Deriving Competitive Advantage from Environmental Regulations

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Abstract

Stringent environmental regulations can be a source of competitive advantage for firms with advanced technologies, superior management, or cost efficiencies. A firm may make the strategic choice to introduce a more costly yet environmentally higher-performing technology in anticipation of future environmental regulation, which will add value to its investment. Such a first-mover firm can actively influence environmental regulation because government regulators use evidence of the technical and cost feasibility of existing or developing technologies to set future standards. Instead of opposing or waiting passively for the next set of standards, first-mover firms compete based on their demonstration of higher environmental performance, while the public benefits from higher environmental quality.

This paper presents two cases from the heavily regulated auto and fuel industries, where first-mover firms introduced cleaner technologies – diesel particulate filters and ultra-low sulfur diesel fuel – ahead of environmental requirements. Documentary research and semi-structured interviews indicate that firm characteristics, industrial structure, industry associations, NGO and public awareness, and regulatory receptiveness have significant impact on first-mover behavior and regulatory influence.

Introduction

Environmental regulations have traditionally been perceived as limiting innovation and economic growth. Encumbered with significant compliance costs, firms in countries with stringent environmental standards may have difficulty competing in international markets. In the U.S., the economic slowdown and productivity decline in the 1970s led some economists to speculate that environmental regulations were partially responsible (Jaffe et al., 1995).

Some companies, instead of viewing environmental regulations as a costly business constraint, were taking advantage of the opportunities to provide new products and services to the regulated industries. As a result, environmental regulations around the world have created a $550 billion global market for environmental technologies and services (EC, 2002). Because the environmental technology industry thrives on pressure to improve performance and lower costs, progressively more stringent regulations are a prerequisite for further investment and innovation.

Beginning in the 1990s, regulated firms began to realize that environmental protection could actually improve their bottom line. Harvard economist Michael Porter's "revisionist" view asserted that environmental regulations would improve firm efficiency and improve national competitiveness (Porter, 1991). Countries adopting higher standards would spur innovation, and give their domestic firms a technological edge over firms in countries slower to adopt the standards. Porter argues that incomplete information and organizational problems hinder profit-maximizing behavior. Regulations offer an impetus for firms to discover and implement more resource-efficient and cost-saving opportunities. Theoretically, environmental regulations can produce "win-win" outcomes for the regulated firm and the environment (Porter, 1991; Porter & Linde, 1995). David Vogel argues that the business case for improved social and environmental performance is usually not strong enough to persuade firms to voluntarily behave more responsibly. Because "win-win" scenarios are not commonplace and most improvements are costly, government regulation is often the only way to motivate higher environmental quality (Vogel, 2005).

The "win-win" theories of Porter and his supporters were heavily criticized by neoclassical economists, who argued that any cost-saving innovation offsets are eclipsed by the opportunity cost of R&D investment and management effort (Jaffe, Newell, & Stavins, 2000). Despite their differences, the neoclassical economists and Porter's adherents agree that market incentive-based, rather than conventional command-and-control regulation, would be most likely to promote innovation. Both treat environmental regulations as exogenous, with national or regional governments setting standards to be met by firms. Firms are assumed to behave as "regulation-takers," when in reality, they influence the stringency of regulations.

The endogeneity of technology development in the regulatory process offers a strategic opportunity to firms which seek competitive advantage from environmental regulations. In regulatory environments where increasing levels of stringency are anticipated but not yet established, firms' progress towards cleaner technologies affects the standards set by regulators. Regulatory agencies routinely conduct technology assessments and request data from firms on the performance of existing and developing technologies. A first-mover firm that demonstrates a high-performing technology and supports more stringent regulation may influence the stringency of future regulation. For example, consider an existing regulation which sets the maximum limit for a pollutant at 100 parts per million (ppm). If a manufacturer demonstrates a new cost-effective technology that gets pollution levels down to 10 ppm, regulators may consider lowering the maximum limit to a level attainable only by the new technology. The manufacturer benefits from the first-mover advantage, with potential gains in market share and reputation as a clean technology leader. This behavior would be considered a "competitive regulatory strategy." Firms compete based on their ability to advance technology beyond regulatory requirements and successfully leverage this technological advantage through support for more stringent regulations (Preston, 2001; Vaitilingam, 1993).

The environmental technology sector, which provides services and products to regulated industries, would be expected to support more stringent regulations because they can sell more products. Adopting a competitive regulatory strategy would be less common for regulated industries, which bear the cost burden of new regulations. They are likely to oppose additional regulations; a firm supporting greater stringency would be an outlier. However, a firm with substantial cost, scale, or scope economies may employ a competitive regulatory strategy if the proposed regulation raises its rivals' costs disproportionately more. The first-mover firm's voluntary introduction of a high-quality technology signals to the regulators that the technology adoption is feasible. The regulator, whose mission is to improve environmental quality, is prompted to mandate the new technology, or its performance equivalent, for the entire industry (Lyon & Maxwell, 2004). Moreover, the first-mover firm may ally itself with environmentalists and obtain reputation and financial gains over its competitors as it presses for more stringent regulations. Higher standards may ultimately prevail across multiple national markets as high-performing firms and countries see the benefit of harmonizing standards upward (Vogel & Kagan, 2002).

A first-mover firm's motivation may range from predatory to defensive. Standards can also create as a barrier to entry for new firms, or a means to squeeze inefficient or technologically laggard firms out of the market altogether (Klassen & McLaughlin, 1996). Supporting more stringent regulations may also be a way to appease criticisms from the public or environmental NGOs, enhance their environmental reputation, and attract environmental conscious customers (Lyon & Maxwell, 1999; Madu, 1996). The uncertainty of future regulations may prompt firms to support an achievable standard in the hopes of preempting an even more stringent standard. Lyon and Maxwell (2004) find that the environmental leader's "quality choice" may actually be lower than it would be if the government set the standard first. However, this assumes that powerful industry opposition to new regulation would not delay or restrict the implementation of proposed standards.

Companies already compete aggressively on attributes such as cost, quality, and technological performance. Since environmental protection is a public good that is undervalued by individual consumers, regulations are a means of giving it a value, by rewarding compliant companies with market opportunities. Competitive regulatory strategies recognize that environmental performance is a desirable product attribute whose value can be increased through regulation. They are an alternative to the more common scenario of an entire industry opposing additional regulation. Under these strategies, some firms will do better than others, depending on their preparedness to adapt to more stringent standards. Meanwhile, cleaner technologies will benefit the public in the form of environmental improvements.

There are legitimate concerns about the risk of competitive regulatory strategies operating as a thinly veiled form of rent-seeking by firms. Rent-seeking occurs when a firm tries to obtain special economic favors or rents from the regulator to the detriment of public interest. These "rents" could come in the form of regulations that would benefit a specific firm or industry. A company wanting to increase demand for its product or technology through regulation would need to credibly convince government regulators that any environmental standards proposed would improve public welfare (Aplin & Hegarty, 1980; Reinhardt, 1999; Winter & May, 2002). Validation by outside groups would lend credibility to a firm's regulatory strategy. This could come in the form of support by well-respected NGOs and citizens' groups, or corroborating evidence from an independent institution, such as a research lab or university. Instead of the common situation of an entire industry opposing additional regulations and receiving criticism from NGOs, a first-mover company or subset of companies stands to gain the respect and praise of the environmental community.

The diesel vehicle and fuel sectors are a particularly interesting source of cases to understand how competitive regulatory strategies work because of the inevitability of increasing regulatory stringency and technology investments. National regulatory and market differences build variation into the single-company cases. The rest of the paper focuses on two cases from those sectors – the introduction of the diesel particulate filter by Peugeot Citroën (PSA) and the introduction of ultra-low sulfur diesel by British Petroleum (BP). They were identified through earlier research into companies that voluntarily adopted technologies ahead of regulatory requirements. The technology introductions influenced future regulations and resulted in the diffusion of the technology, and its associated environmental benefits, through the rest of the industry.

Information sources

A variety of publicly available documentary sources were used to develop the case studies. National and local newspapers, industry publications, press releases, company reports, patent databases, research reports, and regulatory rulemaking documents were used to gather information about companies' technologies and business strategies and governments' regulatory decisions. Periodicals are available through the searchable Lexis-Nexis Academic Universe database; company, trade association, and interest group websites contain press releases and reports; regulatory agencies maintain rulemaking documents as well as supporting technical submissions. From these documentary sources, key individuals involved in each case were identified and contacted about participating in phone or in-person interviews. They were asked about their involvement in the case, their organization's motivation for specific technology or regulatory decisions, and their perspective on first-mover advantages, industry competition, interest group pressure, and regulatory incentives.

Case 1: PSA and the diesel particulate filter

In the 1990s, Europe experienced a boom in the sales of diesel passenger cars. Diesels' share of new passenger cars rose steadily from 13.8% in 1990 to 47.5% in 2004. New car sales in Austria, Belgium, and France are approaching 70% diesels (ACEA, 2004). The combination of the diesel car's greater fuel efficiency, high fuel taxes, and differential taxes favoring diesel has spurred diesel demand. Volkswagen, DaimlerChrysler, Renault and PSA Peugeot Citroen sell more diesel than gasoline vehicles (Lewis, 2004).

The rise in diesel's popularity in Europe has brought it under greater scrutiny by health and environmental groups concerned about the detrimental health effects of diesel particulates. Diesel cars run more efficiently, and therefore emit less carbon dioxide, carbon monoxide, and hydrocarbons. However, they emit more particulate matter (PM) and nitrogen oxides (NOx) than their gasoline counterparts. NOx emissions contribute to acid rain and smog formation, which causes respiratory and cardiovascular ailments. There is mounting evidence from the medical community that diesel particulates are associated with cancer, cardiovascular problems, and premature death. Even though the total mass of PM emitted by diesel engines has decreased, studies show that the ultrafine particles – those most damaging to the lungs – may have increased in quantity (HEI, 2005).

Passenger cars are subject to emission limits imposed by the European Union, under Directive 70/220/EEC. By 2000, diesel cars were expected to meet Euro 3 standards, which set a NOx limit of 0.50 g/km and a PM limit of 0.05 g/km. At that time, Euro 4 standards, which called for half the NOx and PM emissions allowed under Euro 3, had already been finalized for 2005. Some countries, such as the UK and Germany, began to offer tax incentives or registration fee reductions to customers who purchased vehicles meeting the Euro 4 standards early. Euro 5 standards for 2008 had not yet been established.

It was expected that the stringency of the Euro 4 PM standard would require diesel particulate filters (DPFs), but in the early 2000s, some manufacturers met the standard without a filter. Filters trap particles in the engine exhaust, before they exit the tailpipe. Various auto companies and emission control manufacturers continued to develop filter technology in anticipation of one day needing it to meet more stringent PM regulations.

PSA Peugeot Citroen, a French automaker, had been developing filter technologies at a small scale starting in the mid-1990s. Jean-Martin Folz, who became CEO in 1997, led a restructuring effort in early 1998 (Farhi, 2000). The new management board pushed environmental issues to the forefront, and began to consider the introduction of DPFs as a strategic decision. Because of PSA's focus on small and medium diesel cars, growing attention to the health impacts of diesels threatened to dampen diesels' popularity and erode PSA's future market share. From 1994 to 1996, the diesel market share in France, Germany, and UK actually dropped, attributed largely to concerns about diesel exhaust's health effects (ACEA, 2004).

In the late 1990s, Folz put pressure on PSA engineers to develop filters for introduction. By April 1999, PSA announced its plan to offer its new diesel particulate filter system as standard in its Peugeot 607 model by May 2000. According to PSA, the system took 18 months and €66 million to develop. Over the next three years, it introduced the system as standard on six more Peugeot and Citroën models (PSA, 2000-2004).

The effectiveness of the filter system was further validated by a third party study published in August 2001. PSA provided Germany's environmental agency (Umweltbundesamt, or UBA) and the German Auto Club with a filter-equipped Peugeot 607 diesel car for a testing project. Durability testing demonstrated that the filter had a 99.999% efficiency in removing fine diesel particles from the exhaust tailpipe. The diesel car emitted 0.001g of PM per km over an 80,000-km distance, which is 25 times lower than the level required by the 2005 Euro 4 standard (Rodt, 2003).

Following the public announcement of the new filter system's effectiveness, health and environmental NGOs seized upon PSA's filter introduction to criticize other auto manufacturers for not adopting filters. In Germany, where environmental awareness is particularly strong, an alliance of organizations – health insurance companies, the auto club, environmental organizations, children's groups, travel/transport agencies, and health groups – launched a coordinated "shame campaign" in November 2002, aimed at German automakers (VW, DaimlerChrysler, BMW) which did not offer filter-equipped diesel cars. With the tagline, "No Diesel without Filter," the campaign called for a government mandate requiring filters on all diesel cars, while commending PSA for already voluntarily equipping six of their car models with filters (Peckham, 2003a).

The "No Diesel without Filter" alliance held press conferences and issued press releases to build awareness about the value of filters on diesel cars. Their dramatic public displays garnered mainstream media attention. Posters depicted people wearing T-shirts printed with their "dirty" hearts, soiled from breathing diesel exhaust. Television news showed campaign leaders holding a soiled cloth next to an unfiltered tailpipe and a clean white sheet next to a filtered tailpipe. The activists specifically targeted individual companies, especially VW, which holds the largest passenger car market share in Germany. They projected a giant “Diesel Causes Cancer” slide on VW’s headquarters and used costumed protesters to deter customers at VW dealerships (Peckham, 2003a). The campaign had a dramatic effect in Germany. A 2003 consumer awareness survey showed that 93% of Germans surveyed were familiar with diesel particulate filters (PSA, 2005a). Although PSA did not fund the alliance’s activities and made a concerted effort to keep its marketing activities separate, it was definitely a beneficiary of the campaign.

Government interest in the campaign was strong. UBA (the German environmental agency which supports the Environment Ministry) and the World Health Organization were partners in the alliance. Their presence at the campaign’s press events and fact-filled presentations about diesel particulate filters lent credibility to the more activist portion of the campaign. German Environment Minister Juergin Trittin called for the voluntary adoption of filters and floated the proposal for a €600 tax break for filter-equipped diesels.

The alliance placed pressure on individual companies to offer filters, offering to help publicize a company’s filter adoption, even if it only offered the filter in one model. In 2003, other companies, such as Fiat, Ford, Toyota, Renault, and Opel began promising to offer filters in some of their diesel models, but the German auto companies – VW, BMW, and Mercedes – stood firm in refusing the filter option. VDA, the German auto association, challenged the durability of PSA’s filter technology, pointing out the first-generation filter’s inability to meet the Euro 4 NOx standards, and emphasized the uncertainties of diesel exhaust’s health effects. VDA lobbied hard against the government’s proposed €600 filter incentives. VDA claimed that such an incentive would give an unfair advantage to foreign manufacturers who had already chosen to adopt filters. Many of their models already met Euro 4 standards early, and they were likely frustrated that public attention had shifted from their early Euro 4 compliance to a demand for filters, which VDA viewed as a costly and inelegant technical solution. Manufacturers claimed that the filters would add €300-800 to their vehicle prices, while the UBA estimated the real additional costs to be €150-300 (Rodt, 2003).

Besides concern about environmental protection, customers purchased filter-equipped cars for economic reasons. Some were worried about the faster depreciation of a car without a filter. Customers anticipated that tax incentives would eventually be offered. Also, some cities proposed limiting inner city access to all diesel cars, unless they were equipped with a filter.

Impact on regulation

The “No Diesel without Filter” campaign and customer and government pressure for filter options eventually led the German automakers to reconsider their position on filters. By summer 2003, German manufacturers announced their plans to offer filter options in 2004 models. However, unlike PSA, they initially planned to offer the filters for an additional €600-700. This was usually counterbalanced by the existing reductions in registration taxes, up to €614 less, for Euro 4-compliant cars. German manufacturers still objected to the proposed filter-specific tax incentive (Peckham, 2003b).

The attractiveness of the diesel particulate filter as an effective emissions-reducing technology created tension within the German government. Environment Minister Trittin supported a €600 tax incentive for cars with PM levels below 2.5 mg/km, a level attainable only through filters. On the other hand, Finance Minister Hans Eichel openly criticized the proposed tax incentive. Concerned about the competitiveness of the German auto industry, he claimed that the incentive served as an incentive to foreign firms (i.e., PSA, Renault, Fiat) that had already adopted the filters (T&E Bulletin, Aug/Sep 2004). Prime Minister Gerhard Schroeder brokered a compromise in a series of meetings with German automakers. They promised that by 2009, all their diesel models would have filters. New cars meeting the 8.5 mg/km limit between 2005 and 2009 would receive a €600 euro tax break. In February 2005, disagreement among the Environmental and Finance Ministries were resolved, and the German government agreed to offer the tax break starting January 2006 (AFX, 2005).

PSA's early introduction of filter-equipped diesels spurred widespread industry adoption of filters and prompted discussion of more stringent emission standards at the EU level. Since 2003, the German and French environmental agencies have been pressuring the European Commission to adopt a stricter Euro 5 PM standard as low as 0.025 mg/km (Peckham, 2003a, 2003b). Before the Euro 5 emission standards were set, the European Commission issued a document in January 2005, entitled, "Fiscal Incentives for Motor Vehicles in Advance of Euro 5." It suggests that Member States base their fiscal incentives for diesel passenger cars on a PM limit value of 5 mg/km and acknowledges that this value can currently be reached by particulate filters only (EC, 2005). Even though Euro 5 requirements may have ultimately necessitated filters, PSA's early action mobilized by interest groups and government officials and accelerated the adoption of the technology.

Private benefits

PSA posted strong sales following the debut of its first filter-equipped model. In Germany, its passenger car market share grew steadily from 4.5% in 2000 to 5.8% in 2003; in Western Europe, its market share increased from 13.1% in 2000 to 14.8% in 2003. PSA executives are hesitant to attribute any quantifiable financial benefits from their early filter introduction, because it is difficult to separate out the impact of the popularity of their new car models and the restructuring of their sales and distribution system. However, praise from environmental groups and government agencies undoubtedly boosted PSA's reputation. Because of its particulate filter, PSA has won numerous awards from environmental groups, automobile clubs, and auto enthusiast magazines in France, Germany, Italy, UK, and Austria (PSA, 2000-2004, 2005a).

By being the first to embrace DPF technology, PSA generated enthusiasm about filters from government agencies and the environmental community, and put its competitors at a disadvantage when filters became popular. Not only did PSA receive free publicity, but it got a head start on technology development. Even before German manufacturers had their filters ready, PSA had sold 500,000 filter-equipped cars by mid-2003. By February 2005, PSA sold its one millionth filter-equipped diesel, each emitting only 1 mg/km PM, 25 times less than the mandated Euro 4 PM levels. PSA's filter supplier, Faurecia, a PSA subsidiary, held onto a 60% of the filter market in 2004 as other manufacturers also used its filter technology to equip their cars (PSA, 2005a).

Case 2: BP and Clean Fuels

Lowering the level of sulfur in petroleum-based fuels offers direct and indirect benefits to air quality. Less sulfur means fewer fine particulates, which contribute to respiratory ailments and cancer, and fewer sulfur oxides, which contribute to acid rain. Lower sulfur fuel also improves the effectiveness of emission control equipment. For example, the catalysts used to convert pollutants into less harmful substances can be irreversibly "poisoned" by fuels with sulfur levels as low as 50 ppm. Using ultra-low sulfur diesel (below 15 ppm) alone can reduce particulate emissions by 10%, while coupling it with a particulate filter can reduce particulate, hydrocarbon, and carbon monoxide emissions by 90% (BP, 2005).

Despite the well-recognized benefits of sulfur removal, the high costs for the refineries have been a deterrent to desulphurization. Engine and auto manufacturers have a clear incentive to promote lower-sulfur fuels. Near zero-sulfur levels gives them more options in emission control strategies, instead of restricting them to sulfur-resistant technologies. Since 1998, an international coalition of engine and auto manufacturers has supported a Worldwide Fuel Charter calling for a maximum sulfur level of 5-10 ppm for both gasoline and diesel fuels, very low compared to the levels mandated for 2000 (ACEA, Alliance, EMA, & JAMA, 2002).

Fuel Sulfur Levels as of 2000

	Diesel	Gasoline
EU	350 ppm (max)	150 ppm (max)
US	500 ppm (max) / 350 (avg)	1000 ppm (max) / 330 ppm (avg)

Source: (EIA-DOE, 2005)

Although the oil industry in the US and EU recognized the need for low sulfur fuels, it was concerned about the large investment costs and the impact on retail prices. The American Petroleum Industry (API) and Europia, the trade associations representing oil companies in the US and EU, supported a more gradual introduction of the fuels, with longer deadlines and smaller reductions. They questioned the air quality benefits of sulfur levels below 50 ppm, asserting that the high costs did not justify the benefits and that more studies should be done (Automotive Environment Analyst, 1998b; EUROPIA/CONCAWE, 2000). At the heart of this debate was deciding which industry would bear the brunt of the pollution control costs – the oil industry wanted the auto industry to clean up its engines and the auto industry wanted the oil industry to clean up its fuels.

European introduction

Recognizing the health and environmental benefits of sulfur reduction, the European Commission approved a 1998 directive which required maximum gasoline and diesel fuel sulfur levels of 50 ppm by 2005. Individual member states could offer fiscal incentives to encourage early production. Because Sweden and Finland had offered lower tax rates on lower sulfur fuels in the early 1990s, they already had full adoption of ultra-low sulfur fuel by this time. Several other countries, such as the UK, Germany, and Denmark, also employed differential tax rates to accelerate adoption. Prime Minister Gordon Brown of the UK offered a 1 pence per liter tax reduction on ultra-low sulfur fuels in 1997, followed by a 2 pence reduction in 1998, and then a 3 pence reduction in 1999 (Olivastri & Williamson, 2000).

These tax differentials prompted two large UK supermarket chains, Sainsbury and Tesco, which also sell motor fuel, to purchase low sulfur "city diesel" from energy supplier Greenergy and sell it at no additional cost to the consumer. Environmental NGOs criticized the major energy producers, British-based firms BP and Shell in particular, for not following suit (Boulton, 1998). The firms responded that the 1-pence duty differential was inadequate to cover the estimated additional 3 pence per liter cost of producing ultra-low sulfur fuel. Greenergy continued to sell to supermarkets and fleets, but once the duty differential rose to 3 pence per liter in 1999, the large energy producers reconsidered their decisions (Automotive Environment Analyst, 1998a)

In 1999, British Petroleum (BP) began marketing gasoline and diesel fuels with sulfur levels below 50 ppm. Its Clean Cities Programme promised to voluntarily provide cleaner fuel to 40 cities by 2000. In its home market in the UK, BP quickly introduced its new "BP Greener Diesel" to all its retail sites, making it the first energy producer to sell ultra-low sulfur diesel nationwide at no additional cost to the consumer. By the end of 2000, BP had cleaner fuels available in 59 cities and in 110 cities by the end of 2001(BP, 2005). In countries like the UK, Denmark, and Germany, lower tax rates on ultra-low sulfur fuels offset the higher production cost and encouraged 100% penetration of the new fuels, well ahead of the 2005 deadline. BP introduced the clean fuels in France, which did not offer tax incentives. The company proceeded to actively lobby the French government, albeit unsuccessfully, for clean fuel incentives (Europe Environment, 2002). France's lack of incentives has inhibited the widespread introduction of low sulfur fuels.

Europia, the European oil industry association, was very resistant to accelerating the reduction in sulfur levels through financial incentives. It argued that when one company switches to ultra-low sulfur fuel, others will be pressured to follow, disrupting industrial structure and disadvantaging smaller producers (FT Energy Newsletters, 2001). BP has done exactly that, and other large oil companies have followed suit. The new fuel requirements have led to industry restructuring. Already in a market suffering from overcapacity problems, refineries, some European refineries have found it more feasible to close rather than upgrade (Knott, 1998).

As the world's second largest publicly traded oil company after ExxonMobil, BP benefited from scale economies in producing ultra-low sulfur fuels, and used its political clout to push for tax incentives in more countries. BP deviated from the mainstream Europia position. While its competitors eventually reduced sulfur levels in their fuels, BP took advantage of learning from early investment and positive publicity from regulators, the media, and environmental groups. BP has also been able to leverage its global presence and introduce ultra-low sulfur fuels in other markets, such as Australia and the US, which will be discussed later. While Greenergy was the first to supply ultra-low sulfur fuels to the UK market, their small size and limited geographical reach did not attract the same type of attention that BP received for being the first-mover of the large energy producers.

US introduction

Unlike Europe, where diesel-powered cars are increasingly making up the majority of new car sales, the US passenger car fleet is predominantly gasoline-powered. On-road diesel fuel is used primarily to power buses and trucks. In the 1990s, research studies on the detrimental health impacts of diesel exhaust galvanized U.S. environmental officials to take stronger action on diesel emissions. California, arguably the most environmentally progressive state in the US, designated diesel particulate matter as a toxic air contaminant in 1998. This designation initiated a formal state plan to reduce diesel emissions, and threatened to decrease the demand for diesel fuel. States unable to meet their ambient air quality standards for ozone, particulate matter, and other pollutants are expected to adopt more stringent measures to reach attainment levels, or risk losing federal highway funding. In response to these pressures, state regulators passed more stringent vehicle emission standards and offered fiscal incentives for municipal and school bus fleets to purchase compressed natural gas (CNG) vehicles as an alternative to diesel-powered vehicles (EESI, 2005).

In the late 1990s, federal regulators were focusing on new gasoline standards, and did not plan to address new diesel sulfur levels until 1999-2000. There was the expectation that the required diesel sulfur levels would be reduced dramatically, but the numerical standard – be it 15 ppm, 30 ppm, 50 ppm – had not yet been established. Meanwhile, many large metropolitan areas began requiring retrofits and ULSD for their diesel-powered public buses. For example, the California Air Resources Board mandated that by July 2002, all of its urban bus fleets had to run on ULSD (CARB, 2000).

ARCO, a California-based energy company acquired by BP in 1999, responded to the growing public and regulatory attention to diesel emission control. Concerned about diesel fuel losing market share to CNG, ARCO sought to demonstrate emission reductions enabled by cleaner diesel fuel. In 1999, it began providing ultra-low sulfur diesel to municipal fleets in selected California cities for an additional 5 cents per gallon. In large metropolitan areas with serious air quality problems, government air quality and transit agencies provided subsidies to cover the costs of retrofits and ULSD. Unlike the UK or other European countries, the US did not have federal tax incentives which made the ULSD cost comparative to regular diesel fuel. These different incentive schemes changed BP's sales and distribution strategy in the US.

Rather than introducing ULSD throughout its retail stations, BP chose a more targeted sales approach and sold limited quantities directly to urban municipal or school district fleets. BP entered in direct contracts with the fleets, predominantly providing ULSD to retrofitted school and urban buses. For many cities, the combination of ULSD and new or retrofitted clean diesel buses proved to be more cost-effective than CNG buses. For instance, the Cleveland Regional Transit Authority chose diesel over CNG after estimating that a diesel bus running on ULSD would cost $419,000 to operate over its average 12-year lifespan, compared to $550,000 for a CNG bus (Bennett, 2002). As a result of the publicity generated from successful local projects across the US, BP entered into numerous ULSD contracts with local fleet operators.

BP's early introduction of ULSD and its collaborative efforts with regulators, engine and bus manufacturers, and emission control manufacturers did not escape the attention of state and federal environmental officials. The California Air Resources Board used the initial results of diesel retrofit demonstration projects involving ARCO's ULSD to shape its 2000 public transit bus fleet rule. The dramatic emission reductions – 91-99% reduction in particulate matter – prompted regulators to treat retrofitted or new clean diesel buses running on ULSD as an equivalent option alongside CNG vehicles (CARB, 1999). Interim reports of diesel retrofit projects involving BP's ULSD fuel were reviewed by regulators as they finalized diesel fuel sulfur standards for 2006.

In feedback to the proposed diesel sulfur rule, BP set itself apart from other oil companies. BP publicly supported EPA's proposed diesel sulfur cap of 15 ppm, while the majority of the oil industry supported a less stringent counter-proposal of 50 ppm maximum/30 ppm average. The American Petroleum Industry (API) and the National Petrochemical and Refiners Association (NPRA) questioned the alleged air quality benefits and scientific rationale behind the sulfur rule (EPA, 2000). In response to the oil industry's complaints prior to the rule's finalization, EPA cited BP/ARCO's early introduction of 15 ppm ULSD in California as evidence of technological and cost feasibility. The final rule requires at least 80% of the diesel fuel supply to have a maximum 15 ppm sulfur content. The timing of the compliance deadline was another subject of debate. EPA initially proposed a June 1, 2006 full retail compliance date. Desiring more time because of the transition from winter to summer gasoline, API recommended a January 1, 2007 deadline, while BP recommended a September 1, 2006 retail deadline. Ultimately, EPA finalized the rule with a September 1, 2006 retail deadline (EPA, 2000).

Lessons learned from the cases

The two cases offer important insights about the factors important to motivating firms to act as first-movers and to gaining competitive advantage from their strategies. Several characteristics stand out from the cases as significant – firm characteristics, industrial structure, industry associations, NGO and public awareness, and regulatory receptiveness.

Firm characteristics

Commitment to proactive environmental strategies at the highest level of management was critical to both cases. Prior to the start of Jean-Martin Folz's tenure as CEO of PSA in 1997, PSA was not known as a particularly environmentally conscious automobile company. Instead, PSA had a reputation of an environmental laggard in the late 1980s. Environmental groups criticized and boycotted PSA for being a strong opponent of the adoption of the catalytic converter, even as other companies already had installed it in their vehicles (Wurzel, 2002). The new PSA senior management in the late 1990s placed environmental protection high on the agenda, and this contributed to the decision to introduce filters.

Lord John Browne, who has been CEO of British Petroleum since 1995, has been very vocal about BP's commitment to social and environmental responsibility. In 1997, Browne became the first oil industry CEO to acknowledge the human influence on climate change. This move was a radical break from others in the oil industry, who expressed skepticism in climate change science. BP also pursued its own company-wide greenhouse gas emission reduction plan. The production and sale of cleaner fuels fall in line with BP's effort to be recognized as an environmental leader.

Because both firms adopted cleaner technologies that are more costly than the products that they replace, scale economies were important in making their decision economically feasible. PSA eventually installed the same filter system in nine of their diesel models, spreading the €66 million in initial R&D costs across the over 1 million cars sold thus far. By the time that other companies were announcing their filter introductions, PSA already had its third generation of filters on its cars. BP used its size and brand as the second largest oil company to market ultra-low sulfur fuels. It was more able to afford refinery upgrades than small, independent refiners. In the mid-1990s, BP made upgrade investments at its refinery at Grangemouth, Scotland, in anticipation of more stringent fuel requirements (McCrone, 1999). BP was by no means the first in Europe or US to produce ultra-low sulfur fuel. The UK supermarkets sold ULSD purchased from Greenergy, and Philips Petroleum and Chevron began marketing ultra-low sulfur fuels in the US a few months before BP did. However, BP was the first to offer it in multiple retail markets, and in the case of the UK, across all its retail stations.

Industrial structure

The auto and oil industries are both heavily regulated oligopolies. Since they are comprised mostly of large highly competitive companies, an individual company's technology decisions have a powerful impact on the rest of the industry. When one company steps forward to demonstrate the merits of their new cleaner technology, it gives regulators confidence that greater emission reduction is technologically feasible. The R&D and capital investments needed for regulatory compliance are often very sizable, so only the largest firms may survive in the face of greater regulatory stringency.

PSA and BP are in industries where more stringent regulations are inevitable. When PSA was working on its filter system in the late 1990s, it was expected that PM levels would be increasingly lowered for the upcoming Euro 4 and Euro 5 standards. PSA was willing to commit to such a large investment upfront because the management expected regulations to necessitate the filter system at some point down the road. BP began upgrading its refineries in the US and Europe in the mid-1990s, readying them with the equipment and processes necessary to produce ultra-low sulfur fuels. Both companies knew that ultimately their competitors would have to adopt similar technologies to meet future standards, and they made a head start before the standards were finalized.

Industry associations

Industry associations aim to reach consensus on regulatory issues, so it is unusual for a member firm to maintain a separate regulatory position. Typically, a regulated industry resists additional environmental regulation, so tension arises when one firm or a subset of firms in the industry adopts a technology or stance that is inconsistent with the industry view. PSA and BP took approaches in direct opposition to their industry peers. After PSA introduced its filter system, the German automakers publicly criticized PSA's system. However, PSA's strong reputation as a diesel technology leader and its status as an outsider to the tight-knit German auto association, VDA, allowed it to pursue its own strategy without consideration of the German companies. According to a German environmental official, it would have been virtually impossible for a German company to do the same thing if it did not have agreement with the other German automakers.

BP's size and clout made it easier to stand apart from its industry associations which advocated a more gradual reduction of diesel sulfur. However, the rift between BP and the rest of the oil industry, with the exception of Shell, was greater in the U.S. There are three possible explanations for this. First, the relationship between regulators and regulated industries is much more contentious in the US than in Europe, where the political climate is perceived as more conducive to cooperation and negotiation. Secondly, the sulfur reduction in the US was much more dramatic, going from 500 ppm to 15 ppm, while Europe went from 350 ppm to 50 ppm to 10 ppm, so the required capital investments were much more costly, an economic threat to older and smaller refineries. Lastly, in the U.S., the fuel sulfur reduction came as a mandate, while the EU encouraged early introduction with tax incentives.

NGO and public awareness

In the 1990s, an increasing number of reports about the detrimental health effects of diesel exhaust were released in medical journals. Environmental groups led campaigns calling for more stringent diesel standards, and in the extreme case, the banning of diesel vehicles for public bus fleets. Negative publicity on diesels threatened PSA's market share, because a majority of their sales is small and medium-sized diesel passenger cars. Their installation of their filter system on their diesel models was a means to counteract this negativity.

In Europe, BP had also been criticized by environmental groups for not introducing ultra-low sulfur fuels when supermarkets were already marketing cleaner fuels. The oil industry also faced increasing pressure from auto and truck manufacturers to supply cleaner fuel formulations to accommodate advanced emission control technologies. PSA and BP introduced their cleaner technologies in reaction to these external pressures.

After PSA and BP ushered in their new products with technology demonstrations and publicity campaigns, they received attention and praise from environmental groups and regulators. This public affirmation pressured other groups to adopt similar technologies. Ford, Renault, Fiat, and Opel ultimately announced their plans to adopt filter technology after PSA's demonstration. Shell was soon to follow BP's lead on ULSD.

Regulatory receptiveness

Although regulatory agencies are inherently receptive of environmental leaders who voluntarily adopt cleaner technologies, some government agencies are more enthusiastic than others, giving positive publicity for the firm and even proposing fiscal incentives for surpassing existing standards. Regulatory receptiveness of first-mover behavior gives extra encouragement to firms who seek benefits for investing in more costly technology.

Germany has a reputation for being very progressive on environmental issues. Its citizens seek out “green” products, and its government has a long history using environmental taxes and incentives to influence consumer behavior. Therefore, it was no surprise that PSA worked closely with organizations in Germany to demonstrate its filter technology, even though its market share in Germany is only 5%, compared to 15% in Western Europe overall. Representatives of UBA, the German environmental agency, showed off PSA’s technology to audiences outside Germany and asked German automakers why they were not introducing filters as well. Because of pressure from the German and French governments, the European Commission issued guidelines on fiscal incentives for filters or equivalent technologies and will use filter performance as a basis for the 2008 Euro 5 PM standards. The German government’s concern for diesel emission reduction outweighed the resistance of the German automakers towards filter mandates or incentives. Some of the auto manufacturers eventually offered a filter as an option, at a cost of €600-800. In Germany, most customers ordered the filter option, but in countries like the UK, few paid extra for the filter.

While the UK was not as enthusiastic as Germany about filter technology, it was one of the first countries to follow the example of Sweden in offering tax incentives for ultra-low sulfur diesel fuel. Once UK Chancellor Gordon Brown began setting differential tax rates for low-sulfur v. regular diesel fuel, oil companies began seeing the economic rationale in reducing sulfur levels in their fuel. Incidentally, the tax incentives encouraged national companies BP and Shell to move forward with upgrading refineries; after marketing clean fuels to the UK, they would then be prepared to introduce the fuels to outside markets. Countries where there were similar tax advantages to ULSD saw rapid diffusion of the cleaner fuel. In the US, where there are some limited tradable credits but no tax incentives, the adoption of ULSD has been much slower, and widespread adoption will probably not happen until the 2006 deadline. However, the availability of retrofit and fuel purchase subsidies administered through local school districts and municipalities have encouraged pockets of ULSD use.

Conclusion

The PSA and BP cases illustrate instances where firms decided to introduce products that surpassed existing environmental regulations. While the products have clear and significant air quality benefits, their adoption was costly for the first-mover firms. The firms’ behavior was proactive, yet their motivations were largely reactive – PSA was concerned about losing market share amidst growing diesel criticism and BP wanted to demonstrate that clean diesel was competitive against CNG. Competitive regulatory strategies were not premeditated. The companies had not planned to promote more stringent standards from the outset, but their support was incidental to the high performance of their products. By anticipating the inevitable increase in regulatory stringency and actively shaping regulatory standards through technology demonstrations and data submissions, they were better prepared to face the new regulations than their competitors. They were poised to reap the benefits of tax incentives and subsidies introduced by the regulators. In the end, did the first-movers obtain a competitive advantage? Earning the esteem of environmental NGOs and regulators and enhancing the corporate image were obvious benefits, but gauging the financial benefit to the firms is not as easy. Although PSA and BP performed well financially relative to their competitors during their clean technology implementations, environmental performance is but one factor contributing to overall performance.

The cases prove useful in showing the attributes important to the likelihood of first-mover behavior and the extent of regulatory influence: Commitment from top management; firm size and clout; the ability to stand out from a trade association; NGO and public pressure; and regulatory receptiveness to incentivize clean technologies.

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