**An Introduction to Life Cycle Assessment**

Life cycle assessment (LCA) is a process by which the cumulative environmental and economic impacts of a product over its lifetime are measured. It is an important aspect of sustainability, but may be less well known in the coatings industry because a complete assessment is a difficult exercise.

Done properly, LCA covers everything from “cradle to grave.” It begins with an analysis of raw material acquisition and related energy use, atmospheric emissions, and waste. From there, one goes on to manufacturing, the costs and energy used in the processes involved, emissions, and waste. This is followed by transfer of the product to customers, and for coatings, application, and cure of that product—again including costs, energy, emissions, and waste. The baking of a coating raises the energy usage and equipment costs considerably and makes it a major component of the overall impact. The durability of the coating is important, particularly for buildings, bridges, and other structures where repainting is a considerable expense and may require environmentally difficult surface preparation such as blasting. The impact of the disposal of applied coatings when the painted object is scrapped, recycled, or otherwise goes to its “grave” also can be measured. However, it is a negligible part of the total impact compared to the other segments and often is skipped.

The results of assessments can be used to compare products and processes to determine which ones have less overall environmental impact and/or use less energy. For example, LCA can and is being used to compare the overall impact of waterborne coatings compared to high solids coatings to enable users to decide which direction is more environmentally beneficial. Partial assessments, such as for paint manufacturing alone or paint shop operations, can be useful. LCA has provided support for development of products that cure at lower temperatures, wet-on-wet coatings (cutting out an oven), UV-cured products, and other less energy-intensive products and processes. Once an LCA is completed for a given product, changes in raw materials, processes, VOC requirements, energy costs or sources, etc. readily can be factored in and new LCA numbers calculated.

It may seem that LCA is a task for paint users rather than producers. Certainly it is the user who must make the final decision as to which product to choose. However, it is likely that more and more customers, including DIY consumers, will ask paint suppliers for LCA data on their products. A number of producers have analyzed or are analyzing the coatings that they supply. For example, PPG Industries, Inc. has developed a Product Sustainability Scorecard that is linked to LCA. It enables customers to compare products in terms of environmental impact, health effects, and durability and helps them to make informed decisions. In addition, LCA of paint manufacturing should help producers to evaluate the environmental effects of formulation improvements, raw material replacements, and process changes.

There is a considerable literature about LCA, including papers, articles, books, and even a journal concerned with the subject (International Journal of Life Cycle Assessment, Springer). Any search engine will turn up many articles, which vary in clarity and usefulness. A few authors confuse LCA with service life, which is just one part of an analysis. ISO has guidelines for assessments within ISO 14040 and 14044 and the EPA has many publications of interest.

A comprehensive description of the assessment process for a coatings system is found in an article by C.J. Pierce and J.P. Seeley [Paint & Coatings Industry, 30 (7), 42-44, 46-47, July 1, 2014 (references are missing; also retrievable from www.pcmag.com/articles/print/99318-environmental-life-cycle-assessment (references are included, but all tables and nearly all figures are missing)]. The object of the study was to compare automotive OEM high solids solventborne technology to waterborne technology for energy usage and greenhouse gas impact. The authors used GaBi software that included paint data. They only covered paint shop operations, had to make a lot of assumptions, and used a patchwork of data from different sources. However, the study clearly shows what is needed to make a meaningful analysis and the results are in line with those from assessments by others.

An exhaustive list of LCA resources is available from EPA (www.epa.gov.nrmrl/std/lca/resources.html). Computer software tools for calculating LCA include BEES (Building for Environmental and Economic Sustainability) from NIST, GaBi from PE International (www.gabi-software.com/LCA), LCA Calculator (www.lcacalculator.com), openLCA (www.openlca.org) and PRé Consultants’ SimaPro (www.pre-sustainability.com/simapro).