Extended Techno-Economic Assessment (eTEA) Methodology for Biobased Processes

Miet Van Dael[a,b], Tom Kuppens[a], Sebastien Lizin[a], Steven Van Passel[a]

[a] Centre for Environmental Sciences, Hasselt University, Martelarenlaan 42, 3500 Hasselt, Belgium, miet.vandael@uhasselt.be
[b] VITO, Boeretang 200, 2400 Mol, Belgium, miet.vandael@vito.be

Abstract

Many market introductions fail due to economic reasons and not because of process performance. An extended techno-economic assessment (eTEA) tool can help in making good choices during process development and raise the success rate of market introduction. It is important to perform an eTEA in an early development stage of an innovative technology. Seeing the current state of biobased processes and evaluation methodologies, an eTEA can assist in steering further research into the most interesting pathways. We, therefore, elaborate on the methodology that can be used to perform an eTEA and on the specific components which should be taken into account when applying an eTEA on biobased processes.

Introduction

A(n) (extended) techno-economic assessment is a rather new term which has more frequently been used since 2010. Although the use of techno-economic assessments is significantly increasing, no clear accepted definition exists of what constitutes an eTEA. However, some efforts have been made to provide a definition of the eTEA methodology. We will use the definition provided by Kuppens (2012) in which a **TEA is defined** as:

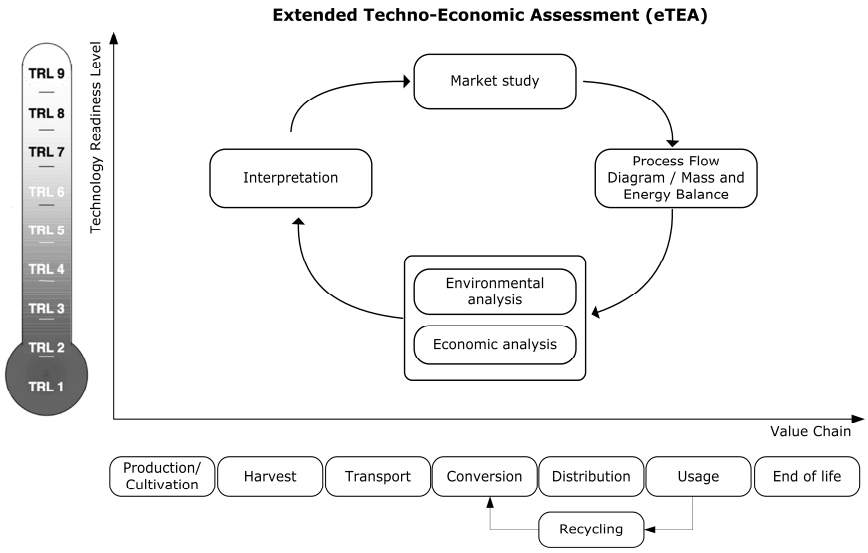
'The evaluation of the technic performance or potential and the economic feasibility of a new technology that aims to improve the social or environmental impact of a technology currently in practice, and which helps decision makers in directing research and development or investments.'.

Although the definition provided by Kuppens (2012) can be used, **clear methodological guidelines** are still lacking. Taking into account the large interest in eTEAs from many different research areas, it is important to know how to perform a proper eTEA. For that reason, we provide a clear explanation of what an eTEA is and how to perform an eTEA in every step of the development process.

Methodology

An eTEA can be divided into **five different phases**. As information gathering is expensive, an eTEA is performed in an iterative way with a go/no-go decision after every iteration.

First, a **market study** is performed.
Second, a simplified **process flow diagram** (PFD) and **mass and energy balance** is designed.
Third, this information is directly integrated into a dynamic **economic analysis**.
Fourth, an **environmental analysis** is added in parallel to the economic evaluation. The environmental analysis is directly integrated with both the technical and economic model.
Fifth, an **interpretation** with **sensitivity analysis** of the results is performed to identify the opportunities and potential barriers.



The eTEA can and should be applied over the entire value chain and during each technology readiness level (TRL). Performing an eTEA should cause the success rate of market introductions to rise.

Based on the results of this cycle, risk reduction strategies can be formulated and steps can be repeated when the results sound promising. It is advised to carry out the evaluation with a **multidisciplinary team**, which provides more insight and helps to attain a broad picture of the innovation process.

Conclusions

To conclude, an eTEA can provide:

(1) an initial assessment on the overall technical and operational barriers to overcome,
(2) an optimal sizing for the project in terms of feedstock availability or plant capacity,
(3) desirable product yields and waste management,
(4) an indication of the (preliminary) economic feasibility or the main technical or financial factors that limit its feasibility, and
(5) an indication of the (preliminary) environmental impact.