ROBECO
The Investment Engineers

Indices Insights Summaries

Introducing climate beta: a complementary climate risk metric

Sustainable Investing Expertise by ROBECOSAM

- Carbon emissions data is inadequate for distinguishing between climate leaders and laggards
- Climate beta measures how sensitive a stock is to climate risk and this metric is able to discern between climate leaders and laggards
- Integrating climate beta in investment strategies can neutralize climate risk without reducing returns

In this Indices Insights Summaries edition, we provide a brief recap of our latest articles related to climate risk measures.[1] Links to the original web articles are also included for readers who are interested in the detailed descriptions of the data and methodology used. We first examined whether the information gleaned from carbon emissions data suffices for identifying climate leaders and laggards, but found that it is inadequate for this purpose. We then addressed this by showing how our climate beta measure, which indicates how sensitive individual stocks are to the climate risk factor, actually captures different information on climate risk compared to carbon footprint data. We, therefore, determined that climate beta is better suited to distinguish between climate leaders and laggards. We then concluded by showing that integrating climate beta can also effectively neutralize climate risk in investment portfolios.

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Sustainable Index Solutions Team

[1] A special thanks goes out to Lucian Peppelenbos, Climate and Biodiversity Strategist at Robeco, and Thijs Markwat, Climate Data Scientist at Robeco, who are co-authors of several articles.

Identifying climate leaders and laggards

As climate change becomes a key issue for most investors, the focus on carbon footprint reduction in investment portfolios has increased and net-zero commitments have moved into the mainstream. In response, industry players have developed several low-carbon investment vehicles and Paris-aligned benchmarks. What these have in common is the exclusion of companies with currently high carbon emissions or intensities.

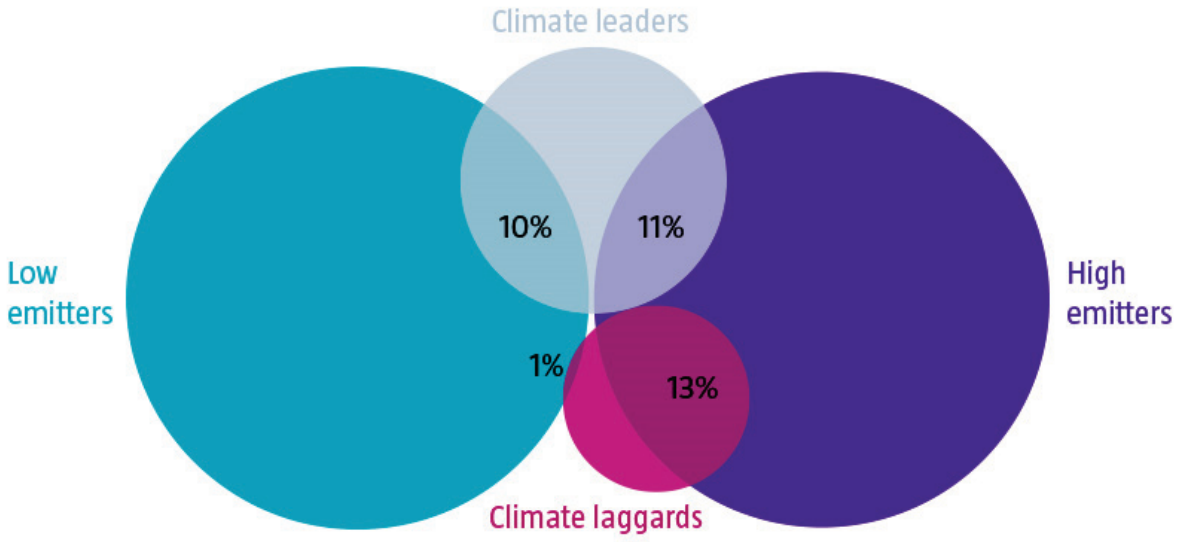
"Carbon footprint data is too crude to discern between climate leaders and laggards"

Undeniably, generic carbon emissions data is useful for mapping out portfolio-level or entity-level decarbonization pathways. However, this begs the question of whether the simple approach of excluding or divesting from high carbon emitters is the most effective mechanism to transition to a low-carbon economy.[2] In other words, it is worth examining whether the information gleaned from carbon emissions data suffices for identifying climate leaders and laggards.

To evaluate this notion, we analyzed the relationship between climate leaders/laggards and their respective carbon footprints. Specifically, we looked at the intersection of companies that have low carbon footprints and either low or high climate-related SDG scores, and the intersection of firms that have high carbon footprints and either low or high climate-related SDG scores.[3] If carbon emissions data is a sufficient measure to differentiate between climate leaders and laggards, we would expect low carbon footprint companies to overlap greatly with high climate-related SDG scores, and high carbon footprint companies to overlap greatly with low climate-related SDG scores.

As shown in Figure 1, we found that carbon emissions data is too crude to effectively differentiate between climate leaders and laggards on an issuer level. While 13% of high emitters are considered climate laggards, there is also a considerable share of 11% of high emitters which are viewed as climate leaders. Put differently, a low-carbon approach that relies solely on carbon footprint data for exclusions or divestments is also likely to ignore high carbon-emitting firms which, in fact, contribute positively to the climate-related SDGs and are deemed essential for the transition to a low-carbon economy.

Figure 1 | A significant number of climate leaders/laggards are not identified with carbon footprint data



Source: Robeco, TruCost. The analysis is conducted using data as of end of December 2021.

[2] Recent research shows that green innovation is primarily driven by the energy and materials sectors, two of the most carbon intensive industries. Carbon emissions data alone is unlikely to be an effective guide to identifying firms involved with green innovation, or to distinguish between climate leaders and laggards, as it only considers past or current emissions.

[3] Robeco's proprietary SDG framework can be used to evaluate the contributions companies make to the UN SDGs, taking into account what they produce and how they operate.For more information about Robeco's SDG framework, see here.

Focusing on the group of low emitters based on carbon emissions, a portion of 1% are seen as climate laggards as these companies contribute negatively to the climate-related SDGs. But more strikingly, only 10% of low emitters are classified as climate leaders, less than the share of climate leaders within the high emitters cluster. This suggests that carbon emissions data is ineffective in identifying firms involved with green innovation. Therefore, complementary stock-level climate data is required to achieve this goal.

For the full web article, please see: "To what extent can carbon emissions data identify climate leaders and laggards?".

Establishing a novel climate risk factor

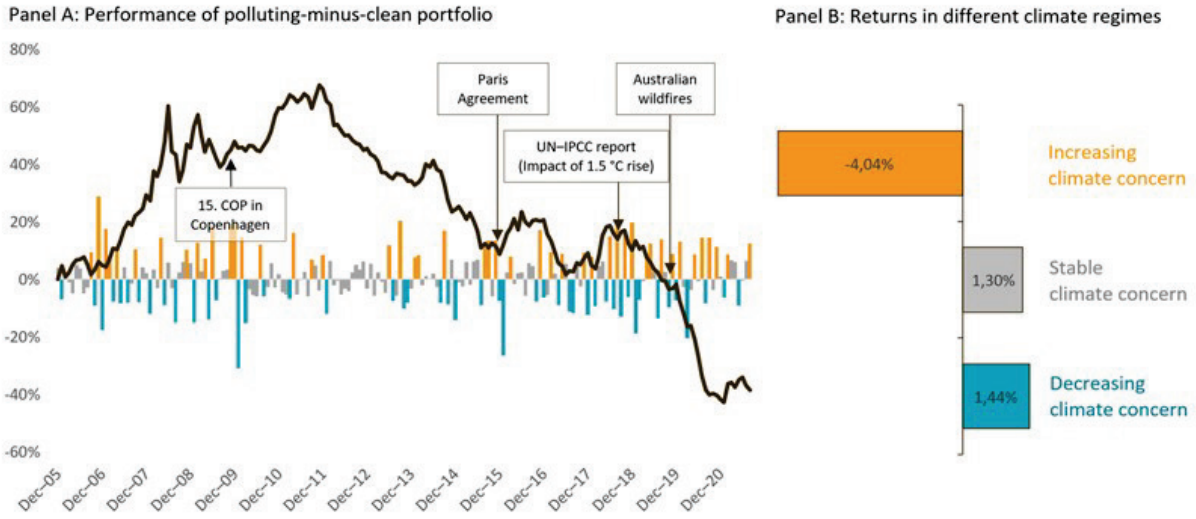
As discussed above, additional stock level climate data that captures other dimensions than the carbon footprint metric is required. We addressed this by introducing a novel long-short climate risk factor. This is based on a portfolio that takes long positions in a basket of stocks that contribute negatively to one or multiple climate-related SDGs ('polluting'), and short positions in a basket of stocks that contribute positively to climate-related SDGs ('clean'). As such, the climate risk factor tracks the difference in returns between the polluting and clean companies.

To assess the insights that can be drawn from the climate risk factor, we first scrutinized its performance over time in relation to sentiments regarding climate change. Specifically, we tested whether companies that contribute negatively to climate-related SDGs are more negatively impacted by an (unexpected) rise in concerns around climate change compared to those that contribute positively to climate-related SDGs. As a proxy for the level of climate concerns, we referred to the climate policy uncertainty (CPU) index. This index is based on the volumes of text-based newsflow linked to climate change as these reflect uncertainty around future climate policy.[4]

In Figure 2, Panel A illustrates the monthly changes in the CPU index alongside the cumulative returns of the climate risk factor. The orange bars denote the months in which there was a relatively significant upward shift in the CPU index, which corresponds to months characterized by rising climate concerns. Similarly, the blue and grey bars reflect the months during which climate concerns decreased significantly and were stable, respectively.

Panel B depicts the average performance of the climate risk factor across different regimes based on sentiment regarding climate change. In periods of rising, stable and subsiding climate concerns, it delivered an annualized return of -4.1%, 1.3% and 1.4%, respectively. This outcome is in line with our expectations and allowed us to conclude that climate laggards tend to be more negatively affected

Figure 2 | Climate risk factor tends to underperform in months with heightened climate policy uncertainty



Source: Robeco. The sample period is from January 2006 until August 2021.

[4] In the original article, we also conduct a robustness test based on an anomalous temperature index, which identifies months with anomalously high or low temperatures.

during periods of increased climate policy uncertainty compared to climate leaders.

For the full web article, please see: "Do investors act on shifts in climate concerns?".

Introducing climate beta

We expanded on our findings by introducing our climate beta measure, which indicates how sensitive individual stocks are to the climate risk factor. More specifically, firms with a high climate beta tend to do well when the climate risk factor has a positive return, while the opposite is typically true for companies with a low climate beta. As a result, we expect stocks with high climate betas to be negatively affected by stricter climate policies, the transition to a low-carbon economy and innovations in green technologies. On the other hand, we expect stocks with low climate betas to benefit from a shift towards net-zero emissions. In general, we contend that climate beta picks up on a different dimension of climate risk compared to carbon emissions or carbon footprint data.

For instance, climate beta has a forward-looking element as it incorporates market expectations, whereas carbon emissions are based on lagged or current datapoints at best. Since climate beta is estimated using returns, it can pick up on important factors such as (changes to) a firm's business model, its access to green technology and innovation, competition and its financial health.

While carbon emissions data can be used to filter out heavily polluting companies, it is not useful for identifying stocks that could benefit from the transition to a low-carbon economy or those that have announced plans to reduce their emissions. Climate beta, on the other hand, can distinguish between firms that are vulnerable to the transition and those that stand to benefit from it.

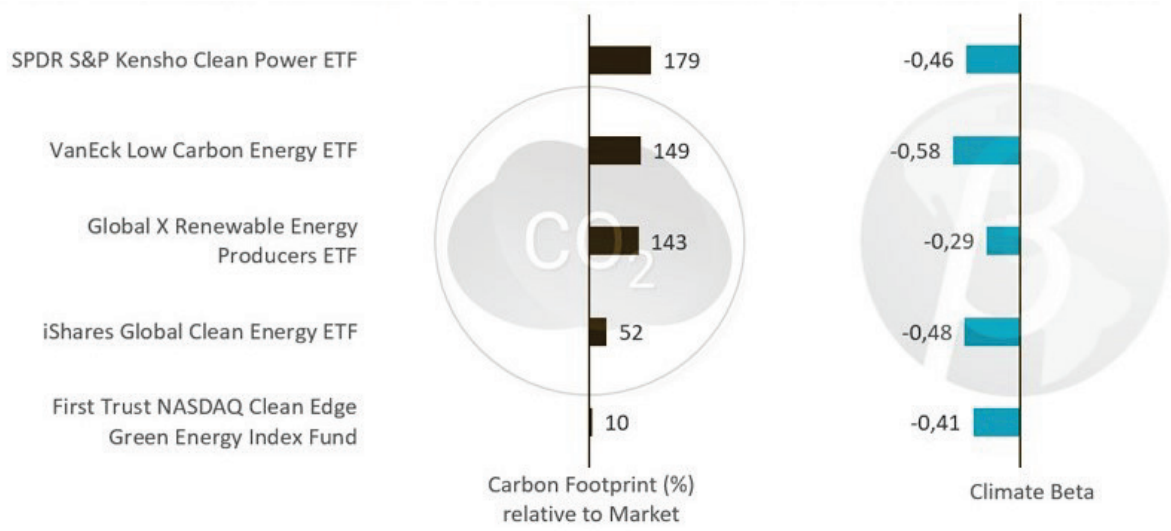
Climate beta: hypothetical example

Using a hypothetical example, we can illustrate this by comparing a company that produces solar panels with one that manufactures vehicles with internal combustion engines. The production processes for both firms are responsible for relatively high levels of carbon emissions, and for the purposes of our argument, we assume that the carbon footprints are the same for both operations.

If a carbon tax is implemented, it will likely lead to increased fossil fuel prices and decreased demand for internal combustion engine vehicles, resulting in a negative return for the car manufacturer. On the flipside, the carbon tax will likely instigate higher energy prices, which in turn will probably drive a rise in solar power demand, thus benefiting the solar panel producer and its share price.

Similarly, we would anticipate a negative return from the climate risk factor if a carbon tax is implemented as it typically underperforms in environments with heightened climate concerns. Based on these dynamics, we would expect the car manufacturer to have a relatively high climate beta and the solar panel producer to have a relatively low climate beta.

Figure 3 | Renewable energy ETFs have high carbon footprints, but negative climate betas (climate leaders)



Source: Robeco, TruCost, FactSet, Morningstar. The analysis is conducted using data as of 31 July 2022.

To assess whether climate beta captures a different dimension of climate risk versus carbon footprint data and whether it picks up on transition risk, we analyzed the holdings of renewable energy and oil ETFs. Specifically, we calculated the estimated climate betas and weighted-average carbon footprints of 'clean' energy versus 'pollutive' oil portfolios.

"Climate beta has a forward-looking element"

Figure 3 depicts the carbon footprints (brown bars) relative to the broad market index and the climate betas (blue bars) of some of the largest renewable energy-focused ETFs.[5] Interestingly, we see that all the renewable energy-themed portfolios have higher carbon footprints than the market, despite their focus on clean energy.

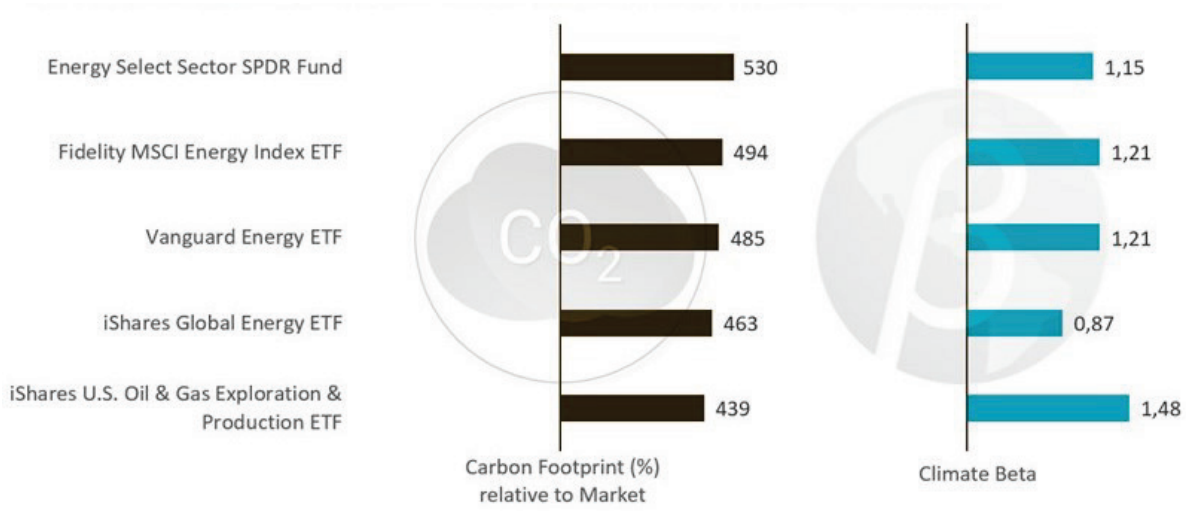
By contrast, their climate betas are negative; implying that they would tend to deliver positive returns when the climate risk factor generates negative performance, and vice versa. In other words, these ETFs exhibit relatively low climate transition risk. Hence, a high carbon footprint does not necessarily equal high transition risk.

Similarly, we observed that all the oil ETFs have significantly higher carbon footprints than the market as shown in Figure 4. However, their climate betas are positive without any exceptions. Therefore, we would expect their returns to move in the same direction as those of the climate risk factor, meaning that they exhibit high transition risk.

This outcome demonstrates that climate beta captures different information on climate risk compared to carbon footprint data, i.e. transition risk. Thus, it is better suited to distinguish between climate leaders and laggards. Put differently, a generic low-carbon investment approach would shy away from investing in renewable energy firms with high carbon footprints, even though these companies are deemed important for the transition to a low-carbon economy.

For the full web article, please see: "Does climate beta pick up on climate risk?".

Figure 4 | Oil ETFs have high carbon footprints and positive climate betas (climate laggards)



Source: Robeco, TruCost, FactSet, Morningstar. The analysis is conducted using data as of 31 July 2022.

Neutralizing climate risk in investment portfolios

Climate beta can be used to reduce stock-specific and portfolio transition risks. We examined value investment strategies and the effects of imposing climate beta constraints on them. A value approach historically has focused on assets in traditional and typically more pollutive, carbon-intensive industries such as utilities, industrials and energy. This gives this strategy a higher transition risk, as

[5] Thus, a carbon footprint of 100% means the ETF has a carbon footprint that is twice as high as that of the broad market index. Please note that the climate beta of the market index is equal to zero.

evidenced by the MSCI World Value Index, for example, having a significantly higher climate beta of 0.2, as opposed to the MSCI World Index beta of 0 as at 31 July 2022.

To assess the effect of integrating climate beta, we looked at three value approaches, leaving the first unencumbered and applying a climate beta restriction to the other two. Long-term average performance conditional on the direction of the climate risk factor allows us to better understand the strategies' sensitivity to climate risk.

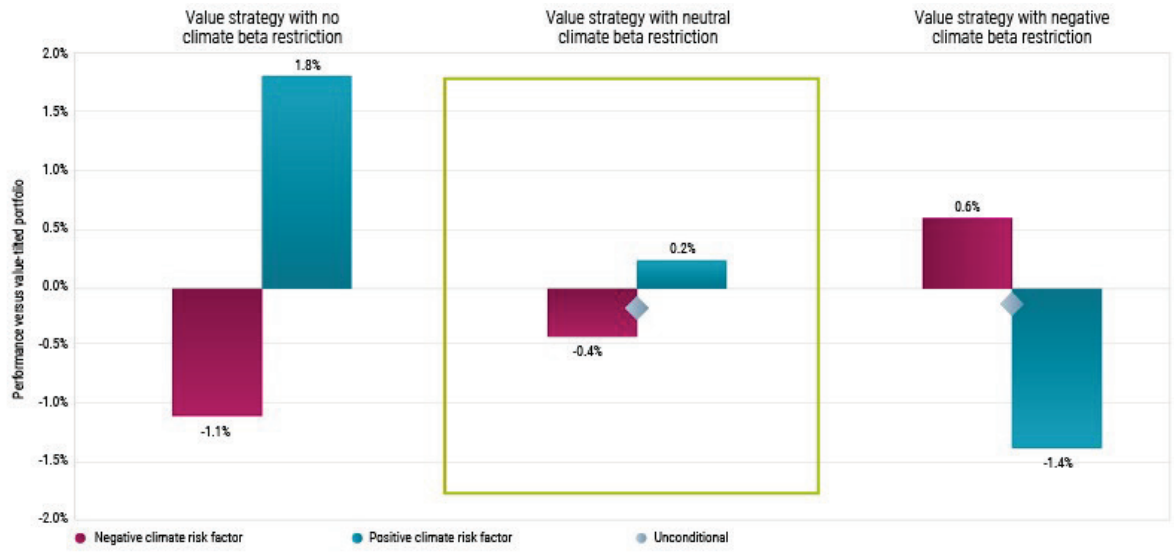
We expected the strategies with an integrated climate beta restriction to outperform the generic approach when the climate risk factor shows negative returns (i.e. 'polluting' stocks in the long term underperform the 'clean' stocks in the short term), and vice versa. Long-term unconditional performance was also examined in order to assess to what extent returns are affected when these constraints are imposed.

For instance, during months when the factor is negative, the annualized performance of the value portfolio is 1.1% lower compared to its own long-term outperformance versus the market index. In positive months, the portfolio has a 1.8% better performance (annualized) compared to its long-term average.

When we then applied a neutral climate beta restriction, meaning the climate beta needed to be zero or lower, we found that the conditional performance is very similar for periods with a negative and positive climate risk factor (0.6% difference). Imposing a climate beta restriction thus effectively reduces transition risk because the sensitivity towards the climate risk factor has been neutralized.

By constraining our value portfolio even further and only allowing it to have a significantly negative climate beta, we see that the conditional performance during periods with a negative climate risk factor is significantly higher than during positive climate risk factor months (2.0% annualized difference).

Figure 5 | Value investors can neutralize their portfolio's climate transition risk without reducing returns



Source: Robeco. The sample period is from January 2011 to July 2022.

In Figure 5, we plot annualized returns of the portfolios with climate beta restrictions relative to our unconstrained value-tilted portfolio, conditional upon the return of the climate risk factor. We split the sample in months during which the climate risk factor return is negative (magenta) and positive (blue). As expected, we indeed find that a generic value strategy is vulnerable to transition risks, and its performance is strongly dependent on the direction of the climate risk factor.

Importantly, if we look at the unconditional performance for the two climate beta-restricted portfolios (gray diamonds), we find that imposing such a restriction does not come at the cost of reduced returns in the long run.

Climate beta can benefit passive strategies too

We continued our analysis by examining the returns of a market-cap weighted strategy with various levels of climate beta restrictions imposed, and compared these to the market-cap weighted portfolio unrestricted by climate beta.

Our results suggest that climate beta integration is an effective approach to reducing the transition risk of a market portfolio, without investors having to compromise on their long-term return objectives. This is an important discovery as it means that passive investors wishing to earn the equity premium but who are concerned with climate transition risk or wish to exploit the climate risk factor can efficiently incorporate this into a market-cap weighted approach by the integration of climate beta.

For the full web article, please see: "Can Value's climate risk be neutralized without reducing returns?".

Conclusion

While carbon footprint is a useful metric for mapping out portfolio-level or entity-level decarbonization pathways, we find that it is less effective in differentiating between climate leaders and laggards. Indeed, a significant number of climate leaders and climate laggards are not identified using this measure. For this purpose, we suggest complementing carbon footprint measures with additional stock-level climate data that captures dimensions in addition to emissions.

We assessed the performance of a novel climate risk factor across different regimes based on climate concerns. In line with our expectations, we found that it tends to underperform in periods of heightened climate policy uncertainty, and vice versa. Moreover, we performed a robustness test and saw that it also lags in periods of anomalously high average temperatures, and vice versa. As a result, we believe the climate risk factor can be used practically by investors to help distinguish climate leaders from laggards.

Based on our analysis, we concluded that the climate beta measure, derived by estimating stock sensitivity to the climate risk factor, provides additional insights on climate risk compared to carbon footprint data. For instance, we demonstrate that the carbon footprints of renewable energy and oil ETFs are both relatively high. However, their climate betas clearly differentiate between the portfolios that are vulnerable to transition risk and those that are likely to benefit from a shift towards net-zero emissions.

Finally, we concluded that integrating climate beta into popular investment strategies proves to be an effective approach to lowering a portfolio's exposure to climate risk. On one hand, a value investor typically exposed to transition risk can earn the value premium while neutralizing its vulnerability to climate risk. On the other, a passive investor can reduce their sensitivity to transition risk by integrating climate beta in their investment strategy without having to compromise on long-term return expectations.

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