

Environmental Regulations Generated Market Opportunities for Engineering and Construction Companies- A Case Study of Petroleum Refineries

Kamalesh Panthi, PhD and
Rebecca Macdonald, P.E.
East Carolina University, Greenville NC

W. Edward Back, PhD
University of Alabama
Tuscaloosa, AL

With more public awareness to the environmental impact of industrializations, governments around the world have imposed stringent regulations on the water and air emission standards. Environmental Protection Agency in the U.S. is responsible for promulgating rules to protect the environment. Some of these new regulations have required investment from a variety of industries under the jurisdiction of Federal and State environmental protection agencies to comply with the standards by upgrading their facilities. This has created a market opportunity for construction / engineering firms within particular industries. The need for the construction industry to understand the way a business / market sector operates is imperative to be predictive of market movement. This paper specifically illustrates this concept by examining the challenges faced by multi-national refineries to meet the new benzene content levels in gasoline recently mandated in a federal regulation. Persistent and ever-changing energy and environmental policy and legislation are key drivers shaping global construction demand. Firms can use the insights presented in this paper to proactively define a strategic response appropriate for their marketplace.

Key Words: Construction Engineering, Environmental Regulations, New Markets

Introduction

In the U.S., several regulations are being promulgated by the Environmental Protection Agency (EPA). Depending on the outcome of any or all of these regulations, there are wide ranges of implications not only on industries, such as oil and chemical, utilities, etc., that are directly affected by the new standards but also on the supply chain side of these industries. The supply-side encompasses manufacturers of pollution control equipment, hazardous and solid waste management firms, makers of waste water treatment systems and products, engineering design, and construction companies, and a wide variety of other firms. It is important to note that the wide variety of engineering and construction work stimulated by the new EPA regulations will not only be handled by a few environmental engineering companies but by firms with a demonstrated expertise in heavy-industrial, process, and other relevant branches of the field. Such firms have already benefitted by allocating resources and expertise aligning with the new business opportunities as a result of these new EPA standards. Large-scale industrial engineering and construction projects carry relatively low margins, ranging from 3-5 percent in most areas to 7-8 percent in some less mature markets. The relatively low profitability stems directly from the industry's intensely competitive nature, with a sizable number of large and small companies competing for relatively few contracts (ICF Resources Inc., 1992).

With far-reaching environmental laws such as Clean Air Act (and amendment), Clean Water Act, Coal Combustion Residuals (CCR), Cross-State Air Pollution Rule (CSAPR) and so on, a huge market has been generated for E&C firms to do business with heavy industrial, processing, chemical, utilities companies so as to comply with the new rules by upgrading and constructing new facilities. As a matter of fact, every title of the Clean Air Act Amendment (CAAA) has something for the wide-ranging engineering industry. Titles I, III, and IV, for example, will provide considerable work in the design, development, and construction of air pollution control devices. In March 2011, EPA issued the Second Prospective Report which looked at the results of the Clean Air Act from 1990 to 2020. According to this study, the direct benefits from the 1990 Clean Air Act Amendments are estimated to reach almost $2 trillion for the year 2020, a figure that dwarfs the direct costs of implementation ($65 billion) (Source:

http://www.epa.gov/air/sect812/prospective2.html). So, there clearly is a very solid ground for the federal agencies to embrace the technological changes that will bring about the benefits as a result of meeting the new standards. In the current technical literature, most studies focus on the impact of regulations on companies rather than on how the regulations might open new markets for service providers and other organizations. Previous studies have also frequently focused on the negative financial impacts resulting from the implementation of new, stricter environmental regulations on the owner/operator company. However, the engineering and construction industry, performing the important role of a service provider that helps these companies meet such requirements may actually foresee a new market developing with the potential for positive financial impacts and opportunities. Owner companies with sufficient technological knowledge are better prepared for adapting to new regulations than ones with insufficient technological knowledge (Canon-De-Francia et al., 2007). In a similar manner, E&C firms that are conversant with the new environmental regulations are better prepared to focus on the market that are impacted by these new EPA regulations. However, it has to be acknowledged that engineering and construction activities spurred by these regulations are highly specialized in nature and as such provides a limited entry to these markets for other companies that do not already have a working relation with the owner companies.

States and local regulations, which vary widely from jurisdiction to jurisdiction, can also have a considerable impact on market opportunities. California, which has a more stringent environmental rules compared to federally imposed regulations, has spurred more business opportunities related to environmental protection. The need for the engineering and construction (E&C) industry to understand the way a business/market sector operates in response to changing or evolving regulation is imperative to be predictive of market movement and opportunity. How do construction companies predict the market generated by evolving EPA regulations is the focus of the paper. Finally, with the help of a case study specific to the petroleum refinery, the research paper demonstrates how a preliminary market study could be conducted using the publicly available data.

Clean Air Act

The two new EPA rules under consideration in the Clean Air Act are the Cross-State Air Pollution Rule (CSAPR) and the Mercury and Air Toxics Standards (MATS). CSAPR will require significant reductions in harmful emissions from coal-fired power plants that drift hundreds of miles downwind and across state lines while the Mercury and Air Toxics rule will require power plants to curb hazardous emissions of mercury, lead, arsenic and acid gases by 2015. Many of the power plants impacted by these rules are more than 50 years old.

Estimates from EPA and others have projected that the total amount of investment needed to comply with the new rules is at least $94 billion. This investment would flow directly to American companies, creating the construction and manufacturing jobs.

The best investment opportunities may not be with the prepared utilities, but rather the engineering companies that will benefit from the contract market for abatement technology. It is estimated that about $20 billion in market opportunities will be generated from the higher oxides of Nitrogen (NOx) and oxides of Sulphur (SOx) standards also announced by the EPA, about $20 billion in new construction to replace dirtier plants phased out completely by the regulations, and another $15 billion in projects related directly to mercury emission abatement. This presents a more than $50 billion opportunity over a rather short 3 to 5 year period (Mulhern, 2011).

Clean Water Act

Federal Water Pollution Control Act, commonly known as the Clean Water Act (CWA), is the federal program designed to restore and maintain the integrity of the nation's surface waters. CWA controls direct discharges to surface waters (e.g., through a pipe) from industrial processes or storm water systems associated with an industrial activity. The Environmental Protection Agency is in the process of developing proposed national rulemaking to strengthen its storm water program. The proposed rulemaking, which was previously announced in the Federal Register on Dec. 28, 2009, could dramatically alter the playing field for development of all types (Hughes, 2010).

The EPA regulations include an extensive overhaul and tightening of permitted run-off effluent from development projects. Estimates of annual costs associated with the proposed regulations run as high as $10 billion annually. The status of the regulations is somewhat in flux based on pending litigation between the National Association of Home Builders and EPA in which EPA was forced to withdraw portions of the regulations for further review and analysis.

No matter what the outcome of the pending litigation is, the construction, real estate and development industry has to make changes for the EPA's proposed changes to storm water regulations. As with most of the regulatory requirements, the construction industry gains from the opportunities created by the implementing the new standards in clean water act. The regulations may also create opportunities for some businesses using green roof design and construction and new products and techniques, such as pervious concrete.

The regulations may cause the use of green roof design and implementation to become far more commonplace. Green roofs offer the potential for capturing a plethora of LEED (Leadership in Energy and Environmental Design) credits; however, some owners have tended to avoid selecting vegetative roofs due to a perception of high costs. Green roofs offer a way to dramatically reduce storm water runoff quantities, estimated in an EPA managed research project at 50% of annual rainfall volume plus increasing the time to peak and slowing peak flows for watersheds. Use of pervious concrete may offer another strategy to dramatically reduce stormwater run-off by infiltrating stormwater on site (Hughes, 2010).

Case Study

To demonstrate how E&C firms particularly can identify business development opportunities more strategically, this case study will illustrate that sufficient information and data is readily available, and publicly accessible to determine the affected parties of new federal benzene emission regulations. The Mobile Source Air Toxics (MSAT) ruling on benzene content provides an excellent case study and is broad in its impact to wide number of organizations and providers. With regards to MSAT, the primary focus has been given to the new technology available to meet required regulation standards. Previous studies address MSAT compliance through implementation of new technology specifically based on existing refinery configuration. (de Klerk and Nel 2008, Meister, et al. 2006, and Rhodes 1996). The opportunity for E&C firms is undeniably significant; however, the specific organizations to target for new business development are unknown without greater investigation. The actual ruling and supporting documentation was readily available via the EPA website with the noticeable exception of any individual party's pre-compliance reports. (Visit http://www.epa.gov for more information) The individual pre-compliance reports are not available to the public due to being deemed proprietary. However, there is a summary report of all the pre-compliance reports posted and further aggregated based on Petroleum Administration for Defense Districts (PADD). With further searching of public domains, information pertaining to all U.S. refineries was obtained through the U.S. Energy Information Administration (EIA). (Visit http://www.eia.doe.gov for more information) A data file created annually by EIA was obtained and included the necessary pertinent information on each individual refinery. Thus the data set was able to be filtered based on the MSAT regulation requirements. Once properly filtered, identification of affected parties, individual refineries in this case, were possible. According to the MSAT rule, all gasoline products produced at U.S. refineries or equivalent imports will be required to have an annual average benzene content of 0.62 percent volume or less by January 1, 2011. Further restrictions apply starting January 1, 2012 requiring that the actual benzene levels be no greater than 1.3 percent by volume. It is important to note that California gasoline standards already meet MSAT requirements through existing state regulation. Further, small refineries, defined as a maximum of 1500 employees at any time in 2005, and crude oil capacity less than or equal to 155,000 barrels per calendar day (bpcd) for 2005, are allowed an additional 4 years to comply with the new regulations.

With a current national benzene content around 1.0% vol, a majority of refineries must make operational changes or significant facility improvements in benzene control technology that result in real reductions. Approved methods to meet requirements are as follows:

- treating the heavy straight run naphtha entering the reformer using light naphtha splitting and/or isomerization,
- treating the reformate stream exiting the reformer using benzene extraction or benzene saturation,
- benzene alkylation,

- directing additional refinery streams to the reformer or treatment as described abovedirecting reformate streams to other refineries with treatment capabilities as described above, and
- not solely achieved through ethanol blending or to consider other alternatives, but can petition EPA for consideration of other means.

The industry-wide refining capital investment for refineries adopting a facility / technology response to the regulatory requirements as described above is estimated to be approximately $1,110 MM. With such significant capital investments, the E&C industry will have significant opportunities within a narrow window of time as Owner organizations bring their facilities into compliance with the new regulations. The simplest way to identify which refineries to target would be by the following decision tree depicted in Figure 1. While this strategic information is provided in mandatory pre-compliance reports starting June 1, 2008 and then annually captured through 2010, refinery-specific data submitted by refiners is deemed proprietary and not available to the public.

Due to this data constraint, the use of other government sources in public domain was pursued. The EPA's Summary and Analysis of the 2010 Gasoline Benzene Pre-Compliance Reports provides pertinent information based on Petroleum Administration for Defense Districts, which allow the identification of U.S. regions.

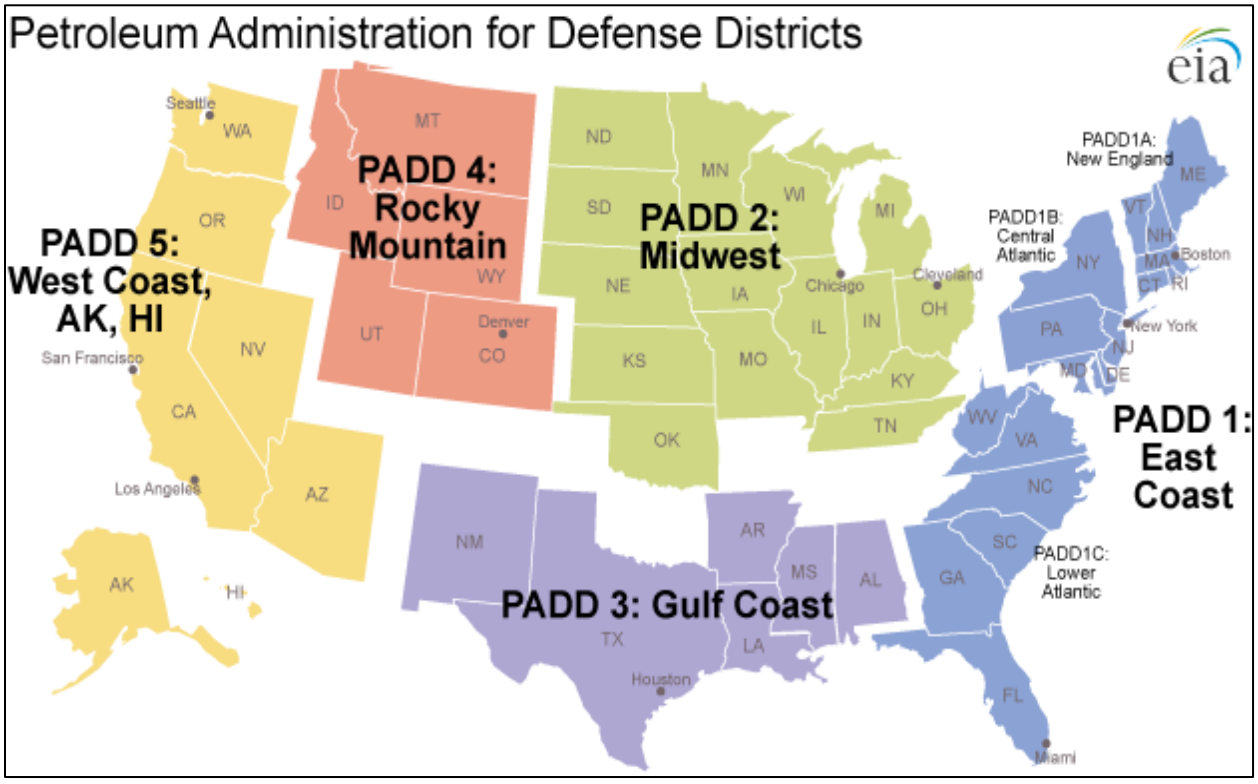

Figure 1: Geographical depiction of Petroleum Administration for Defense Districts
Source: (http://www.eia.gov/todayinenergy/detail.cfm?id=4890&src=email)

The aggregated data by PADD region can be used to rank regions of the U.S. by magnitude of noncompliance, thus where construction services are most warranted. In Table 1, average benzene content, number of noncompliant refineries, and production are listed by PADD yearly.

Table 1
Benzene Compliance Information by PADD

Year		2007	2008	2009	2010	2011	2012	2013	2014	2015
PADD 1	Benzene Content (%)	0.8	0.85	0.82	0.81	0.68	0.58	0.56	0.56	0.55
	# refineries > .62 vol%	10	9	9	9	6	4	3	3	1
	Production (bbls/day)	1,160,559	1,212,887	1,218,671	1,224,865	1,231,487	1,231,487	1,206,725	1,206,725	1,206,725
PADD 2	Benzene Content (%)	1.29	1.29	1.28	1.25	0.72	0.66	0.64	0.64	0.64
	# refineries > .62 vol%	20	20	20	20	10	9	8	8	8
	Production (bbls/day)	1,697,295	1,750,086	1,802,617	1,825,587	1,866,053	1,871,815	1,900,405	1,887,128	1,895,695
PADD 3	Benzene Content (%)	0.95	0.96	0.95	0.94	0.57	0.56	0.55	0.55	0.55
	# refineries > .62 vol%	35	34	34	32	14	14	13	14	13
	Production (bbls/day)	3,521,434	3,691,742	3,831,826	3,964,707	4,195,310	4,203,037	4,199,192	4,200,577	4,205,545
PADD 4	Benzene Content (%)	1.55	1.67	1.68	1.68	1	0.95	0.91	0.91	0.91
	# refineries > .62 vol%	11	11	11	11	6	6	6	6	6
	Production (bbls/day)	231,461	248,451	253,560	258,958	255,526	257,205	256,566	257,458	255,265
PADD 5	Benzene Content (%)	1.41	1.44	1.43	1.41	0.73	0.73	0.69	0.69	0.69
	# refineries > .62 vol%	12	14	14	14	19	19	19	19	19
	Production (bbls/day)	1,160,559	1,212,887	1,218,671	1,224,865	1,231,487	1,231,487	1,206,725	1,206,725	1,206,725

Source: (EPA, 2010)

The following results were gleaned from Table 1.

- PADD 4 refiners are projected to require the most assistance from the credit program or involve capital expenditures but few refiners involved at lowest production numbers.
- PADD 3 has highest number of refineries and production numbers, yet will be in compliance.
- PADD 5 will also be dependent on credits or require capital expenditures. Note: this actually only involves the state of Washington, since California is currently in compliance.
- PADD 2 has second highest number of refineries that will rely on credits.
- PADD 1 has fewest noncompliant refineries.

With regions to target now known, the discovery of actual refinery location was pursued. EIA publishes an annual report on refinery processing capacity including the following pertinent data:

- Corporation
- Company Name
- State
- Site
- PADD
- Product
- Supply

- Quantity

This data can be filtered according to PADD district to allow for the gained knowledge gathered above to be overlaid. The product column provides further insight into what methods are currently in use at a refinery. If aromatics are an existing product line at a refinery, then benzene is already being captured and compliance is most likely being met. The additional filtering according to product type further reduces the refineries to target. Product information also will allow the identification of approved EPA technologies to be matched on a per refinery basis. Ultimately, this all leads to the creation of a list of refineries appropriate to be targeted by the construction industry as new business development.

Table 2
EIA Refinery Sample Data

Corporation	Company	State	Site	PADD	Product	Supply	Quantity
Age Refining and Marketing Inc.	Age Refining Inc.	Texas	San Antonio	3	CAT Reforming: high Pressure	Downstream Charge Capacity, Current Year (barrels per stream day)	6000
Age Refining and Marketing Inc.	Age Refining Inc.	Texas	San Antonio	3	Desulfurization, Diesel Fuel	Downstream Charge Capacity, Current Year (barrels per stream day)	6000
Age Refining and Marketing Inc.	Age Refining Inc.	Texas	San Antonio	3	Desulfurization, Naptha/ Reformer Feed	Downstream Charge Capacity, Current Year (barrels per stream day)	6000
Age Refining and Marketing Inc.	Age Refining Inc.	Texas	San Antonio	3	Total Operable Capacity	Atmospheric Crude Distillation Capacity (barrels per stream day)	14500

Source: (EIA, 2011)

Conclusions

Persistent and ever-changing energy and environmental policies and legislation are key drivers shaping global construction demand. Federal- or national-level legislation will remain a key driver to market demand, and therefore can often be a leading indicator of construction/engineering opportunities within particular industries. Although ideally, these opportunities are open to any construction companies wishing to explore the new territories, but it has to be realized that there is a huge entry-barrier for companies who are not familiar with these highly specialized construction/installation jobs and for those companies that do not have any working relationship with the clients in these industrial/petroleum refinery sector. This paper with the aid of a case study, illustrated the challenges faced by U.S. refineries to meet the new benzene content levels in gasoline recently mandated in an EPA regulation. Although this paper focused on business opportunities pertinent to an oil refinery industry, engineering and construction firms can use the insights presented in this paper to proactively define a strategic response appropriate for their marketplace.

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