

Case study: Adoption of low-sulfur fuel standards in Peru

Authors: Sebastian Galarza and Chris Malins

Date: 29 January 2016

Keywords: low-sulfur diesel, fuel quality, refinery upgrade, refinery financing, air quality

1. Introduction

Peru is one of the fastest growing economies in South America with a GDP that has expanded at a rate of 6.4% on average from 2002 to 2012 (World Bank, 2014). This economic expansion has been accompanied by a strong trend towards urbanization, as elsewhere in the region. Whereas in 1950 only 41% of Peru's population lived in urban areas, by 2010 this number had ascended to almost 77% (United Nations, Department of Economic and Social Affairs, Population Division, 2012). In recent years, rapid urbanization and per capita income growth have also led to an increase in automobile sales. Between 2002 and 2012, private vehicle sales have grown at an average annual rate of 32%, with an estimated 200,000 new vehicles entering the fleet in 2013 alone (BBVA, 2013). Despite this growth, the current motorization rate in Peru is estimated at only 73 vehicles per 1,000 people, still well below that of OECD countries (563 per 1,000) and that of its neighbor Chile (184 vehicles per 1,000) (International Road Federation, 2012). In terms of emissions, the current Peruvian fleet has improved since 2006 when the average emissions of CO₂ (grams/kilometer) were 206 gCO₂e/km to the most recent baseline of 185 gCO₂e/km (G. Lopez, 2014). However, in order to catch up to current industry benchmarks, further improvements in fuel quality and vehicle technology are required.

As a result of the fast growth experienced by the automotive sector over recent years, the Peruvian government, through its Ministry of Transport and Communications (MTC), has embarked on a number of regulatory reforms. These have not only included emissions standards for vehicles but also an elimination of subsidies for high-octane gasoline and the introduction of fuel quality requirements for diesel. The second of these includes a requirement for low sulfur (50ppm) diesel. Currently, this requirement cannot be met internally as Peru's refineries are not equipped to

produce high quality derivatives. Hence, Peru remains a net importer of both crude and refined products, bringing in around 39,000 bbl/day of diesel from the USA (EIA, 2013). For example in October of last year, the Peruvian state oil company—PetroPeru—bought three shipments including 290,000 barrels of ultra low sulfur diesel (15ppm) from Repsol and another 580,000 barrels of diesel with undisclosed (but higher) sulfur content from BB Energy (Peru21.pe, 2013 and Revista Gestion, 2013c). Nevertheless, imports only represent a fraction of the 172,000 bbl/d of petroleum products consumed in the country in 2012 (EIA, 2013). As a result of this, the country is exploring financing mechanisms through which to upgrade its refineries in time to meet with the regulatory requirements set forth by the MTC. The following case study will describe the country's current efforts in meeting these requirements and obtaining financing for refinery upgrades.

2. Fuel quality regulations and history

As previously mentioned, the Peruvian government, through its Ministry of Transport and Communications (MTC), has embarked on a number of regulatory reforms to set emissions standards for passenger vehicles. The first of these was set in 2001, when emission limits were first established for existing light-duty vehicles (LDVs), new imported or domestically assembled vehicles and imported used vehicles (see Decreto Supremo N° 047-2001-MTC). Since then, several amendments have been made to this regulation with the latest taking place in December of 2012. These amendments have included the following requirements for LDVs and heavy-duty vehicles (HDVs) (TransportPolicy.net, 2014a and 2014b):

- Starting in 2003, new LDVs are required to meet either US Tier 0 or Euro II emission standards and new HDVs are required to meet Euro II requirements.

- Starting in 2007, new LDVs must meet Euro III requirements, with US Tier 1 as an option, and new HDVs are required to meet Euro III requirements.
- Starting in 2016, new LDVs must meet Euro IV requirements, with US Tier 2 as an option, and new HDVs are required to meet Euro IV requirements.

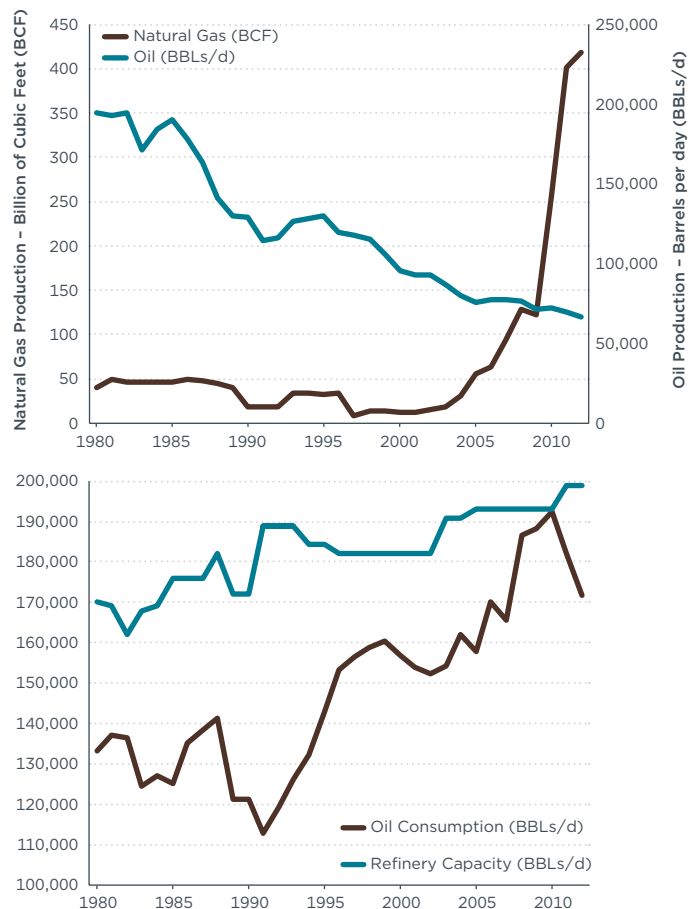
The latest of these regulations (Ley No 28694 from 03/26/2006) is also the first to require low sulfur diesel—the introduction of Euro IV standards includes a sulfur limit of 50ppm at the national level by 2016 for diesel and 2017 for gasoline. In urban areas, in particular in the Lima-Callao corridor (which houses a third of the country’s population), diesel sulfur levels have been limited to 50ppm since 2012 (UNEP, 2012). However, there have been delays in the enforcement of these regulations that have resulted in nationwide sulfur levels remaining as high as 1,500ppm (EPA, 2012). According to Ministerial decree N°139-2012-MEM-DM, it became illegal to sell diesel with sulfur levels above 50ppm in Lima, Arequipa, Cusco, Puno y Madre de Dios (Callao) 120 days after its signature on March 16th 2012 (OSINERGMI, 2012).

3. Refinery capacity overview

Peru currently has crude oil reserves estimated at 632,906,000 barrels (bbl), but crude oil production has steadily declined from its peak in 1982 (195k bbl/day) to its current level of approximately 66,500 bbl/d (2012) (OGJ, 2013 and EIA, 2013). Since the early 1990s, the country has been a net importer of crude oil, which it primarily sources from its neighbor Ecuador. At the same time, Peru, which has natural gas reserves of 15,376 billion cubic feet (bcf) (second largest in the region behind Venezuela), has increased output of natural gas (and natural gas liquids) to the extent that since the early 2000s the country has become a net exporter. Regarding consumption of petroleum derivatives, diesel accounts for the largest share of fuel consumption (47 percent—of which about half is imported low sulfur diesel) followed by liquefied petroleum gas (LPG) (19 percent), with the share of the latter expected to double over the next 10 to 15 years as Peru seeks to tap its vast natural gas reserves (IMF, 2013). There are already several projects being explored to supply liquefied petroleum gas through pipeline to large urban areas outside of Lima but these are to be completed in the next five years. This includes the Gas Natural Fenosa project to develop a gas duct to four major cities in the south of the country, including Arequipa (Gas Natural Fenosa, 2013). In terms of biodiesel, since 2005 the Ley No 28054 regarding biofuel markets and supreme decrees (N°013-2005 EM and N° 021-2007 EM) have established that gasoline must contain 7.8 percent of ethanol and diesel must have 5 percent of

biodiesel (USDA, 2013). Most of the biofuels entering the market are imported from Brazil and Argentina as Peruvian suppliers are not yet price competitive.

In terms of refining, Peru has a capacity of around 200,000 bbl/d served by six refineries. Two of these, Talara and Pampilla, account for 85% of total capacity. The Talara refinery is the largest state owned facility and the subject of a recently passed law that mandates its modernization. It has been in operation for close to a century with upgrades taking place in 1954 (addition of primary distillation unit), 1965 (capacity extended to 62,000 bbl/d), 1974 (installation of catalytic cracking complex) and 1995 (installation of liquid cargo berth used to load products and receive tankers up to 35 Million Deadweight Tonnes) (PetroPeru, 2014). The largest refinery in the country, La Pampilla, is currently owned and operated by Spanish oil and gas company Repsol. This refinery is also being upgraded and is currently looking for ways to help finance this work. Nonetheless, in order to meet its fuel consumption needs, Peru continues to import refined products primarily from the USA for a total of 39,000 bbl/d (EIA, 2013).



Figures 1 & 2. Natural gas and oil production & Oil consumption and refinery capacity in Peru (EIA, 2013)

Table 1. Peruvian Refineries (OGJ, 2012)

REFINERY	OWNERSHIP	CAPACITY (BBL/D)	% OF TOTAL REFINING CAPACITY
Pucallpa	Maple Gas Corp.	3,250	2%
Conchan	PetroPeru SA	13,500	7%
Iquitos	PetroPeru SA	10,500	5%
El Milagro	PetroPeru SA	1,700	1%
Talara	PetroPeru SA	62,000	31%
La Pampilla	Repsol YPF SA	108,000	54%

4. Refinery project overview

Current limitations in refining capacity, particularly to produce low sulfur fuel, have led the country to explore ways to finance upgrades to its existing refineries. The most recent development is Law N° 30130 passed by Congress on the 18th of December 2013. This law declares the modernization of the Talara refinery a priority of national and public interest to preserve the air quality and public health of the country (El Peruano, 2013). The law gives the state oil company the mandate to take any necessary measures to execute the modernization of the refinery in order to meet with fuel quality standards (50ppm sulfur) by 2016. The law also opens the state oil company, Petro-Perú SA, to private participation not

exceeding 49% of its share capital. In essence, this allows for private companies to finance oil and gas projects currently operated/owned by the state and sets the stage for potential refinery upgrades.

The modernization objectives for the Talara refinery include: (i) an expansion of its total capacity from its current 62,000 bbl/d to 95,000 bbl/d—of which 41,000 bbl/day will be low sulfur diesel; (ii) capability to process heavy crudes with APIs as low as 18° (currently at 30°); (iii) reconfiguration of the current refinery to produce less residual fuels and increase production of diesel; and, (iv) improvement of the quality of both gasoline and diesel to 50ppm sulfur content or less (PetroPeru, 2008 and Revista Gestion, 2013b). The current state of proposed additions is highlighted in Figure 3, which shows that the refinery will be reconfigured to handle heavy crudes in an attempt to maintain operational margins at similar levels as before the current set of investments. In addition, PetroPeru has developed an innovative financing concept whereby they have in practice privatized certain refinery units to be owned and operated by private investors. These in turn provide services to the refinery until the investments are fully paid off. The most recent news is that the contract for the new refinery upgrades has been awarded to Tecnicas Reunidas—a Spanish contractor—for a total of US \$2.4 billion (Tecnicas Reunidas, 2014). Given the timeline for financing and construction, it is likely

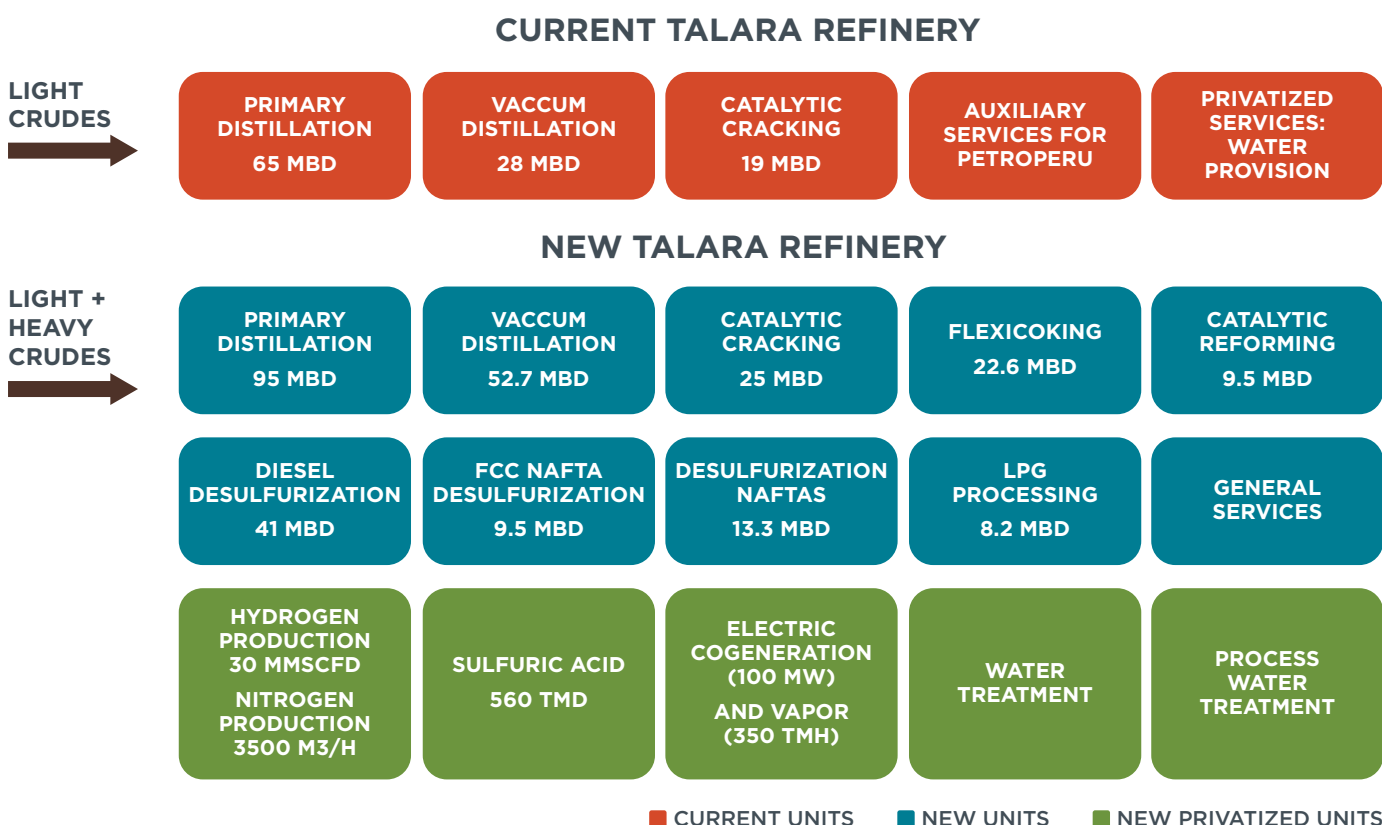


Figure 3. Proposed Modernization of Talara Refinery

that this project will not be complete until after (2019) the current deadline set by Ministry of Transport and Communication regulations.

In addition to the Talara refinery, the government has showed strong interest to upgrade La Pampilla refinery, which is the largest in the country and is currently owned and operated by Repsol. According to an environmental impact study conducted by the firm, upgrading aimed at meeting low sulfur standards would cost around US \$800 million. It would make the refinery compliant with sulfur restrictions and introduce six new processing units and new storage tanks for oil, diesel and petrol (gasoline) (SeeNews Energy, 2013). In a recent presentation, representatives from Repsol announced that the refinery will be upgraded with a total investment of US \$857 million to reconfigure the refinery to handle heavy crudes and produce low sulfur diesel with an expected completion date of late 2017.

5. Refinery financing

According to several estimates, the total cost of upgrading the Talara refinery is expected to reach \$3.5 billion. PetroPeru has secured public investment for a total of \$2.7 billion (77%) while the remaining investment (\$815 million) will come from several other private firms. In order to obtain this capital, PetroPeru plans to raise \$1.3 billion through bonds and loans in international markets while the remaining \$1.4 billion will come from local sources (Reuters, 2013). In addition, it will operate long term concession contracts with private investors for certain refinery units. It remains unclear what international and local sources have been identified for this investment capital, and whether financing from multilateral institutions has been considered. Last year it was announced that a five-year loan for \$500 million had been secured from French investment bank Société Générale, who had been hired to provide financial structuring services by PetroPeru for the Talara project (Revista Gestion, 2013b). The loan has been confirmed by the Ministry of Finance and Ministry of Energy and Mines while Société Générale has remained as a financial partner for the project. In addition to this, it is expected that the partial privatization of PetroPeru will attract new capital to this and other oil and gas projects in Peru. The same law also gives PetroPeru government guarantees for up to \$1 billion for any financial obligations related to the modernization of the refinery.

As previously stated, the government had considered investing in an acquisition and upgrading of La Pampilla refinery, currently owned and operated by Repsol. The Spanish company had recently placed the refinery on sale as part of a divestment effort of its assets in Latin America and elsewhere. It is estimated that the total cost of buying,

upgrading and modernizing the refinery would be approximately \$3 billion. However, during the course of 2013, the government faced stiff criticism from several constituencies that among other things accused the government of meddling in fuel prices and of interventionist state policies (La Prensa, 2013). As a result of this added pressure, the government decided to concentrate on the financing of the Talara refinery in order to reduce any potential loss in business/investor confidence from buying the foreign controlled Pampilla refinery. Subsequently, Repsol decided not to sell the refinery after it failed to receive offers under the terms it required (WSJ, 2013). Given the current mandates for fuel quality, Repsol has since stepped in to refinance and upgrade their refinery as stated above. Given that the investments will only be for desulfurization and total capacity will remain the same, the project is expected to come online before Talara.

6. Barriers to/opportunities for low sulfur fuel adoption

In Peru, the main barriers to low sulfur fuel adoption remain financial. Whereas many countries in the region lack both vehicle and fuel standards, Peru has committed to a stringent set of norms and is actively looking for investments to ensure these are achieved. It remains unclear how this investment capital will be secured and what the economic viability is of the planned investments in the Talara refinery. Further information is needed to better understand some of the other economic barriers to this project. That said, the project is now backed by both the executive and legislative branches of government which gives a strong signal to consumers, oil industry and vehicle manufacturers/importers that the government will continue to enforce vehicle and fuel standards.

Notwithstanding the efforts made by the Peruvian government, there is an opportunity to further reduce the environmental impacts of the transportation sector by upgrading the Talara refinery to produce ultra low sulfur fuel—10 or 15ppm sulfur content. It is unclear what the required additional investments would be but there is a clear opportunity to further reduce impacts on public health and air quality. It is clear from discussions with interested parties that the main roadblock to establishing these stricter regulations is fuel availability, with particular opposition expressed on the part of the refiners. The investment requirements for the new upgrades are deemed restrictive and it is argued that additional costs for sulfur reduction would make these unviable. Given that Peru has been proactive in its adoption of fuel quality requirements, it is foreseeable that this discussion will continue. If so, it will be important to understand why the government has decided to upgrade its refineries to satisfy only 50ppm sulfur requirements.

7. Conclusions and lessons learned

Few countries in Latin America and the Caribbean have adopted vehicle and fuel standards, and in this sense, the actions of the Peruvian government are commendable.

It remains a considerable feat that both the government and private actors have come together to secure investments in excess of \$4 billion to upgrade their refineries to produce low sulfur fuel. As a result, in the next couple of years, the majority of Peruvians will have access to quality fuels and the impacts of these on climate and health will be reduced. That said, there remains concerns regarding the timely delivery of the projects by the contractors involved while the refining capacity available in the Peru will remain insufficient to satisfy national demand in the coming years, meaning that low sulfur diesel imports will maintain their importance in the local economy. Peru still lags behind others in the region (notably Chile) and it is unclear why the country is making investment in refinery upgrades that could lead to outdated policies in the near future. With countries in the region already moving to 10-15ppm sulfur requirements, Peruvian standards may remain outdated despite the considerable investment being made now to satisfy 50ppm sulfur requirements.

8. References

1. BBVA Research (2013). "Peru Situación Automotriz: Análisis Económico 2013". Accessed on April 3, 2014. Available at: http://serviciodeestudios.bbva.com/KETD/fbin/mult/situacion_automotriz_2013_tcm:46-414739.pdf?ts=442014
2. El Peruano (2013) "Normas Legales: Ley No 30120". Accessed on April 3, 2014. Available at: [http://www2.congreso.gob.pe/Sicr/TraDocEstProc/Contdoc02_2011_2.nsf/d99575da99ebf305256f2e006d1cf0/ffa1c0d533c8224305257c45005766ef/\\$FILE/30130.pdf](http://www2.congreso.gob.pe/Sicr/TraDocEstProc/Contdoc02_2011_2.nsf/d99575da99ebf305256f2e006d1cf0/ffa1c0d533c8224305257c45005766ef/$FILE/30130.pdf)
3. Gas Natural Fenosa (2013) "Gas Natural Fenosa entra en Perú para distribuir gas en 4 ciudades del sur, entre ellas Arequipa, la segunda más grande del país". Accessed on June 3, 2014. Available at: <http://www.gasnaturalfenosa.com/es/sala+de+prensa/noticias/1285338473668/1297148363046/gas+natural+fenosa+entra+en+peru+para+distribuir+gas+en+4+ciudades+del+sur+entre+ellas+arequipa+la+segunda+mas+grande+del+pais.html>
4. G. Lopez (2014) "ESTRATEGIA NACIONAL PARA COMBUSTIBLES Y VEHÍCULOS MÁS LIMPIOS Y EFICIENTES EN EL PERÚ". Presented at the CCAC-GFEI Clean Fuel and Vehicle Workshop in Lima, Peru June 10-11, 2014.
5. International Energy Agency (2012) "CO₂ emissions from fuel combustion: Highlights". Accessed on April 3, 2014. Available at: http://www.iea.org/co2_highlights/co2_highlights.pdf
6. International Monetary Fund (IMF) (2013) "Case Studies on Energy Subsidy Reform: Lessons and Implications". Accessed on April 3, 2014. Available at: <http://www.imf.org/external/np/pp/eng/2013/012813a.pdf>
7. International Road Federation (2012). "World Road Statistics". Accessed on April 3, 2014. Available at: <http://data.worldbank.org/indicator/IS.VEH.NVEH.P3>
8. La Prensa (2013) "Siete opiniones en contra de la compra de Repsol". Accessed on April 3, 2014. Available at: <http://laprensa.pe/actualidad/noticia-siete-opiniones-contra-compra-repsol-6045>
9. Oil and Gas Journal (OGJ) (2012) Refinery Survey
10. Oil and Gas Journal (OGJ) (2013) Worldwide Look at Reserves and Production
11. OSINERGMIN (2012) "Resolución Ministerial N°139-2012-MEM-DM". Available at: <http://www2.osinerg.gob.pe/MarcoLegal/doceyv/RM-139-2012-MEM-DM.pdf>
12. Peru.21.pe (2013) "Petroperú entrega contratos de compra de diesel a Repsol y BB Energy". Accessed on April 9, 2014. Available at: <http://peru21.pe/economia/petroperu-entrega-contratos-compra-diesel-repsol-y-bb-energy-2151999>
13. PetroPeru (2008) "Peru: Country of Investment Opportunities" Presentation by Luis Suarez and Gerardo Leon at the Global Petroleum Show 2008. Accessed on April 3, 2014. Available at: http://www.international.alberta.ca/images/about/Peru_-_Talara_Refinery_Modernization_Project.pdf
14. Petroperu (2014) "Facilities: Talara Refinery". Accessed on April 3, 2014. Available at: <http://www.petroperu.com.pe/portalweb/Main.asp?Seccion=55>
15. Reuters (2013). "State-run PetroPeru to raise \$2.7 bln to fund refinery expansion". Accessed on April 3, 2014. Available at: <http://www.reuters.com/article/2013/12/18/petroperu-talara-idUSL2N0JX04C20131218>
16. Revista Gestion (2013a) "Humala: Modernización de Talara obligará a La Pampilla a mejorar su refinamiento". Accessed on April 3, 2014. Available at: <http://gestion.pe/economia/humala-modernizacion-talara-obligara-pampilla-mejorar-su-refinamiento-2084833>
17. Revista Gestion (2013b) "Modernización de la refinería de Talara ya tendría US\$ 500 millones". Accessed on April 3, 2014. Available at: <http://gestion.pe/economia/modernizacion-refineria-talara-ya-tendria-us-500-millones-2072276>

18. Revista Gestion (2013c) “Petroperú lanzó oferta para comprar tres embarques de diésel”. Accessed on April 9, 2014. Available at: <http://gestion.pe/empresas/petroperu-lanzo-oferta-comprar-tres-embarques-diesel-2077057>
19. SeeNews Energy (2013) “Repsol completes study to upgrade refinery in Peru—report”. Accessed on April 3, 2014. Available at: <http://energy.seenews.com/news/repsol-completes-study-to-upgrade-refinery-in-peru-report-363095>
20. Tecnicas Reunidas (2014) “Petroperu awards to TR the Talara refinery modernization project (Peru)”. Last accessed June 3, 2014. Available at: <http://www.tecnicasreunidas.es/recursos/noticias/tre-ri-conversion-talara-eng.pdf>
21. TransportPolicy.net (2014a) “Peru Heavy Duty Emissions”. Accessed on April 3, 2014. Available at: http://transport-policy.net/index.php?title=Peru:_Heavy-duty:_Emissions
22. TransportPolicy.net (2014b) “Peru Light Duty Emissions”. Accessed on April 3, 2014. Available at: http://transport-policy.net/index.php?title=Peru:_Light-duty:_Emissions
23. United Nations Environment Programme (UNEP) (2012) “Status of Fuel Quality and Vehicle Emission Standards: Latin America and the Caribbean—Updated March 2012”. Accessed on April 3, 2014. Available at: http://www.unep.org/transport/pcfiv/pdf/maps_matrices/lac/matrix/lac_combined_march2012.pdf
24. United Nations, Department of Economic and Social Affairs, Population Division (2012). “World Urbanization Prospects, the 2011 Revision”. Accessed on April 3, 2014. Available at: <http://esa.un.org/unup/CD-ROM/Urban-Rural-Population.htm>
25. US Energy Information Agency (EIA) (2013). “Country Analysis Note: Peru”. Accessed on April 3, 2014. Available at: <http://www.eia.gov/countries/country-data.cfm?fips=pe>
26. US Environmental Protection Agency (EPA) (2012) Report to Congress on Black Carbon: Department of the Interior, Environment, and Related Agencies Appropriations Act 2010”. Accessed on April 3, 2014. Available at: <http://www.epa.gov/blackcarbon/>
27. USDA (2013) Peru Biofuels Annual. Last accessed on June 3, 2014. Available at: http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Biofuels%20Annual_Lima_Peru_7-8-2013.pdf
28. Wall Street Journal (2013) “Repsol Decides Not to Sell Refinery in Peru”. Accessed on April 3, 2014. Available at: <http://online.wsj.com/news/articles/SB10001424052702303531204579206292139981008>
29. World Bank (2014). “Peru Overview”. Accessed on April 3, 2014. Available at: <http://www.worldbank.org/en/country/peru/overview>