Beta and ERP for the Rental of Heat Interface Units in the Netherlands

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I. Introduction and Summary

1. Since 2014, the Dutch Authority for Consumers and Markets (ACM) is responsible for setting the maximum prices that heat suppliers in the Netherlands can charge to consumers and small and medium companies with a connection up to 100 kW for the supply of heat.[1] The ACM sets five different tariffs components for: (i) supply, (ii) metering, (iii) connection, (iv) disconnection, and (v) the rental of heat interface units. The tariffs for supply and metering are based on the "no more than usual" principle, which entails that consumers who rely on a heating company for their heat demand shall pay no more than if they had used natural gas for heating with a domestic boiler. The ACM sets the supply and metering tariffs annually using the most recent gas prices as reference prices. The tariffs for the connection and disconnection to the heating network and for the rental of heat interface units are instead cost-based.

2. Since 2019, the ACM determines a nominal pre-tax WACC which is used as an estimate for the maximum return heating companies are allowed to earn on the rental of heat interface units. In 2019, the ACM determined the WACC for the rental of heat interface units for the period 2020-2022 based on the general ACM method. However, a ruling by the Trade and Industry Appeals Tribunal (CBB) determined that the cost of debt should be based on the actual debt costs of the Dutch heating companies. Accordingly, in 2022 the ACM calculated the WACC for the regulatory period 2023-2025 and recalculated the WACC for 2020 using the general ACM method for calculating the cost of equity and using the actual debt costs of a sample of relatively large heating companies to calculate the cost of debt.

3. The ACM is now seeking advice on the calculation of the WACC for the next regulatory period, 2026-2028. Within this context, the ACM has commissioned The Brattle Group (Brattle) to:

    a. Select a peer group of comparable companies that are sufficiently liquid to allow a reliable beta estimate.

[1] Unlike energy networks, heating companies are required by law to be integrated, so that production, transport and delivery are all performed by one single company, due to the very local nature of heat supply.

b. Estimate the asset beta for the rental of heat interchange units in the Netherlands.

c. Estimate the equity risk premium (ERP).

4. The ACM has instructed us to apply the general ACM method for estimating the asset beta and the ERP, and to apply the method already applied in the last method decision and in the 2022 Brattle report commissioned by the ACM for the selection of peers.[2]

5. In preparing this report, we use data up to and including 28 February 2025, being the most recent date available at the time of our analysis.

A. Selection of the Peer Group

6. The risk of the rental of heat interface units is comparable to that of energy networks that do not bear volume risk. That is, networks for which the revenues do not depend on the amount of energy transported. Similar to energy networks, rental income from heat interface units does not depend on the amount of heat transmitted. Accordingly, we estimate the beta for the rental of heat interface units by reference to the median asset beta of energy networks.

7. To select our peer group of comparable companies, we start with the energy networks considered by the ACM in its latest determinations for the energy and the drinking water sectors,[3] and in a recent ACM's decision for the gas and electricity networks.[4] We exclude non-European companies and check that the shares of the candidate peers are sufficiently liquid to provide a reliable beta estimate. After application of these criteria, we end up with seven energy networks: Elia, Enagas, Redeia Corporación, REN, Snam, Transgaz and Terna.

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[2] See ACM, "Openbaar Tarievenbesluit warmteleveranciers 2023", December 2022 (available at: https://www.acm.nl/system/files/documents/tarievenbesluit-warmteleveranciers-2023_0.pdf). See also, Dan Harris and Lucrezio Figurelli, "The WACC for Heat Exchangers in the Netherlands", December 2022 (available at: https://www.acm.nl/system/files/documents/brattle-wacc-for-heat-exchangers.pdf).

[3] See Dan Harris and Lucrezio Figurelli, "The WACC for the Dutch Electricity TSO and Electricity and Gas DSOs", April 2021 (available at https://www.acm.nl/sites/default/files/documents/the-wacc-for-the-dutch-electricity-tso-and-electricity-and-gas-dsos.pdf); Dan Harris, Lucrezio Figurelli and Gleb Kolotvin, "The WACC for Drinking Water Companies in the Netherlands", October 2024 (available at: https://www.acm.nl/system/files/documents/bijlage-1-brattle-drinking-water-report.pdf).

[4] See Dan Harris and Lucrezio Figurelli, "The WACC for the Dutch Electricity TSO and Electricity and Gas DSOs", April 2021 (available at: https://www.acm.nl/sites/default/files/documents/the-wacc-for-the-dutch-electricity-tso-and-electricity-and-gas-dsos.pdf). This 2021 report included Transgaz SA Medias in its sample of peers. We consider Transgaz SA Medias a relevant candidate peer for this report as well, so we include it in our sample of potential peers.

B. Equity and Asset Beta

8. In line with the ACM methodology, we estimate equity betas for the peer group by regressing the daily returns of individual stocks on market returns over sample periods of three years as of the relevant measurement dates. We calculate market returns using a broad Eurozone index. We calculate the gearing of each comparator as of the measurement date as the three-year average of quarterly gearing ratios obtained dividing quarterly net debt over quarterly market capitalization. We then un-lever the equity betas using the Modigliani and Miller formula. Finally, we calculate the asset beta for the rental of heat interface units based on the median asset beta of energy networks. The methodology results in an asset beta of 0.36, which compares to the asset beta of 0.34 we selected for 2023-2025.

C. Equity Risk Premium

9. We calculate the Equity Risk Premium (ERP) using long-term historical data on the excess return of shares over long-term bonds, using data from European markets. Specifically, the methodology requires that the projected ERP should be based on the average of the arithmetic and geometric realized ERP for the Eurozone, using the market capitalization of each country's stock market as weights. The methodology also requires considering whether adjustments to the final ERP need to be made based on considerations of the historical average ERP, and ERP estimates based on dividend-growth models.

10. In our 2022 report for the ACM, we selected an ERP of 5.0%. This was in line with the average ERP over the 2017-2021 period, and consistent with ACM's contemporaneous WACC decisions for the gas and electricity networks.[5] More recently, in our 2024 report for the ACM on the WACC for the Dutch drinking water companies (the 2024 Brattle Drinking Water Report),[6] we recommended the ACM to increase the ERP to 5.10%, to reflect the higher estimates of the realized ERP in 2022 (5.20%) and 2023 (5.23%). 2025 DMS data on the

[5] See Dan Harris and Lucrezio Figurelli, "The WACC for the Dutch Electricity TSO and Electricity and Gas DSOs", April 2021 (available at https://www.acm.nl/sites/default/files/documents/the-wacc-for-the-dutch-electricity-tso-and-electricity-and-gas-dsos.pdf).

[6] See Dan Harris, Lucrezio Figurelli and Gleb Kolotvin, "The WACC for Drinking Water Companies in the Netherlands", October 2024 (available at: https://www.acm.nl/system/files/documents/bijlage-1-brattle-drinking-water-report.pdf).

realized ERP based on data from 1900 up to and including 2024 now indicates that the weighted average ERP for the Eurozone has increased further to 5.27%. The question is then whether the further increase in the realized ERP warrants a further increase in the ERP for regulated companies in the Netherlands.

11. Based on the available evidence, we now recommend the ACM to apply a further increase in the ERP and to select a value of 5.20% to reflect the higher economic uncertainty driven by the continued military conflict in Ukraine and in the Middle East and the increased uncertainty about the direction of global trade policy after the 2024 US elections.

II. Selection of the Peer Group

A. The Systematic Risks of the Rental of Heat Interface Units

12. Understanding the operations and the systematic risks of heating companies – and of the rental of heat interface units in particular – is essential to estimate a reasonable rate of return for this activity. More specifically, because the Dutch heating companies are not listed, we need to estimate beta by reference to a group of comparable companies engaged in similar activities and facing similar systematic risks. In this Section we analyse the risk profile of the rental of heat interface units, in order to identify a set of comparable sectors that can be used to estimate beta.

13. Heating companies are vertically integrated companies, responsible for the production, transport and delivery of heat to consumers. Heat is obtained from several sources – often a generation plant burning fossil fuels – and is transported as steam or hot water through a system of pipes. Steam and hot water are first delivered to a substation, before being delivered to end-consumers through the distribution heating network. Because demand fluctuates considerably over time, the substations are also equipped with back-up boilers to ensure stability of supply. Finally, in order to transfer heat from the heat network to their indoor system, consumers must need to rent a heat interface unit. The delivery of heat thus

requires four main components: (i) a source of heat, (ii) a system of pipes, (iii) a substation with back up boilers, and (iv) heat interface units.

14. In the 2022 Brattle report commissioned by the ACM,[7] we explained that heating companies face significant risks which can be broadly classified into one of four categories: demand risks, supply risks, buildout and take-up risks and regulatory risks.

15. **Demand risks from existing customers**. Heating companies face the risk of revenue fluctuations related to fluctuations in demand. These risks relate to changes in number of consumers and in the quantity of heat demanded by connected consumers. Demand risks from existing customers, however, are relatively low, because customers connected to a heat network have limited capacity to switch to an alternative source without incurring significant costs. As a result, the turnover of existing customers is low.

16. **Buildout and take-up risks**. Similar to investments into a new fiber telecommunications network, the development of a heating network involves a certain degree of demand risks related to buildout and take-up of the heat network. Take-up risk relates to the risk that the rate at which homes connect to the heating networks differs from what is foreseen when the investment is made. Similarly, construction risks relate to the risk of higher costs or longer lead time during the construction period.

17. **Supply risks**. Heating companies face supply risks because they are fully responsible for the generation and supply of heat. The nature and extent of these risks varies by company based on the source(s) used to generate heat and on the degree of vertical integration. In general, supply risks relate to the availability of the sources used to produce heat, which cannot be changed (easily) in the short run, and to their price relative to the price of gas. Unlike regulated transport and distribution networks, the profitability of heat networks is highly sensitive to changes in the supply and relative price of the inputs used in the generation of heat.

18. **Regulatory risk**. In addition to general regulatory risks, heating companies also face potential asymmetric regulatory risk due to the combination of the "no more than usual" clause applied

[7] See Dan Harris and Lucrezio Figurelli, "The WACC for Heat Exchangers in the Netherlands", December 2022 (available at: https://www.acm.nl/system/files/documents/brattle-wacc-for-heat-exchangers.pdf).

to the supply and metering tariffs,[8] and the "rate of return test", which ensures that realized returns of the heating companies do not exceed a reasonable level. Unlike demand, supply, buildout and take-up risks, which are mostly systematic risks, regulatory risks, including asymmetric risk, are mostly non-systematic. Therefore, it should not affect the beta.[9]

19. The risks involved in the rental of heat interface units, however, are fairly limited. This is because the tariff for the rental of heat interface units is a fixed rental charge, which is cost-based and independent from the amount of heat supplied. Therefore, most of the risks faced by the heating companies do not apply to the rental of heat interface units.

20. In more detail, the rental of heat interface units faces very limited demand risk, largely related to the possibility of disconnections. Supply, buildout and take-up risks are also very limited, as costs involve only the purchase and maintenance of one piece of equipment – the heat interface unit – which are only incurred when a home is connected to the heat network.

21. Given the above, the risk of the rental of heat interface units is mostly comparable to that of energy networks subject to revenue regulation. These networks do not face volumes risk. That is, their revenue does not vary with the amount of energy they transport. Similar to revenue-regulated energy networks, the rental income from heat interface units only faces the risk of disconnections. Accordingly, we estimate the beta for the rental of heat interface units by reference to the median asset beta of revenue-regulated energy networks.

B. The Sample of Peers

22. To select a sample of comparable energy networks, we start considering the peer group of companies considered by the ACM in its latest determinations for the energy and the drinking

[8] As explained above, the "no more than usual" principle entails that consumers who rely on a heating company for their heat demand shall pay no more than consumers using gas.

[9] Companies, however, make investment decisions taking non-systematic asymmetric risk into account in developing expected cash flows. In practice, however, adjusting expected cash flows for non-systematic asymmetric risk may be challenging. Determining whether there should be compensation in the WACC for asymmetric risk is outside the scope of this report.

water sector,[10] and in a recent ACM's decision for the gas and electricity networks.[11] All of the candidate peers are revenue-regulated European energy networks.

23. In line with the ACM methodology, we test that the firms' shares are sufficiently liquid to obtain a reliable beta estimate. Illiquid stocks tend to underestimate the beta.[12] Hence, for each of the potential peers in the initial sample, we test to see if the firms' shares are sufficiently liquid.

24. Since 2021, the ACM methodology requires to apply a bid-ask spread threshold of 1% as the primary liquidity criterion.[13] Accordingly, we calculate the average bid-ask spread as a percentage of the stock price over the reference period 1 March 2022 – 28 February 2025.[14] As illustrated in Figure 1, the 1% cut-off leads to the exclusion of Fluxys Belgium, which recorded an average bid-ask spread of 1.5%.[15]

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[10] See Dan Harris and Lucrezio Figurelli, "The WACC for the Dutch Electricity TSO and Electricity and Gas DSOs", April 2021 (available at https://www.acm.nl/sites/default/files/documents/the-wacc-for-the-dutch-electricity-tso-and-electricity-and-gas-dsos.pdf); Dan Harris, Lucrezio Figurelli and Gleb Kolotvin, "The WACC for Drinking Water Companies in the Netherlands", October 2024 (available at: https://www.acm.nl/system/files/documents/bijlage-1-brattle-drinking-water-report.pdf).

[11] See Dan Harris and Lucrezio Figurelli, "The WACC for the Dutch Electricity TSO and Electricity and Gas DSOs", April 2021 (available at: https://www.acm.nl/sites/default/files/documents/the-wacc-for-the-dutch-electricity-tso-and-electricity-and-gas-dsos.pdf). This 2021 report included Transgaz SA Medias in its sample of peers. We consider Transgaz SA Medias a relevant candidate peer for this report as well, so we include it in our sample of potential peers.

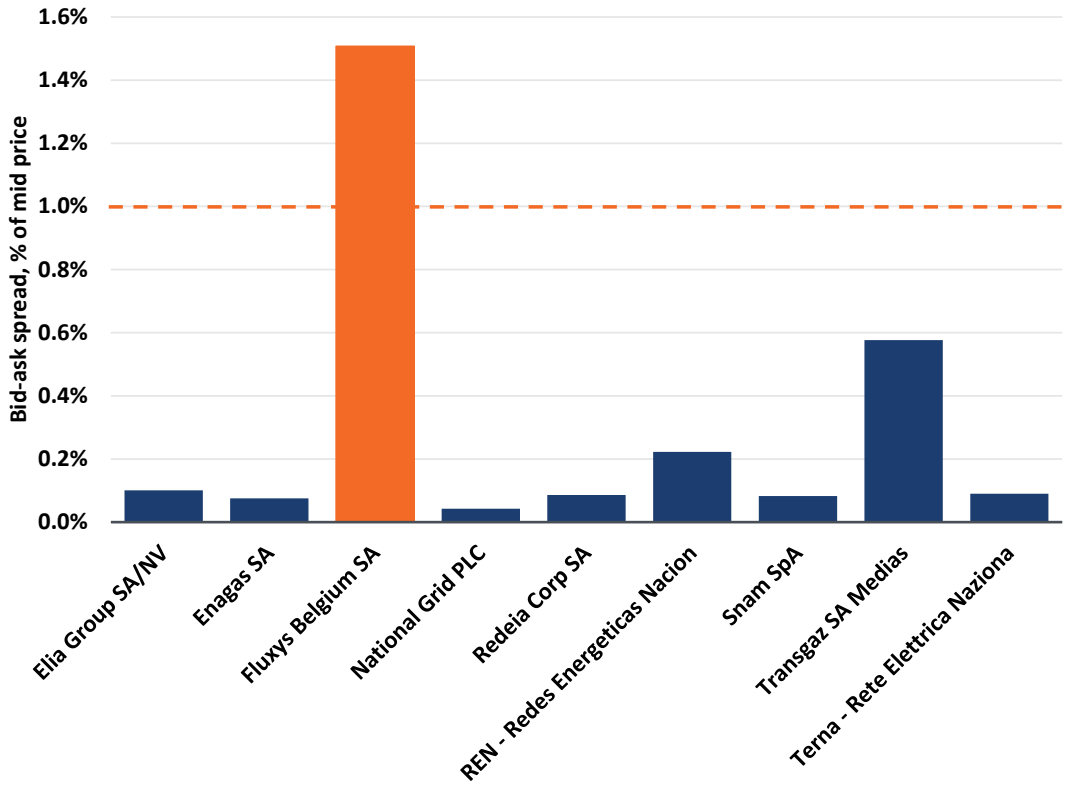
[12] To understand why this is true, for example, consider a firm with a true beta of 1.0, so that the firm's true value moves exactly in line with the market. Now suppose that the firm's shares are traded only every other day. In this case, the firm's actual share price will only react to news the day after the market reacts. This will give the impression that the firm's value is not well correlated with the market, and the beta will appear to be less than one. Using weekly returns to calculate the beta mitigates this problem, since it is more likely that the firm's shares will be traded in the week. However, using weekly returns have other disadvantages, such as providing 80% less data points over any given period.

[13] Historically, the ACM methodology applied two criteria to test for liquidity. First, the shares of the candidate peers had to be traded on at least 90% of the days in which the relevant market index traded over the reference period (the number of trading days test). Second, the ACM methodology required that the candidate peers had annual revenues of at least € 100 million (the annual revenue requirement), on the basis that firms with larger revenues are likely to have shares that are liquidly traded. Later, in response to a court ruling, the ACM commissioned a study to provide a recommendation on the appropriate criteria to select peers for efficient beta estimation. The study determined that a bid-ask spread threshold of 1% should be applied as the primary liquidity criterion. We have applied this criterion in all recent reports for the ACM.

[14] More specifically, we calculate the daily value of the bid-ask spread as the difference between bid price and ask price at closing divided by the average between the bid price and the ask price. We then calculate the simple average of the daily bid ask spreads over the relevant period.

[15] We acknowledge a trade-off in using a lower cut-off point, which would potentially lead to exclude companies otherwise considered as sufficiently liquid. A cut-off of 0.5% would only lead to the exclusion of Transgaz SA Medias.

FIGURE 1: BID-ASK SPREAD



25. We consider two additional screening tests to ensure a reliable beta estimate. Specifically, we check that the credit rating of the candidate peers is not below investment grade and that the companies were not involved in substantial mergers and acquisitions (M&A) activity.[16] All of the candidate peers considered have an investment grade rating and were not recently involved in substantial M&A activity having a noticeable effect on the daily returns of the stock price.

26. Finally, we check the candidate peers earn a majority of their revenues from regulated energy transmission and distribution. We find that all candidate peers derive the vast majority of their revenues from regulated energy transmission and distribution activities, with the exception of National Grid. For National Grid, we find that the firm earns about 50% of its

[16] Share prices of firms with lower credit ratings tend to be more reactive to company-specific news. This will lower the measured beta, in a way that may not be representative of the Dutch heating companies. Similarly, substantial M&A activity will tend to affect a firm's share price in a way that is unrelated to the systematic risk of the business. Hence, the observed beta for a firm with substantial M&A activity will tend to underestimate the true beta for a firm with the same business activity absent M&A activity. Accordingly, we would exclude firms that have been involved in 'substantial' M&A during the period for which data is used to calculate the beta.

revenues from regulated activities in the US. However, for such activities we cannot distinguish between revenues related to energy transmission and distribution and revenues related to the sale of energy. Accordingly, we exclude National Grid from the final sample.

27. Table 1, below, reports the list of peer energy networks we consider to estimate the beta for heat interface units.

TABLE 1: THE FINAL SAMPLE OF PEERS

		Country	Europe	Rating	Bid-ask spread	M&A test	Regulated revenues
Elia Group SA/NV	[1]	Belgium	✓	BBB	✓	✓	✓
Enagas	[2]	Spain	✓	BBB+	✓	✓	✓
Fluxys Belgium	[3]	Belgium	✓	n.a.	×		
National Grid PLC	[4]	UK	✓	BBB+	✓	✓	×
Redeia Corp SA	[5]	Spain	✓	A-	✓	✓	✓
REN - Redes Energeticas Nacionais	[6]	Portugal	✓	BBB	✓	✓	✓
Snam SpA	[7]	Italy	✓	BBB+	✓	✓	✓
Transgaz SA Medias	[8]	Romania	✓	BBB-	✓	✓	✓
Terna-Rete Elettrica Nazionale	[9]	Italy	✓	BBB+	✓	✓	✓

Source: Brattle elaboration on Bloomberg data. Ratings are from S&P and Fitch for Transgaz SA Medias.

III. Beta

A. Peer Group Equity Betas

28. ACM's methodology specifies a three-year daily sampling period for the beta. Accordingly, we estimate equity betas for the peer group of firms by regressing the daily returns of individual stocks on market returns over the three-year period 1 March 2022-28 February 2025.[17]

29. The systematic risk of each peer, as summarised in its beta parameter, must be measured against an index representing the overall market. A hypothetical investor in a Dutch heating company would likely diversify its portfolio within a single currency zone so as to avoid exchange rate risk. Using indices from the relevant country or currency zone avoids exchange rate movements depressing the betas, and should result in a higher beta estimate than if we estimated betas against an index derived in a different currency. Accordingly, because all peers operate in Eurozone countries, we calculate market returns using a broad Eurozone index (the Stoxx Europe 600 (SXXP)).

30. We perform a series of diagnostic tests to assess if the beta estimates satisfy the standard conditions underlying Ordinary Least Squares (OLS) regression. We test for autocorrelation using the Breusch-Godfrey test but rely on the OLS estimate of the beta parameter even in the presence of autocorrelation.[18] We test for the presence of heteroscedasticity using the White's test and use White's-Huber robust standard errors.

31. In addition to the above diagnostic tools and adjustment procedures, we apply a test for market imperfections. This test requires us to use a weekly beta instead of the daily beta, if it appears that share prices react to news the day before or the day after the market index reacts. This could occur because of differences in market opening times and trading hours, or differences in the liquidity of the firm's shares relative to the average liquidity of the market.

[17] We measure daily returns based on dividend adjusted prices using Bloomberg's "TOT_RETURN_INDEX_GROSS_DVDS" function. This function returns stock prices adjusted to account for the issuance of dividends, gross of any applicable withholding tax.

[18] We test for autocorrelation up to three lags. Note that the OLS estimator of the beta is unbiased (not systematically too high or too low) and consistent (converges to the correct value) even in the presence of autocorrelation.

If such an effect is present, a beta estimated using daily returns on the firm's share and on the market index may be biased. Similarly, financial market frictions caused by information asymmetries, transaction costs, limit orders, and overreaction to news may also affect the way information is incorporated in the share price. In contrast, weekly betas are less sensitive to the speed at which share prices assimilate information, because they use returns over five trading days.

32. If the market is perfectly efficient, all information should be dealt with on the same day. The test for market imperfections requires to regress a company's daily returns using the market index returns one day before and one day after as additional regressors. If the lag or the lead coefficients are either significantly different from zero or jointly significantly different from zero, this suggests that information about the true beta may be lost by considering only the simple regression. This problem is addressed using weekly data to estimate the equity beta.

33. We have performed this test for the firms in our peer group. The test is significant for two of the seven firms in the final sample, Elia and Transgaz. Hence for these two firms we take the weekly beta.[19] For the remaining firms we take the daily beta. Table 2 reports the equity betas of the peers. Overall, the equity betas of energy networks range between 0.21 (REN - Redes Energeticas Nacionais) and 0.94 (Elia Group SA/NV).

[19] The daily and weekly betas for Elias Group SA/NV were 0.58 and 0.94 respectively. The daily and weekly betas for Transgaz SA Medias are 0.32 and 0.51 respectively.

TABLE 2: EQUITY BETAS

		Daily		Weekly		
		Beta	Robust Standard Error	Beta	Robust Standard Error	Beta Chosen
Elia Group SA/NV	[1]	0.58	0.17	0.94	0.17	Weekly
Enagas	[2]	0.46	0.05	0.56	0.10	Daily
Redeia Corp SA	[3]	0.40	0.05	0.54	0.09	Daily
REN - Redes Energeticas Nacionais	[4]	0.21	0.04	0.29	0.07	Daily
Snam SpA	[5]	0.64	0.04	0.65	0.09	Daily
Transgaz SA Medias	[6]	0.32	0.15	0.51	0.15	Weekly
Terna-Rete Elettrica Nazionale	[7]	0.56	0.05	0.69	0.10	Daily

Source: Brattle elaboration on Bloomberg data.

B. Peer Group Gearing and Asset Betas

34. As well as reflecting the systematic risk of the underlying business, equity betas also reflect the risk of debt or financial leverage. As debt is added to the company, the equity will become riskier as more cash from profits goes towards paying debt in each year before dividends can be distributed to equity. With more debt, increases or decreases in a firm's profit will have a larger effect on the value of equity. Hence if two firms engage in exactly the same activity, but one firm has more debt, that firm will have a higher equity beta than the firm with less debt.

35. To measure the relative risk of the underlying asset on a like-for-like basis it is necessary to 'unlever' the betas, imagining that the firm is funded entirely by equity. The resulting beta is referred to as an asset beta or an unlevered beta. To accomplish the un-levering, the methodology specifies the use of the Modigliani and Miller formula.[20]

36. Consistent with the three-year reference period used to estimate the beta, we calculate the gearing of each comparator as of each measurement date as the three-year average of quarterly gearing ratios obtained dividing quarterly net debt over quarterly market capitalization.

[20] The specific construction of this equation was suggested by Hamada (1972) and has three underlying assumptions: A constant value of debt; a debt beta of zero; that the tax shield has the same risk as the debt.

37. Table 3 reports the equity beta, the gearing and the resulting asset betas for each peer. Overall, the asset betas range between 0.11 (REN - Redes Energeticas Nacionais) and 0.56 (Elia Group SA/NV). The median asset beta of the peer energy networks is equal to 0.36. We select this value to calculate the asset beta for the rental of heat interface units.

TABLE 3: EQUITY AND ASSET BETAS

		Equity beta [A]	Gearing (D/E) [B]	Tax rate [C]	Asset beta [D]
Elia Group SA/NV	[1]	0.94	92%	25%	0.56
Enagas	[2]	0.46	86%	25%	0.28
Redeia Corp SA	[3]	0.40	66%	25%	0.27
REN - Redes Energeticas Nacionais	[4]	0.21	139%	32%	0.11
Snam SpA	[5]	0.64	92%	28%	0.39
Transgaz SA Medias	[6]	0.51	51%	16%	0.36
Terna-Rete Elettrica Nazionale	[7]	0.56	63%	28%	0.38
Median	[1]	0.51			0.36

Notes and sources:
[A], [B]: Brattle elaboration on Bloomberg data.
[C]: Damodaran, Corporate Marginal Tax Rates - By country, January 2025 Update.
[D]: [A]/(1+(1-[C])x[B]).

IV. The Equity Risk Premium

38. ACM's methodology specifies that the ERP should be based on a historical time-series of the excess return of stocks over long-term bonds for the Eurozone economies. Specifically, ACM has determined to use the simple average of the long-term arithmetic and geometric ERP for the Eurozone as the anchor for the ERP estimate. The ERP for individual countries in the Eurozone should be weighted using the 2024 value of each country's stock market.[21] The methodology reflects an estimate of the ERP in the very long run, and notably excludes countries outside of the Eurozone. This is reasonable, because a Dutch investor is more likely to be diversified over the same currency zone, rather than to incur additional currency risks by diversifying within Europe but outside of the Eurozone.

39. In our 2022 report for ACM on the Dutch heat exchangers, we selected an ERP of 5.0%. This was in line with the average ERP over the 2017-2021 period, and consistent with ACM's contemporaneous WACC decisions for the gas and electricity networks.[22] More recently, in the 2024 Brattle Drinking Water Report,[23] which used historical ERP data up to and including 2023, we recommended the ACM to increase the ERP to 5.10%, to reflect the higher estimates of the realized ERP. The question that we address in this section is whether new data from 2024 warrants a further change in the ERP.

40. Table 4 shows the historical long-run ERP derived from one of the most widely used sources, the data published by Dimson, Marsh and Staunton (the "2025 DMS report").[24] The 2025 DMS report contains ERP estimates for different countries based on data from 1900 up to and including 2024. Columns [A] and [B] show the geometric and arithmetic means of the ERP for the Eurozone countries considered in the 2025 DMS report, while column [C] reports the

[21] Weighting based on the current market-capitalization reflects the idea that a typical investor would invest a larger share of his portfolio in countries with more investment opportunities.

[22] See Dan Harris and Lucrezio Figurelli, "The WACC for the Dutch Electricity TSO and Electricity and Gas DSOs", April 2021 (available at https://www.acm.nl/sites/default/files/documents/the-wacc-for-the-dutch-electricity-tso-and-electricity-and-gas-dsos.pdf).

[23] See Dan Harris, Lucrezio Figurelli and Gleb Kolotvin, "The WACC for Drinking Water Companies in the Netherlands", October 2024 (available at: https://www.acm.nl/system/files/documents/bijlage-1-brattle-drinking-water-report.pdf).

[24] UBS Global Investment Returns Sourcebook 2025, Table 12.

simple average of the two. We find that the Eurozone simple average ERP is 5.84% (see cell [11][C]), while the average ERP weighted by each country's stock market capitalization is 5.27% (see cell [12][C]).[25]

TABLE 4: HISTORIC EQUITY RISK PREMIUM RELATIVE TO BONDS (1900 – 2024)

		Risk premiums relative to bonds, 1900 - 2024			
		Geometric mean % [A]	Arithmetic mean % [B]	Average % [C]	Country Market Cap (2024) USD mln [D]
Austria	[1]	3.30	21.20	12.25	142,485
Belgium	[2]	2.60	4.60	3.60	372,061
Finland	[3]	5.50	9.00	7.25	259,757
France	[4]	3.50	5.70	4.60	2,927,979
Germany	[5]	5.20	8.30	6.75	2,400,751
Ireland	[6]	3.00	5.00	4.00	81,690
Italy	[7]	3.30	6.60	4.95	721,221
Netherlands	[8]	3.70	5.90	4.80	959,196
Portugal	[9]	5.20	9.20	7.20	71,896
Spain	[10]	2.00	3.90	2.95	788,853
Average Eurozone	[11]	3.73	7.94	5.84	
Value-weighted average Eurozone	[12]	3.86	6.68	5.27	

Notes and sources:
[A][1]-[B][10]: Elroy Dimson, Paul Marsh, and Mike Staunton, Credit Suisse Global Investment Returns Sourcebook 2025, Table 12.
[C]: Average [A]:[B].
[D]: Bloomberg.
[11]: Average [1]:[10].
[12]: Average [1]:[10], weighted by [D].

41. Table 5 further illustrates the recent evolution of the ERP estimates for the Eurozone based on data published by DMS in previous years. Columns [A] and [B] show the weighted average of the geometric and arithmetic means of the realized ERPs for Eurozone countries, while column [C] reports the simple average of the two. All three columns rely on the ERP data for the Eurozone countries in the DMS studies weighted by their stock market value. The average of the geometric and arithmetic means for the Eurozone has steadily increased from 4.85%

[25] Note that in calculating the Eurozone averages, at the request of ACM, we include Austria, for which DMS reports an arithmetic average ERP of 21.2%. Excluding Austria would reduce the value of the weighted Eurozone average of the arithmetic mean from 6.68% to 6.43%, and the average between the values of the weighted arithmetic and geometric means from 5.27% to 5.15%.

in 2020 to 5.27% in 2024. We note that the true ERP is unobservable, as it reflects the expected return required by investors as a compensation for market risk. The question is then whether the increase over time represents an increase in the true long-term ERP or is simply a short-lived phenomenon.

TABLE 5: DMS ERP, WEIGHTED AVERAGE OF THE ARITHMETIC AND GEOMETRIC MEANS FOR THE EUROZONE, 2020 – 2024

%	Geometric Mean [A]	Arithmetic Mean [B]	Average [C] Average [A]:[B]
2020	3.38	6.31	4.85
2021	3.60	6.51	5.06
2022	3.79	6.62	5.20
2023	3.82	6.65	5.23
2024	3.86	6.68	5.27
Average	3.69	6.55	5.12

Notes and sources:
Brattle calculation using data from Credit Suisse Global Investment Returns Sourcebook, 2021-2023, and UBS Global Investment Returns Sourcebook, 2024-2025.
[A], [B]: Value-weighted average for the Eurozone.

42. From a theoretical standpoint, an increase in the historical ERP may reflect a short-term impact due to a *decrease* in the true ERP or a medium-term impact due to an *increase* in the true ERP:

    a. In the short term, a decrease in the true ERP will drive stock returns up, as investors re-evaluate existing investment, thus leading to an increase of historical averages.[26]

    b. In the medium term, an increase in the true ERP will gradually lead to an increase in the historical averages as investors will only undertake new investments with higher returns.

43. However, because changes in the true ERP are unobservable, it is generally difficult to determine whether observed changes in the historical ERP reflect a short-term or a medium-term effect.

[26] The increase in the historical averages will be relatively small when the realized ERP is measured using a long-term average.

44. In the 2024 Brattle Drinking Water Report, we attributed the increase in historical ERPs for the Eurozone to an increase in the underlying "market" ERP due to higher market volatility and a temporary increase in the realized historical ERP due to higher inflation.

45. As regards market volatility, both the Covid-19 pandemic and the war in Ukraine triggered a significant increase in the volatility of stock markets.[27] In general, higher market volatility implies higher risk and, therefore, the need for a higher risk premium. It is important to stress that what is relevant here is not necessarily an ex-post measure of realized volatility of stock prices. Rather, it is the volatility of stock prices expected by investors, which is likely linked to the degree of uncertainty about future economic conditions. Arguably, economic uncertainty has increased since the drafting of the 2024 Brattle Drinking Water Report, as a result of continued military conflict in Ukraine and in the Middle East and increased uncertainty about the direction of global trade policy after the 2024 US elections.

46. As regards inflation, the significant and unexpected increase in inflation in the past few years likely resulted in a temporary increase in the measured ERP. In general, real returns on investments tend to have some negative correlation with the rate of inflation, meaning that real returns will decrease when inflation increases. However, the correlation of real equity returns with inflation tends to be smaller in absolute terms than the correlation between real bond returns and inflation.[28] This implies that when inflation increases, real returns to equity will decrease less than real returns to bonds, causing an increase in the difference between the return on equity and the return on bonds. In other words, when inflation increases the realized ERP tends to increase. Since the drafting of the 2024 Brattle Drinking Water Report, inflation has continued to decrease compared to the 2022-23 levels, and the ECB currently expects European inflation to settle at its 2% target by 2026-27, which suggests that the difference between real returns on equity and real returns on bonds is no longer driven by higher inflation rates.[29]

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[27] The volatility index for the S&P 500 (VIX), for example, increased from values of about 100 at the end of 2019 to values exceeding 600 in March 2020 and then remained relatively high until the beginning of 2023. The volatility index for the Euro Stoxx 50 (VSTOXX Index) followed a similar pattern.

[28] The relation between the ERP and the inflation rate has been clearly identified as one of the drivers of the recent increase in the historical ERP by the Body of European Regulators of electronic Communications (BEREC). BEREC cites DMS' finding of a correlation of -0.21 between real equity returns and inflation and a correlation of -0.42 between real bond returns and inflation. See BEREC, "WACC parameters Report 2024", BoR (24) 102, June 2024, p. 60.

[29] ECB, "Monetary policy decisions", Press release dated 5 March 2025.

47. In our recommendation in the 2024 Brattle Drinking Water Report we explained that increasing the ERP from 5.0% to 5.10% was reasonable, to account for a more uncertain economic environment. However, increasing it to as much as 5.23%, equal to the weighted average ERP for the Eurozone as of 2023, would have been too high, because the effect of inflation on the realized ERP was likely temporary. But new data now seems to support a further increase to the ERP.

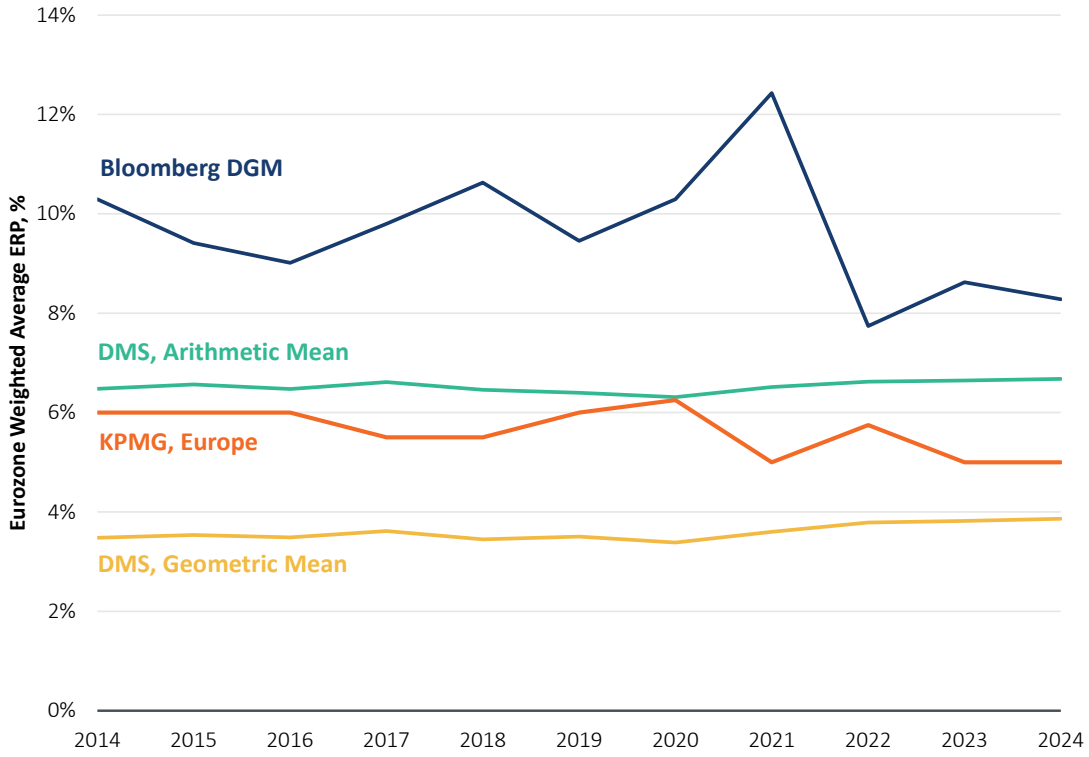
48. ACM's methodology further requires us to look at evidence on the ERP from the dividend-growth model ("DGM") as a "sanity check" to determine whether other market data suggests an increase or decrease in the "market" ERP.[30] In the 2024 Brattle Drinking Water Report we noted that the evidence from the DGMs was highly mixed – with the ERP estimates from KPMG and Bloomberg going in opposite directions – and did not provide us any indication as to whether the market ERP had actually increased.

49. Figure 2 updates Figure 3 from the 2024 Brattle Drinking Water Report to include Bloomberg's and KPMG's DGM-based ERP estimates for 2024. The figure compares the DMS estimates of the arithmetic and geometric means of the historical ERP for the Eurozone to the forward looking DGM estimates from Bloomberg and KPMG since 2014.[31] The DGM estimates for 2024 continue showing mixed results on the market ERP. KPMG's estimate for 2024 remained stable at its 2023 value of 5% and Bloomberg's estimate decreased from 8.62% in 2023 to 8.28% in 2024. On balance, the DGM estimates do not provide a clear conclusion on the direction of the unobservable market ERP.

[30] For example, after the 2009 financial crisis, historical data indicated a decrease in the ERP, because realized returns of stocks over bonds were very low. But the DGM indicated that the ERP had if anything increased after the crisis. The DGM result made sense, since investors would likely have perceived more risk and demanded higher returns immediately after the crisis. Hence, the results of the DGM indicated that, for this period, a downward reduction in the ERP was not justified, even though this is what the unadjusted historical data indicated.

[31] KPMG provides a DGM-based estimate of the ERP for Europe based on the implied equity returns of European indices. See KPMG, "Equity Market Risk Premium - Research Summary", December 2024. Bloomberg provides daily DGM-based estimates of the ERP for individual European countries under the 'Country Risk Premium' function. We use Bloomberg's DGM-based ERP estimates for individual Eurozone countries as of 31 December of each year to calculate a weighted average DGM-based ERP for the Eurozone.

FIGURE 2: EUROZONE EQUITY RISK PREMIUMS, BY YEAR



Source: Bloomberg, various DMS reports, KPMG Netherlands and Brattle calculations.

50. Based on the available evidence, we now recommend the ACM to apply a further increase in the ERP and to select a value of 5.20%. Several reasons support this recommendation. First, economic uncertainty has likely increased. Second, the further increase in the DMS ERP as of 2024 can no longer be attributed to extraordinary inflation levels, as inflation levels in 2024 were significantly lower than in prior years. Finally, the DGM estimates of the ERP do not provide any conclusive evidence of a decline or increase in the ERP. The proposed value of 5.2% is slightly lower than the 5.27% ERP based on the 2025 DMS report, reflecting higher market uncertainty, lower inflation and the lack of conclusive evidence from the DGM.