

## **561a Prism: Product Recycling to Improve the Sustainability of Manufacturing**

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Sustainability is increasingly becoming a buzzword. A quick search on Google resulted in 21.5 million hits for the word “sustainability”. The debate about sustainability includes consideration of economic and social criteria in addition to the traditional environmental criteria. The chemical, polymer and petrochemical process industries have always been supportive of environmental initiatives. Two examples of this pro-activeness are described subsequently. Monsanto (Solutia was formed from it in 1997) was one of the first companies to voluntarily reduce air emissions. British Petroleum (BP) made a pledge in 1998 that it would cut greenhouse gas emissions from its own operations by 10% from 1990 levels by 2010. They announced that this target was achieved by 2002 and at no net cost to the company. Similarly, the industry is being proactive in considering sustainability initiatives. The Dow Jones Sustainability index, the Environmental Sustainability index and the World Business Council on Sustainable Development are all examples of this effort.

While the concept is important, there is clearly a gap between sustainability theory and practice. Sustainability theory has developed rapidly since the idea first emerged from the World Commission on Environment and Development (WCED) (or the Brundtland commission) in 1987. Sustainability practice has evolved since then with several companies being pro-active in this area. One of the factors affecting the adoption of sustainability principles in the chemical, polymer and petrochemical process industries, is the emergence of a global marketplace characterized by increased competition, lower profit margins and increased energy and raw material cost. This environment has resulted in a concerted effort at cost reduction. Examples of these efforts include the utilization of improved procurement strategies for raw materials as well as use of energy integration and plant wide utility assessments to lower energy demands. While these measures are somewhat successful in mitigating the cost pressure felt by various companies, there needs to be a paradigm shift to improve the sustainability of chemical manufacturing in the US. PRISM is a novel framework developed to characterize and quantify product recycling and enables improvement of the sustainability of the process while lowering cost of manufacturing. Product recycling provides the company with a potential source of cheaper raw material. At the same time, the consequences of increased recycling include possible negative impact on the final product quality (due to degradation of the recycled product when compared to virgin material) and higher variance in incoming raw material composition (on account of less control over the source of the recycled raw material). This presentation will summarize this new concept, present some mathematical quantification of the impact of recycling and present an industrial case study dealing with recycling polymers.