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Assessing climate benefits of natural gas and coal electricity generation

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A transition from a system of coal electricity generation to near-zero emission electricity generation will be central to any effort to mitigate climate change. Natural gas is increasingly seen as a 'bridge fuel' for transitions form coal to near-zero emission energy sources. However, various studies use different metrics to estimate the climate impact of natural gas utilization, and led to differing conclusions. Thus, there is a need to identify the key factors affecting the climate effects of natural gas and coal electricity production, and to present these climate effects in as clear and transparent a way as possible.

Here, we identify power plant efficiency and methane leakage rate as the key factors that explain most of the variance in greenhouse gas emissions by natural gas and coal power plants. We then develop a power plant GHG emission model, apply available life-cycle parameters to calculate associated CO_2 and CH4 emissions and assess climate effects. Simple underlying physical changes can be obscured by abstract evaluation metrics, thus we base our discussion on temperature changes over time.

We find that, during the period of plant operation, if there is substantial natural gas leakage, natural gas plants can produce greater near-term warming than a coal plant with the same power output. If leakage rates can be made to be low and efficiency high, natural gas plants can produce some reduction in near-term warming. However, without carbon capture and storage natural gas power plants cannot achieve the deep reductions that would be required to avoid substantial contribution to additional global warming. Achieving climate benefits from the use of natural gas depends on building high-efficiency natural gas plants, controlling methane leakage, and on developing a policy environment that assures a transition to future lower-emission technologies.

For more information please see http://iopscience.iop.org/1748-9326/9/11/114022/article .