BRIEFING PAPER

MAY 2019

Carbon pricing and the Multilateral Development Banks: Comparative analysis and recommendations

Several of the MDBs are currently using shadow carbon pricing which informs decision-making when assessing potential transactions.

To help inform the alignment of the MDBs with the Paris Agreement, this briefing explores the use of shadow carbon pricing by multilateral development banks (MDBs) and considers some best practices and limitations in the application of shadow carbon prices. The executive summary provides recommendations on how the MDBs might better align their shadow carbon pricing approach with the objectives of the Paris Agreement on climate change.

Summary recommendations

The briefing makes the following recommendations:

Recommendations
It is important to complement shadow carbon pricing with other tools to assess the alignment of investments with the Paris Climate Agreement, e.g. against compliance with steering the overall portfolio on a path to a net-zero carbon footprint. Carbon pricing on its own is not sufficient and is not a silver bullet for aligning financial flows with the Paris goals.

When updating their shadow carbon pricing approach, the MDBs should:

- Apply a shadow carbon price across all sectors and for all investments, not only for those that reduce emissions.
- Clarify the procedures on how the shadow carbon pricing is taken into account in decision making.
- Use carbon price scenarios that are at the highest end of the range of the High-Level Commission on Carbon Prices (USD 80 per ton of CO_2 by 2020 and USD 100 per ton by 2030) as a screen for alignment with limiting warming below 2°C, given that the High-Level Commission recommended carbon pricing of at least this level, while also applying a second - higher - carbon price scenario to assess alignment with limiting warming to below 1.5°C[1].
- Disclose which discount rates it is using per category of country, and the rationale and evidence for selecting such rates.
- Ensure that the shadow carbon pricing approach includes indirect emissions even if not directly controlled by the project (“scope 3”). Their inclusion can substantially change assessment of the environmental impact and thus are material to the investment decision.

As the MDBs are introducing more stringent policies on limiting financing for coal and oil, the effectiveness of carbon pricing in tackling the next highest emission source, fossil gas, becomes particularly relevant. To ensure an effective approach MDBs need to:

- *Estimate full life cycle greenhouse gas emissions along the gas supply chain and include fugitive emissions* as Scope 1 emissions, as in AFD and GHG Protocol’s best practice;
- *Use an emissions factor for gas investments in line with latest science* (at least 496g CO2 eq/kWh) and update the global warming potential of methane to a value of 84 based on a 20-year timeframe;
- *Use a time horizon commensurate to the asset lifetime*. Gas infrastructure typically has a lifetime of 30-80 years;
- *Compare a range of options in the economic assessment* – including energy efficiency, demand side response or grid interconnection – instead of comparing just to a business-as-usual option;
- *Consider stranded asset and lock-in risk assessment in view of broader decarbonisation policies/climate targets* like the expected 5-yearly ratcheting up of decarbonisation targets.

[1] Chapter 2 of the IPCC Special Report estimates that the (non-discounted) social cost of carbon for a below- 1.5◦C pathway ranges between $135-5500/tCO2-eq in 2030, and $245-13000/tCO2-eq in 2050. See: **http://www.ipcc.ch/report/sr15/**

Introduction

Shadow carbon pricing is a tool in internal financial or economic appraisal to encourage low-carbon investment or de-prioritise high-emission projects[2]. As shown in previous research, several of the multilateral development banks (MDBs) are using shadow carbon pricing within their economic analysis[3]. If shadow carbon prices are applied at the correct level, theoretically, only projects that are compatible with a low-carbon transition would go ahead[4].

To effectively trigger a transformation of investment portfolios, shadow carbon pricing needs to go beyond the isolated application of a price per ton of CO2e:

- Research has shown that **in many cases shadow carbon pricing is not a panacea or silver bullet to shift investment to low-carbon investment**. In some sectors such as buildings or transport as there are multiple other barriers in place[5].
- The effectiveness of shadow carbon pricing also depends on **how the appraisal process is set up and how its results impact decision making**.
- Its value needs to be connected to the goal as set out in the Paris Agreement on Climate Change. **The High-Level Commission on Carbon Prices (HLCCP), a World Bank initiative, has recommended carbon prices of <u>at least</u> $40-$80 per ton of CO_2 by 2020 and $50-100 per ton by 2030[6] to keep global warming below 2°C**. Given that the High-Level Commission uses the words "at least", the MDBs should be using the highest end of this range. Using an approach looking at the social cost of CO2e puts the price at more than $400 per ton CO_2[7]. Given that the Paris Agreement also strives to limit warming to below 1.5°C, it is also important to consider a second level of shadow carbon prices in line with that aim: the IPCC Special Report on Global Warming of 1.5°C cites a range for the (non-discounted) social cost of carbon of between $135 to 5500 / tCO2-eq in 2030, and $245 to 13000 / tCO2-eq in 2050, ranges which, even when discounted, are substantially higher than the HLCCP ranges for limiting warming to below 2°C[8].

This briefing explores the use of carbon pricing by MDBs and provides recommendations for whether and how MDBs might align their carbon pricing with the Paris Agreement on climate change and the limitations of the tool of carbon pricing.

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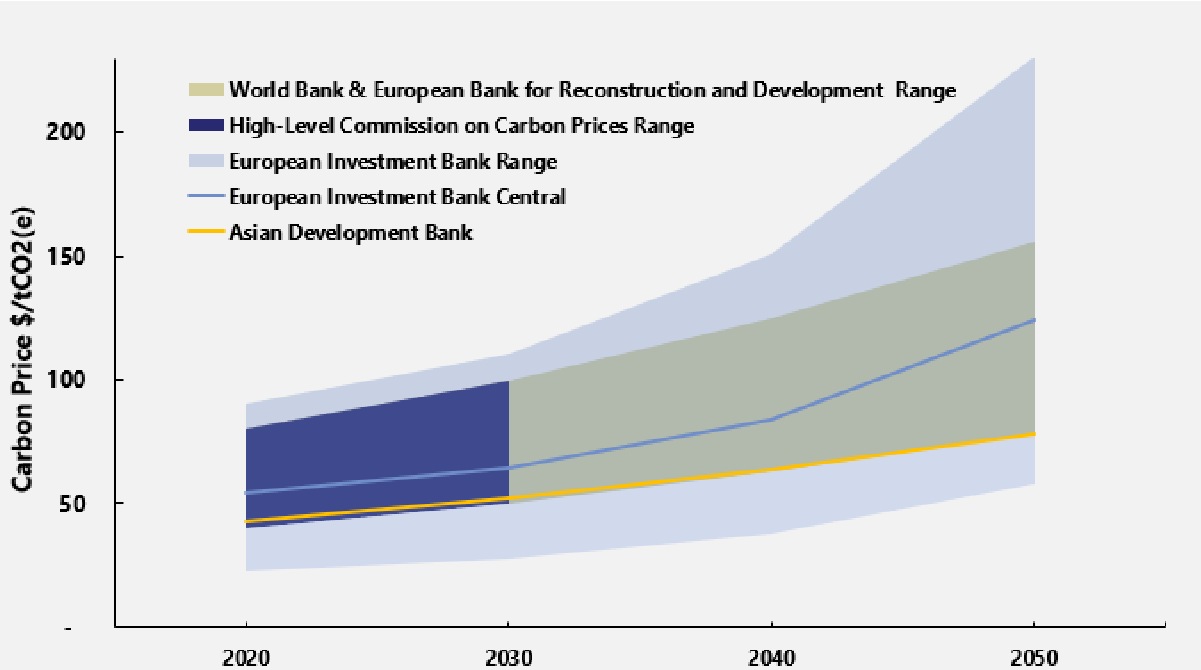
2 IC4E (2016), **Internal Carbon Pricing**
3 See: **https://www.e3g.org/library/banking-on-reform-aligning-development-banks-with-paris-climate-agreement**
4 Please see the E3G blog on this topic from which some of the material in this section is taken: **https://www.e3g.org/library/how-are-development-banks-performing-on-shadow-carbon-pricing**
5 See: **https://www.e3g.org/library/how-are-development-banks-performing-on-shadow-carbon-pricing**
6 HLCCP (2017) **Report of the High Level Commission on Carbon Prices**
7 Ricke et al (2018), Country-level social cost of carbon, Nature Climate Change, volume 8, pages 895–900 (2018) **https://www.nature.com/articles/s41558-018-0282-y**
8 **http://www.ipcc.ch/report/sr15/**

Comparison across MDBs

The figure below shows a comparison of the use of carbon pricing across the MDBs. As shown in the graph below, the European Investment Bank (EIB)'s carbon pricing increases at a faster rate. The Asian Development Bank (AsDB) has prices very much at the lower end of the range recommended by the High-Level Commission on Carbon Pricing. The EBRD has just recently updated their approach to shadow carbon pricing in January 2019, to use the high and low values from the range of prices recommended by the High-Level Commission on Carbon Prices[9].

Figure 1: Comparison of development bank shadow carbon prices in relation to High-Level Commission recommendations



Sources: *EBRD (**2019**), World Bank (**2017**), HLCCP (**2017**), EIB (**2015**), AsDB (**2017**)*
*All in 2017 prices, adjusted for inflation and EIB prices have been converted from EUR to USD using **OECD conversion rates***
Also, the EIB and EBRD use 'tons of carbon equivalent', while the others refer to 'ton of carbon'; it is not clear whether 'carbon' is being used as a shorthand in these documents.

The table below summarises the carbon pricing approaches used by different MDBs. The colours are a qualitative assessment of the level of progress in comparison to peers, with orange depicting average progress and green good progress. Grey indicates a lack of available information.

[9] See: **https://www.ebrd.com/news/publications/institutional-documents/methodology-for-the-economic-assessment-of-ebrd-projects-with-high-greenhouse-gasemissions.html**

Table 1: Summary of MDB carbon price usage

Bank	Which projects subject to greenhouse gas (GHG) assessment	Which projects apply shadow carbon pricing	Price level	How shadow carbon price is used	What is it compared to?	Are scope 3 emissions included?
Asian Develop-ment Bank	All projects with gross emissions above 100,000 tons CO_2eq	All projects where costs and benefits can be quantified.	Borderline on minimum price recommended by HLCCP. AsDB has the lowest carbon price in 2030.	Says 'should'[10] be used as basis for investment decisions. Applies the carbon price to the reduction or increase in project emissions against a baseline[11]. Use of the carbon price as a hurdle and the broad coverage suggests good practice.	The "without project" baseline scenario may not necessarily be the status quo. What matters is what would happen in the absence of the project. In comparing project alternatives, the same "without project" scenario should be used throughout.	No
European Bank for Recons-truction & Develop-ment	Projects which increase net[12] emissions by 25kCO_2e OR Gross emissions over 100ktCO_2e	All projects	Will use the high and low values from the range of prices recommended by HLCCP	Used for appraisal of carbon intensive projects; Clarification required on what counts as a 'carbon intensive project'. Uses levelised cost of energy (LCOE) in assessing coal-fired generation suggesting the carbon price is incorporated into a project baseline[13].	Identify all other realistically available options to meet the same energy needs as the proposed project.	Scope 3 GHG emissions may be taken into consideration where relevant (e.g. energy pipelines)
European Investment Bank	Scope 1 and 2 emissions are usually assessed for the economic appraisal.[14] For carbon footprinting purposes, there is a threshold of 20ktCO_2 absolute or relative emissions[15]	All projects that have been assessed.	EIB does not use the 'low' scenario[16]. EIB policy states will be periodically updated in line with emerging research[17]. This was last done to extend the price out to 2050.	Used for cost-benefit analysis for transport projects and cost-effectiveness analysis for projects in all sectors where cost-benefit is done[18]. Projects should have a positive economic return to pass the screening.	Carbon price is applied to relative emissions against a baseline[19]. EIB's approach aligns with the IFI harmonized approach but there are limitations with this. For its analysis of the Transadriatic Pipeline, EIB did not look at other options to achieve the same goal, e.g. curbing demand, renewable energy or increase interconnection. [20]	No[21]
World Bank	For WB: Over 25ktCO_2 net emissions. For IFC: Over 25ktCO_2 annual gross emissions	For WB: Energy, agriculture, transport, water, urban For IFC: Power, cement, chemicals, O&G, mining, livestock	Carbon prices align with the HLCCP	Will be used for all investment projects subject to GHG accounting. Price used in either cost benefit analysis or cost effectiveness analysis[22]. However, 'scenarios considered in the economic analysis can be done both with and without the shadow price of carbon'[23].	The Energy Sector Directions Paper 2013 specifies that – in the energy sector – global externalities be assessed comparing alternatives delivering the same level of service within the same time frame as the proposed project.	If costs and benefits include indirect costs and benefits, such as induced Investments, emissions generated out of the project need to be considered

***Sources:** AsDB (**2017**); AsDB (**2017b**); EBRD (**2014**); EBRD (**2019**); EIB (**2015**); EIB (**2018**); World Bank (**2017**); Pers. Comm (2018). CPLC (**2018**), TCFD and Carbon Pricing. Germanwatch (**2018**)*
Dark Green = Excellent, Green = Good, Orange = Average, Red = Lack of progress, Grey = Unknown.

[10] AsDB (2017) **Guidelines for the Economic Analysis of Projects**
[11] AsDB (2017) **Guidelines for the Economic Analysis of Projects**
[12] Net emissions refer to the relative change in emissions i.e. estimated gross project emissions compared to the without-project baseline.
[13] EBRD (2014) **Methodology for the assessment of coal fired generation projects**
[14] Information received directly from the EIB.
[15] EIB (2018) **EIB Project Carbon Footprint Methodologies**
[16] Information received directly from the EIB.
[17] EIB (2015) **EIB Climate Strategy**
[18] Information received directly from the EIB.
[19] Information received directly from the EIB.
[20] EIB (2017) **Environmental and Social Data Sheet, Trans-Ariatic Pipeline**.
[21] EIB (2018) **EIB Project Carbon Footprint Methodologies**
[22] World Bank (2017) **Shadow price of carbon in economic analysis**
[23] World Bank (2017) **Shadow price of carbon in economic analysis**

Limitations of carbon pricing

A carbon price must be set at the right level to work. Climate models known as Integrated Assessment Models are often used for estimating price levels for the social cost of carbon. However these models are limited since important climate impacts such as the loss of biodiversity, ecosystem services or coral reefs are difficult to translate to dollar costs, and therefore are usually not factored into models[24]. Moreover, tipping points in the climate system can occur which would trigger catastrophic climate impacts, and these are not factored in, meaning the costs of climate change are underestimated. One study found that a rapid, high-impact tipping point event could increase today's optimal carbon tax by over 200%[25]. The IPCC Fifth Assessment Report (AR5) concluded that "damage functions in existing Integrated Assessment Models (IAMs) are of low reliability" and that generally "some damages are omitted"[26]. Damage estimates should not be misconstrued as prices necessary to deliver alignment with respect to the Paris Agreement.

Carbon pricing is not always enough to encourage green investment and overcome market failures in important sectors such as buildings and transport[27]. An economic case already exists for zero-carbon buildings, but incentives are often not aligned (one example of misaligned incentives in the building sector is the principal/agent problem, where, for example, a tenant might make energy payments but a landlord might be solely responsible for purchases of building appliances and fixtures, which could limit the effect of a carbon price signal on decision-making). In transport, the World Bank has found high carbon prices were not sufficient[28] to incentivize low-carbon transport. A lack of alternative options (such as for seaports) can also mean that putting in place a shadow carbon price would be of limited value.

Fossil fuel subsidies can act as 'negative' carbon prices[29] and these subsidies still exist in most countries[30]. Moreover, public health costs (e.g. air pollution) of fossil fuel investments are also left out of investment decisions[31] but including these health costs would benefit low-carbon energy options. Finally, as climate science is evolving, prices require regular updating, but currently EIB is the only bank which has committed to regularly updating their carbon pricing[32].

The effectiveness of the carbon pricing depends on what tools or appraisals it is used for; whether this is used as a hurdle or merely for information purposes; and since the price is applied to project greenhouse gas emissions, it depends on the robustness of the greenhouse gas accounting methodology (see GHG Section for more information).

Effective shadow carbon pricing must consider an adequate scope of emissions if it is to adequately inform decision-making. For MDBs, consideration of emissions up- or downstream, even if out of project control ("scope 3") is imperative if investment decisions are to consider the full potential climate harm or benefit of a proposed activity. Including scope 3 emissions can help institutions to more correctly identify potentially highly-emitting projects.

Consideration of scope 3 emissions is particularly important in ensuring greenhouse gas emissions resulting from new fossil fuel production or transportation are adequately reflected in the application of shadow carbon pricing. A fossil gas pipeline, for example, may appear to have relatively low overall emissions if only Scope 1 and Scope 2 emissions are considered. However, if the Scope 3 emissions of the same pipeline are considered, the emissions associated with new production and consumption enabled by the pipeline may be orders of magnitude

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[24] See: **https://www.carbonbrief.org/qa-social-cost-carbon**
[25] Lontzek et al (2015) **Nature Climate Change volume 5, pages 441–444 (2015)**
[26] IPCC (2014) **Chapter 3: Social, Economic and Ethical Concepts and Methods**
[27] Germanwatch (2015) **Developing 2°C-Compatible Investment Criteria**
[28] Germanwatch (2015) **Developing 2°C-Compatible Investment Criteria**
[29] HLCCP (2017) **Report of the High Level Commission on Carbon Prices**
[30] See: **https://www.e3g.org/library/negative-carbon-pricing-a-shadow-price-we-need-to-know-blog**
[31] At present, health costs are not usually factored into investment decisions made by at MDBs at project-level, or factored into the global cost-benefit analyses of climate policies. Based on stakeholder conversations. See: **https://www.theguardian.com/environment/climate-consensus-97-per-cent/2018/apr/26/the-missing-maths-the-human-cost-of-fossil-fuels**
[32] EIB (2015) **EIB Climate Strategy**

greater than the Scope 1 or 2 emissions associated with the financed activity.

Some major development finance providers – most notably, the French Development Agency, Agence française de développement (AFD) – are already regularly considering Scope 3 emissions in their project-level assessments[33]. Moreover, the World Bank Group recently clarified in its guidance that costs and benefits "include indirect (out-of-project) costs and benefits, such as induced investments", then the emissions generated out of the project (scope 2 and 3 emissions) "also need to be considered in the analysis"[34].

How does carbon pricing relate to use of discount rates?

The carbon price, when applied to economic analysis, relates to other factors in the project appraisal such as the discount rate. The 'discount rate' is the "rate at which a society would be willing to trade present for future consumption"[35] to reflect that individuals have a preference for immediate rather than delayed gratification. Another reason relies on economic growth rates, where it is assumed that if a country is growing, costs incurred in the future will be more affordable[36]. Its application leads to 'discounted' value for benefits and costs of public projects lying in the more distant future[37].

The choice of discount rate is a key determinant for the result of any climate change cost analysis[38]. Therefore, it is important to understand the rationale for choosing one discount rate over another. Currently, not all MDBs disclose the discount rate being used. For reference, the UK Government uses a discount rate of 3.0 -3.5% for developed countries[39], Germany[40] a rate of 2.54 % and the United States[41] a rate of 3%. For other countries, the UK Government uses a discount rate of 10% - unless customized. The UK also uses declining discount rates for longer term investments in the climate change context to better reflect the existential risk to humankind[42].

Where discount rates are applied, the shadow carbon price weighs less in comparison if emissions savings occur later on or the carbon price does not escalate accordingly. That could lead to a situation where fossil fuels appear to perform better than renewables only because of the discount rate, as the costs of renewables are upfront with the benefits – reduced emissions – occurring distributed over a long time frame. Thus, to have a full understanding of the impact of shadow carbon prices, MDBs should provide more information on the discount rates they are using.

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[33] See: Assessment of Projects' GHG Emissions at AFD: Implementation of a Comprehensive Carbon Footprint Tool. **https://www.mainstreamingclimate.org/wp-content/uploads/2017/10/P4_AFD.pdf**
[34] World Bank (2017) **Shadow price of carbon in economic analysis**
[35] **http://www.sfu.ca/~heaps/483/discounting.htm**
[36] World Bank (2008) **https://openknowledge.worldbank.org/handle/10986/6659**
[37] World Bank (2008) **https://openknowledge.worldbank.org/handle/10986/6659**
[38] IPCC (2007) Fourth Assessment Report, Working Group III: **https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch2s2-4-2-1.html**
[39] HM Treasury, The Green Book - Appraisal and Evaluation in Central Government, 2011. doi:http://greenbook.treasury.gov.uk/index.htm
[40] BMF, Personalkosten, Sachkosten und Kalkulationszinssätze in der Bundesverwaltung für Kostenberechnungen und Wirtschaftlichkeitsuntersuchungen 2013, Bundesministerium Für Finanz. (2014). **http://www.bundesfinanzministerium.de/Content/DE/Standardartikel/Themen/Oeffentliche_Finanzen/Bundeshaushalt/personalkostensaetze-2013.html**
[41] A.S. Rushing, J.D. Kneifel, B.C. Lippiatt, Energy price indices and discount factors for life-cycle cost analysis - 2013, U.S. Department of Commerce, National Institute of Standards and Technology, 2013. doi:http://dx.doi.org/10.6028/NIST.IR.85-3273-28.
[42] See LSE (2014), **Valuing the far off future**. For example the UK uses a discount rate of 1.0% for 301+ years.

Effective carbon pricing for fossil gas investments

As many MDBs are introducing more stringent policies on limiting financing for coal and oil, the effectiveness of carbon pricing in tackling the next highest emission source, fossil gas, becomes particularly relevant.

Emissions from fossil gas account for about a fifth of global energy related emissions[43]. Globally, net anthropogenic greenhouse gas emissions need to be reduced to zero eventually to achieve climate stabilization. This means unabated fossil gas needs to be phased out[44]. The IEA "below 2°C" scenario has gas generation increasing rapidly in China and India, reducing emissions by displacing coal. In OECD countries, gas generation remains at present levels to 2030 and then falls significantly[45]. The IEA scenarios have been criticised for over-estimating the role of fossil fuels as they rely on large scale carbon capture and storage that is yet to be developed[46,47]. This suggests that while gas may have a limited role as part of the transition in some places, it is not a destination fuel for the economy.

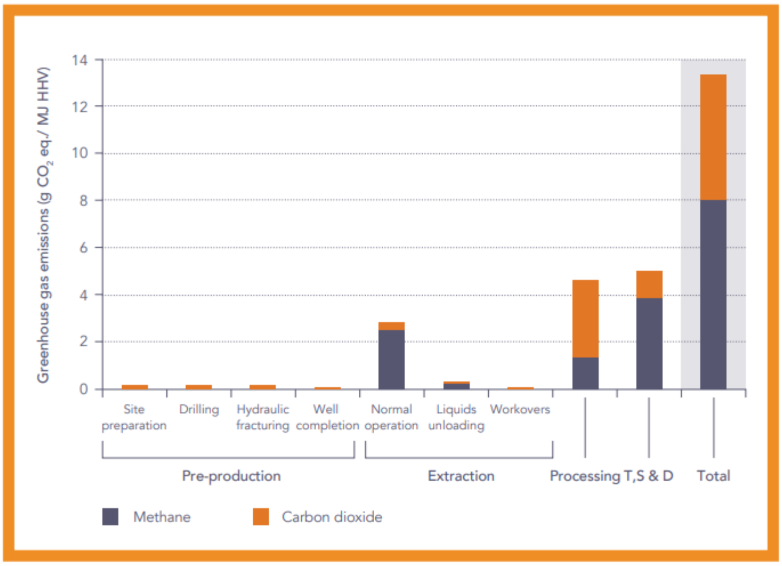
To assess whether gas investments are a sensible investment in view of the Paris Agreement, shadow carbon pricing needs to:

1. **Use the comparison of a range of options not only in the strategic assessment of the environmental impact, but also in the economic assessment.** Instead of modelling one option and a status quo-based reference scenario, fossil gas investments need to be compared to energy efficiency and renewable energy solutions. For example, the EIB assessed the Trans Adriatic Pipeline investment against a route where more methane leakage would occur, but not against the options of reducing gas consumption through deploying efficiency and renewable energy[48]. Replacing coal with gas might achieve emissions reductions temporarily but not if assessed against the introduction of demand side or renewable energy measures in the medium term[49] [50]. Currently, EBRD and WB state in their policies that they use such frameworks (see table 1).

2. **Use an emissions factor for gas in line with latest science. This currently suggests at least 496g CO2 eq/kwh. The high uncertainty related to methane emissions can be captured by testing for higher values[51].** This is based on the following evidence:
    - **For gas, emissions occur along the whole of the supply chain (see chart below). Including all upstream and downstream emissions is important and makes a major difference to the emission calculation.** Methane leakage along the can be significant and, as studies for the US show, can make it as polluting as coal if it exceeds a rate of 3.2% leakage[52]. The EBRD currently does not include upstream emissions as part of the project emissions[53]. The AFD[54] and GHG Protocol[55] recommend the inclusion of fugitive emissions as Scope 1 emissions.

[43] IEA World Energy Outlook 2017, **https://www.iea.org/weo2017/**
[44] Sokolov et al, 2017. Climate Stabilization at 2°C and Net Zero Carbon Emissions Sokolov, A., S. Paltsev, H. Chen, M. Haigh, R. Prinn and E. Monier (2017) Joint Program Report Series, 15 p., March. **https://globalchange.mit.edu/publication/16629**
[45] EA (2016) **Energy, Climate Change, and Environment**.
[46] **http://sarasinandpartners.com/docs/default-source/esg/are-oil-and-gas-companies-overstating-their-position**
[47] Oil Change International and Greenpeace, "The International Energy Agency and the Paris Goals: Q&A for Investors," **http://priceofoil.org/2019/02/07/the-international-energy-agency-and-the-paris-goals-qa-for-investors/**
[48] For its carbon footprint analysis of TAP, EIB used a baseline of more imports from the US or via a different, more "leaky" route. There was no assessment of options to curb demand, install renewable energy or increase interconnection instead. See: EIB (2017) **Environmental and Social Data Sheet, Trans-Ariatic Pipeline.**
[49] For example, RWTH Aachen study quoted in **https://www.welt.de/wirtschaft/energie/article180184444/Gaskraftwerke-koennten-Braunkohle-vollstaendig-ersetzen.html** highlights carbon reduction potential of replacing coal with gas but does not outline opportunities around energy efficiency or renewable energy instead.
[50] E3G report on "More Security, lower cost" showed that energy efficiency, interconnection and integrating electricity and gas markets could render additional gas infrastructure investments in Europe unnecessary.
[51] The Sustainable Gas Institute recommends to use a range of 419–636 g CO2 eq./ kWh, with a central estimate of 496 g CO2 eq./ kWh. The analysis should be tested against the upper bound as well. See **Sustainable Gas Institute (2015)**
[52] **https://theconversation.com/the-us-natural-gas-industry-is-leaking-way-more-methane-than-previously-thought-heres-why-that-matters-98918** and Alvarez et al (2012), PNAS April 24, 2012 109 (17) 6435-6440; **https://doi.org/10.1073/pnas.1202407109**
[53] EBRD (2017) **EBRD protocol for assessment of greenhouse gas emissions**

FIGURE ES-4
Central estimates of greenhouse gas emissions across the supply chain where best available techniques are applied, split into methane and CO_2 emissions, reflecting an 'effective' operation during key supply chain stages
A value of 34 for GWP100 of methane is used. The category 'T, S & D' refers to the transmission, storage and distribution stages.



Source: Sustainable Gas Institute[56]

- The global warming impact of methane is different to CO2. It lasts a much shorter time in the atmosphere[57] but has a much stronger greenhouse effect while it lasts[58]. With the world already experiencing climate change impacts, **there should be a view to minimising short-lived and long-lived greenhouse gases alike[59].** Depending on whether a 100 or 20 year timeframe is used, the global warming potential of methane is 21 or 86 times that of CO2[60].
- The induced emissions from downstream use should also be included in the emissions footprint of upstream and midstream gas projects. The EIB carbon footprinting methodology states that, for extensions of the gas network, "[a]ll emissions associated with the incremental demand are attributed to the project". However, while the EIB included fugitive methane emissions in its footprinting of the Trans Adriatic Pipeline, the footprinting did not include emissions from downstream combustion [61].

3. **Conduct a stranded asset risk assessment in view of broader decarbonisation policies/climate targets**. Carbon pricing can reflect climate impacts of a project but not assess stranded asset risk from climate related issues, as set out by the "Taskforce for climate-related financial disclosures"[62]. MDBs can effectively guard against stranded asset risk, if they include an assessment of how price and policy developments might affect demand for fossil gas, in particular in view of the 5-yearly ratcheting up of climate targets as foreseen under the Paris Agreement. In Europe, the combination of decarbonisation policies and increasing competitiveness of renewables, energy efficiency and battery storage mean that demand in the power sector is likely to be marginalised. European gas demand has been consistently overestimated as the effect of decarbonisation policies was neglected, affecting the economics of some projects such as the Southern Gas Corridor[63] [64]. Globally speaking, renewables are expected to become competitive with *existing* gas plants before 2030[65].

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[54] AFD (2017) **The AFD Carbon Footprint Tool for projects**
[55] GHG Protocol (2014) **Global Protocol for Community-Scale Greenhouse Gas Emission Inventories**
[56] Sustainable Gas Institute (2015) **Methane and CO2 emissions from the Natural Gas Supply Chain**
[57] Atmospheric lifetime for methane is only about 10-12 years: http://www.columbia.edu/~jeh1/mailings/2016/20160414_Electioneering.pdf
[58] **https://theconversation.com/the-us-natural-gas-industry-is-leaking-way-more-methane-than-previously-thought-heres-why-that-matters-98918**
[59] This is particularly important given impacts such as the melting ice sheets and the risk of climatic tipping points. See for example: dx.doi.org/10.1073/pnas.1810141115
[60] IPCC (2014) **Working Group I, AR5, Anthropogenic and natural radiative forcing**
[61] See: TAP assessment: **http://www.eib.org/attachments/registers/66312481.pdf**
[62] FSB-TCFD (2017) **Implementing the Recommendations of the Task Force on Climate-Related Financial Disclosures**
[63] E3G, **Europe's declining gas demand**
[64] OIES (2018), **Southern Gas Corridor Prospects to 2030**
[65] See: **https://www.e3g.org/news/media-room/europes-declining-gas-demand**

4. **Use a time horizon commensurate to the asset lifetime.** A time horizon shorter than that of the asset lifetime can lead to economically sub-optimal decsisions: countries are expected to progressively ratchet up the ambition of their long-term plans with a view to transitioning to a net-zero energy system by the second half of the century. In view of the longevity of gas investments, the appraisal time horizon needs to be reflective of that to maximise optimal use of public funds. For example, gas plants might run for 30 years and a gas pipeline can have an expected design lifetime of 80 years[66]. Taking into account the long time horizon in the project appraisal would reduce the risk of locking the energy system into a "cleaner but not clean enough" future[67].

[66] See: E3G (2018) **Sustainable Infrastructure**

[67] World Bank price grows exponentially between 2020 and 2050, with an average rate of growth of 2.8%. See World Bank (2015) **Guidelines for Economic Analysis of Power Sector Projects**

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