

Implementation of a Modelica Library for Energy Management based on Economic Models

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The use of modeling paradigms for physical systems can in some instances be expanded to include other domains [1]. This paper presents one such example: it describes the implementation of economic models to be used for the purpose of energy management [2].

In this approach, each provider of energy and each consumer is characterized by a specific cost function. A global market or a set of local markets then decide about the distribution of energy flow.

To this end, a new Modelica library has been developed. The library is currently split into two sub-libraries that are geared towards different application domains: source management and load management. In source management, the consumer demand shall be fulfilled with the best possible efficiency. The target for load management is to identify the most important consumers that can be supplied under limited power availability.

The library is not coupled to any specific physical domain. All its components concern energy in its most abstract form. In fact, many energy management tasks involve multiple physical domains and therefore a domain-specific approach would be of limited value. The figure below depicts the Modelica model of a combined generator for electricity and thermal energy (heating) with two separate consumer profiles.

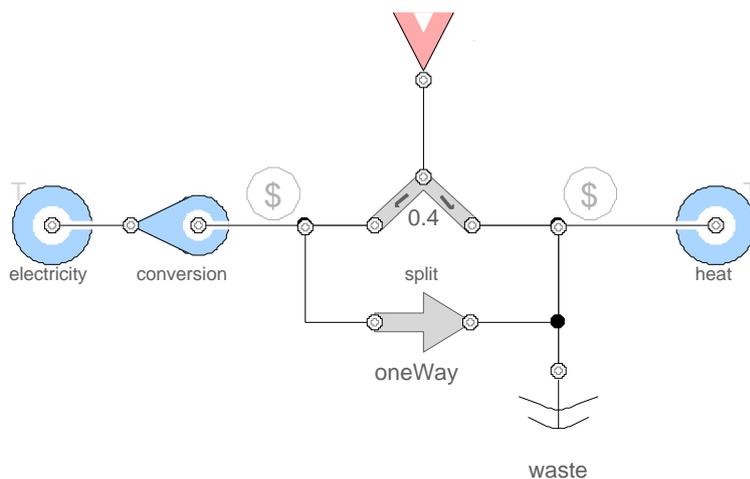


Figure 1: Model diagram of a combined power generator.

References

- [1] Brewer, J. W. and P. C. Craig. Bilinear, Dynamic Single-ports and Bond Graphs of Economic Systems. *Journal of The Franklin Institute*, No 185, 1991
- [2] Schlabe, D., and J. Lienig, "Energy Management of Aircraft Electrical Systems - State of the Art and Further Directions," *International Conference on Electrical Systems for Aircraft, Railway and Ship Propulsion (ESARS)*, Italy, October 2012.