Life Cycle Assessment: Back to the Basics

Interview with Steve Harris, Senior Project Manager at IVL Swedish Environmental Research Institute

1. What is the 'life cycle approach' and why is it important?

A life cycle approach means that the impact of a product is assessed or considered across the whole of its life cycle – from cradle-to-grave, or from cradle-to-cradle in some circumstances.

In the last half of the 1900s, a lot of pressure was placed on manufacturers to reduce carbon emissions from production processes and to clean up so called 'dirty factories.' Later, research illustrated that the impacts from products were occurring not only in production, but during use and disposal. Hence, it was not clear cut where efforts should be made to improve environmental performance.

The methodology of life cycle assessment (LCA) aims to address this by examining a product across the life cycle. Where in the life cycle impacts occur also depends on what impacts are being assessed. LCA can use several indicators from climate change impact, to toxicity, eutrophication, energy and resource depletion.

For the petrol-driven car, the usage phase is the most impacting phase when considering climate change impact, whereas it is the production phase for a smartphone (due to relatively low energy use in the use phase).

From a resource depletion perspective, the production phase or raw material extraction phase is the most critical. Therefore, in order to reduce the impact of products and processes it is important to consider the entire life cycle so that the most critical impacts can be identified and addressed.

In the ZERO BRINE project, we want to use LCA to show how the ZERO BRINE technology systems change (and hopefully improve) the overall system performance, compared to the current treatment and disposal systems.

The ZERO BRINE project (www.zerobrine.eu) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730390.

2. What indicators are most often used in sustainability assessments?

From the environmental side, undoubtedly, the number one is climate change (or greenhouse gas emissions). Eutrophication is also commonly used to illustrate the effects of discharges to water bodies and, for example, the potential impacts of fertilizers that can cause algae blooms and suffocate other water life. Resource depletion provides an indication of how materials are being used considering how stocks are being affected for future generations.

Sustainability criteria also considers social and economic impacts. Our economic assessments are considering life cycle costs, so we are examining the cost not just of equipment (capital) but also the operating costs over the whole life cycle. This is a much better comparison than simply considering capital costs. Included in this are the economic benefits of the material recovery from the brines that the ZERO BRINE systems are aiming for. Early indications are that the ZERO BRINE systems could actually generate revenue, in addition to reducing the environmental impact – a win-win. Other economic indicators are factors such as contribution to regional GDP and employment.

Social indicators are very case-dependent and can range from considering child labor in developing countries, to employment, health and well-being.

Consideration is often given to the effects on the local area of an activity or operation, and whether it enhances or inhibits local amenities, for example. This could also include employees and the effects on their jobs, whether it is more rewarding or safer than an alternative.

3. What are the main challenges in sustainability assessments for projects like ZERO BRINE?

A major challenge is getting the correct data and of good enough quality. This is true for social, environmental and economic assessment indicators. For the environmental data, it depends on getting accurate operational data from the pilot studies and being able to scale that up so it is reflective of a full-scale operation. This is because full-scale operations are more efficient and hence use less energy and materials than bench-scale or pilot-scale tests. Therefore, the environmental impact is less for a full-scale plant, but looking at the supply chain it can be a challenge to get accurate data from manufacturers of components or the materials in the existing systems (which we are comparing) – such as salt.

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Economic data can be sensitive so sometimes we need to find similar data instead, in the literature. Social studies are challenging to identify the best indicators but also the right data in terms of the right people – who might be involved in the supply chain and live in another country.

4. What is Environmental Technology Verification (ETV) and why is it important to the ZERO BRINE project?

ETV is a way to help get new technologies verified and accepted for the market. It is for those technologies which have not yet developed standards or other ways of evaluation, because they are so new. It is an independent, transparent and credible process for evaluating and verifying the environmental performance. It uses independent experts to look at the ZERO BRINE systems, the data and tests that have been performed and acknowledge that the systems perform as stated.

In other words, the ETV process is important as experts will give a "tick or check the box: this technology performs well and does what it says" that allows the ZERO BRINE to go to the market and be advertised with a full seal of approval. Hence the buyer gets verification from a trusted source.

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