FOCAL PAY

2050
Fast Forward to a Greener Future

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Comparative retail and climate analysis of Focalpay AB

2050 Consulting

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Summary

This report presents potential savings in emissions of greenhouse gases expressed as carbon dioxide equivalents (CO_2e) and electricity from stepwise implementation of Focalpay's retail and payment system. Results suggest that annual savings from full implementation vary between 0,95 to 4,46 tonnes of CO_2e (tCO_2e), for small and large retailer stores, respectively. Reduced in-store electricity use from implementation, in turn, ranges from 4 960 to 24 016 kWh per year for the same type of businesses. The report further lays out necessary assumptions regarding the electricity mix, avoided emissions, and allocation of production emissions to reach these conclusions.

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Introduction

Focalpay offers cloud-native checkout and payments services for businesses, primarily within retailing. The payment service employs a system architecture with a considerably lower energy consumption than conventional systems in the industry. Focalpay's system architecture further offers clients an opportunity to avoid purchases of physical equipment, including cashier terminals, conveyor belts and other hardware, and thereby reduces overall material consumption. Focalpay wants to describe the potential climate impact from implementing its payment solution, as compared to conventional payment systems within retailing, for a selection size-varying retailing business. For this purpose, 2050 Consulting is assisting Focalpay in conducting an accurate and pedagogically explained climate calculation accompanied by a detailed description of calculation methods.

Purpose and delimitation

The purpose of this comparative climate analysis is to develop calculations and concrete numbers on potential savings for Focalpay's clients when transitioning from conventional payment systems to Focalpay's cloud-native system architecture. The calculations only study the differences between the baseline and the solution. Any other emissions that occur are not studied. Potential savings studied in the analysis cover the use phase and, for hardware, the production phase. Further, savings are presented from the following perspectives: energy consumption and climate impact.
Whereas there is a wide array of potential end-users of Focalpay's services, the present analysis is delimited to describe implementation steps for businesses within physical retailing.

Implementation steps

The calculations of potential savings of transitioning to Focalpay's services takes four different implementation steps as their starting point. Put together, the steps reflect a gradual phase-in of the cloud-native system architecture as compared to conventional payment systems within retailing. Each implementation step is compared to a baseline, describing estimated energy and resource use in a conventional payment setup. Table 1 provides an overview of the different steps. Appendix 2 lays out more detailed assumptions associated with each of the implementation steps.

Step	Description	Emissions change (compared to previous implementation step)
Baseline	• Local servers. • Fully equipped cashier desks. • PC is active 24/7.	N/A
Step 1	• Local server replaced by cloud server. • Fully equipped cashier desks. • PC active only during opening hours.	• Reduced emissions from in-store electricity use of local server and card terminals. • Increased emissions from electricity use of cloud server and Focalpay payment. • Reduced emissions from production of local server (assumed life length of 4 years).
Step 2	• Local server replaced by cloud server. • Fully equipped cashier desks. • Partial replacement of cash desk computers by tablets (20%). • PC/tablets active only during opening hours.	• Reduced emissions from in-store electricity use of cash desk computers. • Reduced emissions from production of cash desk computers (assumed life length 6 years). • Increased emissions from in-store energy use of tablets. • Increased emissions from production of tablets (assumed life length 2 years).
Step 3	• Local server replaced by cloud server. • Fully equipped cashier desks partially maintained (50%). • Full replacement of cash desk computers by tablets at remaining desks. • Tablets active only during opening hours.	• Reduced emissions from in-store electricity use of desks and desk computers. • Reduced emissions from production of desks (assumed life length 3-10 years depending on type of equipment) and desk computers. • Increased emissions from in-store electricity use of tablets. • Increased emissions from production of tablets.
Step 4	• Full phase-out of conventional payment system. • Focalpay payment only.	• Reduced emissions from in-store electricity use of cash desks and tablets. • Reduced emissions from production of desks and tablets.

Table 1. Implementation steps. A further description of the calculation in each of the implementation steps is presented in Appendix 2.

The main results are presented for three different sizes of a physical retailer store: large, medium, and small. Assumptions with regards to opening hours, the baseline number of fully equipped cashier desks, local data servers, and transactions per day for each of the store sizes are presented in *Table 2*.

Shop	Opening hours per day	Opening hours per year	Number of desks per store	Number of data servers	Transactions per day	Stored gigabyte per store
Large	10	310	8	2	3000	400
Medium	10	310	3	1	1650	200
Small	10	310	1	1	150	200

Table 2. Store sizes and assumptions.

Main results

In the following sections we provide the main results of the analysis. We start off with an analysis on how emissions from production of hardware contribute to the main result, followed by a description of potential savings from transitioning to Focalpay's retail and payment services for large, medium-sized, and small stores, respectively. Lastly, we provide an illustrative example of Focalpay's potential climate and energy savings on an aggregate level, using a major Swedish retailer chain as reference.

Assumptions with regards to included equipment and emissions data are presented in detail in *Appendix 2*. With regards to greenhouse gas emissions from electricity use, which constitutes an important driver of emissions in the baseline step, the Nordic average production mix has been used as reference (90.4 gCO_2e/kWh). The section *Sensitivity analysis* presents potential savings using alternative electricity mixes as input.

Emissions from production of equipment

A core assumption in the present analysis is that implementing Focalpay's system contributes to avoided emissions from production of hardware. That is, the life length of clients' hardware is fully used. Taking the hardware local server as an example, this assumption would be valid if a business introducing Focalpay either avoids replacing a server (with no remaining life length) with a new one, or resales their existing (functional) local server on the second-hand market. If equipment that has not fulfilled its technical life length is thrown away, the results for avoided emissions for production of equipment should be adjusted.

Figure 1 shows how the emissions from production of equipment are distributed over relevant hardware item categories. More than half of the emissions from the production of equipment can be attributed to the local servers (58 percent). It should be noted that the distribution of production emissions depends heavily on assumptions about each item's expected life length and, consequently, how emissions are allocated on an annual basis. Details of assumed life length of included items are presented in *Appendix 2*.

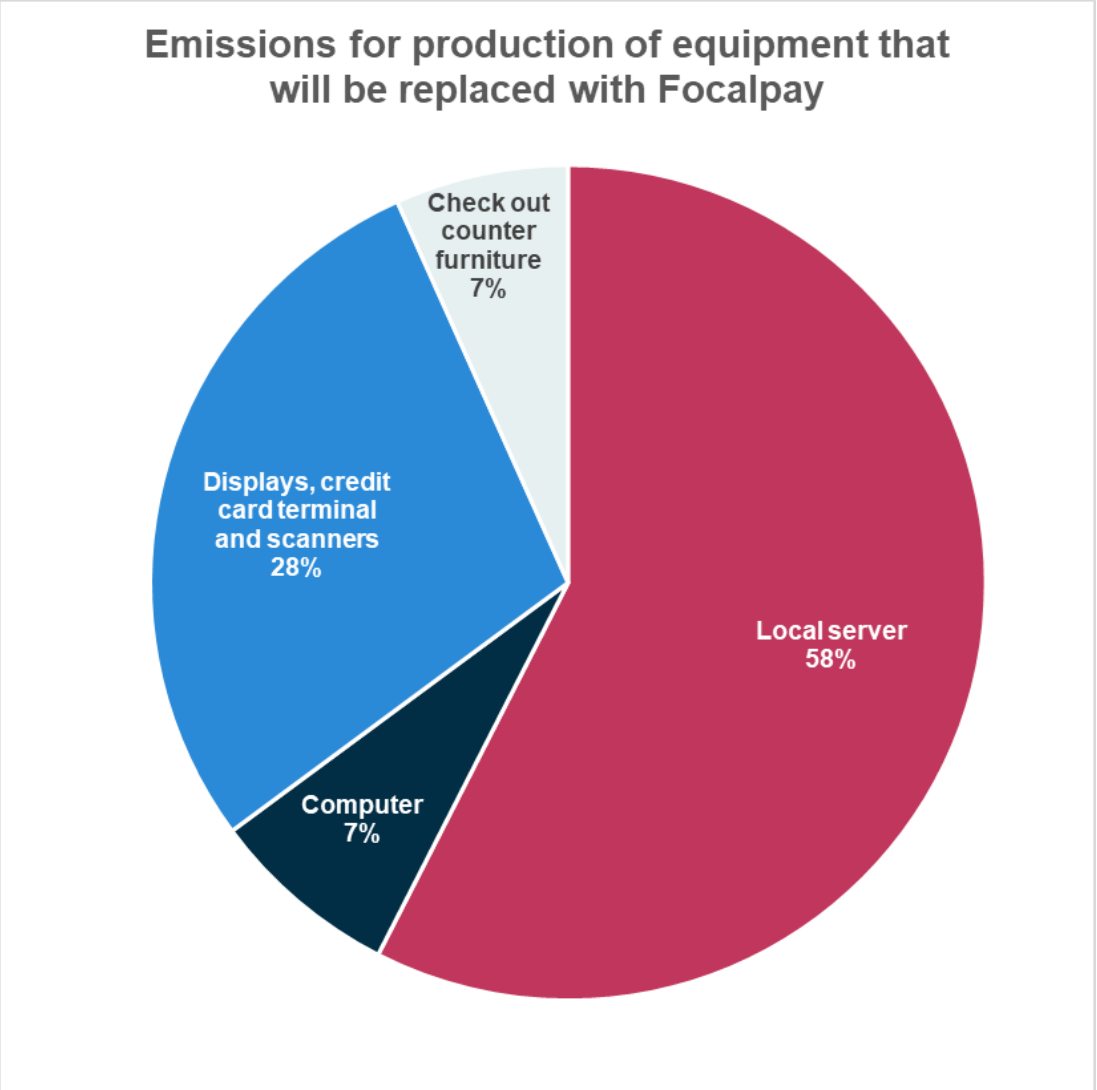

Figure 1. Emissions from production of hardware, potentially avoided when introducing Focalpay.

Large store

Table 3 presents the main results for a large store. Potential savings for a large store implementing Focalpay's system ranges from 1 813 kg CO_2e/year in Step 1 to 4 465 kg CO_2e/year in Step 4, compared to the baseline. The largest energy savings and cuts of CO_2e are made when transitioning from the baseline to Step 1, and correspond to 56,9 and 40,5 percent, respectively. *Figure 2* shows how remaining emissions are divided by electricity consumption and production of equipment for each of the implementation steps.

Step	Electricity consum-ption	Emissions electricity	Emissions produc-tion of equip-ment	Emissions total	Electricity change from baseline	Total emission change from baseline	Electricity per trans-action	Total emissions per trans-action
	kWh/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	kWh/ year (%)	$kgCO_2e$/ year (%)	Wh/ trans-action	gCO_2e/ trans-action
Baseline	24 050	2 174	2 298	4 472	0,0%	0,0%	25,86	4,81
Step 1	10 377	942	1 717	2 659	-56,9%	-40,5%	11,16	2,86
Step 2	9 392	853	1 707	2 560	-60,9%	-42,7%	10,10	2,75
Step 3	2 756	253	815	1 068	-88,5%	-76,1%	2,96	1,15
Step 4	34	7	0,000	7	-99,9%	-99,8%	0,04	0,01

Table 3. Main results – large store.

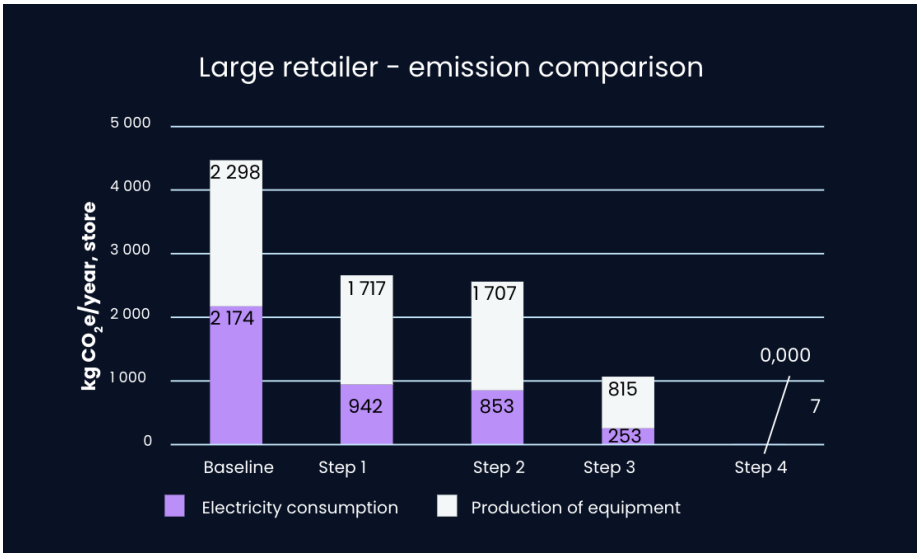

Figure 2. Emissions distribution – large store.

Medium-sized store

Table 4 presents the main results for a medium-sized store. Potential savings for a medium-sized store implementing Focalpay's system ranges from 811 $kgCO_2e$/year in Step 1 to 1 805 $kgCO_2e$/year in Step 4, compared to the baseline. The largest energy savings and emission cuts, respectively, are made when transitioning from the baseline to Step 1, and correspond to 59,7 and 44,8 percent, respectively. *Figure 3* shows how remaining emissions are divided by electricity consumption and production of equipment for each of the implementation steps.

Step	Electricity consum-tion	Emissions electricity	Emissions produc-tion of equip-ment	Emissions total	Electricity change from baseline	Total emission change from baseline	Electricity per trans-action	Total emissions per trans-action
	kWh/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	kWh/ year (%)	$kgCO_2e$/ year (%)	Wh/ trans-action	gCO_2e/ trans-action
Baseline	9 676	875	934	1 809	0,0%	0,0%	18,92	3,47
Step 1	3 896	354	644	998	-59,7%	-44,8%	7,62	1,95
Step 2	3 526	321	640	961	-63,6%	-46,9%	6,89	1,88
Step 3	1 038	96	306	402	-89,3%	-77,8%	2,03	0,79
Step 4	17	4	0	4	-99,8%	-99,8%	0,03	0,01

Table 4. Main results – medium-sized store.

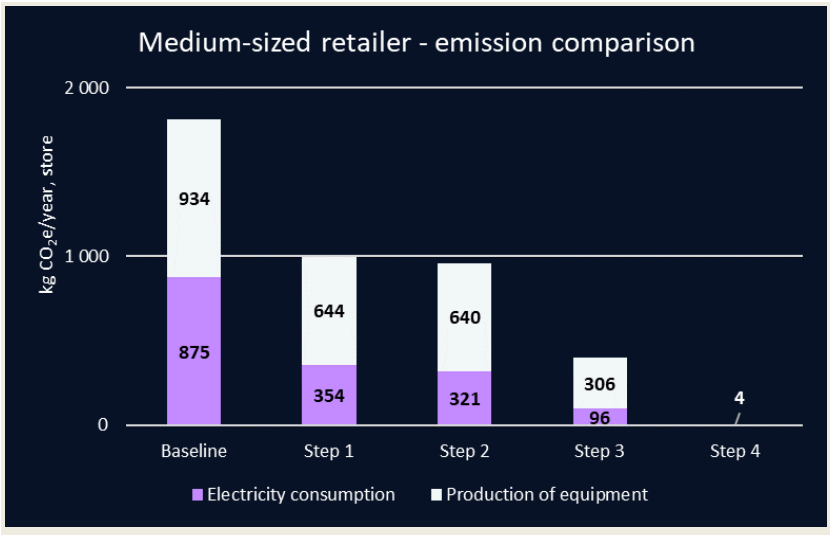

Figure 3. Emissions distribution – medium-sized store.

Small store

Table 5 presents the main results for a small store. Potential savings for a small store implementing Focalpay's system ranges from 620 $kgCO_2e$/year in Step 1 to 951 $kgCO_2e$/year in Step 4, compared to the baseline. The largest energy savings and emission cuts, respectively, are made when transitioning from the baseline to Step 1, and correspond to 73,7 to 64,9 percent, respectively. *Figure 4* shows how remaining emissions are divided by electricity consumption and production of equipment for each of the implementation steps.

Step	Electricity consum-ption	Emissions electricity	Emissions produc-tion of equip-ment	Emissions total	Electricity change from baseline	Total emission change from baseline	Electricity per trans-action	Total emiss-ions per trans-action
	kWh/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	kWh/ year (%)	$kgCO_2e$/ year (%)	Wh/ trans-action	gCO_2e/ trans-action
Baseline	4 977	450	505	955	0,0%	0,0%	107,04	20,54
Step 1	1 310	121	215	335	-73,7%	-64,9%	28,17	7,21
Step 2	1 187	109	213	323	-76,2%	-66,2%	25,52	6,94
Step 3	357	34	102	136	-92,8%	-85,7%	7,68	2,93
Step 4	17	3,698	0,000	4	-99,7%	-99,6%	0,37	0,08

Table 5. Main results – small store.

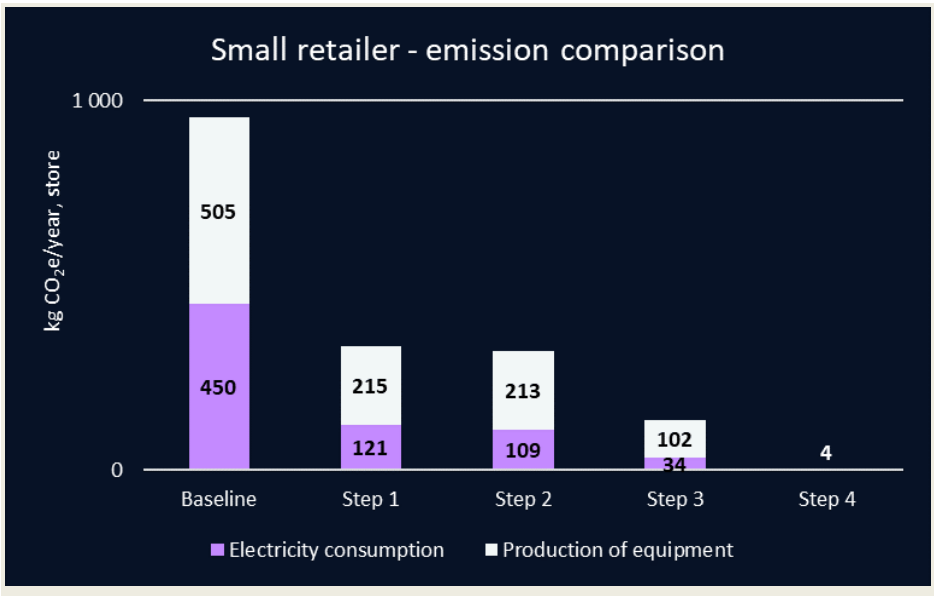

Figure 4. Emissions distribution – small store.

Potential to scale

Table 6 illustrates potential savings of a broad transition to Focalpay's services in a Swedish context. In the example, we use the ICA Gruppen as a reference set of users. Through franchise agreements, ICA Gruppen has over 1 300 stores divided in four size categories.[1] In the accounting example, we proxy the size of the ICA group to exemplify savings from a large retailer chain's transition to Focalpay, assuming Steps 1-4 are implemented broadly across 1 300 stores (700 small, 400 medium-sized and 200 large stores, defined as in previous sections).

The exercise suggests that potential savings for a larger retailer chain (1 300 stores, given the Swedish context) introducing Focalpay, as compared to the baseline, ranges from 1 121 tCO_2e/year in Step 1 to 2281 tCO_2e/year in Step 4.

Step	Electricity consump-tion	Emissions electricity	Emissions production of equip ment	Emissions total	Electri-city change from baseline	Total emission change from baseline	Electricity per trans-action	Total emissions per trans-action
	kWh/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	$kgCO_2e$/ year	kWh/ year (%)	$kgCO_2e$/ year (%)	Wh/ trans-acti on	gCO_2e/ trans-action
Baseline	12 164 190	1 099 643	1 186 856	2 286 499	0%	0%	28,75	5,40
Step 1	4 550 570	414 613	751 076	1 165 689	-63%	-49%	10,75	2,76
Step 2	4 119 492	375 643	746 731	1 122 375	-66%	-51%	9,74	2,65
Step 3	1 216 365	113 200	356 567	469 767	-90%	-79%	2,88	1,11
Step 4	25 534	5 549	0	5 549	-100%	-100%	0,06	0,01

Table 6. Potential savings of broad implementation of Focalpay across 1 300 stores. The following distribution of stores is employed: 700 small, 400 medium-sized, and 200 large.

[1] Nära (660 stores), Supermarket (422 stores), Kvantum (131 stores) and Maxi (88 stores), Link to source.

Sensitivity analysis

Since the main results build upon a large number of assumptions and parameters with importance to the final conclusions, a sensitivity analysis has been conducted. As the electricity consumption is responsible for a large part of the total emissions, the sensitivity analysis focuses on what difference it would make to change the emission factor for the electricity.

If the same calculations are made using a renewable energy mix instead of using Nordic average electricity, there is a large decrease in total emissions. The largest decrease is for the baseline, which correlates to the additional electricity consumption that is used in that scenario, however in step 4 the decrease is barely notable (less than 1%) which can be explained by the fact that the cloud is still assumed to be using a European electricity mix. In the table below, the result for both Nordic electricity mix and renewable mix is presented for all different scenarios and sizes of store.

Step	Size of business	Emissions total, Renewable mix	Emission total, Nordic mix	Difference between mixes
		$kgCO_2e$/year	$kgCO_2e$/year	%
Baseline	Large	2 537	4 472	-43%
Step 1		1 827	2 659	-31%
Step 2		1 807	2 560	-29%
Step 3		850	1 068	-20%
Step 4		7	7	<1%
Baseline	Medium	1 031	1 809	-43%
Step 1		686	998	-31%
Step 2		679	961	-29%
Step 3		319	402	-20%
Step 4		4	4	<1%
Baseline	Small	555	955	-42%
Step 1		231	335	-31%
Step 2		229	323	-29%
Step 3		109	136	-20%
Step 4		4	4	<1%

Table 7. Sensitivity analysis, alternative electricity mix.

Conclusions and discussion

As previously stated, the results presented in this report are based upon general assumptions in how a store can operate in terms of opening hours, number of cashiers, number of transactions, amount of stored information, etc, and the results should be interpreted thereafter. All the assumptions made can be seen in *Appendix 2*.

Based on the calculations in this project, the conventional baseline payment system is responsible for between 0,96-4,5 tCO_2e per year depending on the size of the retailer. Hence, there is a large variance depending on the parameters that are set in the calculations, yet a potential to reduce the emissions.

The largest reduction could be seen when going from the baseline to Step 1: 40-65 percent reduction of emissions of CO_2e, depending on retailers' size. The main driver for the lowering in emissions comes from the change of local data server to a cloud-native storage, together with the emissions from the electricity use for the PC that is set to standby during non-opening hours (instead of always being on "active" electricity use for background updates overnight). The total reduction potential when going through all the steps (from baseline to Step 4) is between 99,7-99,9 percent. In Step 4, the only emissions stem from the use of phones, when operating the Focalpay service, and cloud-native storage.

With regards to the associated climate impact, results vary strongly depending on the input electricity mix considered. It should be noted that the location-based Nordic average electricity mix used in this analysis

constitutes an input mix with relatively low carbon intensity in an international setting.

On the one hand, there are electricity grids with considerably higher emissions per kilowatt hour, resulting in substantially larger emissions savings from implementing Focalpay's services. On the other hand, individuals and/or groups of businesses may choose to purchase renewable electricity through electricity certificates. Taking on a market-based approach in the emissions calculations, the resulting emissions savings from implementing Focalpay's services would for such a business be considerably lower than in the present analysis.

When comparing solutions with a baseline regarding electricity, one method that is commonly used is to look at the consumption on a consequential level, using the emission factor for the grid that represents the production on the margin. That is, the type of production that would go up and down when the consumption varies. The emission factor for the average margin production for the Nordic grid for 2021 was 520 gCO_2e/kWh; more than 5 times the emission factor that is used in the calculations. Employing this method, CO_2e savings would be even larger with Focalpay.

The electricity mix is not the only part that could vary. As this report is based upon a certain set of emission factors and electricity use factors for each equipment part used in a cashier/cloud-server/Focalpay user, the result could differ if other types of assumption are made about these items. However, the result presented in this report gives an indication of the magnitude of the different implementation steps with regards to emissions savings.

Appendix 1 – Method

The starting point of this comparative analysis has been to develop an overall methodology and calculations that indicate differences in energy use and carbon emissions from producing and operating cashier equipment (cradle-to-gate) when transitioning from conventional payment methods to Focalpay's services in retailing business. The below section walks through the calculation method step-by-step.

Phase 1 – Setting the baseline

In the first phase, equipment requirements for the payment method (cashier) were investigated for a conventional retailer. The investigation considered input provided by Focalpay as well as external industry expertise from the retailing industry. The main output from the investigation is a shortlist of equipment with standard models needed to set up a conventional retailing checkout and payment system.

Phase 2 – Defining the steps

Through dialogue with Focalpay, the four different implementation steps were defined. For each step, a reviewed list of necessary store equipment, reflecting a gradual introduction of Focalpay's services, were developed. In this step, the business sizes used for the purpose of the analysis were also set, and three different sizes were decided to use in the calculations (large, medium and small retailer). The main output was defining the implementation steps, and establishing that these steps are the same for

each of the different retailer sizes. However, the number of cashier-desks, local servers and transactions are different for each retailer size. The assumptions made can be seen in the next section (*Appendix 2*).

Phase 3 – Data gathering

Data were collected with regards to the production (cradle-production gate) and use-phase (electricity use) of necessary equipment. If accessible, first-hand data from producers were used as input to the analysis, such as Dell or Apple. In case first-hand data were not available, databases with generic data, such as Ecoinvent, have been used. When data are not available by either means, estimates have been developed through extrapolations. Extrapolations for the production phase of the equipment were built on the weight of the equipment and the production emissions from a similar product.

Note that the emissions from the production stage were allocated to "emissions per year", so the total production emissions were divided by an assumed lifetime of the equipment. This means that the calculation assumes that every equipment is used throughout the whole assumed lifetime and cannot be scrapped beforehand. Extrapolations for the use-phase electricity consumption is based upon the relation between "active" energy consumption from similar products and the standby electricity consumption for a PC, in Watt.

For the use of a cloud server and the "Focalpay" user, the energy use was expressed in kWh per gigabyte stored in a cloud server and kWh per Focalpay user (based on iPhone use), which later was multiplied by assumed

values of gigabyte stored and number of Focalpay users per store. The output from this step was therefore emission from production (gCO_2e per year and equipment), active and standby energy use (watt per equipment, kWh per gigabyte in cloud, kWh per Focalpay user). With regards to data on emissions from the electricity consumption in the use phase (gCO_2e per kWh), first-hand data from AIB, IEA and IVL have been used for different regions. The values used in the calculations can be seen in the next section (*Appendix 2*).

Phase 4 – Model development

When all the background data were defined, a calculation model was developed in Excel integrating that background data together with the assumptions on steps and business sizes. The same calculation methodology is used for each step and business size, which means that it is only the assumed parameters for each specific implementation step and business size that is changing. To calculate the electricity use depending on the implementation steps, the electricity consumption was divided into six parts: Cashier desk, Desk-PC, iPad, Local Server, Cloud server and Focalpay user. The same categorization was made for the production emissions, except the cloud server and the Focalpay user which were assumed to have zero emissions as the cloud server probably would be built anyway and the Focalpay user probably would own a phone for other purposes. To also integrate the different retailer sizes, assumption on opening hours per day, opening days per year, number of desks, number of local data servers, number of transactions and amounts of stored gigabytes was assumed for each store/size. These assumptions can be seen in the next section (*Appendix 2*).

Appendix 2 - Assumptions

In *Table A1* the used values for the production emissions and electricity use for each equipment, respectively, are presented.

Equipment	Source (production)	Production emission (gCO_2e/equip-ment, year)	Electricity use (active/stand-by) (watt/equip-ment)	Assu-med lifetime (years)	Assumption
Local server	Dell LCA	290 520	300/300	4	Electricity assumed from discussion with focalpay.type: Poweredge r230)
Desk-PC	Ecoinvent*	37 167	190/6	6	
Total Desk	Sum of every part	177 427	202,6/10	n/a	
Customer display	Apple	25 000	10/0,3	3	Based on iPad
Cashier display	Dell	69 892	15/4,1	6	S2418H monitor
Bench scanner	Extrapolated	7 474	4,8/0,2	3	Weight 500g.
Hand scanner	Extrapolated	2 541	2,5/0,1	3	Weight 170g
Receipt printer	Extrapolated	23 918	43/1,4	3	Weight 1600g
Keyboard	Ecoinvent*	10 100	2,5/0,1	3	
Card terminal	Extrapolated	4 634	4,8/0,2	3	Weight 310g
Desk	Ecoinvent*	33 867	120/3,8	10	50% stainless steel, 50% aluminium, 95 kg
iPad	Apple	30 960	3/0,4	2	10th generation
Cloud server	n/a	n/a	0,085 kWh/gigabyte	n/a	
Focalpay	n/a	n/a	0,05 kWh per user	n/a	iPhone, 30 min per use

Table A1. Values used for each equipment for both production emission and electricity use. Calculated with the help of Ecoinvent database, and assumptions.

The definitions/assumptions made in method-Phase 1 and method-Phase 2 for the baseline and the different implantation steps are presented in *Table A2*. The percentage is based upon the baseline. For example, if there are 8 desks in the baseline it will be 4 desks (50 percent), 0 computers (0 percent), 4 iPads (50 percent) in Step 3. The percentage for local server and cloud server is representing what type of storage that is used (only 100%). The percentage for Focalpay corresponds to the share of transactions made by

Focalpay users. These values combined with the assumption for each size of retailer is used in the calculations.

Implementation steps	% - desks	% - PC	% - iPads	% - local server	% - cloud server	% - Focalpay
Baseline	100%	100%	0%	100%	0%	0%
Step 1	100%	100%	0%	0%	100%	0%
Step 2	100%	80%	20%	0%	100%	0%
Step 3	50%	0%	50%	0%	100%	50%
Step 4	0%	0%	0%	0%	100%	100%

Table A2. Calculation of implementation steps, used numbers.

Shop	Opening hours per day	Opening hours per year	Number of desks per store	Number of data servers	Transactions per day	Stored gigabyte per store
Large	10	310	8	2	3000	400
Medium	10	310	3	1	1650	200
Small	10	310	1	1	150	200

Table A3. Store sizes and assumptions.

Electricity mix	Emissions factor (gCO_2e/kWh)	Source
Nordic production mix, 2021	90,4	IVL and AIB
European mix	217,5	IEA, OECD Europe 2020
Renewable mix	9,96	Vattenfall, “Bra miljöval”

Table 2. Electricity mixes used.