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Learning to think globally

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Learning to Think Globally

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There is a popular bumper sticker slogan which advises us to 'Think Globally, Act Locally'. But what does it really mean to 'think globally'? One meaning could be to try to estimate the global consequences of the things you do. Here is one way to go about this. There are roughly 1 billion (1,000,000,000 = 10^9) people in the world now that have living standards roughly equivalent to most citizens of the United States (and about 5 billion people who are significantly poorer). Choose an 'everyday action' which you might debate (with yourself or others) whether or not to do, and *estimate* the consequences of 1 *billion* people making the decision to do that action once a week for one year. Choose anything you like, even something apparently trivial like leaving a light on or turning it off, recycling a can or bottle rather than throwing it away, or, at the cafeteria, taking an extra serving you don't really want and not eating it. Be creative, but also try to be realistic.

For this exercise we don't need a precise answer because what we will calculate is not something that will happen (exactly one billion people doing exactly the same thing exactly once a week for exactly one year). Therefore we will estimate the value by keeping only one significant figure for each of the numbers in the problem. For example, a year will have 50 weeks, rather than 52 weeks. A GMC Yukon sport utility vehicle weighs 6000 or 7000 pounds, rather than the 6300-6800 pounds listed in the vehicle specifications. For most liquid weights, remember 'a pint's a pound the world around.'

For most examples you might come up with for 'thinking globally', your final total will be a very big number, because whatever you choose gets multiplied by both 50 (weeks per year) and 1,000,000,000 (people). However, you may find it very difficult to comprehend what that number really means. So you should express your grand global total in terms that are tangible to you.

To do this final step you will again have to do some estimating and 'order-of-magnitude' thinking, and probably look up some useful numbers. For example, rather than having an answer of '400,000,000 gallons of water' (that sounds like a lot of water, and it is, but how much is it really?), convert your answer to something like 'enough water to fill my school 100 times' (is it?). Or enough water to supply 100 homes for 100 years. We estimated this number by assuming each house uses 100 gallons of water a day for domestic use, and that a year has about 400 days. So each home uses 100 gallons/day/home x 400 days/year = 40,000 gallons/year/home. So 400,000,000 gallons ÷ 40,000 gallons/year/home = 10,000 home-years, which means enough water for 1 home for 10,000 years, or 10 homes for 1000 years, or 100 homes for 100 years, or 1000 homes for 10 years, or 10,000 homes for 1 year.

Here are a few examples:

1. A SHORT DRIVE: Recently, it was raining pretty hard, so one of us decided to drive the one-half mile to get somewhere, rather than walk or ride a bicycle. The drive was 1 mile total, there and back, and if we assume the car gets 30 miles per gallon of gasoline, it used 1/30 of a gallon of gas (= 0.033… gal.). If 1 billion people made this decision once a week for a year, they would use

1/30 (gallons gas/trip) * 50 (trips/person/year) * 1,000,000,000 (people) ~ 2,000,000,000 (gallons gas/year)

Two billion gallons is certainly a lot of gasoline, but how much gas is this really? It would be enough to drive a typical car 60,000,000,000 miles (30 miles/gallon x 2,000,000,000 gallons). Since a typical car might drive 100,000 miles in its lifetime, using about 3000 gallons of gas, this would be enough gas to fuel 700,000 cars for their lifetime (2,000,000,000 gallons of gas ÷ 3000 gallons of gas/car lifetime ~ 700,000 car lifetimes). We could also put this number into the context of another fuel use. Although gasoline used in a car and fuel oil used in a home furnace are not exactly the same (gasoline is more refined, and will have a somewhat different energy content per gallon than fuel oil), for estimating purposes we may consider them to be equivalent. Assuming 2000 gallons of fuel oil can heat a house for a year, this gasoline would be the equivalent of heating 1 million homes for a year. In the state we live in, New Hampshire, there are about 1 million people, so there are *about* 300,000 homes, and this fuel would heat all of the homes in New Hampshire for *about* 3 years. For how long would it heat all the homes in your state?

2. A LITTLE WATER: This morning (as a test) we let a kitchen faucet run slowly (much more than a drip, but much less than full force) and filled a 1 quart (0.25 gallon) pot with water in one minute. Suppose 1 billion people wasted this much water once a week for one year.

1/4 (gallons water/leak) * 50 (leaks/person/year) * 1,000,000,000 (people) ~ 10,000,000,000 (gallons water/year)

How much water is this? Using our earlier estimate of 40,000 gallons of water/home/year, it is enough water to supply about 2,000,000 homes for a year (10,000,000,000 gallons/year ÷ 40,000 gallons/home/year). Another way to think of this would be in terms of volume. One cubic foot of water is about 8 gallons of water, so 10,000,000,000 gallons ÷ 8 gallons/cubic foot ~ 1,000,000,000 cubic feet, or a volume of 1000 feet long x 1000 feet wide x 1000 feet deep (that would be a very big and VERY deep pool).

3. AN HOUR OF LIGHT: Suppose you left a light on for one hour when you didn't need it. Light bulbs are rated by power (watts, W) or rate of energy use. At typical light bulb is a 60W bulb (60 watt). In one hour it will use 60 watts x 1 hour = 60 watt-hours of energy. Electric utility companies base their billing on kilowatt-hours, where 1 kilowatt = 1000 watts and 1 kilowatt-hour = 1000 watt-hours, so our bulb used 0.06 kilowatt-hours of energy (0.06 = 60 ÷ 1000). Now have a billion people do this once a week for a year, and it will consume

0.06 kilowatt-hours/light * 50 (lights/person/year) * 1,000,000,000 (people) ~ 3,000,000,000 kilowatt-hours/year

A typical house might use 1000 or 2000 kilowatt-hours of electricity a month, or about 10,000 to 20,000 kilowatt-hours of electricity in a year (ask your parents, or check out how much your school uses). So the 3,000,000,000 kilowatt-hours/year of unnecessary lighting would power about 200,000 homes for a year (a moderate-sized city).