The Downstream Emissions Resulting from the Energy East Pipeline: an evaluation considering economic, technical and political risk factors

Executive Summary

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EXECUTIVE SUMMARY

This paper aims to improve understanding of the potential impact of the Energy East pipeline on global oil consumption and consequent downstream emissions of greenhouse gases responsible for climate change. At a design capacity of 1100 thousand barrels per day (TBD), the Energy East pipeline is expected to take oil from Western Canada through Eastern Canada, largely for export to international markets. If the project proceeds, will this lead to a significant increase in emissions outside of Canada? In this study, we seek an answer to this question by offering an analysis of Energy East's impact on downstream, global emissions that considers economic, technical and political factors.

At the outset, it is important to clarify the distinction between so-called "upstream" emissions, those on Canada's national territory, and "downstream" emissions due to consumption of Canadian oil abroad. Under United Nations accounting rules, countries are only responsible for emissions that occur within a country's national borders (IPCC, 2006: 1.4; UNFCCC, 2006: para.9). Canada is not responsible for emissions resulting from the combustion of Canadian oil elsewhere. However, it is increasingly recognized that the production and consumption of fossil fuels needs to be significantly scaled back to avoid dangerous climate change (McGlade and Ekins, 2015)—assuming that rapid advancement in carbon sequestration technology is not achieved (see Keith et al., 2006; Preston et al., 2005 for discussion). While upstream emissions associated with Energy East are important, in this study we focus on downstream emissions.

The only other study to consider the downstream emissions associated with Energy East has been led by the Canadian consulting firm Navius (Peters et al., 2015). Navius concludes that, as a result of new oil brought to market by Energy East, the global average price of oil is likely to decline slightly which will lead to increased consumption of refined petroleum products outside of Canada and an associated increase in downstream emissions of 4.7-12.0 megatonnes carbon dioxide equivalent (MtCO2e) per year (Peters et al., 2015: vii). Yet in reaching these results, Navius assumes that oil transport by rail will have expanded to effectively compensate for any lack of pipeline. More specifically, their scenarios modelling the absence of new pipelines in Canada anticipate that oil transport by rail will increase from just under 200 TBD in 2013 to 2400 TBD by 2035—an increase of over 1000% (Peters et al., 2015, 27, 31-33). This quantity of oil is itself equivalent to the functional capacity of all pipelines currently being proposed in Canada. Is this assumption valid? In the current paper, we rigorously assess the substitutability between rail and pipeline transport infrastructure. As our findings show, the choice of oil transport scenario against which Energy East is evaluated—the counterfactual scenario—significantly affects results of the evaluation of the pipeline's effect on downstream global emissions.

First, we review Western Canadian oil supply, including estimates of the amount expected to need exit from Western Canada by 2030. Second, we carefully build seven counterfactual reference scenarios of Western Canadian oil exports from 2015 through 2030 that distinguish between different plausible combinations of pipeline and rail oil transport capacity. Third, at the heart of our paper is a careful appraisal of economic, technical and political risk factors affecting the likelihood of each counterfactual scenario's implementation in the absence of Energy East. Based on our risk analysis, we evaluate in a qualitative manner which oil transport proposals are more likely to proceed than others—including different combinations of new pipeline and rail. The examination of political risk focuses on (i) the presence of institutional veto points that allow various political actors to block an oil transport infrastructure project and (ii) how the risks, interests and resources of strategic actors are influenced by the structure of the policy issue, particularly the jurisdictional separation of risks and benefits. Finally, for each counterfactual scenario, the effect of Energy East on global oil consumption and downstream emissions is estimated using an economic model based on

Erickson and Lazarus (2014) but modified in an important way to more accurately represent global price elasticities for oil supply and demand (see Leach, 2014a; b; Levi, 2014). We submit that an extremely-low to low demand elasticity (E_d = *-0.07 to -0.20*) and medium supply elasticity (E_s = *0.75*) are the most appropriate parameters for assessing the impact of new Energy East oil on global markets. We note that the model we use is not perfect, for which reason complex economic models are often favoured for analyses of this kind. However, to the extent that our results approach those of Navius when using their assumptions about substitutability between rail and pipeline, we have confidence in the results presented here. While many factors are important in determining global oil consumption, long-term price elasticities of global oil supply and demand are amongst the most important factors used in modeling such global dynamics.

Across the seven counterfactual scenarios identified, the relative impact of Energy East on global emissions varies from 3-40 MtCO2e (Table ES1). However, based on our risk analysis, we submit that the most likely and therefore appropriate counterfactual scenario against which to measure the effects of Energy East is Scenario 3 where, by 2030, limited new pipeline is constructed (TransMountain Expansion and Enbridge's Line 3 Replacement projects go ahead while Northern Gateway remains unimplemented) and limited new rail transport capacity is developed up to 660 TBD. While the associated amount of new rail is lower than that found in other studies, the resulting 660 TBD is still more than three times 2015 rail movements estimated at 200 TBD. However, while rail is uneconomic at current 2015 oil prices, we do not anticipate the global price of oil to be the limiting factor over the long-term. Rather, the key factors limiting substitutability between rail and pipeline are technical challenges and politics surrounding the prospect of a significant increase in oi transport by rail. Given these technical and political challenges, we maintain that it is highly unlikely that sufficient new rail transport capacity will be constructed to compensate completely for Energy East (990 TBD functional capacity) if the pipeline is not implemented. If a pipeline option is rejected, it does not follow that a politically less-favourable alternative will replace it even if it is economically feasible.

TABLE ES1: ESTIMATES OF THE IMPACT OF ENERGY EAST ON ANNUAL GLOBAL OIL CONSUMPTION AND DOWNSTREAM EMISSIONS USING APPROPRIATE PRICE ELASTICITIES OF GLOBAL SUPPLY AND DEMAND

Scenario	Risk Analysis	Annual Oil Consumption (TBD)	Annual Downstream Emissions (MtCO2e)
1) 2015 Status Quo Pipeline & Rail	Unlikely	78-204	15-40
2) Limited New Pipeline & No New Rail	Unlikely	78-204	15-40
3) Limited New Pipeline & Limited New Rail to 660 TBD	Most Likely	63-165	12-32
4) Limited New Pipeline & Limited New Rail to 400 TBD	Likely	78-204	15-40
5) Limited New Pipeline & Rail Compensates for EE	Unlikely	21-56	4.0-11.0
6) Extensive New Pipeline & Limited New Rail to 660 TBD	Unlikely	26-68	4.8-13.3
7) Navius: Limited New Pipeline & Extensive New Rail	Highly Unlikely	17-46	3.3-9.0

Note: Long-term Price Elasticity of Supply: Medium (E_s = *0.75*). Long-term Price Elasticity of Demand: Extremely-low (E_d= *-0.072*) and Low (E_d= *-0.20*). EE=Energy East, NG=Northern Gateway.

Based on our Scenario 3, we estimate Energy East to most likely lead to an increase in global annual oil consumption of 63-165 TBD per year and downstream emissions by 12-32 MtCO2e per year (Table ES1). When we consider the impact of Energy East relative to a counterfactual scenario that replicates assumptions about the near perfect substitutability of pipeline and rail, our Scenario 7, Energy East increases downstream emissions by 3-9 MtCO2e per year—a figure close to Navius' own estimate of 4.7-12.0 MtCO2e per year. Put different, our estimate of the downstream emissions resulting from Energy East is more than 2.5 times as large as the only other existing study. We conclude that the feasibility of substituting pipeline with rail has a significant impact on estimates of emissions associated with Energy East and should be scrutinized in any evaluation of the global carbon footprint of Energy East. In light of our scenarios, the difference between downstream emission under scenarios assuming perfect and imperfect substitutability between pipeline and rail stands at 8.7-23 MtCO2e per year.

In Table ES2 below we summarize results of our study and other existing studies of Energy East to arrive at an estimate of total upstream and downstream emissions likely due to this new pipeline. We distinguish between studies that question the perfect substitutability between pipeline and rail, including a study by the Pembina Institute (Flanagan and Demerse, 2014) and this study, as well as the study by Navius which assumes near perfect substitutability. In terms of upstream emissions, the Pembina Institute estimated Energy East would result in 30-32 MtCO2e per year on Canadian territory (Flanagan and Demerse, 2014: 21), but did not consider net upstream effects after accounting for global oil market dynamics. Navius finds that while upstream emissions in Canada increase to between approximately 2-11 MtCO2e in Navius' model, this is offset by reduction in upstream emissions linked to reduced production elsewhere in the world (Peters et al., 2015: x). After accounting for global oil market dynamics, Navius concludes that Energy East will likely increase net global upstream emissions by 0.7-4.3 MtCO2e per year (p. viii-ix). We agree with Navius that it is important to consider global oil market dynamics, which we have also undertaken in our analysis. Using a ratio from Navius' estimate of global upstream emissions and Canadian upstream emissions, we estimate that net global upstream emissions associated with the Pembina study would have been approximately 12-13 MtCO2e per year. To the best of our understanding, the discrepancy between Navius and Pembina's adjusted estimate is due to different treatments of the substitutability of rail and pipeline transport in the analysis.

TABLE ES2: TOTAL GLOBAL EMISSIONS (UPSTREAM AND DOWNSTREAM) ASSOCIATED WITH ENERGY EAST, DIFFERENTIATING BETWEEN IMPERFECT AND PERFECT SUBSTITUTABILITY OF PIPELINE AND RAIL

Emissions	Imperfect Substitutability Between Pipeline and Rail		Perfect Substitutability Between Pipeline and Rail	
	MtCO2e /yr	Reference	MtCO2e /yr	Reference
Upstream Emissions*				
-Global	(12-13)	(See Text)	0.7-4.3	(Peters et al., 2015)
-Canada	30-32	(Flanagan and Demerse, 2014)	2.0-11.0	(Peters et al., 2015)
Downstream Emissions				
-Global	12-32	(This Study)	4.7-12.0	(Peters et al., 2015)
Total Global Emissions	24-45		5.3-17.0	

*Note that we estimate global upstream emissions associated with the Pembina Institute's upstream estimate, which does not consider global oil market dynamics, based on a ratio of global upstream to Canadian upstream emissions in Navius' study. This adjusted Pembina estimate of 12-13 MtCO2 per year is reported in parentheses in this table. See text for details.

In terms of downstream emissions, our estimates in Table ES2 differ significantly between the estimate emanating from our study of 12-32 MtCO2e per year in contrast to the Navius estimate of 4.7-12 MtCO2e per year. Again these differences are explained by the different treatment of the substitutability of pipeline and rail in the analysis. Overall, we estimate that, when taking global oil market dynamics into consideration, the total impact of Energy East varies from 24-45 MtCO2e per year when pipeline and rail are considered imperfectly substitutable to 5.3-17.0 MtCO2e per year where they are deemed perfectly substitutable. Given technical and political challenges to the significant increase in oil transport by rail, we have argued in this paper that pipeline and rail are highly imperfect substitutes for bringing Western Canadian oil to global market and thus that the total effect of Energy East in terms of upstream and downstream emissions is more likely to be 24-45 MtCO2e per year. It is important to consider political risks along with economic and technical factors associated with new oil transport infrastructure in the evaluation of emissions related to new pipelines.

Is our estimate of the 24-45 MtCO2e of total upstream and downstream emissions associated with Energy East in the table above significant? We assert that the significance of these figures will also be political. Energy East is but one small piece of a much larger puzzle; however, this large puzzle is itself made of many small pieces and guided by the international norm of common but differentiated responsibilities (Asselt and Zelli, 2014; Purdon, 2015; Stone, 2004). Total global greenhouse gas emissions stood at 46,049 MtCO2e in 2012 (WRI, 2016). Relative to this figure, total upstream and downstream emissions resulting from Energy East range from 0.05-0.10%. However, relative to Canadian emissions, total upstream and downstream associated with Energy East range from 3.4 to 6.4% of Canada's 702 MtCO2e emitted in 2011 (Environment Canada, 2013: 15). Finally, using a greenhouse gas equivalency calculator developed by the EPA (2015), our estimate of the total emissions associated with Energy East is equivalent to adding approximately 5.0-9.5 million cars to the roads of the world. We stress again that under current international accounting rules, Canada is not responsible for downstream emissions resulting from oil consumed outside Canada's borders. However, our findings also contribute to ongoing debates about the appropriate accounting framework for the international climate change regime—consumption or production (Harrison, 2015; Peters and Hertwich, 2008).

While our study is unlikely to be the final word on Energy East, we hope that it helps clarify discussion about new pipelines in Canada and contributes to these important international debates. It also points to a number of recommendations. First, it would be important that more detailed economic modeling is undertaken in conjunction with rigorous vetting of various counterfactual scenarios that includes economic, technical and political factors. Second, it would important to assess the possibility of a significant increase in rail transport implied in counterfactual claims made in reference to Energy East and other pipeline proposals, including effects on safety and congestion. Such recommendations might be incorporated into new rules being developed by the Canadian federal government for the assessment of pipeline proposals (Muise, 2016).

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