SOLACTIVE
German Index Engineering

A STITCH IN TIME SAVES NINE

EU Emission Allowances as a transitory tool for net zero equity portfolios

White Paper

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EXECUTIVE SUMMARY

- We provide a step-by-step construction of portfolios combining an equity index with a position in EU Emission Allowances (EUAs) aimed at offsetting the index's financed Greenhouse gas (GHG) emissions.
- Decarbonizing Solactive's Developed Markets Paris Aligned Benchmark (PAB) by such means takes a 0.8% – 3.8% portfolio allocation to EUAs depending on which emission scopes are considered and how emissions are allocated between equity and bond holders. Corresponding allocations for European and Emerging Markets climate strategies range from 1.4% – 5% and 2.5% – 10.4%, highlighting the different emission levels in the examined regions.
- Adding EUAs to the equity portfolio results in improved risk/return profiles exemplified by higher return and lower volatility. Further analysis shows low correlations between EUA and equity market returns hinting at diversification benefits of adding carbon allowances to existing portfolios.
- EUAs represent a high-quality, regulated and thus viable alternative to commonly used carbon offsets addressing some of their key points of criticism.

INTRODUCTION

Carbon markets have recently received increased attention owed to soaring prices on the one hand [1] [2] but also due to the potential environmental benefits investors can achieve by engaging in these markets [3]. In a recently published paper [4], SparkChange showed how withholding EU Emission Allowances (EUAs) from the market creates lasting environmental impact. In this paper, we go on to demonstrate how investors can make use of EUAs to offset financed emissions of equity portfolios providing a step-by-step implementation methodology, practical examples, analysis of such implementation for different portfolios, and a discussion of practical considerations.

1 CONSTRUCTING "NET ZERO" INDICES

1.1 EXAMINED INDICES

We construct portfolios combining an investment in the underlying index with an allocation to EUAs to offset the latter's financed GHG emissions.

To provide as much insight into the "inner workings" of such a combined index, we take a two-fold approach. First, we construct and analyze various commonly used, regional broad market indices to show how the respective allocation to EUAs varies across these regions and to provide a benchmark for further analyses. It is important to highlight that while "decarbonization" of broad market benchmarks using this methodology is feasible from a purely technical perspective, the more interesting, practical, and intentional use case is to complement existing climate strategies with this EUA overlay thereby making EUAs a transitionary tool within an overall framework of reducing an organization's or a portfolio's net footprint.

Therefore, we analyze the corresponding EU Paris Aligned Benchmarks (PABs) that are based on the aforementioned broad market indices as well. By doing so, we show how a predefined emissions-reduction strategy on the index level impacts EUA allocations versus the parent universe. Furthermore, the results may serve as benchmarks regarding expected allocations and associated investment for financial market participants interested in utilizing EUAs within their sustainability strategy.

The exact indices we examine are listed below:

Developed Markets:

- Solactive GBS Developed Markets Large & Mid Cap Index (GBS DM LM)
- Solactive ISS ESG Developed Markets Paris-Aligned Benchmark Index (DM PAB)

Emerging Markets:

- Solactive GBS Emerging Markets Large & Mid Cap Index (GBS EM LM)
- Solactive ISS ESG Emerging Markets Paris-Aligned Benchmark Index (EM PAB)

Europe:

- Solactive GBS Developed Markets Europe Large & Mid Cap Index (GBS EU LM)
- Solactive ISS ESG Developed Markets Paris-Aligned Benchmark Index (EU PAB)

1.2 FINANCED EMISSIONS

We provide different variations of financed emissions for each index to highlight the effect on the resulting portfolio allocation. In particular, we calculate financed emissions from the perspective of an investor attributing a company's emissions to (1) equity holders exclusively and, alternatively, to (2) equity and bond holders:

$$FE = \sum_{i=1}^{N} w_i \times \frac{CO2e_i}{MCAP_i} \qquad (1)$$

$$FE = \sum_{i=1}^{N} w_i \times \frac{CO2e_i}{EVIC_i} \qquad (2)$$

where FE are financed emissions of the portfolio at hand, w_i is the portfolio weight of stock i, $CO2e_i$ are CO2 equivalent GHG emissions of company i, $MCAP_i$ is the company market capitalization of company i, $EVIC_i$ is the enterprise value including cash of company i, and N is the number of portfolio constituents. Understanding that w_i corresponds to the invested amount in a company divided by the overall portfolio value, FE in the context of this paper corresponds to GHG emissions per $ million invested (assuming that all market values are expressed in $ million).

Although market standards seem to suggest a convergence towards emissions attribution based on EVIC (see e.g. [5]), individual investors invested in equity only and/or those willing to assume more than just equity's share of a company's emissions, might want to continue attributing all emissions to a company's (equity) market capitalization. Our results thus provide indications of expected exposure for each group.

Additional to these variations, we calculate financed emissions for each index using aggregate scope 1 and 2 emissions of each company as well as taking scope 3 emissions into account on top of that. Emission scopes to be considered may be driven by an investor's overall climate strategy, data concerns around scope 3 emissions, or other factors and we thus aim to provide insights for various approaches.

1.3 EUA OVERLAY

The number of EUAs necessary to offset given financed emissions is derived from the formulaic impact mechanism of the Market Stability Reserve (MSR). Withholding 1 EUA for a period of 1 year means that 24% of total allowances in circulation are removed from future auctions and moved to the MSR[1]. Since 1 EUA represents 1 ton of CO2, the impact of (with)holding the EUA for one year can be quantified to 0.24 tons of CO2, resulting in the following formula for the necessary amount of EUAs (EUA):

$$EUA = \frac{FE}{0.24} \tag{3}$$

Conversely, the reduction in emissions achieved by this one year holding ($EmissionReduction_1$) is:

$$EmissionReduction_1 = EUA \times 0.24 \tag{4}$$

In subsequent years, the position continues to produce environmental impact, but at a decreasing rate. Due to the removal of 24% of the original holding, only 0.76 EUAs remain in the second year, producing an impact of:

$$EmissionReduction_2 = EUA \times 0.24 \times 0.76 \tag{5}$$

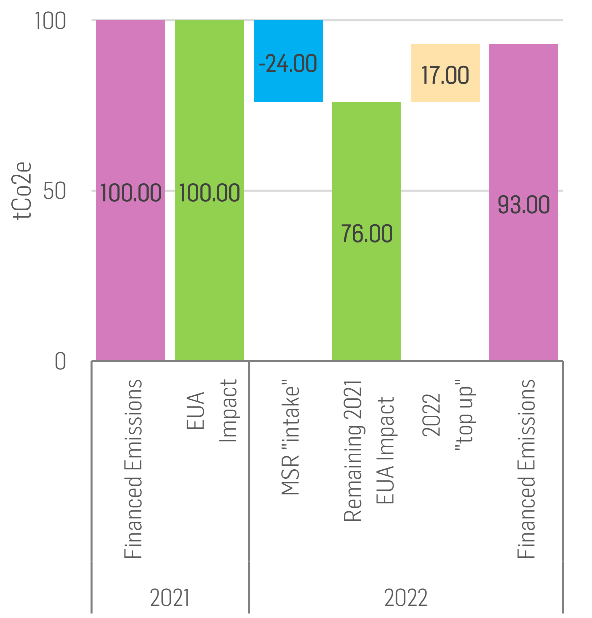
Thus, the impact of withholding 1 EUA for a given number of years T is described by the following formula:

$$Emission\ Reduction_{t \to T} = EUA_t \times 0.24 \times 0.76^{T-1} \tag{6}$$

The decreasing amount of impact generates the necessity to "top-up" the position in EUAs each year even if the portfolio's financed emissions were to stay constant or decrease slightly.

Figure 1 demonstrates the diminishing environmental impact of an EUA position that offsets 100 tons of CO2 in 2021 (the required holding in this case corresponds to 100tCO2e/0.24 = 416.67 EUAs). After fully offsetting the financed emissions in the first year, 24% of the EUA holding are transferred to the MSR and only 76% remain. As these continue to be withheld from circulation, their environmental impact in 2022 amounts to 76 tons of CO2. Even though the portfolio's financed emissions drop to 93 tons for that year, the remaining environmental impact is not enough to offset them. Hence, a top-up investment translating to 17 tons is required to fully offset the 2022 portfolio emissions.[2]

Figure 1: Evolution of exemplary EUA position



Source: SparkChange, Solactive AG

Note that a divestment of EUAs may also take place if portfolio emissions drop sharply (in Figure 1 above, imagine Financed Emissions in 2022 dropping below 76 tons). For a more detailed explanation of the impact mechanism, we reference interested readers to the paper from SparkChange [4].

In our analysis, we follow the steps of determining financed emissions and the

[1] A detailed explanation of the MSR mechanism and required conditions are explained in the paper "*Quantifying the Environmental Impact of investing in Carbon Allowances*"[4].

[2] Following from equation (3) the number of EUAs required for the top-up investment = 17tCO2/0.24 = 70.83.

corresponding EUA positions for the period January 2018 – August 2021 on a semi-annual basis. Importantly, as the generation of environmental impact requires a holding period of at least one year, we do not allow for divestment of any position held for less than one year. EUA holdings are reported as percentage allocations to allow an assessment of the resulting investment for portfolios of various sizes, e.g., an EUA allocation of 3% means that out of a $100 investment amount, $3 are invested in EUAs while the remaining $97 are invested in the underlying equity portfolio. Naturally, the price of EUAs then represents the second determinant of the EUA allocation besides financed emissions.

Lastly, it is important to recognize that the decreasing environmental impact does not decrease the actual amount of EUAs held by the investor. Thus, the described rebalancing mechanism leads to a build-up in the number of EUAs held over time as top-up investments accumulate – unless financed emissions are dropping sharply (triggering a divestment). The resulting EUA position at each point in time is thus path-dependent and a practical implementation of the concept should start with a newly determined allocation to EUAs at the time of the actual start date of such a strategy.

2 RESULTS

2.1 FINANCED EMISSIONS & EUA ALLOCATIONS

Figure 2 depicts the evolution of financed emissions and the resulting EUA positions required to offset them over time for all broad market indices and PABs. Financed emissions, which are calculated on the basis of Scope 1, 2, and 3 emissions and scaled by EVIC in the depicted examples, are decreasing over time across all regions. Furthermore, emission of the respective PABs[3] follow the trajectory embedded in their construction with a minimum reduction of 50% versus their parent index and an annual decarbonization of 7%.[4]

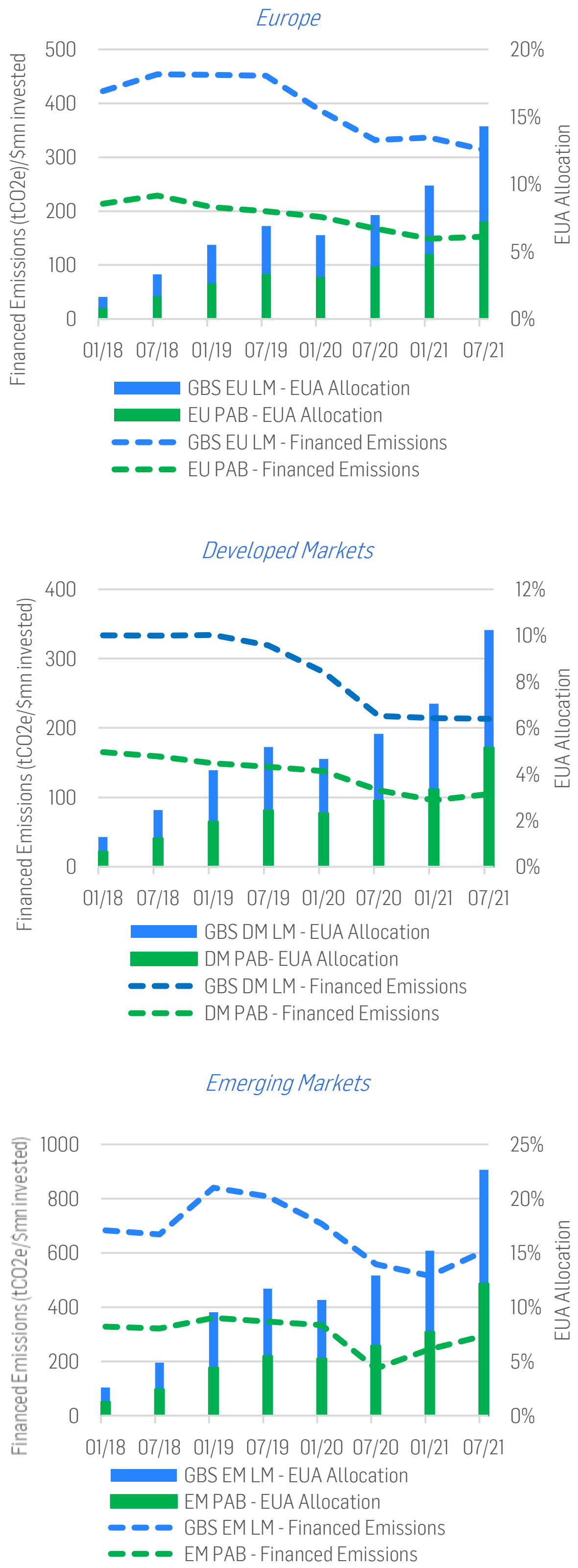
As could be expected, financed emissions for the Emerging Markets indices are higher by a factor of 2-3 compared to the other regions. The fact that the much broader Developed Markets indices exhibit lower financed emissions than their European counterparts, is explained by the greater representation of technology and healthcare companies in the former – two sectors whose high market valuations and low emissions result in lower emission intensities. Additionally, the sector weights of basic materials and industrials are higher for the European indices.

EUA allocations show the build-up over time mentioned in Section 1.3 that is driven by annual top-up investments as well as the steep increase in EUA prices over the examined period affecting both the value of existing and new top-up positions. As the same EUA price applies to all regional indices, the relative size and evolution of EUA allocations over time for the different regions reflect the respective financed emissions and their trajectories.

[3] The depicted trajectory is not exactly equal to the official trajectory of the respective PAB index as the inflation adjustment (Article 7(3) of Commission Delegated Regulation (EU) 2020/1818) is not considered in this analysis.

[4] Positive slopes of PAB trajectories are not inconsistent with the 7% annual self-decarbonization: The target trajectory is calculated in geometric progression from the base year. If the realized trajectory lies below the target in one year, an increase for the subsequent year may still yield an emissions intensity below the target trajectory.

Figure 2: Financed emissions and associated EUA allocations



Sources: EEX, ISS ESG, SparkChange, Solactive AG

Looking at the figures, an offsetting position for the broad Emerging Markets index requires a 2.6% allocation in January 2018, that is growing to 22.7% in July 2021. Even for the much more practical use case where remaining emissions of an Emerging Markets PAB investment strategy would be offset by EUAs, the starting allocation of 1.3% evolves to a 12.2% holding over time. The respective positions for Europe (from 0.8% to 7.3% over the observed period) and Developed Markets (from 0.6% to 5.2%) reflect the much lower level of financed emissions.

Table 1 examines the impact of varying the calculation of financed emissions. The reflected EUA allocations assume a start date of the EUA overlay in July 2021 (i.e. no historical build-up before that date) and thus also provide benchmark values for investors considering such a strategy. The differences between considering all emission scopes and taking into account only Scope 1 and 2 emissions are the most obvious, yet expectable given the magnitude of Scope 3 emissions in the cross section of public companies. A little less significant yet still financially meaningful when considering them in the context of larger portfolio sizes, are the differences between assuming responsibility for all a company's emissions as an equity investor (scaling by a company's market capitalization) in comparison to consideration of the share allocated to equity only (scaling by EVIC). The final approach is very likely to be chosen in conjunction with an investor's overall ESG investment approach and strategy.

For investors considering an offset strategy for existing climate strategies using EUAs as a transition tool in the toolbox of achieving net zero emissions at a certain point, the allocations for

Europe (1.35% - 5.05%), Developed Markets (0.84% - 3.78%), and Emerging Markets PABs (2.53% - 10.36%) can serve as a first indication of the expected allocation and associated investments and demonstrate that offset goals can – in some cases and when paired with a meaningful existing approach to emission reductions – be achieved by moderate allocations to EUAs.

Table 1: EUA positions for overlay start in July 2021 under different emissions accounting regimes*

	Scope 1+2+3 / EVIC	Scope 1+2+3 / MCAP	Scope 1+2 / EVIC	Scope 1+2/ MCAP
GBS EU LM	7.49%	10.97%	2.03%	2.91%
EU PAB	3.79%	5.05%	1.35%	1.82%
GBS DM LM	5.22%	7.37%	1.24%	1.87%
DM PAB	2.63%	3.78%	0.84%	1.20%
GBS EM LM	13.53%	19.35%	3.38%	5.54%
EM PAB	7.06%	10.36%	2.53%	3.68%

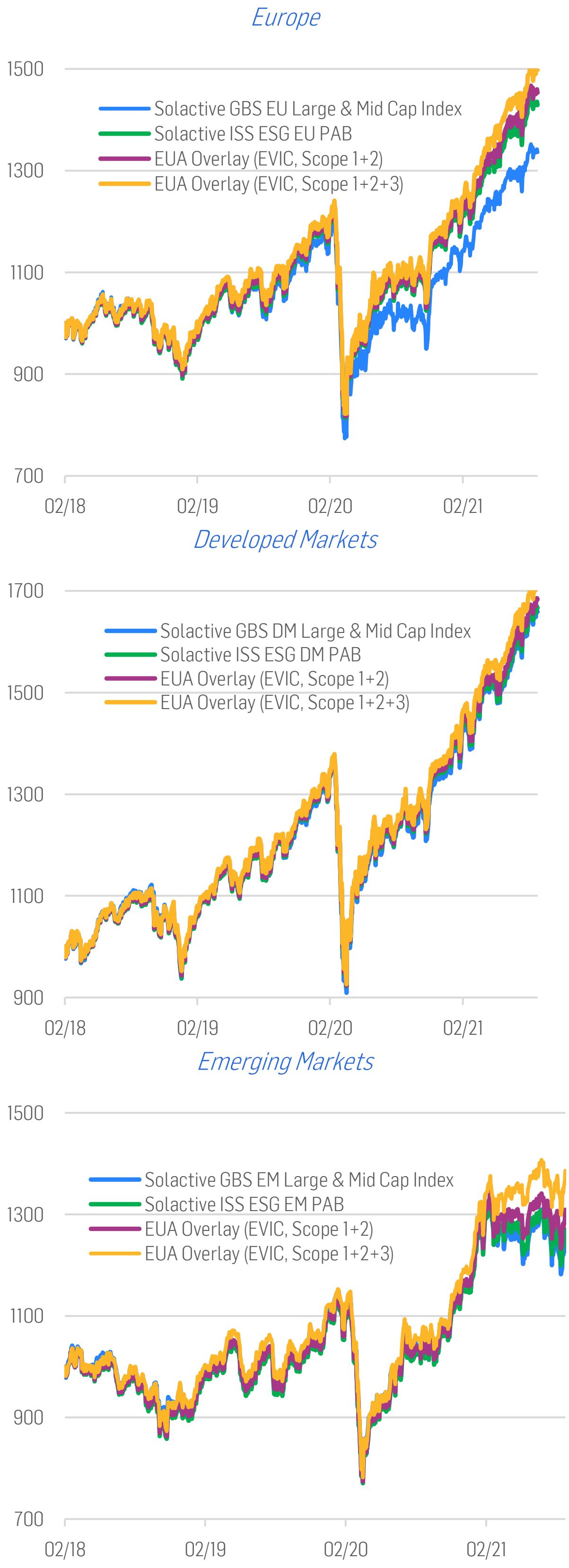
Sources: EEX, ISS ESG, SparkChange, Solactive AG

** Positions as determined on the index selection day on 7 July 2021)*

2.2 RISK/RETURN PROFILE

The combination of an existing equity portfolio with an EUA overlay, effectively results in a two-asset portfolio. Given the steep increase in EUA prices over the period covered in our analysis, the return effect (of adding it to existing portfolios) is known to be positive even before examining return statistics. Given the EU's environmental ambitions that translate into the recently announced *Green Deal* and its *Fit for 55* package with increased decarbonization goals and adjustments to the EU Emissions Trading System (EU ETS), the positive return contribution of EUAs is expected to continue based on various reports stating potential EUA prices in excess of EUR 100 in 2030 [6] [7].

Figure 3 – Performance of PAB+EUA overlay strategies vs. parent universe and PAB



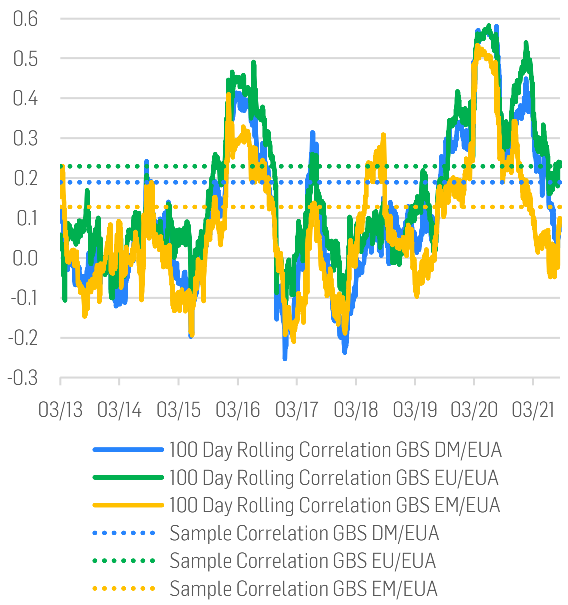
Sources: EEX, ISS ESG, SparkChange, Solactive AG; Indexed to 1000 on 7 February 2018, net total return indices in EUR.

Figure 3 and Table 2 display the historic risk/return profiles focusing on overlay strategies using PAB indices as the equity underlying. In line with existing recommendations from PCAF, the emissions are attributed based on EVIC but considering the impact of using different emission scopes and comparing the results to the respective PAB index.

As expected, the overlay strategies outperformed their respective benchmark. The strategy with the highest return for all regions was the one considering all emissions scopes (i.e., the one with higher EUA allocations). Given the EUA's price performance, it is not surprising that higher EUA allocations resulted in higher outperformance. Naturally, tracking error was also increasing with higher EUA allocation.

The overlay strategies exhibited lower volatility. This effect was also increasing in the EUA allocation and taken together with the positive return impact, eventually resulted in improved Sharpe ratios of the overlay strategies vis-à-vis their respective benchmarks.

Figure 4 – 100-day rolling correlation between EUA prices and equity returns



Sources: EEX, Solactive AG

The decrease in historic volatility hints at potential diversification effects of adding EUAs to existing equity portfolios. To examine this more closely, Figure 4 depicts correlations between EUA and broad market index returns, both over the entire period 2013-2021 (dotted lines) as well as on a 100-day rolling basis (solid lines).

Table 2 – Risk/return profile of EUA overlay strategies

	EUA Overlay (EVIC, Scope 1+2)			EUA Overlay (EVIC, Scope 1+2+3)			PAB		
Region	**DM**	**EU**	**EM**	**DM**	**EU**	**EM**	**DM**	**EU**	**EM**
Drawdown	(32.71%)	(33.62%)	(31.94%)	(32.82%)	(33.76%)	(32.18%)	(32.65%)	(33.55%)	(31.72%)
Total Return	68.28%	45.33%	30.90%	71.88%	49.81%	38.60%	66.63%	42.89%	25.46%
Return p.a.	15.72%	11.06%	7.85%	16.41%	12.01%	9.59%	15.40%	10.53%	6.57%
Volatility p.a.	16.79%	16.91%	16.20%	16.75%	16.91%	16.14%	16.81%	16.94%	16.66%
Sharpe Ratio	0.94	0.65	0.48	0.98	0.71	0.59	0.92	0.62	0.39
Tracking Error vs. PAB	0.34%	0.52%	0.87%	1.06%	1.48%	2.51%	-	-	-

Sources: EEX, ISS ESG, SparkChange, Solactive AG

Looking at the entire period from 2013-2021, the correlation between EUA prices and broad market indices ranges between 0.12 and 0.22 – positive but low figures explaining the diversification benefit observed in the overlay strategies' decreased volatility. However, as the rolling correlations show, these benefits were time-varying as correlations strongly increased during the COVID19-related market downturn in the beginning of 2020.

3 CONCLUSION & PRACTICAL CONSIDERATIONS

The presented strategy represents an alternative to using voluntary carbon offsets. While the latter represent a market that is still in development – with associated criticism regarding offsets' additionality, permanence, and verifiability – EUAs are a viable alternative given the market's established and regulated setup. Furthermore, EUAs in the context of our analysis represent an asset in contrast to offsets, whose value vanishes as soon as they are utilized. It should be noted that even though the presented overlay strategy allows divestment and is set up to generate impact even in the presence of selling, longer holding periods translate to higher environmental impact. Furthermore, it should be considered whether certain holding periods (above and beyond one year as highlighted in this analysis) should be mandated as part of a passive, rules-based strategy.

To achieve the desired impact, it is important to invest in physical EUAs to ensure that one's holdings are withheld from the market triggering the described MSR mechanism. This means that futures-based strategies, where most market participants never take delivery of the physical EUA, are not an appropriate substitute.[5]

Our strategy design relies on the MSR mechanism currently in place in the EU ETS. It generally results in higher initial investments that are driven by high EUA prices in comparison to most offsets. Furthermore, the conservative methodology requires 1/0.24 EUAs for every ton of CO2 to be offset. This higher investment can be seen as the price of choosing a regulated (vs. an unregulated offset) market and holding an asset (vs. incurring a cost) to offset one's financed emissions.

Finally, as pointed out before in this document, our view is that the overlay strategy described here should be applied in conjunction with a coherent climate strategy such that the EUAs serve as a transitory tool to achieve and support existing decarbonization goals. A credible transition towards net zero goals can only be supported by consistent efforts on various organizational levels encompassing an institution's own operations, engagement with companies as well as portfolio design and strategy. As such we think of EUAs as broadening the toolbox available to investors that want to go the extra mile in supporting that transition.

Moreover, the MSR mechanism that allows buy-and-hold investors to achieve impact, will not continue to operate in the current manner indefinitely – and might in fact at some point release EUAs back into the market instead of withholding them – as the carbon budget gets tighter due to ambitious climate goals and the market moves to the desired state. This further supports the notion of the described strategy as a transitory tool available for a limited period of time adding further emphasis to a statement that seems all too familiar by now but cannot receive enough stress: The time for action is now!

[5] Besides the missing environmental impact, additional roll costs can be expected from such a strategy as European carbon futures markets have been in contango since 2009 [8].

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