

13 February, 2008

Introducing Social Justice into a Thermodynamics Course

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Abstract

In the Mechanical Engineering program at the Milwaukee School of Engineering, all students take a full year of thermodynamics. This not only provides the opportunity to cover both the First and Second Laws of Thermodynamics, but also to explore the implications of the Second Law, in particular, for societies that rely increasingly on resource exploitation. Western economic systems are based on the premise that continual growth is necessary for the health of the economy. Continual growth, however, is incompatible with the Second Law. History has shown that cultures will often grow and expand until they reach the limit of their indigenous resources. When this point is reached, they must look beyond their own borders for access to the resources necessary for continued growth. How a society or culture responds to this challenge is a measure of its fundamental values.

Students in the Mechanical Engineering program are exposed to these issues as part of the treatment of the Second Law. It is easy to see that the United States, and in fact most Western nations, are at precisely the point where their growth has exceeded their indigenous resources, most clearly in oil, but also in wood (Japan) and some metal ores (titanium for the US). How do these nations respond to this situation? The students are asked to consider this question. The students understand that the United States buys oil from other countries. The author has put the following question directly to the class: "What would we do if these other countries decided that they did not want to sell us the oil?" Some students said that we would simply have to do without, a wonderfully idealist and naïve answer (or is it the one the instructor was looking for?). One student had the courage to say, "Maybe we take it by force". This is the opening of a dialogue on justice. Students are asked to consider an appropriate response to the resource challenges that they will face in their careers, and in their personal lives.

This discussion on the implications of the Second Law for relations between people and societies is still in development by the author.