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A Strategy-Proof and Budget Balanced Mechanism for Carbon Footprint Reduction by Global Companies

L. Udaya Lakshmi[1], Y. Narahari[2], D. Bagchi[3], P. Suresh[4], S. V. Subrahmanya[5], S. Biswas[6], N. Viswanadham [7]

***Abstract*— The problem addressed in this paper is concerned with an important issue faced by any green aware global company to keep its emissions within a prescribed cap. The specific problem is to allocate carbon reductions to its different divisions and supply chain partners in achieving a required target of reductions in its carbon reduction program. The problem becomes a challenging one since the divisions and supply chain partners, being autonomous, may exhibit strategic behavior. We use a standard mechanism design approach to solve this problem. While designing a mechanism for the emission reduction allocation problem, the key properties that need to be satisfied are dominant strategy incentive compatibility (DSIC) (also called strategy-proofness), strict budget balance (SBB), and allocative efficiency (AE). Mechanism design theory has shown that it is not possible to achieve the above three properties simultaneously. In the literature, a mechanism that satisfies DSIC and AE has recently been proposed in this context, keeping the budget imbalance minimal. Motivated by the observation**

entities that emit pollution. The governing body allocates a limit on the total amount of emissions that could be emitted in a given period, called as *cap* and would issue rights, or allowances, corresponding to that level of emissions. Regulated entities would be required to hold equal or more allowances than their cap for their emissions. Normally the cap on a regulated body is equal or less than the emissions caused by it. A cap on emissions limits the total amount of allowable emissions and it can be lowered to achieve stricter environmental standards.

This paper looks at the problem of emission reduction from the perspective of a global company which has many internal divisions and strategic supply chain partners. The specific problem we address is that of allocating a given target of carbon reduction units among the constituent divisions and partners. To solve this problem in an optimal way,