel standard nationally while with South Africa availing 50 ppm diesel fuels in its the major towns.

VEHICLES: Limitations on importation of second hand vehicles vary across the sub-region. Angola allows individuals to import any aged vehicle but not motor companies. Botswana prohibits import of vehicles with more than 100,000km of mileage. Age limits for second hand imports are set in Lesotho (8 years) and Mozambique (5 years for cars; 9 years for vans), while South Africa bans all second hand vehicles with a few exceptions. South Africa is a major manufacturer of vehicles and has the second highest motorisation rate in Sub-Saharan Africa (after Congo-Brazzaville).

When comparing fuel and vehicle standards (Tables 7 and 8, Annex 2), Mozambique can implement at least Euro 2 vehicle emission standards, based on current fuel quality. Once South Africa implements its 10ppm standard for both gasoline and diesel, it plans to set a Euro 5 vehicle emission standard. Given that Mozambique and South Africa supply most of Southern Africa fuel, it is conceivable that all the countries could likewise implement higher vehicle standards to match the fuel quality.

NORTH AFRICA

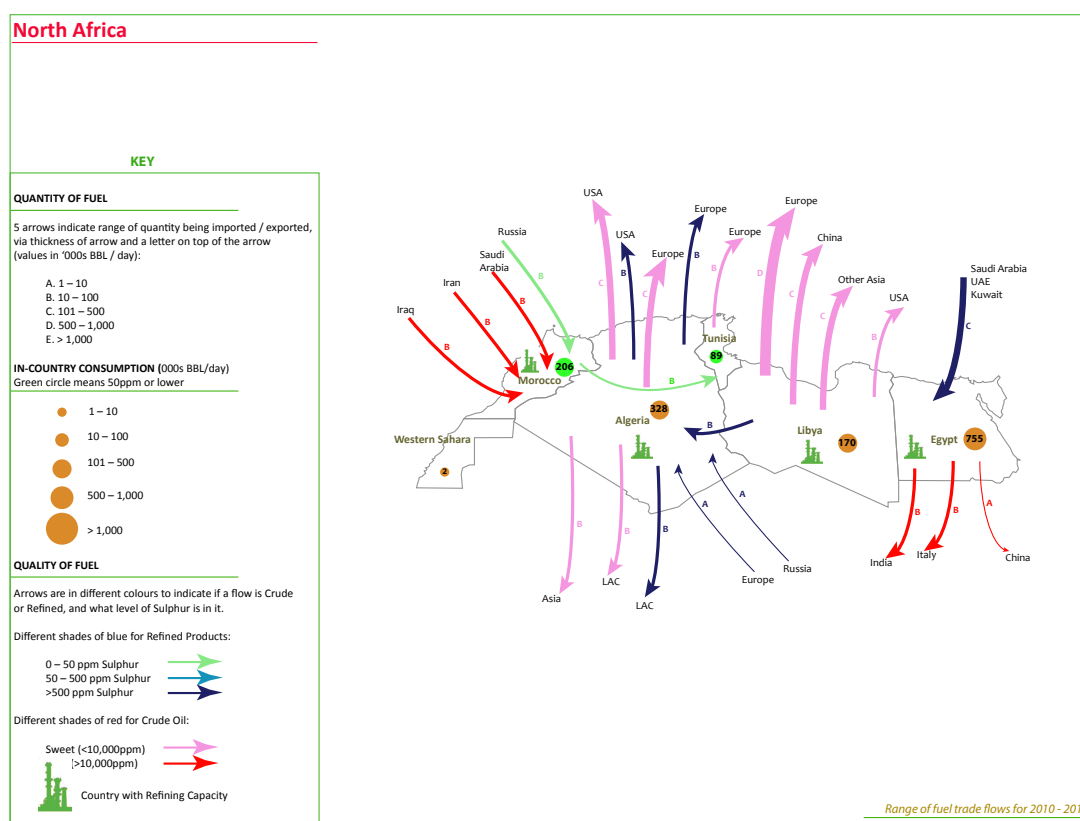


Figure 8: North Africa Fuel Flows

All countries are producers of mostly sweet crude (apart from Egypt, which has sour crude). Morocco, Egypt and Tunisia must import to supply their internal consumption. Tunisia is planning on building a second refinery so it can refine all of its locally produced crude; currently it exports its crude as its current refinery has been closed down. Libya and Algeria are net exporters of sweet crude to USA, Europe and Asia (mainly China), although protests in Libya have disrupted volumes. There is very little interaction within the sub-region or the rest of Africa, apart from a small amount from Algeria to Mauritania.

Morocco and Tunisia are the only countries to have a 50ppm sulphur standard (in reality, Morocco

produces mostly 10ppm sulphur diesel), and Algeria has set 2015 to implement a 50ppm standard. However Algeria has upgraded most refineries to produce 15ppm, with one small refinery remaining (representing about 7% of production); this final upgrade should be completed by 2017. The refined products are for both internal consumption and the EU market.

Egypt's refineries produce products with sulphur levels ranging from 50ppm to 10,000ppm. These products are mixed. As fuel is subsidised, it is unlikely that the nationalised refineries will be able to finance upgrades; however the country could improve the standard for imported fuel, especially since its refined products come from countries that will have low and ultra-low sulphur fuels in the next few years (Kuwait, Saudi Arabia and UAE).

VEHICLES: Although Egypt's fuel quality is quite poor overall, there is a ban on importation of any vehicles that are more than one year old. This means that second hand imports will be close to new, but the potential benefits of this will be lost as the cleaner technology will be damaged or made inoperable by the high sulphur fuel beings used (the standard being 10,000ppm).

Algeria is the only other country with a limit on second hand imports (no vehicles older than 3 years). Similar to Egypt, this provides an opportunity to benefit from the importation of relatively cleaner used vehicles. Given that most of the oil refineries are now producing 15ppm sulphur fuel, and the national standard is set to go to 50ppm by 2015, Algeria could consider introducing at least Euro 4 (and possibly Euro 5) vehicle emission standards, to match with the fuel quality.

When comparing fuel and vehicle standards (Tables 9 and 10, Annex 2), both Morocco and Tunisia have the possibility of going to Euro 4 vehicle emission standards, based on their current fuel quality standards of 50ppm sulphur.

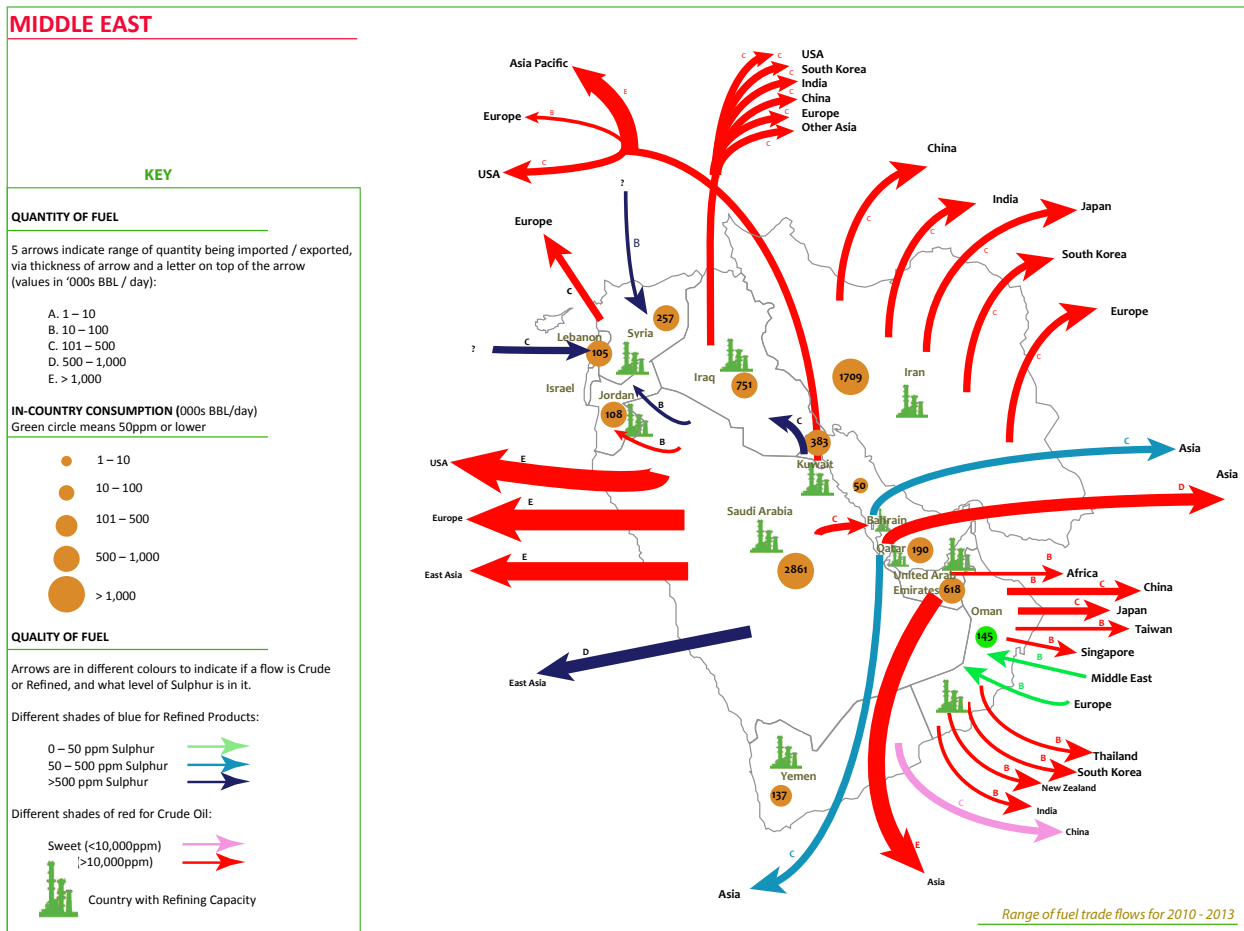


Figure 9: Middle East Fuel Flows

Most of the countries in the region are producers of sour crude, apart from Lebanon and Jordan (which must import all their fuel) and Yemen (which produces sweet crude, although output has declined due to attacks on the pipeline).

Syria currently faces sanctions, which has led to shortfalls of imported refined products, despite receiving some from Iraq and Iran. Prior to sanctions, 99% of its crude went to Europe. Oil smuggling into neighbouring countries is also a problem: Syria uses fuel subsidies to keep prices low, which encourages people to buy Syrian fuel and sell it across the border in countries where fuel is more expensive.

Most of the countries have high sulphur levels in their fuels, although there are a few (Bahrain, Lebanon, Oman, Qatar and UAE) that are at 500ppm. Bahrain, Kuwait and UAE have set 2018 for 50ppm implementation. Kuwait is upgrading their refinery as part of their cleaner fuel project. Saudi Arabia plans to have ultra-low sulphur fuels (10ppm) by 2016 through refinery upgrades; this could have a significant impact on countries that currently import refined product from Saudi Arabia. Israel is already at ultra-low sulphur fuel and is not covered in this report.

Fuel for local consumption is all produced and refined within the region. Apart from Jordan and Lebanon, all the countries are net exporters and have some refining capacity, although Oman, Syria and Iraq also import refined products, mainly from within the region. No one country dominates supply for those few countries that import refined products, although Saudi Arabia of course is

9 Please note the limitations of this study: while the map makes trade relations and flows look very static, this isn't the case; in any one given month, the actual market might be different; data comes from various sources over a period of a few years (mainly 2010 to 2013); for these reasons, values do not add up perfectly (ie: production + imports ≠ consumption + exports); the focus is on the relative magnitude of trade.

the single largest producer.

VEHICLES: Iran is the only country in the region that assembles vehicles, and it produces 46% of all cars in the Persian Gulf and central Asia. It has a strong local market, and it exports throughout the Middle East and Central Asia.

Jordan has age limits on importation of used vehicles, including a very tight limit on used heavy-duty vehicles (no older than 3 years), while personal vehicles have a ten-year limit. Saudi Arabia has age limits for both light duty (5 years) and heavy-duty (10 years) vehicles, and used cars make up 25% of the total vehicles in the country, and represent 15% of the market. Most of the imported vehicles (66%) come from Japan, with most of the remainder coming from the EU.

When comparing fuel and vehicle standards (Tables 11 and 12, Annex 3), Bahrain, Lebanon, Qatar, Saudi Arabia and the UAE have the possibility of going to at least Euro 2 vehicle emission standards, based on current fuel quality, while Oman has the fuel quality for Euro 4 vehicles. Saudi Arabia will be able to implement Euro 5 standards in the next few years.

LATIN AMERICA & THE CARIBBEAN¹⁰

South America

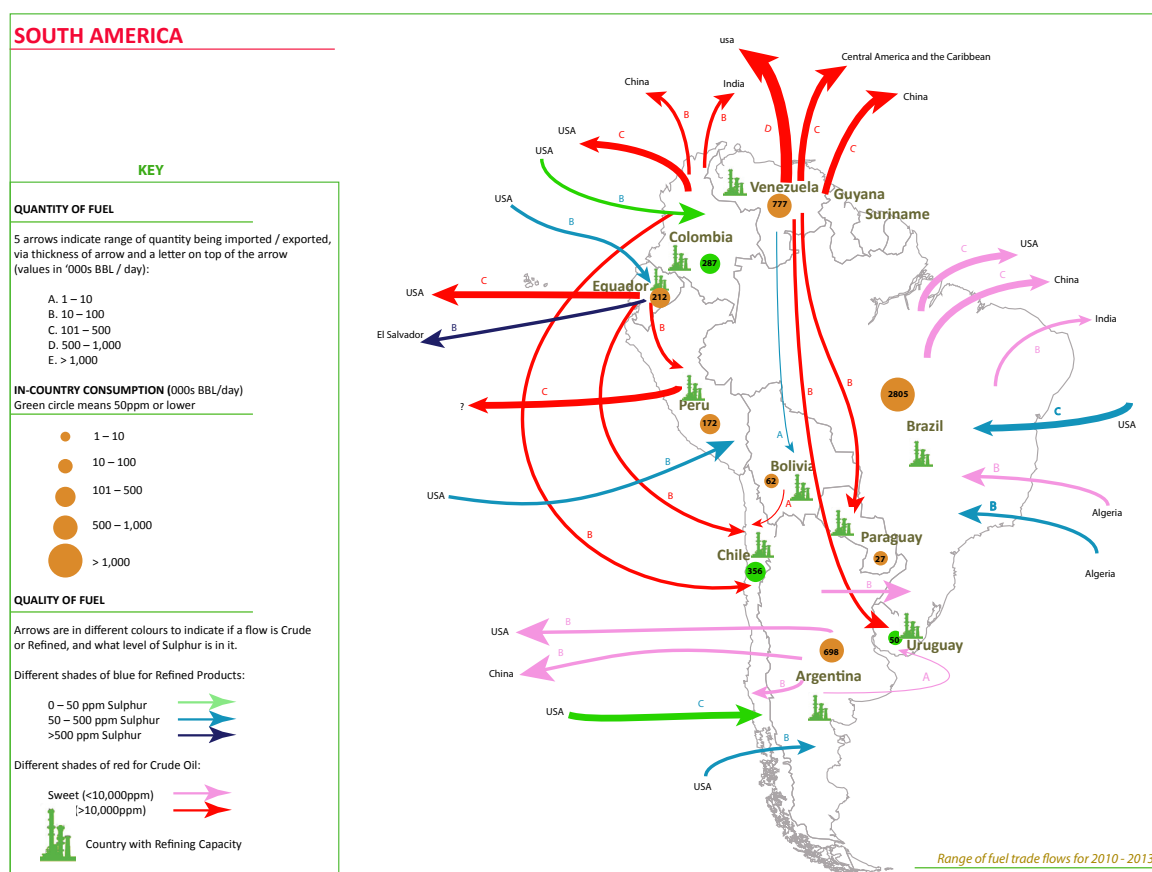


Figure 10: South America Fuel Flows

Many countries in the South American sub-region are oil producers and some of them are net exporters (Argentina, Brazil, Colombia, Ecuador, Peru, Venezuela). Crude exports that leave the sub-region are

¹⁰ Please note the limitations of this study: while the map makes trade relations and flows look very static, this isn't the case; in any one given month, the actual market might be different; data comes from various sources over a period of a few years (mainly 2010 to 2013); for these reasons, values do not add up perfectly (ie: production + imports ≠ consumption + exports); the focus is on the relative magnitude of trade.

primarily destined for USA, China and India. Most of the producers have some refining capacity but apart from Venezuela, all countries import some refined products, mainly from the USA. While the map indicates that some of the US products being imported are at 50-500ppm sulphur levels, it is possible, and even probable, that these are actually low or ultra-low sulphur products, in keeping with the American fuel quality standard; however it's difficult to verify the quality being imported.

In terms of net fuel flows, South America as a whole is fairly self-sufficient.

Within the sub-region, there are fuel flows that also relate to the different trade agreements such as the MERCOSUR and the Andean Community (CAN). In general there appear to be three distinct groups: The coastal Andean countries - Colombia, Ecuador, Peru and Chile - have some trade amongst each other and a very small amount with Bolivia and Argentina (Chile being the main importer of crude from Colombia, Ecuador, Bolivia and Argentina); Brazil, which has little fuel trade with the rest of South America; and Venezuela that has the most trade links within South America, supplying Bolivia, Paraguay, Uruguay, Guyana and Suriname, as well as having a significant presence in Central America and the Caribbean. Across South America, there are a variety of fuel standards, with variation between national and city levels in certain countries. For example, Peru and Paraguay mandate 50ppm diesel in some cities, while higher levels are permitted nationwide.

Other countries have different standards or grades of fuel. Argentina has three grades of diesel (Gas Oil) available on the market: Gas Oil G2 (maximum 1500ppm); Gas Oil G2 (maximum 500ppm, available in at least all provincial capitals); and Gas Oil G3 (10ppm or less). By law, diesel must have 5% biodiesel. The country is also a significant refiner, with nine refineries.

Brazil has three different standards for diesel: 1,800ppm nationwide and for rural areas; 50ppm for Public Transport services in metropolitan areas; and 500ppm for the general public in metropolitan areas. 500ppm is planned for 2014 nationwide. Brazil has a large network of refineries (2 private, 11 state-owned). Biofuels play a big role in Brazil, as 55% of all fuel is ethanol. All new Brazilian cars are equipped with "flex-fuel" engines. Brazil's National Energy Policy Council (CNPE) requires all diesel fuel in the country to contain 5% biofuel.

While Ecuador and Peru are both producers, they export much of their crude. Peru exports most of it, as it is too heavy for their refineries, and instead imports some crude from Ecuador for refining (around 120BBL/d) and some refined products (mainly from the USA; approximately 50,000BBL/d) to meet domestic consumption.

Ecuador imports 110,000BBL/d of refined products, mainly from the USA, and has recently announced plans to build a 200,000BBL/d refinery to add to its current capacity of around 170BBL/d capacity from its existing three refineries. Although the current standard specifies 5000ppm sulphur, in reality the country is distributing 150ppm nationwide, with a target of 50ppm for 2015 (the expected completion date of the new refinery).

While Ecuador and Peru have high sulphur standards (5000ppm), there is an opportunity to improve import standards for refined products, as the fuel from the USA is low sulphur and could be reserved for major cities.

South America still has fairly high sulphur levels in their fuels. However several countries have set target dates for 50ppm: Argentina (2016), Ecuador and Peru (2016). Several countries have already introduced country-wide low sulphur fuels: Chile (15ppm), Colombia (50ppm) and Uruguay (50ppm). In March 2014, at the Latin America and Caribbean Environment Ministers Forum, a Decision on Air Pollution was adopted, which included improvement in fuel quality. Sulphur content of diesel should not exceed 50ppm by 2015, or the soonest possible after this date. Similarly, by 2015, increasingly stringent vehicle emission standards coupled to the appropriate fuel specifications for light, medium and heavy-duty vehicles, as well as motorcycles, should be established. In the case of countries that are not able to establish such standards in 2015, they should have a process in place to establish such standards.

VEHICLES: In recent years, several countries have started adopting more stringent vehicle emission standards. For example, in line with its cleaner fuels, Colombia adopted Euro 4 for light duty vehicles in 2014 and has a target for heavy-duty vehicles to be at Euro 4 emission standard in 2015.

In most cases, vehicle standards follow after the associated fuel quality is in place, as vehicles of a certain standard require a minimum fuel quality in order to function optimally (and in some cases, dirtier fuel will hinder or damage emission control devices). However, both Argentina and Brazil have vehicle emission standards that are higher than the fuel standards. For example, Euro 5 vehicles can run on 50ppm, but are optimised for 10ppm sulphur; Brazil is currently using high sulphur diesel and is only scheduled to move to 500ppm sulphur in 2014, yet has Euro 5 standards for heavy-duty vehicles. Argentina has a 1500ppm sulphur standard for diesel but has vehicle emission standards of Euro 4.

Argentina's major vehicle trade partner is Brazil. Argentina manufactures vehicles, with the current national emission standard of Euro 4 for light and heavy-duty vehicles; Euro 5 will be introduced in 2014 for new models and in 2016 for all models.

Brazil is also a major manufacturer of vehicles, and exports to Africa, Asia, the rest of South America, China, India and Russia. There is a Euro 4 emission standard for light duty vehicles and Euro 5 for heavy-duty vehicles, as well as annual inspections.

Chile will have in place Euro 5 emission standards for all vehicles by the end of 2014.

Although Ecuador bans used vehicle imports, it has only Euro 1 and 2 emission standards for light and heavy-duty vehicles respectively. Uruguay has a vehicle emission standard of Euro 3 and a vehicle fleet with an average age of 17 years.

Bolivia, Paraguay and Peru have age limits on used vehicle imports, while importation of second hand vehicles are banned in Argentina, Brazil, Chile, Colombia, Ecuador, Uruguay and Venezuela.

As part of the Global Fuel Economy Initiative (GFEI), one case study in this region was developed in further detail. Below is a summary of that study (Environmental Monitoring of the Chilean Automotive Market. Mario Molina Center, 2010).

Chile¹¹ :

- 1) Emission standards in Chile are very good: Euro 4 for petrol vehicles (to be increased to Euro 5 by end of 2014); Euro 5 for light duty diesel vehicles; Euro 5 for heavy-duty vehicles by end of 2014.
- 2) The motorisation rate (number of vehicles per 1000 people) has doubled between 1990 and 2010, while the national vehicle fleet in Chile had an average growth rate of 13% between 2005 and 2010.
- 3) Diesel vehicles represented 21% of all sales in 2010; most of those are commercial diesel. Larger vehicles (double cab trucks, SUVs) grew 242% between 2005 and 2010, accounting for almost a third of automobile sales, due to a combination of increased market interest in larger vehicles and lower diesel tax rates and tax discounts for pick-up trucks and 4WD vehicles.
- 4) The Chilean car market is the fourth biggest in Latin America (after Brazil, Mexico and Argentina). In 2010, the total fleet in Chile was around 3 million vehicles. Private vehicles make up 89% of the total fleet, while large vehicles, trucks and buses account for the remainder.
- 5) 50% of the vehicles were manufactured in 2001 or later. As of 2010, the average vehicle age was 8.5 years.

11 Based on Environmental Monitoring of the Chilean Automotive Market (2010)

6) The importation of used vehicles is banned, with a few exceptions.

This national project contributed to the development of a mandatory vehicle labelling, the first one in all of Latin America and the Caribbean. A feebate¹² proposal was also drafted and presented to Congress. At the request of government, this is now being revised as a tax law to tax non-efficient vehicles, thus lowering the relative price of more efficient vehicles in order to encourage people to purchase them. Due to the interest generated in this GFEI project, there are now national projects on-going in Peru and Uruguay in South America, and Jamaica in the Caribbean.

Central America & the Caribbean

CARIBBEAN & CENTRAL AMERICA

Range of fuel trade flows for 2010 - 2013

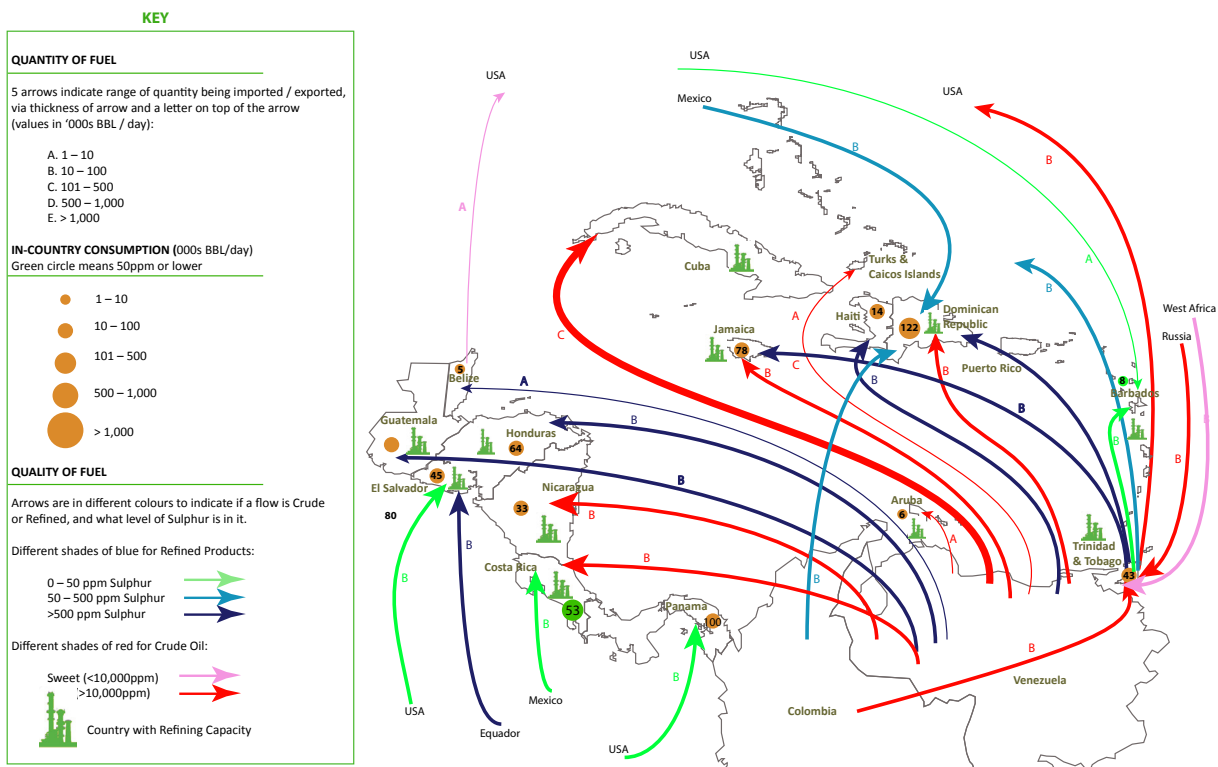


Figure 11: Central America and the Caribbean Fuel Flows

Due to its location, Central America and the Caribbean have a broader trade network than South America. While countries import mainly from Venezuela and Mexico, there are some flows coming from Russia, West Africa, South America and the USA. Trinidad and Tobago, the only producer that is a net exporter, is also a refining centre, importing crude from Russia, Colombia and West Africa and exporting refined products throughout the region. All other countries rely on imports.

Venezuela has significant trade links throughout Central America and the Caribbean, through the PetroCaribe agreement that gives preferential payment conditions to members. It exports both crude and high sulphur fuel products to around 17 countries, including Antigua and Barbuda, Aruba, Bahamas, Belize, Dominica, Dominican Republic, Guatemala, Grenada, Haiti, Honduras, Jamaica, Nicaragua,

¹² Feebates are a fee applied to inefficient technology and a rebate on efficient vehicles, in order to increase the cost of dirtier vehicles and decrease the cost for more efficient vehicles. For more information see http://www.unep.org/transport/gfei/autotool/approaches/economic_instruments/fee_bate.asp

St Lucia, St Kitts and Nevis, Saint Vincent and the Grenadines, Turks and Caicos Islands. However, Barbados, Montserrat and Trinidad & Tobago are not members of the PetroCaribe agreement. Other Caribbean countries not members of PetroCaribe are those with European / US ties (British Virgin Islands, Martinique, St. Barthelemy, St. Martin, Curacao, Anguilla, Cayman Islands, US. Virgin Islands and a few others); they don't import from Venezuela.

Sulphur levels are high, with an average of 5,000ppm. Barbados, who is not a PetroCaribe member, is a notable exception with ultra-low sulphur diesel nationwide (15ppm) imported since December 2013 from the Gulf of Mexico. Costa Rica has 50ppm nationwide; it imports refined products from Mexico and refines crude from Venezuela. Costa Rica is building a refinery to replace its existing one and to triple the country's refining capacity to 60,000BBL/d; the increase in refining capacity is expected to meet domestic demand for the next 15 years. Jamaica has 5,000ppm nationwide, however imports 15ppm fuel for some cities. Since El Salvador receives some clean fuel from the USA, it too could consider providing clean fuels in the cities.

VEHICLES: The following have used vehicle import restrictions: Barbados (no vehicles older than 4 years); Bermuda (no vehicles older than 6 months); Cuba (no vehicles older than 4 years); Dominican Republic (no vehicles older than 5 years for LDV and 15 years for HDV); El Salvador (no vehicles older than 8 years for LDV and 15 years for HDV); Guyana (no vehicles older than 5 years for LDV and 3 years for HDV); Honduras (no vehicles older than 7 years and 13 years for public transport); Jamaica (no vehicles older than 3 years for LDV and 4 years for HDV); and Nicaragua (no vehicles older than 10 years). Few countries in the region have vehicle emission standards, apart from Costa Rica (Euro 1) and El Salvador (Euro 1).

Despite having low sulphur fuel, Costa Rica only has a Euro 1 vehicle emission standard and no limits on used vehicle importation. More than 80% of the fleet is older than 10 years. Although it has clean fuel, Barbados has no vehicle emission standards.

When comparing fuel and vehicle standards (Tables 15 and 16, Annex 4), Costa Rica has the possibility of immediately adopting Euro 4, and Barbados Euro 5, vehicle emission standards, based on current fuel quality. El Salvador receives some clean fuel from the USA, and could consider higher vehicle standards.

EASTERN EUROPE & THE CAUCASUS¹³

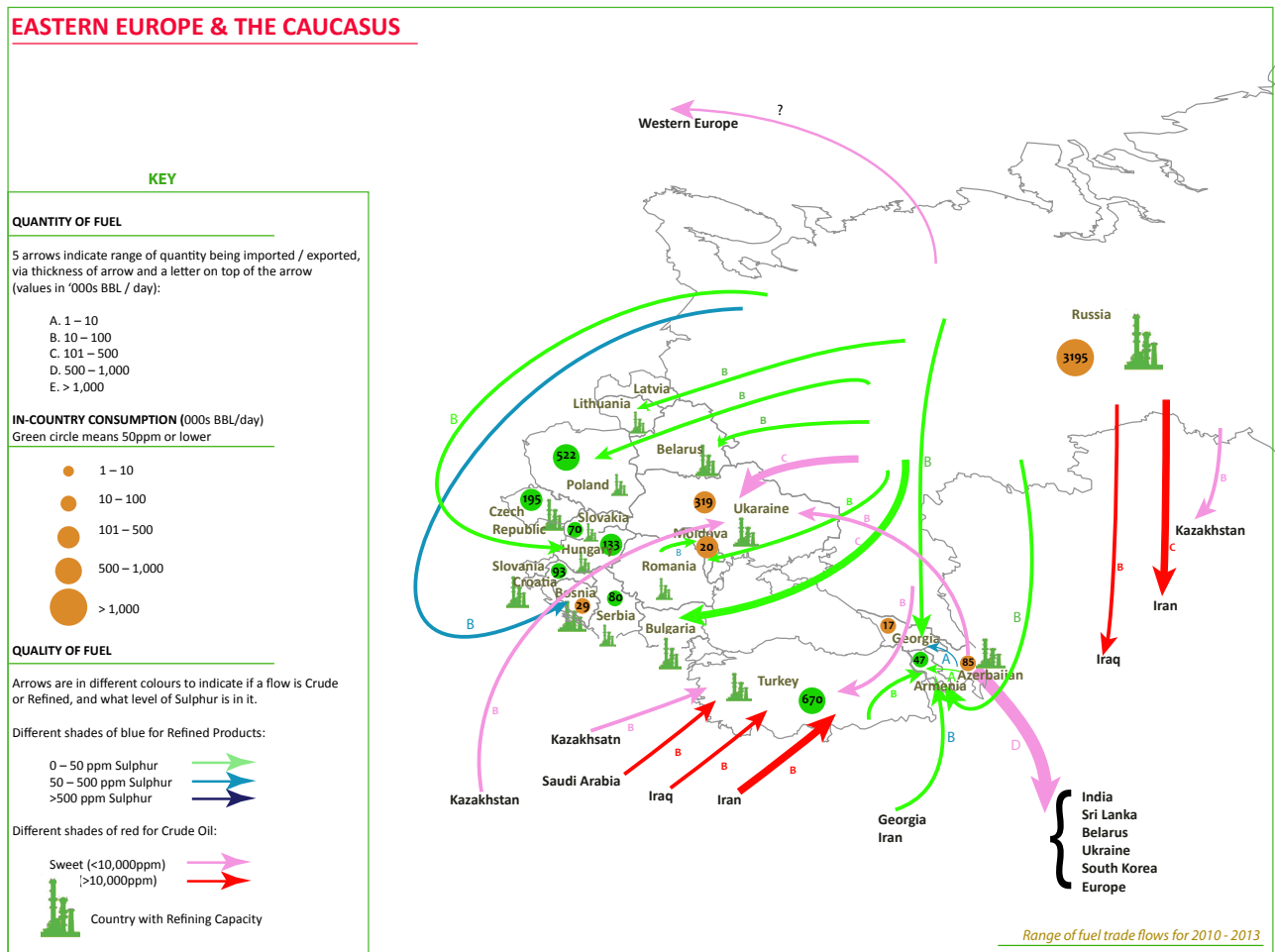


Figure 12: Eastern Europe & the Caucasus Fuel Flows

Russia is clearly the dominant influence in the region, supplying both crude and refined products to Bosnia, Hungary, Bulgaria, Lithuania, Belarus, Georgia, Armenia, Poland, Ukraine, Moldova, Turkey and beyond the region to Asia, Western Europe, Africa and Latin America. It exports most of its low and ultra-low sulphur fuels (10ppm). The country is investing in its refineries in order to meet the increased demand for higher quality, refined products mainly in Western, Northern and Mediterranean Europe (in addition to Central and Eastern Europe). Analysts expect Russian 10ppm diesel output to increase to over 1.1 million barrels per day (Mb/d) in 2016. The government has also heavily incentivized refiners by lowering the diesel product export tax from 2015. Russia's fuel quality timeline requires 50ppm and 10ppm sulphur diesel fuels nationally by 2015 and 2016, respectively.

Azerbaijan plays a considerably smaller role, supplying Georgia, Armenia, Belarus and Ukraine within the region and to EU and Asia through its expanding SOCAR retail network.

Moldova, which imports 50ppm fuel mostly from Russia, has a high sulphur fuel standard, and could possibly go lower to at least match the Russian standard. Moldova also imports refined fuel from neighbouring Romania. Romania's Rompetrol and Petrom are distributors in the region, as is Hungary's MOL group.

Partially thanks to the driving force of EU fuel quality directives, vehicle emission standards and EU

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approximation aspirations, sulphur standards tend to be better in this region than in others: most countries are at or below 500ppm, with plans to move to 50ppm or below. Bosnia-Herzegovina is upgrading its refinery to produce 10ppm by 2015. A number of countries are already below 50ppm: Armenia, Albania, Belarus, Croatia, Bulgaria, Czech Rep, Estonia, Hungary, Lithuania, Poland, Romania, Serbia (as of July 2013), Slovakia, Slovenia and Turkey.

Turkey's importance lies in its role as a transit point from the Middle East to Europe and the Caucasus, but in terms of influencing standards, Russia (for CIS countries in particular) and the EU may play a more critical role.

VEHICLES: With respect to vehicles, Eastern Europe is a significant manufacturing hub, led by Russia. Russia is the second largest manufacturer in Europe, after Germany, and is Europe's largest vehicle market in terms of car sales. Global automakers are investors in most of Russia's 32 auto-assembly and production plants, often through joint ventures with Russian manufacturers, making Russia the third largest producer in Europe after Germany and France.

The majority of production is exported to Western Europe while the region imports the EU's used vehicles. Czech Republic and Slovakia, for example, both assemble more than five times their domestic demand, mostly for export to Western Europe; despite being large vehicle manufacturers, there is a high demand for second hand vehicles due to cost. In Slovakia, used vehicles make up 50% of car sales and the average car age is 13 years; in Czech Republic, the average age is 14 years.

Some countries also maintain dual standards for exports and imports. For instance, Bosnia-Herzegovina requires Euro 4 emission standards for new LDV but Euro 3 for used vehicles; Serbia requires Euro 5 for new vehicles and Euro 3 for used vehicles; Macedonia has set Euro 4 standards for new vehicles but Euro 2 for used vehicles.

Romania is another significant manufacturer with a strong domestic market and is a significant net exporter to Western Europe and Central and Eastern Europe; however, even though the country has a Euro 5 vehicle emission standard, more than 50% of Romanian vehicles do not meet EU emission standards. Poland has a similar situation, with the average vehicle age of 12 years and 7 out of 8 vehicles being older than 5 years.

Non-EU countries tend to have no or lower emission standards. When comparing fuel and vehicle standards (Tables 17 and 18, Annex 5), Albania has the possibility of setting Euro 4, and Georgia Euro 3, vehicle emission standards, based on current fuel quality. Armenia has 10ppm sulphur standard, and so could have Euro 5 vehicle emission standards, to take advantage of the fuel quality.

The following countries have some sort of restrictions on used vehicle importation: Azerbaijan (no older than 5 years and a higher import duty for vehicles older than 1 year); Belarus (although not very meaningful, as custom duties only increase for vehicles older than 10 years); Hungary (no older than 4 years for LDV and 6 years for HDV); Moldova (no older than 10 years with increased taxes for vehicles older than 3 years); Slovakia (no older than 10 years); and Turkey (banned). Albania has an annual tax reduction for more efficient cars. Georgia has an age-dependent tax.

Most countries do have a minimum Euro vehicle emission requirement. The following countries have vehicle emission standards: Azerbaijan (Euro 2, with Euro 4 in 2014, although the fuel is still at 350ppm; this is in addition to an age limit); Belarus (Euro 4 for imports, Euro 5 for local production and export); Bosnia-Herzegovina (Euro 3); Bulgaria (Euro 5, although this may not apply to used vehicles); Croatia (Euro 5); Czech Republic (Euro 5, although this may not apply to used vehicles, and pre-2006 vehicles are allowed with payment of emission-based fees); Estonia (Euro 5); Hungary (Euro 5, in addition to an age limit); Latvia (Euro 5); Lithuania (Euro 5); Montenegro (Euro 3); Poland (Euro 5); Romania (Euro 5); Russia (Euro 4, although 50ppm fuel isn't consistently available across the country); Serbia (Euro 5 for LDV; Euro 4 for trucks); Slovakia (Euro 5); Slovenia (Euro 5); Turkey (Euro 4); Ukraine (Euro 3).

Russia has an age-based taxation system for any car older than 1 year (to encourage consumption of locally produced new cars), and a Euro 4 emission standard, with Euro 5 to be introduced in 2015. However, the requisite fuel quality is not widely available. Outside of major cities and the western part of the country, fuel quality deteriorates. Diagnostic equipment on heavy-duty vehicles that move across country are turned off due to technical failure resulting from inadequate fuel quality and urea distribution networks. Despite being a significant manufacturer of vehicles and having an age-based tax, the average vehicle age in Russia is 12 years.

Another strong manufacturer with strong domestic and export markets, Turkey bans used vehicle importation and has a Euro 4 emission standard, but has an average car age of 16 years. 80% of its production is for export to the EU and Middle East.

As part of the Global Fuel Economy Initiative (GFEI), one case study in this region was developed. (White Paper on Options for Improving Automotive Fuel Economy in Georgia. Caucasus Environmental NGO Network, 2014.)

Georgia¹⁴ :

- 1) The fleet is an aging one, with an average age of 13 years.
- 2) Many second-hand vehicles are imported from Western Europe, Japan and the USA. It has one of the worst average fuel economies in Europe and well above the global average.
- 3) Its taxation regime does not incentivise cleaner, more efficient vehicles, but actually encourages the purchase of older vehicles with the lowest taxation rates for 7 – 12 year old vehicles.
- 4) While the gasoline light duty vehicle (LDV) fleet is slowly decreasing in share of the national fleet, diesel vehicles are increasing: between 2008 and 2012, the share of large LDV increased from 3% to 16%. There is also an increase in the number of diesel LDV, from 4% in 2008 to 18% in 2012. If the trend continues, by 2020 one third or more of all new LDV registrations will be diesel. Therefore diesel fuel quality will become more important in the coming years.
- 5) National standards do not meet EU requirements for either fuels or vehicles.
- 6) The low fuel efficiency, the preference for older vehicles that lack more advanced emission control devices and the use of fuel with 150 – 200ppm sulphur levels combine to create a dirty vehicle stock.
- 7) The transport sector accounts for 71% of air pollution nation-wide and more than 95% of air pollution in Tbilisi.
- 8) The GFEI study recommends five strategies to improve Georgia's fleet. While these are specifically about LDV, similar strategies could apply to heavy duty vehicles as well:
 - Vehicle fuel economy labelling
 - Restrictions on age of second hand vehicles
 - CO₂-based vehicle acquisition and / or registration tax
 - CO₂-based vehicle ownership tax (annual fees dependent on fuel efficiency of vehicle) – this will be feasible after the implementation of vehicle testing standards in 2015
 - Fuel quality standards to support cleaner, more efficient technology

14 Based on White Paper on Options for Improving Automotive Fuel Economy in Georgia (2014)

CENTRAL ASIA

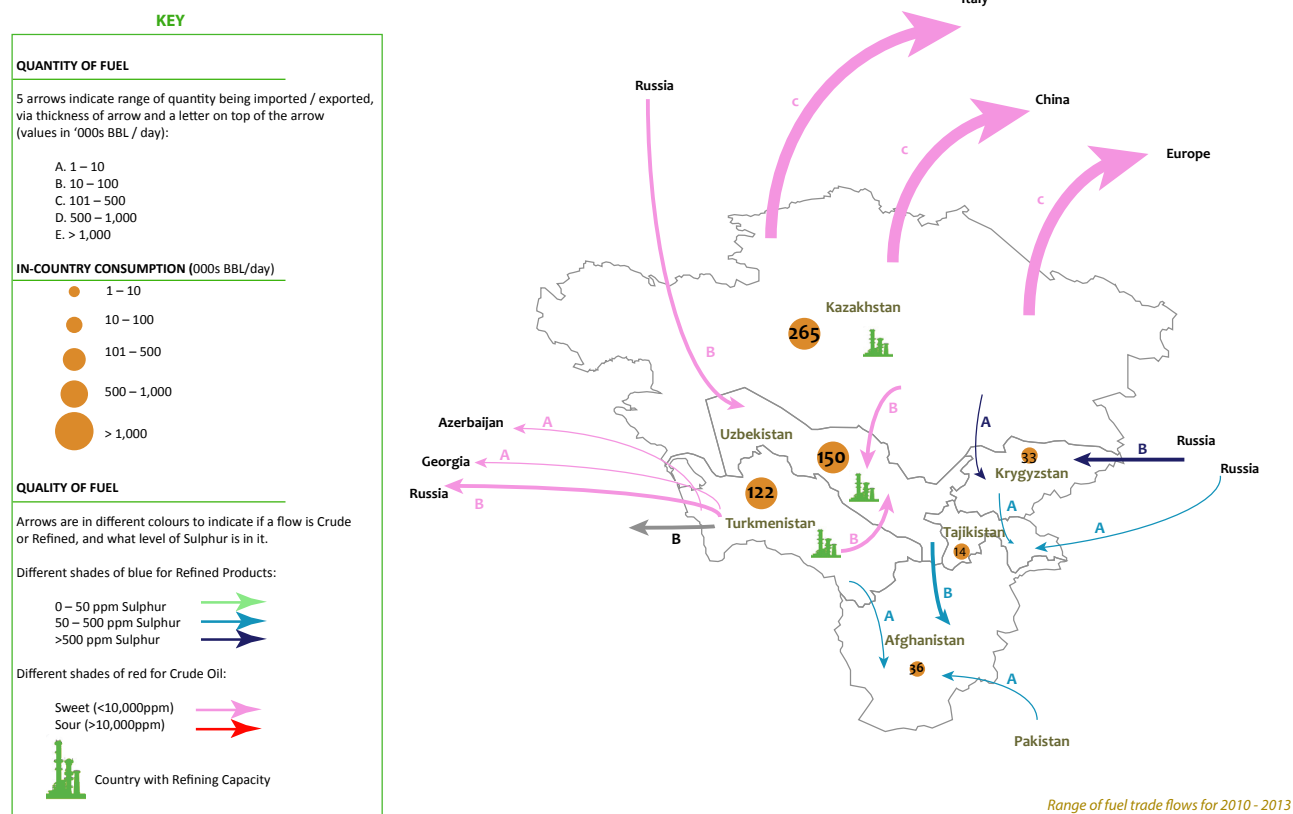


Figure 13: Central Asia Fuel Flows

As a sub-region, Central Asia is a net exporter of sweet crude, with Kazakhstan as the main producer. Although Kazakhstan is a large producer, northern and southern parts of the country import from Russia and Uzbekistan, due to limited infrastructure within the country. It exports most of its sweet crude to Europe, China, Kyrgyzstan and Uzbekistan.

Some refined products are imported from Russia to supplement refining done in Kazakhstan, Kyrgyzstan, Uzbekistan and Turkmenistan. Afghanistan relies on Turkmenistan, Uzbekistan and Pakistan for refined products at 150ppm (petrol) and 350ppm (diesel) sulphur levels, even though its official standard is at 10,000ppm; there is therefore an opportunity to lower the official standard to match the actual fuel quality being used.

Uzbekistan relies on Kazakhstan and Turkmenistan for crude. Kyrgyzstan is building a new refinery, and currently imports refined products from Russia, Kazakhstan, Turkmenistan and Azerbaijan.

Turkmenistan imports crude from Uzbekistan, to supplement its own production, but at the same time exports some crude to Azerbaijan, Russia and Georgia. Uzbekistan, which imports crude to add to its own production, plans to upgrade its refinery to produce fuels with 150ppm (petrol) and 350ppm (diesel) sulphur levels by 2018.

15 Please note the limitations of this study: while the map makes trade relations and flows look very static, this isn't the case; in any one given month, the actual market might be different; data comes from various sources over a period of a few years (mainly 2010 to 2013); for these reasons, values do not add up perfectly (ie: production + imports ≠ consumption + exports); the focus is on the relative magnitude of trade.

Diesel sulphur standards range from 350 to 10,000ppm across the region.

VEHICLES: Central Asia has no limits on used vehicle importation, and few emission standards apart from Kazakhstan and Kyrgyzstan (both have Euro 4, although without matching low sulphur diesel nationwide).

When comparing fuel and vehicle standards (Tables 19 and 20, Annex 6), Tajikistan has the possibility of going to at least Euro 2 vehicle emission standards, based on the current fuel quality of 500ppm. Afghanistan is discussing Euro 3 vehicle standards, in line with the available actual fuel quality of 350ppm.

South Asia

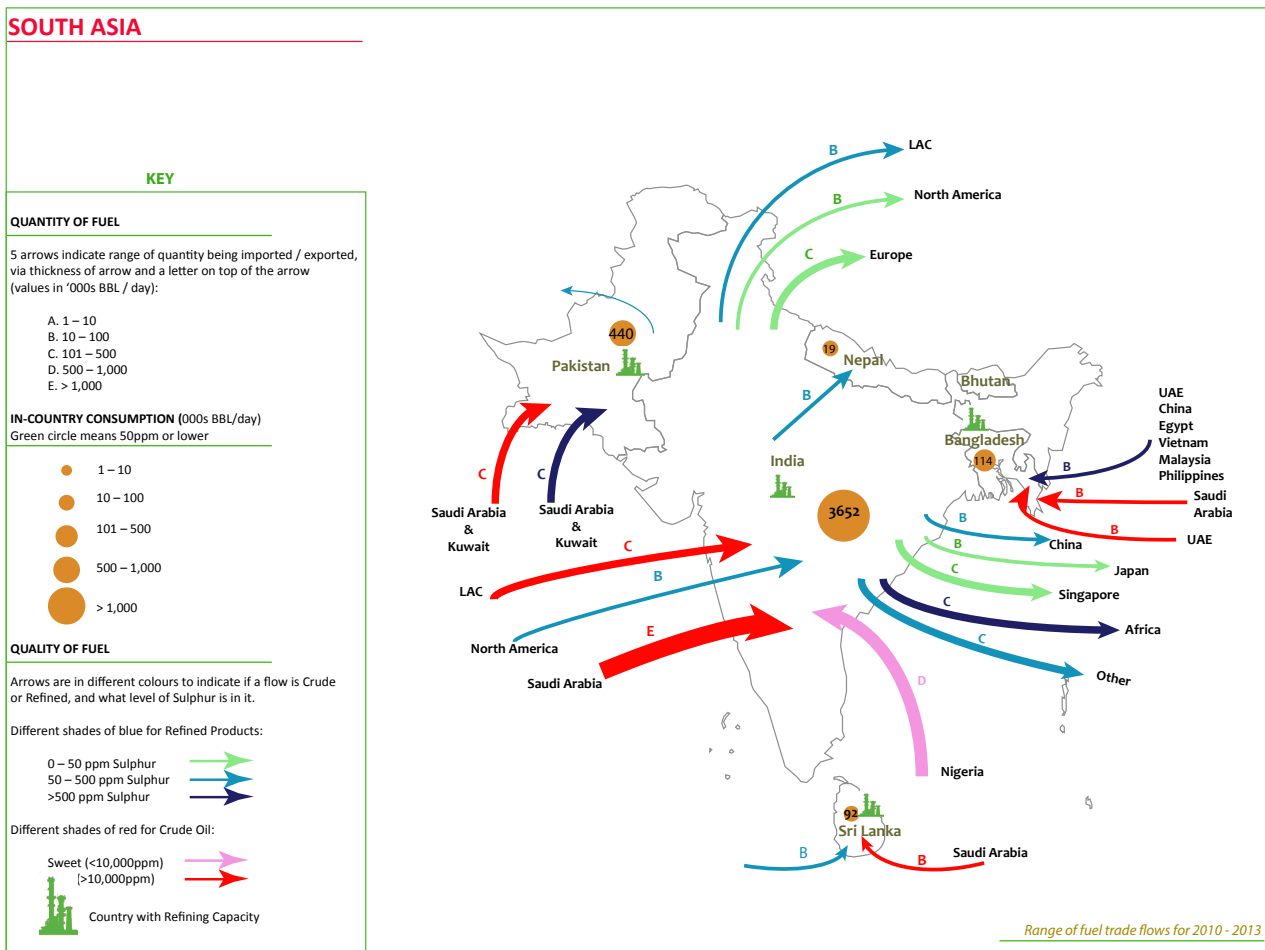


Figure 14: South Asia Fuel Flows

There is very little fuel trade between the countries in this sub-region, with the exception of Nepal, which depends entirely on India for refined products. Saudi Arabia is the main source of crude and some refined products for Pakistan, India, and Bangladesh, followed by Kuwait and the UAE. Apart from India (and by default, Nepal), sulphur levels are quite high in all the countries; however once the Middle East countries complete upgrading their refineries to produce 50ppm fuel or better, these South Asian countries will benefit and could improve their import standard.

Bangladesh plans to go to 500ppm in 2014. Given that most of the products consumed are imported, it should be possible to improve the import standard to 50ppm.

India has a national standard of 350ppm, with low sulphur fuels available in major urban centres. It exports some refined products to destinations all over the world, and will export based on the standard of the importing country. India remains a net importer of crude, which it refines locally along with its own crude.

Pakistan produces a small amount of crude, and imports more crude for local refining. More than 50% of its fuel requirements are met through importing refined products from countries that will soon have low sulphur fuels (Saudi Arabia and Kuwait); it is therefore conceivable that the import standard could be changed from the current 5000ppm to 50ppm. This fuel could either be reserved for urban centres or blended with the high sulphur, locally refined fuel to improve the overall quality nationwide.

Likewise, Sri Lanka imports refined products to meet more than 50% of its demand. Again, the import standard could be changed to 50ppm to provide cleaner fuels for urban centres.

VEHICLES: Vehicle emission standards tend to be on the low side: none or Euro 1 for all but India (Euro 3 nationwide, Euro 4 in 11 cities) and Nepal (which uses India's standards). As yet, the other countries don't have the fuel quality, although this will change as Middle East fuel quality improves. India is the giant in the region, manufacturing over a million vehicles a year. It bans the importation of all second-hand vehicles.

Bangladesh regulates importing used vehicles (nothing older than 5 years of age) and has a Euro 1 vehicle emission standard; 60% of its market (around 9,000 per year) comprises of used vehicles, mostly from Japan. New vehicles come from China, South Korea and Indonesia principally. There are plans to implement Euro 2 vehicles emissions standards nationwide in mid 2014, when 500ppm fuel becomes the standard, with Euro 3 for Dhaka and Chittagong.

Bhutan presents an interesting case: they have banned all vehicle imports since 2012, save for electric and utility vehicles. There is an electric vehicle project between the government and Nissan. Pakistan has no emission standards or limits on used vehicle imports. Sri Lanka has Euro 1 vehicle emission standards.

North Asia

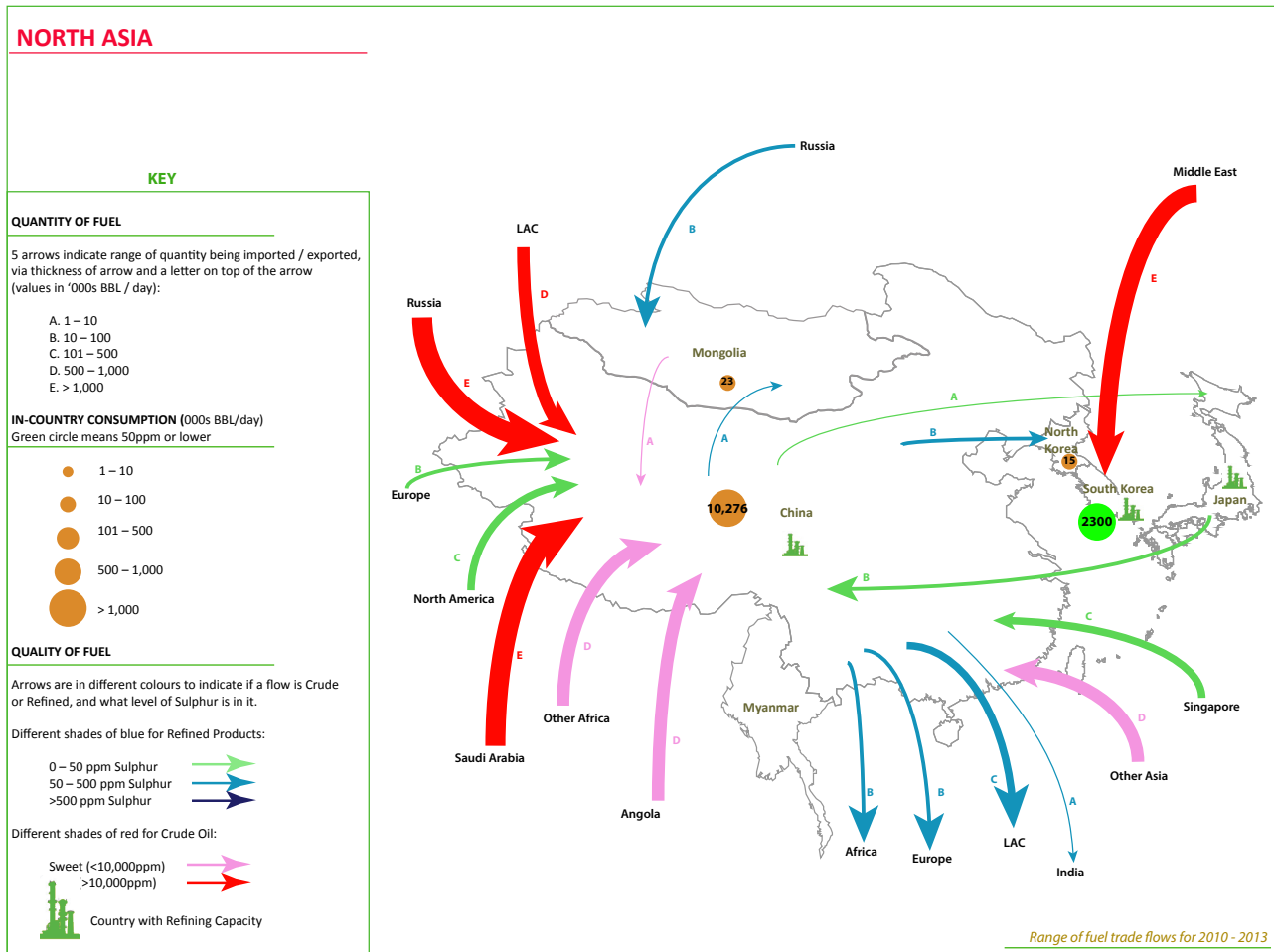


Figure 15: North Asia Fuel Flows

While China is a significant producer and refiner in Asia, it and the sub-region are net importers of both crude and refined products.

China's national standard is 350ppm, while major cities are at 50ppm or lower. While it is a large producer of mainly sweet crude, it is an even larger consumer and must import. A mix of sweet and sour crude is imported mainly from Saudi Arabia and Angola, with more coming from Russia, Latin America and other African countries. Europe and North America supply some refined products. China exports small amounts of mainly refined products within and outside the region.

Similarly, Japan imports both crude and refined from a wide range of sources and is the only country in the region with ultra-low sulphur fuels with 10ppm sulphur. While it does export small amounts of refined products, it refines mainly for its own consumption.

Mongolia exports its sweet crude to China and imports refined products from Russia (mainly) and China. Given that most of the fuel it imports is at 500ppm or better, the standard (currently 5000ppm) could be changed to reflect the quality of fuel it actually consumes.

South Korea, which imports crude from the Middle East for its refinery, has 50ppm sulphur standard. Given that its refining capacity is greater than its consumption, it may in future import more crude for exporting refined products.

North Korea imports refined products from China, but no further information is available.

VEHICLES: With close to 20 million vehicles manufactured a year, China is one of the global giants in production. Much of this production is for the local market, which added 19 million vehicles in 2012. The vehicle emission standard is equivalent to Euro 3 nationwide, with plans for Euro 5 nationwide by 2017. Beijing has Euro 5 vehicle emission standard already (although 10ppm fuel isn't always available), with Euro 6 standards slated for 2016.

Japan and South Korea are second and third largest vehicles producers, with Euro 5 and Euro 4 vehicle emission standards respectively.

When comparing fuel and vehicle standards (Tables 23 and 24, Annex 6), Mongolia has the possibility of going to at least Euro 2 vehicle emission standards, based on current fuel quality.

South-East Asia

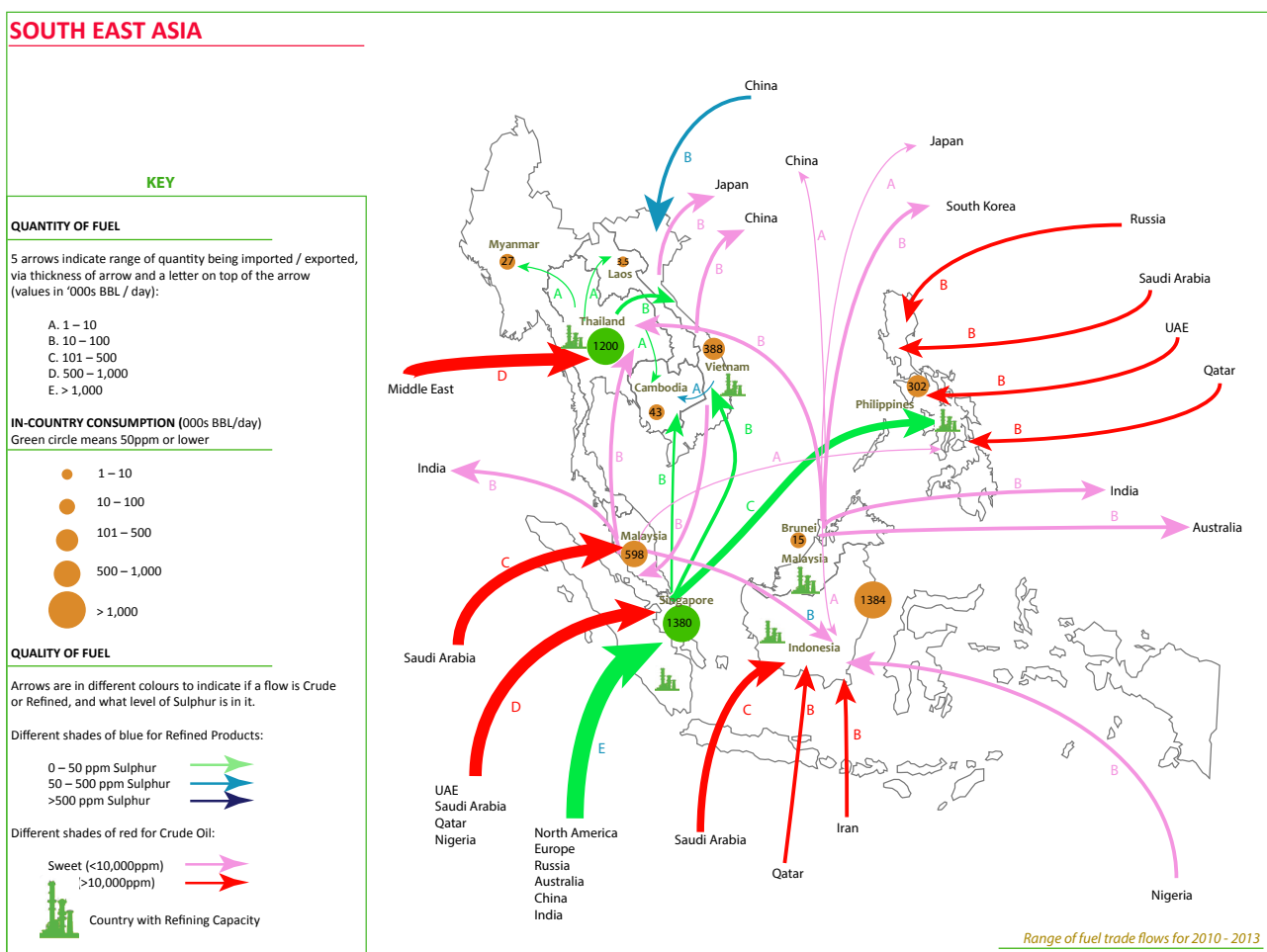


Figure 16: South-East Asia Fuel Flows

South-East Asia is a net importer of mainly sour crude from the Middle East. Singapore is an important refining hub. It imports both crude and refined products for its own consumption as well as for export of refined products within the region to Cambodia, Vietnam and the Philippines, as well as China and beyond.

The main crude producers in the region are Malaysia and Indonesia, with some production from Brunei Darussalam, Thailand and Vietnam. While all these countries are all net importers, Thailand supplies

refined products to Myanmar, Laos, Vietnam and Cambodia, thus acting as a secondary refining hub after Singapore. Malaysia exports some of its crude to India, Thailand and the Philippines.

Brunei Darussalam exports most of its production as sweet crude, mainly within the region. A new refinery is being built, which could make Brunei another refining hub, and it plans to go to 50ppm by 2016.

Cambodia imports refined products from countries with fuel standards of 500ppm or better; therefore it could change its standard from the current 1500ppm to match the quality it currently has access to.

Indonesia has the highest standard in the sub-region, at 3500ppm with no date set for lowering this, although 500ppm is available in certain areas. It imports crude and refines this for its own local production.

Laos and Myanmar import refined products mainly from Thailand, which has a 50ppm standard; therefore the import standards for both these countries could be changed from their current 2500ppm and 2000ppm respectively to 50ppm.

Malaysia exports half of its sweet crude, mostly to Australia, India, Thailand and Japan, and imports cheaper, heavier, sour crude from the Middle East for its refineries. It plans to go to 50ppm by 2016. The Philippines imports a mix of crude and refined products. Most of the refined products come from Singapore, which is at 50ppm sulphur. Conceivably, the Philippines' import standard for refined products could therefore be changed to 50ppm. The Philippines does have plans to improve the national standard to 50ppm by 2016, which would impact both domestically refined as well as imported products. There is indication that fuel is smuggled from Indonesia and Malaysia; one possible proof of this is that fuel demand has been constant or declining even as vehicle numbers have been increasing .

Along with Singapore, Thailand's standard is for low sulphur fuels of 50 ppm. It is a net importer of crude, mainly from the Middle East, and a net exporter of fuel products. Conversely, Vietnam is a net importer of products (from a variety of sources) and a net exporter of sweet crude.

VEHICLES: Emission standards are mixed, ranging from none to Euro 4. Brunei Darussalam imports from Singapore, Malaysia and China, but maintains low vehicle emission standards (Euro 1 for diesel vehicles, Euro 2 for petrol vehicles). Brunei and Malaysia both have a Euro 2 standard and plan to go to Euro 4 in 2016 when their 50ppm sulphur standards come into force. Cambodia imports from China, Thailand and Vietnam, but doesn't have emission standards set, while Vietnam has a Euro 2 vehicles emissions standard and will be moving to Euro 4 by 2017.

Indonesia, a significant vehicle manufacturer in the sub-region (second after Thailand) has Euro 2 standards, with discussions on-going for the introduction of Euro 4 vehicle emission standards, but without the matching fuel available; second hand vehicle imports are banned.

While the Philippines does assemble some vehicles, it is not a major exporter; currently at Euro 2 standards, it plans to go to Euro 4 in 2016. Second hand imports are banned with a few exceptions. Singapore doesn't manufacture vehicles but acts as a significant re-exporter within the region, because of the relatively high vehicle ownership rate and very stringent in-use vehicle regulations. It plans to go to Euro 5 emission standards for diesel vehicles in 2014.

Thailand is a major vehicle producer in South-East Asia, with close to 2.5 million vehicles produced each year, at Euro 4 standards. Second hand imports are banned. Thailand also has the fastest growing domestic vehicle market.

In Vietnam, new vehicle imports outnumber used vehicle imports. While Vietnam is currently at Euro 2 vehicle emission standards, there is a plan to jump to Euro 4 emission standards in 2017.

When comparing fuel and vehicle standards (Tables 25 and 26, Annex 6), Brunei and Cambodia have the possibility of going to at least Euro 2, and Myanmar and Laos to Euro 4, vehicle emission standards, based on current fuel quality.¹⁶

As part of the Global Fuel Economy Initiative (GFEI), two case studies in Asia were developed: Vietnam and Indonesia. Both of these countries manufacture vehicles.

Vietnam :

- 1) In 2011 45,642 new cars were imported into the country against 10,756 used cars. In that same year, 125,147 cars were manufactured and assembled locally within Vietnam, some of which were exported.
- 2) In 2013, a total of 110,519 vehicles were sold in-country (not including motorcycles).
- 3) Vehicle sales experienced a 19% growth rate in 2013 as compared to 2012; SUV and multi-purpose vehicle sales grew by 39%.
- 4) Euro 2 vehicle emission standards were applied in 2007 and Euro 4 emissions standards will be implemented in 2017.

Indonesia :

- 1) All new vehicles sold in Indonesia since 2005 must meet Euro 2 emission standards; however this standard has not been comprehensively implemented and new diesel vehicles don't always comply, due to the poor quality of diesel fuel.
- 2) Local manufacturers aren't prepared to produce cleaner vehicles, as the available fuel quality is too low; at the same time they would like to export their vehicles, which would then need to meet the higher standards that are becoming the norm in South-East Asia. The ASEAN Automotive Federation agreed on the adoption of Euro 4 vehicle emission standards by 2012, a deadline that Indonesia was unable to meet, in large part due to the fuel quality. Only Thailand and Singapore (for gasoline vehicles only) were able to meet this target.
- 3) Hybrid vehicles are considered luxury and thus receive higher taxation and limiting their entry into the market.
- 4) Importation of second-hand vehicles is banned.
- 5) While motorcycles outnumber all other road vehicles combined, there are still a significant number of cars and trucks on the road: 18 million vehicles at the time of the GFEI study, and growing fast.
- 6) In 2013, 1.2 million vehicles were sold; this represents a 10% growth from 2012, the fastest growing fleet in South-East Asia and faster than China.
- 7) The vehicle fleet has an average age of 20 years (in 2010).

¹⁶ Vietnam and Indonesia studies: National Baseline Database Assessment on Automobile Fuel Consumption of Vietnam. Vietnam Register, 2013; Cost Benefit Analysis for Fuel Quality and Fuel Economy Initiative in Indonesia. Ministry of Environment Republic of Indonesia, 2011.

8) When various policy options were analysed, the introduction of fuel efficiency standards combined with a faster implementation of Euro 4 emission standards resulted in the greatest net economic gain, fuel saving and health cost savings; however this depends to a great extent on fuel quality, as more advanced vehicles need cleaner fuel.

9) The GFEI study went on to suggest several recommendations: improve fuel quality; develop a fuel efficiency standard and include labelling; tax differentiation that favours cleaner, more efficient vehicles; financial incentives for older vehicle replacements.

ANNEX 1: REGIONS & SUB-REGIONS

Countries analysed were placed in the following regions and sub-regions, based on current market and political networks.

East Africa

Burundi	Rwanda	Uganda
Djibouti	Somalia	
Ethiopia	Sudan	
Kenya	Tanzania	

West Africa

Benin	Guinea	Nigeria
Burkina Faso	Guinea-Bissau	Senegal
Cote d'Ivoire	Liberia	Sierra Leone
Gabon	Mali	Togo
The Gambia	Mauritania	
Ghana	Niger	

Central Africa

Cameroon	Chad	Equatorial Guinea
Cape Verde	Congo – Brazzaville	Gabon
Central African Republic	Congo – Kinshasa (DRC)	Sao Tome and Principe

Southern Africa

Angola	Mauritius	Swaziland
Botswana	Mozambique	Zambia
Lesotho	Namibia	Zimbabwe
Madagascar	Seychelles	
Malawi	South Africa	

North Africa

Algeria	Libya	Tunisia
Egypt	Morocco	

Middle East

Bahrain	Kuwait	Saudi Arabia
Iran	Lebanon	Syria
Iraq	Oman	United Arab Emirates
Jordan	Qatar	Yemen

South America

Argentina	Bolivia	Brazil
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Chile	Paraguay	Venezuela
Colombia	Peru	
Ecuador	Uruguay	

Central America & the Caribbean

Antigua and Barbuda	Dominican Republic	Montserrat
Aruba	El Salvador	Nicaragua
Bahamas	Grenada	Panama
Barbados	Grenadines	St. Kitts & Anguilla
Belize	Guadeloupe	St. Lucia
Bermuda	Guatemala	Trinidad & Tobago
British Virgin Islands	Haiti	Turks and Caicos Islands
Costa Rica	Honduras	
Cuba	Jamaica	
Dominica	Martinique	

Eastern Europe & the Caucasus

Albania	Estonia	Poland
Armenia	Georgia	Romania
Azerbaijan	Hungary	Russia
Belarus	Latvia	Serbia
Bosnia and Herzegovina	Lithuania	Slovakia
Bulgaria	Macedonia	Slovenia
Croatia	Moldova	Turkey
Czech Republic	Montenegro	Ukraine

Central Asia

Afghanistan	Tajikistan
Kazakhstan	Turkmenistan
Kyrgyzstan	Uzbekistan

South Asia

Bangladesh	India	Pakistan
Bhutan	Nepal	Sri Lanka

North Asia

China	Mongolia	South Korea
Japan	North Korea	Taiwan

South-East Asia

Brunei Darussalam	Malaysia	Thailand
Cambodia	Myanmar	Vietnam
Indonesia	Philippines	
Laos	Singapore	

ANNEX 2: AFRICA FUEL & VEHICLE TABLES

The following are tables with further details of fuel and vehicle standards and markets for Africa. It should be noted that the values provided in the tables are ballpark figures based on different sources and across a range of years (2010 – 2013); they should therefore be viewed as an indication rather than an absolute value.

Table 1: East Africa Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	CURRENT (ACTUAL)	50PPM DATE	CRUDE	REFINED	WHERE FROM	CRUDE	REFINED	WHERE TO		
Burundi	500	2014		2	Tanzania, Kenya					2
Ethiopia	5000 (500?)	2008		54	Sudan Plans to build refinery				0.11	54
Kenya	500	2014		81	India, South Africa			Transit for Uganda, Rwanda, Burundi, Ethiopia		81
Rwanda	500	2014		5	Kenya, Tanzania					5
Sudan, South Sudan	350 (80)	2008				337		China, Japan, Other Asia	450 (sweet)	95
Tanzania	500	2014	15	30	India			Transit point for fuel to Uganda, Rwanda, Burundi, Malawi		47
Uganda	500	2014		17	Kenya, Tanzania					17

Table 2: East Africa Vehicle Market

COUNTRY	IMPORT FROM /EXPORT To	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARD		COMMENTS
				CURRENT	PLANNED	
Ethiopia	Imports \$1,1+37mill		2			No import restrictions on vehicle age basis Assembles vehicles – 450
Kenya	Imports \$966mill Exports \$45mill	< 8 years old	23			Assembles vehicles – 3,080
Rwanda	Imports \$100mill Exports \$30mill		5			
Sudan	Imports \$452mill	Banned, with a few exceptions	3			
Tanzania	Imports \$958mill		7			
Uganda	Imports \$437mill Exports \$65mill		11			

Table 3: West Africa Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	Current (Actual)	50 ppm Date	Crude	Refined	Where from	Crude	Refined	Where to		
Côte d'Ivoire	3,500 (2500)	2017	60		Nigeria	35	40	Nigerian crude to N America, Europe Refine imported crude for Nigeria, Mali, Burkina Faso, Liberia, Sierra Leone, Guinea, Senegal, Ghana, Togo, The Gambia, Benin and Niger	38 (sweet)	24
Ghana	5000	2020	57		Nigeria	100		Europe, South Africa	100 (sweet)	64
Mauritania					Crude from Algeria; Refined from Senegal				7	18
Niger	2000 (380)	2009					14 (to be 60)	Nigeria, Togo	20	6
Nigeria	5000 (1330)			84 – 300 (Sulphur level?)	Niger, Brazil, India, The Netherlands, Cote d'Ivoire Imports up to ¾ oil consumed; largest refinery in Africa is planned to start in 2016	2,200		Production fluctuates conflict USA, India, Brazil, Europe, South Africa, Ghana, Benin, Togo	2,000-2,524 (mostly sweet)	344
Senegal	5000	2009	25	17	Nigeria crude	Re - exports as a hub	Liberia, Guinea Bissau, Guinea, Sierra Leone, Mali		42	

Table 4: West Africa Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARD		COMMENTS
				Current	Planned	
Benin	Imports \$83mill		22			No import restrictions on vehicle age basis
Burkina Faso	Imports \$134mill		11			No import restrictions on vehicle age basis
Côte d'Ivoire	Imports \$456mill					
Exports \$26mill	> 10 years old: fined on import & annually	41				
Ghana	Imports \$2,213mill	> 5 years old pay penalty	31			
Guinea	Imports \$129mill	Ban lifted in 2001				
Mali	Imports \$160mill		11			No import restrictions on vehicle age basis
Niger	Imports \$160mill	< 5 years old if from outside SACU area	7			
Nigeria	Imports \$10,191mill	< 15 years old, Euro 2	20	Euro 2		
Sénégal	Imports \$371mill		37			

Table 5: Central Africa Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	CURRENT (ACTUAL)	50PPM DATE	CRUDE	REFINED	WHERE FROM	CRUDE	REFINED	WHERE TO		
Cameroon	5000		30		Nigeria, Equatorial Guinea - light crude	60		Central African Republic, Equatorial Guinea (?) - heavy crude	63 (sweet)	30
Chad	2000 (166)					103		Via Chad-Cameroon pipeline US & China - most of it S Korea, India	105 (sweet)	2
Congo Brazzaville	10000 (1000)			4	Cameroon	290		China, USA, Europe, Canada, Asia-Pacific	292 (sweet)	12
DRC Congo (Kinshasa)				10	Kenya, South Africa	20		Exports crude	20	10
Equatorial Guinea				2.5		318		USA, China, Europe, Cameroon	318 (mainly sweet)	2.5
Gabon	8000		5			220		USA, India, Europe, Indonesia, Australia, Japan, Malaysia, Trinidad & Tobago, Equatorial Guinea	242 (mixed)	16

Table 6: Central Africa Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARD		COMMENTS
				CURRENT	PLANNED	
Cameroon	Imports \$485mill		14			No import restrictions on vehicle age basis
Central African Republic	Imports \$21mill					No import restrictions on vehicle age basis
Congo (Brazzaville)			232			Used motor vehicles can be imported without inspection as long as they do not have "commercial character"
Democratic Republic of Congo						No import restrictions on vehicle age basis
Gabon	Imports \$305mill	< 4 years old				

Table 7: Southern Africa Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	Current	50ppm Date	Crude	Refined	Where from	Crude	Refined	Where to		
Angola	3000			55	New refinery by 2017 will process local crude for local supply From where?	1,660		China, USA, Europe, India, Canada, Taiwan, South Africa, Sao Tome, Principe, Cape Verde & other neighbours	1,700 (mainly sweet)	94
Madagascar	5000	2008?		19	India					19
Mozambique	500	2008		22	South Africa			Imports more fuel for re-export to other countries		22
South Africa	500 (50ppm in cities)	2020 (10ppm)	420	80	Iran, Saudi Arabia, Nigeria, Angola, Oman		100	Botswana, Lesotho, Namibia, Swaziland, Mozambique, Zambia, Zimbabwe, Malawi 3rd largest refinery system in Africa	181 (160 is synthetic fuels from coal)	609
Zambia	500 (import) 5000 (refine)		10 (?)	10 (?)	Middle East (crude) South Africa (refined)					20

Table 8: Southern Africa Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARD		COMMENTS
				Current	Planned	
Angola		Motor companies can't import used; Individuals can import any age	37			
Botswana	Imports \$618mill	< 100,000km	131			
Lesotho	Imports \$259mill	< 8 years old				
Madagascar	Imports \$175mill		25			
Malawi	Imports \$137mill		9			No import restrictions on vehicle age basis
Mozambique	Imports \$437mill	Cars: < 5 years old Vans: < 9 years old	13			
Namibia	Imports \$778mill Exports \$159mill		107			
South Africa	Imports \$8,768mill Exports \$7,572mill New motor vehicle sales (2008): LDV 295,064 HDV 193,947	Banned with exceptions	169 Vehicle population = 7.7million	Euro 2		Manufactures vehicles – 539,424
Zambia	Imports \$644mill		23			No import restrictions on vehicle age basis
Zimbabwe	Imports \$522mill		58			Assembles vehicles – 829

Table 9: North Africa Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	Current (Actual)	50ppm Date	Crude	Refined	Where from	Crude	Refined	Where to		
Algeria	900	2015	6	25	Italy, Russia, France, Libya	800	250	USA, Europe, Asia, Latin America	1350(sweet)	328
Egypt	10,000		49	164	Saudi Arabia, Kuwait, UAE	114		India, Italy, China, Israel, Malaysia, Spain	720(mainly sour)	755
Libya	1500 (1000)	-				1,250	Small amount	Europe, China, Indonesia, USA Protests disrupted exports in 2013	1,483 (mainly sweet)	170
Morocco	50	-	107	95	Iran, Saudi Arabia, Russia, Iraq				5	206
Tunisia	50			60				Must export some crude as can only refine up to 34,000	66	89

Table 10: North Africa Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENT
				Current	Planned	
Algeria	Imports \$7,565mill	< 3 years	109			
Egypt	Imports \$3,437mill Exports \$120mill to Middle East, N Africa	<1 year	58			Assembles vehicles – 56,480
Libya			317			
Morocco	Imports \$3,307mill Exports \$995mill		81			Assembles vehicles – 108,743
Tunisia	Imports \$1,594mill Exports \$320mill		121			Assembles vehicles – 1,860

ANNEX 3: MIDDLE EAST FUEL & VEHICLE TABLES

The following are tables with further details of fuel and vehicle standards and markets for the Middle East.

It should be noted that the values provided in the tables are ballpark figures based on different sources and across a range of years (2010 – 2013); they should therefore be viewed as an indication rather than an absolute value.

Table 11: Middle East Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S) CRUDE	CONSUMPTION '000s BBL/D (PPM S) REFINED
	Current (Actual)	50ppm Date	Crude	Refined	Where from	Crude	Current (Actual)	50ppm Date		
Bahrain	500 local 10 export	2018	210		Saudi Arabia		215	Mostly India & other Asia	55 (sour)	50
Iran		-				1,500 to 2,400		China, Japan, India, South Korea, Italy, Turkey, Spain, other Europe	3,598 (sour)	1,709
Iraq	10,000 (2000)	-		150	Kuwait	2,400		USA, South Korea, India, China, Other Asia, Europe	2,986 (sour)	751
Jordan	350 (7000)	-	68	36	Saudi Arabia primarily Kuwait, UAE				0.16	108
Kuwait	2,000	2018				2,400		Asia Pacific, USA, Europe	2,796 (sour)	383
Lebanon	500			105	Various. Some fuel smuggled from Syria					105
Oman	500 (50)	-		50	Middle East, Europe, Asia	762		China, Japan, Taiwan, Singapore, Thailand, South Korea, New Zealand, India, USA	923(sour)	145
Qatar	500	2012?				925	464	All crude to Asia	1579 (mostly sour)	190
Saudi Arabia	10000 (500)	2016 (10ppm)				7500	1364	Far East Asia, USA, Europe, Mediterranean	11725 (mostly sour)	2,861
Syria	7000			105 before	With sanctions, receiving some fuel from Iraq and Iran, but still shortfalls	150 before 0 now	36	99% crude to Europe (prior to sanctions) Oil theft into neighbouring countries a problem	400 before crisis 25 now (mainly sour)	257 now Higher before crisis
United Arab Emirates	500	2018	4?			>2500		Asia, Africa	3213 (mixed)	618
Yemen	10000			60	Where?	175	25	Attacks on pipeline lowered output Sweet crude exported, mostly to China	277 (mixed)	137

Table 12: Middle East Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENT
				Current	Planned	
Bahrain	Imports \$992mill Exports \$319mill		580			
Iran	Imports \$2,305mill (HDV, component parts) Exports \$412mill to Middle East, Central Asia New motor vehicle sales (2008): LDV 1,084,389 HDV 204,344		89			Assembles vehicles – 989,110 – 46% of all cars produced in Persian Gulf and Central Asia (but not commercial & HDV – these are imported) Strong local market
Iraq	Imports \$5,120mill		146			
Jordan	New motor vehicle sales (2008): LDV 23,864 HDV 36,365	Personal vehicles < 10 years HDV < 3 years	267			
Kuwait	Imports \$6,438mill Exports \$1,010mill		536			
Lebanon	Imports \$1,444mill		126			
Oman	Imports \$4,445mill		245			
Qatar	Imports \$3,502mill Exports \$665mill		418			
Saudi Arabia	Imports \$19,792mill – 66% from Japan; 25% from EU Exports \$1,979mill (to other Gulf states) New motor vehicle sales (2008): LDV 268,952 HDV 51,758	LDV < 5 years old HDV < 10 year old Used cars = 25% of total vehicles in country & 15% of market	217			
Syria	Imports \$515mill		74			
United Arab Emirates	Imports \$13,244mill Exports \$7,233mill New motor vehicle sales (2008): LDV 174,060 HDV 196,523	Vehicles that have been in accidents banned	191			
Yemen	Imports \$788mill		59			

ANNEX 4: LATIN AMERICA FUEL & VEHICLE TABLES

The following are tables with further details of fuel and vehicle standards and markets for Latin America.

It should be noted that the values provided in the tables are ballpark figures based on different sources and across a range of years (2010 – 2013); they should therefore be viewed as an indication rather than an absolute value.

Table 13: South America Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	Current (Actual)	50ppm Date	Crude	Refined	Where from	Crude	Refined	Where to		
Argentina	1500	2016 (30ppm)		42 + ?	USA	60		Has refineries USA, Chile, China, Brazil	723 (sweet)	698
Bolivia	3000			6	Net importer, 2 refineries Venezuela mainly	0.9		Chile	57	62
Brazil	1800 (rural) 500 (cities)	2014 for 500ppm		470	Argentina USA – what S level? Algeria	550		13 refineries USA, China, India	2,651 (sweet)	2,805
Chile	50		170	170	Crude: Ecuador, Brazil, Colombia, Argentina Refined: USA				17	356
Colombia	50	2014		55	Imports some refined, esp diesel fuel; Imports 58% of diesel consumed USA	730	?	Exports 40% of diesel produced USA, Panama, China, Spain, India	969 (mixed)	287
Ecuador	5000 (150)	2015		110	Imports gasoline, diesel, LPG USA	354	27	USA, Chile, El Salvador, Peru, Japan	505 (sour)	212
Peru	5000	2016	120	49	Crude mainly from Ecuador Refined from US	160		Exports most of its crude as too heavy for refinery WHERE TO?	160 (mixed)	172

Venezuela	2000					2,000		USA, Cuba, Asia, Europe, China; Paraguay, Uruguay, Bolivia; most Central America; all Caribbean except Barbados, Montserrat, Trinidad & Tobago and non-Petrocaribe	2,489 (sour)	777
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Table 14: South America Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARD		COMMENTS
				Current	Planned	
Argentina	Imports \$12,500mill Exports \$9,600mill Major partner: Brazil New motor vehicle sales (2008): LDV 441,032 HDV 182,082	Banned, with exceptions	269	LDV/HDV: Euro 4 for gasoline & diesel	Euro 5: 2014 for new models 2016 for all models	Manufactures vehicles – 764,495 I/M programs are implemented in 7 major cities in the country, with emission inspections beginning January 2008. About 56% of passenger vehicles in Buenos Aires are diesel, 35% are petrol, and the rest are CNG. Currently preparing the network for the availability of Automotive Liquid Urea required for Heavy Duty Engines equipped with SCR technology (NOX Reduction).
Bolivia	Imports (\$865mill) New motor vehicle sales (2008): LDV 402 HDV 4,677	< 3 years old (Or 5 years?)	58			In 2009 prohibits diesel vehicles with engines smaller than 4,000cm3 and all vehicles that use liquefied petroleum gas. Indication of vehicle inspection system.
Brazil	Imports (\$21,681mill) Exports (\$13,000mill): Africa (\$735mill), Asia (\$522), S & Central America (\$10,024mill), China (\$45mill), India (\$22mill), Mexico (\$1,088mill), Russia (\$113mill), S Africa (\$395mill) New motor vehicle sales (2008): LDV 2,111,902 HDV 896,922	Banned with exceptions	176	LDV: Euro 4 HDV: Euro 4 (5?)		Manufactures vehicles – 3,342,617 OBD requirements for domestically produced and imported Otto cycle light commercial vehicles. Import of diesel vehicles banned. Catalytic converters required on all imported vehicles. By 2012, annual statewide vehicular inspections required, with nonrenewal of registrations if cars do not pass or under-go inspections. Vehicle labeling system developed, it is currently voluntary.
Chile	Imports (\$9,000mill) New motor vehicle sales (2008): LDV 136,175 HDV 149,788	Banned with exceptions	191	Gasoline: Euro 4 Euro 5 from 2014 Diesel: Euro 5 for LDV Euro 5 for HDV from 1st September 2014		Annual emissions testing program started in 1994. Incentives for hybrid vehicles. Vehicle labelling system developed, mandatory from 2013. From 1 Jan 2010, all new public transport buses in metropolitan area must meet Euro III standard with particulate filters (DPF) from the factory. In-use petrol vehicles have to meet I/M limits of 0.5% CO and 100ppm HC; diesel light-duty cars must meet PM limit of 0.125 g/km; loading testing of diesel trucks undertaken.

Colombia	Imports (\$6,176mill) Exports (\$563mill) New motor vehicle sales (2008): LDV 118,410 HDV 67,128	Banned	75	Euro 2 – diesel, petrol Euro 4 – public passenger transport New vehicles – Euro 1 HDV diesel – USEPA 1994 New buses – Euro 2 Other new HDV – Euro 1	HDV Euro 4, 2014	Assembles vehicles – 70,686 Catalytic converters required on all imported vehicles. 9.46 Lt/100km for LDV's Bogota will phase out the use of motorcycles and other vehicles with two-stroke engines. As of July 1, 2012, all two-stroke vehicles will be banned from use in Colombia's capital, Bogota. There are incentives for cleaner vehicles – subsidies / reduced taxes. Started ethanol programme in 2002. Vehicles replacing or entering the public passenger transport systems must use clean technologies.
Ecuador	Imports (\$2,100mill) Exports (\$491mill) New motor vehicle sales (2008): LDV 45,957 HDV 78,261	Banned	54	LDV: Euro 1 HDV: Euro 2		Assembles vehicles – 24,322 Models from 2000 and newer cars must have catalytic converters. Emission testing program run by CORPAIRE, a mixed public/private institution.
Paraguay	Imports \$899mill New motor vehicle sales (2008): LDV 6,015 HDV 14,071	< 10 years old	72	Emission standards but no real enforcement		Subsidies for importation of cleaner vehicles (flex fuel).
Peru	Imports \$4,584mill New motor vehicle sales (2008): LDV 31,383 HDV 44,374	LDV < 5 years old HDV < 8 years old There is also mileage limits	55	Euro 3		32,494 second hand LDV's imported in 2007 I/M programs in certain cities, according to USEPA.
Uruguay	Imports \$935mill New motor vehicle sales (2008): LDV 13,903 HDV 12,191	Banned	232	Euro 3		Indication of vehicle inspection system Average age of vehicle fleet 17 years.
Venezuela	Imports 1,722mill Exports \$8mill New motor vehicle sales (2008): LDV 141,382 HDV 127,284	Banned	113			Assembles vehicles – 104,083 Emissions testing in certain areas, with fines for violators.

Table 15: Central America & the Caribbean

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S)	CONSUMPTION '000s BBL/D (PPM S)
	Current	50ppm Date	Crude	Refined	Where from	Crude	Refined	Where to		
Aruba			6		Venezuela					6
Belize				5	Mainly Venezuela	3		USA	3(sweet)	5
Costa Rica	50		16	37	Mexico (refined) Venezuela (crude) Building new refinery to triple capacity					53
Cuba	8000		120		Venezuela				51	171
Dominican Republic	7500		50	70	Venezuela (crude)					
Trinidad (refined)										
Colombia, Mexico					122					
El Salvador	5000		45		Ecuador					45
Guatemala	5000			80	Venezuela	14			14 (sour)	80
Haiti				14	Venezuela					14
Honduras	5000			64	Venezuela					64
Jamaica	5000 15 for cities		30	50	Venezuela (crude) Trinidad (refined)					78
Nicaragua	5000		33		Venezuela					33
Panama	1000			100	Mostly USA					100
Trinidad and Tobago	1000	Sept 2014	61		Russia, West Africa, Colombia Refines 111 (49 from local source)	51	68	US, Jamaica, the Dominican Republic, Barbados	100	43

Table 16: Central America & the Caribbean Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARD		COMMENTS
				Current	Planned	
Antigua and Barbuda	Imports \$13mill		230			No import restriction. There is an environmental tax for vehicles.
Aruba	Imports (\$71mill)					No import restriction
Bahamas	Imports (\$115mill)		342			No import restriction
Barbados	Imports (\$70mill)	< 4 years old	358			Pay environmental tax Introduction of electric and hybrid cars. Ethanol additive as 10% of gasoline planned
Belize	Imports (\$37mill)		98	None		No import restriction An environmental tax is paid on arrival. Indication of vehicle inspection system. Between 5-8% of vehicles run on butane.

Bermuda	Imports (\$18mill)	< 6 months old	415; mostly Japanese cars			Annual inspection required for all cars; extremely strict laws regarding transport. Only one private four-wheeled vehicle per household unit is allowed.
Costa Rica	Imports (\$969mill) New motor vehicle sales (2008): LDV 10,910 HDV 22,384	No limit	191	Euro 1		Imported vehicles must pass EPA Smog Test. All imported vehicles must have catalytic converters. There is an I/M program being implemented. Estimate >80% of the fleet >10yr old.
Cuba	China	< 4 years old	39			Assembles vehicles High proportion of old American (pre-1959) and Russian cars. Inspection system started in 2001.
Dominica	Imports (\$12mill)					No import restrictions, but environmental levy must be paid on arrival (varies for new and vehicles over 5 years old). Considering a vehicle emission testing program.
Dominican Republic	Imports (\$625mill) New motor vehicle sales (2008): LDV 4,642 HDV 15,559	< 5 years old for LDV (but often overlooked) < 15 years old for HDV	135			Engines must be < 2000cc and maximum of 6 cylinders; otherwise subject to high 'luxury' car tax. No I/M program exists. Program planned to be implemented by 2012.
El Salvador	Imports (\$308mill) New motor vehicle sales (2008): LDV 4,129 HDV 8,432	< 8 years old HDV < 15 years old	34	LDV: Euro 1 + 3-way catalytic converter for gasoline vehicles	import requires proof that vehicle complies with emission control requirements. Import tax is collected.	
Guatemala	Imports (\$923mill) New motor vehicle sales (2008): LDV 8,663 HDV 15,830		106			No import restriction. Imported new vehicles have a higher tax rate. I/M program cancelled according to USEPA.
Guyana	Imports (\$113mill)	LDV < 5 years old HDV < 3 years old				No import restriction. Guyana starting ethanol production. As of 2004, Guyana EPA and Bureau of Standards were developing emissions standards.
Haiti			7			No import restriction
Haiti			7			No import restriction
Honduras	Japan Imports (\$449mill) New motor vehicle sales (2008): LDV 2,486 HDV 13,239	< 7 years old Buses, public transport < 13 years old	17			Indication of an inspection system Emission limits for imports are more stringent than for existing vehicles
Jamaica	Imports \$345mill New motor vehicle sales (2008): LDV 1,539 HDV 4,075	LDV < 3 years HDV < 4 years	63			Inspection system in place; Incentives to import diesel cars (to increase fleet portion from 14% to 30%).
Nicaragua	Imports \$337mill New motor vehicle sales (2008): LDV 1,814 HDV 4,328	< 10 years old, must pass emission test	67			Considering phase-in of an I/M program to start with new cars then phase-in older ones.
Panama	Imports \$1,342mill New motor vehicle sales (2008): LDV 18,022 HDV 21,877	None	132	Must pass emissions test before registration		There are no import restrictions on new or used cars and trucks into Panama. Expected to have I/M program implemented in 2010.
Trinidad and Tobago	\$457mill		275			No import restriction Indication of vehicle inspection system

ANNEX 5: EASTERN EUROPE & THE CAUCASUS FUEL & VEHICLE TABLES

The following are tables with further details of fuel and vehicle standards and markets for Eastern Europe and the Caucasus.

It should be noted that the values provided in the tables are ballpark figures based on different sources and across a range of years (2010 – 2013); they should therefore be viewed as an indication rather than an absolute value.

Table 17: Eastern Europe & the Caucasus

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S) CRUDE	CONSUMPTION '000s BBL/D (PPM S) REFINED
	Current (Actual)	50 ppm Date	Crude	Refined	Where from	Crude	Current (Actual)	50 ppm Date		
Armenia	10				Azerbaijan, Iran, Russia - refined					
Azerbaijan	350	2015			Turkmenistan, Kazakhstan	850	Small amount	Russia, Georgia (small amount refined products), Armenia Global (crude) incl India, Indonesia, Sri Lanka, Belarus, Ukraine, S Korea, EU	931 (sweet)	85
Bosnia / Herzegovina	350	2015	4	25	Serbia			Refinery upgrade to 10ppm by 2015		29
Georgia	200	2014 for 200 ppm		16	Azerbaijan, Russia, Turkey(?) - but as re-export			(Fuel flows through Georgia from Russia to other neighbouring countries)	1	17
Moldova	2000			20	50ppm is sold by major fuel distributors Russia (mostly), Ukraine, Romania					20
Russia	350	2015		114		5,000	2,200	Exports most of ULSD Hungary, Bulgaria, UK, Spain, France, Italy, Japan, Lithuania, Sweden, Finland, Belarus, Georgia, Armenia, Poland, China, Netherlands, Germany	10,396 (mixed)	3,195

Turkey	10	-	300	300	Iran, Iraq, Saudi Arabia, Russia, Kazakhstan			Major transit point to Western Europe, Caucasus	56	670
Ukraine	200		239		Russia (mostly) Small volumes Kazakhstan, Azerbaijan			80(sour)	319	

Table 18: Eastern Europe & The Caucasus Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENTS
				Current	Planned	
Albania	Imports \$298mill Used cars from former Yugoslavia, EU		136	None		An annual tax reduction for more efficient cars, excise duty and special duty based on engine size are used to support fuel efficient vehicles.
Armenia	Imports \$160mill			None		Diesel engines must comply with ECE Regulation 49-01 governing CO, NOx, and HC emissions.
Azerbaijan	Imports \$965mill	< 5 years old Higher import duty for > 1 year old	115	Euro 2 Euro 4 in 2014		Follows GOST 17.2.2.03-87 standards on HC and CO emissions.
Belarus	Imports \$1,844mill Exports \$2,942mill	Custom duties increases > 10 years old	338	Euro 4 for imports Euro 5 for locally produced & exported		Manufactures vehicles – 25,425
Bosnia and Herzegovina	Imports \$533mill Exports \$123mill	< 12 years old	229	Euro 3		
Bulgaria	Imports \$1,146mill New motor vehicle sales (2008): LDV 43,758 HDV 11,842	No barriers High demand for 2nd hand cars	418	Euro 5		Quite aged vehicle population (above EU average)
Croatia	Imports \$818mill		387	Euro 5		
Cyprus	Imports \$379mill		529	Euro 5		
Czech Republic	Imports \$13,029mill Exports \$28,515mill New motor vehicle sales (2008): LDV 246,153 HDV 90,941	No barriers High demand for 2nd hand cars Pre-2006 cars pay emission-based fees	498	Euro 5		Manufactures vehicles – 1,178,938 – more than 5 times domestic demand – mostly for export to Western Europe Average vehicle age = 14 years old
Estonia	Imports \$1,020mill Exports \$501mill		511	Euro 5		

Georgia	Imports \$851mill Exports \$636mill	Tax depends on age	165	None		Inspection of light-duty vehicles in private ownership is voluntary prior to 1 January 2014. Tax varies according to the engine volume and age of the vehicle.
Hungary	Imports \$6,087mill Exports \$16,133mill Lot of component parts (ex all Audi engines made here) New motor vehicle sales (2008): LDV 153,278 HDV 23,984	LDV < 4 years HDV < 6 years	342	Euro 5		Manufactures vehicles – 217,840 – production is more than twice domestic sales; export to Western Europe Average car age = 11 years
Latvia	Imports \$841mill Exports \$494mill		333	Euro 5		
Lithuania	Imports \$1,860mill Exports \$1,421mill		612	Euro 5		
Moldova	Imports \$230mill	Custom taxes for > 7 years old Increased taxes for > 3 years old < 10 years old	172			No local production of vehicles or fuels.
Montenegro	Imports \$121mill		262	Euro 3		
Poland	Imports \$14,538mill Exports \$23,327mill More than ½ is component sales New motor vehicle sales (2008): LDV 314,263 HDV 149,053		551	Euro 5		Manufactures vehicles – 647,803 – strong domestic market and significant net exporter Average vehicle age = 12 years 778 cars > 5 years old
Romania	Imports \$4,832mill Exports \$7,502mill to Western Europe & CEE, including parts New motor vehicle sales (2008): LDV 270,995 HDV 49,075		231	Euro 5		Manufactures vehicles – 337,765 – strong domestic market and significant net exporter >50% Romanian vehicles don't meet EU emission standards
Russia	Imports \$40,528mill Exports \$986mill into CIS markets (Ukraine, Kazakhstan, Azerbaijan, Armenia) New motor vehicle sales (2008): LDV 2,831,967 HDV 1,084,411	Age-based taxation system for > 1 year old to shift sales to locally produced new cars	299	Euro 4	Euro 4: 2013 Euro 5: 2015	Manufactures vehicles – 2,231,737 Average vehicle age = 12 years
Serbia	Imports \$1,130mill Exports \$550mill	Euro 3 + higher eco-tax	193	Euro 5 for cars Euro 4 for light trucks		Manufactures vehicles – 11,023 The Serbian eco-tax for first registration of vehicles is lower for vehicles meeting Euro 4 or Euro 5 emission standards as well as for those using LPG.

Slovakia	Imports \$10,519mill Exports \$19,937mill	< 10 years old Used cars = 50% car sales	378	Euro 5		Assembles vehicles – 900,000 – more than 5 times domestic demand – mostly for export to Western Europe Average car age = 13 year
Slovenia	Imports \$3,628mill Exports \$4,634mill to EU		563	Euro 5		Assembles vehicles – 130,949 Average car age = 6 years old
The Former Yugoslav Republic of Macedonia	Imports \$254mill	< 15 years old Ban on Euro 1	165			
Turkey	Imports \$16,368mill Exports \$14,837mill 80% production for export to EU, Middle East New motor vehicle sales (2008): LDV 353,166 HDV 580,092	Banned	165	Euro 4		manufactures vehicles – 1,072,339 – strong domestic market and significant net exporter Average car age = 16 years
Ukraine	Imports \$5,472mill Exports \$520mill Most production is for local market	Below Euro 3 banned Euro 4 in 2014	180	Euro 3		Manufactures vehicles – 76,281 The ban (?) of import of Euro 4 vehicles is planned for January 1, 2014, Euro 5 for January 1, 2016, Euro 6 for January 1, 2018. Excise taxes are lower for vehicles with smaller engine volume and lower CO2 emissions.

ANNEX 6: ASIA FUEL & VEHICLE TABLES

The following are tables with further details of fuel and vehicle standards and markets for Asia.

It should be noted that the values provided in the tables are ballpark figures based on different sources and across a range of years (2010 – 2013); they should therefore be viewed as an indication rather than an absolute value.

Table 19: Central Asia Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S) CRUDE	CONSUMPTION '000s BBL/D (PPM S) REFINED
	Current (Actual)	50 ppm Date	Crude	Refined	Where from	Crude	Current (Actual)	50ppm Date		
Afghanistan	10000 (350)			36	Pakistan, Uzbekistan mainly Iran, Turkmenistan					36
Kazakhstan	350	2016			Northern and southern regions import from Russia and Uzbekistan	1,400		Italy, China, Netherlands, Austria, France, Kyrgyzstan, Uzbekistan	1,605 (sweet)	265
Kyrgyzstan	500	2015		33	Russia, Kazakhstan, Turkmenistan, Azerbaijan		(6 – not included in 33)	Refinery 10 (refines ~1 locally) *China financing new refinery		33
Tajikistan	500			14	Most fuel – Euro 2 (500ppm) Kyrgyzstan, Russia 6 each			(re-exports Russian fuel)	0.22	14
Turkmenistan	2000				Uzbekistan (crude for refinery)	48	74	Crude: Azerbaijan, Russia, Iran, Georgia	244 (sweet)	122
Uzbekistan	5000	2018 (350)	82		Turkmenistan, Russia, Kazakhstan – mainly crude			Plan to upgrade refinery to Euro 3 Exports some refined products	68(sour)	150

Table 20: Central Asia Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENTS
				Current	Planned	
Afghanistan			65	None		Discussion for Euro 3 for new vehicles ongoing
Kazakhstan	Imports \$3,139mill		260	Euro 3 since January 2012	Euro 4: 2013 for imports; 2014 for local manufactured	
Kyrgyzstan	Imports \$648mill Exports \$119mill		141	Use Russian standard Euro 4		
Tajikistan						No information
Turkmenistan						No information
Uzbekistan						Assembles vehicles – 235,518

Table 21: South Asia Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S) CRUDE	CONSUMPTION '000s BBL/D (PPM S) REFINED
	Current (Actual)	50ppm Date	Crude	Refined	Where from	Crude	Current (Actual)	50ppm Date		
Bangladesh	5,000	2014 – 500 ppm	27	81	Crude: Saudi Arabia, UAE Refined: UAE, China, Egypt, Vietnam, Malaysia, Philippines				6	114
India	350	No date	3,547	323	N America, Latin America, Europe, Former Soviet, Saudi Arabia, N Africa, Nigeria, E & S Africa, Australasia, China, Japan, Singapore	-	1,349	N America, Latin America, Europe, Africa, Australasia, China, Japan, Singapore	894 (sweet...?)	3,652
Nepal	350			19	All fuel from India					19
Pakistan	5,000		180	260	Saudi Arabia, Kuwait				60	440
Sri Lanka	2,000	-		42	50	Iran, Saudi Arabia, Malaysia				92

Table 22: South Asia Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENTS
				Current	Planned	
Bangladesh	Imports \$606mill: New from China, S Korea, Indonesia – 40% market Used from Japan (~9,000/year) – 60% market	< 5 year old	5	Euro 1	Euro 2: July 2014 Euro 3: 2019 Dhaka, Chittagong: Euro 3: 2014; Euro 4: 2019	
Bhutan	Ban on ALL vehicle imports since 2012! Lifted ban for electric and utility in Nov 2013. Electric vehicle project with Nissan/Japan		46 (= 34,000 cars)	No info		No comments
India	Imports \$5,870mill Exports \$10,038mill New motor vehicle sales (2008): LDV 957,611 HDV 989,773	Bans	17	Euro 3 Euro 4 in 11 cities		Manufactures vehicles – 4,145,194 Ongoing Auto-Fuel Policy Committee to 2020
Nepal	Imports \$143			Euro 3		No comments
Pakistan	Imports \$1,450mill Exports \$32mill New motor vehicle sales (2008): LDV 29,819 HDV 13,175		13	None		Assembles vehicles – 165,700
Sri Lanka	Imports \$1,145mill		41	Euro 1		No comments

Table 23: North Asia Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S) CRUDE	CONSUMPTION '000s BBL/D (PPM S) REFINED
	Current (Actual)	50ppm Date	Crude	Refined	Where from	Crude	Current (Actual)	50ppm Date		
China (nation wide)	350	2014	5,433	1,729	Saudi Arabia & Angola biggest sources N America, Latin America, Europe, Former Soviet, N Africa, W Africa, E & S Africa, Australasia, India, Japan, Singapore	26	538	N America, Latin America, Europe, Africa, Australasia, India, Japan, Singapore	4,372 (sweet)	10,276
Japan	10	-	3,739	1,004	N America, Latin America, Europe, Former Soviet, Middle East, N Africa, W Africa, E & S Africa, Australasia, China, India, Singapore	-	221	N America, Latin America, Europe, Australasia, China, India, Singapore	135 (only 5 is crude)	4,714

Mongolia	5,000 (500)			23	Most fuels are Euro 2, 3 Russia, China	10		China	10	23
Republic of Korea	50		2300		Middle East (refining capacity of 2700, so may import more crude for exporting refined)				60	2300

Table 24: North Asia Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENTS
				Current	Planned	
China (nationwide)	Imports \$73,972mill Exports \$43,109mill (S Korea, Japan, China)		68 19mill vehicles sold in 2012	China III (Euro 3)	Euro 5 - 2017 Beijing: Euro 5 - 2013; Euro 6 - 2016	Manufactures vehicles - 19,271,808
China (Hong Kong SAR)	Imports \$3,730mill Exports \$2,680mill (incl re-exports)		82	Euro 5		No comments
China (Macao SAR)	Imports \$438mill		165	Euro 4 equivalent		No comments
Chinese Taipei	Imports \$5,399mill Exports \$6,309mill					No comments
Democratic People's Republic of Korea				No info		No comments

Japan	Imports \$20,440mill Exports \$165,888mill, esp to other Asia (\$70,000mill), Australia/ New Zealand (\$11,279mill), Middle East (\$16,169mill), S America (\$6,688mill), Brazil (\$1,432mill), China (\$15,255mill), Russia (\$8,580mill), Mexico (\$3,290mill), S Africa (\$2,453mill), US (\$50,672mill) EXPORTS Used to: Bangladesh, Russia, Mongolia, Kazakhstan, Trinidad and Tobago, New Zealand, Tanzania, Zambia, Malaysia, Australia, Congo, Ireland, Pakistan, Dominican Republic, Peru, Bolivia, Paraguay, Kenya, UK New motor vehicle sales (2008): LDV 4,227,643 HDV 854,592		593 Second fastest growing market (+28% from 2011 to 2012)	~ Euro 5/6 and V/VI		Manufactures Vehicles – 9,942,711 Equivalent to Euro 5/6 and V/VI standards for light-duty and heavy-duty vehicles In January 2011, exported new to: Asia – 47,478 Middle East – 36,860 Europe Total – 94,123 (EU only – 50,936) North America – 119,330 (USA only – 104,245) Latin America – 26,250 (Brazil accounts for ~50% all LAC car sales generally) Africa – 11,140 Oceania – 29,767
Mongolia	Imports \$951mill			No info		No comments
Republic of Korea	Imports \$9,793mill Exports \$72,000mill New motor vehicle sales (2008): LDV 741,341 HDV 413,742		379	Euro 4/IV		Manufactures vehicles – 4,557,738
Taiwan			287			Manufactures vehicles – 339,038

Table 25: South-East Asia Fuel Flows

COUNTRY	DIESEL STANDARDS (PPM S)		IMPORT '000s BBL/D (PPM S)			EXPORT '000s BBL/D (PPM S)			PRODUCTION '000s BBL/D (PPM S) CRUDE	CONSUMPTION '000s BBL/D (PPM S) REFINED
	Current (Actual)	50ppm Date	Crude	Refined	Where from	Crude	Current (Actual)	50ppm Date		
Brunei Darussalam	500	2016				125		New refinery being built Japan, S Korea, India, New Zealand, Thailand, China, Indonesia, Australia	140 (sweet)	15
Cambodia	1,500 (50-500)			43	Singapore, Vietnam, Thailand					43
Indonesia	3,500 (avg.) / 500 ppm	No date	460		Saudi Arabia, Malaysia, Nigeria, Australia, Azerbaijan, Brunei, Iran, Qatar				974(sweet)	1,384
Laos	2,500 (50)			3.5	Thailand					3.5
Malaysia	500	2016	160		Imports cheaper, heavy, sour crude from Middle East (esp Saudi Arabia, UAE, Qatar) & refines	245		Exports within Asia Pacific half its crude oil, Mostly Australia, India, Thailand, Japan	642(sweet)	598
Myanmar	2,000 (50)			7	Thailand mainly, China				20	27
Philippines	500	2016	175	150	Most refined products from Singapore Some 50ppm available Saudi Arabia, UAE, Malaysia, Qatar, Russia, Vietnam, Indonesia	7	37		25	302
Singapore	50	-	948	2,016	N America, Latin America, Europe, Former Soviet, Middle East (esp UAE, Saudi Arabia, Qatar), N Africa, W Africa, E & S Africa, Australasia, China, India, Japan	12	1,479	N America, Latin America, Europe, Africa, Australasia, China, India, Japan Refines up to 1,400	20 (no crude)	1,380
Thailand	50	-	900	84	Net importer of crude Middle East, Indonesia, Australia, Russia		134	Net exporter of products	465	1,200

Viet Nam	500	2018	14	180	Net importer of products Brunei, Singapore, China, Thailand, Taiwan	183		Net exporter of crude Japan, Malaysia, Thailand, Australia, China	363(sweet)	388

Table 26: South-East Asia Vehicle Market

COUNTRY	IMPORT FROM / EXPORT TO	USED VEHICLE IMPORT	MOTORISATION RATE (VEHICLE / 1000 PEOPLE)	VEHICLE EMISSION STANDARDS		COMMENTS
				Current	Planned	
Brunei Darussalam	Imports \$344mill (Singapore, Malaysia, China)		524	Euro 1 – Diesel Euro 2 – Petrol	Euro 4: 2016	
Cambodia	Imports \$413mill (China, Thailand, Vietnam)			No info		No Comments
Indonesia	Imports \$9,608mill Exports \$4,292mill New motor vehicle sales (2008): LDV 47,323 HDV 593,732	Banned	84 +25% growth from 2011 to 2012	Euro 2		Assembles vehicles – 1,065,557 Discussions ongoing for implementation of Euro 4
Malaysia	Imports \$7,363mill Exports 1,530mill New motor vehicle sales (2008): LDV 122,237 HDV 425,955		379	Euro 2	Euro 4: 2016	Manufactures vehicles – 572,150
Myanmar	Imports \$439mill		7	None		No comments
Philippines	Imports \$3,104mill Exports \$1,625mill New motor vehicle sales (2008): LDV 44,425 HDV 80,024	Banned with exceptions (some trucks, buses etc)	34	Euro 2	Euro 4: 2016	Assembles vehicles – 55,360
Singapore	Imports \$4,821mill Exports \$4,283mill + \$3,513mill re-export New motor vehicle sales (2008): LDV 72,751 HDV 8,170		156	Euro 4 / IV	Euro V for diesel: 2014	
Thailand	imports \$13,439mill Exports \$24,276mill New motor vehicle sales (2008): LDV 226,805 HDV 388,465	Banned	173 Fastest growing market: +80% from 2011 to 2012	Euro 4 / IV		Manufactures vehicles – 2,483,043
Viet Nam	Imports \$1,744mill Exports \$968mill New motor vehicle sales (2008): LDV 6,354 HDV 20,723 (in 2011, this more than doubles)		19	Euro 2	Euro 4: 2017 Euro 5: 2022	manufactures vehicles – 40,470 Manufactured + assembled – 125,147 (2011) In 2011: 45,642 new and 10,756 used vehicles imported

ANNEX 7: RESOURCES

In addition to the very helpful staff of UNEP's Transport Unit, the following resources were used for this study.

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<http://crudeoilpeak.info/>

Developments in the international downstream oil markets and their drivers (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48142/2259-int-downstream-oil-mkts-drivers.pdf)

<http://www.dfat.gov.au/fta/mafta/factsheets/MAFTA-the-benefits-import-export-map.html>

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<http://www.mbendi.com/indy/oilg/ogds/af/ma/p0005.htm>

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<http://www.petrotrin.com/Petrotrin2007/UpdateRefineryTTEC2014.pdf>

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Philippine Department of Energy Oil Supply / Demand Report 2012 (<http://www2.doe.gov.ph/DO/OilSupplyDemandReport.htm>)

<http://www.reegle.info/profiles/>

<http://www.theodora.com/>

<http://tribune.com.pk/story/670055/line-extension-pakistan-looks-for-10-billion-oil-credit-facility/>

Understanding Today's Crude Oil and Products Markets: <http://www.api.org/aboutoilgas/upload/oilprimer.pdf>

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