ME 18B Extra Credit Problems – A Check on Reality

The following problems are offered as extra credit. These problems are open ended and will have different outcomes based upon your assumptions. Students are expected to make a presentation on the last day of class, Thursday June 4 showing the results of their analysis. I will help you figure out things you don't already know or can't figure out on your own. (No guarantee I'll be of any help though). You may propose alternate problems with my permission. For example, if you see an "advertised" claim for something that performs with high efficiency or in some other way saves the world's energy problem feel free to investigate the claims with your project.

1. An article on energy consumption and conservation in the April 2009 issue supplement to the National Geographic Magazine stated "Because a compact fluorescent light uses so much less energy than an incandescent bulb, over its lifetime a single one can save electricity equivalent to the quarter-ton pile of coal in the foreground. (See the picture below)

   Prove or disprove the validity of this claim. You'll have to do a bit of research on how long the CFL bulbs are expected to last, the power consumption of the bulb compared to an ordinary bulb, the efficiency of the power plant that produces power for the bulb and the amount of energy available in coal.

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flood of crude from fields around the world will ultimately top out, then dwindle. It could be 5 years from now or 20, no one knows for sure. Geologists and economists are embroiled in debate about just when the "oil peak" will be upon us. But few doubt that it is coming.

The peak will be a watershed moment, marking the change from an increasing supply of cheap oil to a dwindling supply of expensive oil. Some experts foresee dire consequences: shortages, price spikes, and economic disruption. Others think that by curbing our oil use and developing sustainable alternatives now, we can delay the peak and wean ourselves more easily when the inevitable happens.

Is there a simple solution? The short answer is no. Though a few true believers claim that only vast conspiracies or lack of funds stand between us and endless energy from the vacuum of space or the core of the Earth, the truth is that there's no single great new fuel waiting in the heart of an equation or at the end of a drill bit.

The long answer about our next fuel is not so grim, however. Plenty of contenders for the energy crown now held by fossil fuels are already at hand: wind, solar, even nuclear, to name a few. But the successor will have to be a congress, not a king. The solution will also have to incorporate smaller scale solutions like replacing conventional light-bulbs with compact fluorescent lamps and recycling as many products as possible.

Although some politicians believe the task of developing new energy technologies should be left to market forces, many experts disagree. That's not just because it's expensive to get new technology started, but government can often take risks that private enterprise won't. "Most of the modern technology that has been driving the U.S. economy did not come spontaneously from market forces," NYU's Martin Hoffert says, ticking off jet planes, satellite communications, integrated circuits, and computers. "The Internet was supported for 20 years by the military and for 10 more years by the National Science Foundation before Wall Street found it."

Regardless of who foots the bill, it's time to step up the search for the next great fuel for the hungry [illegible] of humankind.

Small solutions can have a big payoff. Because a compact fluorescent light uses so much less energy than an incandescent bulb, over its lifetime a single one can save electricity equivalent to the quarter-ton pile of coal in the foreground.

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PHOTO: SARAH LEEN

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2. Find the engine specifications for your car or any car you wish and perform an analysis of the engine to determine if the ideal analysis method can be a good indication of the fuel economy of the car. There are several assumptions you'll need to make regarding how much power the engine must produce to move the car at say 60 mph. There are performance curves for engines available that can give power as a function of rpm.

3. In homework #5, problem #1, we worked an analysis of the GE 90-115 aircraft engine. The fuel flow rate in that analysis is about twice as large as the actual engine because we ignored the contribution of the bypass fan to the overall thrust of the engine. I believe the bypass ratio for the engine is 9:1 (meaning 9 times more air goes through the bypass than through the compressor – you should check on this). Re-analyze the engine taking into consideration the thrust contribution of the bypass fan.