Factoring in Sustainability – a New Framework to Help Decision-Makers

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by Debi Zaks

Sustainability. It's a commonly recognized word but what does it really mean to people involved with developing, funding and commercializing new bio-based technologies? Frequently, attempting to assess the sustainability of an emerging technology is a hurdle that researchers and program managers alike must grapple with. Until recently, there was no practical approach that would yield consistent assessments of the sustainability of new technologies based on three criteria: environmental, economic and social.

In 2003, Dr. David Minns from the NRC Institute for Chemical Process and Environmental Technology (NRC-ICPET, retired), developed a Sustainability Assessment Framework and Toolkit (SAFT) for technology and innovation roadmapping. A second-generation version, SAFT V2, was launched at a recent workshop hosted by NRC-ICPET. Approximately 25 participants from various government departments including NRC were introduced to SAFT V2 by representatives of Five Winds International, a sustainable management-consulting firm. The company led a hands-on demonstration of the SAFT V2 tool during the workshop.

SAFT V2 was developed with the guidance of an interdepartmental working group from Industry Canada, Natural Resources Canada, Environment Canada and NRC-ICPET, in conjunction with Five Winds International.

Environment Canada's Dr. Terry McIntyre introduces the SAFT2 tool

According to Environment Canada's Dr. Terry McIntyre, a member of the interdepartmental working group, "this tool is expected to significantly improve our overall capability to accurately assess new and emerging bio-based technologies. This is critical as we move from a petroleum-based economy to one that is carbohydrate-based and, where the (time) period for assessing new technologies is diminishing while the need for consistency throughout the assessment process is increasing".

Five Winds' Kevin Brady summed up the technology assessment challenge from a business perspective. "Companies are looking to integrate sustainability considerations at the front end of their business strategy process. They want to create value while managing the risk of adopting or developing new technologies. The ability to produce a

sustainability profile for their products is seen to be a significant competitive advantage in today's markets".

A number of NRC research projects at NRC-ICPET, the NRC Biotechnology Research Institute (NRC-BRI, Montréal) and the NRC Plant Biotechnology Institute (NRC-PBI, Saskatoon) were part of the pilot-testing phase for SAFT V2. NRC-ICPET's Dr. Ashwani Kumar and NRC-BRI's Drs. Adrien Pilon and Jianzhong Yang reported on the performance of SAFT V2 when applied to their research projects.

"Companies are looking to integrate sustainability into their business", observes Kevin Brady, Five Winds International

Specifically, Dr. Kumar's team incorporated SAFT V2 assessment parameters while investigating two different methods for refining isoflavones. Isoflavones are commonly used in natural health products. SAFT V2 was used to contrast and compare two experimental processing methods to extract and concentrate isoflavones, one using soymilk waste and a second using red clover. According to Dr. Kumar, "SAFT V2 is a relatively simple approach that allowed us to evaluate the sustainable aspects of the two different processes. What would add even more value to our SAFT V2 analysis would be the addition of quantitative information on the environmental and social impact of these processes. For example, if red clover replaced an existing agricultural crop, what would be the environmental and social impact? This input to the SAFT V2 model is only possible when quantitative scientific data can be combined with sound economic and social data, and this demands a team effort".

Members of the interdepartmental working group for the development of SAFTV2 (back row: T. McIntyre (EC), J. Jaworksi(IC), Matthew Schacker (EC), front row: K. Jonasson (NRC-ICPET), Maria Wellisch (NRCan-CBIN)

SAFT V2 was also tested on processes developed by NRC-BRI and its partners. In the NRC-BRI case the use of SAFT V2 was somewhat complicated because the entire conversion process includes the post-harvesting of flax up to the end-use of the fibres in industrial materials, namely composite materials for auto manufacturing. As a baseline, the process was compared to existing enzymatic processes used by industry to extract fibres from straw, as well as mechanical processes used for fibre extraction in pulp and paper production. Replacing fibreglass with natural fibres in composite materials for automobiles was also assessed using existing life cycle analysis data and other Green House Gases (GHG) reduction calculations. SAFT allowed for a comprehensive evaluation of the value chain and process train of flax fibres as integrated into the upstream (production) side and the downstream (end-use) side (for example, the use of fibres in industrial materials). The NRC-BRI team also considered a series of social implications along with economic opportunities and environmental impacts on a rural community.

Both Kumar and Pilon conclude that SAFT V2 can provide a structured approach to developing a context for discussion and decision-making regarding the sustainability of new bio-based technologies. Expectations are that it will become a useful screening tool in the technology development and evaluation process, where program managers regularly face the task of making strategic R&D investment decisions related to sustainable technologies. SAFT V2 promises to be a valuable tool to assist this process.

The development of SAFT V2 was supported by the Canadian Biomass Innovation Network (CBIN), a research network that supports applied R&D related to bioenergy, biofuels, bioproducts and industrial biotechnology.

Where can you find the SAFT V2 analysis tool? Go to the CBIN website at www.cbin-rcib.gc.ca and look under "Key Documents".