Common sense about the future of fuels

Why all the fuss about alternative fuels? If we know the truth about energy we can use our advanced technology to escape our historical dependence on fossil fuels, and still prosper. The world now relies on oil, but we cannot pump it out of the ground at 1000 barrels per second for very much longer. We can quibble about when oil production will peak, but the peak is coming soon. Some experts find that it is already upon us, while others say it is still a decade or two away, but all agree that it will come, and even a decade isn't much time to plan for the kinds of changes that will be necessary.

Some people deny that oil will end. But the earth is of finite size, and it has been pretty well explored for oil already. The decline will come. Global warming demands that we reduce our fossil fuel use in any case.

This won't be a sudden crisis like a flood or an earthquake. We won't wake up one morning to find all the gas stations closed. Rather, oil products will gradually get more and more expensive, until it's not practical to use them in the ways to which we're accustomed. This will start before world production reaches a maximum, because population growth demands that oil use must increase constantly to keep even with per-person use. When oil production is growing more slowly than the population, the crisis will be upon us. The actual production decline will come later.

What can we do about this, and how will it change our lives? Our country is saddled with an infrastructure that demands huge amounts of transportation, with our sprawling low-density cities and widely spread centers of employment. Mass transit doesn't work well in such environments, and alternatives such as bicycles won't work for everyone. There's plenty of room for improvement in these areas, but for the short to mid term we're committed by the very layout of our land to largely private, motorized transport.

What form will that transport take? The short answer is that it will be more expensive than what we have now. None of the alternatives approach the convenience and low cost of oil and gasoline. The choices are to find substitute fuels, or to find other ways to propel our vehicles.

Biofuels are the most obvious substitutes. Unfortunately they are not practical, for several reasons. Ethanol from corn, the most popular current alternative in the United States, is doing nothing to ease the crisis, because making it takes as much energy as burning it releases. As ethanol use increases we should see gasoline use decrease, but gasoline use keeps increasing at a constant rate regardless of ethanol production. At present we're using 16% of our corn crop to make 3% of our fuel, so even if we find a way to make ethanol without using large amounts of fossil fuels there won't be nearly enough. Anyone can see that distilling our entire corn crop would yield only one-fifth of the fuel we need. Similar problems crop up for ethanol or biodiesel made from other plants – making it consumes almost as much energy as it releases. Future biofuels may be made more efficiently, but the world can't make nearly enough to replace current fossil fuel demand, even at the theoretical limits of efficiency.

Hydrogen is often touted as the fuel of the future. This too is an illusion, because hydrogen is not a source of energy. It's just a way of moving energy around, and not a very good one at that. There is no natural store of hydrogen, and making it requires more energy than the hydrogen releases. The stuff is hard to handle because it's the most volatile substance on the planet, and its energy density is far less than that of gasoline.

Some people look to unconventional oil to rescue us. The tar sands in Canada contain a lot of oil, but about a third of it is needed to extract the other two-thirds, at enormous environmental cost. Canada is now producing a million barrels per day, with plans to increase eventually to three million. The world now burns 85 million barrels per day. Other unconventional sources such as oil shale are even less promising. Total oil production will inevitably begin to slide downward.

So we are left with other forms of energy. Electricity looms large as the only alternative in sight. This doesn't mean hybrids like the Toyota Prius – all the energy driving the Prius comes ultimately from gasoline. It's a gasoline-powered car with a very efficient transmission. Efficiency helps, but it's not a permanent solution; eventually you reach physical limits.

One dream is the solar-powered car, with rooftop panels that drive the motor. But the engineering doesn't work out; in direct sun the panels can produce about one-tenth of one horsepower. You can do better with a bicycle. The kind of electricity we need is generated elsewhere, brought to the vehicle through wires or batteries. That power can't come from fossil fuels at giant power plants, because those fuels are limited; that's where we came in. How will we generate electricity, and how will we get it into our vehicles?

Here we begin to see viable alternatives for the future. Already some of our electricity comes from renewable sources, mostly hydroelectric. In the West, huge dams generate large amounts of electric power, driving for instance the San Francisco mass transit system. A few places are left where dams could generate significant power. There's an environmental cost, but that cost will be weighed against the cost of generating power by other means, or of doing without. But most of the good hydropower sites are already developed, so we won't get much more from there.

Solar electricity is getting a lot of attention, but it is viable only because of huge government subsidies. We still don't have solar panels inexpensive enough to do the job; they may appear someday, but we can't count on it. There are also heat-based solar plants in the deserts, but they are still experimental, expensive, and small compared to the need. Though the sun is ideal for hot water on your roof, large-scale electric generation is still a dream for the future.

Wind power has become highly developed in Europe, and is already cost-competitive with fossil fuels in some locations. It still takes about two hundred of the largest wind turbines to equal the output of a single fossil-fuel power plant, and that's when the wind is blowing. Some people don't like the looks of the huge turbines, monsters with blades half as long as a football field, but again we will have to balance them against the alternatives. The power is there, though, if it's developed on a large enough scale. That will take a lot of capital.

Geothermal power, underdeveloped at present, may play a role. If you drill deep enough, there is hot rock that can generate steam to drive a generator. Newer drilling technology, ironically developed to drill for oil, may make a great expansion of geothermal power possible. And, though it's not politically correct to say so, nuclear will probably be part of the mix. Most of the development cost has already been paid, and in the United States it has proved safer than coal, which kills thousands every year. France already generates most of its electricity with nuclear power.

A compelling advantage of an electric-based transportation network is that many sources of energy can contribute to it, and one can compensate for another without

rebuilding the whole system. Much of the distribution network is already in place. The most likely scenario is that a combination of wind, hydro, geothermal and nuclear power will gradually substitute for gasoline, in electric vehicles.

We can already build electric cars that go 40-50 miles on a charge, making them practical for the majority of the miles driven today. They can be recharged at night using the existing electrical grid, which is underutilized then. The cars will be more expensive than what we have now, and electric trains will be used to travel for longer distances, with a speed and luxury that most Americans have never experienced. Perhaps we will put coils in the freeways or third rails along the medians, to transfer electricity to vehicles as they go.

All of these things are possible with existing technology – we don't have to pray for miracles to save our civilization. But our lives will be different. The new power will be more expensive and less convenient, meaning that products that require energy for their production or transport to market (that is, all of them) will be more expensive. That's another way of saying that we will all be a little poorer. We can survive and even prosper, though, if we start preparing now and do things right. Investments on a huge scale must be made now, because building new wind turbines, dams and other facilities takes a lot of energy, and construction won't be feasible if oil is in short supply and alternatives aren't yet available. It will take some farsighted government intervention, because some of the needed infrastructure won't be profitable for many years. But we can do it.