Instructor's guide

- The same model used in MacKay's book
- Introduce key ideas from thermodynamics
- A valuable model for figuring out how we're going to save the Earth

Let's start by visualizing the energy flow associated with driving a gasoline-powered car. We will use a box and arrow diagram, where boxes represent where energy can accumulate, and arrows show energy flow.

The energy clearly starts in the form of gasoline in the tank. **Where does it go?**

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Actually ask this of students.

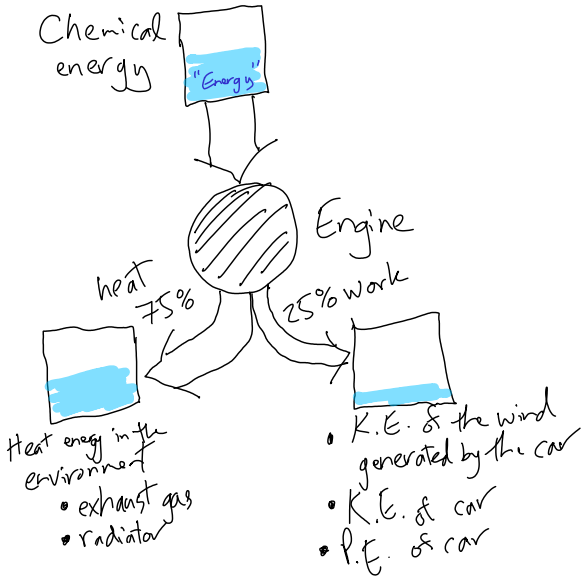

Figure 1: Visualize the energy as an indestructable, incompressible liquid. "Energy is conserved"

The heat can look like

- Hot exhaust gas
- The radiator (its job is to dissipate heat)
- Friction heating in the drive train

The work contribute to

- Rubber tires heated by deformation
- Wind, which ultimately ends up as heating the atmosphere

The most important factors for a coarse-grain model of highway driving:

1. The 75:25 split between "heat" and "work"
2. The trail of wind behind a car

What might we have missed? Where else might energy have gone? We ignored the kinetic energy of the car, and the energy dissipated as heat in the brakes. On the interstate this is appropriate, but for city driving the dominant "work" may be in accelerating the car to 30 mph, and with that energy then converted into heat by the brakes.