

[The Energy Pie, Use More or Conserve?](#)

Over the past several years we have all become painfully aware that CO2 emissions from fossil fuels likely play a significant role in worldwide climate change. Our insatiable demand for energy is driving prices up and generating more CO2 than ever.

How Much We Use

Today, the world uses about 12 Terawatts per year for all uses. That is 12,000,000,000,000 Watts. In a separate article I reviewed these sources of use which break down as:

Built Environment = 52% (40% for operations and 12% for materials)

Industry = 24%

Other Transport = 15%

Passenger cars = 9%

Energy from Many Sources

There has been a lot of conversation about renewable energy sources such as solar, wind and others. One would think we are now generating 30% of our overall needs from these sources. Unfortunately, that is not the case. If we break down the sources of energy worldwide we get:

Oil = 35%

Coal = 27%

Natural Gas = 20%

Hydro = 6%

Biomass = 6%

Nuclear = 5%

GeoThermal = under 1%

Wind, PV, SolarThermal = under 1%

The largest energy sources are Oil, Coal and Natural Gas. All fossil fuels which generate significant CO2 emissions. And the cost of all of these fuels has doubled in from 2007 to 2008.

Future Energy Demand

Our demand for energy is increasing worldwide, at an ever increasing rate. Given the current rate of increase, several estimates put worldwide demand at 30 Terawatts within 30 years, an increase of 18 terawatts, more than double today's requirements. So we need move to renewable sources which don't generate CO2 when burned. Solar, biofuels, nuclear. Sounds like a plan! Or is there trouble in paradise. Let's consider each one.

Nuclear

Nuclear power generation does not emit CO2, or much of anything else. The heat from a controlled nuclear reaction boils water into steam that spins a turbine. 3 new plants are planned and beginning the license process in the US. And possibly as many as 8 worldwide this year (requesting licenses). Let's go out on a limb and hope that somehow that figure grows to 45 new licenses this year, and 45 more every year for the next 30. And they each take no more than 10 years to build. And what is the result of in 30 years? 1 Terawatt. Not the 30 total we need, or the 18 additional Terawatts in growth. Just 1 lousy Terawatt. Puts it all in perspective.

BioFuels

This technology is controversial since it takes real energy to grow and harvest crops. The full analysis of many of the biofuel processes we have suggests that some (such as corn ethanol) use more energy to make and distribute than we get back out. But that argument aside, let's pretend for the moment that we get 100% efficiency and there is no energy required to grow and process the crops. So we will take every acre of plantable land on earth and plant the most efficient crops we know of to generate biofuels. That should do it. Well, not really. That is only about 3 Terawatts. But we are on a roll, so let's continue.

Solar Cells

Photovoltaic technology has come a long way in the last few decades. Efficiencies have improved and costs have come down. And more plants are being built to supply more solar. A good size solar plant today can manufacture enough solar cell's to generate 1 gigawatt annually. Of course it would take 1000 plant-years to get to 1 Terawatt. And a lot of silicon (or other substrate). If we can make 20,000 square miles worth of cells and place them in sunny areas on earth, it will take all of the output of the current and planned plants for the next 25-30 years. And how much power is that? About 2 Terawatts, if all goes right. Of course, only during the day, but that is another issue.

Add It All Up

Adding up the largest sources at levels that we likely cannot attain, we still only end up with 6 Terawatts out of the 30 Terawatts total required to meet our needs. Add in wind, solarthermal, wave energy etc. and there is maybe another Terawatt. So basically, while these are all excellent businesses and fine technologies that must be pursued, we cannot count on renewable energy sources alone to get us to the promised land.

Conservation

The only hope we have of addressing CO2 and climate change is conservation. Since renewables can only deliver some 6 to 9 Terawatts total, we have to deal with as much of the 21+ Terawatts in other ways. As discussed earlier, the built environment is responsible for 52% of worldwide CO2. In order to address the built environment, we need to address the materials (such as new cement, drywall, metal processes) as well as building operations (primarily heating and cooling). Companies like CalStar and Serious Materials are re-inventing the old processes, reducing embodied energy by 75% or more.

We all can address operations, at least at home. Easiest targets are sealing ductwork, installing programmable thermostats, insulating homes that aren't, and choosing high R value windows (at least R6 and preferable higher). Up to 50% of heat loss occurs through windows which are closed. Upgrading to dual pane low E windows is only gets to an R3. New technology is becoming available (such as ThermaProof Windows) which can provide R values above R10. A 300% improvement and a significant savings in heating and cooling bills.

The Result

If we begin addressing our built environment, we can easily reduce the energy required by 75% over today's inefficient buildings and materials. The result would be a 12 terawatt savings in 30 years. And it is the least expensive 12 terawatts available, much less expensive than more coal power plants, which is the alternative.

So what will you do? Save the environment and your energy bill too. Make the right choice and act now.

About the Author

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