Journal Comment

Renewable Energy — *Quo Vadis*?

The December edition of the *Journal* contains 14 papers, split almost equally between mining and metallurgical topics – there is something to cover most interests.

Four papers deal with different aspects of coal mining, with all having an underlying theme of enhancing safety in mining. The next two investigate the testing and mechanized installation of rockbolts, also dealing with safety in mining, albeit at a slight distance. The remaining two mining papers also have an indirect link to mining safety, with the first investigating the numerical simulation of surrounding rock creep. The second paper in this mining group reviews previous methodologies for stope boundary selection (alright, I confess, somewhat of a stretch in finding a safety association here!).

The point is that any research aimed at improving safety in mining just has to be lauded. Safety is the soft underbelly of mining, and comes under constant attack by the public sector and society at large. This Comment is not trying to defend the safety record of the industry, despite there being considerable reason and evidence to do so. It is a fight that is just not winnable, particularly when society singles out one sector while it turns a blind eye to the 14 000 road deaths per year in South Africa, almost half of them being alcohol-related.

So, back to coal. This too is an industry sector under siege. Back in the 1970s the key issue was acid rain from the sulphur dioxide emitted during the combustion of coal for power generation. Then it was particulate matter in the -10 μm range – then acid mine drainage from low-grade waste dumps. Now it's carbon dioxide and greenhouse gas emissions and their contribution to climate change and global warming. Scientific consensus is that climate change is real (excluding the most rabid denialists), but there remains disagreement whether climate change is the result of natural causes that have yet to be identified, or anthropogenic causes. While acknowledging the disagreement, it must be stated that the opinion of most climatologists is heavily weighted in favour of anthropogenic causes. In this case, what should be done about the continuing and increasing use of coal worldwide for power generation?

The cry from environmentalists is 'renewables'. The construction of wind and solar generation capacity is increasing year-on-year, and there appears to be a belief within society that this presents a clear alternative to the use of coal for power generation. Regrettably, the average layperson lacks the technical wherewithal to understand the difference between supplementing the grid with a small amount of renewable power (easy to do), and the necessity for maintaining high baseload capacity (very difficult to do). The example cited is always that of Germany, where it is stated that photovoltaics can, when the sun is shining, provide as much as 50% of demand, allowing Germany to shut down its nuclear power stations permanently. The key statement is 'when the sun is shining'. When it stops shining, Germany simply buys available power from the integrated European grid, with most of the shortfall, ironically, being supplied by the nuclear stations in France.

In most developing countries, such as South Africa, this option is not available. Eskom is already stating that its aging distribution grid is unable to cope with the intermittent feed of renewable power, and that the stability of the grid is at risk nationally should the percentage of renewables be increased much beyond the present level.

Journal Comment *(continued)*

Eskom is pushing strongly for the construction of up to 10 GW of nuclear generation to increase baseload capacity. Unfortunately, the technical merits or demerits of increasing nuclear power capacity as a strategy for capping South Africa's carbon dioxide emissions has been lost in the mire of the political war being waged around the award of the contracts.

To return to renewables and baseload capacity, much is being said about the availability of localized energy storage systems to level out the variability in the generation capacity of renewables. The commissioning earlier this year of the Ingula pump-storage scheme to the north of the existing Drakensberg scheme provides welcome baseload capacity by effectively using off-peak power to pump water to a high-level storage dam and subsequently generating hydropower when it is needed during peaking.

There are also claims being made that molten salt technology, as a heat storage system, could extend the capacity of solar power generation by an additional 2–4 hours after sunset. Others are saying that the future lies in the storage of off-peak and/or variable power in battery farms, citing recent progress in the development of high-capacity lithium and vanadium redox batteries. And yet others say that variable renewable power should be used to electrolyse water to produce hydrogen, store it during off-peak periods, and then 'burn' it in platinum-based fuel cells to generate a stable and continuous power feed to the grid when it's really needed. What can I say, other than we watch and wait with considerable interest.

But until we are able to provide technically sound and economically viable solutions to the variable nature of renewable power generation, these technologies will play second fiddle to coal as a certain and reliable means for baseload capacity. As they say with conviction: 'Coal is dead, long live coal' – or that's what I thought I heard! If you disagree with anything above, I would be delighted to hear from you, but please reply with your comments handwritten on a plain postcard using the postal services.

So, back to the metallurgical papers in the December issue of the *Journal*. Two papers discuss novel processes for the extraction of zinc from zinc ferrites by alkaline leaching and the extraction of copper and gold from anode slimes. There are two papers on process optimization, one investigating the calcination of limestone to produce a highly active lime for use in basic oxygen furnaces during steelmaking processes, and the other studying the influence of the pH of the flotation pulp of an African haematite ore on the final grade and recovery of the concentrate. Finally, there is a paper on the novel technology of spark plasma sintering for the sintering of nano-reinforced composite materials. Although this has been successful at a laboratory scale only, there appear to be opportunities to commercialize the technology for the production of larger components with more complex shapes.

And that's it – enjoy reading the papers in this month's *Journal*.

R. Paul