WHY THERE IS NO SUCH THING AS CLEAN COAL

Summary of report: Potential Impacts of Proposed New Coal Generation by Dr Ranajit Sahu

AIM OF THE REPORT: To describe how the proposed new 1500 Megawatts of coal power generation will cause significant air pollution and greenhouse gas emissions even if the cleanest technology currently available is used, and to explain why these impacts cannot be meaningfully mitigated using notions of "clean coal".

EXPERT BIO: Dr. Ranajit Sahu is a consulting engineer with 30+ years' experience in environmental, mechanical, and chemical engineering, including design and specification of power plants and pollution control equipment. He has taught at various universities on air pollution, risk assessment, and hazardous waste management. He has consulted on air pollution matters for a wide range of clients including the US government, various US states, private industry, and non-governmental organizations.

SUMMARY OF FINDINGS:

1. The 2019 Integrated Resource Plan for Electricity (IRP) proposes adding 1500 MW of new coal generation in South Africa. The IRP states that high-efficiency, low-emission (HELE) generation technology will be used, although it does not state which kind.
2. This report assesses the potential air emissions and feasible timelines of the most likely and feasible types of HELE technology which could be used, namely: pulverised coal units, circulating fluidized bed technology, integrated gasification combined cycle (IGCC), and underground gasification combined cycle (UGCC) power plants. The report notes the following:

    - Ultra-supercritical (USC) efficiency is the highest possible thermal cycle efficiency that can be anticipated for procurement of 1500 MW of new coal under the 2019 IRP because higher efficiency technologies, such as advanced ultra-supercritical (AUSC) efficiency coal plants do not meet the IRP's requirement that chosen technologies "must be based on at least one operational project experience (ideally three) anywhere in the world, to substantiate claims by manufacturers".

    - Circulating fluidized bed (CFB) technology is considered preferable by the IRP due to its ability to handle low quality and waste coals in South Africa. However, to retain ultra-supercritical efficiency, the size of such units is important, and these are not specified in the IRP.

    - Integrated gasification combined cycle (IGCC) and underground gasification combined cycle (UGCC) power plants, and carbon capture (CC) technologies are extremely unlikely to be implemented for the 1500 MW of new coal proposed under the 2019 IRP because they are unproven and cost-prohibitive at scale.

3. The report finds that large quantities of greenhouse gas emissions are unavoidable even from power plants that use HELE technologies. Pulverized coal units, even ultra-supercritical, will not be able to capture their emitted carbon dioxide due to extremely high costs. Circulating fluidized bed technology emits from two to ten times more nitrous oxide than pulverized coal technologies. (Nitrous oxide is a potent, long-lasting greenhouse gas with a global warming potential 300 times that of carbon dioxide.)

4. Furthermore, the report finds that even if HELE technologies are applied consistently and perfectly (a practical impossibility, since the technologies do not work under all modes of operation, such as during startup or malfunction), air emissions are considerable even just at the plant itself. Plus, there are non-air impacts such as waste water and cooling water and waste generation at the plant. Of course, in addition to impacts from the plant, a coal plant will need to rely on an extensive supply chain starting at the coal mine and through disposal of the coal ash, with transportation in between – all of which not only have significant air impacts but also water and waste impacts. Thus, "clean coal" is a myth.
5. Lastly, the report notes that it is unreasonable to expect that any amount of new coal generation could come online by 2023 since it takes much longer than four years to achieve generation starting from scratch, especially with the many unknowns relating to HELE technology selection, design, procurement, and implementation

QUOTES

"I want to stress that contrary to implications in the 2019 IRP and the Ministerial determination, there is simply no such thing as "clean coal", regardless of whether HELE technologies are used to minimize air emissions from coal (or gas derived from coal)."

"The worldwide progress of carbon capture technology has been sluggish, at best. Per the Global CCS Institute, there are currently 23 CC projects in construction or operation around the world. But a review of the website listing the projects shows that not one is located at a coal-fired power plant of commercial scale."

"While the CO_2 emissions intensity for coal plants is reduced somewhat as a result of increasing the efficiency of the thermal cycle, major reductions in CO_2 intensity can only be achieved by way of carbon capture. Based on the track record of carbon capture to date globally, it is my opinion that there is simply no pathway to economically utilize carbon capture in South Africa now or in the foreseeable future for reducing CO_2 emissions from new coal generation. It is impractical to expect carbon capture for the 1500 MW of new coal contemplated in the 2019 IRP and Ministerial determination based on the inefficiency and costs associated with carbon capture."

"The emissions of particulate matter (and associated hazardous air pollutants, mainly metals) from activities such as mining of the coal, its transportation to the plant, and disposal of ash (and its transport) are still unavoidable when relying on coal as a fuel, irrespective of the efficiency of the plant technology."