

## 1.B.3 - Geothermal Energy

Operation of geothermal power stations and heat stations in Germany produces no emissions. The thermal-water circuits of such installations are closed and airtight, both above and below ground level. As a result, no emissions occur during their operation. Even a release of the gases dissolved in the heat-carrying fluid – primarily, hydrogen (H<sub>2</sub>), methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), and hydrogen sulphide (H<sub>2</sub>S) – would not lead to concentrations worthy of reporting.

No emission factors for pollutants that could escape in connection with drilling for tapping of geothermal energy (both near-surface and deep energy) are known for Germany at present.

From a geoscientific standpoint, however, it is clear that virtually any drilling will lead to releases of gases bound in underground layers – and the gases involved can include H<sub>2</sub>, CH<sub>4</sub>, CO<sub>2</sub>, H<sub>2</sub>S and Rn<sup>1)</sup>.

In many cases, and especially in drilling for tapping of geothermal energy near the surface, such emissions would be expected to be very low. “Blow-out preventers”, which are safety devices that guard against gas releases, are now used in connection with all deep drilling. In addition, specially modified drilling fluids are used that force gases that are released into the well back into the penetrated rock layers.

In drilling operations for near-surface geothermal energy, as in drilling of wells for drinking water, only low emissions levels are normally encountered, due to the low gas concentrations found near the surface. In the interest of preventing gas releases, drilling of deep geothermal wells is subject to the same safety regulations that apply to hydrocarbon exploration, including obligations to use Christmas trees and blowout preventers, to prevent accidents. A study by Frick et al. (2007)<sup>2)</sup> estimates that NMVOC emissions from geothermal drilling sum up to nearly 30 kg/a.

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<sup>1)</sup> Theloke et al. (2013): Theloke, J., Kampffmeyer, T., Kugler, U., Friedrich, R., Schilling, S., Wolf, L., & Springwald, T.: Ermittlung von Emissionsfaktoren und Aktivitätsraten im Bereich IPCC - Diffuse Emissionen aus Mineralöl und Mineralölprodukten; Institut für Energiewirtschaft und Rationelle Energieanwendung (IER) (University of Stuttgart) with Eurofins GfA GmbH (Mannheim) and Ökopol GmbH (Hamburg), on behalf of the Umweltbundesamt, Dessau-Roßlau, 2013 (not available online)

<sup>2)</sup> Frick et al. (2007): Frick, St., Schröder, G., Rychtyk, M., and Bohnenschäfer, W.: Umwelteffekte einer geothermischen Stromerzeugung -Analyse und Bewertung der klein-und großräumigen Umwelteffekte der geothermischen Stromerzeugung (FKZ 205 421 10), Institute for Energy and Environment (Institut für Energetik und Umwelt gGmbH (IE)), on behalf of the Umweltbundesamt; [https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/endbericht\\_fkz\\_205\\_42\\_110-gesamtausgabe.pdf](https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/endbericht_fkz_205_42_110-gesamtausgabe.pdf); Leipzig, 2007