Optimising the value of iron ore using a novel rail-running conveyor system

C Wheeler[1], M Carr[2], M Lurie[3] and B Chen[4]

1.
Associate Director, Centre for Bulk Solids and Particulate Technologies (CBSPT), Newcastle Institute for Energy and Resources, The University of Newcastle, Callaghan NSW 2308. Email: craig.wheeler@newcastle.edu.au

2.
PhD Candidate, Centre for Bulk Solids and Particulate Technologies (CBSPT), Newcastle Institute for Energy and Resources, The University of Newcastle, Callaghan NSW 2308. Email: michael.j.carr@newcastle.edu.au

3.
Project Manager – Innovation Management, thyssenkrupp Industrial Solutions (USA) Inc., Greater Denver Area, Colorado, United States. Email: Martin.Lurie@thyssenkrupp.com

4.
Senior Consulting Engineer, TUNRA Bulk Solids, Newcastle Institute for Energy and Resources, The University of Newcastle, Callaghan NSW 2308. Email: bin.chen@newcastle.edu.au

ABSTRACT

The demand for steel products in modern society is prompting the iron ore industry to optimise their operations to maximise the profitability of fines and lump products. One of the key components in the iron ore transportation chain are belt conveyors. The energy consumption of modern belt conveying systems has reduced considerably over the past few decades, although there is still significant scope for further reduction, especially when heavily loaded long overland belt conveyors are considered. A new rail based continuous bulk material transportation system has been developed by researchers at the University of Newcastle to reduce the energy consumption of heavily loaded and long overland conveyors. The new technology is aptly named the Rail Conveyor due to its combination of two well-established transportation technologies. The Rail Conveyor technology provides an innovative and novel departure from conventional continuous bulk material transportation systems with significant energy and economic benefits.

This paper presents an overview of the Rail Conveyor system where a comparison between the energy consumption and motion resistances of the Rail Conveyor system and conventional belt conveyors is made. The Rail Conveyor merges the benefits of both belt conveyor technology and railway to produce a highly energy efficient and cost-effective bulk material transportation system. The Rail Conveyor is a continuous bulk material transportation system that, due to track wheels running on steel rails, shares a rolling resistance similar in magnitude to railway systems. Due to the effective elimination of the indentation rolling resistance and belt and bulk material flexure resistance within the Rail Conveyor system, an approximate reduction of 50% in energy consumption can be achieved when compared to conventional belt conveyors. A cost analysis of the Rail Conveyor system is presented where a reduction of approximately 27-36% in CAPEX of certain major cost elements and an annual reduction of 48-50% in some OPEX factors for a 15 km iron ore system operating in the Pilbara was found when compared to conventional belt conveyors. This is detailed in the presented case study.