Fossil natural gas exit – A new narrative for the European energy transformation towards decarbonization

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1. Motivations underlying the research

This paper discusses the potential role of fossil natural gas in the process of the energy transformation in Europe on its way to decarbonization. Mainstream conventional wisdom has it that natural gas, perhaps in combination with other gases, should maintain an important role in the energy mix, first, as a "bridge fuel", and then through a gradual transition toward "decarbonized gases". However, when considering the ambitious climate targets of the EU and the subsequent need for far-reaching decarbonization, in combination with technical constraints and the results from our own energy system modeling, we arrive at a contrasting result: The disappearance of fossil natural gas and its corresponding infrastructure is the next logical step of the transformation process in Europe. The paper provides a review of the issues at stake and deconstructs the dominant narrative through a detailed technical description of different energy gases and their real climate effectiveness, as well as results from energy system modeling. We conclude that the phase-out of fossil natural gas in Europe needs to be completed towards 2040 in order to comply with climate targets and provide planning reliability for policy-makers and the industry. We develop an opposing narrative of a natural gas exit, by positing that the EU objectives of decarbonization are to be taken serious, and then rejecting the hypothesis that "methane can decarbonize". Our argument relies on a critical analysis of energy gases, and it is supported by modeling evidence on the European energy mix under decarbonization.

2. A short account of the research performed

The paper describes the transformation process of the European energy system over the last decades. From a focus on market restructuring, liberalization, and competition, the focus has shifted to environmental aspects and decarbonization. Clearly, while the former benefitted the natural gas industry, the latter disfavors it, due to its relatively large contribution to greenhouse gas emissions through CO_2 and methane (CH_4). In Section 3 we provide an overview of the technical aspects of fossil natural gas and other energy gases and find that arguments how to "decarbonize" methane are flawed. In Section 4, we place this analysis in the energy economic context and provide model-based analysis of a gradual phase-out of fossil natural gas from the European energy mix in the coming decades; this rests on the assumption that nuclear power is not economically available, and that there be no breakthrough of carbon capture or other carbon dioxide removal technologies.

3. Main conclusions and policy implications of the work

Our analysis has implications, both for concrete business and policy decisions, but also at the more general level of the new narrative:

~ Fossil natural gas is a CO_2-intensive fossil fuel, the climate and other adverse effect of which have been hidden so far, by the focus of the climate debate on the phasing out of coal, and the narrative of "clean" fossil gas as an important bridge of the low-carbon energy transformation. However, taking into account the entire production chain, from production, long-distance transportation, and (often incomplete) burning in motors and turbines, the greenhouse gas impact of methane in many cases resembles

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that of coal (by unit of energy produced), and in some cases even exceeds it. Today, over two decades of attempts to generate "clean" fossil fuels, the illusion of large-scale, technically and economically available CCTS should not be upheld.

~ Some energy gases may remain in the future, also in a 100% renewable system. Hydrogen, locally produced from 100% renewables may be needed for seasonal storage of excess electricity and locally reconversion on cold days with little wind and sun. In addition, hydrogen may be needed for specific industrial applications that cannot be converted to electricity (e.g. steel production or the chemical industry). The failed history of global LNG markets (Jensen 2004; Neumann 2009) suggests not to bet on "globalization" of other gases, such as synthetic fuels or hydrogen.

~ As a long-lived asset, and a system good with heavy interlinkages to upstream, downstream, and side stream activities, fossil gas exit will not happen overnight, but rather on a time span of about two decades. Thus, private and public decisions need to be taken to address natural gas exit in the short term, e.g. through imposing an adequate price on carbon, but also in the long term, e.g. by prohibiting new fossil gas-fueled new heating (such as in the Netherlands from 2025 onwards).

~ Just like for coal, phase-out plans for fossil natural gas will have to be developed. These plans should include phase-out periods with clear end dates for fossil natural gas production and usage in order to enable planning security and to avoid stranded assets and compensation payments. No fossil hydrogen infrastructure including CCTS should be developed: It takes too long to build, will lock-in natural gas production, and will result in stranded assets when natural gas is phased out.

~ More generally, risks of stranding assets are imminent. The current situation, where an industry doomed to disappear starts to sink investments to assure short-term survival, is not new, but observed worldwide. The risk, however, both for outside investors and the state/European regulators, is that the fossil natural gas industry invests in what will become stranded assets. The most prominent example is the € 10 bn. North Stream 2 pipeline connecting Russia to the EU, which is not necessary to assure European supply security, let alone to make a return on investment (Neumann et al. 2018). Smaller investments fall in this category as well, such as new LNG terminals on the shore of the North Sea (Brauers, Braunger, and Jewell 2021) and new natural gas power plants (Gerbaulet et al. 2019).