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Getting the most from minerals

Saving money and impacting less on the environment by using less energy and water receive nearly daily international media coverage. In Australia there is increasing pressure to mandate low-energy design, installation of water tanks, low-flow plumbing and grey-water processing systems in domestic housing. Likewise, in industry there is increased pressure to lower energy and water use, increase resource efficiency and reduce greenhouse gas emissions.

Simply put, sustainability implies that a process is capable of being sustained or kept in existence. But there is more to sustainability than just existing for the long-term. Sustainable development, in terms of the mining and minerals processing industry, needs to include meeting the needs of today's society without compromising future generations' ability to do the same. It is about quality of life now and into the future.

By improving the eco-efficiency of processes used in the resources sector we improve our ability to deliver competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts.

In the minerals and mining industry, a first step towards sustainability is to be able to measure how much energy and water are being used in any process and then identify what can be recovered or re-used from these processes. The Centre for Sustainable Resource Processing (CSRP), which was established to help reduce mineral processing's demand for energy, water and other inputs, is developing a toolkit to help industry translate sustainability principles into practical outcomes in five key research programs: sustainable development, energy efficiency, lower greenhouse gas, zero waste and water resources.

An early practical application of this toolkit that turns sustainable development principles into reality is 'comminution', or crushing rocks. It has been estimated by CSIRO that Australia uses about 14 per cent of its electricity to crush ore – and that much of this energy is wasted.

More efficient rock crushing, when combined with better physical separation and identification of minerals in the early stages of extracting minerals from ore, has the potential to make big savings in Australian energy use.

To practically apply this process, the CSRP and its partners at the University of Queensland have developed a new rock breakage tester. It is being commissioned in South Africa to examine ways of crushing ore in a more energy-efficient way to give the same, or greater, yields from an ore body.

Digging fewer holes in the ground in the first place can be achieved by making more use of what comes out of the ground now. For example, ReSandTM utilises unused byproduct material from mineral processing as a substitute for newly quarried material. ReSandTM has properties that make it suitable for use in engineering applications such as road building, road base, and for mixing in concrete. The material has a smaller ecological footprint than mining virgin sand and allows for large amounts of processing byproduct to be re-used in a constructive and meaningful way that is environmentally sustainable.

Another innovation is the use of geopolymer concrete as an alternative to ordinary Portland cement (OPC), which is estimated to contribute more than five per cent of the world's total greenhouse gas emissions. Geopolymer concrete can offer an alternative that provides a use for large volumes of waste byproduct streams from the minerals industry and produces far fewer greenhouse emissions than OPC-based concrete. A number of demonstration projects are currently under development at CSRP that will showcase road building, concrete structures, mine backfill and precast concrete products such as drainage pipes.

Finally, carbon is required as a reductant and alloy in metal production, such as in steel-making. Looking to biomass as a low greenhouse gas carbon source is a focus of several CSRP projects. It is important to identify good matches between carbon sources and the uses of carbon. One such example is a study examining 'salt into steel': Mallee trees are grown in high-salinity areas to reduce surface salt water penetration and carbon dioxide in the atmosphere; at the same time the trees provide a source of carbon that can be used for the production of charcoal, which in turn is used in the steel industry.

Australia can enhance its sustainable development and play to its strengths by looking for opportunities to get more out of what we already process – and doing so with less energy and less water.

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