A Techno-Economic Cost Assessment Platform for Electrochemical Energy Materials

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There is an increasing need within energy, resource, and manufacturing industries to assess the relative competitive potential of new chemical processes, materials, and technology. For instance, the total global market for materials and devices for renewable-energy systems is worth over $12B. This market has been projected to grow to more than $17B in 2014. However, the deployment of cost-competitive, highly efficient, and renewable energy conversion technologies faces enormous challenges [1,2]. For large-scale commercialization of electrochemical energy devices, manufacturers need to develop low cost materials and fabrication approaches that preserve current levels of performance and stability [2,3].

Techno-economic cost modeling (TCM) allows for a new process, often still at the pilot or R&D stage, to be compared to incumbent processes along relevant parameters [4,5]. Technological constraints and R&D objectives are incorporated into the analysis. The viability of the process for specific applications can be assessed and strategic decisions on production scale-up are informed. Thus, techno-economic cost modeling is an invaluable, direction-steering tool for process-based innovation. We discuss how applying techno-economic cost modeling in the context of a technology innovation can greatly assist in optimising efforts and investment. TCM provides cost and performance boundaries that assist in prioritizing R&D efforts [5]. As a case study, we describe a Technical-Economic Cost model for Polymer Electrolyte Fuel Cells (PEFCs). We particularly focus on MEA materials fabrication process for PEFC. The model is fine-tuned to a range of materials, compositions and fabrication processes in order to inform the materials design in view of ease of fabrication, cost, integration and performance of new generation of fuel cell components.

We also propose an investment methodology for new electrochemical materials development or existing manufacturing processes to reduce risk and shorten gestation time [6]. Risk can be lowered through early viability analysis and gestation time could be shortened, and thus the present value of expected return increased, through earlier and more effective information exchange [5,6].

The cost analysis is performed by using a commercial platform that combines complementary expertise in electrochemical materials, techno-economic cost modeling, and business model creation [7]. The tool quantifies the costs and potential techno-economic benefits associated with the manufacturing technologies of advanced materials for electrochemical technologies [7].

References

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