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## The Volkswagen Emissions Scandal

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In October 2015, Mathias Müller became CEO of Volkswagen (VW), the 78-year-old economic jewel of Germany. His predecessor, Martin Winterkorn, who had led VW for eight years, had resigned suddenly in the midst of one of the biggest scandals to ever hit VW and the auto industry. In September, VW had admitted to United States regulators that it had deliberately installed “defeat devices” in many of its diesel cars, which enabled the cars to cheat on federal and state emissions tests, making them able to pass the tests and hit ambitious mileage and performance targets while actually emitting up to 40 times more hazardous gases into the atmosphere than legally allowed. The discovery had prompted the US Environmental Protection Agency (EPA) to halt final certification of VW’s 2016 diesel models, and VW itself had halted sales of its 2015 models. As fallout from the defeat devices developed, VW posted its first quarterly loss in more than 15 years, and its stock plummeted. Winterkorn and several other top executives were replaced, and VW abandoned its goal of becoming the world’s largest automaker. In addition to significant financial implications, VW was rapidly losing its prized reputation as a trustworthy company capable of outstanding engineering feats.

### Volkswagen Background: The Power of German Engineering<sup>1</sup>

In 1937, VW was founded in Germany under the Nazi regime by the labor unions with the help of Ferdinand Porsche, the inventor of the Beetle (the people’s car). Tasked with making a car that was affordable for all consumers, VW’s flagship car, the compact and iconic Beetle, first rolled off the manufacturing floor in 1945, and by 1949, half of all passenger cars produced in West Germany were built by VW. The company began exporting cars in the late 1940s, and by 1955, the company had sold over one million Beetles worldwide. The Beetle would eventually surpass Ford’s Model T as the highest-selling model ever built, reaching sales of more than 15 million by 1972. When sales of the Beetle began to decline in the late 1970s, VW branched into other models, including the Passat, Jetta, Golf, and Polo. The VW brand eventually folded into a broader public holding company, Volkswagen AG, which by 2014 owned 12 subsidiaries, including VW passenger cars, Audi, Porsche, and Bentley.

By 2014 (**Exhibit 1**), VW was one of the biggest firms in the world. It had factories in 31 countries, employed almost 600,000 people worldwide, and sold its cars around the world. In 2014, it sold 10.2 million

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<sup>1</sup> Most of the material in the first paragraph of this section comes from Tim Bowler, “Volkswagen: From the Third Reich to Emissions Scandal,” BBC, October 2, 2015, <http://www.bbc.com/news/business-34358783>; and from Volkswagen’s own company history and annual reports, available at [http://www.volkswagenag.com/content/vwcorp/content/en/the\\_group/history.html](http://www.volkswagenag.com/content/vwcorp/content/en/the_group/history.html) and [http://www.volkswagenag.com/content/vwcorp/info\\_center/en/publications/publications.acq.html/archive-on/ier-financial\\_publications/annual\\_reports/index.html](http://www.volkswagenag.com/content/vwcorp/info_center/en/publications/publications.acq.html/archive-on/ier-financial_publications/annual_reports/index.html) (accessed Jan. 17, 2016).

vehicles, a 5% growth over 2013, and reached its goal of taking over the title of “world’s largest auto manufacturer” from Toyota. Sales revenue in 2014 was EUR202 billion, with an operating profit of EUR12 billion (**Exhibit 2**).<sup>2</sup>

The shareholders of Volkswagen AG were largely made up of descendants of Porsche (50% ownership), but VW also had significant ownership from the German state of Lower Saxony (20% ownership) and Qatar’s sovereign wealth fund (17% ownership), as well as independent shareholders who made up 10% ownership.<sup>3</sup> Per German corporate law, Volkswagen AG had a 20-member supervisory board responsible for corporate governance, rather than a board of directors. As required by law, 50% of the seats were allocated to VW’s labor force (union representatives and employees that are elected representatives of the union), leaving the other 10 seats to be divvied up among the shareholders. As of 2015, only one of these seats was held by an outsider (Annika Falkengren, the CEO of a Swedish bank); the other nine were as follows: five to members of the Porsche and Piëch (relatives of the Porsche) families, two to Lower Saxony, and two to Qatar.<sup>4</sup>

At a time when Europe was continuing to recover from the global financial crisis, VW was one of the most significant engines in the German economy. In May 2015, it was listed by *Forbes* as the largest public company in Germany by revenue, surpassing its nearest competitor, Daimler, by almost USD100 billion.<sup>5</sup> It was also one of Germany’s largest employers.<sup>6</sup> Wolfsburg, Germany, the town in Lower Saxony where VW was headquartered, owed its existence to the company: it was created out of farmland to be the original site for manufacturing the VW Beetle. By the mid-2000s, the company owned the town’s professional soccer team, its major hotels, and even an automotive theme park that attracted millions of visitors per year.<sup>7</sup>

The company’s stated values included “customer focus, superior performance, creating value, renewability, respect, responsibility, and sustainability”<sup>8</sup> These values were intended to guide decisions made by employees throughout the company and were accompanied by a 25-page Code of Conduct on which every employee was trained after joining VW. This Code of Conduct was written in 2009 and systematically rolled out to employees across the globe in 2010. It addressed topics such as management culture and collaboration, anticorruption, and fair competition, and it was intended to be a “guidepost that combines the essential basic principles of our activities and supports our employees in mastering the legal and ethical challenges in their daily work.”<sup>9</sup> In addition, all VW employees received compliance training; 185,000 were trained on compliance in 2014.<sup>10</sup>

<sup>2</sup> EUR = euros.

<sup>3</sup> Richard Milne, “Volkswagen: System Failure,” *Financial Times*, November 4, 2015, <http://www.ft.com/cms/s/2/47f233f0-816b-11e5-a01c-8650859a4767.html?siteedition=uk&axzz4BTTrG0FY> (accessed Feb. 28, 2016).

<sup>4</sup> Hans Dieter Pötsch, the company’s former finance director who was close to the Porsche and Piëch families, became chairman of the supervisory board in 2015, replacing Ferdinand Piëch, who was the company’s CEO from 1993 to 2002 and chairman of the supervisory board from 2002 to 2015.

<sup>5</sup> Steve Schaefer and Andrea Murphy, “The World’s Biggest Public Companies,” *Forbes*, May 2015, <http://www.forbes.com/global2000/> (accessed Feb. 27, 2016; USD = US dollars).

<sup>6</sup> <http://www.forbes.com/global2000/>.

<sup>7</sup> Joann Muller, “How Volkswagen Will Rule the World,” *Forbes*, May 6, 2013, <http://www.forbes.com/sites/joannmuller/2013/04/17/volkswagens-mission-to-dominate-global-auto-industry-gets-noticeably-harder/#52b13a501ab6> (accessed Feb. 28, 2016).

<sup>8</sup> Volkswagen annual report, 2016.

<sup>9</sup> The Volkswagen Group Code of Conduct, September 2015, [http://www.volkswagenag.com/content/vwcorp/info\\_center/en/publications/2015/09/Verhaltensgrundsätze\\_des\\_Volkswagen\\_Konzerns.bin.html/binarystorageitem/file/20150930\\_Verhaltensgrundsätze%3%A4tze+-+update\\_coc\\_englisch\\_digital.pdf](http://www.volkswagenag.com/content/vwcorp/info_center/en/publications/2015/09/Verhaltensgrundsätze_des_Volkswagen_Konzerns.bin.html/binarystorageitem/file/20150930_Verhaltensgrundsätze%3%A4tze+-+update_coc_englisch_digital.pdf) (accessed Feb. 27, 2016).

<sup>10</sup> The Volkswagen Group Code of Conduct, 2010, [http://en.volkswagen.com/content/medialib/vwd4/de/Volkswagen/Nachhaltigkeit/service/download/corporate\\_governance/Code\\_of\\_Conduct/jcr\\_content/renditions/rendition.file/the-volkswagen-group-code-of-conduct.pdf](http://en.volkswagen.com/content/medialib/vwd4/de/Volkswagen/Nachhaltigkeit/service/download/corporate_governance/Code_of_Conduct/jcr_content/renditions/rendition.file/the-volkswagen-group-code-of-conduct.pdf); [http://www.volkswagenag.com/content/vwcorp/info\\_center/en/publications/2015/09/Verhaltensgrundsätze\\_des\\_Volkswagen\\_Konzerns.bin.html/binarystorageitem/file/20150930\\_Verhaltensgrundsätze%3%A4tze+-+update\\_coc\\_englisch\\_digital.pdf](http://www.volkswagenag.com/content/vwcorp/info_center/en/publications/2015/09/Verhaltensgrundsätze_des_Volkswagen_Konzerns.bin.html/binarystorageitem/file/20150930_Verhaltensgrundsätze%3%A4tze+-+update_coc_englisch_digital.pdf). Although the two versions are similar, the earlier one contains signatures from VW CEO Martin Winterkorn and other top executives; the newer version, republished after the scandal, omits these signatures.

Throughout its history, VW had been widely admired for its innovation in design and engineering. It was one of the first companies to introduce the three-way catalytic converter, prompting it to boast on its website that it was a “pioneer of low-emission monitoring.”<sup>11</sup> The company experienced its first brush with US emissions standards in the 1970s, however, when the EPA caught it installing defeat devices that would allow it to cheat on newly enacted emissions standards. At the time, it paid a USD120,000 fine.<sup>12</sup>

VW had also been known for its quirky advertising highlighting its unique products and top-notch engineering. The company made advertising history with its “Think Small” campaign in the United States in the 1950s, which encouraged Americans to consider smaller vehicles like the Beetle. In recent years, it stressed its virtue through advertisements proclaiming “the power of German engineering,” with commercials featuring engineers sprouting angel wings. At a time when most major US automakers were still struggling to recover from the global financial crisis and both Toyota and General Motors were reeling from major safety recalls, VW was perceived as reliable, successful, and innovative. In his 2014 annual letter to shareholders, CEO Martin Winterkorn wrote: “We stand for strength, reliability, and long-term success—even under less favorable conditions.”<sup>13</sup>

“The power of German engineering” was more than just a marketing tagline for VW; it was a motto, a way of doing business, and a symbol of national pride. Germany had become a country that prided itself on its world-class engineering and precision manufacturing.<sup>14</sup> In part due to the country’s engineering prowess, the automobile industry had become a powerhouse in Germany, and VW had become the leader in that industry. This dominance in manufacturing helped Germany weather the 2008 global financial crisis and kept unemployment low. Germany was able to boost employment and its economy largely through its ability to export products; automobiles made up a full one-fifth of this market. The strength of VW and much of the German economy depended on the growth of its engineering exports, making German engineering more than a just a point of national pride—it was an economic necessity.<sup>15</sup>

## VW Leadership and Strategy 2018

Winterkorn, who took over as CEO in 2007, was focused on leading VW through its Strategy 2018, an ambitious plan to position the company as a global and environmental leader. The overarching goal of the strategy was to transform VW into the world’s largest automaker. Said Winterkorn, “Our pursuit of innovation and perfection and our responsible approach will help to make us the world’s largest automaker by 2018—both economically and ecologically.” Strategy 2018 had four primary goals: (1) to sell 10 million+ vehicles per year (thus making VW the world’s largest automaker); (2) to become the world leader in customer satisfaction and

<sup>11</sup> Danny Hakim, Aaron M. Kessler, and Jack Ewin, “As Volkswagen Pushed to Be No. 1, Ambitions Fueled a Scandal,” *New York Times*, September 26, 2015, <http://www.nytimes.com/2015/09/27/business/as-vw-pushed-to-be-no-1-ambitions-fueled-a-scandal.html?action=click&contentCollection=International%20Business&region=Footer&module=WhatsNext&version=WhatsNext&contentID=WhatsNext&moduleDetail=undefined&pgtype=Multimedia&r=1> (accessed Jan. 25, 2016).

<sup>12</sup> <http://www.nytimes.com/2015/09/27/business/as-vw-pushed-to-be-no-1-ambitions-fueled-a-scandal.html?action=click&contentCollection=International%20Business&region=Footer&module=WhatsNext&version=WhatsNext&contentID=WhatsNext&moduleDetail=undefined&pgtype=Multimedia&r=1>.

<sup>13</sup> Volkswagen annual report, 2014.

<sup>14</sup> Chiyo Robertson, “The Best Engineers Come from Germany,” BBC News, September 18, 2013, <http://www.bbc.com/news/business-24131534> (accessed Jan. 25, 2016).

<sup>15</sup> Rick Noack, “For Germans, VW Scandal is a National Embarrassment,” *Washington Post*, September 23, 2015, <https://www.washingtonpost.com/news/worldviews/wp/2015/09/23/for-germans-the-volkswagen-scandal-is-a-national-embarrassment/> (accessed Feb. 27, 2016).

quality; (3) to achieve an 8% return on sales; and (4) to be the most attractive employer in the automotive industry.<sup>16</sup> Throughout Winterkorn's tenure, VW made steady progress on each of these goals.

Under the leadership of Winterkorn and his mentor, VW Chairman Ferdinand Piëch (a grandson of VW founder Porsche and himself VW CEO from 1993 until 2002), VW became a tightly controlled, highly centralized company. Its corporate culture was one of command-and-control, with leadership setting aggressive goals and senior executives involved in even relatively minor decisions.<sup>17</sup> The company gained a reputation for being hard-charging and brutally competitive, and former employees described an environment in which subordinates were fearful of ever admitting failure or contradicting their superiors.

Both Piëch and Winterkorn came from engineering backgrounds and kept a close eye on product development. Piëch, who recruited Winterkorn to Audi in 1981 and became his mentor for more than 25 years, would boast that he elicited superior performance by "terrifying his engineers."<sup>18</sup> It was well known that VW executives and engineers would be "shaking in their boots prior to presentations before Piëch, knowing that if he was displeased, they might be fired instantly."<sup>19</sup> By the time he became CEO in 2007, Winterkorn was considered "a cold, distant figure...known for obsessive attention to detail."<sup>20</sup> Unlike other contemporary auto industry CEOs who were experts in financial management and turnarounds, Winterkorn was considered a "classic car guy."<sup>21</sup> He was known for carrying a gauge with him at all times to measure flaws in vehicles as they came off the production line and for publicly disparaging subordinates. Said an industry analyst, "He doesn't like bad news. Before anyone reports to him, they make sure they have good news."<sup>22</sup>

Winterkorn was relentless in his pursuit of becoming the world's largest automaker. Speaking at the opening of VW's new factory in Chattanooga, Tennessee, in 2011, he promised that "by 2018, we want to take our group to the very top of the global car industry."<sup>23</sup> Although VW was growing, these promises were still considered ambitious, especially in the United States, a market that VW had previously neglected and where it held a reputation for selling expensive and undesirable cars.<sup>24</sup> In order to meet Winterkorn's goals, the US market would be a critical component to success. The company would need to sell 1 million vehicles (800,000 Volkswagens and 200,000 Audis) annually, tripling its 2007 sales.<sup>25</sup>

<sup>16</sup> Volkswagen's Strategy 2018, <http://www.volkswagenag.com/content/vwcorp/content/de/homepage.html> (accessed Jan. 25, 2016).

<sup>17</sup> Jack Ewing and Graham Bowley, "The Engineering of Volkswagen's Aggressive Ambition," *New York Times*, December 13, 2015, <http://www.nytimes.com/2015/12/14/business/the-engineering-of-volkswagens-aggressive-ambition.html> (accessed Jan. 25, 2016).

<sup>18</sup> Doran Levin, "The Man who Created VW's Toxic Culture Still Looms Large," *Fortune*, October 16, 2015, <http://fortune.com/2015/10/16/vw-ferdinand-piech-culture/> (accessed Feb. 23, 2016).

<sup>19</sup> <http://fortune.com/2015/10/16/vw-ferdinand-piech-culture/>.

<sup>20</sup> <http://fortune.com/2015/10/16/vw-ferdinand-piech-culture/>.

<sup>21</sup> <http://www.forbes.com/sites/joannmuller/2013/04/17/volkswagens-mission-to-dominate-global-auto-industry-gets-noticeably-harder/#52b13a501ab6>.

<sup>22</sup> <http://www.forbes.com/sites/joannmuller/2013/04/17/volkswagens-mission-to-dominate-global-auto-industry-gets-noticeably-harder/#52b13a501ab6>.

<sup>23</sup> <http://www.nytimes.com/2015/09/27/business/as-vw-pushed-to-be-no-1-ambitions-fueled-a-scandal.html>.

<sup>24</sup> <http://www.forbes.com/sites/joannmuller/2013/04/17/volkswagens-mission-to-dominate-global-auto-industry-gets-noticeably-harder/#52b13a501ab6>.

<sup>25</sup> <http://www.forbes.com/sites/joannmuller/2013/04/17/volkswagens-mission-to-dominate-global-auto-industry-gets-noticeably-harder/#52b13a501ab6>.

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**Achieving Ambitious Goals While Meeting Regulations<sup>26</sup>**

In the mid-2000s, when Winterkorn began his tenure as CEO and announced VW's goal of becoming the world's largest automaker within the next decade, the auto industry in the United States and around the world was facing significant engineering challenges. Persistently high prices at the gas pump and toughening mileage standards put pressure on automakers to design more fuel-efficient vehicles, while growing concerns about climate change spurred increasingly stringent emissions regulations. In order to drive sales, automakers needed to find ways to optimize fuel efficiency and emissions while still designing the high-performing vehicles that Americans had become accustomed to driving. The market for hybrid-electric cars, notably Toyota's Prius, was growing rapidly.<sup>27</sup>

Rather than compete with Toyota and other automakers in the hybrid market, VW had opted for a strategy of diesel, viewing it as a huge growth opportunity within the US car market and a viable eco-friendly alternative. While diesel made up almost half of new car sales in Europe, it held just 5% of the US auto market in 2007,<sup>28</sup> and Winterkorn believed it was an opportune time to expand diesel sales in the United States. Diesel offered a cheaper, more powerful alternative to hybrid vehicles, promising high fuel efficiency without sacrificing powerful performance. But before it could market fuel-efficient diesel in the United States, VW had to overcome one major roadblock: diesel cars generated significantly more nitrogen oxide (NOx) than gasoline-powered engines, making it difficult for them to clear the stringent American emissions standards without sacrificing fuel efficiency or performance. In order to sell its cars in the US market, a critical part of the company's goal of becoming the world's largest car manufacturer, VW would have to engineer a way to strip its cars of these pollutants to meet US regulations (**Exhibit 3**).

In 2005, Wolfgang Bernhard, VW's head of brand, was in charge of designing the next-generation diesel engine for consumer cars that would provide both fuel efficiency and meet low US emission standards. Bernhard chose a strategy seen as controversial within the VW management team. Rather than develop an in-house solution, he instead adopted a competitor's technology, a Daimler invention called BlueTec. BlueTec used a substance called urea—essentially cat urine—to neutralize NOx. It required that VW install an extra pump and tank of urea in each vehicle, at a cost of EUR300 per vehicle. But just two years later, in 2007, boardroom battles within VW led to the appointment of Winterkorn as CEO, who promptly ousted Bernhard and cancelled the BlueTec deal. VW leadership stressed that BlueTec was too expensive, took up too much space in small cars, would hamper fuel efficiency, and that VW did not need to partner with an archrival to achieve its engineering goals.

VW engineers were suddenly on their own to find a way to meet stringent US emissions standards on diesel without sacrificing mileage or performance, and they needed to find it quickly. As it struggled to come up with a solution, the company was forced to delay for six months the release of the new diesel Jetta that was to be at the center of its new marketing push.

Whatever solution was devised, software was likely to be at the center of it. Modern cars contained approximately 100 million lines of software code that controlled everything from basic operations to media to safety. Software could also help a car control the amount of pollutants it emitted, by monitoring carbon

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<sup>26</sup> Most of the information in this section is from Dune Lawrence, Benjamin Elgin, and Vernon Silver, "How Could Volkswagen's Top Engineers Not Have Known?," Bloomberg Businessweek, October 21, 2015, <http://www.bloomberg.com/news/articles/2015-10-21/how-could-volkswagen-s-top-engineers-not-have-known> (accessed Jan. 25, 2016).

<sup>27</sup> "U.S. HEV Sales by Model," US Department of Energy Alternative Fuels Data Center, January 2016, <http://www.afdc.energy.gov/data/> (accessed Apr. 1, 2016).

<sup>28</sup> William Boston, "Volkswagen Emissions Investigation Zeroes In on Two Engineers," *Wall Street Journal*, October 5, 2015, <http://www.wsj.com/articles/vw-emissions-probe-zeroes-in-on-two-engineers-1444011602> (accessed Jan. 25, 2016).

monoxide and NOx emissions and then diverting pollutants to special systems that converted them into less harmful substances. Around the time that VW engineers were struggling to determine the right solution, auto industry-supplier Bosch gave VW diesel engine-management software for use during testing. This software could detect when a vehicle was in a testing environment and activated emissions-controlling devices. Bosch believed VW was only using this software during its internal testing, and sold the software to VW with the understanding that utilizing the software in publicly sold vehicles was illegal.<sup>29</sup>

### Clean Diesel Sales Take Off

By 2008, it appeared that “the power of German engineering” had once again pulled through. VW announced the rollout of a new clean diesel technology called the Lean NOx Trap, which it claimed had solved the problem of delivering high fuel efficiency while still meeting emissions standards. The new technology garnered considerable attention for VW. Its 2009 clean diesel Jetta TDI won the Green Car of the Year award, beating out hybrids and electric vehicles. It hosted a multiweek “dieselution tour” to “change any outdated perceptions about diesel technology” and prove its environmental virtue.<sup>30</sup> Some of its vehicles were reportedly getting almost 60 mpg, which was unheard of for a nonelectric or hybrid car. At a conference on diesel emissions the same year, a VW executive boasted that “you don’t have to sacrifice power to be environmentally conscious.”<sup>31</sup> Clean diesel became the centerpiece of VW’s US marketing strategy, and sales took off. Diesel sales grew by 20% in 2010, 26% in 2011, and 25% in 2012, though they began to taper off slightly in 2013 and 2014.<sup>32</sup> By 2014, VW’s diesel cars accounted for 21% of the company’s US sales.<sup>33</sup>

In 2011, VW’s goal of selling 1 million vehicles in the United States was beginning to look achievable. US domestic companies struggled under the weight of economic crises and bailouts, and Toyota and Honda had yet to fully recover from the impact on production of the 2011 Japanese earthquake. By 2012, VW claimed 3% market share in the United States,<sup>34</sup> up from 2.5% in 2011 and 2.2% in 2010.<sup>35</sup> VW sales in the United States hit 440,000 in 2014, more than double 2009 sales.<sup>36</sup>

By 2014, VW was well on its way to achieving all four Strategy 2018 goals. Worldwide sales grew steadily at approximately 7.2% CAGR from 2007, when Winterkorn took over, to 2014.<sup>37</sup> Most notably, the company reached its sales goal in 2014, selling more than 10 million vehicles and surpassing Toyota in sales volume, thereby becoming the world’s largest automaker four years ahead of the deadline it had set for itself (Exhibit 4).<sup>38</sup>

<sup>29</sup> Bob Sorokanich, “Report: Bosch Warned VW About Diesel Emissions Cheating in 2007,” *Car and Driver*, September 28, 2015, <http://blog.caranddriver.com/report-bosch-warned-vw-about-diesel-emissions-cheating-in-2007/> (accessed Jan. 25, 2016).

<sup>30</sup> Volkswagen Group of America press release, September 26, 2007.

<sup>31</sup> <http://www.bloomberg.com/news/articles/2015-10-21/how-could-volkswagen-s-top-engineers-not-have-known->.

<sup>32</sup> Angelo Young, “Volkswagen Diesel Scandal: Here’s How Bad Volkswagen Sales Were Before the Company Was Caught Cheating,” *International Business Times*, September 25, 2015, <http://www.ibtimes.com/volkswagen-diesel-scandal-heres-how-bad-volkswagen-sales-were-company-was-caught-2114603> (accessed Feb. 27, 2016).

<sup>33</sup> Volkswagen of America earnings report, 2014, <http://media.vw.com/release/907/>.

<sup>34</sup> “Volkswagen’s U.S. Market Share from 2012 to 2014,” Statista, <http://www.statista.com/statistics/343189/market-share-of-volkswagen-in-the-us/> (accessed Mar. 3, 2016).

<sup>35</sup> “Volkswagen in the U.S.: An Evolving Growth Story,” Volkswagen Group of America presentation, January 10, 2012, [http://www.volkswagenag.com/content/vwcorp/info\\_center/en/talks\\_and\\_presentations/2012/01/Global\\_Auto\\_Industry\\_Conference.bin.html/binarystorageitem/file/Volkswagen+in+the+US+-+An+Evolving+Growth+Story.pdf](http://www.volkswagenag.com/content/vwcorp/info_center/en/talks_and_presentations/2012/01/Global_Auto_Industry_Conference.bin.html/binarystorageitem/file/Volkswagen+in+the+US+-+An+Evolving+Growth+Story.pdf) (accessed Mar. 3, 2016).

<sup>36</sup> Neal E. Boudette, “How VW Veered Off Target,” *Automotive News*, January 26, 2016, <http://www.autonews.com/article/20150126/RETAIL01/301269949/how-vw-veered-off-target> (accessed Feb. 28, 2016).

<sup>37</sup> Bloomberg Intelligence, Automobiles Dashboard, Annual Unit Sales by Manufacturer (accessed Mar. 31, 2016).

<sup>38</sup> <http://www.nytimes.com/2015/09/27/business/as-vw-pushed-to-be-no-1-ambitions-fueled-a-scandal.html>.

Sales were particularly strong for VW vehicles in China, growing 10% since 2013.<sup>39</sup> Yet sales in the United States were causing concern. US consumers' tastes had shifted toward midsize SUVs, an area in which VW had very few offerings. By 2014, VW held only 2.2% market share in the United States,<sup>40</sup> and VW sales dipped down to just around 370,000, far short of the 800,000 projected and just barely above the company's 2011 numbers.

While VW invested in its US diesel strategy, EPA officials in the Obama administration announced in 2011 a plan to require automakers to increase fleet-wide fuel efficiency from an average of 35.5 mpg to 54.5 mpg by 2025, while also further reducing emissions. To help car manufacturers offset the business implications of these ambitious new standards, companies were able to earn credits for utilizing groundbreaking technology that improved the environmental effects of their fleets, such as hybrids and electric cars. Credits could be used to lower the average fleet miles per gallon or emissions rating of the manufacturer that would otherwise be over the EPA limits. But credits were not offered to diesel manufacturers, as diesel technology was not viewed as the future of environmental car manufacturing. Automakers that had invested in diesel, such as VW and Mercedes-Benz, lobbied for diesel cars to be eligible to earn credits due to the technology's superior fuel efficiency. These firms had made the decision to invest in diesel on the basis that it was environmentally conscious, but the EPA argued that diesel traditionally emitted much higher levels of NOx than gasoline-powered vehicles, and therefore would not allow diesel cars to earn the credits. This left VW with a fleet that did not meet the EPA's new standards, and unlike its competitors, the company had no credit-earning hybrid cars.

### Scandal Unfolds<sup>41</sup>

In 2013, a nonprofit group called the International Council on Clean Transportation (ICCT) noticed something strange: diesel technologies appeared cleaner in the United States than in Europe. The ICCT hoped to identify what made diesel technologies superior in the United States in order to improve emissions in Europe. The traditional in-lab emissions tests had not provided any clues to the engineering differences, which were producing lower-emission vehicles in the United States, so the researchers proposed on-road (as opposed to in-lab) testing of diesel cars in order to better understand these differences. They partnered with West Virginia University's Center for Alternative Fuels, Engines, and Emissions and California environmental regulators to perform tests on several types of diesel vehicles, starting with a BMW X5, a VW Jetta, and a VW Passat (all three selected by chance; they were models conveniently available to the researchers). The researchers compared in-lab and on-road emissions and mileage performance.

Almost immediately, the two VW vehicles stood out. They performed flawlessly in the lab, but once on the open road, their emissions were significantly higher, as shown in **Table 1**. What the researchers unexpectedly uncovered was that these differences were perhaps not the result of superior engineering, but rather the result of cars specifically designed to take advantage of testing environments.

<sup>39</sup> Henk Bekker, "2014 (Full Year) China and Worldwide German Luxury Car Sales," Best Selling Cars, January 9, 2015, <http://www.best-selling-cars.com/china/2014-full-year-china-worldwide-german-luxury-car-sales/> (accessed Feb. 28, 2016).

<sup>40</sup> <http://www.statista.com/statistics/343189/market-share-of-volkswagen-in-the-us/>.

<sup>41</sup> [http://www.bloomberg.com/news/articles/2015-10-21/how-could-volkswagen-s-top-engineers-not-have-known-;](http://www.bloomberg.com/news/articles/2015-10-21/how-could-volkswagen-s-top-engineers-not-have-known-)  
<http://www.nytimes.com/2015/09/27/business/as-vw-pushed-to-be-no-1-ambitions-fueled-a-scandal.html>.

Table 1. Emissions test results.

	EPA Limit	2015 Jetta In-Lab Testing	2015 Jetta On-Road Testing
Emissions level (grams of NO <sub>x</sub> emitted per mile)	0.07	0.07	2.45 (~35× higher than legal limit)

Data sources: Bloomberg Businessweek, <http://www.bloomberg.com/news/articles/2015-10-21/how-could-volkswagen-s-top-engineers-not-have-known>; EPA, <https://www3.epa.gov/otaq/consumer/f99017.pdf>.

In early 2014, the researchers turned over the surprising results of the study to the US EPA, which questioned VW about the findings. VW flatly denied any accusations of wrongdoing. The West Virginia University researcher who led the tests said VW “tried to poke holes in our study and its methods, saying we didn’t know what we were doing.”<sup>42</sup> The researchers eventually conducted an in-depth examination of VW’s software, reviewing millions of lines of code for something to explain the strange discrepancy in emissions. They discovered an unusual set of instructions that was sent to emissions controls whenever the vehicle was only utilizing two of its four wheels (as it would during in-lab testing). In essence, the vehicle recognized whether it was in a test lab or on the road. The defeat device limited emissions in the lab (therefore hindering performance), but once out on the road, emissions returned to levels far above federal regulations and performance did not suffer.

Armed with this information, EPA officials threatened to withhold certification of VW and Audi’s 2016 diesel models, which forced VW’s hand. On September 18, 2015—one week after being named the world’s “most sustainable automaker”<sup>43</sup>—the company publicly admitted that it had installed defeat devices on nearly 500,000 diesel vehicles across 14 models sold in the United States since 2009, when the clean diesel technology launched (**Exhibit 5**). This number was later scaled up to 11 million vehicles worldwide. It was discovered that the vehicles were emitting up to 40 times the US legal limit of pollution into the atmosphere.<sup>44</sup>

VW officials apologized but vehemently denied widespread knowledge of the defeat devices within the company, blaming a few engineers for the error and claiming that senior management had no knowledge of wrongdoing. They claimed that the millions of lines of software code made it impossible for anyone to know every line, particularly upper management, meaning that engineers could have included the emissions-defeating protocol without management knowing.<sup>45</sup> Michael Horn, VW’s CEO of American operations, testified before Congress in October 2015, stressing that the defeat devices were “not a corporate decision” and were instead the work of “a couple of software engineers.”<sup>46</sup> As members of Congress expressed disbelief that VW’s senior leadership did not know about the devices, Horn admitted, “I agree, that’s very hard to believe.”<sup>47</sup>

Despite denying any wrongdoing, CEO Martin Winterkorn resigned five days after the scandal became public, stating that “I am stunned that misconduct on such a scale was possible in the Volkswagen Group. As CEO I accept responsibility for the irregularities that have been found in the diesel engines...even though I am not aware of any wrong doing on my part.” (See **Exhibit 6** for Winterkorn’s full statement.)

<sup>42</sup> <http://www.nytimes.com/2015/09/27/business/as-vw-pushed-to-be-no-1-ambitions-fueled-a-scandal.html>.

<sup>43</sup> Richard Hardymont, “CSR after Volkswagen Scandal,” TriplePundit, October 28, 2015, <http://www.triplepundit.com/2015/10/csr-volkswagen-scandal/> (accessed Jun. 20, 2016).

<sup>44</sup> Guilbert Gates, Jack Ewing, Karl Russell, and Derek Watkins, “Explaining Volkswagen’s Emissions Scandal,” *New York Times*, June 1, 2016, [http://www.nytimes.com/interactive/2015/business/international/vw-diesel-emissions-scandal-explained.html?\\_r=0](http://www.nytimes.com/interactive/2015/business/international/vw-diesel-emissions-scandal-explained.html?_r=0) (accessed Jun. 20, 2016).

<sup>45</sup> Paul Kedrosky, “An Engineering Theory of the Volkswagen Scandal,” *New Yorker*, October 16, 2015, <http://www.newyorker.com/business/currency/an-engineering-theory-of-the-volkswagen-scandal> (accessed Jan. 15, 2016).

<sup>46</sup> “‘It Was Installed For This Purpose,’ VW’s U.S. CEO Tells Congress About Defeat Device,” NPR, October 8, 2015, <http://www.npr.org/sections/thetwo-way/2015/10/08/446861855/volkswagen-u-s-ceo-faces-questions-on-capitol-hill> (accessed Jan. 25, 2016).

<sup>47</sup> <http://www.npr.org/sections/thetwo-way/2015/10/08/446861855/volkswagen-u-s-ceo-faces-questions-on-capitol-hill>.

## Fallout<sup>48</sup>

The fallout of the scandal was swift and far-reaching. Regulators across the United States and across the globe opened investigations. In the United States, the EPA stated that VW could face up to USD18 billion in fines—USD37,500 per car for each of the estimated 500,000 cars impacted.<sup>49</sup> The FBI opened a criminal probe, as did the attorneys general of all 50 states, and the Justice Department opened a civil lawsuit against the company over the deception. Outside of the United States, Germany and the European Union also opened criminal investigations, and German officials raided VW's headquarters days after the scandal came to light.<sup>50</sup>

The scandal had considerable immediate effects on VW's business. In the wake of VW's admission, the EPA withheld final certification on VW's 2016 diesel models, and VW voluntarily halted sales of its 2015 models still in inventory. As diesel vehicles composed approximately 20% of VW's US sales, this significantly affected VW's performance. In October, VW reported its first quarterly loss in 15 years. Furthermore, its market cap shrunk by one-third in the month after the scandal went public (**Exhibit 7**), and the company quickly abandoned its goal of remaining the world's largest automaker.<sup>51</sup> In addition to Winterkorn's resignation, at least nine senior managers were quickly suspended or put on leave, and Matthias Müller, formerly the Porsche brand chief, was appointed VW's new CEO.

VW's American operations and dealers were severely hurt by the scandal they claimed to have known nothing about. VW America said in a statement to American customers, "The recent TDI (Turbocharged Direct Injection) news is a disappointment to the entire VW of America family. We sincerely apologize, and we recognize this matter has jeopardized the strong relationship between our loyal owners and the brand."<sup>52</sup> The scandal had a considerable effect on independent VW dealers, who were crippled by the sudden drop in sales. VW paid dealers up to USD1,000 per car and wired cash to dealers to handle the crisis locally.<sup>53</sup> In November, American consumers who had purchased the vehicles that were affected received a goodwill package in the mail, which included USD1,000 and 24-hour roadside assistance and did not require the consumer to release VW of any liability.

The German economy expected to see a substantial change as a result of VW's actions. The German auto industry, led by VW, accounted for 20% of German exports and 3% of German GDP. One in seven jobs were directly or indirectly linked to the industry, and the country was steeling itself for potential job losses.<sup>54</sup> The city of Wolfsburg, Germany, where VW was headquartered, issued an immediate budget and hiring freeze and halted all infrastructure projects in anticipation of substantially reduced corporate taxes coming from its hometown company.<sup>55</sup> "While the German economy defied Greece, the euro crisis and the Chinese slowdown, it could now be facing the biggest downside risk in a long while," Carsten Brzeski, chief economist at Germany's

<sup>48</sup> Most of this section comes from [http://www.nytimes.com/interactive/2015/business/international/vw-diesel-emissions-scandal-explained.html?\\_r=0](http://www.nytimes.com/interactive/2015/business/international/vw-diesel-emissions-scandal-explained.html?_r=0).

<sup>49</sup> Chris Isidore, "Volkswagen Could Be Hit with \$18 Billion in U.S. Fines," CNN, January 4, 2016, <http://money.cnn.com/2016/01/04/news/companies/volkswagen-emissions-cheating-suit-fine/> (accessed Jan. 25, 2016).

<sup>50</sup> <http://www.npr.org/sections/thetwo-way/2015/10/08/446861855/volkswagen-u-s-ceo-faces-questions-on-capitol-hill>.

<sup>51</sup> Clifford Atiyeh, "Everything You Need to Know About the VW Diesel-Emissions Scandal," *Car and Driver*, May 11, 2016, <http://blog.caranddriver.com/everything-you-need-to-know-about-the-vw-diesel-emissions-scandal/> (accessed Jun. 20, 2016).

<sup>52</sup> "We're Working to Make Things Right," Volkswagen website, [www.vwdieselinfo.com](http://www.vwdieselinfo.com) (accessed Feb. 27, 2016).

<sup>53</sup> <http://www.npr.org/sections/thetwo-way/2015/10/08/446861855/volkswagen-u-s-ceo-faces-questions-on-capitol-hill>.

<sup>54</sup> Ruth Bender, "Town that VW Built Views Future with Caution," *Wall Street Journal*, October 2, 2016, <http://www.wsj.com/articles/town-that-vw-built-views-future-with-caution-1443797584> (accessed Jan. 25, 2016).

<sup>55</sup> <http://www.wsj.com/articles/town-that-vw-built-views-future-with-caution-1443797584>.

ING-DiBa bank, wrote. “The irony of all of this is that the threat could now come from the inside, rather than from the outside.”<sup>56</sup>

In June 2016, VW agreed to a \$14.7 billion settlement in the emissions scandal. The settlement was estimated to provide \$10 billion to fund buybacks of vehicles from approximately 475,000 vehicle owners and additional cash compensation of \$2.7 billion was to assist in environmental clean-up and \$2 billion to fund programs by the EPA and California that focused on cleaner vehicles. The company could still face additional civil penalties or charges in other countries, and the company and some of its executives could face criminal charges as well.<sup>57</sup>

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<sup>56</sup> Jack Ewing, “Volkswagen CEO Martin Winterkorn Resigns amid Emissions Scandal,” *New York Times*, September 23, 2016, <http://www.nytimes.com/2015/09/24/business/international/volkswagen-chief-martin-winterkorn-resigns-amid-emissions-scandal.html> (accessed Jan. 25, 2016).

<sup>57</sup> Chris Isidore and David Goldman, “Volkswagon Agrees to Record \$14.7 Billion Settlement over Emissions Cheating,” CNN Money, June 28, 2016, <http://money.cnn.com/2016/06/28/news/companies/volkswagen-fine/> (accessed Jul. 15, 2016); David Shepardson and Joel Schectman, “VW Agrees to Buy Back Diesel Vehicles, Fund Clean Air Efforts,” Reuters, June 28, 2016, <http://www.reuters.com/article/us-volkswagen-emissions-settlement-idUSKCN0ZD2S5> (accessed Jul. 15, 2016); Jack Ewing and Hiroko Tabuchi, “VW’s U.S. Diesel Settlement Clears Just One Financial Hurdle,” *New York Times*, June 28, 2016, <http://www.nytimes.com/2016/06/29/business/vw-diesel-emissions-us-settlement.html> (accessed Jul. 15, 2016).

## Exhibit 1

**The Volkswagen Emissions Scandal**

## Timeline of Events

**2007**

Martin Winterkorn becomes CEO of VW and through his Strategy 2018 sets ambitious goals for vehicle sales.

**2008**

After canceling deal with BlueTec technology, VW announces new clean diesel technology called Lean NOx Trap and designed to meet regulations.

**2009**

VW's Jetta wins Green Car of the Year award.

**2011**

In reaction to growing public concern, the EPA announces plans to further regulate US emissions by offering “credits” to companies for using new technology, such as hybrid or electric cars, to improve the environmental effects of their fleets. Credits were not offered to diesel manufacturers.

**2013**

A nonprofit group, the ICCT, notices that diesel technology in United States appears to be cleaner—begins road testing of diesel vehicles.

**2014**

Researchers turn over the results of the study to the US EPA. The EPA opens investigation and questions VW about the findings. VW denies accusations of wrongdoing.

VW reaches its Strategy 2018 sales goal early, selling over 10 million vehicles and surpassing Toyota in sales volume, thereby becoming the world's largest automaker.

**2015**

The EPA and the state of California prepare for further testing and confirm that initial test findings are consistent.

**September 18, 2015**

VW publicly admits that it had installed defeat devices on nearly 500,000 diesel vehicles across 14 models sold in the United States since 2009.

**September 23–25, 2015**

Martin Winterkorn resigns as CEO, and Mathias Müller becomes new CEO.

Source: Created by author based on the order of events as portrayed in the case.

## Exhibit 2

**The Volkswagen Emissions Scandal**

## Volkswagen Group Key Financials, Prescandal

	Vehicles Sold	Revenue (EUR millions)	Operating Profit (EUR millions)
2007	6,191,618	108,897	6,151
2008	6,271,724	113,808	6,333
2009	6,309,743	105,187	1,855
2010	7,278,440	126,875	7,141
2011	8,361,294	159,337	11,271
2012	9,344,559	192,676	11,498
2013	9,728,250	197,007	11,671
2014	10,217,003	202,458	12,697

Data source: Volkswagen AG annual reports.

## Exhibit 3

**The Volkswagen Emissions Scandal**Background on US Emissions Regulations<sup>1</sup>

The EPA both sets minimum standards for fuel efficiency for a company's fleet of vehicles and regulates emissions according to the Clean Air Act. The Clean Air Act, passed by the United States Congress in 1970, was designed to combat a number of air pollution problems threatening environmental safety and public health. As the country had grown more industrialized and urban, dense smog was visible in many of the nation's cities and prompted a public outcry for government action. The Clean Air Act required the EPA to "establish national ambient air quality standards for certain common and widespread pollutants based on the latest science."<sup>2</sup> One of the key provisions emphasized minimizing pollution from motor vehicles, focusing on emissions of carbon monoxide, volatile organic compounds, and NOx. Emissions standards were gradually tightened over time.

The Clean Air Act requires that the EPA certify that all motor vehicles sold in the United States meet federal emissions standards. Without this certification, a vehicle cannot be sold in the United States. For decades, tests on new models to be released in the United States have been conducted at indoor laboratories as opposed to performing actual driving tests on the road. The tests use dynamometers—essentially car treadmills—which simulate driving and measure the exhaust emissions of a stationary car. The tests are conducted in laboratories rather than on the road to achieve cost efficiency and ensure standardization of the test from vehicle to vehicle within a fleet.<sup>3</sup>

Source: Created by author.

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<sup>1</sup> Most of the information in this section is from the EPA's "Clean Air Act Overview," <https://www.epa.gov/clean-air-act-overview>; "Clean Air Act Text," <https://www.epa.gov/clean-air-act-overview/clean-air-act-text>; "Clean Air Act Requirements and History," <https://www.epa.gov/clean-air-act-overview/clean-air-act-requirements-and-history>; and "Progress Cleaning the Air and Improving People's Health," <https://www.epa.gov/clean-air-act-overview/progress-cleaning-air-and-improving-peoples-health> (all accessed Jan. 16, 2015); as well as <http://www.bloomberg.com/news/articles/2015-10-21/how-could-volkswagen-s-top-engineers-not-have-known>.

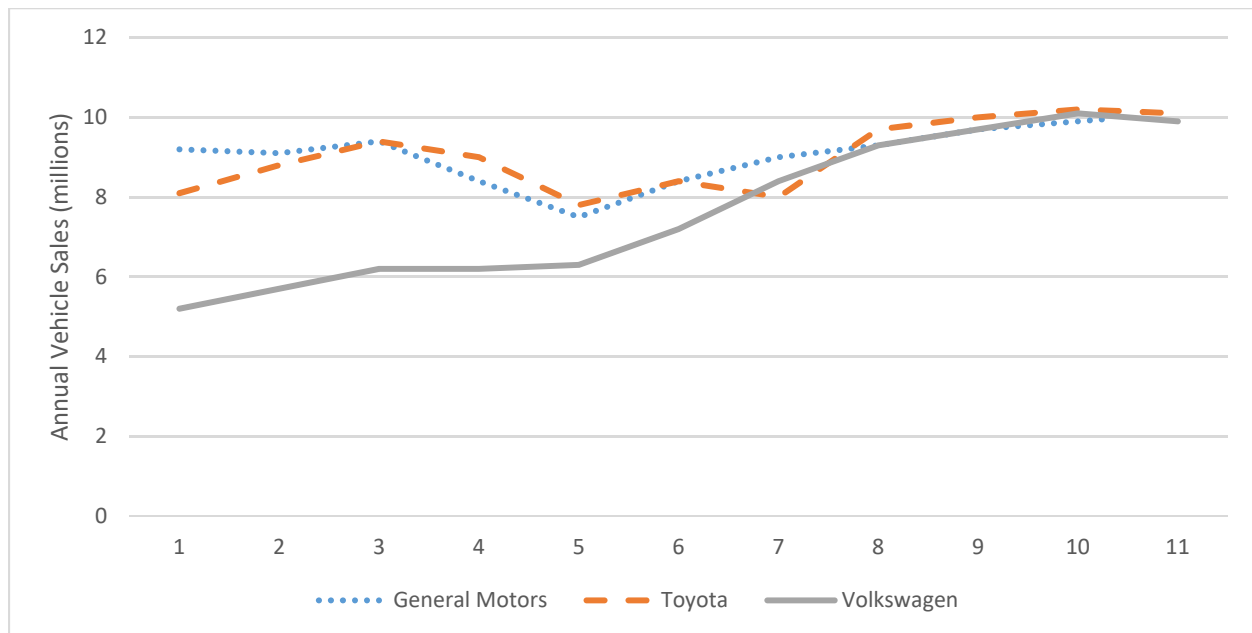
<sup>2</sup> <https://www.epa.gov/clean-air-act-overview/clean-air-act-requirements-and-history>.

<sup>3</sup> "EPA Should Do More Road Emissions Tests, Critics Say," *Automotive News*, September 29, 2015, <http://www.autonews.com/article/20150929/OEM11/150929807/epa-should-do-more-road-emissions-tests-critics-say> (accessed Jun. 20, 2016).

## Exhibit 4

**The Volkswagen Emissions Scandal**

Worldwide Annual Car and Light Truck Sales by Manufacturer, 2005–2015



Data source: Created by author using data obtained from Bloomberg.

## Exhibit 5

**The Volkswagen Emissions Scandal**

## US Models with Defeat Device

**Affected 2.0-Liter Diesel Models:**

- Jetta (2009–2015)
- Jetta Sportwagen (2009–2014)
- Beetle (2012–2015)
- Beetle Convertible (2012–2015)
- Audi A3 (2010–2015)
- Golf (2010–2015)
- Golf Sportwagen (2015)
- Passat (2012–2015)

**Affected 3.0-Liter Diesel Models:**

- Volkswagen Touareg (2014)
- Porsche Cayenne (2015)
- Audi A6 Quattro (2016)
- Audi A7 Quattro (2016)
- Audi A8 (2016)
- Audi A8L (2016)
- Audi Q5 (2016)

Data source: EPA, “Volkswagen Light Duty Diesel Vehicle Violations for Model Years 2009–2016,” <https://www.epa.gov/vw> (accessed Feb. 28, 2016).

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Exhibit 6**The Volkswagen Emissions Scandal**

Postscandal Statement by Martin Winterkorn, September 23, 2015

“I am shocked by the events of the past few days. Above all, I am stunned that misconduct on such a scale was possible in the Volkswagen Group.

As CEO I accept responsibility for the irregularities that have been found in diesel engines and have therefore requested the Supervisory Board to agree on terminating my function as CEO of the Volkswagen Group. I am doing this in the interests of the company even though I am not aware of any wrong doing on my part.

Volkswagen needs a fresh start—also in terms of personnel. I am clearing the way for this fresh start with my resignation.

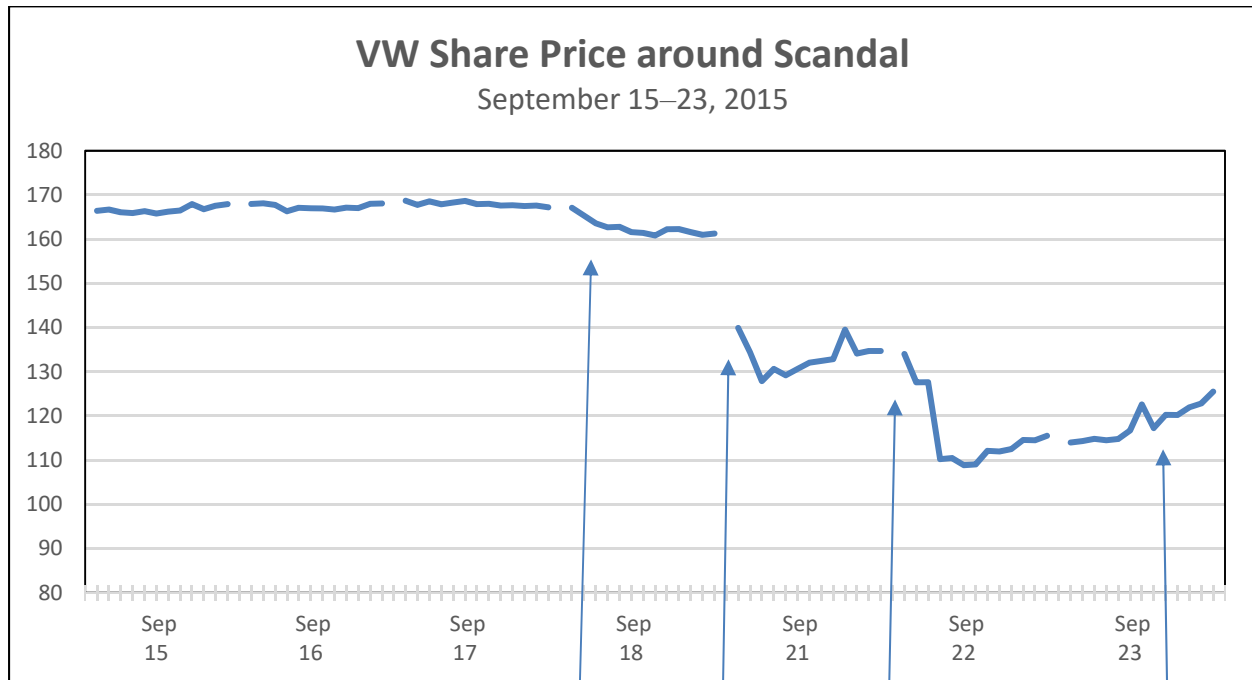
I have always been driven by my desire to serve this company, especially our customers and employees. Volkswagen has been, is, and will always be my life.

The process of clarification and transparency must continue. This is the only way to win back trust. I am convinced that the Volkswagen Group and its team will overcome this grave crisis.”

Source: “Statement by Prof. Dr. Winterkorn,” Volkswagen US Media Newsroom, September 23, 2015, <http://media.vw.com/release/1070/> (accessed Jun. 20, 2016).

## Exhibit 7

## The Volkswagen Emissions Scandal



Data source: Created by author with stock price data from Bloomberg.

Source for announcements: *New York Times*.

EPA says VW cheated on emissions test, announces fines.

VW stops selling certain diesel vehicles.

VW admits 11 million cars included software to defeat emissions test.

CEO Martin Winterkorn announces resignation.