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Business Models for a Battery Electric Truck Manufacturer to Increase Customer Use of Renewable Electricity

A Case Study of a Swedish Truck Manufacturer

Master's thesis in Quality and Operations Management

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Abstract

To prevent negative consequences of climate change, emissions from the transport sector must be reduced. Road freight by heavy trucks accounts for almost a third of global total road transport emissions and the European Commission has presented a legislative proposal suggesting a 90 percent emission reduction for new heavy trucks by 2040. To take responsibility for emissions in the truck's entire lifecycle, several heavy truck manufacturers have committed to following science-based targets, designed to guide companies towards limiting global warming below 1.5 degrees. From a truck life cycle perspective, 90 percent of carbon emissions occur in the use phase which makes decreasing carbon emissions from powering the trucks a priority. Battery electric trucks have the potential of reducing total emissions significantly if they are charged with renewable electricity. Pursuing business models to increase customer use of renewable electricity would help battery electric truck manufacturers ensure that their trucks lead to the emission reduction that is expected of them. Our study was a single case study of a battery electric truck manufacturer on the Swedish market. Through semi-structured interviews and collection of secondary data, seven business models to increase customer use of renewable electricity were identified. By examining strategic alignment between the business models and the case company's established strategy, business model, and external environment, the most appropriate business model to pursue was determined. Being a mediator in a power purchase agreement was the business model with the highest strategic alignment, thus, deemed to be the most appropriate business model for the case company to pursue. By investigating a previously uncharted topic, our study expands existing research and identifies some business models not found in previous research. Furthermore, we introduce a new method for determining a company's strategic alignment with a new BM including a focus on a specific sustainability dimension.

Keywords: Battery electric trucks, renewable electricity, business models, strategic alignment

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1 Introduction

To tackle climate change and prevent its negative consequences, world leaders came to an agreement at the United Nations climate change conference in Paris in 2015 (United Nations, 2023). The Paris Agreement includes long-term goals of reducing global greenhouse gas emissions to limit global temperature increase to a maximum of 1.5 degrees. Road transport accounts for a fifth of all carbon emissions in the European Union and the European Parliament has banned sales of passenger cars powered by fossil fuels from the year 2035 and forward (Europaparlamentet, 2022). The reason for the ban is to achieve a carbon neutral transport sector by 2050 by shifting from fossil fuels to renewable energy sources such as solar and wind power. Road freight by heavy trucks accounted for 28 percent of global total road transport emissions in 2020 (Statista, 2021). The high emissions can partly be explained by the trucks' heavy weight and long distances driven (Bhardwaj & Mostofi, 2022). In February 2023, the European Commission presented a legislative proposal suggesting a 90 percent emission reduction for new heavy trucks by 2040 (European Commission, 2023).

Several heavy truck manufacturers have committed to following science-based targets (SBTs), to take responsibility for their environmental impact (Science Based targets, 2023A). The Science Based Target initiative (SBTi) is a partnership between the Carbon Disclosure Project (CDP), the United Nations Global Compact, the World Resources Institute (WRI), and the World Wide Fund for Nature (WWF), formed to increase companies' ambitions to fight climate change (Science Based Targets, 2023B). By committing to SBTs, companies can see how much, and how quickly, they need to reduce their emissions to align with the Paris Agreement. This is because the goals are based on the latest climate science and align with required actions to limit global warming below 1.5 degrees.

From a truck life cycle perspective, about 90 percent of carbon emissions occur in the use phase (Volvo Trucks, 2023A). Therefore, a high priority for heavy truck manufacturers is to decrease carbon emissions from powering the trucks after they have been sold. A possible solution for decreasing carbon intensity in powering trucks is to manufacture and sell battery electric trucks (BETs); *heavy* trucks driven by electricity instead of fossil fuels (Bhardwaj & Mostofi, 2022). Within the next 15 years, conventional heavy trucks are believed to be greatly replaced by BETs (PWC, 2023). During the use-phase, BETs emit zero greenhouse gases. However, whether the electricity is produced with renewable energy or fossil fuels affects the degree to which emissions are reduced over the complete lifecycle (Bhardwaj & Mostofi, 2022). While a BET charged with electricity from the residual mix has lower emissions than a conventional heavy truck (Volvo Trucks, 2023F), a truck driven by electricity generated from mostly non-renewable energy will be an indirect producer of carbon emissions (Bhardwaj & Mostofi, 2022). BET manufacturers that have committed to SBTs are obligated to take responsibility for emissions in the entire truck lifecycle, including production of energy for the use-phase.

Nevertheless, Costa et al. (2022) highlight that a transition towards charging heavy vehicles with renewable electricity will be a challenge since renewable energy sources today are scarce in many parts of the world. Besides, a large magnitude of energy is required to charge BETs (Randall, 2022). For example, Scania and Midsummer attached 140 square meters of solar panels on a truck trailer, resulting in an extra 14 000 kWh energy per year (Kristensson, 2020). According to the study, this only corresponds to fuel savings of five to ten percent. For comparison, 14 000 kWh is 70 percent of what an electrically heated villa consumes per

year. Truck electrification at a large scale would thus require more electricity production and for BET manufacturers to reach their SBTs, the increase needs to stem from renewable energy sources.

Due to truck electrification being in its infancy (Konstantinou & Gkritza, 2023), the issue of lowering carbon intensity of the electricity consumed in the use-phase has not yet been handled by BET manufacturers at a large scale. Since BET manufacturers want to lower indirect carbon emissions to reach SBTs, they need to gain some form of control over their customers' electricity choices. Incorporating ways to increase customer use of renewable electricity into a BET manufacturer's business would, thus, bring them closer to reaching their SBTs. There are no finished recipes for how a BET manufacturer can increase customer use of renewable electricity, but inspiration could be taken from other companies providing renewable electricity.

Renewable electricity generation has risen significantly in many parts of the world, with wind and solar power accounting for most of the growth (IEA, 2022), and today there are many ways to provide access to renewable electricity. One way to provide customers with renewable electricity generated from wind or solar power is through offering Power Purchase Agreements (PPAs). For example, PPAs are used by some solar firms in Sweden and entail a long-term agreement where the customer periodically pays a stable price for electricity from the provider (Bankel & Mignon, 2022). Another possibility is to offer customers to buy shares in a renewable power plant (VästanVind, 2023A), or to offer renewable electricity contracts (Altunay et al., 2021). Proposing value to their customers in the form of some sort of renewable electricity offer could enable BET manufacturers to influence what type of electricity their BETs are charged with.

To make a business out of a value proposition to the customer, the company also needs to create, deliver, and capture the value, and a business model (BM) describes the logic of how this is done (Richardson, 2008). In a BM, the goal is to capture the highest potential value. When different businesses in a company target completely different market segments, or sell contrasting products, multiple BMs can be suitable (Li, 2020). With this in mind, a heavy truck manufacturer is likely to have multiple BMs due to their differing product offers, such as BETs and conventional heavy trucks. Moreover, value in a BM can be of economic, social, and environmental kind (Bocken et al., 2014). A BM pursued by a BET manufacturer to increase customer use of renewable electricity may have as strong a focus on environmental value as on economic value, because the underlying driving force is to reach the SBTs. By looking at BMs in the renewable electricity sector, inspiration for how a BET manufacturer could increase customer use of renewable electricity when charging BETs could be found. These BMs could be more or less aligned with the BET manufacturer's overall strategy, established BM, and external environment. Therefore, it is important to analyze the company's strategic alignment with the new BM (Altunay et al., 2021).

An organization has a high degree of alignment when its strategies and goals are aligned at different functions and levels (Altunay et al., 2021). When a new BM and the established BM share characteristics such as complementing value proposition or key resources, it increases the alignment. BMs that have a high degree of alignment with the established BM do not require radical changes in existing processes, thus the barriers for pursuing them are lower. An organization's BMs can be interdependent on each other, and those interdependencies could be of either synergetic or conflicting nature (Harren et al., 2022). Also, Wadström (2019) writes that a high degree of alignment between two businesses enables the exploitation of synergies between them. Whether the new BM has a positive or negative impact on the established BMs is thus worth considering. Moreover, Altunay et al. (2021) write that a BM that creates social value has a higher degree of alignment for a company pursuing social goals than a company pursuing economic goals. Likewise,

pursuing a BM for stimulating an increased customer use of renewable electricity may be easier if the BET manufacturer has environmental care as a core value. In other words, the new BM must also align with the overall strategy for there to be a unanimous sense of direction. Otherwise, the BET manufacturer will be less likely to pursue it.

There are unexplored opportunities for a BET manufacturer to increase customer use of renewable electricity when charging BETs. Because truck electrification is a relatively new area, there is little to no research on how BET manufacturers could take responsibility for indirect emissions in the use-phase of their trucks at a large scale. Therefore, inspiration could be taken from other sectors by examining other companies' BMs for enabling their customers access to large-scale renewable electricity generated from wind or solar power. For a BET manufacturer to consider pursuing a BM, it needs to add value to the company. Thus, it is also relevant to examine the strategic alignment between the BMs and the BET manufacturer's established strategy, BM, and external environment.

1.1 Thesis Aim

The aim of the study is to find the most appropriate BM for a BET manufacturer to increase customer use of renewable electricity. In a larger context, the insights from the study may help guide BET manufacturers towards reducing their indirect emissions and determining how to do so.

1.2 Scope

Since BET manufacturers work business to business (B2B), all BMs in this study target businesses and not private consumers. Furthermore, since most BETs are today used in distribution, they are mostly charged at their home depot overnight (Engdahl, 2021). Longer distances will be driven by BETs in the future so charging opportunities along the route will become more common (Engdahl, 2021). Even so, stimulating renewable private charging is a relevant starting point. Therefore, this study will focus only on private charging, and not public charging.

Due to the large magnitude of electricity required to charge BETs, focus will lie only on large-scale renewable electricity generation. Therefore, only centralized electricity generation is of interest. Centralized generation refers to large-scale electricity generation at facilities that are often located away from the end-user (EPA, 2023).

Most BET manufacturers have several BMs due to a varied product offering of heavy trucks driven by diesel, electricity, and gas. Since this report focuses on BMs that are related to BETs, only the BET BM will be analyzed.

1.3 Research Questions

Deriving from the aim of the thesis, the following research questions are answered:

RQ1: What BMs for increasing customer use of renewable electricity could be pursued by a BET manufacturer?

RQ2: Which BM is the most strategically aligned with a BET manufacturer's established strategy, BM, and external environment?

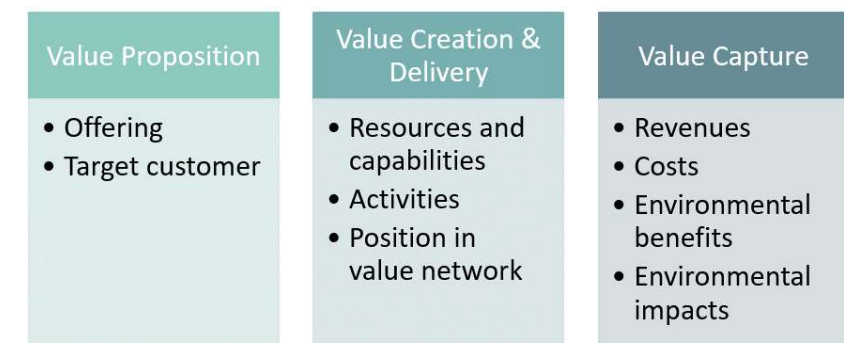
2 Frame of Reference

2.1 Business Models and Strategic Alignment

A BM describes how a firm does business (Richardson, 2008). Richardson (2008) explains that the three elements, *value proposition*, *value creation and delivery*, and *value capture*, are what define a BM. The value proposition describes what the company offers the target customer. Value creation and delivery concerns how value is created from capabilities and resources and how value is delivered through organizational activities. This dimension also includes where in the value network the company is positioned, and thus partners may be of importance. Lastly, value capture concerns how revenue is generated, and costs are structured. Osterwalder (2010) explains that the BM is used to help companies unlock value and create a market outcome of an innovative idea. It describes how different activities of a firm work together (Osterwalder, 2010), and how a company can create economical value by converting its capabilities and resources to meet customer needs (Tece, 2010). For a BET manufacturer to be able to increase customer use of renewable electricity, they need to deliver a value to the customer that results in an increased renewable electricity use. At the same time, value needs to be captured by the BET manufacturer, for example, in the form of profit. A BM would also help the BET manufacturer understand *how* to create the value.

While many definitions of BMs focus on monetary value realization, sustainable BMs also focus on value in environmental and social contexts (Wadin & Ode, 2019). For companies, such as BET manufacturers, who focus on reaching environmental goals, considering only monetary value may not be enough. Bocken et al. (2014) describe that sustainable BMs are built on the triple bottom line approach and considers society and environment as stakeholders. Joyce and Paquin (2016) created the *Triple Layered Business Model Canvas* which consists of: the *Economical BM*, the *Environmental Life-cycle BM*, and the *Social Stakeholder BM*. The environmental and social layers aim to ensure that the organization generates more environmental and social benefits than impacts. Environmental benefits and impacts are the positive or negative environmental outcome of an organization's actions. Social benefits and impacts concern how the company's action affects society and its people. While Joyce and Paquin (2016) emphasize the importance of considering all three layers for achieving a sustainable BM, the framework can serve as inspiration for companies looking to improve their BMs in a specific sustainability dimension. This could be true for BET manufacturers looking to achieve a more environmentally friendly BM in line with the SBTi. Figure 2.1 visualizes a framework, adapted from Richardson (2008) and Joyce and Paquin (2016), that could be used by companies to describe their business in terms of capturing both monetary and environmental value.

Figure 2.1 *Business Model Framework adapted from Richardson (2008) and Joyce and Paquin (2016)*



Richardson (2008) states that “the business model can be seen as the conceptual and architectural implementation of a business strategy and as the foundation for the implementation of business processes” (p. 136). Strategic alignment occurs when the BM mirrors what is clearly reflected in the firm’s strategy (Sholihah et al., 2019). Wadström (2019) writes that firms are generally pressured to grow, and by entering new lines of business, the firms become multi-businesses. The author highlights two corporate strategy challenges that arise when this happens. First, the firm needs to decide what businesses should be part of the organization. Second, it needs to be ensured that the businesses contribute beneficially to the whole organization. Here is where strategic alignment comes in, because integrating and aligning new businesses is a way to create synergies for the firm (Wadström, 2019). Sholihah et al. (2019) underline strategic alignment as both a challenge and a requirement and define it as “the appropriateness of various elements to one another” (p. 2). Chorn (1991) explains that, while strategic alignment is an ideal state to strive for, it is hard to achieve since a firm operates in a dynamic nature. Too much alignment may, in fact, inhibit a company from adapting to a dynamic environment (Kathuria et al., 2007). Thus, there could be situations when a company intentionally causes misalignment for a shorter period of time, to be able to produce an increased alignment in the long term (Chorn, 1991). This could, for example, happen when the company needs to prepare for a future shift in the environment. Over time, the company will adjust and achieve alignment.

Strategic alignment is approached from two different perspectives in management theory; *internal* and *external* (Wadström, 2019). Internal alignment concerns fit between internal organizational factors such as strategies, structures, and goals on different levels (Altunay et al., 2021). Consequently, research divides internal alignment into *vertical* and *horizontal* alignment (Altunay et al., 2021; Wadström, 2019; Kathuria et al., 2007).

Vertical alignment refers to alignment between an individual BM and the overall strategy of the company (Altunay et al., 2021; Wadström, 2019). This concerns alignment across hierarchical levels (Wadström, 2019). Zott et al. (2011) highlight how the BM can be seen as a realization of the firm’s strategy. The individual BMs are designed to create and capture value in specific product markets, while the company strategy provides an overall sense of direction for businesses to be run (Altunay et al., 2021). Differences in terms of overall goals between organizations may, thus, also lead to different patterns for adopting new businesses. This is because a new BM could either enable goal achievement or create goal conflicts. Altunay et al. (2021) highlight compatibility with *corporate goals*, *business logic* (what kind of company they want to define themselves as), and *market strategy* as important factors for determining the level of vertical alignment. When entering a new business, it is common to use partners to acquire resources and competitive advantage (Järvi et al., 2008). For example, oil companies entering the renewable energy market tend to strategically use partners to bring in new capabilities and the ability to share risks (Jenkins et al., 2021). To get these necessary resources, value must be created for the partner as well (Järvi et al., 2008). From a vertical alignment perspective, it is important to ensure that such a partnership fits with the overall strategy of the firm (Jenkins et al., 2021).

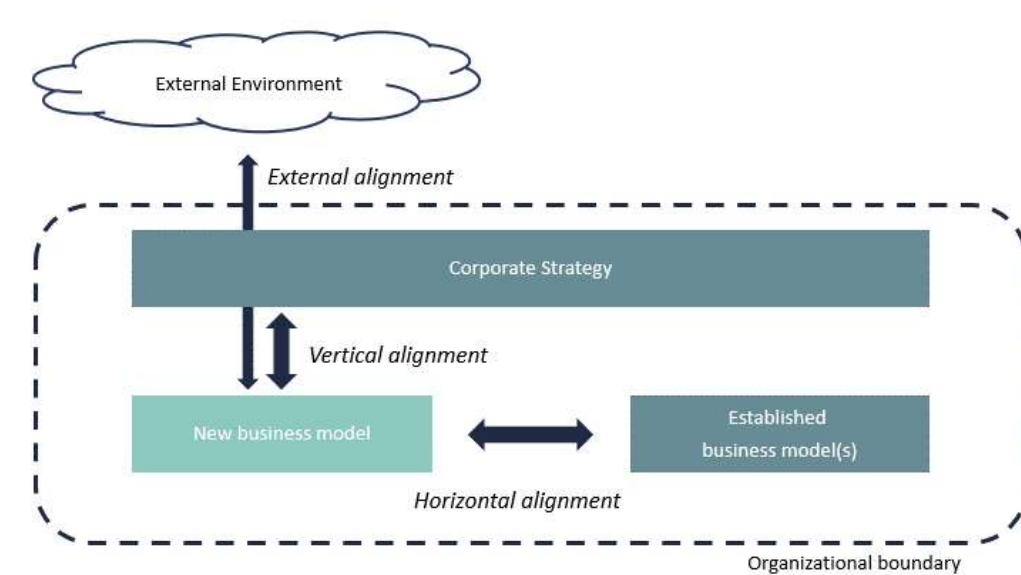
Furthermore, horizontal alignment entails the alignment between a new business and already established businesses in a company (Altunay et al., 2021). In other words, it concerns alignments across an organization’s lower levels (Kathuria et al., 2007). A company is more likely to pursue a new BM that has a high degree of alignment with their already established BMs (Altunay et al., 2019). Furthermore, alignment in terms of horizontal factors such as value proposition, key resources, and activities, could result in exploitation of synergies between the businesses. This means that the new BM is sustaining and

competence-enhancing. In a case where there is no horizontal alignment, however, the new BM is disruptive and competence-destroying. When examining horizontal alignment in the context of energy incumbents adopting solar BMs, Altunay et al. (2021) found that alignment in different components had varying degrees of importance for the adoption of a BM. For example, alignment in value proposition was not sufficient for a BM to be pursued while alignment in resources, activities, and partnerships was most important for adoption.

Lastly, external alignment concerns fit between the organization and external factors such as market demand, competition, and regulations (Altunay et al., 2021). A BM which creates a competitive advantage for the company, is compatible with regulations, or helps the company meet a customer demand, shows a higher degree of external alignment. When formulating and implementing a strategy, an external assessment of threats and opportunities should be made to ensure that the strategy is aligned with the external environment (Kathuria et al., 2007).

The Strategic Alignment framework, depicted in Figure 2.2, could be used by companies to explore whether a new BM clearly reflects their overall strategy, complements their established BM, and aligns with the company’s external environment.

Figure 2.2. *Strategic Alignment Framework adapted from Altunay et al. (2021).*



2.2 Business Models in the Renewable Electricity Sector

Research can be found on BMs for providing customers with renewable electricity at a large scale. These are *Renewable Standard Electricity Contracts*, *Power Purchase Agreements* (PPAs), and *Community Ownership* of wind or solar power.¹

To understand how the origin of the electricity is proved in the BMs, the concept of Guarantees of Origin (GOs) must be understood. Electricity is a homogenous good, so the origin of a specific MWh cannot be determined (Wimmers & Madlener, 2020). To prove that a certain amount of renewable electricity has been produced and consumed, the concept of GOs arose. GOs are used to disclose purchases of renewable electricity and can be traded like certificates. In other words, GOs can mark the electricity as “green”. The theoretical design of the GO system is that for every MWh of renewable electricity fed into the grid, the producer can be issued one GO (Wimmers & Madlener, 2020). When new renewable energy is generated and fed into the grid, the term *additionality* is used (Delardas & Giannos, 2023). In other words, when contributing to additionality of renewable electricity, GOs are issued. Consequentially, this GO can be traded and sold internationally to other actors on the GO market until a corresponding amount of electricity has been consumed by a customer (Wimmers & Madlener, 2020). Thereupon, the GO is cancelled and can no longer be used as proof for renewable electricity. If the GO has not been cancelled after one year, it is deleted from registry even if electricity of a corresponding amount has not been sold.

2.2.1 Renewable Standard Electricity Contracts

When GOs are bundled together with a standard electricity contract, it becomes a renewable electricity contract (Bröckl et al., 2011). Altunay et al. (2021) describe this BM as established on the market, thus it is widely adopted by electricity suppliers. GOs enable electricity to be sourced from specific sources, and the contracts exist for both wind and solar power (Altunay et al., 2021).

Value Proposition

The value proposition of a renewable electricity contract is reliable renewable electricity supply at a reasonably low cost, and it targets any electricity consumer (Altunay et al., 2021).

Value Creation and Delivery

Suppliers who offer renewable electricity contracts can source the electricity from their own solar parks, from community solar parks, micro-producers, or the spot market (Altunay et al., 2021). Sourcing electricity from own production is in research described as the production being host-owned (Xiang et al., 2019). This is when an actor builds a power plant and captures the profits by selling the electricity to the grid. Sometimes another company provides the actor with the technology, installation, and maintenance, but the actor can also do it by itself (Xiang et al., 2019). For example, Horváth and Szabó (2018) describe that most host-owner companies in Germany operate the whole system themselves which makes technical knowledge of high importance.

¹ The Leasing BM is also identified in research (Altunay et al., 2021; Bankel & Mignon, 2022). However, this BM is considered small-scale (Bankel & Mignon, 2022) and is, thus, excluded from our study.

Value Capture

Electricity sales and GOs generate monthly revenue, and costs come from purchasing or producing electricity and GOs (Altunay et al., 2021). Moreover, if the electricity is sourced from a host-owned power plant, the initial investment cost is often high with long payback times (Horváth & Szabó, 2018). Jansen et al. (2016) write that an increasing number of companies subscribe to renewable electricity contracts with the purpose of reducing their indirect greenhouse gas emissions, which is an environmental benefit with the BM.

2.2.2 Power Purchase Agreements

Another BM for providing renewable electricity is through Power Purchase Agreements (PPAs) which aim to create a fair and risk-controlled agreement between producer and consumer (Mendicino et al., 2019). In fact, over 60 percent of solar projects are financed using the PPA structure (Thumann & Woodroof, 2021). A PPA is a long-term agreement that binds the customer to purchase electricity from the company producing the electricity for 15-20 years at a known price (Thumann & Woodroof, 2021). Thus, both parties are shielded from the price variability and political uncertainty of the electricity market (Mendicino et al., 2019).

Value Proposition

The PPA frees the customers of any upfront costs and enables them to run their business as usual without having to worry about owning, operating, or maintaining the power plant (Mendicino et al., 2019). The customer also receives a stable electricity price for up to two decades that is lower than they would pay for electricity from the utility (Thumann & Woodroof, 2021). The starting kWh price will depend on the solar installation location, the project size, and other parameters that could affect electricity production. Additionally, the customer will receive GOs and be part of renewable electricity investments, thus contributing to additionality (Delardas & Giannos, 2023). For example, Google, Philips, AkzoNobel, and DSN utilize a PPA to source electricity from a wind farm in the Netherlands (Roobeek et al., 2018). The low degree of responsibility required of the customer is what makes the PPA unique (Thumann & Woodroof, 2021). All responsibilities and risks connected to the host-ownership of the plant are assumed by the PPA provider.

Value Creation and Delivery

Mendicino et al. (2019) write that centralized PPAs that can supply large-scale renewable electricity often are structured as *sleeved* PPAs or *virtual* PPAs. In a sleeved PPA, the centralized power plant has a physical connection to the grid (Mendicino et al., 2019). The seller sells all the power that the power plant generates to the corporate buyer through a first contract. This PPA enables the corporate buyer to buy electricity from a remote power plant thanks to the presence of a licensed supplier who sleeves the electricity through the grid. The supplier also manages billing and energy mismatch by making sure that the renewable electricity is topped off with extra electricity when necessary. Mendicino et al. (2019) also describes that some regulations can require an electricity retailer to put electricity into the grid so a licensed supplier as an intermediary might be necessary since not all producers have retail licenses.

The virtual PPA can be viewed as a financial version of the sleeved PPA (Mendicino et al., 2019). This agreement creates a financial model that replaces the physical model and allows the seller to virtually sell its produced electricity to the corporate buyer. Since the electricity supply is virtual and not physical,

renewable electricity is guaranteed with the help of GOs (Das & Malakar, 2021). The way the agreement works is that, via a standard PPA, the seller sells electricity at a market price to a licensed supplier (Mendicino et al., 2019). However, the licensed supplier continues to sell electricity through standard electricity supply contracts to the corporate buyer. At the same time, the seller and corporate buyer sign a virtual PPA where they agree on a strike price for the renewable electricity from the power plant. This is for both the seller and buyer to be sheltered from the risk of fluctuations in the market price. If the strike price differs from the market price positively, the corporate buyer must pay the difference to the seller. If the difference is negative, the seller must pay the corporate buyer.

Value Capture

Revenues are generated from selling electricity to the corporate buyer or a licensed supplier, as well as from a positive difference between the strike price and market price (Mendicino et al., 2019). Moreover, investments in solar and wind power come with high initial costs (Mendicino et al., 2019). In fact, up to 90 percent of the costs in a renewable power plant originate from the investment while costs from operations and maintenance are significantly lower. However, the PPA ensures that future cash flows are secured for the PPA provider, thus it decreases the risks and makes it a more attractive investment for third-party investors who often finance the power plant (Thumann & Woodroof, 2021).

2.2.3 Community Ownership

As mentioned in chapter 2.2.1, power plants can be host-owned. The ownership of plants can also be shared, and this BM is mentioned in research as the community ownership BM (Altunay et al., 2021; Stauch & Vuichard, 2019; Lantz & Tegen, 2009; Deutsch & Berényi, 2020). For example, Deutsch and Berényi (2020) explain that the community solar BM can be described as when multiple users can cover parts of their electricity consumption by owning shares in a power plant.

Value Proposition

Altunay et al. (2021) describes the value proposition of community ownership as customers being allowed to cover parts of their electricity consumption by owning a share in a plant. For example, members get the opportunity to financially participate in large solar PV systems and receive solar power or financial compensation in return (Stauch & Vuichard, 2019). Moreover, owning a share does not come with any financial risks for the customer who can sell the share back to the utility at any time. The shares have the potential of generating a positive return on investment.

Research has also found that community solar could increase the value of another offer. Stauch (2021) conducted a study in Germany where it was found that the adoption rate of electric cars increased if the car was bundled with community solar power. People buying an electric vehicle are typically also interested in renewable electricity. Thereby, a BM that bundled a vehicle with electricity resulted in added value for the customer, who only needed to make one purchase.

Value Creation and Delivery

Altunay et al. (2021) write that some electricity suppliers in Sweden engage with community solar parks. The supplier can take the role of an intermediary meaning that they start the project and enroll citizens and businesses, to then detach the ownership into a cooperative. The cooperative owns the land and the plant, sells shares, and pays dividends to members. At the same time, the supplier handles plant maintenance and sells electricity to the members of the cooperative. This way, the members can also receive complementary

electricity when needed. Although the plant is owned by the cooperative, there is a strong dependency on the suppliers' technical knowledge. Altunay et al. (2021) write that community solar can also be utility-led. This means that the projects are initiated and administrated by the utility or a third-party entity (Funkhouser et al., 2015). Community ownership exists for wind power as well, and like community solar, these projects should be at least partially owned by businesses or individuals (Lantz & Tegen, 2009). Lantz and Tegen (2009) write about community wind in the United States where ownership could be concentrated to the same region or the same state depending on the narrowness of the definition.

Value Capture

Revenues are generated through selling shares and costs from paying dividends to members (Altunay et al., 2021). As previously mentioned, building and maintaining a power plant also comes with costs (Mendicino et al., 2019). An environmental benefit of community ownership of solar power is that the BM that has been identified as a driver for keeping the solar power growth rate at a high level (Stauch & Vuichard, 2019). Likewise, community wind power has been applauded by researchers because of benefits such as improvement of local environment, capacity building, increasing awareness of renewable energy, and making energy production visible (Baxter et al., 2020).

2.3 Summary

BMs for enabling customers access to large-scale renewable electricity are identified in previous research. Combining established BMs in the renewable electricity sector with theory of strategic alignment could determine the level of applicability of these BMs in the BET industry, thus pointing to the relevance of our study. The combined BM definitions from Richardson (2008) and Joyce and Paquin (2016) are used to understand the BMs and what would be required for a BET manufacturer to pursue them. Previous research explains the importance of strategic alignment so the *Strategic Alignment Framework* in Figure 2.2 is used in our study to fill the research gap of which BMs would be the most appropriate for a BET manufacturer to pursue.

3 Methodology

3.1 Research Design

A single, qualitative case study of the Swedish BET manufacturer Volvo Trucks has been conducted. The study partly focused on identifying BMs that a BET manufacturer could pursue to stimulate an increased customer use of renewable electricity when charging BETs. The study also examined the strategic alignment between these BMs and Volvo Trucks' established strategy, BET BM, and external environment to determine which is the most appropriate to pursue.

According to Bell et al. (2019), qualitative research generates theory inductively rather than testing theories that are already specified, and data collection focuses on words rather than numbers. Furthermore, qualitative studies focus on applying theory in a context and using the perspective of the participants to gain an understanding. This study has exploratory research characteristics since it explored a topic that has not been researched in depth before.

The aim was to understand a real-world problem, and thus a case study was suitable (Yin, 2014). Different BMs with the potential of leading to an increased customer use of renewable electricity when charging BETs were analyzed and supported by interviewees' perceptions of the real-world problem. To fulfill the criterion of data triangulation and strengthen the findings of the study, semi-structured interviews were conducted and supported by secondary data.

3.2 Study Context

Sweden has a well-developed renewable electricity production (Energimyndigheten, 2022A), and is pervaded by the electrification trend to reach zero emissions by 2040 (Energimyndigheten, 2023). Large-scale electrification is seen as both possible and necessary (Energimyndigheten, 2023). Therefore, Sweden was chosen as study context when exploring large-scale renewable electricity BMs and examining strategic alignment. Swedish electricity producers and suppliers have experience in producing and selling renewable electricity, indicating that they have renewable electricity BMs that can benefit this study. Moreover, Sweden has a deregulated electricity market and electricity can be purchased under free conditions (Svenska kraftnät, 2023), thus the market environment can foster innovative solutions. Approximately 16 percent of the electricity in Sweden was produced by wind power, and one percent by solar power in the year 2021 (Energimyndigheten, 2022B). The electricity produced by solar power increased by 40 percent between the years 2020 and 2021, which reflects a rapid expansion of renewable electricity producing facilities (Energimyndigheten, 2022B). Moreover, Sweden has become one of the most significant wind power markets in Europe due to its beneficial weather conditions and stable environment for renewable energy investments (Axpo, 2023).

The electrification trend encompasses the transformation towards electric vehicles and a lot of electrification is happening in the transport sector (Energiföretagen, 2023). Investments are allocated to support and speed up the electrification of heavy vehicles (Energiföretagen, 2021), something that benefits BET manufacturers in their work towards scaling up BET sales. Prognosis point towards the number of BETs in Sweden going from about 30 vehicles today to 12500 in the year 2030 (Power Circle, 2023). Sweden's well-developed renewable electricity production and the dedication towards electrifying BETs implies a potential for finding interesting BMs for increasing customer use of renewable electricity.

3.3 Case Selection

The BET manufacturer, purposely selected for the single case study, is Volvo Trucks. Volvo Trucks is a truck manufacturing division of Volvo Group which, in turn, is a subsidiary of AB Volvo. Volvo Group is one of the largest manufacturers of vehicles such as buses, trucks, industrial engines, and construction equipment in the world (Volvo Trucks, 2023C). Volvo Trucks was founded in 1927, operates in 130 markets worldwide, and has their headquarter in Gothenburg, Sweden (Volvo Trucks, 2023B). They have a strong environmental focus and environmental care has been one of their core values for over 50 years (Volvo Trucks, 2023A).

With the goal of reaching net zero greenhouse gas emissions by 2050 in accordance with the Paris agreement, Volvo Trucks has committed to SBTs (Volvo Group, 2023B). For Volvo Trucks, this commitment includes emissions from their internal operations, as well as emissions from vehicles' tailpipes and from producing the electricity that powers the trucks. To drive the electrification trend of the heavy truck industry, the company has started manufacturing and selling BETs (Volvo Group, 2023A). They have sold over 4300 BETs in 38 countries and are the market leader for BETs in Europe (Volvo Trucks, 2023G). Volvo Trucks want to encourage their customers to charge their BETs with renewable electricity and explore available alternatives to do so, in line with their SBTs. This requires new actions beyond their current operational activities. Therefore, Volvo Trucks was a suitable candidate for the case study in this report. One of the writers of this report worked at Volvo Trucks during the summer of 2022 and made contacts that enabled this collaboration.

BMs and strategies exist on different levels in an organization (Altunay et al., 2021). Hence, Volvo Group has an overall strategy and BM, while Volvo Trucks also inhibit their own strategy and BM on a lower level. This report only focused on the strategy and BM of Volvo Trucks when examining the alignment with the new BMs.

3.4 Data Collection

To be able to answer the study's research questions and form a base for the study's data analysis, both secondary and primary data was collected. Secondary data was collected from websites and reports while primary data was in the form of semi-structured interviews. The semi-structured format benefited this study since there was an interest in finding new insights that were not necessarily considered before the interviews started. The possibility of asking follow-up questions enabled a deeper understanding of the topic and steered the interview towards interesting topics discovered during the interviews. Follow-up questions also enabled clarification of answers to ensure they were correctly understood. Bell et al. (2019) write that semi-structured interviews are based on an interview guide that does not need to be followed precisely. When the interviewer picks up on something the interviewee said, additional questions can be posed.

Our data was collected for four different purposes, divided into the following themes:

- 1) Strategy and Business Model of Volvo Trucks
- 2) Business Models to Increase Customer Use of Renewable Electricity
- 3) External Environment of Volvo Trucks
- 4) Volvo's Perception of Identified Business Models

The data was collected iteratively because this allowed for generating richer qualitative data. By performing the data collection iteratively, learnings and findings from one research theme could be incorporated into another. For example, it was valuable to get the interviewees' perceptions on collected secondary data.

Secondary data was collected consequently between January and May 2023, and the interviews were held during March and April. Each interview was between 30 to 60 minutes long and was held in person or digitally over Microsoft Teams, depending on accessibility.

The following chapters explain how data was collected for each theme more in depth.

3.4.1 Strategy and Business Model of Volvo Trucks

For this theme, the purpose was to map out Volvo Trucks’ overall strategy based on the components: *goals*, *business logic*, and *market strategy*, and their current BET BM, based on the *Business Model Framework* in Figure 2.1. This was to be able to make a more accurate analysis of vertical and horizontal strategic alignment between Volvo Trucks and the BMs for increasing customer use of renewable electricity.

Data was collected through both secondary and primary data. Secondary data was collected from Volvo Trucks’ website and press releases to map out Volvo Trucks’ strategy and BET BM. The benefit of collecting secondary data about Volvo Trucks’ strategy and BET BM is that the data is public, easily accessible, and provides a comprehensive overview of their business. Examples of search phrases used at Volvo Trucks’ website were: “strategy”, “core values”, “sustainability strategy”, “emission targets”, “battery electric trucks”, and “service offering”.

To triangulate and nuance findings, semi-structured interviews were conducted with employees at Volvo Group: some of them working closely with Volvo Trucks’ strategy and some having a connection to electromobility and/or electricity. Interviews were chosen to complement secondary data collection because it enabled a deeper understanding of strategy and business elements discovered on the website. The elements were discussed with knowledgeable employees and could be further understood through follow-up questions. For example, a deeper understanding was gained of Volvo Trucks’ experience in and attitudes towards renewable electricity.

The employees were chosen based on a purposive strategy and Bell et al. (2019) explain that purposive sampling entails selection of people that are relevant for answering the study’s research questions. Therefore, the interviewees were contacted based on their knowledge of areas relevant to answering the research questions. The sampling context was expanded beyond Volvo Trucks to Volvo Energy and Volvo Buses because knowledge in these business areas influences Volvo Trucks’ BM. The different employees have different roles and, thus, also different areas of expertise. Questions were, therefore, partly tailored for their expertise to ensure a deep understanding of their specific area of the company. Bell et al. (2019) highlight how purposive sampling with members of different characteristics can give a good variety in the result. There is, however, a risk that such variety could inhibit generalization. A more detailed aim of each interview and example questions are included in Table 3.1.

Table 3.1. *Interviews conducted to map out strategy and business model of Volvo Trucks*

Interviewees	Aim of Interview	Examples of Questions
Interviewee D Employee at Volvo Trucks, working closely with the company’s strategy	Gain understanding of Volvo Trucks’ strategy and BET BM	<ul style="list-style-type: none"> • What are the most important aspects of Volvo Trucks’ strategy? • What are the most important considerations when entering a new business, project, or market? • How are BETs sold today?

Interviewee E Employee at Volvo Trucks, responsible for the environmental sustainability strategy	Gain understanding of Volvo Trucks’ sustainability strategy and BET BM	<ul style="list-style-type: none"> • What are the most important aspects of Volvo Trucks’ sustainability strategy? • What actions, related to renewable electricity, are Volvo Trucks’ taking to become more sustainable? • How are BETs sold today?
Interviewee F Employee at Volvo Trucks, working with charging solutions and projects	Gain understanding of Volvo Trucks’ renewable electricity considerations	<ul style="list-style-type: none"> • How do you work with renewable electricity? • What renewable electricity solutions for powering trucks have you considered? • How do you perceive the possibility of Volvo offering electricity to customers?
Interviewee G Employee at Volvo Buses, working with electromobility	Gain understanding of Volvo Buses’ renewable electricity considerations	<ul style="list-style-type: none"> • How do you work with renewable electricity? • How are your customers' attitudes towards renewable electricity?
Interviewee H Employee at Volvo Buses, working with electromobility		
Interviewee I Employee at Volvo Energy working with charging infrastructure	Gain understanding of Volvo Energy’s renewable electricity considerations	<ul style="list-style-type: none"> • How do you work with renewable electricity? • How could offering services that bundle private charging with renewable electricity benefit Volvo? • What initiatives could Volvo take to contribute to the development of the electromobility market?
Interviewee J Employee at Volvo Energy working with charging infrastructure		
Interviewee K Employee at Group Truck Purchasing, working with electricity purchasing	Gain understanding of how Volvo Group acquires renewable electricity today	<ul style="list-style-type: none"> • How do you work with renewable electricity? • How is the renewable electricity to Volvo Trucks’ facilities produced and supplied today?

3.4.2 Business Models to Increase Customer Use of Renewable Electricity

To explore what BMs for providing customers with large-scale renewable electricity exist today, websites of electricity producers and suppliers in Sweden were explored. For example, we searched for different ways that electricity suppliers offer their *corporate* customers access to large scale renewable electricity. Electricity supplier websites were explored until collected data did not generate any new BMs or insights about the already discovered BMs. Bell et al. (2019) explain that theoretical saturation occurs when sampling is carried on until a category have saturated data. This is when new data does not generate new dimensions of a category or new insights.

Since Volvo Trucks is an automotive company, the study also investigated BMs that automotive companies use for investing in or selling renewable electricity, either by themselves or via collaborations with electricity producers/suppliers. Only a few examples were found in Sweden, and thus the exploration of other automotive companies’ initiatives was expanded beyond Sweden to Europe. Examples of search phrases used in Google’s search engine were “renewable electricity and EV collaborations”, “automotive companies offering electricity”, and “automotive companies investing in renewable electricity”.

Mostly, secondary data was used for identifying and mapping the different BMs. This was because the data was easily accessible, comprehensive, and enabled the researcher to gather a lot of information efficiently.

To further ensure that all relevant BMs had been identified, experts in the renewable electricity sector were interviewed. These interviews were of exploratory character and the purpose was to find out if even more options for providing renewable electricity generated from solar or wind power in Sweden exist. Furthermore, the interviews enabled further discussing the identified BMs to ensure a correct interpretation of how value is proposed, created, delivered, and captured in them. Three interviews were held with members of Swedish solar and wind power industry associations, as depicted in Table 3.2. The members were chosen based on their expertise in the renewable electricity market and/or knowledge about solar or wind power. Finding interviewees with this expertise required purposive sampling outside of Volvo Trucks. Interviewees A and B were chosen to represent one renewable energy source each, based on the industry association they belong to. Furthermore, Interviewee B recommended contacting Interviewee C because of their expertise in the electricity market. Thus, Interviewee C was chosen based on snowball sampling. Snowball sampling is a type of purposive sampling where sampled participants suggest further people to interview based on their experience (Bell et al., 2019).

Table 3.2. *Interviews conducted for ensuring a comprehensive identification of business models*

Interviewees	Examples of Questions
Interviewee A Employee at Svensk Solenergi	<ul style="list-style-type: none"> • What ways are there to generate large-scale electricity from wind power?
Interviewee B Employee at Svensk Vindenergi	<ul style="list-style-type: none"> • What ways are there to generate large-scale electricity from solar power?
Interviewee C Board member of Svensk Vindenergi and Partner at Bodecker Partners, with expertise in the electricity market and PPAs	<ul style="list-style-type: none"> • What different forms of PPAs exist?

The identified models were mapped according to the *Business Model Framework* in Figure 2.1.

3.4.3 External Environment of Volvo Trucks

To collect data about Volvo Trucks' external environment, both primary and secondary data was used. For this purpose, data about customer demand, competition, and regulations were collected.

To gain an understanding of Volvo Trucks' customers' (and their customers') demand for renewable electricity and whether some sort of renewable electricity offer from Volvo Trucks would be of interest, interviews were conducted with seven of Volvo Trucks' customers. Interviews were conducted with Volvo Trucks customers owning one or more BETs, see Table 3.3. Conducting interviews was necessary since the wanted information was a personal opinion from the customers, something that cannot be found through secondary data. The customers were chosen purposively with help from recommendations from employees at Volvo Trucks. The demands were that they owned at least one BET. An additional interview was also held with an employee at Volvo Trucks who works closely with customers, also based on a recommendation from an interviewee in Table 3.1.

Table 3.3. *Interviews conducted for understanding customer demand*

Interviewees	Examples of Questions
Interviewee L Employee at Volvo Trucks, working in electromobility business development, with close customer contact	<ul style="list-style-type: none"> • How do you work with renewable electricity? • How does the demand look for renewable electricity from Volvo’s customers and their customers? • How would an offer from Volvo related to securing renewable electricity be received? • How many BETs do you have? • What kind of electricity do you charge them with? • How do you access your electricity today? • How does demand look for transportation driven by renewable electricity? • How would your attitude look towards a potential all-in-one solution that bundles electricity with a BET?
Interviewee M Business Area Manager at Göteborgs Lastbilcentral (GLC)	
Interviewee N CEO of Alfredsson Transport AB	
Interviewee O CEO of Perssons Åkeri i Svenljunga AB	
Interviewee P CEO of Schenker Åkeri AB	
Interviewee Q Key Account Manager, Electric Trucks, at Erikssons Åkeri AB	
Interviewee R CEO of Stay Fresh Sweden AB	
Interviewee S CEO of WIBAX Logistics AB	

In contrast, data about competition on the electricity market and regulations for pursuing the BMs was only collected through secondary data. This information could easily be found online on municipality and authority websites. Examples of search phrases used in Google’s search engine were: “number of electricity suppliers in Sweden”, “electricity market competition”, “regulations for selling electricity”, “regulations for producing electricity”, and “how to become an electricity supplier”. Moreover, when the identified BMs were discussed with experts in the renewable electricity sector (see Table 3.2), some further regulations came up that nuanced the secondary data collection.

3.4.4 Volvo’s Perception of Identified Business Models

To complement and nuance the data collected from the other three themes, interviews and a focus group were used to discuss the identified BMs in terms of Volvo pursuing them.

All interviewees in table 3.1, were to some extent discussing the identified BMs in relation to Volvo Trucks potentially pursuing them. The insights gave a deeper understanding of the BMs in terms of a Volvo perspective. It also gave an understanding of the employees’ perception of what would be required of Volvo Trucks to pursue the models and in what dimensions the BMs were following the company’s strategy or complemented their current BET BM.

However, since the data collection was an iterative process, all BMs had not been collected or fully developed by the time the interviews in Table 3.1 were held. The same goes for data collected of Volvo’s external environment. Therefore, a focus group was scheduled in the middle of May after all other data

collection had been conducted. In this way, we made sure that employees had the opportunity to discuss all BMs to the same extent and with a comprehensive understanding of their context.

The focus group consisted of six employees from Volvo Trucks, see Table 3.4, all connected to the company’s strategy. Interviewees D and E had been interviewed separately as well, but the remaining participants were involved for the first time during the focus group session. To ensure that all participants understood the topic and the study’s results, relevant information was sent out a day in advance and the session commenced with a presentation from the researchers. In the focus group, the result and parts of the analysis were presented and discussed in terms of applicability in practice. Applicability was discussed based on knowledge that the employees had of Volvo Trucks’ resources, experience, and strategy. The employees were able to respond to the result and to each other's views. A focus group was suitable because the different perspectives and experiences from Volvo Trucks’ employees could build on earlier data collection. The result from the focus group was added to our findings to nuance, strengthen, or contrast previous data collection. According to Bell et al. (2019), focus groups are suitable when researchers want to reveal how participants view an issue as members of a group.

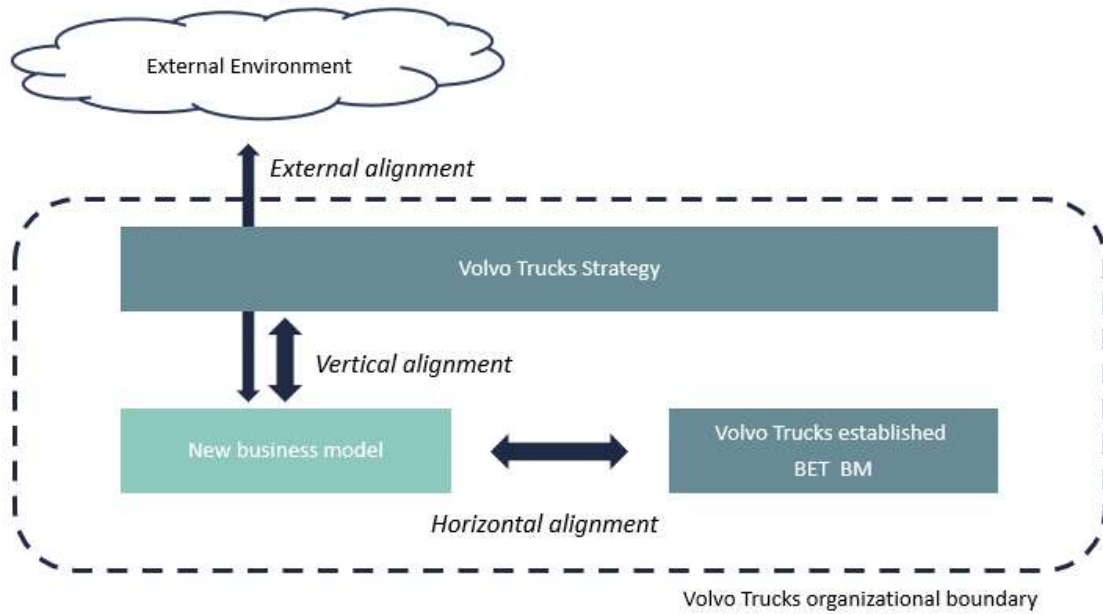
Table 3.4. *Focus group participants*

Focus Group Participants
Interviewee D Employee at Volvo Trucks, working closely with the company’s strategy
Interviewee E Employee at Volvo Trucks, responsible for the environmental sustainability strategy
Interviewee T Employee at Volvo Trucks working as director of new services
Interviewee U Employee at Volvo Trucks working with climate targets
Interviewee V Employee at Volvo Trucks working with the global sustainability strategy
Interviewee W Employee at Volvo Trucks working with transport development

3.5 Data Analysis

The aim of the analysis was to determine the most appropriate BM for Volvo Trucks to increase customer use of renewable electricity by examining strategic alignment. Since research emphasizes the importance of strategic alignment when pursuing new BMs (Sholihah et al., 2019; Wadström, 2019), the adapted framework from Altunay et al. (2021) in Figure 2.2, was used to examine the appropriateness of the BMs. A nearly identical version of the framework, adapted to the case company, is depicted in Figure 3.1. Strategic alignment was analyzed between all mapped BMs and Volvo Trucks’ established strategy, BET BM, and external environment. Each BM’s vertical, horizontal, and external alignment with Volvo Trucks was examined.

Figure 3.1. *Strategic Alignment Framework adapted from Altunay et al. (2021). Further adapted to the case company.*



Vertical alignment between each new BM and Volvo Trucks’ overall strategy was analyzed. This was done by comparing how well the BMs align with the company’s *goals, business logic, and market strategy*. The more aspects the BM followed or complemented, the higher was the alignment. For example, Volvo Trucks has goals of contributing to environmental benefits. Thus, pursuing a BM that generates more renewable electricity to the grid experiences a higher vertical alignment than BMs consuming already existing renewable electricity.

Furthermore, horizontal alignment between each new BM and Volvo Trucks’ established BET BM was analyzed through a component-by-component comparison of the three components in the Business Model Framework: *value proposition, value creation and delivery, and value capture*. For example, one could argue that Volvo Trucks lacks the knowledge needed to sell electricity to end-consumers. Thus, pursuing a BM that requires such resources points towards lower horizontal alignment than, for example, pursuing a BM where a partner will handle all responsibilities connected to selling electricity instead.

Consequently, data collected about *customer demand, competition, and regulations* was used to analyze each BM’s external alignment with Volvo Trucks. In line with this, pursuing a BM that meets customer demands and experiences lower competition in the market may have a higher external alignment compared to a BM that is not demanded by customers and is exposed to high competition.

The three dimensions of alignment, and their associated components are summarized in Table 3.5.

Table 3.5. *Alignment dimensions and their components*

Alignment Dimension / Components	Vertical alignment	Horizontal alignment	External alignment
	Goals	Value Proposition	Customer Demand
	Business Logic	Value Creation & Delivery	Competition
	Market Strategy	Value Capture	Regulations

Alignment was graded for each of the seven BMs in each of the three alignment dimensions based on the scale *Low, Relatively Low, Medium, Relatively High, and High*. The scale corresponds to how well the BMs are aligned with the company’s strategy, BM, and external environment. In the *vertical* dimension, the grading is based on how well the BM follows or complements the established strategy, i.e., the goals, business logic, and market strategy. For example, if the BM strictly follows and complements the established goals of the company, the score would be *High* for the goals component. If the model predominantly follows and contributes to the established goals of the company but also conflicts them in some respects, it would be scored *Relatively High*. The same reasoning goes for the lower grades on the scale. A *Medium* score means that the complementing and conflicting factors outweigh each other. In the horizontal dimension, the grading is based on how well the components, value proposition, value creation & delivery, and value capture, in the new BM complements or corresponds to the same components in the established BM. For example, if the new BM adds to, and thus, complements the established value proposition, the score would be *High*. Lastly, in the external dimension, the grading is based on how well the BM corresponds to customer demand, and the degree to which the pursuit of the BM is *not* hindered by competition and regulations.

From this, conclusions about which BM is the most strategically aligned with a BET manufacturer, in each alignment dimension, could be drawn and further discussed. Table 3.6 shows the scoring system that was applied to each component of the alignment dimensions. The three separate scores for the three components in each dimension were then compiled into an average that in turn corresponded to a grade on the scale for the whole dimension. For example, if the average vertical alignment scored 1.33 for a BM, the score is closer to 1 than 2, and thus the compiled vertical alignment for that BM would be *Relatively High* and not *High*.

Table 3.6. *Scoring system for grading of alignment*

		Only conflicts or is hindered by	Predominantly conflicts or is hindered by	Factors outweigh each other	Predominantly complements or is <i>not</i> hindered by	Only complements or is <i>not</i> hindered by
Alignment Dimension	Component 1	-2	-1	0	1	2
	Component 2	-2	-1	0	1	2

	Component 3	-2	-1	0	1	2
Alignment Scale		Low	Relatively Low	Medium	Relatively High	High

3.6 Method Discussion

Ethics have been highly considered during this study. There was a close collaboration with Volvo Trucks, and it was important to make sure no confidential information was published. Publishing confidential or misleading information could result in lost competitive advantages for Volvo Trucks. Moreover, one of the researchers has been employed and worked in other areas at the case company before. To ensure that the former employed researcher have not biased the results in any way, actions have been taken. For example, the two researchers have conducted all interviews and analyses together to ensure agreed perceptions. All written texts have also been reviewed by the other researcher to ensure that people not working at Volvo Trucks will understand the study as well.

Moreover, the fact that both writers of the report attended all interviews ensured consistency. The interviews were also recorded and transcribed to ensure correct interpretation of information in the report. Bell et al. (2019) write that not recording interviews may result in the distortion of answers by the interviewer, hence introducing error. For ethical reasons, the interviewees were asked prior to the interview if they allowed it to be recorded. The interviewees were also asked to which degree they wanted to be anonymous in the published report. Before the report was published, all interviewees were presented with the opportunity to read through and comment on the result to validate citations and interpretations.

Our study was a single case study of Volvo Trucks on the Swedish market. While the format allowed for a deep analysis of the specific case, studying one BET manufacturer on one market naturally entails limitations, especially when it comes to generalizability. Choosing Sweden as study context was motivated because of a well-developed renewable electricity, as well as the country being pervaded by the electrification trend. While this implies potential for finding interesting BMs, it means that the results likely are not generalizable in terms of applicability in markets that are less developed. According to Bell et al. (2019), external validity ensures that the result can be used outside of its context. In other words, the chosen study context could limit external validity. The sampling strategy used for selecting customers to interview was also affected by the choice of study context. We purposively selected seven Volvo Trucks customers in Sweden because they owned at least one BET, and all customers charged their BETs renewably already. This possibly stems from Sweden having a well-developed renewable electricity production. Therefore, Volvo Trucks’ chances of increasing customer use of renewable electricity may be greater on other markets that are less developed.

Likewise, choosing Volvo Trucks who is the market leader of BETs and a large-sized company, could limit understanding of companies that are smaller and more narrowly established. For example, Volvo Trucks’ size entails a strong bargaining power which influences the pursuit of some of the BMs. A limitation is, therefore, that the result may not be generalizable to BET manufacturers of all sizes.

While the findings of the study are most applicable to Volvo Trucks, they provide insights into how other BET manufacturers could reduce their indirect carbon emissions. For Swedish BET manufacturers sharing characteristics with Volvo, such as their large size and global establishment, who also have a similar

strategy and BM, there is no direct reason why the results would not be applicable. For companies sharing less similar characteristics, the method to examine strategic alignment and, thus, determine how appropriate a BM is to pursue, could still be used. The same method could be applied to other BET manufacturers on other markets, and also to companies in other industries with a few alterations. For example, then the regulations components may concern other activities than selling or producing electricity.

4 Findings

This chapter presents Volvo Trucks' established strategy and BET BM, our seven identified BMs for increasing customer use of renewable electricity, as well as Volvo Trucks' external environment. The data presented in this chapter is used in chapter 5 to analyze strategic alignment. We use Volvo Trucks' strategy to analyze vertical alignment between Volvo Trucks and the seven BMs. Consequently, data about the established BET BM is used to analyze horizontal alignment, and data about the external environment to analyze external alignment.

4.1 Strategy of Volvo Trucks

Volvo Trucks states that they have made driving progress a promise to their customers, to society, and to the transport industry since the company was founded in the 1920s (Volvo Trucks, 2023D). When being asked about the most important part of Volvo Trucks' strategy, Interviewee D states: "Volvo Trucks is committed to tackling the global challenges in the transport industry and at the same time building our sustainable business. We are a world-leading truck manufacturer, and we want to shape the future by driving sustainable transportation."

Goals

First of all, Volvo Trucks is always striving for a leading level of customer satisfaction, and it is important to create value by securing customer success (Volvo Group, 2023C). For example, several interviewees highlight that the customer is extremely important and customer value always needs to be in focus. Interviewee D says that the basic mindset is that "if the customer is successful, we will be successful". Our findings also show the importance of looking at decisions from the customer's perspective and continuously asking "what's in it for them?".

All Volvo Group brands, including Volvo Trucks, are striving towards having an industry leading profitability (Volvo Group, 2023C). Interviewees highlight that the B2B truck manufacturing industry generally generates profit based on higher margins rather than higher volumes, as opposed to high-volume, low-margin industries such as supermarkets and fast fashion. This is because the industry is characterized by highly specialized solutions, high customization, and relation-based selling. Interviewee D says that monetary results are of importance for a listed BET manufacturer because earning a profit is expected of them.

With help from collaborations with transport buyers, research institutions, and universities, Volvo Trucks aims to shape the future landscape of sustainable transport (Volvo Trucks, 2023D). Interviewees D and E highlight that for a business to be sustainable, both financial and environmental sustainability must be considered. Interviewee E continues: "As a company, I believe you should not only focus on profitability. You also need to make sure that you give something back to society and customers, to contribute to a positive development. The bottom line is that we should strive for sustainable growth in both the economic aspect and all other sustainability aspects at the same time."

To tackle environmental problems such as global warming, depleted natural resources, and exhaust emissions, Volvo Trucks states that they have a strong focus on energy efficiency and alternative fuels (Volvo Trucks, 2023D). This environmental care strategy encompasses their entire business and shapes all decisions made about the future. Interviewee E highlights the importance of considering the entire value

chain. Volvo Trucks has committed to following SBTs that encompass a 50 percent reduction of CO₂ from use of sold products by 2030, and 100 percent reduction by 2040, compared to a 2019 baseline. This means that all sold BETs will need to be driven by carbon neutral electricity by 2040. Electric vehicles are an important piece of the puzzle to reach net-zero emissions by 2040 (Volvo Trucks, 2023D). The main driving force for the transition towards electric vehicles is the need for sustainable transport (Volvo Trucks, 2023E). When driving the transition, Volvo Trucks generally wants to prevent environmental impacts rather than compensate for them, according to Interviewee E.

Business Logic

Our findings show that Volvo Trucks' focus lies on delivering sustainable total transport solutions. According to Interviewees D and E, the strategy is to continue growing truck offerings, while also driving towards increased services sales. Increasing the service offer would be facilitated primarily where the services are globally scalable and thus applicable in many of Volvo Trucks' markets, according to Interviewees E and J. Scaling up the sales of BETs will result in increased demand for electricity, and several interviewees reflect on Volvo Trucks' opportunity to produce and/or supply electricity as a potential service.

Electricity is not part of Volvo Trucks' offerings to customers today, so several interviewees highlight that this would require new knowledge and longer-term investments than the truck manufacturing industry is generally characterized by. If entering a certain business does not align with what Volvo is doing today, it could still be an active choice to enter that business, for example, to reach SBTs, according to Interviewee F. When asked about their attitude towards Volvo Trucks entering the electricity market, Interviewee E reflects: "We have a need to make sure that a transformation from fossil fuels to renewables is happening. And it could be an opportunity to offer the total package to our customers. I think it would be exciting but at the same time challenging. [...] We have a problem that we need to solve, and we need to learn things on the way."

To acquire the necessary knowledge for entering the electricity market, several interviewees reflect on the possibility of collaborating with an experienced partner. For example, Interviewee D says that it is difficult to realize a new offer fully on your own, and that Volvo Trucks is generally open to partnerships. Top of mind, customers may not turn to Volvo Trucks when needing electricity supply, so partnering up may be a more natural solution. Likewise, Interviewee E states that partnerships are often central in driving sustainable initiatives forward: "You need to make use of other actors' competence, knowledge, and assets and make things happen together. If we take an electric truck as an example, it is somewhat of a chicken or egg problem. It is not enough to have the truck if there is no charging infrastructure or if there is no renewable electricity."

Market strategy

Creating value through social, environmental, and economic responsibility is the basis for the credibility of the Volvo Trucks brand (Volvo Trucks, 2023D). Regarding Volvo Trucks' market strategy, Interviewee D states that "if we ask 5000 customers, driving different brands, which brand they would like to drive, it is important for us that they answer Volvo". To strive for sustainable transport that is designed with the driver's needs in focus, the company is pervaded by the core values quality, safety, and environmental care (Volvo Trucks, 2023D). Quality and safety are about leaving nothing to chance and producing solutions that prevent accidents. Furthermore, the Volvo sustainability framework includes the three pillars climate,

resources, and people, and corporate social responsibility (CSR) is part of the company culture (Volvo Trucks, 2023D).

Interviewee D explains that Volvo Trucks has the ambition to create sustainable solutions before customers start demanding them, rather than after. For example, they started developing BETs before there was a large demand, and once the demand arose the company was prepared to meet it. One big win when focusing on sustainability is Volvo Trucks' contribution to the greater good, according to Interviewee J. All sustainability initiatives may not be that competitive, but into and promote Volvo Trucks' core values.

As previously mentioned, our findings show that Volvo Trucks is in a relation-based selling industry, meaning close customer relationships are important. This also makes owning the customer interface important. Interviewees G and E discuss how partnerships could strengthen the company's offer, but also inhibit customer relationships. Therefore, it is important to consider which actor in the partnership will handle the customer interface and what that could imply in terms of customer contact. To attract partners who have clever ideas, PR is important, according to Interviewee E. Press releases make it possible to reach out to possible partners, and Volvo Trucks' sustainable image has led to successful collaborations in the past.

4.2 Business Model of Volvo Trucks

Value Proposition

The findings of this study show that Volvo Trucks' main BET value proposition consists of offering the customer a BET with value-adding services. The BETs are safe, and of high quality and comfort. Along with the BET, the customer is offered a service agreement, driver education, charging infrastructure, financial options, route planning, as well as access to a large service network. For example, Interviewees D and E discuss that route optimization is valuable for the customer since charging electric vehicles requires a different planning than just filling up a fossil driven vehicle. The interviewees highlight that Volvo Trucks wants to place the BET in a larger context and how the value-adding services help create an eco-system with the goal of offering a total transport solution, both before and after a purchase has been made.

Volvo Trucks is a premium brand, and according to Interviewee D, early BET customers have sustainability as a core value and are interested in testing new technology. They are also image driven and connect driving a premium truck to good company branding. Not all truck segments are ideal for BETs today (Volvo Trucks, 2023E), but over time, Interviewee D explains that Volvo Trucks wants to be able to target most of their existing customer base with BETs. Interviewee E highlights that these existing customers are of varying sizes, and that many are smaller, owning between one and 20 trucks. Interviewee D also mentions that the BET business can open for new customers that have not previously bought trucks from Volvo Trucks.

Value Creation and Delivery

Our findings show that Volvo Trucks is developing and building BETs. This is done with help from a chain of important internal and external partners. For example, Interviewee J explains that Volvo Energy is an internal partner that creates charging solutions for Volvo Trucks' business and works with battery life cycles. Interviewee I says that Volvo Energy now helps BET customers understand how they can charge renewably and possibly pass that information along to their stakeholders. Interviewee I also explains that such guidance creates customer value since the market for renewable charging is still immature.

Electricity suppliers are also becoming important partners to Volvo (Öresundskraft, 2022). Volvo Trucks has, in collaboration with Daimler Truck and Traton Group, entered a joint venture where they invest and install at least 1700 charging points for BETs in Europe (Broback, 2021). These charging points will be strategically located and enable BETs that are driving long distances to be charged with green electricity. Besides the charging network, Volvo Trucks is also working with electricity providers to build and invest in smaller projects that increase charging possibilities of BETs (Volvo Trucks, 2022). For example, they collaborate with OKQ8 and Öresundskraft to install renewable charging stations along roads in Sweden (Öresundskraft, 2022). Interviewee F says that Volvo Trucks lets OKQ8 build charging stations on Volvo Trucks' dealers' land which enables more flexible charging opportunities. These collaborations and investments increase the possibilities for renewably charging BETs and thereby also increase the total value offered to the customers.

Collaborating with partners could be a way to both learn more and acquire necessary competencies for entering a new business. As an example, Interviewee G says that Volvo has the resources and competence for selling vehicles, and that they do it well. However, for a company in the automotive industry to start selling something other than a vehicle, new knowledge and experience would be required.

Value Capture

According to Interviewee D, revenue in the BET BM comes from sold BETs and from leasing agreements. The BETs are always sold with service agreements that generate additional revenue. In turn, costs come from R&D, production, investments in the production facilities and equipment, as well as from sales and services. The BETs are sold either by Volvo Trucks or through independent dealers.

Interviewee D states that the environmental benefits from selling BETs can be seen in the total well-to-wheel calculations since BETs emit zero tailpipe emissions in the use-phase. Provided that the BETs are charged with renewable electricity, they will have a significantly lower environmental impact compared to diesel driven trucks. Volvo Trucks is also striving towards making their entire BET production process 100 percent renewable (Volvo Trucks, 2023A). For example, Interviewee K mentions that electricity used in the facilities is primarily hedged with bundled GOs. Volvo Trucks is making sure that they purchase GOs in, for example, Sweden, France, Belgium, Germany, Poland, and the UK. Their electricity suppliers are then redeeming the GOs on behalf of Volvo Trucks when the electricity is used. Depending on the market availability and local purchasing decision the procurement of electricity, including the procurement of renewable electricity, can vary between countries. Interviewees D and E mention that, in Gent, Volvo Trucks enabled the building of three wind power plants by being a buyer in a PPA. Volvo Trucks let an electricity company build the power plants and are now buying all electricity produced by them. Likewise, Volvo Group has recently committed to buy 50 percent of the electricity produced by a wind farm in Sweden, owned by Vattenfall, over a 10 year-period (Volvo Group, 2023D). Building of the wind farm will commence during the summer of 2023. Interviewee E also states that Volvo Trucks has tried doing the same in Sweden on several other occasions, but the building was hindered by recreation areas, nature reserves, and a bird protection area.

4.3 Business Models to Increase Customer Use of Renewable Electricity

Based on secondary and primary data, we were able to identify seven business models, i.e., *Offer Electricity through Partner, Purchase and Sell Guarantees of Origin, Mediate PPA, Purchase Electricity and Sell*

Contracts, Invest and Sell PPA, Invest and Sell Shares, and Invest and Sell Contracts. We introduce each of the seven business models below and provide a summary in chapter 4.3.8.

4.3.1 Offer Electricity through Partner

In this BM, the customers are offered a renewable electricity contract along with a BET. To enable this offer, a BET manufacturer could partner up with an electricity supplier.

Value Proposition

Interviewee J discusses that Volvo Trucks could potentially offer their customers an electricity contract to influence them to charge renewable. Volkswagen has offered their customers a similar value proposition in Sweden (Volkswagen, 2020). They offered each buyer of a chargeable Volkswagen passenger car an electricity contract comprised of renewable electricity through the electricity supplier Jämtkraft. Electricity for home charging was also included for free for three years. The collaboration was further upgraded in 2020, to also apply to Volkswagen's transport vehicles. Volkswagen hoped to facilitate sustainable transportation for customers and that more customers would choose to buy an electric car and charge it renewably (Volkswagen, 2020). Also, Tesla and Skellefteåkraft initiated a collaboration where all Tesla owners received a monthly 100 SEK discount on their electricity contract for 36 months if choosing Skellefteåkraft as electricity supplier (Skellefteåkraft, 2023C). When asked about bundling a BET with an electricity contract, Interviewees H and W raise some concerns regarding bundled offers. While it may be necessary at the beginning when a concept is new, it may not serve as a long-term solution since the demand decreases when general knowledge about the concept increases.

Value Creation and Delivery

To be able to create and deliver this value proposition to the customer, Interviewee J lifts the possibility of taking help from a partner in the renewable electricity sector: "With a good partner, we could bundle a renewable electricity contract with an electric truck, instead of offering electricity ourselves". Volkswagen did something similar in 2019; they entered a collaboration with the electricity producer and supplier Jämtkraft with the purpose of driving electrification of the transport industry forward (Jämtkraft, 2020; Volkswagen, 2020). From December 2022, no new customers can sign up for Volkswagen's and Jämtkraft's renewable electricity contract (Volkswagen, 2023). However, customers who have already signed the agreement can expect the contract to continue as planned. The reason why the collaboration ended is not evident from either of the companies' websites.

Watenpaugh (2018) points out that, in a partnership, value must be created for the company, the customer, *and* the partner. The author writes that managing a partnership requires collaborative competencies such as being able to set up joint governance, resolving conflicts, and creating win-win outcomes for both actors. The value of the partnership comes from creating greater value together than could be created alone. During the focus group session, it was brought to light that electricity suppliers generally are positively inclined to such partnerships with BET manufacturers since they get to sell the electricity while also reaching a new customer base without effort. "They receive the revenues, and we provide them with customers", says Interviewee W. Likewise, Interviewee E says that electricity companies have begun to understand the importance of collaborating with BET manufacturers. Moreover, Interviewee A states: "Trucks will require a lot of electricity if they are going to be driven by electricity rather than diesel. And I think there is a great understanding on the market that they [truck manufacturers] need to enter the electricity market."

Value Capture

There is no information about revenue or cost structures in Volkswagen's or Tesla's collaborations with electricity suppliers. As Interviewee W states, revenues are likely procured by the electricity supply partner. However, Interviewee D lifts the possibility of negotiating a margin with the electricity supplier that could be split between Volvo Trucks and the customers to create an attractive value proposition, as well as business for Volvo Trucks.

Interviewee E states that while the model would not provide Volvo Trucks with high revenue, it also would not imply any high costs. Therefore, it could be relevant to pursue the BM with the purpose of reaching sustainability goals. In Jämtkraft's and Volkswagen's case, the companies wanted to be a driving force in the transition towards a more sustainable world (Volkswagen, 2020; Jämtkraft, 2020). This implies that this BM captures environmental value for both partners. For Volvo Trucks to be able to account for the environmental benefits of the BM, Interviewee U highlights that the partnership also needs to provide Volvo Trucks with some form of guarantee that the charging is done with renewable electricity.

4.3.2 Purchase and Sell Guarantees of Origin

Interviewee C states that GOs can be issued as a complement to electricity and thus they can be bought and sold unbundled. Thereby, a simpler variant of the BM for purchasing and selling electricity (with GOs), which is explained in chapter 4.3.4, is for a BET manufacturer to purchase and sell unbundled GOs to their customers.

Value Proposition

Our findings show that GOs ensure that the end consumer can prove that they have renewable electricity. In other words, the value proposition is an easy way for the customer to make sure that the electricity that they are already using gets a renewable stamp. Therefore, target customers are customers wanting to keep their non-renewable electricity contract.

Value Creation and Delivery

In this BM, value is created and delivered to the customer through trading of GOs. Electricity producers sell GOs on an open market (Energimyndigheten, 2022C), and thus a BET manufacturer could purchase them and resell them to their customers. When asked about whether a company could purchase and resell GOs, Interviewee K states: "You can buy and sell GOs however you want really, but today we [Volvo] do not buy them. We simply ask our supplier to redeem them for us and we receive proof that we have used them up. But you could absolutely buy, keep, and resell them.". Interviewee K further speculates that a BET manufacturer would have to join some kind of trading hub to do so. Interviewee C also sees purchasing and selling GOs as a possibility for a BET manufacturer: "Absolutely, it is not that complicated. Volvo could buy GOs and add them to an account similar to a bank account. Then, their customers need an account as well. An alternative is that Volvo becomes some sort of electricity company to be able to buy GOs on behalf of their customers, enabling them to take credit for the renewable electricity.".

Value Capture

Cost and revenue streams would consist of purchasing GOs from electricity producers and selling them to the customer. Our findings show that the environmental benefits of GOs are that they stimulate the demand

for renewable electricity, although they do not directly contribute to additionality of new renewable electricity to the grid.

4.3.3 Mediate Power Purchase Agreement

A PPA agreement is generally a bilateral agreement between the electricity producer and the buyer, but some actors sign PPAs to cover their customers' demand (Svenskt Näringsliv, 2020). These actors serve as a middle hand and mediate the PPA from producer to buyer. For example, Göteborg Energi acts as a link between producers and buyers in PPAs and Energi Försäljning Sverige aggregates one or several customers to an electricity producer using a PPA (Göteborg Energi, 2023B; Energi Försäljning Sverige, 2023). A BET manufacturer could take the role of being an intermediary and help their customers into a PPA agreement, along with selling a BET. PPAs can look different, and the BM explained in this chapter will be in the simplest form. It will, therefore, be presumed that the customers already have some type of agreement with an electricity supplier, and that the offered PPA is financial.

Value proposition

The value proposition of a PPA is that the customer gets a long-term, stable price agreement where electricity is bought directly from a renewable source (Svenskt Näringsliv, 2020). The long-term, stable prices facilitate the customers' financial planning, and many customers also use the PPA as a marketing tool to promote their sustainable choices. Furthermore, a PPA enables the customer to contribute to the development of new renewable electricity without having to make an upfront investment themselves. The customers can both track their electricity purchase to renewable resources and contribute to additionality. Buyers of PPAs are often companies with quite high electricity use (Svenskt Näringsliv, 2020). However, if the PPA is mediated to several customers, it enables PPAs for companies that do not have an electricity consumption that corresponds to an entire solar power plant or wind farm (Energi Försäljning Sverige, 2023). This means that also smaller companies can benefit from long-term stable prices and contribute to a direct investment in renewable energy sources. However, Interviewee C states that a PPA is generally difficult to get out of, thus the customer needs to have a stable future electricity demand. Still, Interviewee V reflects over the possibility of Volvo offering PPAs with a shorter binding period than Volvo Trucks would need to sign with the electricity producer.

Value Creation and Delivery

In Energi Försäljning Sverige's case, they (as the mediator) handle risk and electricity delivery (Energi Försäljning Sverige, 2023). They do not produce electricity themselves but handle the contact with producers of solar and wind power. Energi Försäljning Sverige signs an agreement with an electricity producer that establishes new renewable electricity corresponding to the demand from a customer. Similar to when there is only one customer, they also offer a pool PPA that connects several customers to cover the production from newly built power plants. Furthermore, Axpo Nordic recently signed two ten-year PPAs for buying all electricity produced by two wind farms, Hulterna and Norra Hunna, that are being built in Sweden (Axpo, 2023). The investment will generate electricity with a capacity of 60 MW and 16,4 MW respectively from the two wind farms. Axpo Nordic then resold the electricity to their customers through new PPAs (Borealis, 2022). For example, they signed a PPA with Borealis, agreeing to supply them with the 60 MW capacity of the Hulterna wind farm.

When asked about whether Volvo Trucks could become a mediator in a PPA, Interviewee C states: "If they were to sell to other companies, Volvo could sign a PPA with a few wind and solar parks, for example, in

a baseload structure. Then you could split it up and, in turn, sell it on to other smaller companies via a smaller, simpler PPA.”. Furthermore, Energi Försäljning Sverige and Axpo Nordic are both electricity suppliers, but Interviewee C states that being an electricity supplier is not a necessity for becoming an PPA aggregator: “You can aggregate companies in a PPA without being an electricity supplier, because then these companies will have their own individual electricity supplier. Then they can just tell their electricity supplier that they need to consider this new PPA.”.

Our findings show that a PPA can be structured in two different ways. One way is to sign a baseload agreement and one is to sign a pay-as-produced agreement. When the customer pays for a baseload, the provider needs to deliver a certain volume every hour, no matter how much the wind blows or the sun shines. This means that the provider may need to purchase additional electricity on the market, thus increasing the risk for the provider. Pay-as-produced, on the other hand, means that the customer has agreed to buy what the power plant produces. Therefore, the risk for the provider is much smaller than in a baseload agreement, says Interviewee C. However, that risk is then taken over by the customer instead who will take on the uncertainty of not knowing exactly how much electricity will be generated.

Value Capture

The revenue structure from the PPA depends on whether it has a baseload structure or a pay-as-produced structure, according to Interviewee C. Furthermore, whether the electricity becomes cheaper in a PPA than in a standard electricity contract or not, varies from case to case. Among other things, it varies based on investment costs, operating costs, investment returns for owners, and the electricity market price. Interviewee C continues by saying that “if you experience high market prices, such as in southern Sweden, the PPA prices could be lower than the market price”. Still, the interviewees in the focus group discuss that Volvo Trucks could have the possibility of buying large amounts of electricity and perhaps then negotiate a lower electricity strike price than a small customer could. Also, the BM would not require many employees nor include high investments, indicating a potential for a good return on the investment.

However, Interviewee C highlights that PPAs come with credit risks and that unpredicted events could affect the long-term agreement. Interviewees in the focus group also reflect over the potential problem of Volvo Trucks signing a large PPA, but not being able to sell all the electricity that they have bought, thus pointing to long-term risks with being a mediator. Even so, taking on risks generally indicates a higher revenue potential, says Interviewee W.

An important environmental benefit is that PPAs drive the development of renewable electricity production, thus contributing to additionality if new building of power plants is initiated (Svenskt Näringsliv, 2020). Our findings show that many power plants are not built until a PPA is signed, since the PPA provides security to the investor that revenue will be generated for a long time. Thereby, PPAs enable solar parks to be built.

4.3.4 Purchase Electricity and Sell Contracts

Several Swedish electricity suppliers are purchasing renewable electricity and GOs from the Nordic electricity market Nord Pool or directly from producers, to then sell the electricity along with GOs through standard electricity contracts (Krafringen, 2023; Nordic Green, 2023; Mälarenergi, 2023; Bixia, 2023; Göteborg Energi, 2023A; Tigerstedt, 2021; Montel, 2019; Vattenfall, 2023; Telge Energi, 2023). There are examples of similar BMs pursued by automotive companies in the European market. Interviewee J states that “other passenger car OEMs have started their own electricity companies, to bundle green electricity

with a wall box for charging electric cars at home and that is an idea I believe we [Volvo] could consider for private charging” In contrast to the *Offer Electricity through Partner BM*, the BET manufacturer would be the one purchasing the electricity and offering the renewable electricity contracts to the customers.

Value Proposition

Our findings show that the value proposition of offering renewable electricity contracts is that the customer can easily acquire renewable electricity without high investments costs or long binding times. Interviewee C states that a fixed price standard electricity contract rarely has a binding time over three years. Some electricity suppliers offer their customers the chance to choose where they want the electricity to stem from (Mälarenergi, 2023; Bixia, 2023; Vattenfall, 2023). For example, in Mälarenergi and Bixia’s case, the customers can choose to buy GOs from a list of actors that offer locally produced renewable electricity (Mälarenergi, 2023; Bixia, 2023). Moreover, Volkswagen Group offers their German customers the opportunity to buy electricity contracts with renewable electricity sourced from power plants in Germany, Austria, and Switzerland (Elli, 2023). Apart from offering renewable electricity, Volkswagen Group also highlights that they offer an all-in-one solution where both the electric car and the electricity can be offered from a single source.

Value Delivery and Capture

Electricity suppliers procure electricity in different ways. Some purchase it from the spot market Nord Pool and some purchase it directly from producers (Krafringen, 2023; Nordic Green, 2023; Mälarenergi, 2023; Bixia, 2023; Göteborg Energi; 2023A; Tigerstedt, 2021; Montel, 2019; Vattenfall, 2023; Telge Energi, 2023). From producers, the electricity can be bought via PPAs (Tigerstedt, 2021; Montel, 2019).

The electricity is delivered to the customer through electricity contracts via the energy mix in the grid, but GOs will ensure that a corresponding amount of renewable electricity has been produced (Bixia, 2023). For example, in Bixia’s case, GOs are bought from local electricity producers who have produced the same amount of electricity as the customers have bought. In Volkswagen Group’s case, the electricity contracts are offered via their own energy company Elli (Elli, 2023).

Supplying end-consumers with electricity also comes with duties. For example, Interviewee C states that selling electricity comes with load management responsibilities. The supplier must predict electricity customers’ consumption to make sure that the supplied amount corresponds to what is consumed or transfer this responsibility to a third party (Energy Plaza, 2023). In case of miscalculations, fees need to be paid. Even so, Interviewee A does not think it would be very difficult for a company with no electricity sales experience to enter the electricity market: “All rules are clearly explained on municipality and authority websites, so I gather that it is not complicated”.

Value Capture

Revenues in this BM are generated through either fixed or variable prices paid by the customers (Fortum, 2023C). In a fixed contract, the prices stay the same during the contract period, while a variable price follows market fluctuations. Costs include purchasing electricity and GOs from producers, as well as the eventual fees for miscalculations in predicted consumption. When asked about whether a BET manufacturer could sell electricity to their customers, several interviewees state that it would be complex for them to enter an industry that is characterized by lower margins and higher volumes than the automotive industry.

Even so, taking on that challenge may be necessary to drive renewable electricity charging, Interviewee J adds.

As mentioned in chapter 4.3.2, our findings show that GOs help stimulate demand for renewable electricity. Thus, pursuing this BM would lead to this environmental benefit as well.

4.3.5 Invest and Sell Power Purchase Agreement

Several electricity producers in Sweden own renewable power plants that generate wind or solar power (Skellefteåkraft, 2023A; Jämtkraft, 2023A; Fortum, 2023A; Vattenfall, 2018; SunSpark Nordic, 2023; Svea Solar, 2023; Göteborg Energi, 2023A). Some of these companies offer their customers to buy electricity via PPAs (Vattenfall, 2018; Fortum, 2023B; SunSpark Nordic, 2023; Svea Solar, 2023). A BET manufacturer could invest in a power plant and then offer their BET customers a bundled offer with a BET and a PPA. As in chapter 4.3.3, the PPA is financial and, thereby, it will be presumed that the customers already have some type of agreement with an electricity supplier.

Value Proposition

The value proposition of this BM is the same as for the *Mediate PPA* BM described in chapter 4.3.3, a stable electricity price for a long period of time with no upfront investment cost (Svenskt Näringsliv, 2020). The customer can contribute to the expansion of renewable electricity infrastructure without having to build it themselves. One difference from the *Mediate PPA* BM is that this BM can create extra branding opportunities to offer the customer. Interviewee C states that a company owning a power plant can offer to market the customer's brand on a wind turbine, for example.

Value Creation and Delivery

The owner of a power plant is often either an independent electricity producer or company, or some form of investment company with a focus on infrastructure and renewable energy (Svenskt Näringsliv, 2020). There are possibilities of letting a third party plan the building of the power plant (Skånes Vindkraftsakademi, 2016). For example, Volkswagen are investing in wind power plants in Sweden and express that they are not interested in building the power plants themselves and have instead partnered up with other companies that will do it (Mattson, 2021). The third party can also be responsible for applying for permissions and locations, as well as for examining environmental impacts (Skånes Vindkraftsakademi, 2016). They can also handle the operation and maintenance of the plant. Operating a power plant requires service, maintenance, surveillance, and administration, and such activities are often outsourced and agreed through service contracts. Several interviewees reflect that Volvo Trucks doing these activities on their own could be inconvenient and costly because of their inexperience.

Moreover, companies can own entire wind power plants or only parts of them (Svenskt Näringsliv, 2020). For example, SunSpark Nordic and Svea Solar provide financial PPAs from their own solar power plants (SunSpark Nordic, 2023; Svea Solar, 2023). In contrast, Vattenfall owns only 30 percent of a wind farm that they are operating, while investors own the rest (Vattenfall, 2018). This wind farm is Sweden's largest, and 60 percent of the production is sold to the company Norsk Hydro via a 20-year-long PPA.

When discussing whether Volvo Trucks could invest in a power plant and produce electricity, Interviewee F expresses some concerns: "You cannot forget that we are a small player on the electricity market in comparison to established electricity producers." Moreover, Interviewee B and C highlight that knowledge and experience is required to own a power plant. Interviewee C states: "Automotive companies have

knowledge about manufacturing vehicles or other products, but if you are going to own a wind or solar park, it demands new resources and knowledge about power plants, as well as upfront capital investment. [...] If you are going to own a larger solar or wind park, there are operational risks entailing everything that comes with owning a wind or solar park. They can break or electricity may not be produced to the extent that was intended. It is an entirely different business to enter.”.

Furthermore, owning a power plant comes with certain regulations to follow which are elaborated on in chapter 4.4.3.

Value Capture

Revenue from sold electricity is the biggest revenue stream connected to owning a power plant, but revenue also comes from selling GOs (Skånes Vindkraftsakademi, 2016). As mentioned in chapter 4.3.3, revenue in a PPA can be generated either through a baseload or a pay-as-produced structure. Since the PPA is a form of price securement for both the customer and the electricity producer, the revenue from sold electricity is secured for a long time, according to Interviewee C. Thus, a PPA shields the electricity producer from a market price drop, says Interviewee W. However, deciding and securing the electricity price beforehand also entails a risk, according to Interviewee A. Several interviewees discuss that investing in a power plant would come down to the concept of risk versus reward. “Our revenue potential is definitely bigger, but so is our risk potential”, Interviewee V states.

Investing in a power plant comes with high investment costs. An average investment cost per MW wind power in Sweden is estimated between 10 to 13 million SEK (Skånes Vindkraftsakademi, 2016). The high investment costs entail solar power as well, and an 18 GWh solar power plant in Strängnäs cost approximately 100 million SEK to build (Campanello, 2019). Furthermore, costs related to owning a power plant come from services, maintenance and administration, along with capital costs, which depend on the interest rate (Svensk Vindenergi, 2021). Costs can also arise from compensation to people living close to the power plant (Skånes Vindkraftsakademi, 2016). Besides, insurance and fees need to be paid to the grid owner. Still, owning a wind power plant can be a profitable investment even though the investment entails an economic risk highly dependent on the market electricity prices (Skånes Vindkraftsakademi, 2016). Yet, Interviewee C mentions that PPA prices are often based on the investment and operational costs, which means that the strike price does not always strictly follow the expected prognosis of the electricity market price.

As stated in chapter 4.3.3, an environmental benefit is that a PPA contributes to additionality on the instances where it initiates the building of a new renewable electricity production. Svenskt Näringsliv (2020) explains that investing in a power plant captures value by both selling electricity and by having the ability to include “green values” in the portfolio. For example, Volkswagen are investing 40 million euros on renewable electricity projects to make sure that their electric passenger cars will be charged with renewable electricity, thus capturing the “green values” of the investment (Mattson, 2021). Another benefit of investing in a power plant is the social contribution of strengthening the power transmission in the grid, according to Interviewee W.

Although the production of renewable electricity benefits the environment, a power plant also contributes to some negative impacts (Naturvårdsverket, 2023). For example, a wind power plant affects both animals and people living close to it. The power plant is loud, can hurt nature around it, and can injure birds and

other flying creatures. Moreover, manufacturing of solar panels requires extraction of silicon which is energy demanding (Energimyndigheten, 2021).

4.3.6 Invest and Sell Shares

Some electricity producers offer customers the opportunity to buy shares in their renewable power plants to acquire renewable electricity (Jämtkraft, 2023B; Campanello, 2019; Horn, 2019; Storuman Energi, 2023). For example, Jämtkraft and Östersundshem together invested in and financed a solar power plant called Östersund Solpark, in which other companies and private customers can buy shares and receive access to a responding amount of the produced electricity (Jämtkraft, 2023B). Based on this, a BET manufacturer could invest in a power plant and allow their customers to buy shares for the corresponding amount of electricity that is required to charge their BETs.

Value Proposition

Owning a share in a renewable power plant gives the customer access to renewable electricity that will be less expensive than the market price in the long run (Jämtkraft, 2023B). Based on today's electricity prognosis, the investment will have paid off in 15 years, making the electricity generated from the shares free during the remaining 15 years of the solar power plant's lifetime (Jämtkraft, 2023B). In the case of Jämtkraft and Östersundshem, the customer is given compensation for their shares in the form of a discount on their ordinary electricity bill that they receive from Jämtkraft. The discount, thus, depends on how many shares the customer has bought and how much electricity those shares generate. One share costs the customer 850 SEK and corresponds to 100kWh per year. To avoid the shares surplus the cost of their consumption, customers are only allowed to buy shares that correspond to 80 percent of their electricity consumption. Furthermore, with electricity supply partners, the cooperatives Storuman Vind and VästanVind offer customers both wind farm shares and complementary electricity (Storuman Energi, 2023; VästanVind, 2023B). The customers buy the shares at cost price (Storuman Energi, 2023), and are not expected to contribute to the electricity production with either time or money (VästanVind, 2023C).

Value Creation and Delivery

Like in chapter 4.3.5 and 4.3.7, value is created through owning and operating a renewable power plant. In the case of Östersund Solpark, half the shares are owned by Östersundshem, one sixth of the shares is owned by Jämtkraft, and approximately one third is owned by private and company members of the cooperative (Jämtkraft, 2023B). To be able to offer customers electricity contracts and complementary electricity, the power plant owners collaborate with electricity suppliers (Storuman Energi, 2023; Göteborg Energi, 2023C). Apart from handling the electricity delivery, the electricity suppliers also help with administration of shares (Storuman Energi, 2023; Göteborg Energi, 2023C). Furthermore, maintenance and operation of the power plant is in VästanVind's case taken care of by Siemens through a service agreement (VästanVind, 2023C). Chapter 4.3.5 covers risks and responsibilities connected to owning a renewable power plant, relevant for this BM as well. Furthermore, regulations for owning a power plant are covered in chapter 4.4.3.

Value Capture

Revenue is captured through sales of shares at cost price (Storuman Energi, 2023). As mentioned in chapter 4.3.5, investing in a power plant demands high upfront capital investments (Skånes Vindkraftsakademi, 2016). The biggest cost for VästanVind was the investment in the wind farm, while the production of

electricity experiences low marginal costs (VästanVind, 2023C). The service agreement that VästanVind has with Siemens generates costs as well. To make sure that all shares would be sold, Storuman Vind signed an agreement with another actor guaranteeing to buy the remaining shares (Storuman Vind, 2023). Environmental benefits and impacts are the same as described in chapter 4.3.5.

4.3.7 Invest and Sell Contracts

As mentioned in chapter 4.3.5, several electricity producers in Sweden own wind and/or solar power plants (Skellefteåkraft, 2023A; Jämtkraft, 2023A; Fortum, 2023A; Göteborg Energi, 2023A). All these electricity companies offer their customers standard electricity contracts with electricity from their plants. Like in the two previous chapters, a BET manufacturer could invest in a power plant, but instead sell the electricity via standard renewable electricity contracts.

Value Proposition

Since the customer is offered a renewable electricity contract, our findings show that the value proposition is the same or very similar to the *Purchase Electricity and Sell Contracts* BM in chapter 4.3.4. That is an easy way to access renewable electricity, free of upfront investment costs, and without having to sign up for a long-term agreement. The difference is that this BM can particularly interest customers that want to know exactly where the electricity originates from.

Value Creation and Delivery

Like in chapters 4.3.5 and 4.3.6, value is created through owning and operating a renewable power plant. One example of an electricity producer that offers renewable electricity contracts is Skellefteåkraft (Skellefteåkraft, 2023B). The renewable electricity in the contracts originates, as far as it is possible, from their own electricity production. However, when selling more electricity than is being produced, Skellefteåkraft trades from other producers as well. Chapter 4.3.5 covers risks, responsibilities, and costs connected to owning a renewable power plant that are relevant for this BM as well. Furthermore, regulations for owning a power plant and selling electricity are covered in chapter 4.4.3.

Value Capture

As mentioned in chapter 4.3.4, revenues are generated in the form of customers' payments for the electricity contracts (Fortum, 2023C). When producing renewable electricity instead of purchasing it, Interviewee C also mentions that extra revenue is generated in the form of sold GOs. As mentioned in chapter 4.3.5, investing in a power plant is not a lucrative business case if the market price drops, and thus this is a risk when capturing revenue based on the electricity market price through contracts. Costs related to owning and operating a power plant, as well as environmental benefits and impacts, are described in chapter 4.3.5.

4.3.8 Summary

The seven identified BMs for increasing customer use of renewable electricity are summarized in Table 4.1., alongside Volvo Trucks' established BET BM.

Table 4.1. *Volvo Trucks BET BM and the identified BMs mapped with the Business Model Framework*

Business Models	Value Proposition	Value Creation & Delivery	Value Capture
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<i>Volvo Trucks BET BM</i>	BET and value-adding services. Targets existing customers and new customer base within the transport industry.	Assembly, development, sales. Both in-house competence and collaborations to drive transition towards electrification.	Revenue from sold BETs and services. Costs from R&D, development, facilities, sales. Environmental benefits in the form of lowering emissions. Renewable electricity in facilities.
<i>Offer Electricity Through Partner</i>	Bundled solution with BET and electricity, to discounted price. Customer gets effortless access to renewable electricity, with low risk, no binding time, and no high investment. Targets all customers.	Value is created through partnership with electricity supplier and delivered with the partner. Being able to negotiate and manage the partnership is required.	Revenue and costs depend on the partnership agreement. Environmental benefits in the form of stimulated demand for renewables. No contribution to additionality.
<i>Purchase and Sell GOs</i>	Bundled solution with BET and GOs. Customer gets easy add-on service to ensure renewable electricity without having to switch contract. No binding time or high investment. Targets customers who want to keep their standard electricity contract.	Value is created and delivered through trading of GOs. Knowledge about trading GOs is required.	Revenue from sold GOs. Costs from purchasing GOs and administration. Environmental benefits in the form of stimulated demand for renewables. No contribution to additionality.
<i>Mediate PPA</i>	Bundled solution with BET and PPA. Customer gets access to renewable electricity at stable prices, long term. Customer also gets opportunity to contribute to additionality without any investment responsibilities. PPAs target customers with large electricity demand. Pool PPAs target smaller demands.	Value is created when matching the customer to a producer and when buying PPA on behalf of customers. Value is delivered by offering PPA. Knowledge about PPAs and related risks is required. Aggregation and negotiation skills are required.	Revenue from selling electricity at strike price. Possible revenue from mediating fee. Cost from paying strike price to producer, and administration. Environmental benefits in the form of contribution to additionality.
<i>Purchase Electricity and Sell Contracts</i>	Bundled solution with BET and electricity. Customer gets effortless access to renewable electricity, with shorter binding times and no high investment. Targets all customers.	Value is created by trading electricity and GOs and delivered by offering renewable electricity contracts. Knowledge about trading electricity and administering electricity contracts is required.	Recurring revenue from contracts. Costs from purchasing electricity and GOs from spot market and from administration. Environmental benefits in the form of stimulated demand for renewables. No contribution to additionality.
<i>Invest and Sell PPA</i>	Bundled solution with BET and PPA. Customer gets access to renewable electricity at stable prices, long term. Customer also gets opportunity to contribute to additionality without any investment responsibilities. Customers can also be offered additional branding opportunities. PPAs target customers with large electricity demand. Pool PPAs target smaller demands.	Value is created when initiating the building of a power plant. Capital is needed for investment cost. Value is delivered when offering customers PPAs. Knowledge about owning a power plant, risks, PPAs, and selling electricity to spot market is required. Outsourcing maintenance and operation of plant.	Revenue from selling electricity to spot market. Possible revenue from PPA contract if strike price differs positively from market price. Cost of initial investment in power plant, and for maintaining and operating power plant. Monthly payment to customer if strike price differs negatively from market price. Environmental benefits in the form of contribution to additionality. Environmental impacts from building power plant.

<i>Invest and Sell Shares</i>	Bundled solution with BET and electricity. Customer gets discount on electricity bill and ownership of shares (at cost price) in a power plant. Customers can also be offered additional branding opportunities. Targets all customers who can afford the initial investment necessary to buy the shares.	Value is created when initiating the building of a power plant. Capital is needed for investment cost. Value is delivered by offering customers a share in the power plant. Knowledge about owning a power plant, risks, and selling shares is required. Outsourcing maintenance and operation of plant. Long-term partnership with an electricity supplier is needed.	Revenue from selling shares. Cost of initial investment in power plant, and for maintaining and operating power plant. Possible costs in partnership agreement with electricity supplier. Environmental benefits in the form of contribution to additionality. Environmental impacts from building power plant.
<i>Invest and Sell Contracts</i>	Bundled solution with BET and electricity. Customer gets effortless access to renewable electricity, with shorter binding times and no high investment. Customers can also be offered additional branding opportunities. Targets all customers.	Value is created when initiating the building of a power plant, and sourcing complementary electricity from spot market. Capital is needed for investment cost. Value is delivered by offering electricity contracts. Knowledge about owning a power plant, risks, trading electricity and administering electricity contracts is required. Outsourcing maintenance and operation of plant.	Recurring revenue from contracts. Costs from initial investment of power plant and purchasing electricity and GOs from spot market, as well as administration. Environmental benefits in the form of contribution to additionality. Environmental impacts from building power plant.

4.4 External Environment of Volvo Trucks

4.4.1 Customer Demand

All interviewed customers show an interest in contributing to the greater good of the environment. Several interviewees convey a will to become leaders in the transformation towards electric vehicles. For example, Interviewee N states that “if we are to be the best and lead the development, we simply must invest in electric vehicles”. Furthermore, Interviewee O states that “it is our responsibility to do what we can if we have the possibility”.

In line with their will to decrease their environmental impact, all interviewees consider charging BETs with renewable electricity to be essential. Interviewee P says that “we are setting targets for our company from well-to-wheel so then, of course, the origin of the electricity that we use matters a lot”. Several interviewees acquire their electricity through renewable electricity contracts, that ensure its renewable origin. Furthermore, Interviewee O charges their BET at a customer’s depot and is unsure of what kind of electricity is used, although that customer has installed solar panels on their roof. Interviewee R describes that they charge at Volvo Trucks’ charging stations, and thereby charge with green electricity. Interviewee M states that their main driving force for becoming more environmentally sustainable comes from within, and in 2019 they included sustainability as part of their business plan. Likewise, Interviewee N says that using renewable electricity is in line with their strive towards becoming the best in the industry and wanting to reduce their environmental footprint. Interviewee P states that it was decided long ago that their corporate group only uses renewable electricity but is unsure of exactly how the electricity is procured.

Interviewee L, working at Volvo Trucks, states that some customers have started looking at what they could do themselves in terms of installing solar panels or building their own small wind farms. The customer interviews point to this as well. For example, Interviewee Q states that they have installed solar panels to complement their electricity contract. The solar panels produce enough electricity to cover charging of their six medium BETs. This is to decrease costs and avoid market price fluctuations. Interviewee S also shows an interest in self-production and plans to tackle future electrification of their around 100 heavy trucks by producing the necessary electricity themselves, either through wind or solar power generation.

The customer interviews further show that *their* customers' interest in environmentally sustainable solutions in turn affects their environmental focus. To be able to work with more environmentally sustainable transportation, the interviewees need interested customers with a willingness to pay for it. For example, Interviewee P says that "we are leading in the transformation towards sustainable transport, and if you are our customer, you also simulate the transformation". Several interviewees say that sustainable transport demand has increased during the last years. Even so, Interviewees M and Q state that sometimes their smaller customers do not have the ability to pay for electric transportation.

Finding transport buyers willing to pay for environmentally sustainable solutions is important because they are currently costly for Volvo's customers to provide. The investment cost element of BETs and related projects is worrisome for many of the interviewed customers. Several interviewees state that BETs are expensive to buy, and Interviewee N highlights that building charging infrastructure comes with immense costs. Some also show concern for electricity market price fluctuations and the increasing electricity prices. When asked about their attitude towards entering into long-term agreements to achieve stable prices, Interviewee N says that a 10-year agreement could be of interest considering that the market prices are expected to keep increasing. Interviewee R also highlights the value of stable electricity prices since it could facilitate calculations and price suggestions to the customers. Interviewee Q, on the other hand, expresses concern about committing to such a long contract due to ever-changing customer demands.

Moreover, several interviewees reflect over the importance of charging at home as much as possible since public charging is more expensive. During the interviews, questions were posed regarding whether Volvo Trucks could offer customers a bundled offer with a BET and electricity for home charging. Interviewee N and O point out that such an offer would feel safe. For example, Interviewee N discusses that entering the world of BETs and charging for the first time is like entering a jungle and elaborates: "Such an offer could be smart since it creates some kind of safety when buying a BET. Perhaps Volvo Trucks could also offer some kind of guidebook to explain how it all works and what to consider, for example, around costs and public charging.". Interviewees O and P are also positively inclined to the idea and mention that the typical Volvo Trucks customer may not have the resources and time to handle issues regarding electricity themselves. "If their customers have high demands for sustainability, it would be valuable to pay for such a service", says Interviewee P.

While several interviewees see benefits with such an offer, many also see drawbacks since the offer is not of value for them specifically. Interviewee P states: "We are the wrong target customer. We are a large corporate group and want to handle such questions ourselves. We already have many employees working with sustainability.". The interviewee sees no benefit in a bundled offer when they could negotiate a deal themselves. They do not want to be strategically dependent on Volvo Trucks in such a question either. Interviewee M also has a skeptical attitude towards such a bundled offer and says that "we have already taken an active choice regarding sustainability and renewable electricity and would, therefore, not be

interested”. Being a chemical supplier, Interviewee S also mentions that they have used renewable electricity for a long time and have no need for a bundled electricity contract: “For us, buying green electricity is something we have done for a long time. We use a lot of electricity for heating up cisterns and products, so it has never been an issue for us.”. Instead, they would value more help with issues related to the effect of the charging and help with the connection to the grid, since that has been challenging for the company.

Some interviewees also highlight that Volvo Trucks may not be the natural actor to turn to for electricity supply. For example, Interviewee P says that they would rather turn to an established electricity supplier. This perception is shared by Interviewee F who says that “the natural part is not to go to Volvo Trucks, but we [Volvo] may get the question sometimes and then it could be good to have a connection to an energy supplier”. Even so, Interviewee L, also working at Volvo Trucks, states that not many customers have asked for help with securing renewable electricity, but that it may be more common in the future.

An additional concern that the interviewees highlight regarding the bundled offer is the price of it. Several interviewees say that price is of high importance. This should come as no surprise considering Interviewee W estimates that electricity constitutes 40 percent of the customers’ costs. Many customers think that the bundled offer would only be appreciated if the price is good. Interviewee O states that “it would be terrific if Volvo had a good, well-priced electricity agreement to offer, both for home and public charging”. Interviewee N speculates that a bundled offer could be of interest, despite a higher price, when having just entered the market: “At least it would be safe to understand what the maximum price is, and then you can calculate and compare by yourself. It could serve as a base offer when you are a beginner.”.

4.4.2 Competition

Since 1996, the Swedish electricity market has been deregulated and exposed to high competition (Konkurrensverket, 2018). The deregulation of the market resulted in electricity trading becoming separated from the physical electricity transmission (Energimarknadsinspektionen, 2023B). In other words, financial agreements are not directly connected to the physical delivery of electricity. The three largest electricity producers in Sweden, 2016, had a total market share of 71 percent (Konkurrensverket, 2018). These producers are Vattenfall, Fortum, and Uniper396. Electricity is in majority bought at Nord Pool and priced based on supply and demand (Lindholm, 2022). Around 380 commercial actors are active on Nord Pool and these are, for example, electricity producers and suppliers (Konkurrensverket, 2018). Purchases can also be made directly between producer and buyer. The three largest actors in selling electricity to end-consumers together had 45 percent of the market in 2018 (Konkurrensverket, 2018). These are Vattenfall, Eon, and Fortum.

According to Konkurrensverket (2018), there is a belief that the competition on the electricity market is about to change. The more technology is developed related to electricity, the more the role of the electricity supplier will be threatened. The electricity suppliers’ negotiation capabilities may decrease and thus the competition increases.

In terms of competition between automotive companies, this study has not identified any cases of BET manufacturers offering renewable electricity to their customers. However, as mentioned in 4.3.1, there are cases where electric passenger car manufacturers have collaborated with Swedish electricity suppliers to offer their customers a beneficial electricity contract along with an electric vehicle (Volkswagen, 2020;

Skellefteåkraft, 2023C). Even so, this has not happened in many instances, and the only identified cases in Sweden are those of Volkswagen and Tesla (Volkswagen, 2020; Skellefteåkraft, 2023C).

4.4.3 Regulations

For companies to be allowed to produce, purchase, and sell electricity on the Swedish market, there are regulations to consider. The *Regulation on Wholesale Energy Market Integrity and Transparency* (REMIT) aims to contribute to transparency and integrity on the Swedish wholesale energy market (Energimarknadsinspektionen, 2022). This regulation gives market participants obligations such as reporting and registering transactions as well as disclosing inside information. Swedish companies that wish to carry out transactions on the whole sale energy market need to be registered as *market participants*, and the registration is done in the system *Centralised European Registry for Energy Market Participant* (Energimarknadsinspektionen, 2023A; CEREMP, 2023). Examples of market participants on the Swedish market are energy producers, energy suppliers, and large consumers (Energimarknadsinspektionen, 2023A).

In Sweden, the origin of renewable electricity is guaranteed by GOs (Energimyndigheten, 2023C), and thus all identified BMs involve GOs in some respect. Electricity producers are given a GO for each produced MWh electricity by the Swedish government (Energimyndigheten, 2023C). It comes in an electric form and the electricity producer can then sell the GOs on an open market. An electricity supplier that wants to sell electricity from a renewable source can either cancel the GOs stemming from their own power plant or buy GOs and cancel them when a corresponding amount of electricity is sold to the end consumer (Energimyndigheten, 2022C). As mentioned in chapter 4.3.2, Interviewee C highlights that a company needs to become an electricity supplier to be able to cancel GOs on behalf of their customers. All parties that produce or supply electricity with GOs need a certificate account in the system Cesar (Riksdagen, 2022). In the Cesar portal, electricity producers will be assigned GOs, and can then transfer them to an agreed GO purchaser. The cancellation of GOs can also be done in Cesar (Cesar, 2023A). A GO trader can apply for an account online, while electricity suppliers and some producers first must apply for quota obligations at Energimyndigheten, before applying for a Cesar account (Cesar, 2023B).

Many of the identified BMs for increasing customer use of renewable electricity involve buying or selling electricity to the spot market. If a company is selling electricity to the spot market in Sweden, they are selling to Nord Pool; the leading power market in Europe (Nord Pool, 2020A). If a company wishes to trade electricity on Nord Pool's markets, they need to go through an application process (Nord Pool, 2020B). The applicant needs to be financially stable and have a registered Value Added Tax (VAT) number. Holding an agreement with the Transmission System Operator in the requested area is also a requirement.

Furthermore, some of the BMs also involve selling electricity to end-consumers, and there are general terms and conditions for doing so in Sweden (Energimarknadsbyrån, 2018). For example, important matters such as price and responsibilities need to be described in detail. According to the electricity law in Sweden, all electricity suppliers must take on a load management responsibility (Energy Plaza, 2023). This means that the supplier needs to create a balance in the electricity delivery by adding the same amount of electricity to the grid as their customers are consuming. The electricity supplier can either take on this responsibility themselves or hire another firm to do it. If an actor with load management responsibility cannot maintain the balance, Svenska Kraftnät will step in and handle the balance problem (Energy Plaza, 2023). The firm that failed their responsibility then have to pay charges as a compensation. Interviewee C says that the party

responsible for load management needs to send a daily prognosis to Nord Pool stating how much electricity will be produced and the expected consumption. Miscalculations result in fees for the supplier.

Actors can also increase customer use of renewable electricity by initiating the building of new renewable power plants. In Sweden, there are regulations that need to be followed when investing in new electricity production. For example, building large-scale renewable power plants in Sweden requires an application for a permit to the municipality's building committee (Energimyndigheten, 2022D). Only the best wind power projects in Sweden are realized due to strong competition of approved locations (Skånes Vindkraftsakademi, 2016). There are also many laws that need to be considered, such as The Environmental Code, The Environmental Assessment Ordinance, The Cultural Environment Act, and the Planning and Building Act (Energimyndigheten, 2022D). Companies may also need to apply for a building permit (Energimyndigheten, 2019A). The permission often depends on the design of the installation, where the building is located, and its value. Furthermore, when buying a solar power facility in Sweden, the buyer needs to make sure that the installation follows rules from the Electrical Safety Act (Energimyndigheten, 2019B). This is to ensure safe and correct electrical installations. There are further requirements related to maintenance and operation of a power plant (Energimyndigheten, 2022D). For example, environmental reports need to be submitted annually and regular controls must be made. There are also requirements regarding disassembling of the power plant when it is no longer in use.

5 Analysis

Our findings present seven different BMs for a BET manufacturer to increase customer use of renewable electricity. Some of the BMs are prevalent in previous research, while some are not. An important difference is that the BMs found in previous research do not involve a BET manufacturer. This is likely because no BET manufacturer has offered their customers renewable electricity yet.

The BM *Offer Electricity through Partner* has not been found in research in the form where an electricity supplier partners up with another actor and creates a business case out of it. This could be because previous research focuses on established actors in the electricity market whose core business concerns producing or selling electricity. These actors are likely less dependent on partnerships compared to new actors entering the same market. Similarly, both the BMs *Purchase and Sell GOs* and *Mediate PPA* have not been found in research in the form in which they are presented in our findings. However, GOs and PPAs commonly occur in previous research, but are brought up in other contexts. For example, GOs are only mentioned when included in electricity contracts, and not as a self-standing BM. Furthermore, previous research indicates that only three actors are involved in a PPA: the producer, buyer, and investor (Mendicino et al., 2019; Thumann & Woodroof, 2021), while our findings reveal the role of the mediator. Another interesting observation is that research explains that customers get lower electricity prices with PPAs than if purchasing electricity from utilities (Thumann & Woodroof, 2021). In contrast, our findings show that electricity prices from PPAs *can* be lower, but that it is not always the case. The PPA price is based on costs from the power plant, while electricity price from a utility is based on the market price. If the market price drops, the PPA price may not always be lower.

In contrast, the *Purchase Electricity and Sell Contracts*, and all the BMs related to investing in renewable electricity production are common in previous research. However, the BMs in our findings are slightly more comprehensive. This is because this study's definition of a BM is that value must be proposed, created, delivered, and captured (Richardson, 2008). Therefore, a BM must both acquire electricity (or GOs) in some way and sell it to the end-consumer in some way. Even so, some BMs found in previous research seem to only cover *either* creation and delivery, or capture. An example is the host-owned BM, described by Xiang et al. (2019), where a company owns a power plant, but it is not evident *how* the electricity is sold to the end-consumer. Likewise, Altunay et al. (2021) write that electricity contracts can be sourced from the suppliers' own production but does not go into any detail on how the production looks. In other words, the BM *Invest and Sell Contracts* could be seen as a combination of the two.

Regarding *Invest and Sell Shares*, two different kinds of shared ownership are found in research, either cooperative or utility led (Altunay et al., 2021). Since our study examines ways for a BET manufacturer to stimulate an increase in the use of renewable electricity, Volvo Trucks should be the initiator. Therefore, the *Invest and Sell Shares* BM corresponds better to the utility led BM in previous research, provided that a BET manufacturer can enter the industry and take on a similar role which will be further analyzed in the following chapters.

According to previous research, BMs are useful for creating a market outcome out of an idea (Osterwalder, 2010), but it can be more difficult to pursue a new BM that is not clearly reflected in the firm's strategy (Sholihah et al., 2019). When the BM is aligned with the established BM and the strategy of the company, strategic alignment occurs (Altunay et al., 2021). In the following subchapters, the seven BMs from our

findings are analyzed based on vertical, horizontal, and external alignment with Volvo Trucks. The analysis is based on this study's *Strategic Alignment Framework* in Figure 3.1, adapted from Altunay et al. (2021).

5.1 Vertical Alignment

In this subchapter, alignment between the identified BMs and Volvo Trucks' overall strategy is analyzed.

Goals

Our findings show that Volvo Trucks' main long-term goals are related to always having the customer in focus, to profitability, and to sustainability. Owning the customer interface is important for Volvo Trucks, which suggests that the BMs where a partner does most of the work, may have a lower alignment when it comes to keeping the customer close. In the *Offer Electricity through Partner* BM, Volvo Trucks may not own the entire customer interface depending on the number of interactions customers will have with the electricity supplier. The same could be said for the *Invest and Sell Shares* BM provided that the partner handles the electricity delivery. Even so, Volvo Trucks would sell shares to the customers and thus keep the customers as shareholders for many years. Our findings also show that Volvo Trucks wants to support their customers' profitability, and according to Jämtkraft (2023B), customers owning shares longer than 15 years will earn money from the investment. In the remaining BMs, Volvo Trucks sells electricity and/or GOs to the customer in one way or another, implying the alignment is higher in the customer interface dimension. For example, in the *Mediate PPA* BM, Volvo Trucks would act as a mediator between producer and buyer, implying they would take over the customer interface from the producer. Likewise, offering electricity contracts would enable long customer relations, and PPAs even longer. Whether the BMs lead to customer satisfaction is analyzed in chapter 5.3 that covers the customer demand perspective.

Furthermore, our findings show that electricity sales generally experience lower margins than the truck manufacturing industry. Therefore, all identified BMs experience low or uncertain profit margins to some extent and may benefit from high volumes. In other words, pursuing them clashes with the industry in which Volvo Trucks currently operates and, thus, their current way of doing business. Overall, the findings of this study show that *Invest and Sell PPA*, *Invest and Sell Contracts*, and *Mediate PPA* have the highest potential for capturing a profit. While the first two are connected to high costs, Volvo Trucks being the producer also allows for collecting more revenue. Furthermore, our findings show that *Mediate PPA* may not generate the same revenue as the first two, but the low costs of the BM allow for a high return on the investment anyway. In contrast, the shares are sold at cost price in *Invest and Sell Shares*, indicating no profit can be captured.

All identified BMs would be pursued with the hopes of increasing customer use of renewable electricity. Encouraging customers to charge renewably contributes to the greater good of the environment, and thus all BMs align more or less with Volvo Trucks' environmental sustainability goals. To grade how well the BMs align, they can be separated by whether they directly contribute to additionality of renewable electricity to the grid. This is because it is evident from findings that Volvo Trucks wants to prevent environmental impact to as great extent as possible. The BMs that contribute to additionality are the three BMs where Volvo Trucks invests in a power plant and produces electricity themselves, as well as the *Mediate PPA* BM. Thus, the alignment with Volvo Trucks' environmental strategy is a little higher for these BMs. Additionally, investing in new renewable electricity generation strengthens the power transmission in the grid, further contributing to the greater good of the environment. Even so, the remaining

BMs contribute to stimulating demand for renewable electricity, indicating a relatively high alignment with the environmental strategy for them as well.

Business logic

Our findings show that Volvo Trucks has a general strategy of driving towards increased service sales and all BMs contribute to another value-adding service, which is further elaborated on in chapter 5.2.

Investments in new electricity production are generally characterized by long-term investment horizons. For example, our findings show that buying a share in a solar power plant has a pay-back time of about 15 years. Interviewee E raises that the electricity industry is prone to longer-term investments than the truck manufacturing industry in which Volvo Trucks operates. This could indicate that the BMs related to building new power plants are slightly less aligned with Volvo Trucks' current business logic.

Our findings also show that Volvo Trucks generally has an openness to partnerships, and several interviewees state that a partnership with an experienced player in the electricity industry would facilitate entering the electricity market. In line with this, research highlights the commonness of using partners to acquire necessary resources when entering new businesses (Järvi et al., 2008). As an example, Jenkins et al. (2021) mention that oil companies entering the renewable energy market often strategically take help from partners, thus indicating it would be possible for Volvo Trucks to do the same. This, in combination with the company's openness for partnership, could indicate that BMs involving a partner better align with their current business logic of collaborating with partners to drive sustainability initiatives. In other words, the *Offer Electricity through Partner* BM and the *Invest and Sell Shares* are the most aligned in this aspect, while *Invest and Sell Contracts* is the least aligned. The low alignment is because Volvo Trucks would need to both produce and supply electricity on their own. However, research also mentions that for a partnership to align vertically, the partners need to share a similar strategic vision (Jenkins et al., 2021), something Volvo Trucks should consider if or when choosing a partner.

Market strategy

According to our findings, Volvo Trucks wants to be driving in the development of sustainable transportation. Just as the alignment with Volvo Trucks' environmental goals depends on the additionality aspect, it could be assumed that the greater the environmental action taken, the greater the PR for Volvo Trucks. Therefore, the BMs where Volvo Trucks invests in a power plant could be assumed to align better. Nevertheless, any BM that tackles environmental challenges in the transport industry can be seen as value-adding and contributes to Volvo's market strategy.

Summary

In terms of goals, *Mediate PPA*, *Invest and Sell PPA*, and *Invest and Sell Contracts* have potential for higher profit margins compared to the rest, as well as for keeping the customer interface. All these BMs also align well with Volvo Trucks environmental strategy. Moreover, *Offer Electricity through Partner* has the highest alignment in terms of business logic since the BM involves taking help from partners and does not imply a long investment horizon. Lastly, all BMs follow Volvo Trucks' market strategy well. Table 5.1 provides the overall vertical alignment for all seven BMs, where the *Mediate PPA* has the highest vertical alignment, and *Purchase and Sell Electricity* the lowest.

Table 5.1. *Compiled vertical alignment for each business model*

Business Models	Offer Electricity through Partner	Purchase and Sell GOs	Mediate PPA	Purchase and Sell Electricity	Invest and Sell PPA	Invest and Sell Shares	Invest and Sell Contracts
<i>Goals</i>	-1	0	2	0	2	-1	1
<i>Business Logic</i>	2	1	1	0	0	1	-1
<i>Market Strategy</i>	1	1	2	1	2	2	2
AVG	0.67	1	1.67	0.33	1.33	0.67	0.67
Compiled Vertical Alignment	Relatively High	Relatively High	High	Medium	Relatively High	Relatively High	Relatively High

5.2 Horizontal Alignment

In this subchapter, alignment between the identified BMs and Volvo Trucks' BET BM is analyzed.

Value Proposition

Our findings show that, in the established BET BM, Volvo Trucks wants to provide a BET together with value-adding services to offer total transport solutions. All identified BMs increase the value of the total offer package surrounding the BET. Thus, they all complement the existing value proposition by adding another service. Additionally, Stauch (2021) conducted a study where it was found that the adoption rate of electric cars increased if it was bundled with solar power. Possibly, such an increase in value proposition could be applicable for BETs as well. Furthermore, our findings show that current BET BM targets both existing Volvo Trucks customers and new ones within the transport industry. Since the potential value-adding service is meant to be offered along with a BET, the new BM should preferably target the same customers as the established BET BM. All identified BMs target any customer that would want to buy a BET, with one exception. The exception is *Purchase and Sell GOs* since this BM only targets customers that have a non-renewable electricity contract which they want to keep. Thus, this BM has a lower horizontal alignment than the rest when it comes to target customers in the value proposition.

Value Creation and Delivery

The different BMs require Volvo Trucks to operate more or less far from their current BET core business.

By pursuing the *Offer Electricity through Partner* BM, the partner could handle the electricity contracts and the electricity delivery. Thus, Volvo Trucks would not need to enter a business that requires knowledge and resources that are not in their current BM. Volvo Trucks also has some experience in partnering up with electricity suppliers. For example, they have partnered with Öresundskraft to provide renewable electricity charging stations (Öresundskraft, 2022) as well as with Vattenfall for electricity supply to their facilities (Volvo Group, 2023D). Besides, the findings of this study highlight that electricity suppliers would be positively inclined to such partnerships because of the easy access to a new customer base. Even so, negotiating a good deal for all parties as well as managing the partnership may require additional efforts

for Volvo Trucks since they do not have such a close relationship with an electricity supplier in their established BM.

Similarly, in the BM *Invest and Sell Shares*, Volvo Trucks needs to partner up with an electricity supplier. However, in this BM, the partnership would need to be more long-term, and thereby the choice of partner is even more important and possibly more difficult. The supplier would take the responsibility of offering customers complementary electricity, electricity contracts, handling the electricity delivery, and administering the selling of shares. In other words, the supplier would handle many of the activities not included in Volvo Trucks' established BET BM. To enable this BM, Volvo Trucks would need to own the power plant, sign service contracts for the power plant, and maintain a good relationship with the partner. Research shows that operation and maintenance of power plants in Germany is often done by the owner itself, and thus the owner needs high technical knowledge (Horváth and Szabó, 2018). However, in the BMs involving investments in a power plant in this study, Volvo Trucks could outsource the operation and maintenance of the power plant similar to how Xiang et al. (2019) describe a host-owned power plant. By outsourcing the operation and maintenance, Volvo Trucks avoids the need to gain such knowledge which was also strongly advocated for by interviewees. Still, by being the investor, some knowledge about producing and selling electricity may be necessary.

In the BMs *Mediate PPA* and *Invest and Sell PPA*, Volvo Trucks would need to gain knowledge about PPAs. Our findings show that the company is currently a buyer in several PPAs but has not been a PPA provider. In the last-mentioned BM, Volvo Trucks also needs to sell electricity to Nord Pool. This is because the PPA would be financial (Mendicino et al., 2019). Producing and selling electricity are not activities included in a BET manufacturer's current BM, making the horizontal alignment in terms of value creation and delivery lower in this BM compared to the *Mediate PPA*. If customers are offered a baseload PPA, the company, upon that, would need to learn how to trade complementary electricity.

The BM *Purchase and Sell GOs* also requires trading, but only of GOs and not electricity. According to our findings, trading GOs is not that complicated, but the trading and administration of GOs are still outside of Volvo Trucks' core business today.

Pursuing the BM *Purchase Electricity and Sell Contracts* would be far away from Volvo Trucks established BET BM, in terms of both activities and resources. This BM would require the company to trade electricity and GOs, while also administering electricity contracts and taking on load management responsibilities. These activities are not part of Volvo Trucks' BET BM today. Furthermore, our findings show that entering a new business area without partners can be tricky. The BM *Invest and Sell Contracts* requires similar activities and resources, plus activities and resources related to investing in a power plant. Therefore, both BMs entail a low horizontal alignment in terms of activities, resources, and partners, whereas the alignment for *Invest and Sell Contracts* is slightly lower.

Value Capture

In the established BET BM, our findings show that revenues are generated from selling the BET and services. The identified BMs would complement the established BM with revenue streams in different ways. In all BMs, except *Offer Electricity through Partner*, the sold electricity and GOs will naturally result in complementing service revenue streams for Volvo Trucks. However, many interviewees perceive the margins of the electricity sales industry to be lower than the automotive industry that Volvo Trucks currently operates in. Moreover, it is not evident from our findings how revenue streams from the *Offer*

Electricity Through Partner BM look since it depends on the terms in the partnership agreement. While our findings highlight a possibility of negotiating a revenue stream with the electricity supplier, it is not confirmed by secondary data or previous research. Thereof, it is not certain that this BM would complement the established BET BM with a new service revenue stream.

Just as the *Offer Electricity through Partner* BM may not provide Volvo Trucks with a revenue stream, it may not lead to additional costs either. However, all the other BMs add costs to the established BET BM in different ways. For example, investing in a power plant entails a high upfront cost and comes with risks (Horváth and Szabó, 2018). At least, signing PPAs in the BM *Invest and Sell PPA* could lower the investment risk and secure future stable cash flows (Thumann & Woodroof, 2021). Producing electricity could possibly also lead to cost reductions. The findings of this study show that Volvo Trucks buy electricity for their own facilities today, thus it is already a cost in their established BET BM. If they would invest in a power plant, they could supply themselves with electricity at cost price. Moreover, it is not only investments in electricity production that come with new cost risks. Signing a large PPA as a mediator would require Volvo Trucks to make sure that all the electricity will be sold. One way to alleviate this risk could be to take inspiration from the *Invest and Sell Shares* BM and make a deal with a larger actor to purchase leftover electricity. A positive finding is that the *Mediate PPA* would not lead to high personnel costs.

From previous research it is evident that value in a BM is not only created through monetary means but can be of environmental character as well (Bocken et al., 2014; Joyce & Paquin, 2016). The analysis of horizontal alignment in this study incorporates environmental benefits and impacts into the *value capture* category, with inspiration from Joyce and Paquin's (2016) *Environmental Life-cycle BM* layer. This is done because BET manufacturers are targeting the full well to wheel emissions from the use phase. All identified BMs complement the already existing environmental benefits of selling a BET, to varying degrees, since they help encourage customers to choose renewable electricity for charging. To grade how well the BMs align, the same reasoning can be used as in the goals dimension of chapter 5.1. Because they directly add more renewable electricity to the grid, the three BMs related to investing in a power plant, and the *Mediate PPA*, complement the established BET BM with the most environmental benefits. However, the BMs related to building power plants directly lead to some environmental impacts as well.

Summary

In terms of value proposition, all BMs complement the current BM in the same way except for *Purchase and Sell GOs* because it does not target as many BET customers. Value proposition is also affected by customer demand, but this aspect is instead covered in chapter 5.3. Moreover, the BM *Offer Electricity through Partner* requires the least activities and resources outside of Volvo Trucks' core business, followed by *Mediate PPAs* and *Purchase and Sell GOs*. Therefore, these BMs have a higher horizontal alignment with Volvo Trucks BET BM in terms of value creation and delivery compared to the other BMs. Lastly, *Mediate PPA* is the most aligned in terms of value capture since it, for example, contributes to additionality while at the same time avoiding the investment cost of a power plant. The BMs that require an investment in a power plant contribute to additionality as well, and add strong revenue streams, but also entail high investment costs. Thus, their alignment is slightly lower. Table 5.2 shows the overall horizontal alignment for the seven BMs where all BMs were deemed with a similar horizontal alignment, except *Invest and Sell Contracts* that was deemed lower.

Table 5.2. *Compiled horizontal alignment for each business model*

Business Models	Offer Electricity through Partner	Purchase and Sell GOs	Mediate PPA	Purchase and Sell Electricity	Invest and Sell PPA	Invest and Sell Shares	Invest and Sell Contracts
<i>Value Proposition</i>	2	1	2	2	2	2	2
<i>Value Creation & Delivery</i>	2	0	0	-1	-1	-1	-2
<i>Value Capture</i>	-1	1	2	1	1	1	1
AVG	1	0.67	0.67	0.67	0.67	0.67	0.33
Compiled Horizontal Alignment	Relatively High	Relatively High	Relatively High	Relatively High	Relatively High	Relatively High	Medium

5.3 External Alignment

In this subchapter, alignment between the identified BMs and Volvo Trucks’ external environment is analyzed.

Customer Demand

Our findings show that all interviewed customers have an interest in charging their BETs renewably, and several interviewees have had renewable electricity contracts for years. Several interviewees also express a feeling of safety when being proposed a bundled offer with a BET and a renewable electricity contract. Since all interviewed customers already charge their BETs with renewable electricity, switching to Volvo Trucks’ potential offer would have to provide them with additional benefits compared to their current electricity agreement. According to our findings, the price of the electricity contracts is of high importance for the customers. Even though some customers discuss that their customers are, in turn, willing to pay more for sustainable transportation, prices should be as low as possible for the new offer to be considered.

One way in which Volvo Trucks could provide additional benefits in the form of a lower price is through using their size and bargaining power to create a more beneficial offer for the customer. However, such a benefit seems to be more interesting for smaller customers than large. This is because large customers have the resources to handle sustainability issues on their own. For example, interviewees M and P state that they would rather negotiate a deal themselves. This entails that all the identified BMs are more suitable for the demand of the smaller customers who could benefit from Volvo Trucks’ bargaining power. For example, smaller customers may not be able to sign a PPA with a producer themselves due to not having a large enough electricity consumption. Volvo Trucks offering a pool PPA could thus enable long-term price stability and an opportunity to contribute to additionality even for smaller customers. However, some customers express concerns about binding themselves to long-term agreements such as PPAs. Since the BET market is still new and continually improves, binding is considered a risk. To alleviate this worry, our findings show that Volvo Trucks could perhaps take on the risk of offering shorter binding times to their customers. Furthermore, another BM that could offer the customer a beneficial price is *Invest and Sell Shares*. This is because the customer buys the shares at cost price, gets a discount on their electricity contract, and is expected to earn back the investment in 15 years. While the payback time is as long as 15

years, there is no binding time since the shares can be sold at any time. In contrast, *Purchase and Sell GOs* may not provide the interviewed customers with any additional benefits since they already charge renewably. Thus, the BM has a low alignment when it comes to meeting customer demand.

Furthermore, our findings show that several customers show an interest in producing electricity themselves, which points to a potential interest in buying shares in a power plant. In this aspect, *Invest and Sell Shares* could be more aligned than the other BMs when it comes to customer demand.

Another aspect highlighted in our findings is that, while some interviewees would consider Volvo Trucks offering electricity to be reassuring, some customers also state that it would be more natural to turn to an established electricity supplier. With this in mind, partnering up with an electricity supplier may be the smarter choice and result in a higher alignment with the customer demand. On the other hand, our findings show that Volvo Trucks wants to be at the forefront and be ready to offer customers what they want *when* they start demanding it, rather than waiting for customers to turn to them for help. Thus, it may not be an issue that customers would not *naturally* turn to them for electricity supply as long as they would appreciate the offer when it is presented to them.

Offering their customers electricity is a way for Volvo Trucks to support them in the sustainable transformation. Our findings show that customers who are new to the world of BETs would be more appreciative of receiving help compared to the experienced BET owners in the interviews. In other words, the demand for this kind of support is likely higher when the customer has not yet gone through the transformation. As BET sales scale up, there will be more opportunities for Volvo Trucks to help guide the new customers through the transformation. Thus, the identified BMs may align better with future customer demand than with the established BET customers.

Competition

While there have been instances where a passenger car has been bundled with electricity in Sweden, our findings show that no BET manufacturer has done anything similar. Thus, Volvo Trucks would have the opportunity to distinguish themselves from other BET manufacturers.

The electricity market in Sweden is competitive and there are some strong market leaders. Almost all electricity suppliers on the Swedish market offer renewable electricity contracts, indicating that the BMs offering contracts are exposed to high competition. Entering a competitive market and competing with established players alone may be challenging. Thus, those BMs could be interpreted to have a low external alignment in terms of competition. The same goes for *Purchase and Sell GOs*. While it is not found in Sweden as a stand-alone BM, Bröckl et al. (2011) say that having a standard electricity contract and additional GOs is similar to having a renewable electricity contract. The *Offer Electricity through Partner* BM may, therefore, indicate a slightly higher alignment since the partner would already be an established player on the market.

On the Swedish market, offering PPAs is not as common as offering renewable electricity contracts. There are some actors offering PPAs or mediating in them (Vattenfall, 2018; SunSpark Nordic, 2023; Energi Försäljning Sverige, 2023). Thus, pursuing the *Mediate PPA* BM or *Invest and Sell PPA* BM would provide an opportunity for Volvo Trucks to distinguish themselves from other electricity suppliers, indicating a higher external alignment when it comes to competition. The same goes for *Invest and Sell Shares* since

only a few actors offer solar and wind power shares (Jämtkraft, 2023B, VästanVind, 2023C, Storuman Energi, 2023).

Regulations

Pursuing the different BMs entails different regulations to consider and follow. The BMs *Offer Electricity through Partner* and *Mediate PPA* do not concern Volvo Trucks producing nor selling electricity, so external regulations would not hinder or complicate the pursuit. Following from this, the external alignment in terms of regulations is high for both of them.

In contrast, pursuing the BMs related to investing in a power plant entails several regulations to follow. Our findings show that Volvo Trucks would need to apply for permits and follow environmental laws. Getting a building location approved is also a challenge. Once the plant is built, there are further regulations to consider related to selling the electricity that has been produced. This indicates a low alignment between these BMs and regulations in Volvo Trucks' external environment.

Regulations for selling electricity affect many of the BMs. The BMs *Purchase and Sell Contracts* and *Invest and Sell Contracts* require selling electricity to end-consumers and trading electricity on the spot market. Thus, Volvo Trucks would need to follow many regulations, take on load management responsibilities (Energy Plaza, 2023), and send in applications to Nord Pool (Nord Pool, 2020B). The BM *Invest and Sell PPA* does not entail selling electricity to end-consumers but selling to the spot market. Since a partner handles the electricity delivery in *Invest and Sell Shares* Volvo Trucks would not need to consider regulations for selling electricity.

In contrast to the more regulated BMs, our findings show that selling GOs is not strictly regulated which indicates a higher alignment for *Purchase and Sell GOs*. In broad terms, the company simply needs to apply for an account on the platform Cesar and apply for quota obligations to be able to redeem GOs on behalf of customers (Cesar, 2023B).

Summary

In terms of customer demand, *Offer Electricity through Partner* and *Invest and Sell Shares* have the highest external alignment. This is because it may be more natural for a customer to turn to an electricity supplier and because customers show a general interest in self-production. Moreover, *Mediate PPA*, *Invest and Sell PPA*, and *Invest and Sell Shares* experience the least amount of competition. Thus, the alignment of these BMs in terms of competition is higher. Lastly, since *Offer Electricity through Partner* and *Mediate PPA* are not affected by any regulations, they have the highest alignment in that aspect. In contrast, the BM *Invest and Sell Contracts* involves producing electricity, selling electricity to end-consumers, and trading at Nord Pool. Thus, it is affected by more regulations than the rest and has the lowest alignment in terms of regulations, followed by *Invest and Sell PPA* and *Purchase and Sell Contracts*. Table 5.3 provides the overall external alignment for all seven BMs, where *Mediate PPA* and *Offer Electricity through Partner* were deemed highest.

Table 5.3. *Compiled external alignment for each business model*

Business Models	Offer Electricity through Partner	Purchase and Sell GOs	Mediate PPA	Purchase and Sell Electricity	Invest and Sell PPA	Invest and Sell Shares	Invest and Sell Contracts
<i>Customer Demand</i>	1	-2	0	0	0	1	0
<i>Competition</i>	-1	-2	1	-2	1	1	-2
<i>Regulations</i>	2	-1	2	-2	-2	-1	-2
AVG	0.67	-1.67	1	-1.33	-0.33	0.33	-1.33
Compiled External Alignment	Relatively High	Low	Relatively High	Relatively Low	Medium	Medium	Relatively Low

5.4 Compiled Strategic Alignment

The analysis of vertical, horizontal, and external alignment between the seven BMs and Volvo Trucks is compiled into Table 5.4.

Table 5.4. *Compiled Alignment*

BM	Offer Electricity through Partner	Purchase and Sell GOs	Mediate PPA	Purchase and Sell Electricity	Invest and Sell PPA	Invest and Sell Shares	Invest and Sell Contracts
<i>Vertical Alignment</i>	Relatively High	Relatively High	High	Medium	Relatively High	Relatively High	Relatively High
<i>Horizontal Alignment</i>	Relatively High	Relatively High	Relatively High	Relatively High	Relatively High	Relatively High	Medium
<i>External Alignment</i>	Relatively High	Low	Relatively High	Relatively Low	Medium	Medium	Relatively Low

As depicted in Table 5.4, *Mediate PPA* experiences the highest overall strategic alignment with Volvo Trucks since it scored *High* or *Relatively High* in all three alignment dimensions. The reasons why the BM is deemed to have a high strategic alignment with Volvo Trucks is, among other things, because it does not require Volvo Trucks to become an electricity supplier, has the potential of capturing a steady profit, while at the same time contributing to additionality. Based on this study’s framework, the high strategic alignment implies that *Mediate PPA* would be the best BM for Volvo Trucks to pursue. The BM is followed by *Offer Electricity through Partner*, *Invest and Sell PPA*, and *Invest and Sell Shares* which also have a compiled score above *Medium*. The first, *Offer Electricity through Partner*, does not require Volvo Trucks to engage in activities far from their core business and regulations do not affect the BM. The second is similar to *Mediate PPA* in the sense that it has the potential of capturing a profit and that it contributes to additionality. However, the investment in the power plant complicates the BM and lowers the external alignment because

of regulations, for example. Moreover, *Invest and Sell Shares* alleviates Volvo from handling electricity responsibilities since the partner does all the work and contributes to additionality, but is exposed to building regulations and has little to no profit potential.

In contrast, *Purchase and Sell GOs*, *Purchase Electricity and Sell Contracts*, and *Invest and Sell Contracts* scored *Medium*, making them the least strategically aligned BMs. For example, neither of the first two contribute to additionality or has potential for reaching high profit margins, while the third implies that Volvo Trucks needs to both produce and sell electricity on their own. All three are also exposed to high competition.

The alignment of the BMs could be affected by *when* they are pursued. One aspect that could affect this result is the fluctuating electricity market prices. For Volvo Trucks, a long-term set price agreement such as in *Mediate PPA* may be less beneficial than a shorter-term electricity contract provided that the electricity prices drastically increase. Similarly, *Mediate PPA* would become further beneficial if the prices dramatically descend. Of course, a better deal for Volvo Trucks does not necessarily mean a better deal for the customer, and no customer demand equals no revenue. Another aspect related to timing is that the BMs could be implemented in different stages. Jumping straight into becoming an electricity producer may be overwhelming for both the BET manufacturer and the customers. Starting out small and gradually stepping outside of the core business may be smarter since it provides Volvo Trucks with an opportunity to learn while allowing customers to warm up to the idea that the company is involved in electricity supply. Thus, the BMs *Offer Electricity through Partner* or *Purchase and Sell GOs* could be the most appropriate to pursue at an early stage.

Our findings also highlight the trade-off risk versus reward. Pursuing a BM that exposes Volvo Trucks to high risks also increases the revenue potential. However, pursuing a low-risk BM is unlikely to put them in a position where the investment is not paid back. The BMs that require investments in power plants or signing up for long-term agreements naturally entail a higher risk for Volvo Trucks, while the risk for pursuing *Purchase and Sell GOs* is significantly lower. In *Mediate PPA*, for example, it would be risky for them to sign a long-term agreement with an electricity producer, to then resell it with shorter binding times to their customers. However, the risk would be lowered if the same long-term agreements were accepted by Volvo Trucks' customers. At the same time, taking on this risk could result in a more attractive offer to the customer. Since the element of risk also entails a higher revenue potential and largely depends on how the agreements are negotiated or offered, it is not evident whether a high-risk or low-risk BM is to be preferred. One solution could be to pursue several BMs at once in a portfolio to spread out the risks, although this would naturally require handling even more activities outside the core business of a BET manufacturer.

Lastly, Altunay et al. (2021) highlight that alignment in certain components in the BM was more important than others when determining the likelihood of adoption of solar models in their study. For example, alignment in *value proposition* was not sufficient for a BM to be adopted, while complementing resources, activities, and partnerships were of higher importance. In our study, this could indicate that alignment in *value creation and delivery* should be a more decisive factor than alignment in *value proposition* when determining which BM is the most strategically aligned. However, since the adopter in this study is a BET manufacturer and not an energy incumbent, the exact same phenomena may not apply. A BET manufacturer's core business concerns selling trucks and not electricity, indicating that other factors may be considered. Even so, the *value proposition* of all identified BMs largely complements the established

BET BM in the same way, that is with an extra value-adding service. Therefore, *value creation and delivery* is naturally a more decisive component when examining strategic alignment in this study. Regardless, the findings of Altunay et al. (2021) could indicate that all components of the analysis should not be weighted equally in the decision for which BM is the most appropriate. Unfortunately, this study's analysis cannot be compared to reality since no BET manufacturers have pursued any of these BMs yet. This means that no conclusions can be drawn on which components must be aligned for the BMs to be pursued.

6 Discussion

Our study has identified seven BMs a BET manufacturer could pursue to increase customer use of renewable electricity. Based on the *Strategic Alignment Framework*, the *Mediate PPA* BM is the most strategically aligned with Volvo Trucks. The BM scored *Relatively High* or *High* in all three alignment dimensions. The vertical alignment is *High* partly because of potential for return on the investment, contribution to additionality and since it follows Volvo's market strategy. Furthermore, the horizontal alignment is *Relatively High* because the BM does not involve activities or knowledge far away from Volvo Trucks' established BET BM. Also, external alignment is *Relatively High* because of few regulations hindering the pursuit, quite low competition, as well as possibilities for offering a good price to the customers. Previous research does not cover how a BET manufacturer could stimulate an increased customer use of renewable electricity. By analyzing possible BMs for a BET manufacturer to offer electricity to their customers and, through strategic alignment, determining which is the most appropriate to pursue, this study has contributed to existing research.

The first aspect to discuss is to what extent strategic alignment should determine whether a BM is appropriate to pursue. Our study is based on the premise that the higher the strategic alignment, the more appropriate the BM is to pursue. While previous research highlights that a company is more likely to pursue a new business that has a high degree of alignment with their already established BMs and strategy (Altunay et al., 2021; Wadström, 2019), some authors mean that too much alignment *can* be negative. Research shows that too much alignment could inhibit adapting to a dynamic external environment (Kathuria et al., 2007; Chorn, 1991). This means that a company only pursuing BMs that are perfectly aligned with their current business could be hindered from evolving and trying new things. Neither of the identified BMs in this study are, however, perfectly aligned with Volvo Trucks and nearly all of them require the company to enter a new industry. Therefore, the risk that the highest aligned BMs would inhibit Volvo Trucks from evolving is small.

Volvo Trucks is a global company, and to efficiently evolve their business it is preferable if a solution is globally scalable. Our study's context is limited to Sweden, so it cannot be assumed that our findings are applicable in other markets. An optimal BM for increasing customer use of renewable electricity should work anywhere in the world, but likely there is no such solution. This is because of varying availability and demand for renewable electricity, differing regulations related to entering the electricity market, as well as region specific restrictions for greenhouse gas emissions. For example, the optimal way to scale up the *Offer Electricity through Partner* BM would be to find a partner with a large network to avoid having to partner up with one or more electricity suppliers in each country. The fragmented electricity market would, however, likely not allow for one or a few partners to cover all 38 countries in which Volvo Trucks has sold BETs today. As BET sales scale up, a comprehensive solution will be further difficult to achieve.

Just as one BM may not work for all countries, some BMs in this study may be more aligned outside of Sweden. For example, *Purchase and Sell GOs* experiences a low strategic alignment in Sweden since renewable electricity contracts are common. In countries where access to renewable electricity is limited and most customers have a standard electricity contract, the value proposition of simply adding GOs to make it renewable is likely more attractive. This, however, raises the issue of how long the geographical distance can be between the electricity production and the GO purchasing customer. Nevertheless,

conducting the same study on other markets than Sweden could help determine the BMs appropriateness on different markets and thus decide to what extent the BMs are globally scalable.

If Volvo Trucks pursues a BM and increases the customer use of renewable electricity, they also want to be able to account for this. For them to credit the renewable electricity to the SBTs, the data on how the customer is charging must likely be collected somehow. Ways to access the data should be further looked at along with data protection aspects related to data sharing and collection. Furthermore, even if Volvo Trucks had access to the data, one challenge in terms of data is that a customer can only have one electricity agreement per electricity meter. Many transport providers own BETs from several different BET brands. This means that the electricity offer from Volvo Trucks might make BETs sold by competitors run on renewable electricity as well. While this is a positive effect in terms of environmental benefits, it raises the issue of who is allowed to account for the renewable electricity. If both Volvo Trucks and the competitor take credit for renewably charging the competitor's BET, the environmental benefit would be accounted for twice in the SBTs. Thus, it needs to be made clear how the electricity links to each vehicle.

Furthermore, selling a renewable electricity agreement to a customer will not guarantee renewable electricity in public charging stations, and thus no BM in this study can guarantee renewable charging in other places than at the customer's home base. As BETs scale up and are used in the long-haul segment, charging along the route will become more prevalent. In line with BETs scaling up, public charging should also be taken into consideration by looking at how BET manufacturers can affect the origin of electricity in public charging stations along the route. The electrification trend also needs to be accompanied by a growing public charging infrastructure. Furthermore, a growth in both public and private charging infrastructure and an increased use of electricity will require strengthening of the grid. Therefore, studying how BET manufacturers or other actors in the electrification industry could stimulate infrastructure development on different markets would be of relevance.

Our study has, in a single case study, analyzed strategic alignment between the BMs and Volvo Trucks and, thus, the result is not necessarily applicable to BET manufacturers in general. One aspect distinguishing Volvo Trucks from many other BET manufacturers is their large size and global establishment. This could indicate that Volvo Trucks has more bargaining power than other companies, which facilitates taking the mediator role. For example, being a mediator in a PPA may, thus, not be as beneficial for smaller manufacturers who are less able to negotiate a solid deal with the producer. Volvo Trucks has also committed to following SBTs, which could make environmental benefits more important in their value capture compared to other companies that have not made such a commitment. Even so, the decision to start manufacturing BETs likely originates from a desire to become more sustainable.

Although the outcome of our study is not fully generalizable to all BET manufacturers, the identification of the seven BMs as well as the method of assessing the BMs according to strategic alignment *are* applicable for all BET manufactures. In other words, our study has the potential of guiding them in assessing how BMs for offering electricity to their customers could complement or inhibit their established BM and strategy. We would go as far as saying that heavy truck manufacturers could pursue some of the BMs in this study for other renewable fuels as well, with a few alterations. For example, they could partner up with a biomethane or hydrogen fuel supplier and offer their customers fuel instead of electricity. Likewise, the company could be an aggregator between their customers and producers of renewable fuels.

Lastly, while the *outcome* of our study may not be generalizable outside of the heavy truck industry, the *method* could be used in other contexts as well. The overall idea of the frameworks could be used for any company contemplating whether they should enter a new business in any market or industry. Although the frameworks are adapted from Richardson (2008), and Joyce and Paquin (2016), and Altunay et al. (2021) this study presents a new method for analyzing alignment of a BM in the context of wanting to improve a business in the environmental sustainability dimension. The components *Environmental Benefits* and *Environmental Impacts*, incorporated into the BM framework, could be switched to, or complemented with, *Social Benefits* and *Social Impacts* if the company wishes to improve in the social sustainability dimension. Thus, this study contributes a new, generalized way for a company to determine its strategic alignment with a new BM.

7 Conclusion

The aim of the study was to find the most appropriate BM for a BET manufacturer to increase customer use of renewable electricity. More specifically, our study has answered two research questions: (1) What BMs for increasing customer use of renewable electricity could be pursued by a BET manufacturer, and (2) Which BM is the most strategically aligned with a BET manufacturer's established strategy, BM, and external environment?

By reviewing literature, two frameworks were adapted for being able to determine strategic alignment between a BM and the company wishing to pursue it. These frameworks are the *Business Model Framework* and the *Strategic Alignment Framework*. Furthermore, Volvo Trucks was chosen as case company and the scope of the study was limited to the Swedish market.

For RQ1, interviews and secondary data about the automotive and electricity sector revealed seven BMs a BET manufacturer could pursue to increase customer use of renewable electricity. These BMs are:

- Offer Electricity through Partner
- Purchase and Sell GOs
- Mediate PPA
- Purchase Electricity and Sell Contracts
- Invest and Sell PPA
- Invest and Sell Shares
- Invest and Sell Contracts

For RQ2, our frame of reference, in the form of the two frameworks, was used to analyze vertical, horizontal, and external alignment between the seven BMs and the case company's established BET strategy, BM, and external environment. Our study found that the BM *Mediate PPA* had the best compiled strategic alignment with the case company. This is because the BM, for example, contributes to additionality, has a potential for a good return on the investment, and does not require knowledge and activities too far away from the established core business. In contrast, the *BM Purchase and Sell GOs*, *Purchase and Sell Electricity*, and *Purchase Electricity and Sell Contracts* have the poorest alignment, partly because of no contribution to additionality, and exposure to high competition.

The outcome of the study contributes to research by investigating a topic previously unstudied. While electrification of heavy trucks is in its infancy, it is expected to rapidly grow in the future. Therefore, providing BET manufacturers with a BM to stimulate renewable electricity charging at a large scale is important to lower total emissions in the transport industry. The insights from our study may help guide BET manufacturers towards reducing their indirect emissions and determine the best way to do so. Furthermore, our study has introduced a new method that any company could use for analyzing strategic alignment when wanting to improve in a certain sustainability dimension. Further research could, for example, investigate which BM is most aligned in other markets than Sweden and how charging and grid infrastructure could be incentivized to accompany the increased production and use of renewable electricity.

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