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Greenhouse gas emissions implications of the Keystone XL pipeline

Peter Erickson and Michael Lazarus

Stockholm Environment Institute – U.S. Center

EXECUTIVE SUMMARY

Climate policy and analysis often focus on energy production and consumption, but seldom consider the role of energy transportation infrastructure. How might the choices we make about coal export terminals, or oil and gas pipelines, shape the future development of our energy systems? How might they affect energy use, and the resulting greenhouse gas emissions?

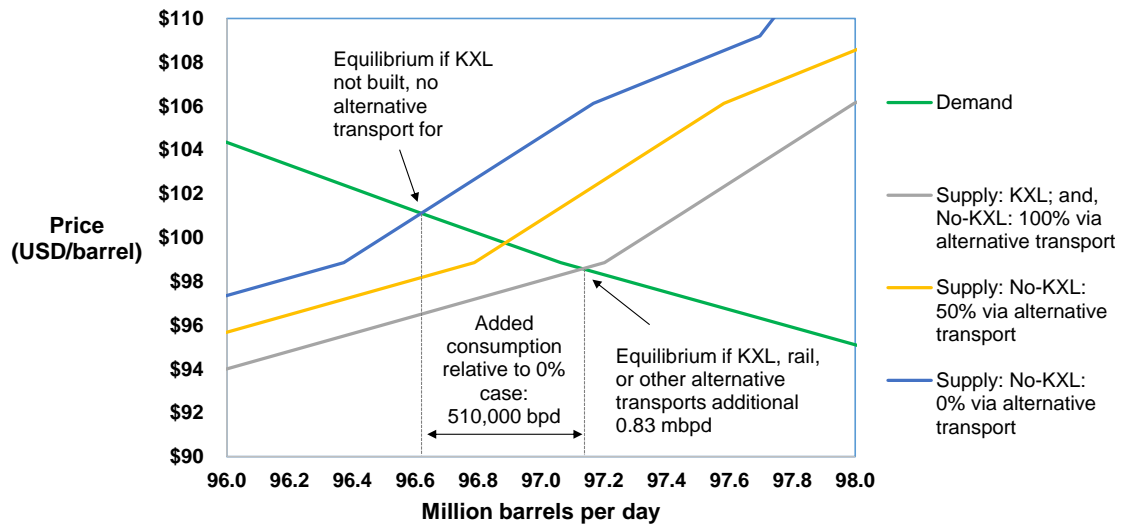
The proposal to extend the Keystone XL pipeline, to connect Canadian oil sands production with refineries and ports in the Gulf of Mexico, has brought these questions to the fore. Environmental activists have argued that Keystone XL would strike a serious blow to the climate, and President Barack Obama has said he will only approve Keystone XL if it “does not significantly exacerbate the problem of carbon pollution”. Similar issues have been raised with regard to proposed coal export terminals in the U.S. Pacific Northwest.

Several analyses of Keystone XL’s emissions impact have been published, with very different conclusions. Draft analysis commissioned by the U.S. Department of State found that the pipeline would lead to little change in global GHG emissions. Other studies refer to the emissions associated with oil transported by the Keystone XL pipeline – 830,000 barrels per day, and 181 million tons of carbon dioxide equivalent (CO₂e) per year. Many have emphasized the emissions associated with the high resource intensity of oil sands production, on the assumption that Canadian oil sands would substitute for less resource-intensive sources of oil – without changing global oil consumption – the difference amounting to roughly 19 to 25 million tons CO₂e per year.

To a great extent, the different estimates reflect divergent, even opposing perspectives on how Keystone XL would affect the amount of Canadian oil sands production that reaches the market, and whether that added production would either displace other supplies or add to them. This paper does not assess whether Keystone XL would in fact lead to more Canadian oil sands production, a highly speculative question given the politicized nature of various pipeline and rail expansion proposals. Rather, it focuses on a key issue that has received much less attention: how Keystone XL might affect the global oil market by increasing supply, decreasing prices, and thus increasing global oil consumption. Even if those effects are small in global terms, they could be significant in relationship to Keystone XL and U.S. climate policy.

To capture a range of possibilities, we examined three possible implications for Canadian oil sands production if the Keystone permit were rejected: 1) that the same amount of oil (100% of Keystone capacity) would reach the market anyway through other transport options; 2) that half of it would; or 3) that none would. For the latter two cases, our analysis finds that the pipeline's impact on global oil prices, though modest (less than 1%), would be enough to increase global oil demand by hundreds of thousands of barrels per day. Figure ES-1 summarizes the model and its results. Based on our assumptions regarding demand and supply responsiveness, and consistent with other, peer-reviewed literature, global oil use would increase by as much as 510,000 barrels per day, or 62% of Keystone XL capacity, in the case that none of the oil would otherwise reach the market.

Figure ES-1: Simple model of global supply and demand for oil

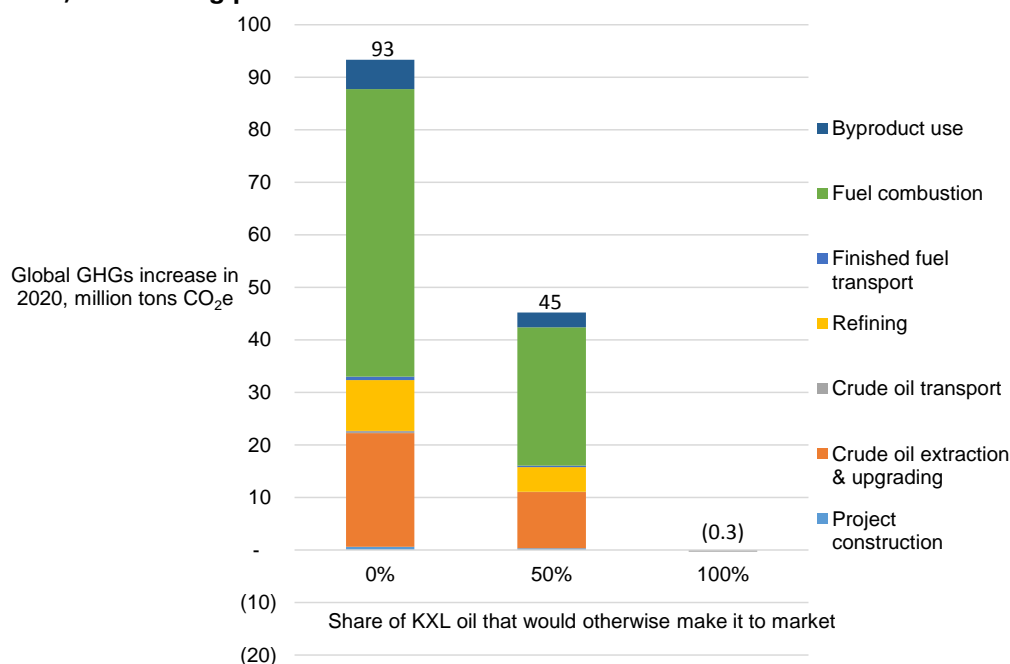


Note: Analysis assumes elasticity of demand to be -0.2 .

As shown in Figure ES-2, such an increase would boost global GHG emissions by as much as **93 million tCO₂e per year**, potentially for most of Keystone XL's 50-year lifespan. If only half of the oil would otherwise reach the market, the impact would be roughly half that size.

These potential impacts are about **four to five times greater than** the GHG implications of simply *displacing* average crude imported into the U.S. with oil-sands crude. A 93 million tCO₂e increase in annual emissions would be roughly equivalent to 1–2% of current U.S. emissions and 10% of the emission reductions that the U.S. government has pledged to achieve by 2020 (to 17% below 2005 levels). It would also be greater than the emission reductions that several proposed federal climate mitigation policies could achieve in 2020, such as U.S. Environmental Protection Agency performance standards on industrial boilers, cement kilns, and petroleum refineries.

Figure ES-2: Total annual GHG emissions impact of Keystone XL, by life-cycle phase, 2020, considering price effects



Policy implications

Our analysis points to a gap in existing assessments of the Keystone XL project. If a simple supply-and-demand model such as ours shows that the pipeline's effect on oil prices could quadruple its total GHG impact, it is crucial that such effects be more clearly addressed in analyses that could inform President Obama's decision. An advantage of a simple model such as the one we constructed – using publicly available supply curves and peer-reviewed demand elasticities (the extent to which changes in oil consumption have responded to changes in oil prices) – is that it is highly transparent, and allows one to gauge the magnitude of possible effects. By contrast, proprietary models like the one used for the prior State Department market analysis lack transparency in key assumptions, such as how the global oil market may respond to changes in supply.

The answer to the question of whether Keystone XL will “significantly exacerbate the problem of carbon pollution” is likely to hinge upon how much the pipeline increases the global oil supply – and through its price effects, global oil consumption. At full capacity, Keystone XL is expected to be able to carry 830,000 barrels per day. Some have argued that if the pipeline is not built, then other modes, particularly rail, will be used to transport an equivalent amount of oil. However, there is far more prospective added Canadian oil sands production (4.5 million barrels per day) than Keystone XL itself can carry. Rail routes may be needed and used whether or not Keystone XL is completed. If Keystone XL ultimately enables significantly greater development of Alberta's oil industry, and thus increases the global oil supply and, in turn, consumption, then indeed, the “problem of carbon pollution” could be “significantly exacerbated”.

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