

STOP BURNING BIOMASS!

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The contribution of carbon dioxide to global warming is caused solely by the quantity of carbon that is added to the cycle on the surface of the earth by releasing fossil fuel. It is useless to slow down the process of releasing fossil carbon by economising and by using alternative energy sources. Global warming is caused, not by the speed in which extra carbon is added to the cycle, but by the cumulative effect of burning fossil fuels over a long period of time. There are only two options to deal with the problem of global warming. One is to close down immediately all gas and oil wells and coal mines in the entire world. The other is to take as much carbon out of the cycle on the surface of the earth as fossil fuels add to it. The political will in the world community to choose the first option is absolutely absent. So only the second option is available. This choice implies that burning of biomass fuels must be stopped and technology must be developed to grow biomass to capture carbon dioxide and subsequently isolate it from the carbon cycle on the surface of the earth for ever. This approach poses new challenges to the biomass industry: **BIOMASS FOR NEW SINKS**

1. BURNING BIOMASS IS HARMFUL

A lot of money and effort is spent on alternative energy sources to reduce the quantity of fossil fuel needed to support growing and emerging economies. At the same time exploration of new resources of fossil fuel is stimulated and there are no indications that any government in the world is tending towards measures to close down sources of fossil fuel in order to reduce carbon emissions. The use of fossil fuel will continue until alternative technology produces cheaper energy. Subsidised programs for the use of alternative energy sources will stimulate, not reduce, the use of fossil fuel because such programs will have the effect that the market price for gas, oil and coal will go down. In this political and environmental reality we can conclude that '*biomass for energy*' programs are not only a waste of money and scientific effort, they are also harmful for the environment.

2. A NEW APPROACH

A completely new approach is needed to seriously avoid the risks of global warming. All fossil carbon was once, although not necessarily simultaneously, part of the carbon cycle on the surface of the earth. It was caught in *sinks* of seashells and vegetation and isolated from the cycle. If there are good reasons to bring that carbon back into the cycle, we must create new *sinks* to take the same quantity of carbon out of the cycle if we want to avoid global warming. Scientists who are now working on biomass for energy technology, must divert their efforts to biomass isolation programs. The direction of research should be that of creating natural sinks in the oceans and on land and in growing crops for isolation. But also outside the realm of biomass technology a new approach is needed. A new technology of waste conservation must be developed and atmospheric carbon dioxide must be stored in suitable layers underground.

3. FOSSIL FUEL IS CHEAPER AND CLEANER

Fossil fuel is now preferred over alternatives because it is cheap and clean. Millions of years of compression have created relatively pure energy and decades of research have created a technology that leaves hardly anything but water

and carbon dioxide after combustion. In themselves these are harmless substances and if there are other options to prevent global warming, fossil fuels must be considered less harmful for the environment than biomass fuels. This was strikingly illustrated when an enormous health problem occurred when Borneo's biomass went up in flames. Of course it must be possible to develop technology to process the combustion gases of biomass so well that they will be as clean as those of natural gas, but so far that standard has not been achieved. For at least some decades to come, fossil fuel will be cleaner than biomass at a given price. The choice for biomass for energy is only justified if it is certain that an equivalent of fossil fuel will remain in its source forever.

4. BREAKING EVEN

Commercially exploitable oil and coal reserves will last for at least 50 years and natural gas for a few decades more at the present projections. The sooner alternative sources of energy will be available at a lower price than fossil fuels, the sooner the addition of fossil carbon to the cycle will cease. In other words, the more efficient the technology for alternatives, the smaller the commercially exploitable reserve of fossil carbon will become. Reaching this break even point must be a market phenomenon. If it is directed through subsidies and taxation, a change of government policies by some dissenting nation will again open the leak of fossil carbon into the atmosphere. Biomass technology will play a crucial role in reaching the break even point. The great challenge for the biomass researchers is to develop a source of energy that is cleaner and cheaper than fossil fuels. The sooner that goal is reached, the less fossil fuel will be added to the atmospheric cycle. But as long as this break even point is not reached, the experiments should remain in the laboratories. Not implementing available expensive technology will keep the price of fossil fuels high and so far this is the best we can do for the environment.

5. USELESS EFFORTS

Saving and expanding the rain forest is very important for maintaining bio-diversity, but it has no function at all when

it comes to capturing carbon dioxide. The forest wraps all the carbon in morsels of food for bacteria, beetles, caterpillars, parrots, monkeys, men, women and children and they breathe it all back into the atmosphere. The layer of humus under a rain forest is virtually non-existent and the only real contribution that vegetation has in the struggle against global warming is the forming of a new sink in the form of humus. Grassland, not forest, is the best producer of humus. It is of course true that a forest captures carbon, but it will always be a limited quantity per hectare and it will always be temporary, since forest fires are a natural phenomenon. The only safe and unlimited way to store carbon is underground.

Using wind, sunlight, tides, waves and waterfalls to create energy is very clean and therefore advisable. But using these clean forms of energy does not contribute to the prevention of global warming since it has no effect on the cumulative quantity of fossil carbon that will be burnt in the next centuries. Only if technology is developed at which these forms of energy can be delivered at permanently lower cost than 'fossil energy', will these clean technologies be useful.

Burning biomass or domestic waste to produce energy is not clean, even less clean than burning fossil fuel and does not contribute to the prevention of global warming for the same reasons as mentioned in the previous paragraph and is therefore useless.

Recycling and economising may be useful for many reasons, but it does not contribute to the prevention of global warming, since it has no effect on the quantity of fossil carbon that will eventually be added to the cycle on the surface of the earth. So it is useless.

The same goes for programs aimed at increasing the efficiency of processes or the reuse of carbon dioxide from refineries or power plants, such as a program of Shell in the Netherlands that feeds carbon dioxide to greenhouses to stimulate plant growth. Creating a greenhouse effect to prevent a greenhouse effect would have been too fantastic.

Still, billions of euros of corporate and public funds are spent on these useless programs and these programs have public support because people *believe* that these will stop the dreaded greenhouse effect. Natural gas that is produced in Norway is rich in carbon dioxide, which is separated and fed back into the earth, where it stays, instead of into a greenhouse. Now, that's a start.

6. USEFUL EFFORTS

Global warming is a real threat. Nobody knows what the effect will be, but nobody can take the risk to wait and see. In theory global warming is reversible. It is created by the amount of carbon that is added to the cycle on earth by the release of fossil carbon, so it could be reversed by withdrawing carbon from that cycle once it has proven to be harmful. But unfortunately it is not just a matter of an atmosphere that gets a bit too warm and must cool down again. Once the Gulf Stream has changed its course, to name one effect, nobody gets it back where it 'belongs'.

My approach is that the only useful effort to prevent global warming is to create a balance between carbon addition and carbon withdrawal. For every atom of carbon that is added to the cycle on the surface of the earth, another atom

must be withdrawn. Technology can be developed in several fields and the biomass industry will have to play an essential role. My plea to stop burning biomass is not an attack on the biomass industry but an effort to promote more effective ways to direct investments in this field. A new challenge to scientists, politicians, oil companies and environmentalists is hopefully the result of this approach. In my view new technology must be developed in the following fields.

6.1 The most direct way to reduce the quantity of carbon dioxide (and maybe NO_x) in the atmosphere is to take it right out. A device that separates greenhouse gases from useful elements of the atmosphere, a hole in the ground, a pump and a supply of energy are all it takes. Exhausted gas fields are ideal for storage. What I see is a windmill or a solar cell situated on top of an exhausted gas field that creates the energy for gas separation and a pump that just keeps putting the carbon back to where it came from. At least all the carbon that was released in the form of natural gas can be withdrawn in this way in exhausted gas fields, but I do not regard it as unlikely that other layers may be suited just as well or even better. Of course there need be no relationship between the location where natural gas is released or used and carbon dioxide is withdrawn. Oil companies could be made responsible for this part of the effort.

6.2 New technology for the disposal of carbon containing waste must be developed. At present the focus is on the cleanest possible way to use the potential energy of the waste mass, or on recycling the raw materials as many times as possible before they finally end as disposable waste and eventually be burnt for energy. This must cease in spite of the created common sense that reuse of materials is good. We must learn to *waste waste*. Technology must be developed to create the waste disposal of the future: a safe way to dump carbon containing waste. Maybe wrapped in glass and used as landfills, maybe islands can be built on yesterday's papers, maybe safe storage can be created in deep trenches in the oceans. We have now learnt the dangers of traditional waste disposal, so it must be possible to develop safe technology to store organic waste out of the reach of oxygen and anaerobic bacteria.

A huge mind-shift is necessary, for instance to go from minimising the use of packing materials, to being as abundant as the consumer is willing to pay for. The more carbon is used in packing material, and the more of that material is isolated in waste disposal, the more effective the contribution to the prevention of global warming. Once the consumer is convinced of the beneficial role of creating waste, he will be very willing to pay for this indulgence.

6.3 The use of durable organic materials for construction purposes can play an important buffer role. Using wood as building material will of course not be helpful in the long run as we may expect that every wooden house will eventually burn, be eaten by termites or rot away. But many items made of wood have a life span of five centuries or more. Using organic material for construction and durable goods in abundance will create a buffer that will give respite to develop the other technologies necessary to prevent global warming. The biomass industry can play a role in this field, together with governments which must then promote the use of organic material (including plastics

and other products made of fossil carbon) and discourage the use of non-carbon materials. Especially the use of concrete must be discouraged. It does not capture carbon, on the contrary, during the production of concrete a lot of carbon dioxide is released. The use of carbon fibres must be promoted instead of aluminium for cars, bicycles etc. The consumer will be prepared to pick up the tab.

6.4 Even more important for the bio-industry is the development of programs to create sinks. Plant a tree. Let it capture carbon for twenty years. Chop it down. Drive it vertically into the ground within a hundred metres of where it was grown. There is no transportation, the trees are not processed, not burnt, but taken out of the carbon cycle above the ground permanently.

Just growing and maintaining forests above the ground is useless in the struggle against global warming because the trees take up space and will ultimately burn in forest fires or decompose and thus have a carbon capture balance of zero. Only if the trees are excluded from the cycle above the ground, will they contribute to the reduction of carbon in the atmosphere. Trees are very helpful through their shape and structure. The very house I find myself in is built on wooden poles. They have been a firm foundation for well over a hundred years and may continue to be just that for centuries more. The beauty of this example is that it is very visual; you can see the leaves inhale the carbon dioxide and store it in solid potential energy. Next you can feel yourself resist the temptation to use the wood for something 'purposeful' and ram it right back into the soil it sprang from. And in your minds eye, you can see this up side down forest that holds an equivalent of millions of cubic metres of clean natural gas which we can consume without contributing to global warming.

6.5 Of course trees are not the only crop that can store carbon in new sinks. There must be fast growing vegetation that stores carbon much faster than wood and that can be harvested and buried at lower cost per equivalent of a barrel of oil. The technology for growing biomass must not be directed on how the stored carbon can be turned back into carbon dioxide, delivering energy on the way, but on how it is best prevented that the stored carbon will ever turn back into airborne carbon dioxide. After all, global warming does not discriminate between 'good' and 'bad' molecules of carbon dioxide. Government subsidies for the next decade should mainly be directed at the development of technology for these new sinks. Once the technology is available and affordable, concessions for mining should be revised globally in the sense that the fossil fuel industry must be able to prove that for every atom of carbon that is released from an old sink, another is added to a new sink. Of course this will increase the price of gas, oil and coal, but will only bring the break even point with durable forms of energy closer.

7 CAN WE TRUST THE WORLD?

There appears to be one weak point in my argument. The application of taxation and subsidies as an instrument to discourage the use of fossil fuel and promote alternatives is the wrong method, I claim, because future generations and 'other' countries cannot be trusted to keep their fingers off the gold in the ground. Yet my proposal that oil companies and governments world wide must finance the programs to extract enough carbon from the cycle on the surface of the

earth, is based on the presumption that they *can* be trusted. There is, I think, an essential difference between the two situations. In the approach which I have defined as *useless*, the pace of global warming is slowed down, but it can only be stopped if sources of fossil fuel are closed down permanently. Not a single government in the world has issued a moratorium on exploration, let alone exploitation, of fossil fuel. So it is proven that they cannot be trusted to take the measures necessary to divert global warming.

In my approach the 'gold in the ground' will either vanish or turn out to be worthless. So in the long run, nobody will be tempted to exploit what's left of it because the alternatives are cheaper and cleaner. In the mean time an extra effort, at extra cost, must be made to extract carbon from the cycle. The extra cost created by the necessary measures are not financed by taxation, but by environmental conditions. Many industries have been forced to stop polluting. Companies that exploit gas, oil or coal can simply be forced to prove that for every atom of carbon that they take out, another atom must go back in. Governments which are afraid that the increased price of energy will hamper economic growth, can subsidise these programs or decrease taxation if they wish. The United Nations must see to it that the time table of carbon withdrawal is met and that a fair distribution of cost is made between poor and developed regions.

8 THE CHALLENGE

Permanent storage of carbon dioxide in porous layers, and creating new sinks made of carbon containing waste and biomass that is especially grown for this purpose... That, I think, will be the challenge for those who really want to tackle the greenhouse effect. Economising is a universal human reflex when the future poses a threat, but in this case it is not the solution. Scientists still have the alchemist in their genes who wants to create gold and perpetual motion, but now they must concentrate on sweeping the floors of their laboratories and safely dumping the refuse. It will take some getting used to. But once the public, governments and scientists realise that spending so much money and effort on finding perpetual motion while in the mean time carbon is squeezed out of the earth everywhere while none of their efforts will stop it, there will have to be a turning point.

While many scientists concentrate on a good system to monitor and maintain the quantity of carbon in the cycle on the surface of the earth to the point that the use of fossil fuel has become unattractive to anyone, others can go on refining the technology to safely and affordably use the sun, wind, water and soil to give us all the energy we need to fulfil our dreams.