Journal Comment

Heaping coals of fire upon our heads

A blessing at the best of times, electricity has become the bane of life in South Africa: it adds quality to life, but when supply is erratic, as we all know too well, the effects cripple and evoke anger. Constraints in the supply of electricity are damaging the economy. Some predictions even foretell a crisis of monumental proportions. Eskom can barely meet current demand. It will fall short of growing demand in the near future. There are simply too few power stations to meet the country's current and growing energy needs. Building new power stations—an obvious solution—takes years, so there is no quick fix. Making matters worse is the sharply rising cost of electricity. South Africans will be digging deeper into their pockets, and industry will see its operating costs increase. There is, in short, a debilitating disparity between the provision of power, on the one hand, and needs and expectations on the other. The disparity raises distressing alarms in many quarters.

What, you might ask, does this alarming and embarrassing predicament have to do with coal, the theme (one could say) of the papers appearing in this issue of the journal? Coal is vital to the South African economy. Exported, it exceeds all other commodities in bulk and revenue.[1] It is all but integral to the generation of electricity in South Africa: more than 95% of our electricity is generated from coal. Yet some critics, notably the American environmentalist and author Bill McKibben, have argued that—

> 'There is an urgent need to stop subsidizing the fossil fuel industry, dramatically reduce wasted energy, and significantly shift our power supplies from oil, coal, and natural gas to wind, solar, geothermal, and other renewable energy sources.'[2]

South Africa has heeded the call. It, too, is committed to reducing carbon emissions: in the next 50 years coal will drop to 20% of the energy mix; the rest of demand will be met by nuclear and renewable energy.[3] But half a century is a long time, and all the while in this country electricity will continue to be generated from coal. Coal mining, processing, and combustion, in all likelihood, will be with us for a long time. This, however, does not mean that the old practices can or should continue as before.

Two conferences last year attracted papers that addressed questions of change and challenge in coal mining and power generation. Both conferences were held in Johannesburg. The first one focused on '21st century challenges to the southern African coal sector'[4]. Coal mining, as for mining in any sector, faces new challenges as high-grade, readily accessible seams are mined out, the grade of resources declines, and operations switch to coalfields in more remote locations. Attention and efforts are now directed at mining thin seams, beneficiating fines, and transporting bulk material from locations that lie some distance from available routes. These and other challenges were highlighted and discussed in 22 papers presented at the conference, three of which appear in this issue of the journal.

Two of the papers presented at the coal conference discussed a matter at the heart of a sub-theme of the second conference.[5] IFSA 2014, a conference on industrial fluidization and fluid-bed technologies, was held towards the end of the year. It is held every three years; this one was the fifth in the series. Although 'industrial' appears in its title, the papers presented over the two days covered topics both fundamental and applied. A scan of the titles of papers listed in the proceedings, however, reveals a telling bias: only six of the 28 papers covered topics other than the combustion or gasification of a variety of carbonaceous fuels (coal, including discard coal, biomass, and oil). The three papers selected for inclusion in this issue of the journal discuss three elements of the subject: namely, the role of fluid-bed technologies (1) in converting coal of all grades (2) into electricity or syngas (3).

Standard textbooks list the advantages of fluidized beds in the design of reactors. Circulating fluidized beds (or CFBs) operate in a regime called fast fluidization: the mixing of particles, which aggregate in clusters that break apart and reform, is extensive and slip velocities (between gas and solids) are an order of magnitude greater than the terminal velocity of the particles. Higher fluidizing velocities lead to the pneumatic transport of particles. CFBs confer advantages on the burning of carbonaceous fuels for power generation:[6] a given design can stably burn a variety of fuels in type (coal or biomass) and quality; the solid fuel does not need to be pulverized or necessarily dried; temperatures are uniform and heat transfer is even; limestone captures SO_2 in the bed, which does away with the need for flue-gas desulphurization; and because temperatures are lower (850°C, compared with 1500°C in conventional pulverized-fuel boilers) ash does not melt or slag; and the formation of NO_x is minimal, which does away with the need for selective catalytic reduction (or SCR). These advantages impart flexibility, save money, and significantly lessen hazardous components in flue-gas emissions.

The committee drafting the Integrated Resource Plan (IRP 2010) recognized these advantages when it recommended the procurement of fluid-bed boilers for the burning of high-ash discard coals. Estimates put this resource at about 1.5 billion tons. This measure would go a long way in utilizing a resource that has been cast aside and, in doing so, bring some redress to the energy needs of this country. In the meantime load shedding, higher prices for electricity, and constraints in supply remain a burden. Nevertheless, unless we act now, implementing measures that will work for a country that is rich in coal, the future will be a bleak one.

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[1]This and many other facts in the editorial piece are quoted from the preface and papers of the proceedings of IFSA 2014.
[2]W.E. McKibben
[3]Department of Energy, Integrated Resource Plan for Electricity 2010–2030, Revision 2, Final report, promulgated on 25 March 2011; Integrated Resource Plan for Electricity (IRP) 2010–2030, Update report, 21 November 2013
[4]This conference styled itself as a symposium.
[5]'The future of coal in the low-carbon economy and the impact of natural gas' by Dave Collins (MAC Consulting) and 'South Africa's answers to climate change: challenges and opportunities in clean-coal technologies' by Professor Rosemary Falcon (University of the Witwatersrand).
[6]See, for example, 'The value proposition of circulating fluidized-bed technology for the utility power sector' in this issue of the *Journal*.

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