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PRESS REVIEW

Newspaper articles :

- ***Old Clean Coal.*** September 6th 2007, The Economist Print Edition.
- ***Ethanol, schmethanol.*** September 27th 2007, The Economist Print Edition.
- ***Challenging Gasoline : Diesel, Ethanol, Hydrogen.*** October 24th 2007, The New York Times.

As my view, energetic issues and climate stakes are a major problem of this century. Nowodays, they can find more articles on the alternative energies, eletric motor cars or global warming… The world grants more interest for the 'green revolution'. It has become a main concern for the politicians and new solutions are proposed by scientists. In this press review, I've tried to tackle some side of this very broad subject. I would to point out some news technologies and give ideas to extend the scope of reflexion.

First, I have choosen a article on biotechnology developped to capture carbon dioxyde emission of coal power plant. We will try to bring out the economic and environnemental impact. Then, I will use an article on biofuel to show the dualism of this solution. Finally, the last article is comparison between diesel, biofuel and hydrogen.

Old clean coal

Sep 6th 2007
From The Economist print edition

Energy: Using photosynthesis to capture exhaust gases from power plants could reduce the emissions produced by coal-fired stations

FOR its supporters, the idea of growing single-celled algae on exhaust gas piped from power stations is the ultimate in recycling. For its detractors, it is a mere pipe dream. Whoever turns out to be right, though, it is an intriguing idea: instead of releasing the carbon dioxide produced by burning fossil fuels into the atmosphere, why not recapture it by photosynthesis? The result could then be turned into biodiesel (since many species of algae store their food reserves as oil), or even simply dried and fed back into the power station. Of course, if it were really that easy, someone would have done it already. But although no one has yet commercialised the technology, several groups are trying.

One of them is GS CleanTech, which has developed a bioreactor based on a patent held by a group of scientists at the Ohio Coal Research Centre, at the University of Ohio. The GS CleanTech bioreactor uses a parabolic mirror to funnel sunlight into fibre-optic cables that carry the light to acrylic “glow plates” inside the reactor. These diffuse the light over vertical sheets of polyester that form the platform on which the algae grow. Eventually the polyester is unable to support the weight of the algae, and they fall off into a collection duct positioned underneath.

GreenFuel Technologies, based in Cambridge, Massachusetts, has a different approach. Its reactor is composed of a series of clear tubes, each with a second, opaque tube nested inside. This arrangement makes it possible to bubble the exhaust gas down through the outer compartment and then bubble it back up through the opaque middle. The bubbling gas causes turbulence and circulates the algae around the reactor. The constant shift between light and darkness as the algal cells circulate increases the amount of carbon that they fix, probably by promoting chemical reactions that occur naturally only at night.

A preliminary test of GreenFuel's reactor design, which was performed at the Massachusetts Institute of Technology's campus power plant, suggested that it can remove 75% of the carbon dioxide from a power station's exhaust. A more serious test is now being carried out by Arizona Public Service, that state's power utility, at its Redhawk plant. Another test is planned in Louisiana.

GreenFuel claims that over the course of a year, a hectare (2.5 acres) of its reactors should be able to produce 30,000 litres (8,000 American gallons) of

oil, which could be used as biodiesel, and enough carbohydrates to be fermented into 9,000 litres of ethanol, which can be used as a substitute for petrol.

There is, of course, no free lunch. As Rob Carlson of the University of Washington points out, if money is to be made selling products made from exhaust gas, then that gas goes from being waste matter to being a valuable resource. Far from giving it away, power companies might even start charging for it. That would, indeed, be a reversal of fortune.

First, this article is about new technology to control carbon dioxide emission. The journalists talks about experimental devices and brings out advantages of it. Scientists are developping systems with single celled algae, indeed this micro-organism uses carbon in a chemical cycle : the photosynthesis. It's a complex chain reaction requiring a source of carbon ($C0_2$) and a source of a light. Experiments are trying to build a living environment conducive to algae developpement, scientists are using for example glow plates and bringing light with fibre-optic. Also, algae stores their food reserves as oil, it's an interesting system to produce biodiesel. At the present time, scientists carry out some tests on coal power plant, like at the MIT's campus power plant. This technology seems to be a great mean to improve cost-effectiveness, oil will be sold. If tests are conclusive, a lot of coal power plant could be equiped.

Nevertheless, I think this system can't be a lasting solution, indeed coal power plant will continue to produce carbon dioxyde, photosynthesis is interesting on existing thermal power station but not to build new. Approach is really interessant, we can ask ourselves about reusing. Our society produces a lot of waste but some systems could be developped. To cope with the energetic crisis, waste are a not insignificant source of energy, urban politics should develop this.

Finally, scientist are a lot of interests to explore the field of biology to develop new energy devices and maybe to favour reusing. Biology could have a real impact on energetical crisis.

Economist.com SCIENCE & TECHNOLOGY

Advanced biofuels

Ethanol, schmethanol

Sep 27th 2007 | EMERYVILLE, REDWOOD CITY AND SAN CARLOS, CALIFORNIA
From The Economist print edition

Everyone seems to think that ethanol is a good way to make cars greener. Everyone is wrong

Illustration by Stephen Jeffrey

Get article background

SOMETIMES you do things simply because you know how to. People have known how to make ethanol since the dawn of civilisation, if not before. Take some sugary liquid. Add yeast. Wait. They have also known for a thousand years how to get that ethanol out of the formerly sugary liquid and into a more or less pure form. You heat it up, catch the vapour that emanates, and cool that vapour down until it liquefies.

The result burns. And when Henry Ford was experimenting with car engines a century ago, he tried ethanol out as a fuel. But he rejected it—and for good reason. The amount of heat you get from burning a litre of ethanol is a third less than that from a litre of petrol. What is more, it absorbs water from the atmosphere. Unless it is mixed with some other fuel, such as petrol, the result is corrosion that can wreck an engine's seals in a couple of years. So why is ethanol suddenly back in fashion? That is the question many biotechnologists in America have recently asked themselves.

The obvious answer is that, being derived from plants, ethanol is "green". The carbon dioxide produced by burning it was recently in the atmosphere. Putting that CO_2 back into the air can therefore have no adverse effect on the climate. But although that is true, the real reason ethanol has become the preferred green substitute for petrol is that people know how to make it—that, and the subsidies now available to America's maize farmers to produce the necessary feedstock. Yet such things do not stop ethanol from being a lousy fuel. To solve that, the biotechnologists argue, you need to make a better fuel that is equally green. Which is what they are trying to do.

Designer petrol

The first step on the road has been butanol. This is also a type of alcohol that can be made by fermenting sugar (though the fermentation is done by a species of bacterium rather than by yeast), and it has some advantages over ethanol. It has more carbon atoms in its molecules (four, instead of two), which means more energy per litre—though it is still only 85% as rich as petrol. It also has a lower tendency to absorb water from the atmosphere.

A joint venture between DuPont, a large American chemical company, and BP, a British energy firm, has worked out how to industrialise the process of making biobutanol, as the chemical is commonly known when it is the product of fermentation. Although BP plans to start selling the stuff in the next few weeks (mixed with petrol, to start with), the truth is that butanol is not all that much better than ethanol. The interesting activity is elsewhere.

One route might be to go for yet-larger (and thus energy-richer) alcohol molecules. Any simple alcohol is composed of a number of carbon and hydrogen atoms (like a hydrocarbon such as petrol) together with a single oxygen atom. In practice, this game of topping up the carbon content to make a better fuel stops with octanol (eight carbon atoms) as anything bigger tends to freeze at temperatures that might be encountered in winter. But living things are familiar with alcohols. Their enzymes are geared up to cope with them. This makes the biotechnologists' task that much easier.

The idea of engineering enzymes to make octanol was what first brought Codexis, a small biotechnology firm based in Redwood City, California, into the field. Codexis's technology works with pharmaceutical precision—indeed, one of its main commercial products is the enzyme system for making the chemical precursor to Lipitor, a cholesterol-lowering drug that is marketed by Pfizer. Codexis controls most of the important patents for what is known as molecular evolution. This designs enzymes in the way that normal evolution designs organisms. It creates lots of variations on a theme, throws away the ones it does not want, and shuffles the rest in a process akin to sex. It then repeats the process on the survivors until something useful emerges—though, unlike natural evolution, there is a bit of intelligent design in the process, too. The result, according to Codexis's boss, Alan Shaw, is enzymes that can perform chemical transformations unknown in nature.

Dr Shaw, however, is no longer so interested in octanol as a biofuel. Like two other, nearby firms, he is now focusing Codexis's attention on molecules even more chemically similar to petrol. The twist that Codexis brings is that unlike petrol, of which each batch from the refinery is chemically different from the others (because the crude oil from which it is derived is an arbitrary mixture of hydrocarbon molecules), biopetrol could be turned out exactly the same, again and again, and thus designed to have the optimal mixture of properties required of a motor fuel.

Exactly which molecules Codexis is most interested in these days, Dr Shaw is not yet willing to say. But Amyris Biotechnologies, which is also based in California, in Emeryville, and which also started by dabbling in drugs (in its case an antimalarial medicine called artemisinin), is slightly more forthcoming. Under the guidance of its founder Jay Keasling, it has been working on a type of isoprenoid (a class of chemicals that include rubber).

Unlike Codexis, which deals in purified enzymes, Amyris employs a technique called synthetic biology, which turns living organisms into chemical reactors by assembling novel biochemical pathways within them. Dr Keasling and his colleagues scour the world for suitable enzymes, tweak them to make them work better, then sew the genes for the tweaked enzymes into a bacterium that thus turns out the desired product. That was how they produced artemisinin, which is also an isoprenoid.

Isoprenoids have the advantage that, like alcohols, they are part of the natural biochemistry of many organisms. Enzymes to handle them are thus easy to come by. They have the additional advantage that some are pure hydrocarbons, like petrol. With a little judicious searching, Amyris thinks it has come up with isoprenoids that have the right characteristics to substitute for petrol.

The third Californian firm in the business, LS9 of San Carlos, is cutting to the chase. If petrol is what is wanted, petrol is what will be delivered. And diesel, too, although in this case the product is actually biodiesel, which is in some ways superior to the petroleum-based stuff.

LS9 also uses synthetic biology, but it has concentrated on controlling the pathways that make fatty acids. Like alcohols, fatty acids are molecules that have lots of hydrogen and carbon atoms, and a small amount of oxygen (in their case two oxygen atoms, rather than one). Plant oils consist of fatty acids combined with glycerol—and these fatty acids (for example, those from palm oil) are the main raw material for the biodiesel already sold today.

LS9 has used its technology to turn microbes into factories for fatty acids containing between eight and 20 carbon atoms—the optimal number for biodiesel. But it also plans to make what it calls “biocrude”. In this case the fatty acids would have 18-30 carbon atoms, and the final stage of the synthetic pathway would clip off the oxygen atoms to create pure hydrocarbons. This biocrude could be fed directly into existing oil refineries, without any need to modify them.

These firms, however, have one other competitor. His name is Craig Venter. Dr Venter, a veteran of biotechnological scraps ranging from gene patenting to the private human-genome project, has been interested in bioenergy for a long time. To start with, it was hydrogen that caught his eye, then methane—both of which are natural bacterial products. But now that eye is shifting towards liquid fuels. His company, modestly named Synthetic Genomics (and based, unlike the others, on the east side of America, in Rockville, Maryland), is reluctant to discuss details, but Dr Venter, too, is taken with the pharmaceutical analogy. Indeed, he goes as far as to posit the idea of clinical trials for biofuels—presumably pitting one against another, perhaps with petroleum-based products acting as the control, and without the drivers knowing which was which.

Whether biofuels will ever be competitive with fossil fuels remains to be seen. That will depend on a mixture of economics and politics. But the political rush to back ethanol, just because it is green and people have heard of it, is a mistake. Let a thousand flowers bloom, and see which one wins Dr Venter's Grand Prix.

This article is taken from the Economist, an English-language weekly magazine, subjects covered are international news, economics, politics, business, finance, science, technology, and the arts. Dated from the 27th september, this article is about biofuel and new researchs. The journalist adopts a critical point of view on the 'political rush' for biofuels and shows the forthcoming patent war. The question is ' Why is ethanol suddently back in fashion ?' and What solutions can be made through research ?

At first, I will sum up scientific information given by the journalist, then I will tackle the forthcoming patent war. Finally, we can discuss how policians use science to mask the real issue.

To begin with, the journalist points out the drawbacks of ethanol : less efficient, damaging engines, less steady than petrol … That's why I give to this reader many solutions to reach fuel requirements. Research explores various way notably using mico-organism to produce alcohol or other powerfull molecules. Biology seems to be the new way to develop fuel and produce it. Interests of firms like BP or Pfitzer in developping this technologies are also raised. From my point of view, the journalist's approach is really interesting, because he gives some keys in order to explain chemistry to a largest public. He wants people to stand back about scientific technologies.

In this way, we can ask ourselves about this research and the forthcoming patent war. Indeed, it seems clear that chemical giants or oil giants want to control these technologies and also benefit from the 'green revolution'. In a way, a patent war will be declared to control it. Many risks could be raised and notably in genetic, economic interests should be stronger than the principle of care. This issue could be linked with GMO's, we miss backdown. Even if new fuels are an environmental stakes, they are foremost economical stakes. Oil firms could at the same time, control the biofuel advent and manage petrol sales. Oil lobbies putting pressure on polictícians, we can ask what policies will be taken ?

Climate changes have become a really politics issue for few years, and it have began to be integrated in political discourses. The journalist draw the reader attention on the use of science to mask some problems, for example bioethanol seems to be an illusion. Indeed, the issue is only move, not solved. Bioethanol continues to produce carbon dioxyde, but it's putted forward like clean technology. Rather than to adopt a real solution, politicians prefers, according to oil giants, favour the biofuel solution. In this way, it could be interesting to compare biofuel and Hydrogen technologies, and to assess the situation on carbone emission.

Green revolution seems to be a real opportunity to change our manner to design energy, we must attentive at politic and economic interests that could not become dominant on environmental stakes. People must further open their eyes to the use of scientist discoveries by politicians.

The New York Times
nytimes.com

October 24, 2007

Challenging Gasoline: Diesel, Ethanol, Hydrogen

By MATTHEW L. WALD

YES, gasoline has the corner on the American car fuel market, but maybe not forever. Carmakers already produce passenger vehicles that run nicely on diesel fuel, ethanol or hydrogen. The first two are on the road in the millions around the world, and the third is moving slowly toward viability.

The catch is that the path to the pump, as Thomas Hobbes might have said, can be nasty, brutish and long. And the overall picture for pollution and energy — which the engineers call "well to wheels" — might have drawbacks to equal gasoline's.

Still, the supply chains for diesel, ethanol and hydrogen are immature. That should change in a few years, as the most important choice for consumers in car showrooms may be what kind of fuel they want to use.

"Buying a car is not going to be about color choices or automatic versus manual transmission," said Allen Schaeffer, the executive director for the Diesel Technology Forum, a trade association. "It's going to be about getting into a powertrain."

Here is a status report on the alternatives:

DIESEL

Carmakers are selling models in Europe that are clean, odor-free and peppy. Computer control over fuel injection has reduced diesel cars' clattering noise, and ultralow-sulfur diesel, now widely available in the United States, has made it possible for carmakers to install filters and other devices to clean up the exhaust.

Chrysler and Mercedes-Benz are offering diesels in 45 states, and Mercedes is planning to sell one that meets the stricter requirements of California, which have also been adopted by New York, Massachusetts, Maine and Vermont.

Although diesel engines cost more to make and buy, they can make sense for a car owner. For one, they use fewer gallons per trip than gasoline engines.

Besides regular diesel fuel from petroleum, there is biodiesel. Chemicals extracted from soy or other vegetables, or from beef tallow or other animal fats, burn well in a diesel engine. These substances become waxy at low temperatures, so they are usually blended in small quantities with petroleum diesel.

But like ethanol, producing biodiesel requires farmland, which could otherwise be used to raise food. Yet making biodiesel takes less natural gas and other fossil fuels than making ethanol. A gallon of diesel will power a car 20 to 40 percent more miles than a gallon of gasoline, though the energy gain and the reduction in carbon dioxide emissions are not that large.

The reason is that diesel has more carbon than a gallon of gasoline. It also has more energy, about 138,000 B.T.U. versus about 118,000 for gasoline. That distinction may be lost on consumers, because motor fuel is sold by a unit of volume, the gallon, not a unit of energy.

Despite these issues, there is a real advantage to driving a diesel engine because it burns fuel at a higher temperature than a spark-ignited gasoline engine does, thus squeezing more work from the fuel.

Skeptics still abound. Lee Schipper, a former oil industry executive who leads a transportation and environmental study program at the World Resources Institute, said that what pushed European drivers to diesel was a tax policy that made the fuel cheaper, but buyers there tend to drive more, so they don't save on total consumption.

"There are limits to diesel," Dr. Schipper said. "Unless a diesel car is driven the same as a gasoline car, on 35 percent less fuel per kilometer, the CO2 benefit is marginal and may be negative." Hybridization might be a better option, he suggested.

ETHANOL

The United States consumes about 140 billion gallons of liquid transportation fuel a year, about 6 billion from ethanol. Half of all gasoline contains some ethanol, which ordinary cars can burn at a concentration of up to 10 percent. About six million cars can now use any mixture of ethanol and gasoline, up to 85 percent ethanol, known as E85. Domestic carmakers view ethanol as a way to cut gasoline consumption and to avoid making major changes in their production.

Ethanol has strong political support. "I'd rather be paying farmers than the people overseas for the energy that fuels this country," President Bush told auto workers at a speech at a Ford plant in Claycomo, Mo., this year. From a driver's viewpoint, ethanol may perform well in the engine.

But it contains only about two-thirds as much energy per gallon as gasoline. It has what Dr. Schipper calls "closet carbon," meaning carbon dioxide is created when ethanol is manufactured, which may amount to slightly less or more than in gasoline.

HYDROGEN

President Bush said in 2003 that there was hope that a baby born that year would grow up to buy a hydrogen fuel-cell vehicle as a first car. That baby is now nearly in kindergarten, and the fuel cell still has far to go.

Fuel-cell cars require improving two fairly young technologies, fuel cells and making hydrogen for them. Honda recently announced progress on the fuel cell, which combines hydrogen fuel with oxygen from air to make electric current, a little heat and some pure water.

Fuel cells are bulky, however. Honda's first effort, in 1999, produced 60 kilowatts, enough for a modest-size sedan, but a fuel cell weighed close to 450 pounds and filled a volume of 4.7 cubic feet. This year it has given testers a new version that is 100 kilowatts; at about 150 pounds it is one-third the size of the old one. Honda's trick was to turn the fuel cell sideways, to improve the flow of chemicals.

But Honda will not say what the fuel cell costs; no manufacturer is open about that.

On the hydrogen aspect, environmentalists dream of ranks of windmills making electricity that will be used to split water into hydrogen. They also wouldn't mind fields of solar cells to do the same. But such renewable power may be more useful to replace coal, which is far dirtier than gasoline. And the cheaper way to make hydrogen may be the general technique, by taking it out of the methane in natural gas.

H2Gen, a small company in Alexandria, Va., is selling a chemical processing plant that can be delivered on a truck and turns natural gas into hydrogen fast enough to support fueling several dozen cars, about right for a

corner gasoline station.

So far, H2Gen's customers have been industrial users.

A Shell station in Washington that opened a hydrogen pump in late 2004, to supply the demonstration vehicles that automakers traipse through the city, uses hydrogen produced cryogenically. At either an oil refinery in Ontario or in Louisiana, the hydrogen is chilled to an extremely low temperature, condensing into a liquid. The result is pure, though it takes a lot of energy to make. It is then put into a cylinder truck with a diesel-powered engine and hauled to Washington, which works well for a test program but hardly saves any energy.

This article is taken from the New York Times, the largest metropolitan newspaper in the United States. Dated from the 24th October 2007, this article compares various fuels and gives some way of developpement in the United States. The journalist shows that the choice of the kind of fuel will be predominant for motorists in coming years. The US point of view can be examined.

At first, I will discuss about this three kind of fuel, then I will search what measures could help the developpement of clean fuel. Finally, we can see that the countries do not address the problem in the same way.

First, the journalist gives new evolutions in diesel engines, notably by european carmakers. He compares diesel and gasoline on their consumption, but on their energetic efficient. He raises that motor fuel should be sold by unit of energy and of volume. This remark is really interesting notably to compare objectively some fuels. The question of ethanol is also tackled. Now, ethanol is 4,3 % of fuel used, I should become a not insignificant kind of fuel. Also, we can view a politic interest, indeed President Bush said that he prefers paid american farmers rather than foreigner petrol producters. We see again the use of 'bioethanol' for politcal purposes., thus ethanol appears to be conducive to agriculture and consistent with foreign policy. Besides, we have a last solution hydrogen cell-fuel. This technology's already developped by japanese and european constructors, notably Honda who's leading this sector. America awareness is becoming, hydrogen station is opening and constructors are developping cars. But the really question is : « why can we produce hydrogen ? » The green point of view would like produce it by solar energy or windmills, but in reality the easiest produce a lot of carbon dioxyde with methane. We can see here that a new fuel should be considered from production to intended end use.

Then, we can ask how political measures should help green fuel developpement. For example, environmental measures taken by California's governor must encourage companies to consider green stakes. I take the view that States had better to incite people use new fuel for their energetical independence. Researches should be financed to find cheap and clean processes to produce hydrogen.

Finally, we can view that countries have various point of view, europeans and japaneses seem to be more implicate in Hydrogen process. Competition should stimulate researches between countries and could change americans'point of view on their gas guzzlers. Moreover, foreign models arrived on the american market will be soon joined by american's ones. In this way, oil firms had better to develop today a new generation of stations.

To put it in a nutshell, this article allows us to understand various fuel and their stakes. We could be able to link this with political and environmental aspects.

Finally, we have a real problem with the energy. Scientists could find some solutions but there are economical and political choices, and we are at crossroads. You have to choice for a better future, people have to be more implicated in this choice because it's fundamental.

Glossary

1 pound	454 grams
BTU = British Thermal Unit	1055 Joules
Windmill	Eolienne
Peppy	enjoué
Waxy	cireux
Kindergarten	Jardin d'enfant
Fickle	Inconstant
A geezer	Un type
A den	Une tanière, un repère
Funnel	Entonnoir, cheminée
Duct	Conduite, canalisation
Nested	Avec des nervures
Yeast	Levure
Wreck	Démolir, dévaster
A joint venture	Une coentreprise
To cope	Tenir le coup
Willing	Enthusiastic
To tweak	Pincer, tirer
To bloom	éclore