We've already looked at the Second Law of Thermodynamics:

$$\Delta S_{system} + \Delta S_{surroundings} \geq 0$$

As it turns out, there are several ways to state this law, and even more ways of understanding it. These other formulations are frequently convenient in that they enable us to rapidly assess whether some hypothetical process (or more likely invention) will violate the Second Law.

Kelvin formulation *No process is possible in which the sole result is the absorption of heat from a reservoir and its complete conversion into work.*

Kelvin paraphrased *You cannot make a perfect engine.*

Clausius formulation *No process is possible whose sole result is the transfer of heat from a body of lower temperature to a body of higher temperature.*

Clausius paraphrased *You cannot make a perfect refrigerator.*

Both of these formulations are actually equivalent to the definition we gave above. These formulations also make it clear that if you could violate the Second Law, you could become filthy rich. You would have both a free source of energy, and at the same time a free source of refrigeration. The connection between these very different ways of looking at (and thinking about) the Second Law lies in the idea of a **heat engine**.