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STUDIES IN GLOBAL ENERGY SAVINGS AN APPLIED MECHANICS APPROACH TO RUSHING, GRINDING AND TRANSPORTING MINERALS

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ABSTRACT

The world consumes vast amounts of energy to mine, transport, comminute, and liberate our mineral wealth. Over 4% of Australia's electric bill is consumed by this process. Chile's consumption is about double that of Australia, and the U.S.A.'s is about half. Conveyor Dynamics, Inc., (CDI) has developed technologies that may be capable of reducing this energy consumption by up to 40%. This paper outlines some of the successes we have achieved in obtaining this goal and the special applied mechanics tools that have been developed, together with other relevant comminution research. The research has advanced the understanding of rubber's contribution to belt conveyor power consumption reduction by 30% and strength increase by 25%. Rock breakage mechanics understanding is being advanced, from its in-situ state to the milling process mineral liberation size. This process follows from the representation of the coupling of rock motion, as breakable granular media, together with non-Newtonian fluid slurry and its free surface in a grinding mill.

Fred Bond's Theory of Comminution is advanced beyond treatment of the ore's discrete size Work Index to a strain energy continuum function defining the ore breakage function in broad terms.

The importance of the Population Balance Model (PBM) and our advancements from the chemical reactor sciences is illustrated. Integration of the ore breakage function (B) and the breakage rate function (S) as defined by the physical study of the multiphase charge motion in the mill is also illustrated.

Verification of the theories and performance improvements are illustrated by examples.

Prospects for the future are reviewed.