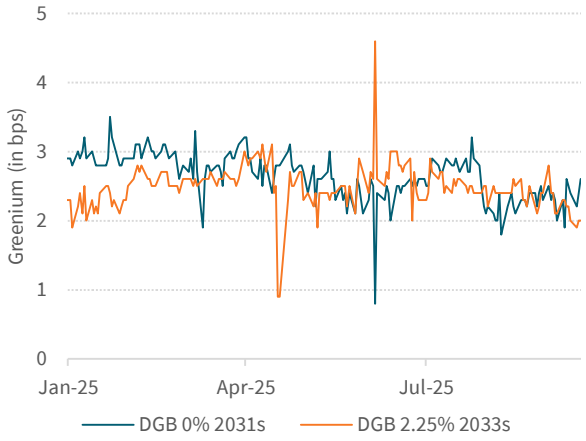
Twin bonds: recap ahead of Denmark's EuGB issuance

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The Kingdom of Denmark (ticker DGB), rated AAA/Aaa with stable outlook by the major rating agencies,[1] is coming to the market with its third green bond.[2] In line with previous issuances, the DKK-denominated green bond will be issued as a twin bond, with the same financial terms as the DGB 2.25% 2035s.

This would be the first government bond issued under the European Green Bond (EuGB) Standard.[3] Established as a voluntary "gold standard" for green bonds, it requires the use of proceeds to be aligned with the EU Taxonomy.[4] External reviews and specific reporting should ensure high transparency.

Figure 1. Greenium of Denmark's green bonds (year-to-date). Source: AFII, Bloomberg Finance L.P., accessed 17 Sep 2025.



Twin bonds offer a unique opportunity to observe and analyse "greenium", which we calculate as the difference between the yield of the conventional bond and the green bond. While the observed greenium between twin bonds does offer a precise apples-to-apples comparison, investor bases in different currencies may have different dynamics.

In this note we examine the government twin bond pairs that exist in the market, to see if this structure can support attractive issuance spreads for issuers.

- Amongst twin bonds, Denmark stands out with a persistent positive greenium of 2-3bps over time (see Figure 1). To the extent this is driven by investor preference, use of the EuGB Standard may generate additional greenium due to its high transparency.
- Germany's greeniums have been compressing, and are mostly below 1bp this year. Colombia's and Japan's greeniums are currently negative.
- One important feature offered by Denmark is the option to convert the green bond into a conventional bond. Such a mechanism is intended to support tradability and allay any investor concerns about lower liquidity in green bonds. It also offers value to green bond holders, which may contribute to observed greenium.

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[1] "Rating", Danmarks Nationalbank, accessed 16 Sep 2025.
[2] "The Kingdom of Denmark is preparing the issuance of a 10-year European Green Bond under an updated green bond programme", Danmarks Nationalbank, 3 Sep 2025.
[3] "The European green bond standard – Supporting the transition", European Commission, accessed 16 Sep 2025.
[4] For the first corporate issuer please see "A2A goes for gold with an EU green bond", AFII, 23 Jan 2025.

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The idea of twin bonds

The twin bond structure was introduced in 2020 by Germany's Finance Agency, which is responsible for the government's debt management. The underlying idea is a pair of bonds with identical financial terms, including coupon, payment schedule, and maturity date.[5] One of the pair is a conventional bond of significantly larger issuance volume, while the other is a green bond, typically issued later than the conventional bond and smaller in volume. The green bond comes with additional reporting on the use of proceeds and impact of expenditures.

In the case of Denmark, a unique feature is the convertibility of these green bonds into their conventional twin bond (but not the other way around). Given the identical financial terms, the twin bond structure can provide valuable market insights on pricing.

Expanding on earlier work on twin bonds,[6] we revisit the concept using government bond data from relevant transactions in recent years.[7] The objective is to analyse historical trends and find possible explanations for the persistence of positive greeniums in some countries.

Denmark's EuGB issuance

As shown in Table 1, the Kingdom of Denmark has two green bonds outstanding, issued in twin format under the Green Bond Framework (2021).[8] The upcoming issuance is based on the government's updated green bond programme, and is aligned with the ICMA Green Bond Principles and the EuGB Standard. The related factsheet,[9] reviewed by Sustainable Fitch,[10] outlines key details, including 100% allocation of proceeds to environmentally sustainable activities under the EU Taxonomy. Allocation reporting suggests that all previously issued green bonds were already fully aligned with this taxonomy.[11]

The maximum proceeds are expected to total DKK 10bn in 2025. The initial issuance will be via syndication, followed by regular auctions.

Table 1. Overview of Denmark's twin bonds. Source: Bloomberg Finance L.P., accessed 18 Sep 2025.

ISIN	Type	Coupon	Current YTM	Issue date	Maturity	Amount outstanding	Currency
DK0009924102	Conventional	0%	2.18%	22/01/2021	15/11/2031	43,505,000,000	DKK
DK0009924375	Green	0%	2.15%	21/01/2022	15/11/2031	16,240,000,000	DKK
DK0009924532	Conventional	2.25%	2.35%	10/02/2023	15/11/2033	71,665,000,000	DKK
DK0009924615	Green	2.25%	2.33%	03/10/2023	15/11/2033	18,165,000,000	DKK
DK0009924961	Conventional	2.25%	2.51%	07/02/2025	15/11/2035	29,415,000,000	DKK
upcoming	*Green*	*2.25%*			*15/11/2035*		*DKK*

Besides renewable energy and clean transportation, which were already part of the earlier framework, a new category was added under the updated programme: Environmentally Sustainable Management of Living Natural Resources and Land Use. This refers to afforestation

[5] "Twin Bond Concept", Finance Agency, accessed 16 Sep 2025.
[6] "Green Bond Risk Premiums: A Twin-Bond ULFP Approach", Erlandsson, 2020.
[7] See appendix for an overview of relevant government bonds for this analysis.
[8] "Kingdom of Denmark: Green Bond Framework", Ministry of Finance, Dec 2021.
[9] "Kingdom of Denmark: European Green Bond Factsheet", Ministry of Finance, Sep 2025.
[10] "Kingdom of Denmark: Pre-Issuance Review – European Green Bond", Sustainable Fitch, 3 Sep 2025.
[11] "Kingdom of Denmark Green Bond Allocation Report 2023", Ministry of Finance, Nov 2024.

and restoration of wetlands. Infrastructure for rail transport, the only EU Taxonomy activity highlighted under clean transportation, has a lower preference than the other categories.

Use of the EuGB Standard has the potential to impact investor demand, and could enable observation of an EuGB-specific greenium.[12]

Pricing of government twin bonds

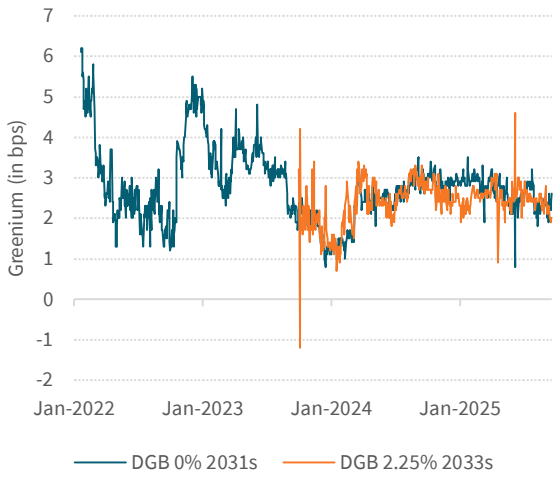
Denmark

As shown in Figure 2, the two existing green twin bonds have traded with a positive greenium since issuance, meaning the yields of the green bonds are lower than those of their conventional counterparts, even though the financial terms are the same.

On average, our calculations show 2.8bps of greenium for the 2031s and 2.4bps for the 2033s. For the 2031s, which were issued earlier than the 2033s, the greenium reached levels over 5bps in 2022.

Notably, volatility in the greenium has decreased over time and has mostly tracked in a range of 2-3bps this year.

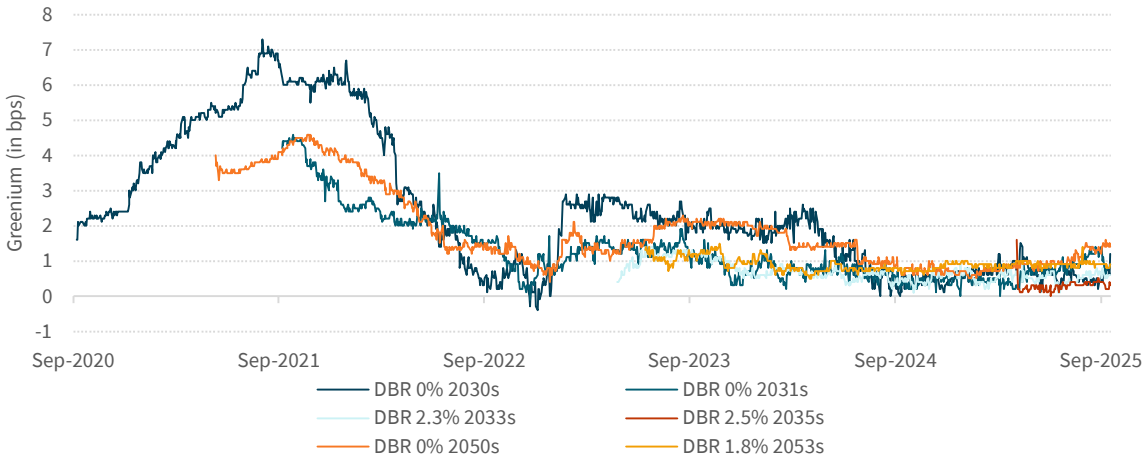
Figure 2. Greenium of Denmark's green bonds (since issuance). Source: AFII, Bloomberg Finance L. P., accessed 17 Sep 2025.



Germany

Looking at Figure 3, German government bonds show similar trends: the greenium has decreased over time and appears less volatile. Since the beginning of this year, most of the green bonds have been trading with a positive greenium of less than 1bp, with some exceptions (e.g. the 2050s which have exhibited a greenium closer to 1.5bps as of late).

Figure 3. Greenium of Germany's green bonds (since issuance). Source: AFII, Bloomberg Finance L.P., accessed 17 Sep 2025.



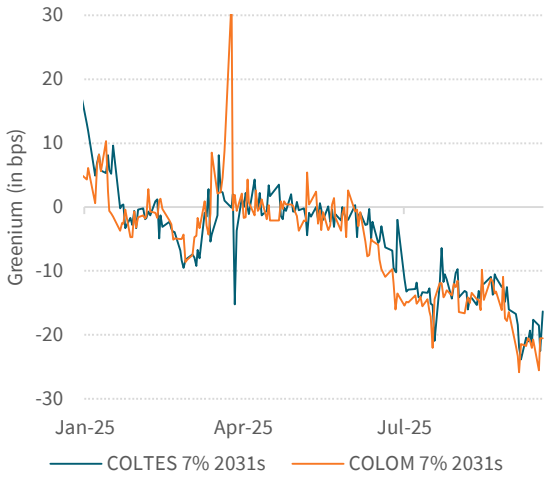
[12] There have been some initial observations that greenium may be higher, however the sample size for observation is low as described in "European Green Bonds – Initial Pricing Insights", M&G, 16 May 2025.

Colombia

In 2021, Colombia became the first country to issue a local-currency green bond in Latin America, adopting the twin bond approach.[13] Besides the local-currency bond (COLTES), investors can also trade it via international bonds (COLOM) in dual-currency format.[14]

As shown in Figure 4, the greeniums of these two different formats are very similar, as one would expect. The more interesting observation is that the greenium has drifted significantly into negative territory this year, meaning the yield of the green bond is higher than that of the conventional bond. Lately, this difference has exceeded 20bps.

Figure 4. Greenium of Colombia's green bond (year-to-date). Source: AFII, Bloomberg Finance L.P., accessed 17 Sep 2025.

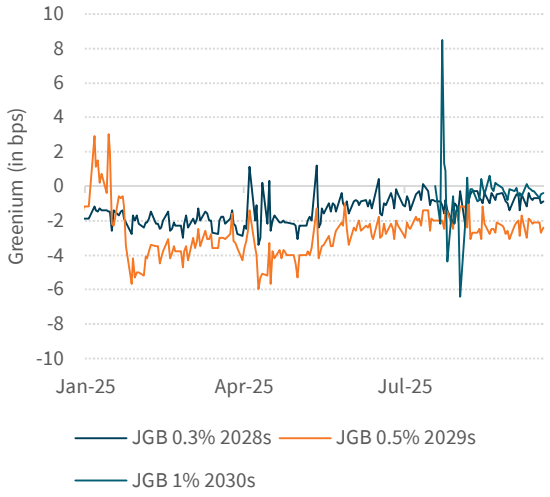


Japan

Issued as part of Japan's Green Transformation (GX) plan, the greeniums of three transition bonds were also mostly negative this year, as shown in Figure 5.[15] We note, Japan Climate Transition Bonds (JCTBs) have only been issued since 2024, and may have their own investor demand dynamics as it is a new label.

While these bonds match their conventional pairs in terms of financial terms and can be used to derive a greenium, they are conceptually different as they are not explicitly issued as twin bonds based on our understanding. In the case of the 2029s, for instance, the GX bond was issued before the conventional bond.

Figure 5. Greenium of Japan's transition bonds (year-to-date). Source: AFII, Bloomberg Finance L.P., accessed 17 Sep 2025.



The amounts outstanding of labelled bonds are usually lower than for the conventional bonds, potentially weighing on market liquidity. However, for the longer-established JGBs, like the 2028s and 2029s, the size of the transition bonds is 32% and 27% of their conventional pairs, respectively. On average, this is broadly in line with Germany's green bonds, raising the question as to what other factors might be at play.

[13] "COLOMBIA: The First Sovereign Green Bond in Local Currency in Latin America", World Bank, Jul 2022.
[14] COLTES are local bonds, COLOM are international bonds. Dual-currency bonds are denominated in local currency but settle in USD.
[15] For a more detailed analysis of the pricing please see "Latest 5yr JCTB auction receives warm reception despite market volatility", AFII, 18 July 2025.

The value of convertibility

There is one additional factor in twin bonds that is worth examining in further detail: their potential convertibility options.[16]

With the Denmark twin bonds, a green bond holder has the option at any time to switch the security into the equivalent conventional bond.[17] This is reportedly to support the liquidity of the green bond, and allay any investor concerns about being 'stuck' in the less liquid security. In practice, this provides explicit convertibility for green bond investors. Our interpretation of this document is that switch trades can be executed costlessly.

In the case of Germany, the Finance Agency provides market liquidity to ensure secondary market tradability of green bonds is comparable to that of conventional bonds. It seems to offer both switch trades with investors, and also it will trade in the individual securities to support the market. While the specifics are not confirmed, our interpretation is the switch trades are not necessarily costless, meaning they offer implicit convertibility.[18]

We have been unable to confirm if Colombia's green bonds and Japan's transition bonds also benefit from such mechanisms. We would expect these to be mentioned in the relevant frameworks, but their absence means they are not included in the following analysis.

Where green bond holders do have an option which the conventional bond holder does not have, this does in principle give rise to a value differential between the two structures. By offering optionality to the green bond holders only, the issuer (perhaps inadvertently) creates a theoretical source of 'greenium', which could support tighter issuance spreads.

Implicit versus explicit convertibility

The explicit convertibility offered in the Denmark twin structure is effectively an option on the greenium at 0bp, i.e. if the green bond were to trade wider than the conventional, an investor would rationally exercise the option to capture the positive spread (negative greenium).

The implicit convertibility in the German structure appears less valuable. It may be that switch trades are offered at market rates, and the government liquidity support through trading the individual securities is subject to discretion. Even if the commitment appears strong, we would interpret this as an option struck higher, i.e. it will not stop the greenium ever being negative, but it could serve to prevent it rising too high.

Interestingly, as shown in Figure 1 and Figure 2 earlier in this paper, Denmark's greenium seems to have historically been around 2bps, whereas the German greenium has been volatile, recently between 0 and 1bp. This difference may be attributable to the higher value of the explicit option. Meanwhile, the fact that DGBs are denominated in DKK, a non-G10 currency, is also relevant as it implies a different investor base.

[16] What follows is our interpretation of the relevant framework documents. EU sovereigns tend to execute their issuance in quite short form, and are exempt from needing full prospectuses under the EU Prospectus Regulation, which is why these details are not confirmed.
[17] "Green bonds", Danmarks Nationalbank, accessed 16 Sep 2025.
[18] "Green Bond Framework", Federal Ministry of Finance, 2020.

Impact on greenium of Denmark convertibility option

The explicit convertibility in Denmark's structure should mean the green bond can never trade with a higher yield than its twin, because the moment this happened the investor would swap to the conventional bond and capture the difference. Therefore, the value of this convertibility option is maximised when the greenium is trading close to zero.

As a back-of-the-envelope calculation, consider a 10-year bond with issuance greenium of 2bps (around 15c, trading at 100.15) and annualised daily price volatility of 0.5%.[19] The value of a 1yr par call would be around 13c, or around 1.75bps of spread.[20] This value increases to 20c, or around 2.7bps when the greenium is trading at zero.

As an indicative order of magnitude, this could suggest investors would forego a few basis points each year in return for this option.

Impact on bond volatility

A second potential source of value for green bond holders is that this option could result in lower volatility.

It is often argued that green bonds exhibit lower volatility, perhaps attributed to their investors being more 'sticky',[21,22] and this can justify the tighter issuance spreads. However, as this convertibility option should stop the green bond trading wide of its twin, it is reasonable to investigate how this may impact the relative realised volatility of the instruments.

Table 2 shows the realised volatility of green and twin bond prices since the issuance of the relevant green bond.[23] There is very little observed difference in volatility; in some pairs the green is slightly less volatile but in others it is the conventional twin.

The option owned by green bond investors is an option on the spread between the two securities, struck at zero. Its value is maximised when the spread is close to zero, while earlier analysis has shown the average value is around 2bps for the Denmark structures.

Table 2. Realised annualised volatility in bond price since issuance of green bonds. Source: Bloomberg Finance L. P., AFII.

Bond	Green issuance date	Annualised volatility GREEN	Annualised volatility TWIN	Lower volatility instrument
DGB 33s	03-Oct-23	5.84%	5.79%	TWIN
DGB 31s	21-Jan-22	7.83%	7.86%	GREEN
DBR 53s	20-Jun-23	15.49%	15.47%	TWIN
DBR 50s	18-May-21	22.29%	22.30%	GREEN
DBR 35s	10-Apr-25	4.96%	4.95%	TWIN
DBR 33s	03-May-23	6.05%	6.05%	TWIN
DBR 31s	10-Sep-21	7.64%	7.66%	GREEN
DBR 30s	09-Sep-20	6.34%	6.34%	TWIN

[19] This is the annualised volatility of the greenium in price terms, which is 0.56% for the DGB 33s and 0.33% for the 31s.
[20] This is using a Black-Scholes calculation to estimate the value as a European option, even though the true option is American.
[21] "Green bonds exhibit lower volatility and higher liquidity than non-green bonds", ABN AMRO Bank, 27 Mar 2025.
[22] "Green bond comeback: one month after 'Liberation Day'", AFII, 20 May 2025.
[23] Note due to different issuance dates, the periods of analysis are different for each bond, but are the same within each pair.

Nevertheless, this option does provide something with value greater than or equal to zero to the green bond investor, which could support realised greenium, even if we do not see a lower volatility in market prices at the moment.

Conclusions

In light of Denmark's upcoming green bond issuance, we have assessed a range of relevant government bonds in twin bond format. Such twin bond pairs offer a unique opportunity to assess the so-called greenium.

In our analysis, Denmark stands out with a persistent positive greenium over time, meaning the yields of its green bonds are slightly lower than those of its conventional bonds, even though the financial terms are the same. Accordingly, this structure can support attractive issuance spreads for issuers. Importantly, Denmark's upcoming issuance is expected to be the first government bond aligned with the European Green Bond (EuGB) Standard. Accordingly, it will provide further market insights into the value of this "gold standard".

However, Germany's greeniums have been compressing, and are lower than Denmark's. In Colombia and Japan, greeniums are currently trading at negative levels. However, the latter were issued under the climate transition label. While the observed greenium between twin bonds does offer a precise apples-to-apples comparison, investor bases in different currencies may have different dynamics.

One important feature offered by Denmark is the option to convert the green bond into a conventional bond, supporting tradability and allaying any investor concerns about lower liquidity in green bonds. At the same time, it also offers value to green bond holders, which may contribute to observed greenium.

Appendix

Table 3. Overview of relevant government green bonds. Source: Bloomberg Finance L.P (accessed 18 Sep 2025).

Ticker	ISIN	Type	Coupon	Current YTM	Issue date	Maturity	Amount outstanding (in EUR)	Currency
DGB	DK0009924102	Conventional	0%	2.18%	22/01/2021	15/11/2031	5,847,855,090	DKK
DGB	DK0009924375	Green	0%	2.15%	21/01/2022	15/11/2031	2,181,892,720	DKK
DGB	DK0009924532	Conventional	2.25%	2.35%	10/02/2023	15/11/2033	9,622,602,880	DKK
DGB	DK0009924615	Green	2.25%	2.33%	03/10/2023	15/11/2033	2,435,563,200	DKK
OBL	DE0001141828	Conventional	0%	1.91%	10/07/2020	10/10/2025	27,500,000,000	EUR
OBL	DE0001030716	Green	0%	1.88%	06/11/2020	10/10/2025	8,500,000,000	EUR
OBL	DE0001141869	Conventional	1.3%	1.96%	30/06/2022	15/10/2027	30,000,000,000	EUR
OBL	DE0001030740	Green	1.3%	1.96%	07/09/2022	15/10/2027	9,000,000,000	EUR
OBL	DE000BU25026	Conventional	2.1%	2.13%	18/01/2024	12/04/2029	25,000,000,000	EUR
OBL	DE000BU35025	Green	2.1%	2.12%	03/05/2024	12/04/2029	6,500,000,000	EUR
DBR	DE0001102507	Conventional	0%	2.23%	19/06/2020	15/08/2030	33,500,000,000	EUR
DBR	DE0001030708	Green	0%	2.22%	09/09/2020	15/08/2030	11,000,000,000	EUR
DBR	DE0001102564	Conventional	0%	2.32%	18/06/2021	15/08/2031	32,000,000,000	EUR
DBR	DE0001030732	Green	0%	2.31%	10/09/2021	15/08/2031	9,500,000,000	EUR
DBR	DE000BU2Z007	Conventional	2.3%	2.48%	13/01/2023	15/02/2033	38,250,000,000	EUR
DBR	DE000BU3Z005	Green	2.3%	2.47%	03/05/2023	15/02/2033	12,000,000,000	EUR
DBR	DE000BU2Z049	Conventional	2.5%	2.64%	10/01/2025	15/02/2035	35,000,000,000	EUR
DBR	DE000BU3Z047	Green	2.5%	2.64%	10/04/2025	15/02/2035	5,000,000,000	EUR
DBR	DE0001102481	Conventional	0%	3.22%	23/08/2019	15/08/2050	44,500,000,000	EUR
DBR	DE0001030724	Green	0%	3.20%	18/05/2021	15/08/2050	12,750,000,000	EUR
DBR	DE0001102614	Conventional	1.8%	3.24%	18/10/2022	15/08/2053	33,500,000,000	EUR
DBR	DE0001030757	Green	1.8%	3.23%	20/06/2023	15/08/2053	12,000,000,000	EUR
COLTES	COL17CT03771	Conventional	7%	10.99%	23/06/2021	26/03/2031	6,869,601,760	COP
COLTES	COL17CT03797	Green	7%	11.15%	29/09/2021	26/03/2031	961,276,836	COP
COLOM	USP28769AH30	Conventional	7%	10.95%	23/06/2021	26/03/2031	6,689,047,047	COP
COLOM	USP28769AK68	Green	7%	11.16%	29/09/2021	26/03/2031	481,366,324	COP
JGB	JP1051651Q27	Conventional	0.3%	1.00%	13/02/2024	20/12/2028	15,474,734,451	JPY
JGB	JP1470011Q24	Transition	0.3%	1.01%	28/02/2024	20/12/2028	4,896,703,518	JPY
JGB	JP1051721Q98	Conventional	0.5%	1.06%	11/09/2024	20/06/2029	16,389,808,811	JPY
JGB	JP1470021Q71	Transition	0.5%	1.09%	19/07/2024	20/06/2029	4,081,796,316	JPY
JGB	JP1051791R76	Conventional	1%	1.15%	09/07/2025	20/06/2030	28,040,106,629	JPY
JGB	JP1470031R78	Transition	1%	1.15%	16/07/2025	20/06/2030	1,739,883,304	JPY

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