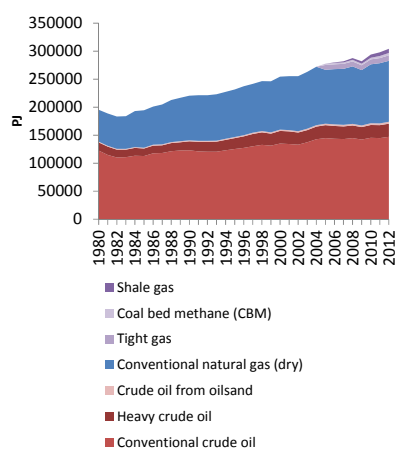


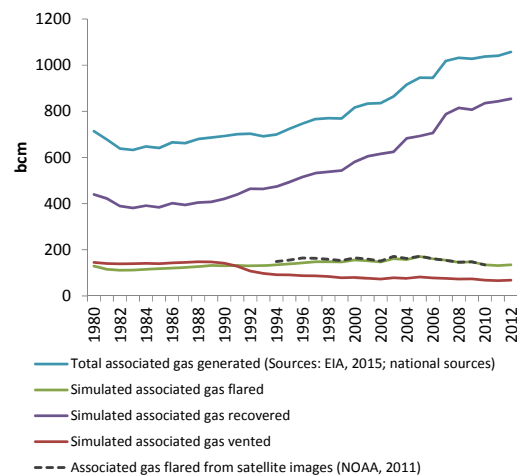
Novel approach: simulation of associated gas flows

Existing bottom-up emission inventories of historical methane and ethane emissions from global oil and gas systems do not well explain year-on-year variations in emissions estimated by top-down models from atmospheric measurements. This paper develops a bottom-up methodology which allows for country- and year specific source attribution of methane and ethane emissions from global oil and natural gas production for the period 1980 to 2012. The analysis rests on country-specific simulations of annual associated gas flows constructed from country information on oil and gas production, associated gas generation and recovery (EIA, 2015; national information sources). Acknowledging that associated gas generated must be either recovered (for reinjection/utilization), flared or vented, the flows to either of these destinations are simulated. The flows were calibrated to match the simulated amount of gas flared with estimates of gas flares from satellite images (NOAA, 2011). Summing up simulated emissions from associated gas flows and global estimates of emissions from unintended leakage, natural gas transmission and distribution (Höglund-Isaksson, 2012), preliminary results show global emissions of ethane from oil and gas systems correspond reasonably well with estimates of ethane emissions from top-down models (Simpson et al., 2012; Aydin et al., 2011). With oil and gas production being the principal source of ethane and ethane's considerably shorter lifetime than methane, ethane is used as a validator of the simulated methane emissions. An interesting finding is that the fall of the Soviet Union in 1990 appears to have had a significant negative impact on methane and ethane emissions from global oil and gas systems over the period 1990 to 2005.

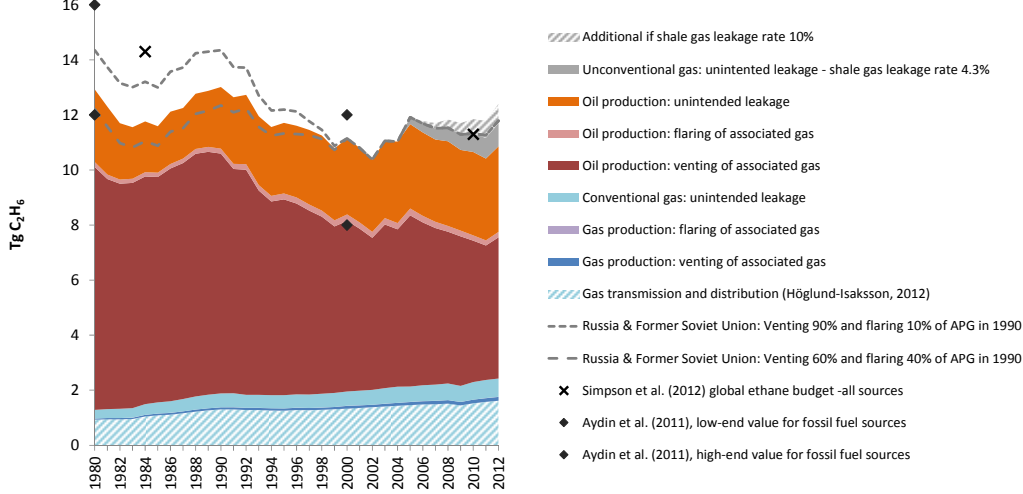
Global oil and gas production 1980-2012



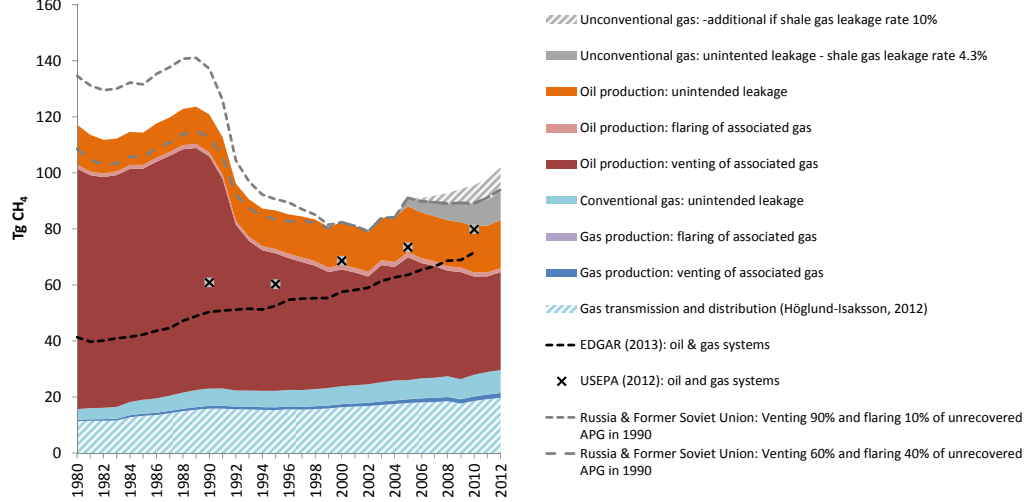
Associated gas flows



Simulated global ethane emissions from oil and gas systems



Simulated global methane emissions from oil and gas systems



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