

RESPONSE TO ANP'S CONSULTATION ON THE APPLICATION OF RCM TO CALCULATE TAG'S RAB FOR THE 2026-2030 REGULATORY PERIOD

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CONTENTS

1	Executive Summary (Portuguese)	4
1.1	A aplicação proposta pela ANP do RCM contradiz seus objetivos regulatórios	4
1.2	A sensibilidade do RCM a correções de erros e verificações cruzadas padrão invalida a metodologia	5
1.3	As evidências internacionais não apoiam o uso do RCM no contexto brasileiro	7
2	Executive Summary	9
2.1	ANP's proposed application of the RCM contradicts its regulatory objectives	9
2.2	The sensitivity of the RCM to error corrections and standard cross-checks invalidates the methodology	10
2.3	International evidence does not support the use RCM in the Brazilian context	11
3	Introduction	13
3.1	Purpose of the report	13
3.2	Structure of the report	13
4	ANP's choice and application of the RCM is inconsistent with its regulatory objectives	15
4.1	ANP's regulatory framework is based on multiple, potentially competing objectives	15
4.2	ANP's approach undermines regulatory stability and internal coherence	16
4.3	ANP's emphasis on short-term tariff affordability comes at the expense of long-term economic efficiency	21
4.4	ANP does not reach its objective to prevent over-remuneration of the transporter because its RCM methodology is flawed	24
4.5	ANP's proposed application of the RCM should not be adopted as the basis for determining TAG's opening RAB	26
5	ANP's application of RCM relies on unjustified inputs and assumptions which result in an unreliable and underestimated RAB	27
5.1	Reliance on unrobust replacement costs results in underestimating the 2026 RAB estimate by a factor of at least 4	29

5.2	Aligning asset lives with international regulatory practice increases the resulting 2026 RAB estimate by a factor of 5 to 8	38
5.3	Adjusting asset commissioning dates to reflect the dates in ANP's Authorisations of Operation increases the resulting 2026 RAB estimate by a factor of nearly 7	41
5.4	Using the most reliable data available on operating expenditure increases the resulting 2026 RAB estimate by at least a factor of 6	43
5.5	Holding the WACC constant as per standard practice for long-term contracts increases the resulting 2026 RAB estimate by a factor of more than 20	48
5.6	The sensitivity of the RCM to error corrections and standard cross-checks invalidates the methodology	54
6	International regulatory practice does not support the use of RCM when introducing economic regulation	56
6.1	No European country has used an RCM approach to establish the opening value of the RAB	57
6.2	The Australian case does not support that RCM meets the requirement that any alternative valuation methodologies must be " <i>widely recognised and adopted by the market</i> "	67
6.3	As a result, international evidence points to disregarding RCM in the Brazilian context	70

1 Executive Summary (Portuguese)

O marco regulatório de transporte de gás no Brasil está passando de acordos bilaterais legados para um modelo regulado de acesso aberto com entrada e saída. Para o período regulatório de 2026 a 2030, a ANP deve determinar a Base de Ativos Regulatórios (BAR) inicial para os ativos existentes, incluindo os ativos da TAG sob o Contrato Legado da Rede Nordeste. A BAR inicial é um insumo central na definição de tarifas, pois determina o valor do ativo sobre o qual o transportador obtém retorno e a partir do qual é calculada a depreciação regulatória.

A ANP está atualmente realizando consultas sobre a BAR inicial, que foi calculada para os ativos da TAG no âmbito do Contrato Histórico da Rede Nordeste utilizando o Método de Capital de Recuperação (RCM). Nossa avaliação conclui que a ANP não deve basear-se no RCM para determinar a BAR inicial dos ativos da TAG no âmbito do Contrato Histórico da Rede Nordeste. Essa conclusão se baseia em três constatações principais.

1.1 A aplicação proposta pela ANP do RCM contradiz seus objetivos regulatórios

Em primeiro lugar, a abordagem contradiz os princípios da ANP de estabilidade regulatória e coerência interna, bem como os princípios da regulamentação por incentivos, segundo os quais os investidores arcam com o risco de perdas, mas também devem poder reter os ganhos quando estes surgirem. Na Nota Técnica nº 8, a ANP concluiu que as informações disponíveis eram insuficientes para aplicar o RCM de maneira tecnicamente consistente e prudente. Na Nota Técnica nº 15/2026, a ANP, no entanto, aplica o RCM sem demonstrar que as limitações de dados previamente identificadas tenham sido resolvidas. Além disso, na Nota Técnica nº 8, a ANP desconsiderou o uso de custos históricos para determinar a BAR por motivos que também se aplicam ao RCM.

Além disso, os contratos históricos foram celebrados e executados sob um marco regulatório diferente, fora do atual regime tarifário ex ante. A aplicação do RCM é retroativa: a ANP reavalia, a posteriori, qual nível de retorno deveria ter sido obtido durante o período histórico. Isso equivale a reabrir as consequências econômicas de acordos comerciais passados. Adicionalmente, isso é incompatível com a regulamentação incentivadora prevista na Resolução 991/26 da ANP para ativos regulados (incluindo, doravante, os ativos da Malha Nordeste), que estabelece os princípios econômicos que a ANP pretende aplicar na determinação das tarifas para o período de 2026 a 2030. Mais especificamente, a Resolução 991/26 da ANP introduz a regulamentação incentivadora, que permite aos investidores reter parte dos ganhos para incentivar a eficiência, o que, em última instância, leva a tarifas mais baixas para os clientes. A aplicação de metodologias retroativas, como o RCM, que privam os investidores de todos os ganhos obtidos por meio do aumento da eficiência, vai contra esse princípio.

Em segundo lugar, a abordagem da ANP corre o risco de prejudicar a eficiência econômica. Uma BAR substancialmente subestimada pode reduzir as tarifas no curto prazo, mas também pode enfraquecer os fluxos de caixa disponíveis para manter a rede, financiar investimentos de sustentação e apoiar a qualidade de crédito da transportadora. Com o tempo, isso pode aumentar os riscos de confiabilidade, elevar os custos de financiamento e resultar em resultados menos favoráveis para os usuários.

Por fim, a ANP apresenta o RCM como uma ferramenta para evitar a dupla remuneração do capital. No entanto, a metodologia não atinge esse objetivo no contexto do Contrato Histórico da Rede Nordeste da TAG. A implementação da ANP baseia-se em uma reconstrução retrospectiva de receitas e custos, mas o faz utilizando premissas inconsistentes com a própria lógica do RCM, incluindo o uso de custos de reposição em vez dos custos históricos reais de construção para ativos anteriores a 2006. Como resultado, a metodologia não fornece uma medida confiável para determinar se o capital foi de fato recuperado.

Por essas razões, a ANP não deve adotar o RCM para determinar o valor inicial da BAR da rede do Nordeste. A aplicação do RCM pela ANP não é consistente com seus próprios objetivos regulatórios — ela enfraquece a estabilidade regulatória e a coerência interna, além de correr o risco de produzir resultados ineficientes tanto para a TAG quanto para os usuários da rede. Ao mesmo tempo, a aplicação do RCM pela ANP não fornece uma base robusta para evitar a dupla remuneração.

1.2 A sensibilidade do RCM a correções de erros e verificações cruzadas padrão invalida a metodologia

Existem erros e problemas metodológicos nos dados estimados pela ANP para calcular a BAR resultante para 2026.

Pode ser inevitável recorrer a premissas simplificadas e referências para preencher as lacunas ao aplicar um cálculo retrospectivo como o RCM. No entanto, nesse contexto, é prática recomendada em regulamentação assegurar que os resultados não sejam excessivamente sensíveis às premissas. Os reguladores costumam utilizar verificações cruzadas para testar isso, mas tais verificações não são apresentadas na documentação da ANP.

Aplicamos uma série de análises de sensibilidade ao cálculo do RCM para corrigir os erros identificados e preencher a lacuna na verificação cruzada.

- O ajuste dos custos dos gasodutos de 2006 corrige a dependência da ANP de um único parâmetro de referência dos EUA que não reflete os tributos de importação brasileiros e não foi confrontado com outras evidências relevantes.

RESPONSE TO ANP'S CONSULTATION ON THE APPLICATION OF RCM TO CALCULATE TAG'S RAB FOR THE 2026-2030 REGULATORY PERIOD

- O ajuste da vida útil do ativo alinha o modelo às práticas regulatórias internacionais, nas quais a vida útil dos gasodutos é significativamente mais longa do que os 30 anos considerados pela ANP.
- O ajuste da data do ativo aplica uma data de entrada em operação consistente e objetiva, com base nas próprias Autorizações de Operação da ANP.
- O ajuste do OPEX se baseia nas demonstrações financeiras anuais da TAG como a fonte mais transparente disponível, em vez de estimativas anteriores a 2018, que carecem de visibilidade das rubricas de custo.
- O ajuste do WACC reflete os aspectos econômicos dos contratos de longo prazo e a própria prática posterior da ANP de aplicar valores fixos de WACC ao longo dos períodos regulatórios.

A Tabela 1 abaixo resume o impacto isolado dos ajustes considerados nesta seção. Constatamos que a BAR de 2026 é excessivamente sensível as premissas alternativas testadas, a ponto de invalidar a confiança na aplicação do RCM pela ANP.

Tabela1 Impacto dos ajustes no modelo da ANP sobre a BAR

Cenário	Justificativa para o ajuste	BAR resultante (R\$ m)
Cenário base da ANP	-	595
Custos de dutos de 2006	Ajustar o benchmark da ANP nos EUA para os impostos de importação brasileiros	3.045
Vida útil dos ativos	Ajustar a vida útil dos ativos para 40 anos, em conformidade com as práticas internacionais	3.924
Datas dos ativos	Utilizar as Autorizações de Operação da ANP para as datas de entrada em operação	4.056
OPEX	Utilizar as demonstrações financeiras anuais da TAG como a fonte observável mais confiável	3.107
WACC	Aplicar premissas fixas de WACC consistentes com as tarifas de longo prazo	4.269–13.160

Fonte: Análise da Frontier Economics com base no modelo da ANP para o TAG

1.3 As evidências internacionais não apoiam o uso do RCM no contexto brasileiro

As evidências internacionais analisadas não oferecem suporte para ao uso de uma abordagem baseada no RCM para estabelecer o valor inicial da BAR dos ativos sob o Contrato Legado da Rede Nordeste.

Em toda a Europa, a introdução da regulamentação econômica no setor de gás exigiu que os reguladores estabelecessem valores iniciais dos ativos para a infraestrutura de rede existente, frequentemente no contexto da liberalização do mercado e, em alguns casos, da privatização. Nossa análise mostra que nenhuma jurisdição europeia estabeleceu a BAR inicial dos ativos de transporte de gás utilizando uma abordagem RCM. Em vez disso, os reguladores basearam-se em metodologias fundamentadas em custos históricos, custos atuais (incluindo custo de reposição e abordagens baseadas em valor) ou valores de ativos atualizados, conforme mostrado na tabela abaixo, com base em um relatório da ACER.

Tabela 2 Visão geral das abordagens utilizadas para estabelecer os valores iniciais dos ativos na Europa

Tipo de abordagem utilizada para determinar a BAR	Número de países europeus
Com base em custos históricos	11
Com base nos custos atuais	8
Valores dos ativos atualizados	2
Outros	5

Fonte: Estudo da ACER de 2018 intitulado "Metodologias e parâmetros utilizados para determinar a receita permitida ou alvo dos operadores de sistemas de transporte de gás", elaborado pela Economic Consulting Associates (ECA)

Analizamos detalhadamente diversos estudos de caso para demonstrar ainda mais a inadequação do RCM no contexto da definição do valor inicial para uma BAR. Notavelmente, mostramos que o RCM foi explicitamente considerado e rejeitado na Romênia, devido à constatação de que a inflação histórica, as repetidas mudanças nas regras contábeis e de depreciação e a extensa reestruturação do setor tornaram a abordagem pouco confiável na prática.

A ANP se baseia no setor de gás australiano como evidência que sustenta o uso de uma abordagem do tipo RCM para a avaliação de ativos regulados. No entanto, uma análise mais detalhada do precedente australiano conclui que ele também não oferece suporte à proposta da ANP. O marco regulatório australiano contempla uma abordagem do tipo RCM apenas no contexto específico de disputas de acesso envolvendo gasodutos fora do regime regulatório, que não estão sujeitos à regulamentação econômica integral. Isso difere substancialmente do contexto brasileiro, no qual a ANP propõe o uso do RCM para determinar a BAR inicial para ativos legados em transição para um regime regulado. Mesmo nesse contexto de arbitragem, as Regras Nacionais de Gás exigem que a metodologia seja desconsiderada quando não produzir resultados consistentes com um mercado competitivamente viável. O próprio Regulador Australiano de Energia reconheceu as limitações do RCM, observando sua sensibilidade às premissas e o risco de que ele possa produzir valores inconsistentes com o objetivo regulatório.

É importante ressaltar que os precedentes arbitrais não demonstram que o RCM tenha sido amplamente adotado pelo mercado: o RCM foi aceito por apenas um árbitro em um processo, envolvendo um gasoduto fora do esquema.

Em conjunto, as evidências internacionais mostram que os reguladores têm recorrido consistentemente a abordagens alternativas ao estabelecer os valores iniciais da BAR. O precedente internacional, portanto, não oferece base para concluir que o RCM seja uma metodologia apropriada para estabelecer o valor inicial da BAR no contexto brasileiro.

2 Executive Summary

Brazil's gas transmission framework is moving from legacy bilateral arrangements towards a regulated open-access entry-exit model. For the 2026–2030 regulatory period, ANP must determine the opening Regulatory Asset Base (RAB) for existing assets, including TAG's assets under the Northeast Network Legacy Contract. The opening RAB is a central input into tariff setting because it determines the asset value on which the transporter earns a return and from which regulatory depreciation is calculated.

ANP is currently consulting on the opening RAB for that has calculated for TAG's assets under the Northeast Network Legacy Contract using the Recovery Capital Method (RCM). Our assessment concludes that ANP should not rely on the RCM to determine the opening RAB for TAG's Northeast Network Legacy Contract assets. This conclusion is based on three main findings.

2.1 ANP's proposed application of the RCM contradicts its regulatory objectives

First, the approach contradicts ANP's principles of regulatory stability, internal coherence and the principles of incentive regulation, under which investors bear downside risk but must also be able to retain upside gains when they arise. In Technical Note No. 8, ANP concluded that the available information was insufficient to apply the RCM in a technically consistent and prudent manner. In Technical Note No. 15/2026, ANP nevertheless applies the RCM without demonstrating that the previously identified data limitations have been resolved. In addition, in Technical Note No. 8 ANP disregarded the use of historical costs to determine the RAB for reasons that are also applicable to RCM.

Furthermore, the legacy contracts were entered into and performed under a different regulatory framework, outside the current ex ante tariff regime. Applying the RCM is retroactive: ANP reassesses, after the fact, what level of return should have been earned during the legacy period. That is equivalent to reopening the economic consequences of past commercial arrangements. And it is inconsistent with the incentive regulation foreseen in Resolution 991/26 ANP for regulated assets (including Malha Nordeste assets going forward), which sets out the economic principles which ANP aims to apply when determining the tariffs for 2026-2030. More specifically, Resolution 991/26 ANP introduces incentive regulation, which allows the investors to keep some of the gains to incentivise efficiency that ultimately leads to lower tariffs for customers. Applying retroactive methodologies such as the RCM, which strip investors of all gains achieved through increased efficiency, goes against this principle.

Second, ANP's approach risks undermining economic efficiency. A materially understated RAB may reduce tariffs in the short term, but it can also weaken the cash flows available to maintain the network, finance sustaining investment and support the credit quality of the

transporter. Over time, this may increase reliability risks, raise financing costs and result in poorer outcomes for users.

Finally, ANP presents the RCM as a tool to prevent double remuneration of capital. However, the methodology does not achieve that objective in the circumstances of TAG's Northeast Network Legacy Contract. ANP's implementation relies on a backward-looking reconstruction of revenues and costs, but it does so using assumptions that are inconsistent with the logic of the RCM itself, including the use of replacement costs rather than actual historical construction costs for pre-2006 assets. As a result, the methodology does not provide a reliable measure of whether capital has in fact been recovered.

For these reasons, ANP should not adopt the RCM to determine the opening RAB value of the Northeast network. ANP's application of the RCM is not consistent with its own regulatory objectives – it weakens regulatory stability and internal coherence, and it risks producing inefficient outcomes for both TAG and network users. At the same time, ANP's application of the RCM does not provide a robust basis for preventing double remuneration.

2.2 The sensitivity of the RCM to error corrections and standard cross-checks invalidates the methodology

There are errors and methodological issues in the inputs estimated by ANP to calculate the resulting 2026 RAB.

It may be unavoidable to rely on simplifying assumptions and benchmarks to fill the gaps when applying a retrospective calculation such as RCM. However, in such a context it is regulatory best practice to ascertain that the results are not overly sensitive to the assumptions. Regulators standardly use cross-checks to test for this, but such cross-checks are not presented in ANP's documentation.

We have applied a number of sensitivities to the RCM calculation to adjust for identified mistakes and to fill the gap in cross-check.

- The 2006 pipeline cost adjustment corrects ANP's reliance on a single US benchmark that does not reflect Brazilian import duties and is not cross-checked against other relevant evidence.
- The asset-life adjustment aligns the model with international regulatory practice, where gas pipeline lives are materially longer than the 30 years assumed by ANP.
- The asset-date adjustment applies a consistent and objective commissioning date based on ANP's own Authorizations of Operation.
- The OPEX adjustment relies on TAG's annual accounts as the most transparent available source, rather than on pre-2018 estimates that lack cost-line visibility.

- The WACC adjustment reflects the economics of long-term contracts and ANP's own later practice of applying fixed WACC values over regulatory periods.

Table 3 below summarises the isolated impact of the adjustments considered in this section. We find that the 2026 RAB is excessively sensitive to the alternative assumptions tested, to an extent that invalidates the reliance on ANP's application of RCM.

Table 3 Impact of the adjustments to ANP's model on RAB

Scenario	Rationale for adjustment	Resulting RAB (R\$ m)
ANP's base case	-	595
2006 pipeline costs	Adjust ANP's US benchmark for Brazilian import duties	3,045
Asset lives	Adjust asset lives to 40 years in line with international practice	3,924
Asset dates	Use ANP Authorizations of Operation for commissioning dates	4,056
OPEX	Use TAG annual accounts as the most reliable observable source	3,107
WACC	Apply fixed WACC assumptions consistent with long-term tariffs	4,269-13,160

Source: Frontier Economics analysis based on ANP model for TAG

2.3 International evidence does not support the use RCM in the Brazilian context

The international evidence reviewed provides no support for the use of an RCM approach to establish the opening value of the RAB of the assets under the Northeast Network Legacy Contract.

Across Europe, the introduction of economic regulation in the gas sector required regulators to establish opening asset values for existing network infrastructure, often in the context of market liberalisation and, in some cases, privatisation. Our review shows that no European jurisdiction established the opening RAB of gas transmission assets using an RCM approach. Instead, regulators relied on methodologies based on historical costs, current costs (including replacement cost and value-based approaches), or rolled-forward asset values, as shown in the table below based on an ACER report.

**Table 4 Overview of approaches used for establishing opening asset values
across Europe**

Type of approach used to determine the RAB	Number of European countries
Based on historical costs	11
Based on current costs	8
Rolled-forward asset values	2
Other	5

Source: ACER's 2018 study *Methodologies and Parameters Used to Determine the Allowed or Target Revenue of Gas Transmission System Operators*, prepared by Economic Consulting Associates (ECA)

We have reviewed a number of case studies in detail to further demonstrate the unsuitability of RCM in the context of setting the initial value for a RAB. Notably, we show that RCM was explicitly considered and rejected in Romania, due to the consideration that historical inflation, repeated changes to accounting and depreciation rules, and extensive sector restructuring made the approach unreliable in practice.

ANP relies on the Australian gas sector as evidence supporting the use of an RCM-type approach to valuing regulated assets. However, a closer review of the Australian precedent concludes that it does not provide support for the ANP's proposal either. The Australian regulatory framework only contemplates an RCM-type approach in the specific context of access disputes involving non-scheme pipelines, which are not subject to full regulation. This is materially different from the Brazilian context, where ANP proposes to use the RCM to determine the opening RAB for legacy assets transitioning into a regulated regime. Even within this arbitration context, the National Gas Rules require that the methodology be disregarded where it would not produce outcomes consistent with a workably competitive market. The Australian Energy Regulator has itself recognised the limitations of the RCM, noting its sensitivity to assumptions and the risk that it may produce values inconsistent with the regulatory objective.

Importantly, the arbitration precedents do not demonstrate that the RCM has been widely adopted by the market: the RCM has only been accepted by one arbitrator in a proceeding, involving a non-scheme pipeline.

Taken together, the international evidence shows that regulators have consistently relied on alternative approaches when establishing opening RAB values. The international precedent therefore provides no basis for concluding that the RCM is an appropriate methodology for establishing the opening value of the RAB in the Brazilian context.

3 Introduction

3.1 Purpose of the report

Brazil's gas transmission framework is moving from legacy bilateral arrangements towards a regulated open-access entry-exit model. For the 2026-2030 regulatory period, ANP must therefore determine the opening Regulatory Asset Base (RAB) for existing assets, including TAG's assets under the Northeast Network Legacy Contract. The opening RAB is a central input into tariff setting because it determines the asset value on which the transporter earns a return and from which regulatory depreciation is calculated.

ANP's position has evolved during the consultation process. Technical Note No. 2/2026, dated 23 February 2026, set out the general methodological framework under Resolution ANP No. 991/2026. Technical Note No. 8/2026, also dated 23 February 2026, applied a New Replacement Cost approach to TAG's Northeast Network and stated that ANP did not then have sufficient information to apply the Recovered Capital Methodology (RCM) in a technically consistent and prudent manner. In Technical Note No. 15/2026, dated 1 June 2026, ANP applied the RCM to the same assets, on the basis that revenues from the Northeast Network Legacy Contract may have already recovered part of the invested capital. ANP's RCM application produces an opening RAB of approximately R\$ 595 million.

Frontier has been mandated by TAG to assess ANP's proposed RCM methodology for determining the opening RAB of TAG's Northeast Network Legacy Contract assets for the 2026–2030 regulatory period. Our report:

- Evaluates whether the methodology meets ANP's regulatory objectives;
- Assesses the inputs used in ANP's calculations and the robustness of the resulting asset valuation; and
- Evaluates the consistency of ANP's approach with international regulatory practice.

3.2 Structure of the report

This report is structured as follows:

- **Section 4** explains why ANP's approach does not meet its stated objectives, including avoiding over-remuneration, preserving regulatory stability and internal coherence, and promoting economic efficiency.
- **Section 5:** reviews the main inputs used in ANP's RCM calculation and shows how alternative, more robust assumptions materially change the resulting 2026 RAB.

- **Section 6** reviews European and Australian precedent and concludes that international practice does not support ANP's reliance on the RCM.

4 ANP's choice and application of the RCM is inconsistent with its regulatory objectives

We understand that ANP's choice to apply the RCM to determine the opening RAB of the Malha Nordeste pipeline is motivated by the objective to avoid double remuneration of assets that ANP considers to have already been recovered through revenues from the Northeast Network Legacy Contract.¹ This objective may be legitimate in principle.

However, in the following, we show that:

- ANP's regulatory framework is based on multiple, potentially competing objectives;
- ANP's approach undermines regulatory stability and internal coherence;
- ANP's emphasis on short-term tariff affordability comes at the expense of long-term economic efficiency;
- ANP does not reach its objective to prevent over-remuneration of the transporter because its RCM methodology is flawed; and

We therefore conclude that ANP's proposed application of the RCM should not be adopted as the basis for determining TAG's opening RAB.

4.1 ANP's regulatory framework is based on multiple, potentially competing objectives

ANP's regulatory framework for natural gas transportation is mainly grounded in Law No. 14.134/2021, Decree No. 10.712/2021, Federal Decree 12.153/24 and ANP Resolution No. 991/2026. Together, these instruments establish the legal and methodological basis for the transition to a regulated-access regime.

As ANP notes in Technical Note 2, Law No. 14,134/2021 establishes the structuring principles of the natural gas sector. These include open access to the network, separation between activities, and economic regulation based on tariffs approved by ANP. Federal Decree No. 12.153/2024 explicitly sets out ANP's obligations in the context of tariff setting and the guiding principles that the regulatory framework for tariff setting should abide to.² These are acknowledged by ANP in Technical Note 2:³

¹ Technical Note 15, Section 2.1 and Annex II; Resolution 991/2026, Art. 6 §9.

² Federal Decree No. 12.153/2024, Section I.

³ Technical Note 2, paras. 5, 8.

- **Tariff affordability**, meaning that tariffs should be set at levels that are reasonable for users and should avoid imposing inefficient or unjustified costs on gas consumers.
- **Economic efficiency**, meaning that tariffs should allow cost recovery, provide appropriate signals for the use and expansion of the transportation network, promote efficient allocation of costs between users.
- **Transparency**, meaning that the methodology used to calculate tariffs should be clear, predictable and subject to public scrutiny, including through consultation processes and the disclosure of the assumptions, criteria and regulatory parameters used by ANP.
- **Economic and financial balance of authorised agents**, meaning that transporters should be able to recover efficiently incurred costs and earn an appropriate return on prudent investments, so that the regulated service remains financially sustainable and investment incentives are preserved.

ANP also states in its Technical Note 2, as in the Decree No. 10,712/2021, the need for **regulatory stability** as a condition for infrastructure expansion.⁴ It further notes that maintaining the **internal coherence** of the regulatory model, the stability of rules and adherence to the legal principles of the sector is necessary to support the economic and financial sustainability of the service, legal certainty and efficient long-term infrastructure development.⁵

As ANP acknowledges in Technical Note 2, meeting this set of objectives in the context of setting the opening RAB is a balancing exercise.⁶ For example, tariff affordability may point towards limiting the recognised asset base or operating expenditure, while economic efficiency and the preservation of transporters' economic and financial balance may require allowing recovery of incurred costs and a reasonable return on efficient investment.

4.2 ANP's approach undermines regulatory stability and internal coherence

As explained above, ANP is required to consider the stability and internal coherence of the regulatory framework when making tariff decisions. But its decision to rely on the RCM to determine TAG's regulatory asset base is difficult to reconcile with those principles. By departing from its own regulatory framework and previous positions, ANP creates uncertainty regarding the rules governing asset valuation and tariff setting. This risks undermining investor confidence gas transportation sector and, more broadly, in regulated infrastructure sectors in Brazil.

⁴ ANP's Technical Note 2, para. 9.

⁵ ANP's Technical Note 2, para. 96.

⁶ ANP's Technical Note 2, para. 72.

This section shows that:

- ANP's decision to rely on the RCM departs from the approach set out in its own regulatory framework and resolutions; and
- The RCM constitutes an ex post regulatory intervention that is inconsistent with the principles of incentive regulation.

4.2.1 ANP's decision to rely on the RCM departs from the approach set out in its own regulatory framework and resolutions

ANP's choice of the RCM to determine the opening RAB for the Malha Nordeste pipeline suffers from several inconsistencies.

The use of the RCM appears inconsistent with ANP's own regulatory framework

Both Resolution No. 15/2014⁷ and Resolution No. 991/2026⁸ establish historical cost and replacement cost methodologies as the standard approaches for determining the RAB of gas transmission assets. While both resolutions allow ANP to consider alternative methodologies, they expressly require such methodologies to be *"widely recognised and adopted by the market, net of depreciation and amortisation incurred up to date on which the transmission tariff is set"*. The RCM does not satisfy this requirement.

First, as discussed in Section 6 below, the methodology is not widely recognised or adopted in the context of regulated infrastructure. No European regulator has used the RCM to establish the opening RAB of gas transmission assets when introducing tariff regulation. In Australia, which ANP cites in Technical Note No. 2 as an example supporting the use of the RCM, the only example identified is an arbitration concerning non-scheme pipelines. However, a single arbitration precedent does not demonstrate that the methodology is widely recognised or adopted by regulators or the market.

⁷ Article 6, § 3: *"In the case of Transport Pipelines in the operational phase, including those in operation on the date of publication of this Resolution, the methodology for valuing the Regulatory Asset Base used by the ANP shall take into account: - the present value of the assets, net of depreciation and amortisation accrued up to the date of setting the Transport Tariff; - the replacement cost of the assets, net of depreciation and amortisation incurred up to the date of establishment of the Transport Tariff; - the value of the assets resulting from the application of alternative methodologies that are widely recognised and adopted by the market, net of depreciation and amortisation incurred up to the date of establishment of the Transmission Tariff."*

⁸ Article 6, § 2: *"In the case of gas transmission pipelines in the operational phase, including those in operation on the date of publication of this Resolution, the BRA valuation methodology used by the ANP shall take into account: I - the Inflation-Adjusted Historical Cost (CHCI), which consists of the present value of the assets, net of depreciation and amortisation incurred up to the date of setting the transport tariff; II - the New Replacement Cost (CRN), which consists of the replacement cost of the assets, net of depreciation and amortisation incurred up to the date of setting the transmission tariff; or III - the value of the assets resulting from the application of alternative methodologies that are widely recognised and adopted by the market, net of depreciation and amortisation incurred up to the date on which the transmission tariff is set."*

Second, the RCM is unlikely to be widely adopted by the market because its underlying logic differs materially from the economic mechanisms through which prices are formed in competitive markets. The RCM determines current asset values by reference to the extent to which historical investment costs may have already been recovered through past revenues. By contrast, prices in workably competitive markets are typically determined on a forward-looking basis, reflecting opportunity costs (i.e. the costs that would need to be incurred to maintain, replace or replicate the services provided by those assets).

Third, the requirement that any alternative methodologies should be applied “*net of depreciation and amortisation*” means that the depreciated portion of the assets should not be included in the asset valuation. This effectively excludes the use of the RCM, since the RCM does not value assets by deducting depreciation and amortisation from their original cost, but by assessing the extent to which historical investment costs may have already been recovered through past revenues.

ANP's decision to rely on the RCM is also difficult to reconcile with its own previous assessment of the methodology's practical applicability

When ANP initially examined the possibility of applying the RCM (because Resolution No. 991/2026 provided it with the option - not the obligation - to consider it), it concluded that the available information was insufficient to do so in a robust manner:⁹

“In light of the documentation submitted, it is evident that, [...] the information made available was insufficient to enable the Recovered Capital Method (RCM) to be applied in a technically consistent and prudent manner. In particular, it was not possible to ensure, with the degree of traceability and granularity required by the method, the full reconciliation of revenue actually earned, operating costs incurred, taxes paid and the appropriate rate of return throughout the entire contract period – elements that are indispensable for the residual calculation of capital not yet recovered.

Given that the RCM presupposes a complete, auditable and methodologically robust information base, its use, under current conditions, could introduce a risk of distortions in the valuation of the Regulatory Asset Base, with potential impacts on tariff moderation and regulatory neutrality.”

ANP is now proposing to rely on the RCM to determine TAG's opening RAB, but it has not provided any justification as to why its concerns about the application of the RCM would have been resolved between February and May 2026. Without transparent justification, this change of approach appears arbitrary and inconsistent with a stable regulatory environment.

⁹ Technical note 8, paras. 39-40.

ANP's treatment of the RCM also appears inconsistent with the approach it adopted when assessing alternative valuation methodologies

In its evaluation of other approaches, ANP placed significant emphasis on the reliability and availability of historical information. For example, ANP rejected the Inflation-Adjusted Historical Cost methodology in part because it considered that the reconstruction of historical values would require assumptions and estimates that could not be reliably supported.¹⁰ However, similar concerns apply to the RCM: it requires the reconstruction of historical information over long periods and depends on historical indices, for example when converting real WACC assumptions into nominal values. ANP accepted the RCM despite concerns of this nature, while rejecting alternative approaches on similar grounds. Such differential treatment is not consistent with the principle of internal coherence.

4.2.2 The RCM constitutes a retroactive regulatory intervention that is inconsistent with incentive regulation

In Resolution No. 991/2026, ANP does not foresee retroactive regulatory intervention – any updates to the allowed revenues may only be made if there is *“insufficient or excessive recovery”* within *“the same tariff cycle”*.¹¹ In addition, the New Gas Law explicitly requires preservation of the revenue earned by transporters under the existing contracts.¹²

However, in Technical Note 15, ANP attempts to distinguish the RCM from a retroactive tariff review, arguing that its application is *“not as an exercise in retroactive tariff review, but as a recognition of the economic reality”*¹³, and characterising it as having instead a *“retrospective logic”*.¹⁴

But applying the RCM to legacy contracts is precisely equivalent to a retroactive regulatory intervention. It is also inconsistent with ANP's intention to apply incentive regulation when determining the 2026-2030 tariffs.¹⁵

First, we note that ANP has moved from a forward-looking efficiency approach in Resolution No. 991/2026 and Technical Note 8 to a backward-looking regulation approach in Technical Note 15:

- Resolution No. 991/2026 adopts a forward-looking perspective. It provides that future tariffs should compensate for excessive or insufficient recovery that occurs during the

¹⁰ Technical note 8, paras. 60-64 and first bullet point in the box “Regulatory decision” on page 20.

¹¹ Resolution 991/2026, Art. 13.

¹² New Gas Law No 14.143, Art. 44 §1.

¹³ Technical Note 15, Annex II, Section 7.

¹⁴ Technical Note 15, Title of Section 2.2.

¹⁵ Resolution 991/2026, Art. 9.

regulatory period as a result of unforeseen events.¹⁶ The focus is therefore on differences between expected and actual revenues during the regulatory period, with any adjustment made through future tariffs. The allowance of new investment follows the same forward-looking logic. It focuses on whether the assets included in the RAB are necessary and efficiently incurred to provide the service going forward.¹⁷

- Technical note 15 then adopts a different approach: with the RCM, the value assigned to the assets depends not on their current economic value but on an assessment of the extent to which investors have already recovered their historical investment costs through past revenues. Crucially, implementing the RCM requires ANP to make assumptions about the level of WACC that investors should have earned on those investments over time (and infers that the residual revenue not used to earn a return or cover OPEX constitutes investment recovery). This boils down to retroactive regulation because the resulting asset value depends on a regulatory reassessment of past returns.

Second, ANP's approach in Technical Note 15 is inconsistent with the principles of incentive regulation. Under incentive regulation, investors bear the risks associated with their investment decisions. If revenues are lower than expected, investors bear the losses. If revenues are higher than expected, they retain the gains. This balance creates incentives to invest and operate efficiently. Within such framework, investors accept downside risk because they are allowed to retain upside gains when they arise. ANP's approach departs from these principles: by reducing the opening RAB to account for revenues earned in the past, ANP effectively removes returns *ex post*. This changes the economic consequences of past commercial arrangements after the fact and therefore constitutes a retroactive intervention.

Third, the retroactive nature of the RCM is even clearer because many of the assets and contracts that ANP corrects with the RCM were in place before the 2009 regulatory framework and were explicitly excluded from ANP's tariff approval process.¹⁸ Applying a backward-looking recovery test to these contracts changes the economic outcome of commercial arrangements that were entered into under a different regulatory framework and despite the expectations that TAG had formed at the time. ANP's own reasoning confirms this point. In Technical Note 15, ANP describes the revenues earned under these contracts as being "*higher than would be regulatory acceptable*"¹⁹ and replaces the actual returns earned with a calculated "*fair return on capital*" when determining the opening RAB.²⁰

The RCM therefore reopens past commercial outcomes and changes their economic consequences after the fact. This is inconsistent with the expectations created under the pre-

¹⁶ Resolution No. 991/2026, Article 13.

¹⁷ Resolution No. 991/2026, Article 6 § 1; and application in Technical Note 8, Section 6.

¹⁸ Law No. 11,909/2009, Article 31, as explicitly acknowledged by ANP in Technical Note 15, Section 3.3.2.

¹⁹ Technical Note 15, Annex II, Section 5.

²⁰ Technical Note 15, Annex II, Section 6.

2009 framework and with the principles of incentive regulation foreseen as a guiding principle for the determination of the 2026-2030 tariffs.²¹ More specifically, Resolution 991/26 ANP introduces incentive regulation, which allows the investors to keep some of the gains to incentivise efficiency that ultimately leads to lower tariffs for customers. Applying retroactive methodologies such as the RCM, which strip investors of all gains achieved through increased efficiency, goes against this principle.

Importantly, as explained in the following section, it also creates regulatory uncertainty and weakens incentives for efficient investment and operation.

4.3 ANP's emphasis on short-term tariff affordability comes at the expense of long-term economic efficiency

By applying a backward-looking approach, the RCM can reduce the opening RAB to reflect what ANP considers to be excess historical returns. Under a building block approach, the opening RAB determines both the return on capital and the depreciation allowance. If the opening RAB is set below the value of the assets, the transporter's allowed revenues and cash flows are reduced. While it may benefit current users through lower tariffs in the short term, it can do so at the expense of long-term economic efficiency.

In this section, we demonstrate that a RAB that is artificially understated can lead to three forms of inefficiency:

- **Productive inefficiency:** TAG may not have sufficient cash flow to maintain and operate the network efficiently.
- **Dynamic inefficiency:** TAG and future investors may have weaker incentives to undertake sustaining and replacement investments.
- **Intertemporal inefficiency:** current users may benefit from lower tariffs, while future users bear the costs through lower reliability, catch-up investment and higher financing costs.

We discuss the productive and dynamic inefficiency in Section 4.3.1 and the intertemporal inefficiency in Section 4.3.2.

²¹ Resolution 991/2026, Art. 9. The fact that 2016

4.3.1 By artificially reducing the value of the RAB, the RCM weakens incentives to maintain and invest in the network

TAG may not have sufficient cash flow to maintain the network efficiently

A materially understated RAB reduces the revenues available to fund the operation and maintenance of the network. In particular, TAG may need to rely on cash-flows that would otherwise support day-to-day operations in order to fund capital expenditure.

Gas transmission assets require continuous maintenance and periodic replacement of low-visibility assets, including control systems, metering equipment, power supply systems and safety-critical components. Deferring these investments may reduce short-term cash requirements, but over time, this can weaken TAG's ability to maintain assets efficiently and sustain the quality of service expected by users. It can increase outage risk, emergency maintenance costs and compliance risk.

TAG and future investors may have weaker incentives to invest in sustaining and replacement CAPEX

By reducing the opening RAB, ANP reduces future allowed revenues and weakens the cash flows available to support investment. This can reduce TAG's ability and incentive to undertake sustaining and replacement investments, other than the mandatory ones.

This concern is particularly relevant given the nature of TAG's planned investments. These include expenditures necessary to preserve the existing network and maintain operational efficiency, rather than to expand capacity.²² For example, TAG proposes investments to replace obsolete programmable logic controllers, noting that the Northeast Network includes more than 70 programmable logic controllers and that around 80% are already officially obsolete.²³ TAG also states that the intervention is not intended to increase capacity, but to preserve existing capacity and ensure continuity of current service.²⁴

The consequence of an unreliable RAB framework may be the deferral of investments that are needed to maintain the safety, reliability and efficiency of the existing network.

²² Specifically, for the period 2026-2030, in Technical Note 8 ANP allowed R\$ 284 million and R\$ 427 million of sustaining capex on respectively a conditional or contingent basis, while not allowing any expansion capex. (Technical Note 8, Table 19)

²³ TAG Technical Note on the Value of the regulatory asset base subject to the tariff review, submitted for Technical note 8, page 164.

²⁴ TAG Technical Note on the Value of the regulatory asset base subject to the tariff review, submitted for Technical note 8, page 173.

4.3.2 Current users may benefit from lower tariffs, while future users bear the costs through lower reliability, catch-up investment and higher financing costs

A preliminary consideration which is essential to highlight is that the extent to which a lower RAB would translate into lower tariffs for end users may be uncertain. It will depend on the degree to which tariffs paid by shippers are passed through to consumers. Some downstream or retail contracts may not provide for cost pass-through at all. Reviewing the evidence on the extent of any potential pass-through falls outside the scope of this report. But we note that it cannot be assumed that end consumers will necessarily and systematically benefit from lower tariffs.

This said, tariff affordability it is not the only objective that ANP must pursue in relation to consumer welfare. Consumers benefit not only from lower tariffs today, but also from a reliable network, efficient maintenance, efficient investment and a predictable regulatory framework that supports affordable tariffs over time.

A lower RAB can undermine these objectives in two ways.

First, as explained above, lower cash flows may lead to reduced maintenance and lower sustaining investment. While this may lower tariffs in the short term, it can result in asset deterioration, lower service quality and the need for significant catch-up investment in the future. Future consumers would ultimately bear these costs through higher tariffs and greater reliability risks.

Second, ANP's application of the RCM may increase financing costs for future investment:

- Weaker cash flows can weaken TAG's ability to raise debt and its credit metrics. Creditors will consider whether TAG's regulated revenues are sufficient to support debt service and sustaining investment. If the RAB is too low, TAG may not earn sufficient revenues from its allowance for return on the RAB and depreciation. This can weaken credit metrics and increase the cost of debt as evidenced by rating methodologies and reactions to regulatory announcement.²⁵
- Equity investors may also require a higher return to compensate for greater regulatory risk. ANP has changed its approach to asset valuation and has introduced a methodology

²⁵ Inefficiently low RAB and an unstable regulatory environment can affect negatively the credit rating of a company. Credit rating companies explicitly consider the regulatory environment when assigning a credit rating. (<https://www.spglobal.com/ratings/en/credit-ratings/about/understanding-credit-ratings>). Specifically, Moody's methodology for non-financial corporate companies in Brazil explicitly considers regulatory trends, regulatory pressure to a company's finances, regulatory changes and regulatory challenges to requested costs. ([ML-BR-Non-Financial-Corporates-Methodology-EN.pdf](#)). In the past, utilities have been downgraded despite positive revenue outcomes, following poor regulatory environment (<https://www.ctinsider.com/business/article/moodys-downgrade-eversource-connecticut-cl-p-20393225.php>).

that retroactively adjusts the opening RAB based on revenues earned in the past. Such retroactive intervention will undermine investor confidence, not only in the gas sector but more broadly across regulated infrastructure sectors. It creates uncertainty as to whether efficient and prudent investments will continue to be recognised and remunerated in the future, and whether investors will be allowed to retain the benefits of those investments, independently of ANP's ex post view on "*fair return*". Investors may therefore perceive a greater risk that future regulatory decisions could reopen past commercial outcomes.²⁶ As acknowledged multiple regulators,²⁷ increased regulatory risk raises the return required by investors and, ultimately, to discourage investment and growth. ANP was aware of this risk²⁸ but ignored it for the purpose of (ineffectively) recouping over-remuneration.

As a result, higher regulatory risk is likely to increase the WACC required by debt and equity investors. While consumers may therefore benefit from lower tariffs in the short term, they may face higher financing costs and higher tariffs in the medium and long term.

4.4 ANP does not reach its objective to prevent over-remuneration of the transporter because its RCM methodology is flawed

In Technical note 15, ANP argues that tariffs from Northeast Network Legacy Contract with excessive prices enabled substantial capital recovery during 2006-2025 and that the RCM is therefore needed to avoid over-remuneration (or "*double recovery*" in ANP's terms).²⁹

However, ANP's technical application of the RCM is flawed and incapable of estimating TAG's alleged "*double recovery*".³⁰

In its application of the RCM, ANP estimates replacement costs to determine the costs for pre-2006 assets, based on unit costs observed in comparable US transmission pipeline projects as of December 2025.³¹ Specifically, ANP estimates the costs for existing pipelines built between 1970 and 2005 based on cost estimates for pipelines built between 2004 and 2005, without making any adjustments for the asset's age or physical condition.³² ANP motivates its

²⁶ UBS downgraded United Utilities from "buy" to "neutral" because of its negative exposure to regulatory change.

²⁷ For example, the US National Association of Regulatory Utility Commissioners (NARUC) notes that regulatory risk is one of the most important business risks for utilities and that investors assess regulatory quality when judging utility risk. See [NARUC, COST OF CAPITAL AND CAPITAL MARKETS PRIMER FOR UTILITY REGULATORS](#) (2019), page 9. Also, a [report](#) commissioned by the UK economic regulators and the UK Office of Fair Trading considers regulatory risk as one of the elements that affects the systematic risk, which is an element that determines the cost of equity.

²⁸ „Frequent or retroactive changes in methodology tend to increase regulatory risk and the cost of capital, affecting the economic and financial sustainability of the service and the institutional credibility of regulation.“ (Technical note 2, para. 52)

²⁹ Technical Note 15, Section 2.1.

³⁰ In Section 5 we also show that ANP's application of the RCM is unreliable.

³¹ Technical note 15, Annex II, Section 2.1.

³² Technical note 15. Section 2.4.2.

choice by referring to the Australian National Gas Rules (NGR) and a Brattle report on the application of the NGR.

However, the use of replacement costs within the RCM is inconsistent with both the principles of the RCM itself and regulatory precedents, contrary to ANP's assertions.

First, combining the RCM with replacement-cost valuation inevitably produces inconsistent and unreliable RAB estimates. The purpose of the RCM is to reconcile the historical costs actually incurred by an operator for its existing investments with the historical revenues earned to recover those costs. Replacement-cost valuation, by contrast, seeks to estimate the cost of recreating the asset base today rather than the costs actually incurred when the investments were made. Depending on how the costs have evolved between today and when the investment in the assets was initially made, the replacement-cost valuation can result in higher or lower opening RAB and only by accident estimate historical costs correctly.

Hence, replacement-cost valuation is inherently forward-looking and is generally used in tariff-setting frameworks that seek to reflect the cost of future investment.

The Brattle Group report cited by ANP in Technical Note 15 explicitly recognises this distinction, noting that a valuation based on replacement costs *"does not provide investors with a normal rate of return on their existing investments (except by accident)"*³³. The report also clearly states that the RCM should be based on construction costs rather than replacement costs.³⁴

Second, in Technical note 15, ANP justifies departing from actual construction costs and relying on replacement costs instead for pre-2006 assets by referring to two Australian non-scheme pipelines cited by the Brattle group report (MAPS and APA pipelines)³⁵. However, ANP appears to be misinterpreting these precedents. In both examples, asset valuation was not based on replacement costs. Instead, they both relied on adjusted historical costs: in the MAPS case, alternative proxies for historical revenues and costs were used for the period during which the pipeline was regulated; in the APA case, historical costs were reallocated across different parts of the business.³⁶

³³ BRATTLE GROUP. Financial information disclosed by gas pipelines in Australia. Boston: The Brattle Group, 2018, para. 63. https://www.brattle.com/wp-content/uploads/2021/05/18330_financial_information_disclosed_by_gas_pipelines_in_australia.pdf.

³⁴ *"For the RCM, service providers are required to report the construction cost, additions and disposals for two broad categories of assets (direct assets and shared assets) for every year since the construction of the pipeline"*. BRATTLE GROUP. Financial information disclosed by gas pipelines in Australia. Boston: The Brattle Group, 2018, para. 112.

³⁵ Technical note 15, section 2.4.2.

³⁶ BRATTLE GROUP. Financial information disclosed by gas pipelines in Australia. Boston: The Brattle Group, 2018, para. 82-83. https://www.brattle.com/wp-content/uploads/2021/05/18330_financial_information_disclosed_by_gas_pipelines_in_australia.pdf

4.5 ANP's proposed application of the RCM should not be adopted as the basis for determining TAG's opening RAB

ANP's proposed application of the RCM contradicts a number of ANP's objectives.

First, the approach contradicts ANP's principles of regulatory stability, internal coherence and the principles of incentive regulation, under which investors bear downside risk but must also be able to retain upside gains when they arise. In TN 8, ANP concluded that the available information was insufficient to apply the RCM in a technically consistent and prudent manner. In Technical Note No. 15/2026, ANP nevertheless applies the RCM without demonstrating that the previously identified data limitations have been resolved. In addition, in TN 8 ANP disregarded the use of historical costs to determine the RAB for reasons that are also applicable to RCM.

Furthermore, the legacy contracts were entered into and performed under a different regulatory framework, outside the current ex ante tariff regime. Applying the RCM now requires ANP to reassess, after the fact, what level of return should have been earned during the legacy period. That is equivalent to reopening the economic consequences of past commercial arrangements. And it is inconsistent with the incentive regulation applied by ANP for all regulated assets (including Malha Nordeste assets going forward) that allows the investors to keep some of the gains to incentivise efficiency that ultimately leads to lower tariffs for customers.

Second, ANP's approach risks undermining economic efficiency. A materially understated RAB may reduce tariffs in the short term, but it can also weaken the cash flows available to maintain the network, finance sustaining investment and support the credit quality of the transporter. Over time, this may increase reliability risks, raise financing costs and result in poorer outcomes for users.

Finally, ANP presents the RCM as a tool to prevent double remuneration of capital. However, the methodology does not achieve that objective in the circumstances of TAG's Northeast Network Legacy Contract. ANP's implementation relies on a backward-looking reconstruction of revenues and costs, but it does so using assumptions that are inconsistent with the logic of the RCM itself, including the use of replacement costs rather than actual historical construction costs for pre-2006 assets. As a result, the methodology does not provide a reliable measure of whether capital has in fact been recovered.

For these reasons, ANP should not adopt the RCM to determine the opening RAB value of the Malha Nordeste pipeline. ANP's application of the RCM is not consistent with its own regulatory objectives – it weakens regulatory stability and internal coherence, and it risks producing inefficient outcomes for both TAG and network users. At the same time, ANP's application of the RCM does not provide a robust basis for preventing double remuneration.

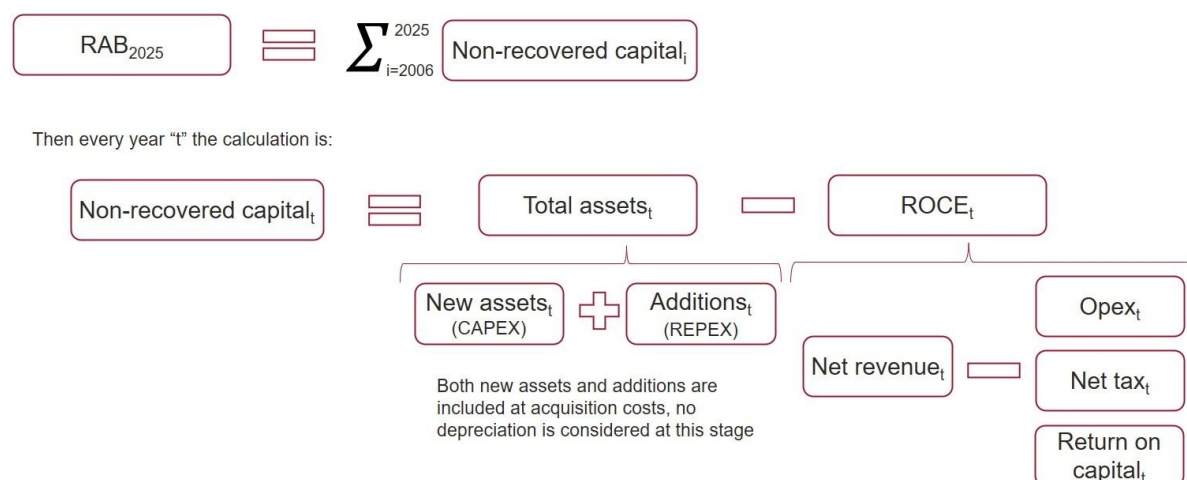
5 ANP's application of RCM relies on unjustified inputs and assumptions which result in an unreliable and underestimated RAB

The RCM as applied by ANP aims at reconstructing historical cash flows associated with the Malha Nordeste assets. Technical Note 15 describes the RCM as a backward-looking financial test that reconstructs historical revenues, operating costs, taxes and the return on capital to estimate the amount of capital remaining unrecovered at the end of the legacy period.

To implement this approach, ANP:

- First estimates the capital invested.
 - For pre-2006 assets it uses the depreciated replacement cost for pre-2006 assets using US EIA pipeline project benchmarks;
 - For 2006 onwards, it uses historical accounting data;
- Then calculates the return of capital obtained by TAG until the end of 2025. This return is calculated as:
 - The estimated annual net revenues for 2006–2025;
 - Minus the estimated costs incurred, which include the estimated OPEX, taxes and the interest earned on the capital invested;
- And finally calculates the residual RAB at the end of 2025 by subtracting the return of capital earned by TAG until the end of 2025 to the capital invested.

Figure 1 Schematic description of the RCM methodology as applied by TAG



Source: Frontier Economics

ANP's application of RCM to the assets relating to the Northeast Network Legacy Contract results in an opening RAB of approximately R\$595 million.

In this section we review the methodology and inputs used by ANP to estimate the residual value of the assets and analyse the impact of using alternatives which correct for the errors and methodological issues identified. Specifically:

- In relation to the capital invested:
 - We assess the replacement-cost estimates used for assets that already existed in 2006. ANP does not rely on the actual historical construction costs of these assets. Instead, it estimates 2006 replacement values using a benchmark of US pipeline projects. We explain that this is conceptually inconsistent with the RCM and show that, even if replacement costs were accepted, ANP's benchmark relies on inconsistent data and requires further adjustment and cross-checking.
 - We calculate the impact on the resulting 2026 RAB of using a 40-years regulatory asset life instead of the 30-year regulatory asset life used by ANP. 40 years is closer than 30 years to the economic life of the asset (which is what RCM is assessing) and is the minimum applied across the European countries³⁷.
 - We correct the dates used by ANP as the starting point to depreciate the assets. We apply two corrections: a) we apply commissioning dates for all the assets instead of ANP's unjustified mix of commissioning dates and capitalization dates; and b) use

³⁷ With the exception of Austria, which in 2021 reduced the regulatory asset life to 30 years due to the risk of asset stranding stemming from decarbonisation.

the commissioning dates indicated in ANP's Authorizations of Operations or validated ANP previous registers for each asset. These changes are relevant because: a) they affect the depreciated replacement value of pre-2006 assets; and b) they affect the methodology used to value two pipelines because ANP uses different valuation methodologies for pre-2006 assets and later assets.

- In relation to OPEX, ANP applies different methodologies to estimate OPEX over time, with materially greater transparency from 2018 onwards when TAG annual accounts become available. We explain why the pre-2018 estimates lack transparency and appear likely to be understated, and we propose an alternative estimation based on rolling back 2018 OPEX using IGP-M.
- In relation to the WACC, we explain why ANP's use of a floating annual WACC in the early part of the 2006-2025 period is not consistent with the evidence on long-term contracts and tariff setting methodologies. We also calculate the impact of two alternative options: a) assuming that the WACC remains constant during the early part of the 2006-2025 period; and b) assuming that the WACC remains constant between 2006 and 2025.

For each of these RCM inputs, we first describe ANP's approach, then explain the main methodological concerns, suggest alternative assumptions, and finally assess the impact of applying these.

Applying any of the adjustments we propose in isolation (ignoring combined effects from multiple adjustments) increases the value of the resulting RAB between 5 and 20 times the 2026 RAB calculated by ANP.

This reinforces our broader concern that ANP's RCM estimate should not be treated as a robust measure of capital recovery or as a reliable basis for setting TAG's opening RAB.

5.1 Reliance on unrobust replacement costs results in underestimating the 2026 RAB estimate by a factor of at least 4

As explained in Section 4, the purpose of the RCM is to determine whether investors have recovered their historical capital through historical revenues. ANP nevertheless departs from this principle and estimates replacement values for assets commissioned before 2006.

In addition to being inconsistent with the spirit of the RCM, estimating replacement values as of 2006 requires making assumptions that materially influence the resulting RAB.

ANP has relied on a single benchmark for replacement costs rather than testing a range of benchmarks. Specifically, it uses estimates of the cost of gas pipelines at the end of 2005 in

the United States. The implicit assumption is that pipelines' cost in Brazil at the end of 2005 was the same as the cost in the US.³⁸

Our analysis in Section 5.1.2 challenges ANP's application of the US benchmark. We first show that ANP has failed to consider whether US costs constitute a relevant benchmark and to adjust the benchmark for Brazilian import duties. We also note that ANP has not presented any cross-checks for the benchmark. We use two benchmarks to fill this gap and find that these cross-checks cast significant doubt on the reliability of the benchmark used by ANP. We estimate that the reliance on the US benchmark retained by ANP without adjustments results in an underestimation of the 2026 RAB by a multiple of at least 4.

5.1.1 ANP's approach relies on a single, unjustified and unrobust benchmark and fails to consider import duties

For assets commissioned before 2006, ANP chooses not to rely on the actual historical construction costs incurred by Petrobras. Instead, ANP estimates replacement costs as of 2006 using historical pipeline project data published by the United States Energy Information Administration (EIA). In ANP's model, this methodology is relevant for the 11 assets commissioned between 1981 and 2005, which were not fully depreciated by 2006.³⁹

ANP's methodology begins with a database of 111 pipeline projects completed between 2004 and 2006. Following a series of filtering criteria, including the exclusion of projects with incomplete information, projects involving multiple pipeline diameters and certain outliers, the sample is reduced to 61 projects. ANP then classifies these projects in 4 groups according to pipeline diameter and calculates weighted-average unit construction costs for each category, in US\$/m/inch. These unit costs are subsequently applied to the relevant TAG assets to estimate their replacement value as of 2006.

³⁸ ANP uses 2025 average R\$/US\$ rate from Banco Central do Brasil [lpeadata](#).

³⁹ There are 3 assets from 190, 1974 and 1975 which are fully depreciated by 2006 with the 30-year asset life considered by ANP.

Table 5 ANP's US benchmark

Category	Diameter range	Nr of projects	Length (km)	Total Cost (US\$ million)	US\$/m/inch (Weighted average)
I	≤10"	5	113	55.6	54.39
II	12"-20"	22	525	422.4	44.81
III	22"-30"	19	1,233	1,194.9	39.29
IV	>30"	15	1,699	1,387.5	22.08
TOTAL		61	3,570	3,060.4	-

Source: Frontier analysis based on ANP's model for TAG

This approach raises three main concerns.

- First, the EIA database does not appear to be a robust source of consistent and reliable data in this instance. It compiles project cost estimates reported by pipeline companies in regulatory applications, press releases and other public sources, sometimes even before the projects were completed. As a result, the reported project costs may reflect different estimation methodologies, levels of project maturity and reporting conventions across projects.⁴⁰
- Second, the benchmark is based exclusively on US pipeline projects. Project costs are influenced by a wide range of local factors, including labour costs, engineering standards, regulatory requirements, taxes, import duties, terrain and supply-chain conditions. Yet ANP does not provide any reason to believe that US construction costs are an appropriate proxy for pipeline construction costs in Brazil in the period.

⁴⁰ See 'Definitions' tab in the EIA Natural Gas Pipeline Projects Database, which contains the same number of projects as the database relied upon by ANP [EIA-NaturalGasPipelineProjects_May2018.xlsx](#). ANP states in section 4.1 of the Technical Note No. 15/2026/SIM-CTR/SIM/ANP-RJ that "The cost figures in the database reflect the total construction cost of the projects, including line pipe materials, direct field labour, miscellaneous costs (equipment, mobilisation, engineering supervision) and right-of-way, in accordance with the FERC standard project certification form. The database contains 840 projects of various types and from different periods."

The EIA explains that "EIA updates its Natural Gas Pipeline Project Tracker quarterly, based on the best available information from pipeline company websites, trade press reports, and government documents. These data reflect reported plans. These resources are not forecasts and do not reflect EIA's assumptions on the likelihood or timing of project completion." Source: [Recent completions of natural gas pipeline projects increase transportation capacity - U.S. Energy Information Administration \(EIA\)](#)

- And third, even if ANP considers the EIA database to be an appropriate benchmark for pipeline costs in Brazil, it fails to account for the import duties that would have applied at the time in Brazil.

5.1.2 Adjusting ANP's benchmark to include import duties increases the RAB by a factor of 4

For the reasons set out above, our primary position is that replacement costs should not be used within the RCM framework. The RCM should assess actual capital recovery, which requires historical costs and historical revenues.

However, even if replacement costs were a valid input to RCM, and if the EIA database was assumed to include reliable and homogeneous cost data, ANP's implementation would still be flawed. ANP applies a US benchmark to estimate Brazilian replacement costs but fails to recognise that these costs should be adjusted – at least – for import duties applying in Brazil.

In what follows:

- We calculate the replacement cost for pre-2006 assets applying the import duties applied by Brazil in 2006 to the cost estimated by ANP in the US.
- We calculate how the result of ANP's RCM model (the 2026 starting RAB) changes using the adjusted replacement costs.

Adding import duties to the US benchmark

We have first considered whether the benchmark costs already include import tariffs. Based on our review of the US tariff regime applicable in 2006, the main pipeline categories relevant to ANP's benchmark were generally subject to little or no import duty in the United States. Therefore, the US benchmark costs do not appear to embed import duties comparable to those applied in Brazil, and adding Brazilian TEC rates is a reasonable adjustment when translating US benchmark costs to a Brazilian replacement-cost estimate.⁴¹

⁴¹ Based on the 2006 Harmonized Tariff Schedule of the United States ("HTS"). Line pipe used for oil and gas pipelines (HTS headings 7304, 7305 and 7306) was generally subject to a 0% General Rate of Duty. Tanks and reservoirs (HTS heading 7309) were also generally duty-free, while pipe fittings (HTS heading 7307) were subject to materially lower duties than the Brazilian TEC rates applied in this analysis. Likewise, instrumentation, measurement and control equipment classified under HTS Chapter 90 was generally subject to low import duties, typically between 0% and 4.4%, compared with the 18% TEC rates applied to comparable equipment in Brazil. See U.S. International Trade Commission, [Harmonized Tariff Schedule Archive \(2006 edition\)](#), Chapters 73, 85 and 90.

Second, to adjust ANP's replacement cost estimates to add Brazilian import duties, we apply to each of the pipeline elements included in ANP's model the applicable import tariff according to the most likely NCM category⁴² in Mercosur's Common External Tariff (TEC)⁴³ as of 2006.⁴⁴

The resulting classification produces tariff rates ranging from 0% to 18%:

- For main pipeline and mechanical equipment, including pipelines, valves, filters, heaters, compressors, generators and related equipment: 14%;
- For instrumentation and electrical control equipment: 18%;
- For other electrical equipment, including signage plates, UPS systems and batteries: 16%; and
- For specific items and services without a clear NCM classification: 0%.

Impact of including import duties in ANP's US benchmark

Adjusting US pipeline costs with tariffs increases the average unitary cost by 14.2%, from 45.95 US\$/m/in to 52.5 US\$/m/in. The replacement value (at 2006) of assets commissioned before 2006 also increases by 14.2%, from 450 US\$ million, to 514 US\$ million.

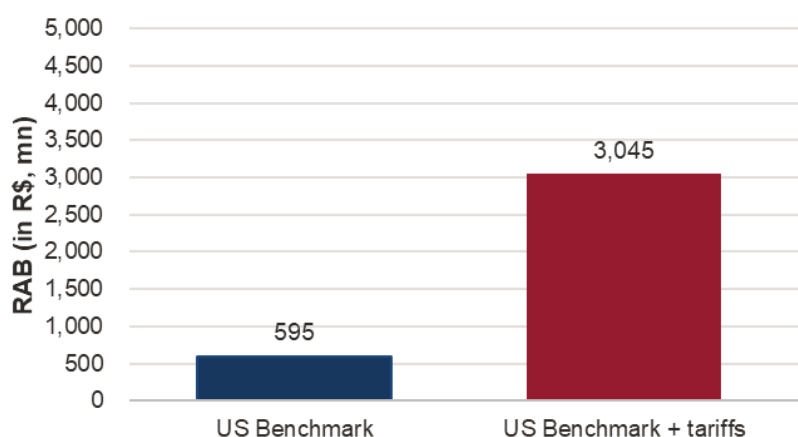
As we present in Figure 2, the sensitivity of the 2026 RAB to the replacement value at 2006 is very large: the new replacement cost at 2006 is five times larger than ANP's RAB.

⁴² The NCM (Nomenclatura Comum do Mercosul) is the 8-digit tax classification code used by Brazil and other Mercosur member states to identify and categorize goods in international trade and domestic transactions

⁴³ Tarifa Externa Comum, Mercosur, 2006 [RESOLUÇÃO CAMEX Nº 43, DE 22 DE DEZEMBRO DE 2006](#)

⁴⁴ Assets with a clear customs classification, such as pipelines, valves, filters, compressors, heaters, instrumentation and electrical panels were mapped to the specific NCM code most commonly associated with equivalent equipment in Brazil. Where no robust NCM classification could be identified from the available description, such as civil works, engineering services, commissioning activities and certain miscellaneous assets, a 0% tariff was conservatively applied.

Figure 2 Impact on 2026 RAB of including import duties in replacement costs



Source: Frontier Analysis based on ANP mode and, Mercosur's Common External Tariff

5.1.3 Additional benchmarks for 2006 pipeline costs increase the resulting RAB by a factor of more than 4

The adjustment to ANP's benchmark in the previous section does not solve two of the issues we flagged: no justification to rely solely on this US benchmark and potential problems with this database. It is regulatory best practice to rely on cross-checks where data limitations lead to relying on benchmarks that may suffer from comparability issues. ANP has not presented any such cross-check in Technical Note 15.

In order to test fill this gaps, we have considered two benchmarks: one of comparable costs in Europe and one of comparable costs in Brazil. We note that both have a limited sample size, but they are worth considering as cross-checks.

European benchmark

The European Commission commissioned a study that analyses the costs of gas pipeline projects in Europe from 2004 to 2006.^{45,46} The sample includes 17 projects, all of which are Projects of Common Interest (PCIs) or Projects of European Interest (PEIs).⁴⁷

The sample size is more limited than ANP's US sample. For this reason, we do not create separate diameter groups. The following table shows the main characteristics of the cost of the European pipelines.

Table 6 European benchmark

Variable	Weighted average by length	Range (min - max)
Diameter (in)	43.3	23 - 56
Length (km)	926	100 - 3,300
Total cost per project (US\$ million)	4,006	98 - 6,640
US\$/m/inch	52.7	4.1 - 142.8

Source: Frontier analysis based on TEN-E report.

Note: Where information is missing in the TEN-E report, we supplement it with [Global Energy Monitor](#)

Brazilian benchmark

ANP publishes a report on the statistical analysis of the costs of constructing oil and gas pipelines in Brazil.⁴⁸

⁴⁵ Implementation of TEN-E projects (2004-2006) Evaluation and Analysis. [TEN E EvaluationAnalysis Report.doc](#)

⁴⁶ The TEN-E report reviews the implementation of priority energy infrastructure projects during the 2004-2006 period. As such, it includes projects at different stages of development, including some that entered operation after 2006. We do not consider this to materially affect the benchmark, as the report provides contemporaneous cost estimates for projects being planned, authorised or constructed during the relevant period and therefore remains informative of pipeline construction costs around 2006.

⁴⁷ As explained in the opening paragraphs of Section 5.1.2, the purpose of the two alternative benchmarks is simply to illustrate that ANP's US benchmark is unrealistic if no import duties are considered. There is no need to include import duties in our alternative benchmarks. Doing so would only increase costs further, making the gap with the US benchmark even larger. Moreover, if importing equipment into Brazil had been more expensive than sourcing comparable inputs from the US, a Brazilian importer would likely have chosen the US source instead.

⁴⁸ Statistical analysis of the costs of constructing oil and gas pipelines in Brazil. [Microsoft Word - NT_15_2019_custos REIDI rev final.docx](#)

From this report, we selected only gas pipeline projects and then identified the projects we considered relevant based on date of construction. This leads to two relevant projects. We deflate these costs 2006 using IGP-M and convert them into US dollars using the 2006 exchange rate of R\$2.18/US\$.

Table 7 Brazilian benchmark

Project	Year	Length	Diameter	Original cost
Guamaré-Cabo (Nordestao)	2004	31.8 km	12 inches	R\$ 43m
Cacimbas-Catu (GASCAC)	2007	946 km	28 inches	R\$ 3,547m

Source: Frontier analysis based on ANP report.

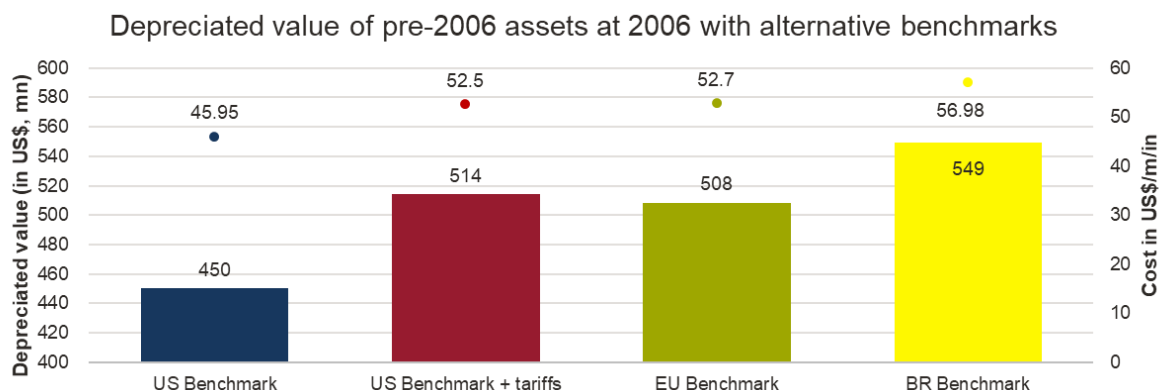
Impact on 2026 RAB

The following figure compares the average unit costs and depreciated value (at 2006) of assets commissioned before 2006 under the different benchmarks for replacement costs.

Average unit costs under the alternative benchmarks range between 52.5 and \$56.9 US\$/mi/in, equivalent to 14% to 24% above the US benchmark before adjustment for Brazilian import duties. The depreciated 2006 replacement costs under these alternatives range between US\$514 million and US\$549 million, respectively 14% and 22% above the value estimated by ANP.

Therefore, applying the tariff adjustment to ANP's US benchmark produces results that are broadly consistent with the European and Brazilian cross-checks, and materially above ANP's original estimate. This reinforces the point that ANP's unadjusted US benchmark is likely to understate replacement costs.

Figure 3 Unitary cost and depreciated value of pre-2006 assets with alternative benchmarks

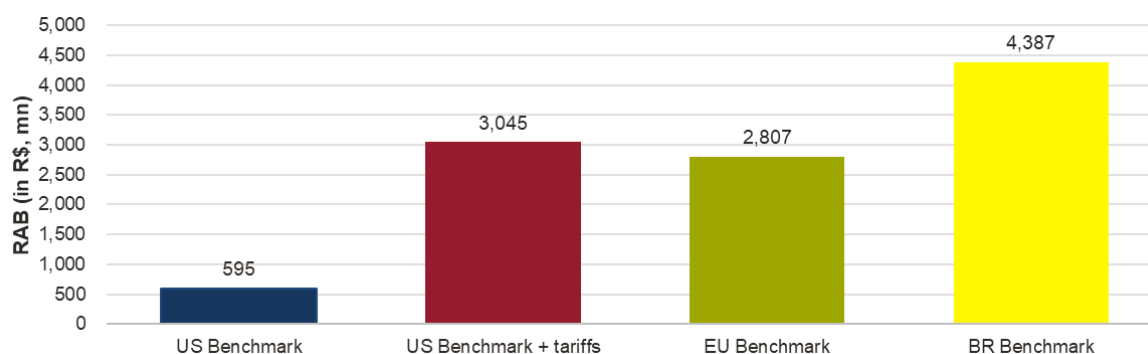


Source: Frontier analysis based on ANP model, Mercosur's Common External Tariff, EIA data, TEN-E report and ANP Brazilian pipeline-cost report

Note: A larger weighted average cost does not necessarily imply a larger depreciated value. Since cost per unit is not the same for all projects in the US benchmark (with projects classified in 4 groups), a larger depreciated value will come not only from a higher cost per unit but also on the distribution of cost per unit across projects and the life time left for each pipeline. A larger depreciated value, which already accounts for the remaining life of each asset, does always imply a larger RAB.

Figure 4 below shows how the underestimation of 2006 replacement values is amplified by the subsequent stages in the implementation of the RCM methodology and thus drives the 2026 RAB to be likely underestimated by a factor of at least 4.7.

Figure 4 Impact on 2026 RAB of alternative benchmarks for 2006 replacement costs



Source: Frontier analysis based on ANP model, Mercosur's Common External Tariff, EIA data, TEN-E report and ANP Brazilian pipeline-cost report

5.2 Aligning asset lives with international regulatory practice increases the resulting 2026 RAB estimate by a factor of 5 to 8

A key input into ANP's RCM methodology is the asset life assumed for gas transmission pipelines. Under ANP's application of the methodology, the asset life assumption directly affects the resulting 2026 RAB because:

- It excludes depreciated assets;
- It calculates the investment cost of pre-2006 assets as the depreciated replacement cost in 2006; and
- The asset life affects the depreciation, which affects the tax liabilities from 2006.

5.2.1 Evidence suggests ANP has assumed too short asset lives

ANP retains a regulatory asset life of 30 years for gas transmission pipelines.

This life is both shorter than the life used in other countries; and shorter than the economic life of the assets. The latter is all the more relevant as RCM aims at reconstructing economic flows and, consistently with that, considers the assets until they cease to operate. Therefore, the economic life of the assets should be used when calculating the depreciation.

Asset lives in Europe

European regulatory benchmarking indicates that:

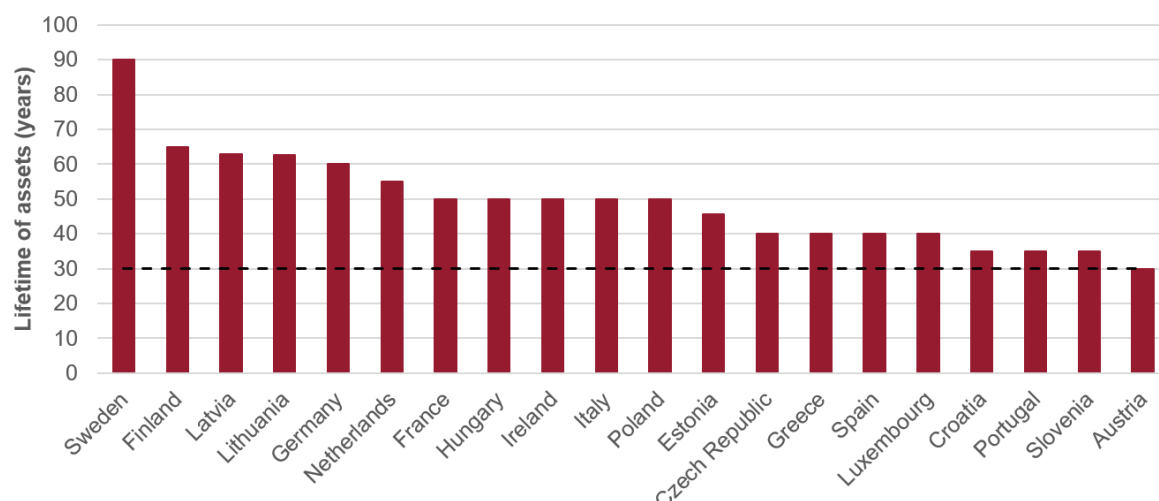
- All European regulators apply asset lives materially longer than 30 years⁴⁹;
 - The only exception is Austria, where the asset life was reduced recently to 30 years to avoid the risk of asset stranding due to decarbonisation. However, this is not a comparable example, as we have not seen evidence that decarbonisation is to lead

⁴⁹ Austria is the only jurisdiction identified in the benchmarking exercise that applies a 30-year regulatory life to gas pipelines. However, Austria should not be interpreted as evidence that 30 years represents a typical technical life for gas transmission assets. The available regulatory documentation indicates that Austria introduced a specific regulatory reform in 2021 aimed at addressing stranded asset risk associated with expected demand decline and decarbonisation. The reform shortened depreciation periods as a policy response to these concerns, rather than as a reassessment of the technical life of gas transmission infrastructure. The DNV report (2022) notes that Austria: *"recently (2021) changed its depreciation method so that the regulatory depreciation time now equals the depreciation used for accounting purposes. As a result, shorter depreciation periods are applied, to address the potential risk of asset stranding"*. More recent, Austrian regulatory documentation also indicates that different regulatory treatment applies to investments made before and after 2021, further confirming the transitional nature of the reform. Austria therefore appears to represent a specific stranded-asset mitigation case rather than a representative benchmark for the technical life of gas transmission pipelines.

to the widespread disuse of gas pipelines built before 2006 in Brazil before they reach 30 years of age.

- Average asset lives are around 40 to 50 years, with several regulators applying lives substantially above 50 years.⁵⁰

Figure 5 Regulatory asset lives of gas pipelines in Europe (years)



Source: DNV (2022), *Future Regulatory Decisions for Natural Gas Networks*, prepared for the Agency for the Cooperation of Energy Regulators (ACER), Table 2 "Regulatory asset lives (years)", based on responses from European National Regulatory Authorities (NRAs).

Note: In Germany, regulatory asset lives for steel pipelines with cathodic protection are 55-65 years; in Estonia, the DNV report identifies values of 27, 50 and 60 years; and in Lithuania, values of 55 and 70 years. For the purposes of this figure, the average value has been used in each case.

Economic life of the assets

Economic life of gas assets is normally higher than 30 years. The available evidence suggests that regulatory asset lives may understate the period over which gas transmission assets continue to provide service. Natural gas pipelines are identified as the asset category most likely to remain in operation beyond the end of their regulatory asset lives, reflecting long technical life expectancy.⁵¹

In line with this, Brazil's Northeast network, ANP's RCM model shows that 6 of the 14 assets commissioned before 2006 will be 30 years or more by 2026 and, according to ANP's model,

⁵⁰ Future regulatory decisions on natural gas networks: repurposing, decommissioning and reinvestments, Section 4.4.1. Source: [acer.europa.eu/sites/default/files/documents/Media/News/Documents/Future Regulation of Natural Gas Networks - Final Report DNV.pdf](https://acer.europa.eu/sites/default/files/documents/Media/News/Documents/Future%20Regulation%20of%20Natural%20Gas%20Networks%20-%20Final%20Report%20DNV.pdf)

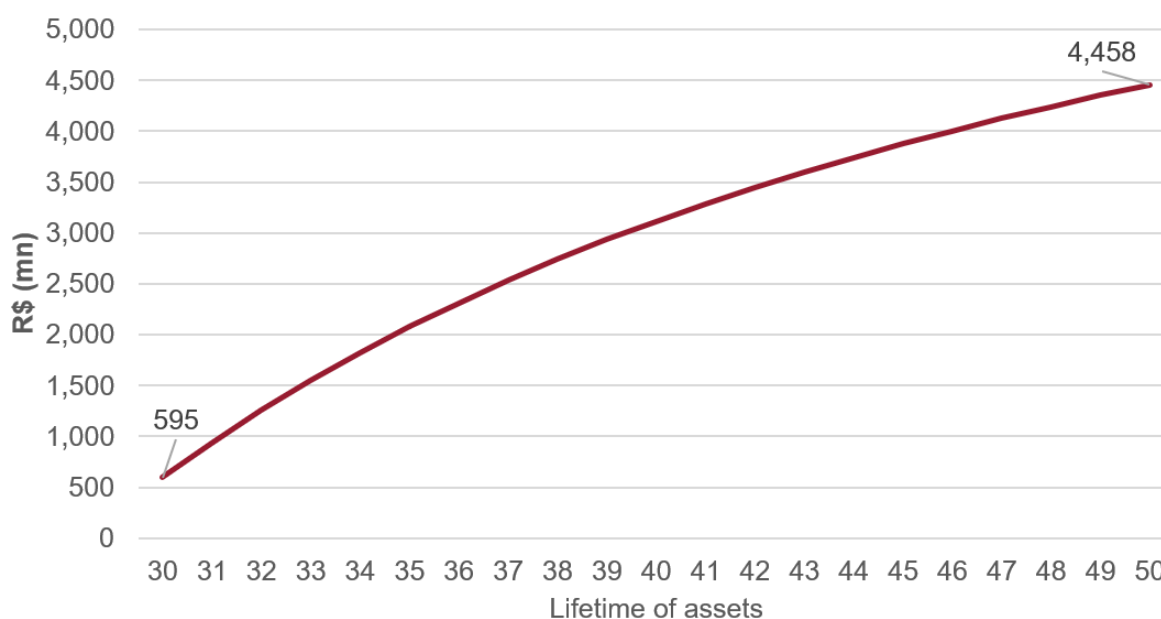
⁵¹ Future regulatory decisions on natural gas networks: repurposing, decommissioning and reinvestments, Section 4.4.1. Source: [acer.europa.eu/sites/default/files/documents/Media/News/Documents/Future Regulation of Natural Gas Networks - Final Report DNV.pdf](https://acer.europa.eu/sites/default/files/documents/Media/News/Documents/Future%20Regulation%20of%20Natural%20Gas%20Networks%20-%20Final%20Report%20DNV.pdf)

all of them will still be operating. On the contrary, we are not aware of any assets in Malha Nordeste that stopped operating before reaching 30 years of service.

5.2.2 Aligning asset lives with international precedent increases the 2026 RAB value by a factor of 5 to 8

Figure 6 below shows the sensitivity of the resulting 2026 RAB to alternative regulatory asset lives between 30 and 50 years. Note that the analysis only adjusts the regulatory asset life used in the model until 2006 and holds tax depreciation assumptions constant at 30 years. Keeping a 30-year asset life for tax purposes leads to a lower estimated 2026 RAB than using a 40-year asset life, but it is in line with the objective of the RCM methodology of replicating actual tax payments.

Figure 6 Impact of regulatory asset lives on the 2026 RAB



Source: Frontier analysis based on ANP model for TAG

As shown in Figure 6:

- Increasing the asset life from 30 to 40 years increases the resulting 2026 RAB from approximately R\$595 million to approximately R\$3.1 billion (5.2 times increase);
- Increasing the asset life to 50 years increases the resulting RAB to more than R\$4.5 billion (7.6 times increase).

5.3 Adjusting asset commissioning dates to reflect the dates in ANP's Authorisations of Operation increases the resulting 2026 RAB estimate by a factor of nearly 7

The commissioning date assigned to each asset is a key input into ANP's RCM methodology. Under ANP's application of the model, the selected date directly affects the resulting RAB because:

- It determines the age attributed to each asset and therefore the accumulated depreciation applied under the RCM for pre-2006 assets; and
- It determines whether an asset is treated as a pre-2006 or post-2006 investment, which affects the valuation methodology applied to the asset.

5.3.1 ANP inconsistently uses capitalisation dates and authorization of operation dates

ANP applies different date conventions across different groups of assets, using operation dates for some assets and capitalisation dates for others.

For assets commissioned before 2006, ANP determines asset age using the operation dates reported in the tab "*Evolução Malha Nordeste (KM)*" of the model.⁵² By contrast, for post-2006 investments ANP relies mainly on the "*Data de Imobilização*" (capitalisation date), even though operation dates for those same assets are also available in the "*Evolução Malha Nordeste (KM)*" tab.⁵³

ANP provides no explanation or justification for applying different date conventions to pre-2006 and post-2006 assets.

The use of capitalisation dates for some assets and operation dates for others materially affects the age attributed to assets and, consequently, the depreciation accumulated under the RCM. In the absence of any regulatory justification, the methodology should apply a single and consistent date convention across the entire asset base.

5.3.2 Dates should be determined by Authorization of Operation/ Initial Operational Date

As discussed in Section 5.3.1, ANP uses capitalisation dates to include assets acquired after 2006. However, since the RCM aims at reflecting the economic depreciation, the relevant date

⁵² Column N of the spreadsheet.

⁵³ "*Data de Imobilização*" (capitalisation date) is reported in column I of the "3.1 – CAPEX_BRA_R2" tab. This is then used in the "CORE_CAPEX" tab.

is the date the asset is placed into service (commissioned), not the date it is immobilised or capitalised in the accounting records.

This is in line with Technical Note 15, which states that assets are registered according to the year of start of operation.

However, we observe in ANP's model this is not always the case. We have assessed the impact of this mistake on the 2026 RAB value. In order to obtain dates of start of operation, we rely on the Authorization Notes issued by ANP for each of these assets, which are still available in the "Atos Oficiais" section in their website.⁵⁴

Table 8 compares the dates used in ANP's model with the corresponding AO dates obtained from the relevant ANP Authorizations – and Technical Note 15.

Table 8 **Dates in ANP's model v Authorization of Operation date**

Pipeline	Year (ANP Model, TN nº 15)	Year (AO)
Assets post-2006		
Açu-Serra Do Mel (GASMEL)	2009	2008
Carmópolis-Pilar	2008	2007
Catu-Itaporanga	2009	2008
Itaporanga-Carmópolis	2009	2008
EDG Catu	2009	2007
EDG Pilar	2009	2008
EDG Atalia	2011	2010
Assets originally pre-2006		
FAFEN-SERGAS	2001	2009
Nordestão loop	2001	2010

Source: Frontier analysis based on ANP Technical Note 15 and Technical Note 8.

Note: For all the 9 assets we use Authorization of Operation (AO) date. For the first 6 assets, this matches Technical Note 8. Authorization of Operation dates from ANP's Authorizations ,Nº 123, Nº 444 and Nº 561

⁵⁴ See, for example, Authorization 561 for Loop Nordestão in 2010 ([Autorização 561 2010 da ANP BR](#))

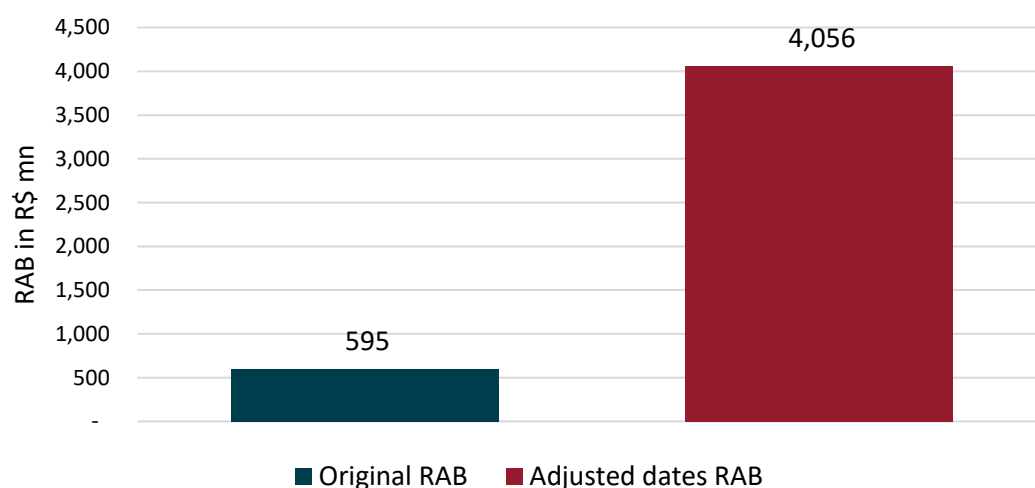
5.3.3 Using dates of the Authorizations of Operation increases the resulting RAB by nearly 7 times

As Table 8 sets out, there are 9 assets where ANP used dates that do not match authorization dates. This leads to:

- Two assets (FAFEN-SERGAS and Nordesteão loop) being classified as post-2006 instead of pre-2006 and therefore changing their valuation to historical costs instead of replacement costs; and
- Higher replacement value in 2006 for the other 7 pre-2006 assets.

Applying the authorization dates increases the resulting RAB by approximately R\$3.4bn, resulting in a RAB almost seven times larger than ANP's original estimate, as illustrated in Figure 7.

Figure 7 Resulting RAB from using AO dates



Source: Frontier Economics based on ANP's model, Technical Note 8 and Authorization of Operation dates from ANP's Authorizations Nº 444 and Nº 561

5.4 Using the most reliable data available on operating expenditure increases the resulting 2026 RAB estimate by at least a factor of 6

Operating expenditure (OPEX) is another input to ANP's RCM calculation. Under the RCM framework, historical revenues are compared against the costs that the transporter is deemed to have incurred over the relevant period. The treatment of OPEX therefore affects the amount

of capital considered to have been recovered and, consequently, the Regulatory Asset Base (RAB) remaining at the end of 2025.

In this section, we explain:

- The approach adopted by ANP to estimate OPEX between 2006 and 2025;
- Why the pre-2018 OPEX estimates lack transparency and are likely to be understated;
- The alternative methodology that is based on the most reliable data; and
- The impact of this adjustment on the 2026 RAB.

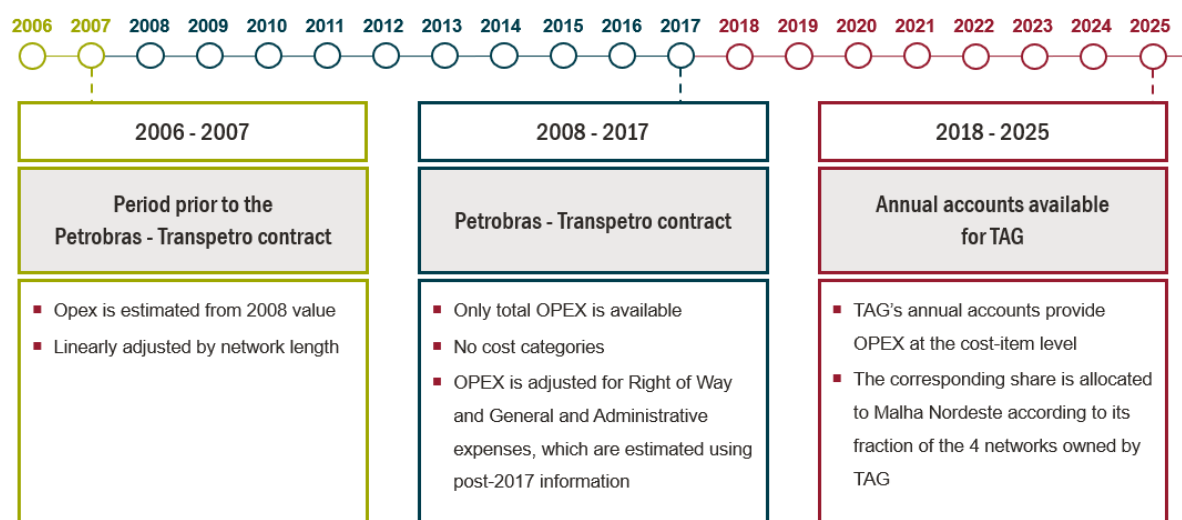
5.4.1 ANP uses non-transparent sources and unjustified assumptions

ANP does not apply a single OPEX methodology across the full 2006-2025 period. Instead, the model applies three different approaches, depending on the information available in each period.

- For 2006 and 2007, ANP did not have any direct OPEX information. It therefore estimated OPEX by taking the 2008 value and adjusting it for the differences in network length.
- Between 2008 and 2017 there are no individual accounts for TAG. ANP instead relied on OPEX from the Transpetro-Petrobras contract. This approach provides a total OPEX estimate but does not provide visibility of the underlying cost categories. ANP applies adjustments to include right-of-way costs and General and Administrative expenses (G&A).
- From 2018 onwards, ANP uses TAG's annual accounts. This data is available at cost-line level. From TAG's OPEX figures, ANP calculates Malha Nordeste's OPEX in proportion to network length⁵⁵. This is the only adjustment that ANP includes for OPEX from 2018 onwards.

⁵⁵ Malha Nordeste is one of four networks operated by TAG during the relevant period together with Sistema Gasene, Pilar-Ipojuca and Sistema Urucu-Coari-Manaus. In the model, Malha Nordeste represents 45.72% of TAG's network length.

Figure 8 ANP's methodology for OPEX



Source: Frontier analysis based on ANP model for TAG

We identify several limitations in ANP's approach.

The methodology used from 2018 onwards is materially more transparent than relying on the Petrobras-Transpetro contract. It allows individual cost categories to be identified, including insurance, licensing, third-party services and compression-related costs. By contrast, the pre-2018 methodology only provides an aggregate amount, with no visibility of individual cost items.

This is relevant because we should be able to confirm the pre-2018 amount captures the full set of costs that TAG incurred in providing transportation services. By looking at the model, one cannot confirm that Right-of-Way and G&A expenses are the only cost items not considered in this contract.

The use of different methodologies over time creates an artificial discontinuity in the OPEX series. In 2018, when ANP changes from using the Petrobras-Transpetro contract to TAG's annual accounts, OPEX increases by 40%. Even after removing the impact of inflation, OPEX still increases by 32% between 2017 and 2018.

Additionally, the 2006/07 adjustment multiplies 2008 OPEX by the proportion of network length compared to 2008. The implicit assumption from this adjustment is that OPEX increases linearly with network length. However, a material proportion of OPEX is fixed or semi-fixed. Network control, management, insurance, systems, operational readiness and other central support functions do not necessarily vary one-for-one with kilometres of pipeline. A linear adjustment for network length may therefore understate OPEX in years where the network was still undergoing an expansion.

5.4.2 We calculate OPEX using the most reliable information

Given the unreliability and transparency concerns affecting pre-2018 data, ANP should consider cross-checking their OPEX estimation with TAG's annual accounts, as this is the most consistent observable source. The post-2018 annual accounts provide two important advantages.

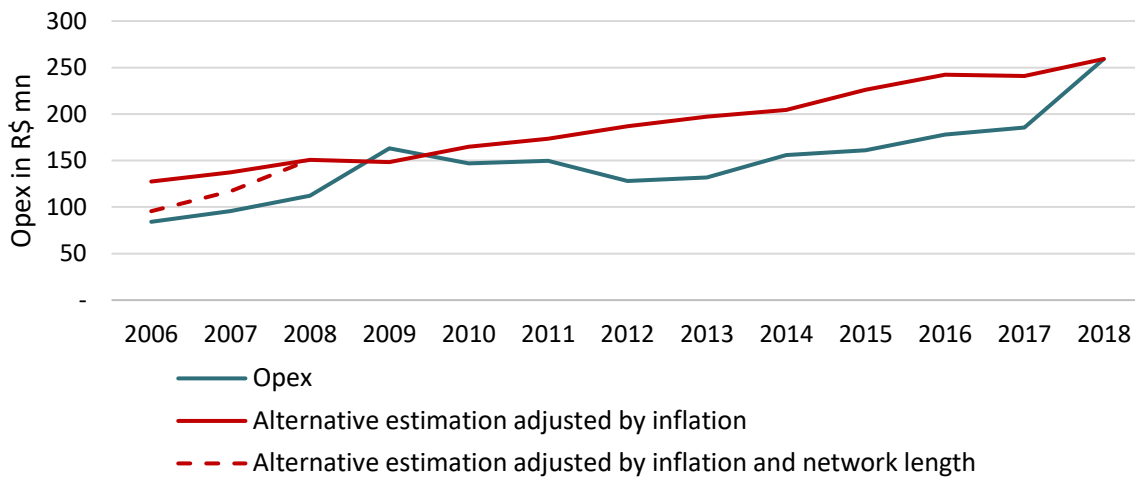
First, they are based on TAG-specific information rather than an indirect reconstruction. This is important because the RCM calculation is intended to assess the economic position of the transporter, not to derive a generic OPEX proxy. And second, they provide greater cost-line visibility. This makes it possible to confirm all relevant cost categories are included in the OPEX considered in the RCM.

We therefore present an alternative estimation methodology for the pre-2018 period. The proposed approach uses 2018 OPEX as the anchor point and rolls this value backwards using IGP-M. This applies the same logic consistently over the pre-2018 period and avoids relying on a less transparent historical OPEX series that appears to break materially when the methodology changes. This approach is consistent with the logic that ANP itself applies where direct information is unavailable.

For 2006 and 2007, years where the network was still undergoing an expansion, we calculate a range.

- We calculate the lower bound applying TAG's correction, which consists in adjusting OPEX in proportion to network length. This would be the lower bound of the OPEX range because, as explained above, there are material OPEX items which are fixed and semi-fixed
- To determine the upper bound, we do not apply any OPEX adjustment related to network length. This would be the upper bound of the OPEX range because there are material OPEX items which depend on network length.

Figure 9 ANP's OPEX vs alternative estimation (2018 OPEX adjusted by IGP-M and network length)



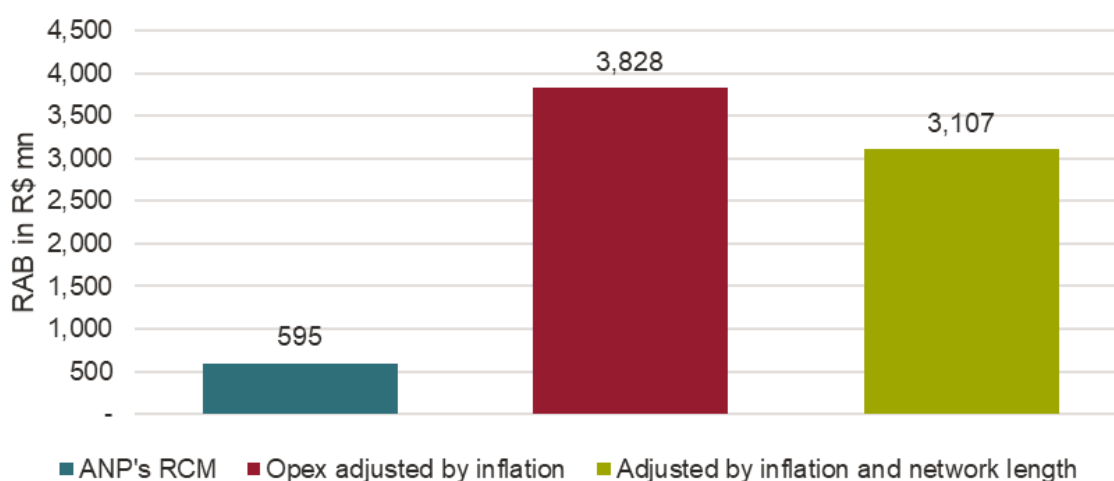
Source: Frontier analysis based on ANP model for TAG

5.4.3 Adjusting the operating costs multiplies the resulting RAB by at least 6

The impact of correcting ANP's methodology is material (see Figure 10).

Using ANP's RCM model, the resulting 2026 RAB is approximately R\$ 595 million. Applying our proposed methodology, the resulting RAB increases to a range of R\$ 3.1 billion - R\$ 3.8 billion.

Figure 10 Impact of OPEX adjustment on 2026 RAB



Source: Frontier analysis based on ANP model for TAG

The adjustment therefore increases the 2026 RAB by approximately five to six times relative to ANP's result. This magnitude reflects both how unstable the RCM model is, and the role of OPEX within the RCM framework. With historical OPEX understated, the model overstates the net revenues that have been available to recover capital over the 2006-2025 period. This mechanically reduces the amount of capital deemed unrecovered at the end of the period.

5.5 Holding the WACC constant as per standard practice for long-term contracts increases the resulting 2026 RAB estimate by a factor of more than 20

Under the RCM framework, the WACC determines the allowed return on unrecovered capital. ANP's TN 15 states that the WACC is the parameter used to remunerate invested capital recognised in the regulatory asset base and is therefore a central component of the capital revenue calculation.⁵⁶

5.5.1 ANP assumes a floating WACC over the 2006-26 period

ANP's methodology considers three different periods for estimating the WACC applicable to the RCM calculation:

⁵⁶ ANP, Technical Note No. 2/2026/SIM-CTR/SIM/ANP-RJ, Legal grounds, theoretical basis and methodological references applicable to the valuation of the Regulatory Asset Base and operating costs applicable to the natural gas transmission service, section 3, "Maximum Allowed Revenue and the role of the RAB", paragraphs 18-20

RESPONSE TO ANP'S CONSULTATION ON THE APPLICATION OF RCM TO CALCULATE TAG'S RAB FOR THE 2026-2030 REGULATORY PERIOD

- **2006-2013:** the WACC is estimated following the methodology set out in Technical Note 027/2006-SCM. Under this approach, ANP applies an adapted CAPM for emerging markets. The methodology combines a US risk-free rate, a global market risk premium, a sector beta and a Brazil country risk premium. Over this period, ANP updated the relevant market parameters annually. ANP transposes this approach to the RCM calculation and thus retains a different WACC for each year in the period.
- **2014-2018:** the WACC estimation relies on the same broad adapted CAPM logic, but the regulatory framework changes following Resolution ANP 15/2014. From this point, ANP moves from annual parameter updates to a fixed regulatory WACC for a five-year period. ANP's 2026 technical note explains that this shift was intended to improve regulatory predictability and reduce tariff volatility linked to cyclical changes in financial parameters.⁵⁷ ANP transposes this logic to the RCM calculation and thus a fixed WACC is retained across the five years.
- **2019-2025:** the WACC is estimated following the revised methodology set out in NT 013/2019-SIM. The rate remains fixed for the period, reflecting the five-year review process established under Resolution ANP 15/2014. ANP retained the adapted CAPM framework, but updated several inputs, including extending the risk-free rate window to 20 years, using a 20-year median for EMBI+ Brazil, adopting KPMG's implied equity risk premium and expanding the beta sample.

The following table provides a brief description of the methodology applied on each of the WACC parameters for the different periods.

Table 9 WACC methodology applied by APM

Parameter	2006-2013	2014-2018	2019-2025
Framework	Adapted CAPM under NT 027/2006-SCM.	Adapted CAPM under RANP 15/2014. Points back to 027/2006-SCM	Revised adapted CAPM under NT 013/2019-SIM.
Cost of equity	Risk-free rate + beta × market risk premium + Brazil risk.	Same broad formula, with parameters fixed for the cycle.	Same broad formula, with updated data sources and averaging periods.
Risk-free rate	10-year US Treasury bond reference, updated annually.	10-year US Treasury bond reference, fixed for the cycle.	US Treasury bond reference, using a longer historical

⁵⁷ ANP, Technical Note No. 15/2026/SIM-CTR/SIM/ANP-RJ, section 7.3, "2014-2018 period: Regulatory WACC of 7.15% - RANP No. 15/2014

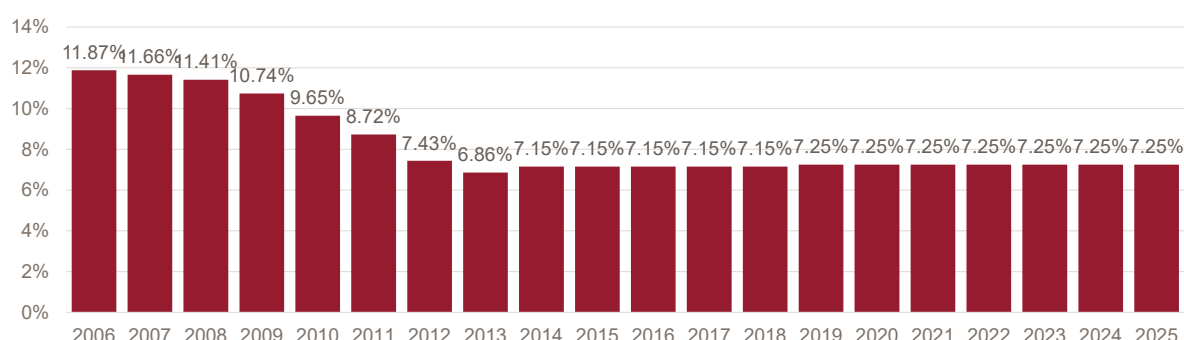
RESPONSE TO ANP'S CONSULTATION ON THE APPLICATION OF RCM TO CALCULATE TAG'S RAB FOR THE 2026-2030 REGULATORY PERIOD

Parameter	2006-2013	2014-2018	2019-2025
			window, fixed for the cycle.
Market risk premium	Equity-market risk premium based on methodology of Rocha, Camacho and Fiúza. Updated annually	Equity-market risk premium based on methodology of Rocha, Camacho and Fiúza. Updated annually	KPMG implied equity risk premium, fixed for the cycle.
Beta	International gas/pipeline benchmark, adjusted for leverage.	International gas/pipeline benchmark, adjusted for leverage.	Broader international transporter sample, adjusted for leverage.
Country risk premium	EMBI+ Brazil, updated annually.	EMBI+ Brazil, fixed for the cycle.	EMBI+ Brazil, using a longer historical reference period, fixed for the cycle.
Cost of debt	Risk-free rate + Brazil risk + default spread.	Same broad approach, fixed for the cycle.	Risk-free rate + Brazil risk + default spread based on CDS (Damodaran)
Gearing	Notional approach	Notional approach	Notional approach
US inflation	Current-year implied US inflation from 10-year nominal Treasury and 10-year TIPS data. Updated annually.	Current-year implied US inflation from 10-year nominal Treasury and 10-year TIPS data. Updated annually.	FED target
Brazil inflation	IGP-M. Applied annually.	IGP-M. Applied annually	IGP-M. Applied annually
Update frequency	Floating annual WACC	Fixed WACC.	Fixed WACC

Source: Frontier based on ANP model and technical notes

As a result, ANP obtains the following post-tax real WACC for the 2006-2025 period:

Figure 11 Post-tax real WACC values applied by ANP



Source: Frontier Economics

5.5.2 A floating WACC may be inconsistent with RCM

As noted above, ANP applies a floating WACC for the period 2006-2013 and a fixed WACC for the periods 2014-2018 and 2019-2025. In our view, applying a floating WACC for 2006-2013 is not the most appropriate interpretation for the purposes of the RCM calculation.

- First, NT 027/2006-SCM provides a methodology for estimating the cost of capital, but it does not necessarily require the WACC to vary annually.
- Second, a floating annual WACC is inconsistent with the approach adopted in later periods. From 2014 onwards, ANP explicitly moved to fixed cycle rates. ANP states that this change was intended to enhance regulatory predictability and reduce tariff volatility associated with cyclical movements in financial parameters.⁵⁸ The same logic applies to 2006-2013. A fixed WACC provides a more stable and predictable measure of the return expected by investors at the time the contract was entered into or the investment was committed.
- Third, a fixed WACC is more consistent with the economics of project finance and long-term ship-or-pay contracts. Equity and debt providers commit capital over long horizons and price risk at the time of investment, taking account of expected macroeconomic and regulatory conditions over the contract term with the information they have at the time of starting the project. Allowing the WACC to float retrospectively each year reinforces the retroactive regulation embedded in the RCM calculation (see section 4.2.2 above)

Fourth, the fixed-WACC approach is also consistent with ANP's approach in other long-term TAG contracts. For example, in the Urucu-Coari-Manaus, ANP assessed the tariff

⁵⁸ ANP, Technical Note No. 15/2026/SIM-CTR/SIM/ANP-RJ, section 7.3, "2014-2018 period: Regulatory WACC of 7.15% - RANP No. 15/2014

using a 20-year contract horizon and a single return.⁵⁹ This shows that, even where ANP did not accept TAG's proposed return, it still treated the tariff calculation as a long-term project exercise using a fixed return parameter. GASTAU provides a further example of the same contractual logic. The Caraguatatuba-Taubaté pipeline was included in Petrobras' request to ANP for firm transport capacity under Resolution ANP 27/2005, after which ANP instructed TNS to initiate the Public Process for Capacity Allocation. The GASTAU contract annex then records a fixed real annual IRR applied in a 20-year discounted cash-flow tariff model.

5.5.3 Applying a fixed WACC increases the resulting RAB by 20 times

We consider two approaches to assess the sensitivity of the 2026 RAB to ANP's choice to set a floating WACC over the period:

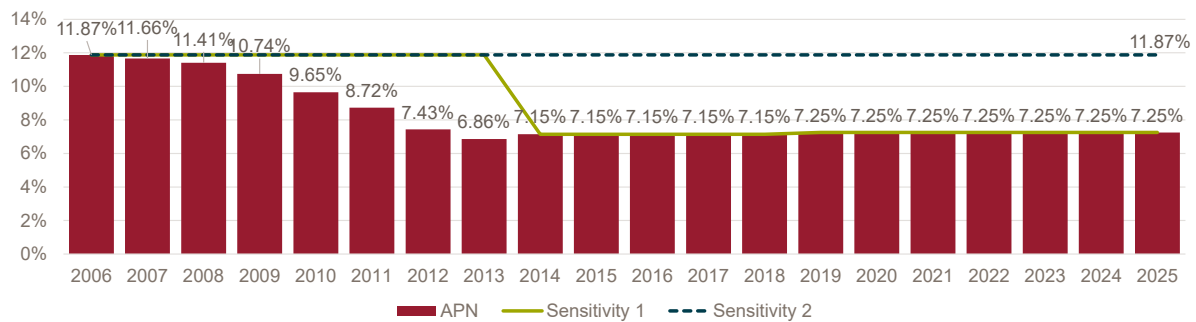
- **Alternative 1:** a fixed real WACC for the period 2006-2013. This applies the 2006 real WACC of 11.87% throughout 2006-2013, while keeping ANP's fixed rates for 2014-2018 and 2019-2025 unchanged.
- **Alternative 2:** a fixed real WACC for the full 2006-2025 period. This applies the 2006 real WACC of 11.87% throughout the full period. This sensitivity tests the effect of treating the WACC as the return required at the start of the long-term contract period.

These alternatives test the effect of applying ANP's own WACC methodology in a way that is more consistent with long-term tariff setting, contractual certainty and the approach used in later regulatory periods. The first sensitivity removes only the annual reset in 2006-2013. The second sensitivity applies the interpretation that the relevant WACC is the required return at the beginning of the full legacy-contract period.

The table below compares the post-tax real WACC assumed by ANP with the resulting WACC after applying sensitivities 1 and 2.

⁵⁹ ANP (2011), Nota Técnica nº 006/2011-SCM, sections III.1, III.2.8 and III.2.9. ANP records TAG's proposed 13.0% real IRR and 20-year FCLF tariff model, then calculates a 10.51% real CMPC/WACC using the adapted CAPM methodology from NT 027/2006-SCM and applies it in the SCM/ANP tariff calculation.

Figure 12 Post-tax real WACC values applied by ANP and sensitivities



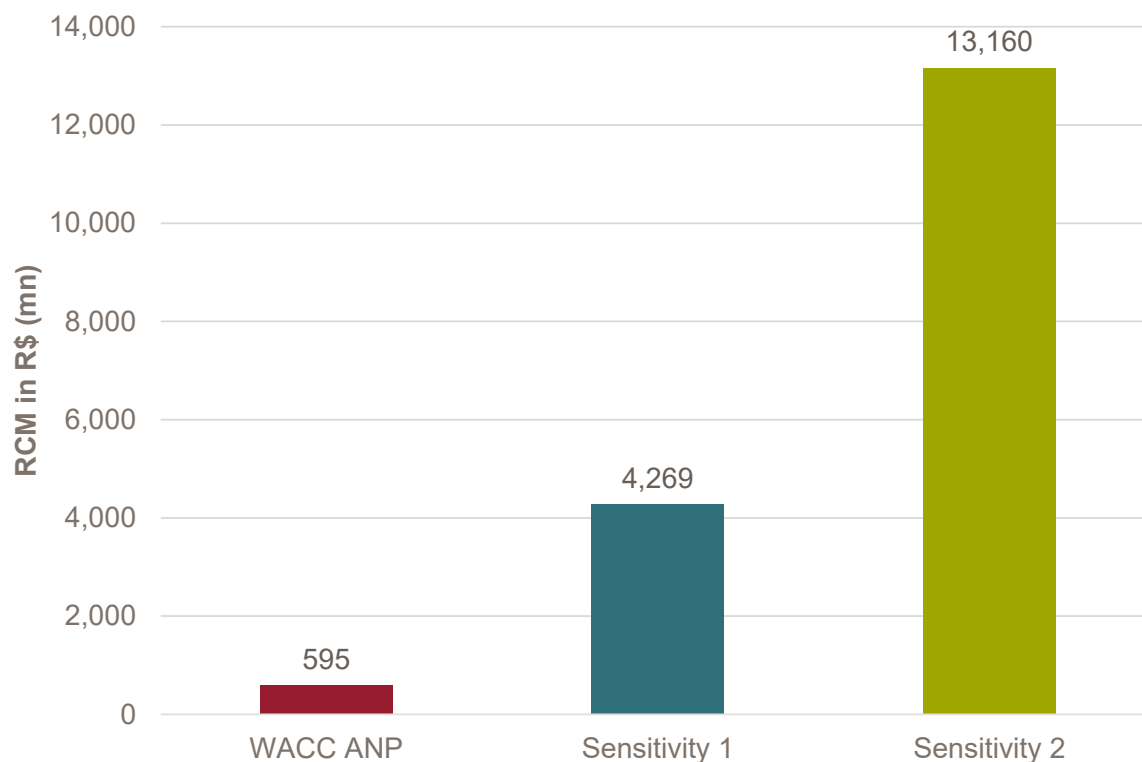
Source: Frontier Economics

The following figure illustrates the material impact of the WACC assumption on the RCM asset base. ANP's base case produces an asset base of R\$595 million:

- Fixing the real WACC for 2006-2013 increases the asset base to R\$4,3 billion; and
- Fixing the real WACC for the full 2006-2025 period increases it to R\$13,1 billion.

This demonstrates that the RCM result is highly sensitive to whether the WACC is treated as a floating annual parameter or as a fixed long-term return assumption. This further undermines the appropriateness of relying on RCM to set the 2026 RAB.

Figure 13 Resulting 2026 RCM RAB under ANP WACC and fixed-WACC sensitivities



Source: Frontier Economics

Note: The WACC applied is expressed in nominal terms. We consider the same IGP-M conversion used in the base model.

5.6 The sensitivity of the RCM to error corrections and standard cross-checks invalidates the methodology

This section has shown that ANP's RCM result is not a robust estimate of unrecovered capital. There are errors and methodological issues in the inputs estimated by ANP to calculate the resulting 2026 RAB.

It may be unavoidable to rely on simplifying assumptions and benchmarks to fill the gaps when applying a retrospective calculation such as RCM. However, in such a context it is regulatory best practice to ascertain that the results are not overly sensitive to the assumptions. Regulators standardly use cross-checks to test for this, but such cross-checks are not presented in ANP's documentation.

We have applied a number of sensitivities to the RCM calculation to adjust for identified mistakes and to fill the gap in cross-check.

RESPONSE TO ANP'S CONSULTATION ON THE APPLICATION OF RCM TO CALCULATE TAG'S RAB FOR THE 2026-2030 REGULATORY PERIOD

- The 2006 pipeline cost adjustment corrects ANP's reliance on a single US benchmark that does not reflect Brazilian import duties and is not cross-checked against other relevant evidence.
- The asset-life adjustment aligns the model with international regulatory practice, where gas pipeline lives are materially longer than the 30 years assumed by ANP.
- The asset-date adjustment applies a consistent and objective commissioning date based on ANP's own Authorizations of Operation.
- The OPEX adjustment relies on TAG's annual accounts as the most transparent available source, rather than on pre-2018 estimates that lack cost-line visibility.
- The WACC adjustment reflects the economics of long-term contracts and ANP's own later practice of applying fixed WACC values over regulatory periods.

Table 10 below summarises the isolated impact of the adjustments considered in this section. We find that the 2026 RAB is excessively sensitive to the alternative assumptions tested, to an extent that invalidates the reliance on ANP's application of RCM.

Table 10 Impact of the adjustments to ANP's model on RAB

Scenario	Rationale for adjustment	Resulting RAB (R\$ mn)
ANP's base case	-	595
2006 pipeline costs	Adjust ANP's US benchmark for Brazilian import duties	3,045
Asset lives	Adjust asset lives to 40 years in line with international practice	3,924
Asset dates	Use ANP Authorizations of Operation for commissioning dates	4,056
OPEX	Use TAG annual accounts as the most reliable observable source	3,107
WACC	Apply fixed WACC assumptions consistent with long-term tariffs	4,269-13,160

Source: Frontier Economics analysis based on ANP model for TAG

6 International regulatory practice does not support the use of RCM when introducing economic regulation

The previous sections explained why the RCM approach is not an appropriate basis for establishing the opening value of the RAB in Brazil. Section 4.2, in particular, showed that the RCM approach has not been adopted by any European regulator and that the Australian precedent does not support its use in the Brazilian context. This section assesses in detail whether RCM satisfies the requirement set out in Resolution No. 15/2014⁶⁰ and Resolution No. 991/2026⁶¹ that any alternative to historical cost and replacement cost must be *widely recognised and adopted by the market*”.

In this section:

- We show that no European country used an RCM approach to establish the opening value of the RAB when introducing economic regulation in the gas sector. Instead, regulators have relied on a range of asset valuation methodologies typically based on historical costs, replacement costs, or market values.
- We show that the Australian experience does not support the requirements set out in the Brazilian regulatory framework. While the Australian framework allows RCM-type valuations to be considered for certain non-regulated assets, the methodology has been applied only once, in an arbitration proceeding.
- We therefore conclude that the international evidence provides no precedent for using RCM to establish the opening value of the RAB in Brazil.

⁶⁰ Art. 6 § 3: “In the case of Transport Pipelines in the operational phase, including those in operation on the date of publication of this Resolution, the methodology for valuing the Regulatory Asset Base used by the ANP shall take into account: I - the present value of the assets, net of depreciation and amortisation accrued up to the date of setting the Transport Tariff; II - the replacement cost of the assets, net of depreciation and amortisation incurred up to the date of establishment of the Transport Tariff; III - the value of the assets resulting from the application of alternative methodologies that are widely recognised and adopted by the market, net of depreciation and amortisation incurred up to the date of establishment of the Transmission Tariff.”

⁶¹ Art. 6 § 2: “In the case of gas transmission pipelines in the operational phase, including those in operation on the date of publication of this Resolution, the BRA valuation methodology used by the ANP shall take into account: I - the Inflation-Adjusted Historical Cost (CHCI), which consists of the present value of the assets, net of depreciation and amortisation incurred up to the date of setting the transport tariff; II - the New Replacement Cost (CRN), which consists of the replacement cost of the assets, net of depreciation and amortisation incurred up to the date of setting the transmission tariff; or III - the value of the assets resulting from the application of alternative methodologies that are widely recognised and adopted by the market, net of depreciation and amortisation incurred up to the date on which the transmission tariff is set.”

6.1 No European country has used an RCM approach to establish the opening value of the RAB

Beginning in the late 1990s, the First Gas Directive (98/30/EC)⁶² required European Member States to introduce regulated third-party access to gas networks and establish transparent tariff-setting arrangements. The Second Energy Package⁶³ further strengthened these requirements and the transition towards regulated and competitive gas markets. As part of this process, European regulators were required to determine opening asset values for existing network infrastructure. In some instances, regulation was established after the privatisation of state-owned companies.

Our review of the European precedent shows that no European country established its opening RAB using an RCM approach. Instead, regulators adopted a range of alternative asset valuation methodologies, including approaches based on historical costs, replacement costs and market values.

In this section, we:

- Provide an overview of the asset valuation methodologies adopted by European regulators when establishing opening RAB values for gas networks; and
- Present representative detailed examples illustrating how each of these broad valuation methodologies has been applied in practice.

6.1.1 Overview of European approaches when establishing opening RAB values

The ACER study prepared by Economic Consulting Associates (ECA) in 2018⁶⁴ provides an overview of the approaches used across Europe to establish opening RAB values. The study reviewed the methodologies applied by European regulators and classified them into three broad categories: (i) historical cost accounting methods, (ii) current cost accounting methods (i.e. value-based methods), and (iii) rolled-forward values.

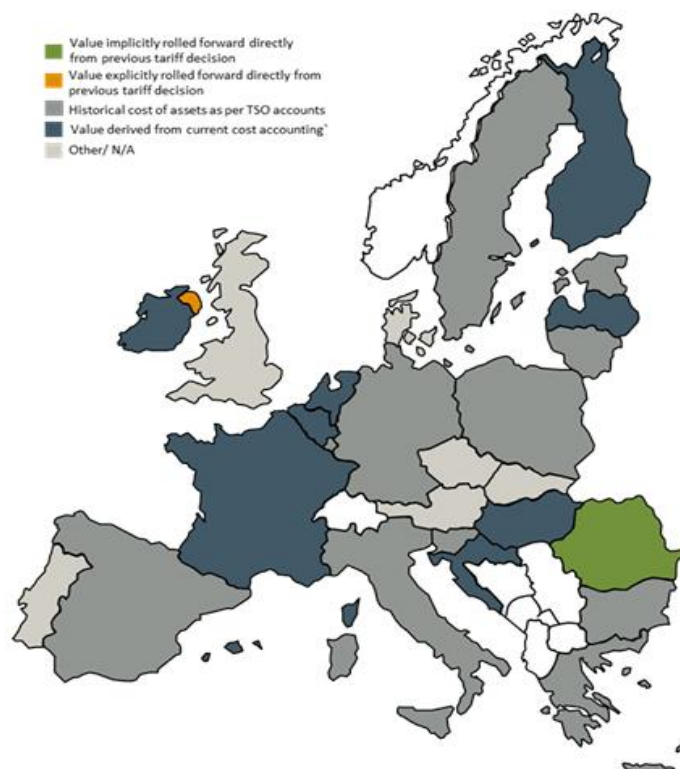
Figure 14 summarises the approaches adopted across European jurisdictions.

⁶² Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas. <https://eur-lex.europa.eu/eli/dir/1998/30/oj/eng>

⁶³ Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC. <https://eur-lex.europa.eu/eli/dir/2003/55/oj/eng>

⁶⁴ [ACER. Methodologies and Parameters Used to Determine the Allowed or Target Revenue of Gas Transmission System Operators](#), prepared by Economic Consulting Associates (ECA) (2018).

Figure 14 ACER's analysis of methodologies used for establishing opening asset values across Europe



Source: ACER's 2018 study *Methodologies and Parameters Used to Determine the Allowed or Target Revenue of Gas Transmission System Operators*, prepared by Economic Consulting Associates (ECA)

Historical cost accounting methods

ACER defines historical cost accounting methods as:

“an accounting method in which assets are listed on a balance sheet with the value at which they were purchased or constructed, rather than the current market value. The historical cost principle is used to reflect the amount of capital expended to acquire an asset”.

According to the report, historical cost accounting has been the most commonly used approach when setting the RAB upon entry of energy networks into regulation. It was adopted in 11 European countries. Under this approach, the opening RAB is derived from the actual costs incurred in constructing or acquiring network assets.

Current cost accounting methods

ACER defines current cost accounting methods as:

"a method of accounting in which assets are valued based on their current replacement cost or 'fair market value' rather than historical or original costs. In practice, current costs can be determined employing several different approaches".

According to the report, current cost accounting approaches were used in 8 European countries. These approaches comprise the following methodologies identified by ACER:

- **Replacement cost methods**, which are based on the cost of replacing the service capability of existing assets today, adjusted for depreciation and the remaining useful life of the assets.
- **Economic value methods**, which are based on the asset's "value in use", reflecting the present value of the future net cash flows expected to be generated by the operation of the assets.

Rolled-forward values

ACER identifies a third category comprising jurisdictions where the opening RAB was derived from asset values recognised, either explicitly or implicitly, in previous tariffs or revenue determinations. According to the ACER review, only Romania and Northern Ireland fell within this category, but neither case is comparable to the RCM:

- In Romania, the opening RAB was reverse-engineered from the level of tariffs negotiated between the regulator and the operator in the base year (see section 6.1.2).
- The Northern Irish framework does not provide a relevant precedent for the RCM either. Rather than reflecting a new regulatory valuation exercise, it is based on licence-holder-specific arrangements. For GNI, capital allowances are embedded within licence provisions governing revenue recovery and are therefore determined outside the price control process. Other TSOs operate under a debt-funded model, with bond repayments recovered in accordance with a pre-agreed schedule.⁶⁵

Other approaches

The approaches used in remaining countries are classified as "Other" in the ACER report:⁶⁶

- **Czech Republic**, where the RAB was set at a level intended to preserve existing profitability.
- **Denmark**, where an equity value equivalent to the company's net asset value was established, although this was not formally treated as a RAB.

⁶⁵ Utility Regulator, GT27 Approach Decision, p.8 <https://www.uregni.gov.uk/files/uregni/documents/2026-02/GT27%20Approach%20Decision.pdf>

⁶⁶ ACER also classifies Austria under the "Other" category. However, the Austrian approach can more accurately be described as a hybrid valuation methodology combining historical-cost and replacement-cost principles. Specifically, the debt-financed portion of the RAB was valued at historical cost, whereas the equity-financed portion was valued at replacement cost.

- **Portugal and Great Britain**, where the opening values were derived from company valuations undertaken in the context of privatisation and therefore shared some characteristics with economic value methodologies.

Overall, the conclusions from the 2018 ACER study are consistent with more recent evidence from CEER's Report on Regulatory Frameworks for European Energy Networks,⁶⁷ which was relied upon in the Synergies report on alternative asset valuation methodologies.⁶⁸ Neither review identifies any European jurisdiction that has adopted an RCM approach to establishing opening RAB values.

6.1.2 Detailed case studies

To complement the high-level review presented above, this section examines in greater detail a selection of European case studies illustrating the different approaches used to establish opening RAB values. Specifically, we consider examples from Italy, Germany, Belgium, Great Britain and Romania, with each country representing a distinct methodological approach. For each case study, we review (where available): (i) the regulatory context in which the RAB framework was introduced; (ii) the methodology used to determine the opening RAB value; and (iii) the rationale underpinning the regulator's choice of approach.

Table 11 summarises the key findings from these case studies. It illustrates the diversity in approaches used by regulators but shows that this diversity does not extend as far as including RCM⁶⁹. Only one jurisdiction in the reviewed countries, Romania, considered an RCM-type approach – but ultimately rejected it. Indeed, the regulator concluded that such an approach could not be implemented reliably given the historical economic context, including high inflation rates, repeated changes to accounting and depreciation rules, and important restructuring within the sector.

⁶⁷ Council of European Energy Regulators (CEER), Report on Regulatory Frameworks for European Energy Networks (2024). https://www.ceer.eu/wp-content/uploads/2025/02/GA191_05_2_IRB-Regulatory-Frameworks-Report-2024-Main-report-1-1.pdf

⁶⁸ Synergies Economic consulting, Analysis of alternative asset valuation methodologies: A report prepared for NTS/TAG (2026).

⁶⁹ We do not present detailed case studies for each and every country in Europe where regulation has been implemented for the sake of conciseness. However, we note that as part of our investigation we did not identify any jurisdiction where RCM was implemented.

Table 11 Summary of the selected case studies

Country	Year	Asset valuation method	Rationale (as explicitly stated by the regulator)
Italy	2001	Indexed depreciated historical cost accounting	Preserve the current value of the asset base and reflect asset ageing, while avoiding the circularity problem arising from a discounted cash flow approach
Germany	2005	Hybrid: Historical-cost and replacement-cost approach	N/A (not explicitly stated in regulatory documentation)
Belgium	2003	Depreciated replacement cost	N/A
Great Britain	1986	Market valuation	N/A
Romania	2001	Implicit RAB derived from base tariffs	The Romanian regulator considered the RCM, but concluded that the historical economic context, characterised by high inflation, repeated changes to accounting and depreciation rules, and sector restructuring, made the application of this methodology unreliable in Romania.

Source: Frontier Economics analysis

Historical cost accounting methods

Italy

Italy established its modern gas transmission tariff framework in 2001 following the liberalisation of the gas sector under Legislative Decree 164/2000. The framework was introduced through Delibera 120/01, which defined the opening RAB, allowed revenues and tariff-setting methodology for gas transmission and LNG regasification activities.⁷⁰

⁷⁰ Autorità per l'Energia Elettrica e il Gas (AEEG), Deliberazione 30 maggio 2001, n. 120/01, 2001. https://www.arera.it/fileadmin/allegati/docs/01/120-01_3.pdf and Autorità per l'Energia Elettrica e il Gas (AEEG), Relazione Tecnica alla Deliberazione 30 maggio 2001, n. 120/01. <https://www.arera.it/fileadmin/allegati/docs/01/rt120-01.pdf>

The Italian regulator adopted an indexed historical cost approach. Specifically, the opening RAB was determined by:⁷¹

- Identifying annual historical asset additions still recorded in the balance sheet as of 31 December 2000. This included capitalised in-house construction costs, ancillary charges and interest during construction that had been capitalised in the financial accounts. Non-capitalised interest during construction was excluded because it had already been recovered through historical operating costs and tariffs;
- Revaluing historical asset additions using a gross fixed investment deflator reconstructed from Istat⁷² historical investment series;
- Reconstructing depreciation using economic-technical asset lives.

The resulting opening RAB was calculated as indexed gross asset value less economic-technical depreciation and public grants.

The regulator considered indexed historical cost appropriate because it preserved the current value of the asset base through revaluation of historical book costs, while reflecting asset ageing and obsolescence using economic-technical useful lives. The regulator considered the gross fixed investment deflator consistent with the inflation adjustment used in the price cap regime.⁷³

The regulator rejected a discounted cash flow approach because it would create a circularity problem: the value of regulated assets would depend on future tariff revenues, while future tariff revenues themselves depend on the value of the regulated asset base.⁷⁴

Germany

Until 2005, gas network tariffs in Germany were largely based on agreements negotiated between market participants (Verbändevereinbarungen).⁷⁵ This changed with the 2005 reform of the Energy Industry Act (*Energiewirtschaftsgesetz*, EnWG),⁷⁶ which implemented the EU Second Energy Package. As part of these reforms, Germany introduced the Gas Network

⁷¹ Autorità per l'Energia Elettrica e il Gas (AEEG), Deliberazione 30 maggio 2001, n. 120/01, 2001, para. 3.5.

⁷² Institut für angewandte Statistik (Institute for Applied Statistics).

⁷³ Autorità per l'Energia Elettrica e il Gas (AEEG), Relazione Tecnica alla Deliberazione 30 maggio 2001, n. 120/01, Section 6.2.

⁷⁴ Idem.

⁷⁵ Von Danwitz (2006) 'Regulation and Liberalization of the European Electricity Market - A German View', Energy Law Journal, 27(2), pp. 423-450. <https://www.eba-net.org/wp-content/uploads/2023/02/7-423-450.pdf>

⁷⁶ Lieb-Doczy et al. (2005). The new German Energy Law: green light for competition? https://www.hoganlovells.com/-/media/hogan-lovells/pdf/publication/europeanelectricityreview_pdf.pdf

Tariff Ordinance (*Gasnetzentgeltverordnung*, GasNEV), establishing a formal methodology for setting gas network tariffs.⁷⁷

Germany followed a hybrid approach for the valuation of its legacy assets. Specifically, under the GasNEV framework:

- The debt-financed portion of the assets was valued at historical acquisition and production costs,⁷⁸ and
- The equity-financed portion was valued based on indexed historical acquisition and production costs, using asset-specific price indices published by the Federal Statistical Office.⁷⁹

The regulatory equity ratio was capped at 40%.⁸⁰

The regulator did not explicitly state the rationale for applying historical-cost valuation to debt-financed assets and indexed historical-cost valuation to equity-financed assets.

Current cost accounting methods

Belgium (Replacement cost method)

Belgium implemented the EU gas reforms through the Gas Act of 29 April 1999.⁸¹

As part of the transition to economic regulation, the new Commission for Electricity and Gas Regulation (CREG) published guidelines defining the methodology for valuing invested capital and establishing the initial RAB for gas transmission and distribution networks in 2003.⁸²

Under CREG's 2003 guidelines, regulated tangible assets were primarily valued based on their economic replacement value ("*valeur de reconstruction économique*") or depreciated replacement cost (DRC), defined as the depreciated current cost of acquiring an asset that, using current technology, would provide the same services as the existing asset.⁸³

⁷⁷ Federal Republic of Germany, *Gasnetzentgeltverordnung (GasNEV) - Ordinance on Gas Network Tariffs*, 25 July 2005, BGBl. I S. 2197. <https://www.gesetze-im-internet.de/gasnev/BJNR219700005.html>

⁷⁸ §6(2)1 GasNEV.

⁷⁹ §6(2)2 and §6(3) GasNEV.

⁸⁰ §6(2) GasNEV.

⁸¹ Belgian Gas Act, 29 April 1999. <https://onlinelibrary.wiley.com/doi/abs/10.1002/1099-1808%28200003/04%2911%3A2%3C64%3A%3AAID-ULR164%3E3.0.CO%3B2-F>

⁸² CREG (2003), Lignes directrices concernant la marge bénéficiaire équitable applicable aux entreprises de transport du gaz naturel et aux gestionnaires des réseaux de distribution du gaz actifs sur le territoire belge, Décision (R) 030618-CDC-219, 18 June 2003 <https://www.creg.be/sites/default/files/assets/Publications/Guidelines/Div-R219FR.pdf>

⁸³ Idem, p. 7.

The economic replacement value of the assets was based on current unit costs, reflecting current technology, and depreciated in accordance with regulatory depreciation rules set up in the table below. As shown in the table, for some assets (pipes, installations metering, expansion and compression, storage facilities as well as telecommunication and fibre optics), the regulator decided to keep their residual value (20%) in the RAB once fully depreciated.

Table 12 Depreciation rules in the Belgian gas sector

Asset	Annual depreciation / Asset life	Residual value
Industrial buildings	3% (33 years)	0%
Office buildings 2	2% (50 years)	0%
Pipes	2% (50 years)	20%
Installations metering, expansion and compression	3% (33 years)	20%
Storage facilities	3% (33 years)	20%
Telecommunications and fibre optics	10% (10 years)	20%
Tools and furniture	10% (10 years)	0%
Vehicles	20% (5 years)	0%

Source: CREG 2003 Guidelines, p.9

This economic replacement value method was reliably used for those gas network operators that maintained a detailed technical register of their tangible fixed assets, aligned with their accounting records and allowing checks that the recorded assets match the physical assets in place.⁸⁴

For others, the initial asset value was determined based on historical acquisition costs, indexed using price indices and adjusted for technological progress⁸⁵ before depreciation was deducted.⁸⁶

⁸⁴ Idem, p. 7-8.

⁸⁵ Originally, assets were revalued annually based on their economic replacement value. Since 1985, revaluations were instead based on book value, adjusted each year in line with changes in the average of the industrial producer price index and the consumer price index. To reflect the impact of technological progress, a cap on annual adjustment applies at 80% of the change in these price indices.

⁸⁶ CREG (2003), Lignes directrices concernant la marge bénéficiaire équitable applicable aux entreprises de transport du gaz naturel et aux gestionnaires des réseaux de distribution du gaz actifs sur le territoire belge, Décision (R) 030618-CDC-219, 18 June 2003, p.8 <https://www.creg.be/sites/default/files/assets/Publications/Guidelines/Div-R219FR.pdf>

The CREG guidelines do not explicitly justify the choice of DRC over alternative valuation methodologies.

Great Britain (economic value method)

Great Britain introduced economic regulation of the gas sector as part of the privatisation of British Gas under the Gas Act 1986.⁸⁷ Prior to privatisation, the gas transmission network was owned and operated by the state-owned British Gas Corporation. The Gas Act transferred the assets and liabilities of the corporation to British Gas plc⁸⁸ and established the Office of Gas Supply (Ofgas) as the sector regulator.⁸⁹ The privatisation of British Gas formed part of the broader UK privatisation programme of the 1980s under the Conservative Government of Margaret Thatcher, which sought to raise money, improve industry efficiency, and broaden share ownership among the public.⁹⁰

Great Britain established the opening RAB using the value of British Gas at privatisation:

- The Government adopted a fixed-price offer at 135 pence per share, supported by an extensive marketing campaign. The offer was heavily oversubscribed, with demand exceeding the number of shares available by around four times. The transaction generated proceeds of approximately £5.6 billion from equity alone and £8.1 billion when including the debt introduced as part of the transaction.⁹¹
- The market value established through the privatisation process became the basis of the initial RAB, which was subsequently used to determine future price controls and allowed investor returns.⁹²

Rolled-forward values

Romania

Romania consolidated its modern gas transmission tariff framework through ANRGN Decision No. 1078/2003. This built on the regulatory framework established when ANRGN was created

⁸⁷ Gas Act 1986. <https://www.legislation.gov.uk/ukpga/1986/44/introduction/enacted>

⁸⁸ Idem, Part II, Section 49 (1).

⁸⁹ <https://www.legislation.gov.uk/ukpga/1986/44/introduction/enacted> Idem, Schedule 1(1).

⁹⁰ House of Commons Library (2014), Privatisation, Research Paper RP14/61, p.3.
<https://researchbriefings.files.parliament.uk/documents/RP14-61/RP14-61.pdf>

⁹¹ Idem, p.11.

⁹² Ofgem (2020). RIIO-2 Final Determinations Impact Assessment Annex (2020) states that the RAB “is calculated by summing an estimate of the initial market value of each licensee’s regulated asset base at privatisation and all subsequent allowed additions to it at historical cost”.
https://www.ofgem.gov.uk/sites/default/files/docs/2020/12/final_determinations_-_impact_assessment_annex.pdf

under Government Ordinance No. 41/2000 and assumed responsibility for gas tariff regulation.

Decision No. 1078/2003 discussed two methods for setting the opening RAB.⁹³

Firstly, the regulator considered an RCM-type approach to reflect the assets used in the regulated activity, and the extent to which those assets had already been recovered through past tariffs. Specifically, this method would have been based on:

- A physical inventory of regulated assets;
- The reconstruction of the operator's accounting records from establishment to the base year; and
- The reconstruction of regulated revenues over the same period.

However, Article 109 of Decision No. 1078/2003 recognised that the RCM could not always be applied in practice. In particular, the Romanian regulator concluded that the historical economic context, characterised by high inflation, repeated changes to accounting and depreciation rules, and changes in the status of operators, including restructuring, separations and mergers, made the application of this methodology unreliable in Romania.

As a result, the regulator did not establish the opening RAB using an RCM-type approach. Instead, it established the opening RAB based on a certain level of tariffs in the base year. The regulator used the following step-by-step methodology:⁹⁴

- Establishing, together with each regulated operator, a reasonable level of tariffs for regulated services in the base year;
- Estimating the revenue implied by these tariffs and forecast service volumes;
- Determining the efficient level of operating expenditure and the allowed weighted average cost of capital;
- Establishing the average remaining useful life of regulated tangible and intangible assets for depreciation purposes;

⁹³ Dec. 1078/2003 Decision no 1078 of 18 december 2003 on approval of Criteria and methods for approving prices and establishing regulated tariffs in natural gas sector, Chapter VI.

⁹⁴ Idem.

- Reverse-engineering the asset base from the building block model, such that the implied return on capital and depreciation allowance were consistent with the allowed revenue after deducting operating expenditure.⁹⁵

The resulting opening RAB corresponded to the asset value implicitly reflected in the regulated tariffs.

6.2 The Australian case does not support that RCM meets the requirement that any alternative valuation methodologies must be *“widely recognised and adopted by the market”*

ANP relies on the Australian gas sector as evidence supporting the use of an RCM-type approach to valuing regulated assets. In the Technical note 15, ANP notes that the methodology was originally developed in the context of Australian gas pipeline regulation.⁹⁶

However, a closer review of the Australian precedent concludes that it does not demonstrate that the RCM is a methodology widely recognised and adopted by the market. We find that the methodology is subject to strict limitations and has played only a very limited role in practice. In the remainder of the section:

- We show that the Australian framework only provides for an RCM-type approach in the context of non-regulated assets and in specific circumstances;
- We show that the RCM-type approach in fact has not been relied upon by the regulator and has only been accepted in one arbitration proceeding – confirming that the RCM is not a methodology widely recognised and adopted by the market.

6.2.1 The Australian framework imposes strict conditions on the use of an RCM-type approach

The RCM approach is not widely used in the Australian regulatory framework. Rather, its application is limited to a specific subset of access disputes and is subject to important safeguards.

First, the Australian gas sector is governed by the National Gas Law (NGL) and the National Gas Rules (NGR), which establish the framework for economic regulation and third-party access to gas pipelines. The framework distinguishes between:⁹⁷

⁹⁵ $RAB_0 = \frac{VB_0 - OPEX_0}{WACC + \frac{1}{n}}$ where RAB_0 is the RAB implicit value, VB_0 is the base revenue, n is the average remaining economic and technical useful life of regulated tangible and intangible assets.

⁹⁶ ANP, Technical note 15, p. 5.

⁹⁷ <https://www.aer.gov.au/gas-pipeline-regulatory-determination-role>

- scheme pipelines, which are subject to “full regulation”; and
- non-scheme pipelines, which are subject to a “lighter-handed regulation”.

Within this framework, RCM appears only in a specific context: the resolution of access disputes involving non-scheme pipelines under Part 23 of the NGR.⁹⁸ Rule 113Z(5) requires arbitrators to apply an RCM-based valuation approach when determining the terms and conditions of access⁹⁹ where negotiations between a pipeline owner and a user have failed. The purpose of this framework is therefore to resolve commercial access disputes, rather than to establish the value of assets for economic regulation.

Consistent with this purpose, the framework has been used in only two arbitrations, neither of which resulted in the relevant pipeline becoming a regulated (scheme) pipeline or involved the establishment of an opening RAB.¹⁰⁰

By contrast, ANP proposes to use the RCM as part of the transition from a legacy regime to economic regulation in Brazil. The Australian precedents therefore relate to a different regulatory objective.

Second, even within the limited context in which the Australian regulatory framework provides for the use of RCM, the NGR expressly recognises that an RCM-based valuation should not be applied in certain circumstances, specifically where it would produce outcomes inconsistent with those expected in a workably competitive market (emphasis added):

(5)For the purposes of subrule (4)(a):

*(a)the value of any assets used in the provision of the pipeline service must be determined using asset valuation techniques consistent with the objective of facilitating access to pipeline services provided by means of non-scheme pipelines on reasonable terms, which is taken to mean at prices and on other terms and conditions that, so far as practicable, **reflect the outcomes of a workably competitive market**; and*

(b)unless inconsistent with paragraph (a), the value of any assets used in the provision of the pipeline service is to be calculated as:

(i)the cost of construction of the pipeline and pipeline assets incurred before commissioning of the pipeline (including the cost of acquiring easements and other interests in land necessary for the establishment and operation of the pipeline);

plus:

(ii)the amount of capital expenditure since the commissioning of the pipeline;

less:

(iii)the return of capital recovered since the commissioning of the pipeline; and

(iv)the value of pipeline assets disposed of since the commissioning of the pipeline.

⁹⁸ Part 23 was subsequently replaced by Parts 10, 11 and 12.

⁹⁹ <https://energy-rules.aemc.gov.au/ngr/482/276940>

¹⁰⁰ <https://www.aer.gov.au/arbitration-access-disputes>

Therefore, Rule 113Z(5)(b) provides that the RCM may not always meet the regulatory objective of reflecting the outcomes of a workably competitive market. In these cases, an alternative valuation methodology must be used.

Third, the Australian regulator (AER) has itself recognised the limitations of using an RCM-based valuation. As explained in the Synergies report¹⁰¹, the AER is responsible for the application of Part 23 of the NGR which establishes information disclosure requirements for non-scheme pipelines. In the context of these disclosure requirements, the AER has issued Guidelines that further emphasise the inherent limitations of the RCM (emphasis added):¹⁰²

- “In some circumstances, the recovered capital method **may produce values that are inconsistent with the asset valuation objective.**”
- “We generally do not support the use of replacement cost methodologies, as they share a **similar limitation to the recovered capital method in that they are highly sensitive to the inputs and assumptions used in their calculation.**”

Recognising these limitations, the AER provides that non-scheme pipelines provide alternative asset valuation measures when disclosing financial information, alongside with RCM-based valuations. In particular, the AER's Guidelines prescribe valuation methodologies based on actual historical costs.¹⁰³

6.2.2 In practice, the RCM approach has never been relied upon by the Australian regulator, and has only been accepted in one arbitration proceeding

While non-scheme pipelines are required to disclose asset valuations based on the RCM alongside alternative measures based on historical costs, the RCM has not been widely used in practice in Australia.

In particular, the RCM has never been used by the regulator to establish the opening value of the regulatory asset base for regulated gas transmission assets.

The limited practical application of the RCM is also evident in arbitration proceedings related to non-scheme pipelines. As noted in the Synergies report and discussed above, the RCM was considered only in two non-scheme pipeline arbitrations conducted under Part 12 of the NGR: the Tasmanian Gas Pipeline Pty Ltd arbitration and the Carisbrook to Horsham Pipeline

¹⁰¹ Synergies Economic consulting, Analysis of alternative asset valuation methodologies: A report prepared for NTS/TAG 2026), Section 5.2.

¹⁰² AER's Explanatory note: Pipeline Information Disclosure Guidelines and Price reporting guidelines for Part 18A facilities – October 2023, p.6 https://www.aer.gov.au/system/files/2023-10/AER%20-%20Final%20-%20Explanatory%20note%20-%20Pipeline%20information%20disclosure%20guidelines%20and%20Price%20reporting%20guidelines%20-%20October%202023_0.pdf

¹⁰³ “We consider that valuation methodologies based on actual historical costs are most suitable and most likely to produce outcomes consistent with workably competitive markets”. p.6.

(CHP) arbitration,¹⁰⁴ and neither arbitration led to the relevant pipeline becoming a regulated pipeline.

Of these two cases, only the CHP arbitration resulted in the acceptance of an RCM-based valuation. By contrast, in the Tasmanian Gas Pipeline Pty Ltd arbitration, the arbitrator rejected the RCM in favour of a modified historical depreciated cost approach. The fact that the RCM was accepted in only one of the two arbitrations in which it was considered does not provide evidence that the methodology is widely recognised or adopted by market participants. Rather, these cases suggest that the RCM has been applied only in limited circumstances, and that its suitability has been assessed on case-by-case basis.

6.3 As a result, international evidence points to disregarding RCM in the Brazilian context

The international evidence reviewed in this section provides no support for the use of an RCM approach to establish the opening value of the RAB in Brazil.

Across Europe, the introduction of economic regulation in the gas sector required regulators to establish opening asset values for existing network infrastructure, often in the context of market liberalisation and, in some cases, privatisation. Our review shows that no European jurisdiction established its opening RAB using an RCM approach. Instead, regulators relied on methodologies based on historical costs, current costs (including replacement cost and value-based approaches), or rolled-forward asset values.

The case studies reviewed further reinforce this conclusion. Notably, Romania explicitly considered RCM but ultimately rejected it, concluding that historical inflation, repeated changes to accounting and depreciation rules, and extensive sector restructuring made the approach unreliable in practice.

The Australian experience does not provide support for the ANP's proposal either. Although the Australian regulatory framework provides for the application of the RCM, this is in the specific context of access disputes involving non-scheme pipelines, which are not subject to full regulation. This is materially different from the Brazilian context, where ANP proposes to use the RCM to determine the opening RAB for legacy assets transitioning into a regulated regime.

Importantly, the RCM has not been applied by the Australian regulator itself. Rather, it has only been accepted by one arbitrator in a proceeding involving a non-scheme pipeline. Even in this arbitration context, where the use of the RCM is allowed, the National Gas Rules require that the methodology be disregarded where it would not produce outcomes consistent with a workably competitive market. The regulator has itself recognised the limitations of the RCM,

¹⁰⁴ Synergies Economic consulting, Analysis of alternative asset valuation methodologies: A report prepared for NTS/TAG 2026), Section 5.4.

noting its sensitivity to assumptions and the risk that it may produce values inconsistent with the regulatory objective.

Taken together, the international evidence shows that regulators have consistently relied on alternative approaches when establishing opening RAB values. The international precedent therefore provides no basis for concluding that the RCM is an appropriate methodology for establishing the opening value of the RAB in the Brazilian context.



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