

Letter From The Editor

by Philipp Steger

Welcome to the 2nd English-language edition of “Voices on U.S. Science & Technology (S&T) Policy”. As evidenced by the wide range of topics that our authors wrote about in the May edition of “Voices”, we look at S&T policy in the broadest sense of the term.

Therefore, the articles you’ll find in this publication go beyond the immediate concerns of S&T policymakers and look not only at the issues that are strongly shaped and influenced by new technologies, new scientific findings and overall innovation, but also at the framework under which S&T either flourishes or withers.

Stephan Neuhäuser’s article about the different approaches and attitudes towards genetically modified organisms (GMO) in the U.S. and the EU is an example of how new technologies – in this case, the various applications of biotechnology – raise a whole new series of questions that need to be addressed by policymakers, hopefully while relying on the advice of scientists. The very recent failure of talks between the U.S. and the EU on opening Europe to GMOs shows how deep the divide over this issue is threatening to become. Donal Nugent, an Irish science journalist, takes a look at some of the more mind-boggling products of biotechnology.

Jutta Kern’s article provides a general overview of what is, without doubt, one of the most relevant frameworks out of which the S&T enterprise draws its continuing strength: the American education system and the current administration’s efforts at reform. Talking to European educators, be it on the level of primary or secondary education, one cannot fail to notice certain misconceptions and a certain lack of knowledge about the general lay-out of the U.S. educational system – this article aims at addressing this perceived deficit.

Environmental policy is the area that will likely be most influenced by the availability of both good science and new technologies. Sylvia Pilz and Himangi Zanpure-Sattler provide a very informative outline of the environmental policy issues that are currently at stake in the U.S. in what is the first in a series of articles about how the U.S. deals with the various environmental challenges. This article is complemented by an analysis of the President’s “Hydrogen Initiative”. With this new initiative, the Bush administration is laying the foundation for an innovation process, the consequences of which will likely be irreversible for a long time given the long cycles the implementation of major innovations, especially in the transportation and energy sector, require.

Achim Seifter, an Austrian scientist working at Los Alamos has also contributed to this edition of “Voices” with an article about this famous laboratory, which as the institution at the center of the “Manhattan Project,” has for better or worse shaped the history of 20th century science.

Last, but not least, Sabine Herlitschka’s contribution about the American Association for the Advancement of Science (AAAS) LINK aims at informing our European audience about this truly outstanding organization. Let’s hope that this is one more step to creating an organization that is similarly beneficial to the advancement of science in Europe.

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Genetically Modified Organisms: The Transatlantic Conflict Is Picking Up Speed

by *Stephan Neuhäuser*

On May 13, 2003 the United States finally filed the long awaited suit at the World Trade Organization (WTO) to force the European Union to lift its "moratorium on the approval of biotech products." The term "biotech products" refers to genetically engineered (GE) food and crops also known by the more general term "genetically modified organisms" (GMOs); the most common being GE-corn (maize) and soybean. "The approvals moratorium has restricted imports of agricultural and food products from the United States." says the U.S. administration. At the outset of the looming trade dispute that will quite likely involve numerous scientists testifying as experts for either side, it makes sense to take a look at the different viewpoints on both sides of the Atlantic.

- *World Trade Organisation* (<http://www.wto.org>)
- *WTO Dispute DS 291, Request for Consultations by the United States* (http://www.wto.org/english/tratop_e/dispu_e/dispu_status_e.htm)

The European Stance: In Dubio Pro Securitate

Usually European governments and the European Commission alike don't speak of a "ban" or a "moratorium" on the import of GE food; although, since spring 1998, aside from GMOs already approved, no new GMOs have been authorized for planting or use in the E.U. This de facto moratorium was imposed at an E.U. Environment Ministers Council meeting in June 1999 when five Member States – Denmark, France, Greece, Italy and Luxembourg – issued a declaration, that they would effectively block new GMO approvals until appropriate E.U.-legislation was in place. Austria soon followed suit as a supportive Member State with Germany and Belgium making their declarations in October and December 2001 respectively. In fact, a new regulatory framework entered into force in the E.U. in October 2002. A number of GMOs have been submitted for approval under these new rules by various biotech companies, but haven't been approved as of yet. Regulations on labeling and traceability of GMOs though, are still under discussion in the European Parliament and may enter into force in the course of 2003.

In its policy on GMOs the European Union is led by the "precautionary principle", laid out in the United Nations' "Cartagena Protocol on Biosafety to the Convention On Biological Diversity." The much discussed "precautionary principle" means that preventive action should be taken, even without full scientific certainty about the problem that is being addressed. As of May 2003 there are 103 signatory states of which 49 have ratified the Convention On Biological Diversity. The U.S.A. has neither signed nor ratified it and downplays the relevance of the Cartagena Protocol.

The "precautionary principle" is largely in line with prevailing views among Europe's public and consumers' organisations, underlining the widespread skepticism about GE food amongst Europeans. One of the periodic "Eurobarometer" surveys by the European Commission addressed Europeans' attitude towards science & technology in general and found that 71% of Europeans oppose food containing GMOs. In contrast, a 1999 Gallup survey showed that 66 % of Americans are in favour of GE foods; still, "if a crisis were to occur, there could be a very swift and strong backlash against the technology" Gregory Jaffe, director of biotechnology issues at the Center for Science in the Public Interest, is quoted in the Washington Post on May 30, 2003.

- *Convention On Biological Diversity* (<http://www.biodiv.org/default.asp>)

- ❑ *Convention on Biological Diversity (Cartagena Protocol*
<http://www.biodiv.org/biosafety/>)
- ❑ *Fact Sheet on the "International Protocol on Biosafety" by the U.S. Department of Agriculture* (<http://www.fas.usda.gov/info/factsheets/biosafety.html>)
- ❑ *The Cartagena Protocol on Biosafety: An analysis of results (International Institute for Sustainable Development, Winnipeg, Canada), containing an extensive analysis of the "precautionary principle"* (<http://iisd.ca/pdf/biosafety.pdf>)
- ❑ *The Precautionary Principle In Action – A Handbook (Science and Environmental Health Network, Windsor, North Dakota, and Lowell Center for Sustainable Production, University of Massachusetts, <http://www.biotech-info.net/handbook.pdf>)*
- ❑ *Eurobarometer survey on science & technology: Europeans and Biotechnology 2002* (http://europa.eu.int/comm/public_opinion/archives/eb/ebs_177_en.pdf)
- ❑ *Europeans and Science and Technology 2001 (Eurobarometer Report, European Commission, http://europa.eu.int/comm/public_opinion/archives/eb/ebs_154_en.pdf)*
- ❑ *Gallup survey on biotechnology* (http://www.biotech-info.net/gallup_issue.html)
- ❑ *Center for Science in the Public Interest* (<http://cspinet.org>)
- ❑ *No Deal on Biotech Food – Industry, Opponents Fail to Agree on Recommendation for Regulation (Washington Post, May 30, 2003, <http://www.washingtonpost.com/wp-dyn/articles/A55678-2003May29.html>)*

A New European Legislation

"If we are to make acceptance of GMO products possible in the European Union, then we must restore public and market confidence. In order to do so, we must provide consumers with an effective choice between GMO and non-GMO products. Labeling and traceability of GMO products will enable them to choose," the European Environment Commissioner Margot Wallström argued in December 2002. Her statement came in reaction to the common position agreed upon by the European Council and the European Commission on the GMO-labeling regulations last December. The agreement between Council and Commission provides for measures on European national levels to be replaced by common EU-legislation as soon as the European Parliament approves the proposed legislation (probably during 2003). The issue is now on the agenda of the European Parliament's "Committee on the Environment, Public Health and Consumer Policy".

As soon as the proposed legislation is adopted, products containing GMOs made available to European consumers will always have to be labeled as such. In addition, throughout the production and distribution chains, all information concerning GMOs will have to be handed from one party in the chain to the next, therefore providing for traceability. Codes for individual GMOs that have been used to constitute the original raw material for products intended for food, feed and processing, will have to be listed in documentations accompanying the final products.

- ❑ *Margot Wallström (biography, http://europa.eu.int/comm/commissioners/wallstrom/personal_en.htm)*
- ❑ *Full text of Commissioner Margot Wallström's statement on labeling and traceability of GMO products* (<http://www.eurunion.org/News/press/2002/2002069.htm>)
- ❑ *Committee on the Environment, Public Health and Consumer Policy* (http://www.europarl.eu.int/committees/envi_home.html)
- ❑ *Margot Wallström welcomes agreement on traceability and labelling of genetically modified organisms (GMOs)* ([http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/02/1836\[0\]RAPID&lg=EN; 10dec02](http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/02/1836[0]RAPID&lg=EN; 10dec02))
- ❑ *European rules and regulations (European Commission, http://europa.eu.int/comm/food/fs/gmo/gmo_index_en.html)*

The U.S. Stance: Is It Just About Trade?

In their WTO "Request for Consultation," the United States accuse the European Commission and a number of European Union Member States of enforcing "a moratorium on the approval of biotech products," further, of suspending the "consideration of applications for, or granting of, approval of biotech products under the EC approval system," thus harming U.S. trade: "The approvals moratorium has restricted imports of agricultural and food products from the United States."

In a testimony to the Committee on Agriculture in the U.S. House of Representatives, House Speaker Dennis Hastert, a powerful Republican from Illinois, estimates the annual losses in corn exports for U.S. farmers at over \$ 300 million. The E.U.'s "ban" on GMOs is "based on fear and conjecture – not science," says Hastert, and, he claims, had been imposed primarily "because we [American farmers] are technologically superior." The U.S. Trade Representative Robert Zoellick recently talked about "the European fog of misinformation and protectionism resulting from E.U. biotech policies" and Senator Charles Grassley (R-Iowa), Chairman of the Senate's Committee on Finance, called the E.U.'s policy "misguided" and "based on politics, not science" whilst "farmers are suffering from the European Union's policies."

- *House Speaker Dennis Hastert (biography, <http://speaker.house.gov>)*
- *Dennis Hastert's testimony to the Committee on Agriculture in the U.S. House of Representatives (http://www.usis.it/file2003_03/alia/A3032620.htm)*
- *Robert Zoellick (biography, <http://www.whitehouse.gov/government/zoellick-bio.html>)*
- *Robert Zoellick on European biotech policies (<http://usinfo.state.gov/topical/econ/wto/03012401.htm>)*
- *Charles Grassley (biography, <http://grassley.senate.gov/>)*
- *Senator Charles Grassley's press release on European biotech policies (<http://www.grassley.senate.gov/releases/2003/p03r05-13.htm>)*

Argentina and Brazil take over from the U.S.

The United States is the largest corn (maize) and soybean producer in the world and exports approximately 20% of its corn crop and even 40% of its soy bean crop. Numbers published by the European Commission prove that the GMO-issue has hit the U.S. corn industry hard: In 1995 the E.U. imported 3,325,082 tons of corn from the United States, in 1997 imports decreased to 1,708,445 tons, in 1998 U.S.-exports to the E.U. sank drastically to 237,567 tons. In 2002 the E.U. imported a mere 25,934 tons. On the other hand corn imports from Argentina to the E.U. increased from 528,028 tons in 1995 to 1,347,595 tons in 2002. Both Argentina and the U.S. grow GE corn, with one decisive difference: a number of U.S. varieties have not been approved in the E.U., whilst all Argentinian varieties are E.U. approved. To make things worse for North American exporters, only about 2% of GE corn and non-GE corn are segregated. Therefore, approximately 98% of U.S. corn may contain GE corn varieties not approved in the E.U. This may change, however, as the U.S. Department of Agriculture (USDA) has recently proposed to create a voluntary labeling system for GE and non-GE crops. This proposal was made in the wake of the 2000 "StarLink-incident," during which GE-corn branded "StarLink" meant only for animal consumption, had made its way into taco shells, chips and other food products. The reason was careless grain handling, forcing millers and processors to spend \$ 1 billion in an effort spanning three months to get rid of the unhealthy corn-combination.

The GE soybean exports too seem to have been affected by the same debate that has been raging over GE corn, although U.S. farmers grow only varieties also approved in the E.U. Whilst Brazil tripled its soybean exports to the European Union (3,073,057 tons in 1995; 8,933,295 tons in 2002), U.S. exports to the E.U. decreased from 9,811,570 tons in 1995 to 5,518,096 in 2002.

- *U.S. Department of Agriculture (USDA, <http://www.usda.gov/>)*
- *European Commission regrets US decision to file WTO case on GMOs as misguided and unnecessary (press release by the European Commission containing detailed statistical data,*

[http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/03/681|0|R APID&lg=EN&display=\)](http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/03/681|0|R APID&lg=EN&display=))

- *Detailed statistics on U.S. agriculture by the USDA*
(<http://www.usda.gov/nass/pubs/agstats.htm>)

The Dispute Over The American Regulatory System

Along with the trade issue, there is an ongoing debate within in the U.S. about tightening rules for the biotech industry. Especially consumers' associations, environmentalists and organisations dealing with science and the public are supportive of a stricter regulatory framework similar to European rules. Even some food companies fearing decreasing sales in foreign markets resistant to GMOs, have teamed up with them. In the past 2 years the "Pew Initiative on Food and Biotechnology" has brought together organisations supportive of stringent regulations like the Consumers' Union, Environmental Defense, the Center for Science in the Public Interest and the Union of Concerned Scientists with food companies and the big names of the biotech industry (Monsanto, DuPont etc.).

The idea behind the "Pew Initiative on Food and Biotechnology" was inter alia to come up with a consensual proposal on how to improve federal legislation concerning the agricultural biotech industry. New legislation would give the USDA, the Environmental Protection Agency (EPA), and the Food and Drug Administration (FDA) more regulatory power in respect to the possible impacts of GMOs on agriculture, the environment and food safety. After exactly 2 years of negotiations the plan ultimately failed, but nevertheless the Pew Foundation issued a "final report" end of May 2003 that might be the starting point for the resumption of talks next year.

Though no official reasons were given why the talks were unsuccessful, the Washington Post links the breakdown of the Pew Initiative with the WTO action taken by the Bush administration: "As part of that case, the administration will take the position that the current American regulatory system is fine. European consumer and environmental groups consider it to be egregiously inadequate. As the Pew discussions unfolded, the biotech industry grew wary of endorsing any compromise that would appear to support the European view and thus undermine the Bush legal case..."

Without new legislation, the regulatory status quo concerning GMOs continues to favour the biotech industry: Currently the FDA runs a voluntary system under which biotech companies themselves decide on how to assess the safety of their products. Generally, biotech companies submit data of their GE products to the FDA which checks them and subsequently informs the companies that the FDA has no objections.

Though federal lawmakers are still undecided on how to address issues raised by agricultural biotechnology, the states' governments are all the more active. During the 2001-2002 legislative session alone, 158 pieces of legislation related to agricultural biotechnology were introduced in 39 states. The Pew Initiative on Food and Biotechnology keeps track of new and changing legislation in its "Legislation Tracker" released on June 11, 2003. This database can be used to research data on all legislation related to agricultural biotechnology submitted in the 107th Congress (2001-2002), all legislation related to agricultural biotechnology sorted by state, topic or bill status and an overview of ballot initiatives and town hall resolutions related to agricultural biotechnology initiated in select states since 2000.

- *"Pew Initiative on Food and Biotechnology"* (<http://pewagbiotech.org/>)
- *The Pew Foundation's "final report" of the "Pew Initiative on Food and Biotechnology"*
(<http://pewagbiotech.org/consensus/FinalReport.pdf>)
- *No Deal on Biotech Food – Industry, Opponents Fail to Agree on Recommendation for Regulation* (Washington Post, May 30, 2003, <http://www.washingtonpost.com/wp-dyn/articles/A55678-2003May29.html>)
- *Consumers' Union (pages on GE food,*
http://64.224.99.117/i/Food_Safety/Genetically_Engineered_Food/index.html)

- *The Union of Concerned Scientists (biotechnology pages, http://www.ucsusa.org/food_and_environment/biotechnology/index.cfm?pageID=9)*
- *Center for Science in the Public Interest (biotechnology pages, <http://cspinet.org/biotech/>)*
- *Environmental Defense (pages on GMOs, <http://www.environmentaldefense.org/system/templates/page/issue.cfm?subnav=11>)*
- *Monsanto (agricultural biotechnology pages, http://www.monsanto.com/monsanto/layout/sci_tech/ag_biotech/default.asp)*
- *DuPont (biotechnology pages, <http://www.dupont.com/biotech/>)*
- *U.S. Food and Drug Administration (FDA, pages on bioengineered food, <http://www.fda.gov/oc/biotech/default.htm>)*
- *U.S. Food and Drug Administration (FDA), Center for Food Safety and Applied Nutrition (<http://vm.cfsan.fda.gov/%7elrd/biotechm.html>)*
- *U.S. Department of Agriculture (USDA), Foreign Agricultural Service (<http://www.fas.usda.gov/>)*
- *Environmental Protection Agency (EPA, <http://www.epa.gov>)*
- *Factsheet on biotechnology legislation in the U.S. state by state (<http://pewagbiotech.org/resources/factsheets/legislation/factsheet.php>)*
- *Legislation tracker on agricultural biotechnology (<http://pewagbiotech.org/resources/factsheets/legislation/>)*

Bickering Over Food Aid

Another argument frequently voiced by the U.S. side is that the European Union is forcing a growing number of developing countries into refusing GE crops and seeds that have the potential of aiding starving populations. This disregards the fact that GE-crops of interest to developing countries, such as drought or salt water resistant crops haven't yet left the laboratories. The U.S. Trade Representative Robert Zoellick accused the European Union of leaning on poor countries and threatening them to withdraw economic aid unless they prohibit genetically modified crops. In a letter to the editor of the Wall Street Journal he praised a previous editorial that had talked about "Immoral Europe" and "The Human Costs of Biotech Fear-Mongering." Zoellick's views found favor with the 1970 Nobel Peace Laureate Norman Borlaug, a central figure in the "Green Revolution" of the 1960 and 1970s, who in January published an Article in the Wall Street Journal's "OpinionJournal" aptly titled "Science vs. Hysteria – European Environmentalists' Tactic Against Biotech: Starve Africans."

Zoellick's allegations were quickly countered by the E.U.'s Trade Commissioner Pascal Lamy in a letter also published in the Wall Street Journal: "To say Europe is bullying Africa into refusing to accept American food aid even though millions are malnourished and starving is downright irresponsible... We very much regret that U.S.-officials are peddling this rumour, and even more that the Wall Street Journal is giving credence to it, without checking the facts on E.U. food aid." It should be mentioned, however, that the European Commission has asked the United Nations' World Food Programme to purchase only non-GE corn for distribution of food aid in a move to ensure that food aid is not rejected by the governments of recipient countries.

- *Robert Zoellick, "The Human Costs of Biotech Fear-Mongering" (Letter to the Editor, *The Wall Street Journal*, 24 January 2003, <http://usinfo.state.gov/topical/econ/wto/03012401.htm>)*
- *Pascal Lamy's reaction to Robert Zoellick's allegations (http://europa.eu.int/comm/trade/goods/agri/repwsj_en.htm)*
- *Norman Borlaug (biography, <http://www.nobel.se/peace/laureates/1970/borlaug-bio.html>)*
- *Norman Borlaug, "Science vs. Hysteria – European Environmentalists' Tactic Against Biotech: Starve Africans." (<http://opinionjournal.com/forms/printThis.html?id=110002964>)*
- *Pascal Lamy (biography, <http://trade-info.cec.eu.int/europa/lamy/lamy.php>)*

“Washington Has Pulled The Trigger”

Eventually, the Bush Administration’s WTO case may lead to a veritable trade battle, doing the United States more harm than good, argue David Victor, director of the programme on energy and sustainable development at Stanford University, and Ford Runge, professor of applied economics and law at the University of Minnesota, in the Financial Times’ op-ed on May 15, 2003. They have identified three possible scenarios:

The “most likely (and worst)” scenario, according to Victor and Runge, would be an American victory. As a case in fact they quote the trade dispute over hormone-treated beef in the 1990s the European Union lost. The “precautionary principle” brought forward in this case by the E.U. had not (yet) been accepted by the WTO’s appellate body as a principle of international law. Despite victory, hormone-treated U.S.- beef has still not found European customers. In fact, the defeat of the U.S. beef-industry in the “courts of customer opinion” (Victor and Runge) has led to counter-sanctions and political damage to transatlantic relations. The controversy over GM food seems likely to unfold in a similar way.

The European Commission has drawn up in brief its trade-war-timetable, already considering the establishment of the panels of the WTO’s “Dispute Settlement Body”; whilst the Speaker of the U.S. House of Representatives Dennis Hastert speaks of battle: “Hopefully, the WTO will act quickly to resolve the Administration’s case on behalf of American farmers. There’s no doubt that the U.S. and American agriculture go into this battle with the facts on our side. We simply cannot allow the free trade of our fine products and services to be rendered meaningless if they are short-circuited by the EU’s unfair and unjust trade barriers cloaked in fear and conjecture – not sound science.”

- *A Trade Battle That Will Cost America Dear (Financial Times’ op-ed on May 15, 2003, <http://www.cfr.org/publication.php?id=5967>)*
- *Brief summary of the WTO beef hormone case (<http://seattlepi.nwsourc.com/national/case22.shtml>)*
- *European Commission regrets US Decision to file WTO case on GMOs as misguided and unnecessary (http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/03/681|0|RAPID&lg=EN&display=))*
- *The WTO’s “Dispute Settlement Body” (http://www.wto.org/english/tratop_e/dispu_e/dispu_e.htm#intro)*
- *Speaker Hastert Praises the Administration’s Challenge Against European Union’s “Protectionist, Discriminatory Trade Policies” (news release, May 13, 2003, <http://www.speaker.gov/library/intrelations/030513europe.asp>)*

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**Where change is the only constant.
A diverse range of applications over the next decade will
change the nature of the debate about biotechnology.
Europe's response will be critical.**

a commentary by Donal Nugent (Council for Agricultural Science and Technology)

For the Spanish conquistadores who encountered the flourishing civilizations of Mexico in the 16th century, the diet of these new peoples was a source of some wonder. Corn (maize), in particular, they noted was held in the highest regard. Ironically for a crop that had its own god, this food is almost entirely the product of human ingenuity. From humble weedy relatives, centuries of selective breeding have created these powerful stalks crowned with golden cobs. The modification of genes has been a human endeavor since the birth of civilization but, as the ancient Mexicans knew, nature likes to take its time. Today, even at its most advanced, conventional agronomy needs between 10 to 12 years to generate a new crop variety. This is because plants need to be back-crossed, that is bred with distant relatives, to ensure unwanted genes are eliminated while retaining the desired trait. Biotechnology, as a process that facilitates the transfer of individual genes, bypasses this process and allows for the direct incorporation of traits. This is the source of both its promise and its controversy.

To date, the most commercially successful genetically modified varieties of crops have had genes added that make them either disease resistant or herbicide tolerant. There is a good reason for this. The need to commercialize crops that bring significant financial returns is a matter of business expediency, given the enormous costs and rigorous regulatory procedures involved. On-going research in universities and industry around the world points to an array of novel applications for biotechnology which will certainly impact further the food we eat but which will also bring even more dramatic developments in diverse applications from biofuels, plastics and pharmaceuticals.

Jurassic Park – Not Yet Open For Business

While the best-known biotech engineered crops are soy and corn, disease resistant or herbicide tolerant varieties of most major fruits and vegetables have also been developed. For a variety of reasons, mostly to do with consumer acceptance, the majority has yet to be commercialized. One notable exception, however, points to the future potential of the technology. The dream of resuscitating extinct species may still be the stuff of Spielberg, but a more practical success can be claimed with the resuscitation of the ailing Papaya industry in Hawaii. Papaya Ringspot Virus had put the industry into a serious long-term decline until disease resistant varieties, developed using biotechnology, were introduced in the late 90s. Europe obviously places a high value on its food security and should crops (or animals) succumb to diseases, which cannot be conventionally managed, biotech solutions could find themselves high on the agenda. At the height of the BSE crisis in Britain, American soy was imported on a large scale. The usually skeptical British raised few questions about the use of a biotech-derived crop when the alternative (feeding the animals to themselves through meat and bone meal) had proved such a disastrous course.

Whatever about the return of the dinosaur, the dream of feeding the world is one thankfully not the preserve of mad scientists. Born in Hirschberg, Germany in 1933 and gaining his doctorate at the Max-Planck-Institute in Cologne, Dr Ingo Potrykus has played a major role in developing and applying genetic engineering technology to crop plants and diseases in the Third World. Potrykus made the cover of Time magazine in 2000 with the development of GM 'golden rice', a variety rich in beta-carotene from which the body produces vitamin A (conventional rice has no vitamin A). The Time headline ran 'This rice could save a million kids a year.' The biotech element of the rice incorporates daffodil genes, which provide the

golden colour and helps fortify it with beta-carotene. Commercialisation of this rice is still a few years down the line and should provide an interesting case study in consumer response to a biotech product with a significant health benefit over its conventional counterparts.

The International Food Information Council has identified a number of biotech-enhanced products at research level, which may soon find their way to the supermarket shelf. These include: cooking oils with higher stearate levels; small, single serve, seedless melons; tomatoes with increased lycopene; higher starch potatoes (which absorb less fat); and strawberries containing ellagic acid (a natural cancer-fighting agent). Developments in biotech derived foodstuffs are not limited to plants. The US Food and Drug Administration (FDA) is currently considering a license for the first transgenic animal into the food chain, a salmon that grows at four times the rate of conventionally farmed salmon. The marketing of this food will certainly bring the debate about biotechnology to a new level. Opponents will argue that such fish will represent a real danger of transgenic gene flow into the environment and the FDA is certain to consider security and containment issues as the most important in deciding if a license should be granted. Supporters will point to more efficient energy consumption and less waste production from these animals as compared to their conventionally farmed counterparts. They will also argue from experience that farmed fish simply do not prosper in the wild.

The Third Wave

Biotechnology has been used to derive medicines such as insulin from plants and animals since the 1980s. Advanced medical applications, such as the potential for transplanting rejection-free animal organs into people, have received widespread attention and will continue to register as fascinating confluences of science and ethics.

Less well known is the so-called 'third wave' application (medicine and agriculture being the first two), namely industrial biotechnology. Dr Barry Marrs, executive director of the Fraunhofer USA Center for Molecular Biotechnology believes that the application of biotechnology to manufacture industrial chemicals is fast approaching a reality while the production of biodegradable plastics and fibers from corn is already feasible. Industrial biocatalysis could change the nature of many aspects of the industry, he says: "The drivers are very powerful. We are finding better catalysts and improving them through directional evolution." Dr Marrs believes that molecular farming, where complex chemicals are grown as components of GM crops, could transform chemical manufacturing into a greener, cleaner enterprise and reduce costs to a fraction of current levels. The technology may be groundbreaking but applications are not necessarily so: One biochemical he had developed is processed into a plastic with short-term cohesion properties, which finds perfect use in kitchen paper. After use, the plastics break down into the same biodegradable compounds as milk. (Dr Marrs spoke on May 7, 2003, at the EPA 2003 Science Forum: Partnering to Protect Human Health and the Environment, May 5-7, 2003, Washington DC in a session entitled Emerging Technologies)

Animal Crackers

Science has long recognized spider silk to be among the strongest fibers on earth but harvesting it for industrial uses was impractical (spiders being averse to domestication). A major project at the University of Wyoming has involved inserting spider silk genes into goat DNA resulting in transgenic animals that produce the spider silk proteins in their milk. The proteins can then be processed into a material that, under the trade name Biosteel, will find applications in medical equipment in the near future.

More conventional applications of biotechnology in animals could lead to enhanced productivity, less pollution and greater disease control. The birth of Dolly the sheep raised many long-term ethical questions, but the practical application of the technology in animal breeding is fast approaching feasibility. According to the FDA, cloned animals of high genetic merit could become available for breeding in the U.S. within three years.

Handling biowaste has become one of the big environmental issues in modern intensive farming. In the University of Guelph, Ontario, Canada, the Enviropig is living proof of one

biotech-derived solution. The pig has been engineered to produce less phosphorus in its waste and therefore introduce less potential pollution in the environment. It will require several years more testing before the Enviropig is considered for introduction to the market.

Researchers investigating biotech applications in poultry are examining the possibility of enhancing resistance to pathogens through genetically engineered vaccines, a procedure that would have application in all food animals.

The study of microbial DNA is also allowing for a better understanding of how pathogens develop and interact with their hosts, a knowledge base will almost certainly contribute to the development of future disease treatments.

Taking Stock

Biotechnology is providing European science, and the industries that depend on it, with a challenge. On the one hand, EU consumers continue to reject the use of biotechnology in food and demonstrate grave misgivings about the presence of biotech crops in their environment. On the other, European science is recognizing that biotechnology will become an important tool in the development of an increasingly diverse array of foods, medicines and chemicals. Some interesting anomalies point to the complexities inherent in the debate. In spite of consumer misgivings about genetic engineering, biotech-derived enzymes have found widespread use in the production of cheeses and beers in the EU. The EU does not require them to be identified on labeling because they are part of a process rather than actual ingredients. Golden rice, which may ultimately provide huge help benefits (by preventing blindness) in developing countries, was developed in Europe with EU funds part financing it.

Repeated scientific studies in all EU member states have come out in favor of biotechnology as safe and environmentally friendly science but receive little coverage in the media. In April this year, the British government established a citizens' jury to examine all the aspects of the debate. By a narrow majority it came out in favor of the use of the science. On the other hand, the formal complaint by the U.S. government about the 'de facto' EU moratorium on biotechnology will do little to warm European consumers to the prospect of biotech foods.

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The Politics of Energy

by Sylvia Pilz and Himangi Zanpure-Sattler

Undeniably, energy is fundamental for economic performance. At the same time, most experts agree that greenhouse gas and carbon emissions are related to all facets of energy use in the economy. Global climate change is one of the key concerns of the 21st century, with serious implications for economies, societies and the environment. A central challenge is the integration of climate and environment policy objectives into other sectoral policy areas.

The present article is an attempt to outline the characteristic problems faced by the United States as a function of high energy consumption, growing energy needs and a lack of agreement on how to reconcile the environmental concerns. We will also take a look at the National Energy Plan of the Bush Administration and the on-going debate around the Energy Bill, currently a hot issue in Congress.

Consider These Figures.....

In 2001, 3 countries – the United States, Russia and China, with a combined population of 1.71 billion out of a global 6.30 billion - were the leading producers and consumers of world energy. They together produced 38% and consumed 41% of the world's total energy. The United States is the global leader in energy consumption. In the year 2001, it made up almost a quarter of the world's primary energy consumption. Primary Energy includes coal, natural gas, petroleum, and electric power (nuclear, hydro, alcohol fuels, geothermal, solar, wind, and wood and waste). Out of the world consumption total of 403.92 quadrillion Btu (British thermal unit), the United States alone consumed 97.05 qBtu. To compare, Canada spent 12.51 qBtu of energy and Austria contented herself with 1.42 qBtu, France consumed 10.52 qBtu, Germany used up 14.35 qBtu and Angola and Bangladesh claimed their share of 0.09 and 0.51 qBtu respectively.

Now translate this into per capita figures and it becomes obvious that the U.S. has one of the highest per capita energy needs in the world - 341.8 million Btu. (incidentally, the per capita energy consumption in Canada is even higher - 402.6 million Btu). The average per capita in western Europe ran to about 150 million Btu. In France the per capita consumption was 177.8 million Btu, in Austria it was 175 and in Spain 141.5 million Btu. To continue with our example of Angola and Bangladesh, the per capita figures were really modest: 6.9 and 3.7 mbtu respectively. In the U.S. the transportation sector alone gobbled up over 27% of total energy, being only surpassed by the industry with a narrow margin. World-wide, the United States remains the single largest consumer of energy, matching its share of energy consumption with its share of GDP (Gross Domestic Product) in the world total.

- *Useful energy statistics from the Energy Information Administration of the U.S. Department of Energy (<http://eia.doe.gov/emeu/iea/>)*
- *Energy Statistics from the International Energy Agency (<http://www.iea.org/statist>)*

In the United States coal, oil and natural gas and nuclear energy represent the chief sources of energy production.

Black-Out

Traditionally, the US has depended on coal as a major source of primary energy and in particular, for electricity generation. In the U.S. in 2001 more than half of total domestic electricity generation was from coal, whereas only 20% came from oil and gas together, the same as from nuclear energy.

Worldwide, according to the Energy Information Agency (EIA, <http://www.eia.doe.gov/>) of the U.S. Department of Energy, coal use is expected to decline in Western Europe, Eastern Europe, and the former Soviet Union. Increases are expected in the United States, Japan, Australia, New Zealand, and developing Asia, in particular, China and India. In Western Europe, coal consumption declined by 30% between 1990 and 2001 displaced in large part by the growing use of natural gas and, in France, nuclear power, where it constitutes 77% in electricity generation. A similar decline occurred in the countries of Eastern Europe and the former Soviet Union where coal use fell by 40 percent between 1990 and 2001 as a result of the economic collapse that followed the breakup of the Soviet Union, as well as some fuel switching. In 2001, coal provided 24 percent of world primary energy consumption, down from 26 percent in 1990 and is projected to fall to 22 percent by 2025.

The Oil Factor

The U.S. meets just under one third of its demand for oil domestically, and imports about 9,651 thousand Barrels per day. The top exporters to the U.S. of oil in recent years have been Saudi Arabia, Mexico, Canada, Venezuela and Nigeria. The relative importance of each supplier has varied periodically, shaped to a certain extent by the reigning political circumstances. The NAFTA partners Mexico and Canada have become major suppliers to the U.S. market in the past decade. Since 1991 (first Gulf War) Canada has been the second largest exporter to the US, Saudi Arabia being the number one with more than 1,600 thousand barrels per day. Mexico as a major exporter entered the fray in 1993 and has held top ranks ever since. Venezuela, an OPEC member, supplied 1,538 thousand barrels a day in 2001. The share of OPEC in total oil supplies to the U.S. has fallen from around 53% in the early 90s to about 45% since 1995. Iraq's oil has been reaching the world market through the "Oil for Food" program of the United Nations, but in modest measures.

Renewables: Can They Ever Catch Up?

The share of renewables in the total U.S. energy consumption constitutes a meagre 5.7 qbtu, or about 6%. Hydropower has the lion's share (which, incidentally, has been steadily decreasing over the decades) and the rest is contributed by geothermal, wind, solar and wood and waste energy combined.

The current debate around energy from hydrogen is not about the "if", but about the "how". There is disagreement between the Americans and the Europeans about the "how". The Europeans are convinced that renewables have to form the cornerstone of a future hydrogen energy economy. The Americans are determined to find ways to produce hydrogen from nuclear energy and by using cleaner coal-burning technology. In his State of the Union address of January 2003 President Bush declared: "In this century, the greatest environmental progress will come about.....through technology and innovation. Tonight I'm proposing \$1.2 billion in research funding so that America can lead the world in developing clean, hydrogen-powered automobiles."

In order to get a complete picture, the energy consumption figures have to be seen in the context of their effect on the environment and public health.

- *For more on hydrogen, see the article in this issue by Stephan Neuhäuser 'Hydrogen – the Ultimate Freedom Fuel?'*
- *Text of President Bush's State of the Union address (<http://www.whitehouse.gov/news/releases/2003/01/20030128-19.html>)*

Greenhouse Gases: A heavy burden to carry

Threats posed by climate change, air pollution and endangered ecosystems remain global in nature. The problem becomes particularly acute in a country that has only 4% of the world's population, but emits nearly 25% of the total global greenhouse gases. The chief culprits here are the fossil fuels: petroleum, natural gas and coal. The United States continues to be the largest single national source of fossil fuel-related CO2 emissions, with 1.5 billion metric tons

carbon equivalent in 2001, - although its share of global emissions did decline from 44% to 24% in the period 1950-1990s because of higher growth rates in other countries.

The U.S. Energy Information Administration projects that carbon dioxide emissions will continue to increase by an average rate of 1.5% per year. If current trends continue, CO₂ concentrations would increase by 30 - 150% by the year 2100. 39% of U.S. fossil-fuel emissions stem from the consumption of petroleum products and 38% from coal usage. In 1999, the U.S. consumption of coal was 20,498.0 Trillion Btu, that of natural gas and petroleum 22,294.9 Trillion Btu and U.S. 37,960.01 Trillion Btu respectively.

- *The International Energy Annual 2001 of the Energy Information Administration* (<http://www.eia.doe.gov/emeu/iea/overview.html>)
- *A Compendium of Data on Global Change 2002 by the Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy* (http://cdiac.esd.ornl.gov/trends/emis/tre_usa.htm)

Regional Impacts Of Growth And Climate Change In The U.S.

Due to great geo-physical and demographic differences in the country, the nature of environmental problems varies regionally. The Southeast has faced frequent natural weather disasters in the past 20 years, costing the region over \$85 billion in damages, mostly associated with floods and hurricanes. At the same time, the heat wave and drought of 1998 resulted in damages in excess of \$6 billion and 200 deaths.

In the West, population figures have quadrupled since 1950, with major concentrations in urban areas accompanied by problems of water shortages, high levels of air pollution and urban sprawl. California, the most populous state with 35 million inhabitants (about 8% of total U.S.) alone accounted for almost 11 percent of all freshwater used in the United States in 2002. Most of the water used in California was for crop irrigation; in fact, 22 percent of all the Nation's irrigation water used was in California.

What scientists agree on is that climate change has become a global phenomena; disagreement remains about the extent of influence of human activity on these changes. Policy-makers today face the challenge of visualizing alternative futures in concrete and human terms for a regional mosaic of consequences that are possible due to climate change and variability.

- *The U.S. Census Bureau of the Department of Commerce* (<http://www.census.gov/>)
- *Findings of the U.S. Global Change Research Program (an interagency research program,* <http://www.usgcrp.gov/usgcrp/Library/nationalassessment/overviewregions.htm>)

Though the effects of most environmental problems can be measured in monetary terms, their impact on human health is harder to quantify.

Worldwide, low lying ozone and air pollution have led to elevated rates of cardiac and respiratory illnesses and deaths in recent years. The Environmental and Energy Study Institute (EESI, <http://www.eesi.org/>) in its report "Public Health Impacts of Climate Change" of July 2002 cites a study conducted in 1997 by the Working Group on Public Health and Fossil-Fuel Combustion, comprised of the World Health Organisation (WHO, <http://www.who.org>), World Resources Institute (WRI) and others. The study estimated that world-wide up to 700,000 deaths annually were related to air pollution and roughly 8 million excess deaths could occur by 2020.

Some Like It Hot?

Heat waves are not just continually claiming lives around the globe; fainting, heat exhaustion and heat stroke pose constant risks to human health as the frequency and intensity of heat waves increases. The IPCC report mentioned previously predicts that by the second part of

this century roughly half of the world's population may live in areas where malaria is prevalent as a result of climate change. It looks like the only ones who won't be complaining about the rise in temperatures will be the mosquitoes and other blood feeding insects who will enjoy longer breeding and virus transmission seasons.

- ❑ *Study EESI: Public health impacts of climate Change*
(<http://216.239.37.100/search?q=cache:kj9xHziMPyJ:www.eesi.org/publications/>)
- ❑ *Physicians of Social Responsibility* (<http://www.psr.org>)
- ❑ *see this issue's guest article "Preventing or Curing Climate Change?" by Dr. Thomas Lörting, an award-winning Austrian scientist in the Group of Professor Mario Molina at the Department of Earth, Atmospheric and Planetary Sciences, MIT Boston.*

The above paragraphs contain but a few challenges that the world is facing today on energy and environment issues. There are no tailor-made solutions to the problems; at best there are initiatives and resolutions which depend on national and individual commitment for their successful implementation.

Global Initiatives On Environment and Energy

The 2nd Earth Summit of 1992 in Rio de Janeiro, Brazil turned out to be the largest gathering of world leaders ever. The Earth Summit created the United Nations Framework Convention on Climate Change, also known as the Rio Convention. This convention, perhaps too ambitiously, called upon the world to stabilize 1990 greenhouse gas emissions by 2000. Both Canada and the United States signed and ratified this convention. Importantly, former U.S. President George Bush negotiated an agreement to allow developing nations to increase emissions, the reason they are not included in the Kyoto Protocol.

At the third Conference of Parties (COP) to the Rio Convention in 1997 in Kyoto, Japan, new targets for controlling greenhouse gas emissions were set. The regulation of CO₂ emissions was the main item on the agenda, with varying targets set for varying countries. The onus of reducing most of the emissions lies on the so-called Annex B countries (United States, Canada, Australia, New Zealand, Japan, European Union, Russia, Ukraine and Eastern European countries). The European Union operates under a "bubble", a system whereby quantitative emission divergence among the operating countries is allowed as long as the aggregate quantified emission stays within the set target. (to illuminate: EU target is 92%, Austria has committed itself to a reduction to 87% of 1990 levels, Greece may reach 125% of the same within the set time-frame).

Under Kyoto, the Clinton Administration committed itself to reducing greenhouse gas emissions to 93% of 1990 levels by the year 2012. But even before President Bush made it clear that he did not support the provisions of the Kyoto Protocol, the Senate, in 1997 had delivered its verdict. The Byrd-Hagel Resolution (Senator Byrd, http://byrd.senate.gov/byrd_bio/byrd_bio.html, a West Virginian Democrat, is serving the eighth consecutive six-year term in the U.S. Senate; Senator Chuck Hagel, <http://hagel.senate.gov/>, is a Republican from Nebraska) passed in July of that year by a margin of 95-0, thus transcending all partisan lines, stated that the U.S. Senate will not ratify any international agreement on greenhouse gases emissions under the United Nations Framework Convention on Climate Change that "would impose binding limits on the industrialized nations but not on developing nations within the same compliance period and would result in serious economic harm to the economy of the United States."

On March 13, 2001 President Bush wrote to four conservative Senators – Hagel, Helms, Craig and Roberts - outlining his opposition to the agreement, referring in it to the Senate's vote in 1997 against the Protocol. In that letter, the President repeated the economic reasoning used by the Senate in it's time. The President reiterated his commitment to address global climate change issues in the context of a national energy policy. "Any such strategy [multi-pollutant strategy to require power plants to reduce emissions of sulfur dioxide, nitrogen oxides, and mercury] would include phasing in reductions over a reasonable period of time, providing regulatory certainty, and offering market-based incentives to help industry meet the targets. I do not believe, however, that the government should impose on power plants man-

datory emissions reductions for carbon dioxide, which is not a 'pollutant' under the Clean Air Act."

Until the official announcement by Environmental Protection Agency Administrator Christine Todd Whitman on March 27 2001 that the Administration had "no interest in implementing that treaty", meaning the Kyoto Protocol, there had still been some hope in the European Union and Japan that the Bush Administration would resort to further negotiations to change some of the rules to better suit it's agenda. Greenpeace said that Bush's decision was driven "by oil, coal and gas interests" and expressed it's outrage at the decision in the following words: "Greenpeace is disgusted and appalled at the United States".

The Administration's stand found support and applause among U.S. industry groups like the Global Climate Coalition.

- *Letter from the President to the Senators*
(<http://www.whitehouse.gov/news/releases/2001/03/20010314.html>)
- *National and international reactions to the U.S. withdrawal from Kyoto*
(<http://www.climnet.org/news/march2001.html#bushkp>)
- *Byrd-Hagel Resolution of 1997 on rejection of Kyoto Protocol*
(<http://thomas.loc.gov/cgi-bin/bdquery/D?d105:1:./temp/~bdeddZ:@@@L&summ2=m&/bss/d105query.html>)

Putting The Nation On A New Path: The National Energy Plan

After just two weeks in office, in January 2001 President Bush set up a National Energy Policy Development Group, headed by Vice-President Cheney directing it to "develop a national energy policy designed to help the private sector, and, as necessary and appropriate, State and local governments, promote dependable, affordable, and environmentally sound production and distribution of energy for the future."

The task force was directed to develop a long-term comprehensive national energy policy. The basic premise was that the prosperity of the country and the American Way of Life require a steady and reliable supply of large amounts of energy. In it's report the Group made the case that a fundamental imbalance between supply and demand defines the nation's current energy crisis and that if energy production will increase at the same rate as during the last decade the projected energy needs will far outstrip expected levels of production. To correct the imbalance between supply and demand a 3-pronged approach was recommended: achieve greater energy efficiency, modernize energy infrastructure, and increase energy supplies. The fact that "America leads the world in scientific achievement, technical skill, and entrepreneurial drive" and possesses "abundant natural resources, unrivaled technology, and unlimited human creativity", the report surmised, should come in good stead to meet the goals.

Very few of the recommendations in the report concerned demand side corrections. Federal agencies were encouraged to take actions to conserve energy use in their facilities and increase funding for renewable energy and energy efficiency research and development programs.

The recommendations to increase supply and reduce dependency on foreign energy were manifold. The existing energy infrastructure, warned the report, was in dire need of modernization and repair. In addition, in order to avoid supply bottle-necks 38,000 miles of new natural gas pipelines and about a quarter million miles of distribution lines would be required.

The Plan made a strong case for increasing energy production capacity. To strengthen it's case, the Plan presented the following estimates: over the next 20 years, U.S. oil consumption would increase by 33%, natural gas consumption by over 50% (one of the reasons for this high demand is that about 90% of all new electricity plants under construction would be fueled by natural gas) and demand for electricity would rise by 45%.

The fact that in recent years natural gas has increasingly substituted coal in energy generation is a result of the recognition world-wide that natural gas, though not the cleanest technology, does produce lower levels of harmful emissions than coal.

One specific recommendation of the Plan was to open the Arctic National Wildlife Refuge (ANWR) to oil and gas exploration. The recommendations with regards to coal went towards maintaining the status quo. The way President Bush and his team saw it, time was not yet ripe for decreasing the dependence on coal, since, as they put it “the U.S. has enough coal to last for another 250 years”. Perhaps to take away some of the force of the criticism that might possibly ensue, the Plan made a recommendation in the same breath to provide \$2 billion over 10 years to fund clean coal technology research. Discernible readers might remember from a previous article in *Voices on U.S. R&D budget* that the R&D budget for the FY 2004 alone is \$122 billion!

Increased use of nuclear energy for power generation was also advocated in the report, citing the examples of countries like France and Japan that rely heavily on nuclear energy. The legislators were called upon to enact “multi-pollutant” legislation with an aim to cap emissions of sulphur dioxide, nitrogen oxide and mercury from electric power generators. The recommendation omitted any mention of carbon dioxide as a pollutant, which is, in fact one of the main sources of greenhouse gases. We will consider the implications of and political reasons behind this omission in our article on Clean Air and the legislation around this issue.

- *Report of the National Energy Policy Development Group*
(<http://www.whitehouse.gov/energy/>)

The Congress, Environment And Energy

The 107th Congress (2001-2002) that convened after the Presidential elections of 2000 was faced with a tough challenge – how to reconcile the Congress’s commitment of the past decade to enact legislation to protect the environment with the new agenda of the Bush Administration on environmental and energy matters, specifically the National Energy Plan. The Bush agenda on energy, environment, and the handling of corporate interests differed in many regards from that of the previous administration’s. The Congress Senators and Representatives very soon found themselves confronted with the task of transforming that agenda into legislation or rather, from preventing that agenda being transformed wholesale into legislation.

In June 2001, the House blocked the Interior Department from issuing permits for coal mining and oil and gas drilling in national monuments, in 2002 it passed the Bipartisan Campaign Reform Act (BCRA) which aimed to reduce the disproportionate influence of special interests through donations to election campaigns. One of the notable achievements in favour of protecting the environment was the passing of the brownfield legislation that would help revitalize abandoned industrial sites around the country.

Post September 11, “homeland security” took on a new meaning. For the energy policy of the country it meant a dramatic shift of emphasis on the need to take urgent steps to reduce U.S. dependence on oil from volatile and “hostile” regions of the world. The Administration started pushing for swift legislation to allow drilling for oil in America’s pristine wilderness.

Sweeping exemptions from environmental laws such as the Clean Air Act and the Endangered Species Act were sought for the Department of Defense and as part of the Homeland Security Bill corporations were granted broad exemptions from public disclosure about spills, leaks and pollution releases.

The movement and discussion around the comprehensive Energy Policy Act of 2002 (H. R. 4) in the 107th Congress and the inability of that Congress to find common acceptable grounds on energy legislation are a clear reflection of the tug-of-war that took place in the Congress.

Senator Tom Daschle (<http://daschle.senate.gov/>), a Democrat from South Dakota, the then Senate majority leader stood strong on environmental issues, and in particular on the issue of oil drilling in the Arctic National Wildlife Refuge (ANWR) with solid backing from Senator Jim Jeffords (Independent from Vermont, <http://jeffords.senate.gov/>) as Chairman of the Environment and Public Works Committee and Senator Jeff Bingaman (Democrat from New Mexico, <http://bingaman.senate.gov/>) of the Energy and Natural Resources Committee.

A renewal of the debate over key energy issues including the newly proposed Energy Bill in the current 108th Congress will very likely reflect a shift in priorities as a result of the new Senate leadership which went to the Republicans in the wake of the mid-term elections of October 2002 and the ensuing changes in committee chairmanships in both Chambers of the Congress. The turbulent events of the past year, viz. the war in Iraq and the crisis in Venezuela, a major oil supplier to the US will undoubtedly contribute to the changed climate.

The Energy Bill: Solution In sight?

Introduced by Congressman Bill Tauzin (R-Louisiana, <http://www.house.gov/tauzin/welcome-english.htm>), who is the Chairman of the House Committee on Energy and Commerce (<http://energycommerce.house.gov/>) and a senior member of the House Resources Committee (<http://www.house.gov/resources/>), a comprehensive energy bill H.R. 6 was passed by the House on April 11, 2003.

The bill is a composite of separate measures approved by four House committees. H.R. 6 includes several provisions that were part of comprehensive energy legislation (H.R. 4) debated during the 107th Congress like energy efficiency and conservation, clean coal technology, and reauthorization of the Price-Anderson Act nuclear liability system. It would also establish a Renewable Fuels Standard for gasoline of 2.7 billion gallons by 2005 and 5 billion gallons by 2015, chiefly intended to increase the use of ethanol. The bill passed by the House would also eliminate the current 2% oxygenate mandate for reformulated gasoline (RFG), but would not ban MTBE (methyl tertiary butyl ether) outright. It is an additive used to improve combustion in RFG and an octane enhancer in non-reformulated gasoline. MTBE is notorious as a ground water contaminant and has been banned in 17 States including New York and California.

The bill also approves exploration, development, and production of oil in the Arctic National Wildlife Refuge (ANWR), it would seem, almost in defiance of the Senate. On March 19, 2003, almost a month before the House passed H.R.6, the Senate voted 52 to 48 in favour of an amendment introduced by Senator Barbara Boxer (D-CA, <http://boxer.senate.gov/>) to prevent consideration of drilling in ANWR in a fast-track budget reconciliation bill. (A "reconciliation" bill precludes Senate filibusters, which are procrastinating and obstructionist tactics in legislative assemblies. It has particular reference to the U.S. Senate, where the tradition of unlimited debate is very strong).

This was an astonishing development given the fact that the Senate is under Republican majority rule (Bill Frist, R-TN is the majority leader) and there had been hopes among Republican leaders that the takeover of the Senate would change the upper chamber's longstanding opposition to oil production in the Arctic Refuge. The hopes were shattered by 8 Republicans who sided with the Democrats against the drilling, including Senator John McCain (<http://mccain.senate.gov/>) of Arizona and Senator Lincoln Chafee (<http://chafee.senate.gov/>) of Rhode Island. The crucial votes came from Senators Norm Coleman of Minnesota and Gordon Smith of Oregon, whose position was not final until the floor vote. Senators from Alaska expressed their fury by saying that apparently caribou was more important than jobs for the people.

Alaska supposedly holds 30 trillion cubic feet of undeveloped natural gas reserves, about 18% of total U.S. reserves; these estimates have been disputed by many. The House bill limits the surface of "production and support facilities" to 2,000 acres, but leaves open the question of the distribution of these 2000 acres. The House bill also authorizes construction of a natural gas pipeline from the Alaskan North Slope to the lower 48 states, but allows the Federal Energy Regulatory Commission (FERC) – which must issue a certificate of convenience

and necessity for construction of the pipeline – to do so only for a southern route through Alaska, a route to which conferees on H.R. 4 had informally agreed.

ANWR: The Last Refuge?

The Alaska National Interest Lands Conservation Act (1980) established the Arctic National Wildlife Refuge (ANWR). In section 1002 of that act, Congress deferred a decision regarding future management of the 1.5 million acre coastal plain ("1002 area") in recognition of the area's potentially enormous oil and gas resources and its importance as a wildlife habitat. Drilling in this area began only after a report on resources of the 1002 area was submitted in 1987 to Congress by the Interior Department. The ANWR comprises 19 million acres out of which drilling is permitted in 1.5 million acres.

The proponents of drilling stress the need for increased self-sufficiency in natural gas production, so that a move away from coal can be speeded. The exploration would cover about 8% of the total area on the northern shore, leaving the other 92% untouched. If oil is discovered, less than 2000 acres would be affected. Additional employment of anything between 25,000 and 735000 would be created.

The main opposition stems from environmental considerations. Toxic and methane emissions, gas spills that contaminate the environment, encroachment upon the habitat of some of the most endangered species of wild and marine life like the bowhead whale are some of the issues that are obvious at first scrutiny. What the opponents fear most is the irreplaceable damage that will be done to one of the worlds last wildlife refuges. The laying of natural gas pipelines spanning the length of the State will inevitably lead to opening up of areas not within the drilling area. Drilling in remote corners of the Refuge will necessitate transportation infrastructure from areas of production to area of refining/consumption. And the main argument of self-sufficiency stands on wobbly legs: there is disagreement even among experts about the estimated oil reserves.

- *arguments for the drilling (<http://www.anwr.org/topten.htm>)*
- *U.S. Geological Survey assessment of oil reserves in ANWR (<http://pubs.usgs.gov/fs/fs-0028-01/fs-0028-01.htm>)*

The Last Word Has Not Been Said Yet

In the Senate, action on comprehensive energy legislation is in progress. On April 3, 2003 the Energy Tax Incentives Act of 2003 was referred to the Senate Committee on Finance. The bill foresees incentives in the form of tax credits for energy produced from alternative sources, for measures undertaken to increase energy efficiency and for investments in clean technologies. Out of the roughly \$18 billion in incentives over a 10 year period, \$5 billion is targeted to the oil and gas industry, \$2.6 billion to producers of renewable energy sources, \$2.4 billion for alternative fuels and fuel cell vehicles, and \$4 billion for utilities to implement electricity restructuring.

Most recently the Senate approved a plan to double the use of ethanol in gasoline to at least 5 billion gallons a year by 2012 and ban the use of MTBE. The measure introduced by Senator Bill Frist (R-Ten), the Senate Republican leader and by Senator Tom Daschle, his counterpart for the Democrats was approved 67 to 29. Supporters of the bill said that the measure would help energy independence by displacing up to 250,000 barrels of oil a day by 2012.

In a very surprising development on June 10th of this year Mr. Alan Greenspan, the Federal Reserve Chairman, expressed his worry before the Congress that short supplies and sharply rising natural gas prices could eventually contribute to 'erosion' in economy. The current price of natural gas at \$6.4 per million Btu is 74% above last year's level. At the same time, Mr. Greenspan said lawmakers should give new consideration to expanding the nation's capacity for nuclear power, a position that was narrowly embraced the next day by the Senate, which

voted 50 to 48 to keep new federal loan guarantees for the construction of nuclear plants in the emerging energy bill.

Close on the heels of Mr. Greenspan's testimony before the Congress, the Senate voted 54 to 44 to let the Interior Department measure the amount of gas and oil beneath the outer continental shelf. This is a victory for Messrs. Domenici and Tauzin, strong proponents of more offshore drilling. Legislators from Florida, California and other coastal states had successfully blocked new exploration along the coastline since the 80's. Democratic Senator Bob Graham of Florida called the provision a "prelude to a direct attack".

The Senate stood united on one front: more innovation from the country's leader. It adopted by a vote of 99 to 1 the proposal by Senator Mary Landrieu, Democrat of Louisiana, to require the President to develop a plan to decrease oil consumption by 1 million barrels of oil per day within a decade.

- *The Congressional research service reports are an excellent source of information on issues before the Congress (<http://www.ncseonline.org/NLE/CRS/>)*
- *For information on current and past legislation (<http://thomas.loc.gov/>)*

Only The Beginning, Not The End....

As great as the needs of this country for energy are, so are the issues surrounding it complex. The need for an environmentally sound sustainable energy policy is widely recognised among lawmakers in the country. Many initiatives are under way, also in a global context. One such initiative is the recent U.S.- EU summit to create an international partnership to develop hydrogen energy.

In the coming issues of the Voices Newsletter we will present to our readers an overview of and latest developments on the many facets that make up the environment and energy policy of the United States, beginning with Clean Air and Clean Water.

Further Links:

- *Pew Center on Global Climate Change (<http://www.pewclimate.org/>)*
- *U.S. Department of Energy (<http://www.energy.gov/>)*
- *Energy Information Administration (www.eia.doe.gov)*
- *Intergovernmental Panel on Climate Change (<http://www.ipcc.ch/%20>)*
- *Physicians of Social Responsibility (<http://www.psr.org>)*

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Hydrogen – the *Ultimate Freedom Fuel*?

by *Stephan Neuhäuser*

In a move to counter America's increasing dependency on oil imports, President George W. Bush announced the "Hydrogen Fuel Initiative" early this year. He called for investment in technologies and infrastructure that produce, store and distribute hydrogen for use in fuel-cell vehicles and the generation of electricity. "Tonight I'm proposing \$1.2 billion in research funding so that America can lead the world in developing clean, hydrogen-powered automobiles.... Join me in this important innovation to make our air significantly cleaner, and our country much less dependent on foreign sources of energy," the President said in his "State of the Union" address on January 28, 2003. The "Hydrogen Fuel Initiative" is embedded in the wider framework of the "Energy Bill" currently under consideration in the U.S. Senate.

"Sometimes We Import Oil From Countries That Don't Particularly Like Us"

It is a well-known fact that the United States relies heavily on foreign oil. Imports have risen to 55 % of the overall petroleum demand. The U.S. Department of Energy predicts imports climbing as high as 68% during the next two decades. Transportation accounts for nearly two thirds of the 20 million barrels of oil Americans use each day. The U.S. Department of Energy estimates that without a change in direction, the U.S. economy will face costs of \$188 billion per year for oil imports of more than 19 million barrels per day by 2025. Given the importance of oil to the U.S. and the instabilities in major oil exporting regions in the Persian Gulf, Northern Africa and South America, dependency on foreign oil poses a potential risk to U.S. security. President Bush put it this way last February: "Sometimes we import oil from countries that don't particularly like us". At an opening ceremony for a fuel-cell test site, Senator Bob Inouye from Hawaii was recently quoted in California's Pacific Business News as saying that oil has been at the root of most U.S. military conflicts in the last few decades.

Hydrogen: How Does It Work?

Referring to the two major energy-related issues of oil dependency and environmental protection, President Bush recently explained that "the idea is to see that a car born today – I mean, a child born today will be driving a car, as his or her first car, which will be powered by hydrogen and pollution-free." Spencer Abraham, U.S. Secretary of State for the U.S. Department of Energy, even called hydrogen "our ultimate freedom fuel."

To be precise, hydrogen itself will not fuel future generations of cars, but rather with the electricity produced by fuel cells that use hydrogen and oxygen to create current. The fuel cells themselves are environmentally clean and emit only heat and water. However, the environmentally crucial question remains: how should the hydrogen be produced? One of the most common methods involves reforming natural gas. Several other methods include the transformation of biomass or coal into a gas from which pure hydrogen can be generated, biological systems using microbes, thermal water splitting, solar- and wind energy, etc...It currently appears as if natural gas and coal will become the United States' first choice for hydrogen production (cf. the announcement of the "FutureGEN" project by Energy Secretary Spencer Abraham on February 27, 2003).

The main reason hydrogen fuels are not widely used today is because of the high costs associated with them. In the 1960s, power produced by fuel-cells cost \$600,000 per kilowatt-hour. This only paid off in the U.S. space program. Hydrogen is still considerably more expensive than the fuels it would be meant to replace. Commercial systems available today average prices up to \$4,500 per kilowatt-hour (United Technology Corporation's "commercial phosphoric acid fuel-cell power plants"). In comparison, one kilowatt-hour produced from

conventional sources is currently available for an average price of 7¢ in the United States. However, at a briefing on “Alternative Hydrogen Futures” on March 28, 2003, Robert Olsen, Research Director at the Washington, D.C.-based Institute for Alternative Futures, said that costs for hydrogen-based fuel-cells are predicted to drop significantly by the end of this decade, which will make them competitive for most types of power applications.

Demonstration Projects And First Steps Towards Commercialization

Nevertheless, small fleets of fuel-cell powered cars are already on the road today for demonstration purposes throughout California. Also, North America’s largest commercial fuel-cell power plant was added to the power grid by the Los Angeles Department of Water and Power on March 14, 2003. The \$3 million “John Ferraro Building Fuel-Cell Power Plant” uses natural gas to produce hydrogen and provides power to only 250 homes at costs five times higher than traditional power. However, the project is seen as an investment in the future, forging the way for ultra-clean energy production in Los Angeles. A second fuel cell power plant currently under construction in Los Angeles will supply renewable power by utilizing digester (is this the correct word? I don’t know it.) gas from a nearby wastewater treatment plant.

How Much Money? Who Will Be In Charge?

The “Hydrogen Fuel Initiative” proposed by President Bush to develop the technologies and infrastructure to produce, store and distribute hydrogen for use in fuel-cells. It is part of the “Energy Bill” that is currently on the docket for consideration and approval in the U.S. Senate (see this issue’s article *The Politics of Energy* by Sylvia Pilz and Himangi Zanpure-Sattler)

The “Hydrogen Fuel Initiative,” which includes \$720 million in new funding over the next five years, adds to the \$500 million research program “FreedomCAR Program” announced in January 2002 by the Bush Administration to develop fuel-cell powered vehicles. “FreedomCAR” (CAR stands for “Cooperative Automotive Research”) is a research partnership between the government and car manufacturers including Ford, General Motors and Daimler/Chrysler. It replaces an earlier initiative – the Partnership For The Next Generation Vehicles (PNGV) – begun under the Clinton Administration. Both the “Hydrogen Initiative” and the “FreedomCAR program” will be run by the Department of Energy (DOE) over the next five years.

The Ideal Scenario: Full Transition To A Hydrogen Economy by 2040

In 2001, the Department of Energy began working on a hydrogen vision and road mapping effort. It led to the release of the “National Hydrogen Energy Technology Roadmap” in November 2002. The roadmap describes the steps required to make a successful transition to the “hydrogen economy.” In his testimony before the House Committee on Science, David K. Garman, Assistant Secretary for Energy Efficiency and Renewable Energy at the DOE, outlined four phases the Department of Energy believes are necessary for the United States’ eventual transition to a “hydrogen economy.”

Phase 1 is already underway with government and private organizations completing research on hydrogen-related topics. The results should enable industry to make a decision on commercialization of hydrogen-powered vehicles by 2015. Transition to the marketplace during Phase 2 could begin as early as 2010 for portable and some stationary applications. Wide-scale marketing of fuel-cell vehicles might start around 2020. Phase 3 would allow the U.S. government to further support market growth by taking the role of an “early adopter” (meaning that government agencies would switch to fuel-cell technologies as early as possible) thus stimulating the market. Phase 4 should begin about 2025 when globally competing industries would begin receiving adequate returns on their investments. Ideally, the DOE hopes America’s transition to a full hydrogen economy would be complete by 2040.

“People Aren’t Going To Buy Many Cars If They Can’t Refuel Their Car.”

Despite the DOE’s positive scenario, there is a very real possibility that these benefits might not be achieved, as Robert Olsen from the Institute for Alternative Futures points out. The creation of an adequate infrastructure for hydrogen distribution and storage could be a major obstacle on the way towards the hydrogen economy.

“There would be nothing worse than developing a car and having no place for somebody to find the fuel. People aren’t going to buy many cars if they can’t refuel their car,” President Bush recently explained. The Department of Energy supports this view and DOE’s David Garman warns of this possible stumbling block: “Our current gasoline/hydro-carbon infrastructure has been forged in a competitive market. It is ubiquitous and remarkably efficient. It can deliver refined petroleum products that began as crude oil half a world away to your neighborhood for less than cost of milk, drinking water, or many other liquid products you can buy at the supermarket. We are currently bound to that infrastructure. We have no alternative. Eventually replacing it with something different will be extremely difficult. But that is what we must do if we expect to achieve success with the FreedomCAR partnership. Drivers must be able to go anywhere in America to refuel their hydrogen-powered vehicle before they will be comfortable purchasing one”. Coincidentally, California has already begun developing plans for a “hydrogen highway” of refueling stations from Mexico to Oregon (see *Fuel-Cell Caravan In Central Valley - Hydrogen Car Rally Promotes Technology*, The San Francisco Chronicle, May 15, 2003).

A Dirty Energy Plan?

“As we act on President Bush’s National Energy Policy, we are focusing on next generation technologies that expand the diversity of America’s supply of energy and ‘leap frog’ the status quo,” Spencer Abraham said in the preface to the National Hydrogen Energy Roadmap. It is precisely this “leap-frogging” that skeptics are criticizing about the Bush Administration’s “Hydrogen Fuel Initiative” and the “FreedomCAR Program”.

The Union of Concerned Scientists (UCS), the Ecological Society of America (ESA) and other environmentally-aware organizations see the hydrogen-related activities of the Bush Administration as a diversion from short-term measures that could make a big difference right away. A \$1.5 billion initiative by the Clinton Administration aimed at making cars fuel-efficient, raising fuel economy standards and setting tougher emission standards was abandoned by the current administration. Indeed, increased funding for hydrogen-related initiatives comes largely at the expense of other energy-efficiency and renewable energy programs. Robert Olsen thus perceives a certain danger of hydrogen losing political support “by the way U.S. efforts to promote it got off on the wrong foot with environmentalists.” This would especially be the case if the hydrogen R&D programs are denounced as a “dirty energy plan,” provided that much of the research is focused on methods of producing hydrogen from oil, coal and nuclear power.

Transatlantic Cooperation

A means to avoid losing support for research on “hydrogen fuel” is to take a global view and embark on international cooperation. After all, geologists estimate that global oil production will begin to decline somewhere during the period from about 2015 and 2030. Formalized international research cooperation on hydrogen technology would indeed create a *fait accompli*.

“Hydrogen is certainly one of the most important and promising areas we must develop in the coming years. I believe this is an area where both the U.S. and the E.U. would benefit from cooperating notably on our research programs and demonstration projects,” the European Commission’s Vice President Loyola de Palacio said after meeting with U.S. Secretary of State for the U.S. Department of Energy Spencer Abraham on May 1, 2003 in Madrid. Like the United States, the European Commission has also named research on hydrogen fuel technology one of its main priorities in its energy and transport policies. The E.U. has thus begun to implement a project called Clean Urban Transport for Europe (CUTE). CUTE is

aimed at supplying 10 major European cities with fuelcellpowered buses for public transport. It is the first project of its kind worldwide. Another world premiere will be the launch of German-built "U 31" – the world's first fuel-cell powered submarine – in July 2003.

As a direct result of all this varied activity, the transatlantic dialogue on hydrogen research has increased in the recent months. After a meeting with the European Research Commissioner Philippe Busquin on March 6, 2003, Spencer Abraham announced that the European Commission and the United States would shortly be signing an annex to the current cooperation agreement in order to formalize research cooperation on hydrogen fuel technology. During their meeting on May 1, Loyola de Palacio, who is responsible for energy and transport policy within the European Commission, and Spencer Abraham agreed upon increased transatlantic cooperation in policy development, research cooperation and coordination, common positions in international fora and common evaluation criteria for demonstration projects – all in the field of hydrogen fuel technology.

The Mysterious Island

If all the challenges and obstacles are overcome, then Jules Verne's prophetic words in *The Mysterious Island* (from 1874) might well come true in the near future:

"Without coal there would be no machinery, and without machinery there would be no railways, no steamers, no manufactories, nothing of that which is indispensable to modern civilization!"

"But what will they find?" asked Pencroft. "Can you guess, captain?"

"Nearly, my friend."

"And what will they burn instead of coal?"

"Water," replied Harding.

"Water!" cried Pencroft, "water as fuel for steamers and engines! Water to heat water!"

"Yes, but water decomposed into its primitive elements," replied Cyrus Harding, "and decomposed doubtless, by electricity, which will then have become a powerful and manageable force, for all great discoveries, by some inexplicable laws, appear to agree and become complete at the same time. Yes, my friends, I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable. Some day the coalrooms of steamers and the tenders of locomotives will, instead of coal, be stored with these two condensed gases, which will burn in the furnaces with enormous calorific power. There is, therefore, nothing to fear. As long as the earth is inhabited it will supply the wants of its inhabitants, and there will be no want of either light or heat as long as the productions of the vegetable, mineral or animal kingdoms do not fail us. I believe, then, that when the deposits of coal are exhausted we shall heat and warm ourselves with water. Water will be the coal of the future."

Resources:

People:

- *Spencer Abraham, U.S. Secretary of State for the U.S. Department of Energy* (<http://www.whitehouse.gov/government/abraham-bio.html>)
- *Loyola de Palacio, European Commission's Vice President* (http://europa.eu.int/comm/commissioners/palacio/index_en.htm)
- *Senator David Inouye* (<http://www.senate.gov/%7einouye/>)
- *Robert Olsen, Research Director at the Institute for Alternative Futures* (http://www.altfutures.com/futurists_det.asp?staff=4)

Organizations:

- *The U.S. Department of Energy (Energy Outlooks,* <http://www.eia.doe.gov/oiaf/aeo.html>)
- *The U.S. Department of Energy (Forecasts,* <http://www.eia.doe.gov/oiaf/aeo.html>)

- *The U.S. Department of Energy (Hydrogen, Fuel Cells & Infrastructure Technology Program, <http://www.eere.energy.gov/hydrogenandfuelcells/>)*
- *Ecological Society of America (<http://www.esa.org/>)*
- *Institute for Alternative Futures (<http://www.altfutures.com/>)*
- *Los Angeles Department of Water and Power (<http://www.ladwp.com/home.htm>)*
- *Union of Concerned Scientists (<http://www.ucsusa.org/>)*
- *United Technology Corporation ("commercial phosphoric acid fuel cell power plants") (<http://www.utcfuelcells.com/residential/faq.shtml#2>)*

Further Links:

- *President Bush announces the "Hydrogen Initiative" (<http://www.whitehouse.gov/news/releases/2003/02/print/20030206-2.html>)*
- *Hydrogen Fuel Initiative Can Make "Fundamental Difference", Remarks by the President on Energy Independence (<http://www.whitehouse.gov/news/releases/2003/02/20030206-12.html>)*
- *Pacific Business News (<http://pacific.bizjournals.com/pacific/stories/2002/01/14/story5.html>)*
- *Spencer Abraham's remarks at the Princeton Plasma Physics Laboratory ("freedom fuel") (http://www.pppl.gov/common_pics/secretary_remarks.pdf)*
- *Remarks of Energy Secretary Spencer Abraham at the announcement of the FutureGen Power Plant of the Future Project (http://www.fe.doe.gov/events/speeches/03_sec_futuregen_022703.shtml)*
- *FreedomCar Fact Sheet (Department of Energy, <http://www.energy.gov/HQPress/releases02/janpr/FreedomCarFactSheet.htm>)*
- *FutureGen (<http://www.netl.doe.gov/coalpower/sequestration/>)*
- *National Hydrogen Energy Technology Roadmap (http://www.eere.energy.gov/hydrogenandfuelcells/pdfs/national_h2_roadmap.pdf)*
- *White House Fact Sheet on the "Hydrogen Fuel Initiative" (<http://www.whitehouse.gov/news/releases/2003/02/print/20030206-2.html>)*
- *President George W. Bush's State of the Union address on January 28, 2003 (<http://www.whitehouse.gov/news/releases/2003/01/20030128-19.html>)*
- *Energy Bill (<http://thomas.loc.gov/cgi-bin/bdquery/z?d108:h.r.00006>)*
- *David K. Garman's (Assistant Secretary for Energy Efficiency and Renewable Energy, U.S. Department of Energy) testimony before the House Committee on Science (<http://www.house.gov/science/hearings/full03/mar05/garman.htm>)*
- *Fuel-Cell Caravan In Central Valley – Hydrogen Car Rally Promotes Technology, The San Francisco Chronicle, May 15, 2003 (<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2003/05/15/BA166765.DTL&type=science>)*
- *Loyola de Palacio meets Spencer Abraham for a further energy dialogue between EU and the USA, Press Release of the European Commission. May 1, 2003 (http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/03/613|0|RAPID&lg=EN)*
- *U.S. Global Climate Change Policy (<http://www.state.gov/g/oes/climate/>)*

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Preventing or Curing Climate Change?

Commentary by Thomas Loerting, Massachusetts Institute of Technology

In order to assess scientific, technical and socio-economic information relevant to the understanding of climate change, its potential impacts and options for adaptation and mitigation, the Intergovernmental Panel on Climate Change (IPCC) has been established by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP). In 2001, the IPCC released its third and latest assessment report (available at www.ipcc.ch) summarizing the cutting-edge work of numerous leading scientists. The report summarizes which climatic changes have already occurred, how well past and present climates are understood and which changes could lie ahead. It also mentions how over the past 50 years there has been an increase in the Northern Hemisphere's average surface temperature of approximately 0.7°C (1.3°F). According to tree ring and ice core reconstruction, as well as thermometer observation, this increase is unprecedented in the past millenium. Along with the increasing temperature, the hydrological cycle has been accelerated; there is 10% more water vapor per decade in the lower atmosphere since the 1980s and almost 1% more precipitation per decade on land. Furthermore, there is also strong correlation between the increasing temperatures and a loss of 10% of snow-cover and land-ice extent, including deglaciation, and Arctic Sea ice. The global sea levels have risen during the 20th century by 100-200 millimeters according to tide-gauge data.

Since all of the climatic changes observed in the last few decades are more intense than the natural variations observed in the last millenium, an anthropogenic influence is surmised. The world population was less than one billion people for more than 800 years during the last millenium. It has only exploded in the last three quarters of a century from less than two billion in 1927 to approximately 6.3 billion by January 2003. During the same period, countless technologies evolved and a great deal of the Earth's natural resources were consumed. Large amounts of energy were also generated. As a result, most of the energy produced in the world comes from burning carbon-based fossil fuels. The end-product, carbon dioxide or CO₂, is emitted into our atmosphere in huge quantities.

Earth's atmosphere is very thin in comparison to its diameter. It is like the skin of an apple. Therefore, it is understandable that the composition of the atmosphere is changing as a result of human influence. The mixing ratio of the trace gas CO₂ in our atmosphere was constant at 280 parts per million volume (ppmv) in the period from 1000 to 1900 A.D., After this period, a steep increase of 30% to the present level of 366ppmv has been recorded. CO₂ has the ability to hold back a portion of the infrared radiation coming from Earth's surface and for this reason is referred to as a greenhouse gas. Without an atmosphere that can contain greenhouse gases, our Earth's average temperature would be -18°C/0°F, which is similar to the average mean temperature on the Moon, rather than the actual average of +15°C/59°F. All oceans would be frozen and life as we know it would never have evolved. An increase in greenhouse gases, such as the man-made increase in CO₂ we now have, causes an additional warming effect and is most likely responsible for the modest warming we have seen in the last few decades. Aside from CO₂, other greenhouse gases have accumulated in our atmosphere per research that indicates that these other gases remained at approximately the same levels for many hundreds, and even thousands, of years. These include methane (130% increase), nitrous oxide (15% increase) and chlorofluorocarbons (CFCs). The latter have almost no natural sources and were not found in the atmosphere before the Industrial Revolution.

Computer models have been used to predict future global average surface temperatures. However, using these models as tools assumes that the scientist has foreknowledge of all the 'climate forcings,' especially the mixing ratios of all greenhouse gases in the future, of 'forcings' related to clouds and aerosols in the troposphere, and also assumes that the solar

energy output remains constant. According to various scenarios for population growth and economic development, especially in the developing world, the IPCC predicts an increase of the global average surface temperature of between +1.4°C and +5.8°C (2.5-10.4°F) by 2100 compared to 1990. Sea levels are expected to rise between 0.2 and 0.7 meters in the same time-frame. Considering that the last Ice Age was only 5°C colder than current temperatures, and North America was covered by an ice layer that was miles thick, these changes can certainly not be dubbed minor. Of course, no scientist is a fortune-teller and there are uncertainties in some of the assumptions underlying these predictions, as was recently pointed out in the news. However, the predictions represent the current voice of the scientific community.

The question of how to react or, indeed, whether to react at all to the current situation and these future projections does not fall within the realm of science. This is a question every person needs to answer alone. In particular, it needs to be answered depending on how much time, effort and money one is willing to spend in order to mitigate climate change for future generations. On an individual level, the focus is on using energy efficiently and thereby not producing unnecessary CO₂. There is a huge potential for reducing CO₂ emissions if individuals make an effort to reduce their reliance on cars and when possible find alternative modes of transportation, such as biking, walking, or using public transportation. Carpooling or shutting off the engine when the car is idling can help in situations where there is no alternative to using a car. Other simple energy-saving measures include insulating your living area to reduce the energy necessary to heat or air-condition your home, putting a lid on a pot when boiling water, buying locally produced items rather than products that travel hundreds of miles on the highway to reach you or to buy products causing less waste or food and beverages in reusable containers.

In addition to every individual, governments and industries all over the world have to decide what action to take. A set of potentially effective measures was put forward in the Kyoto Protocol by the "The United Nations Framework Convention on Climate Change" (UNFCCC) in 1997. It was designed to control the emissions of six greenhouse gases, especially CO₂. The commitment to reduce the collective emissions by at least 5% compared to 1990 levels by the period 2008-2012 is intended to stabilize the current trend of steeply increasing concentrations of greenhouse gases in the atmosphere. As of April 28, 2003, the protocol has been ratified or accepted by 108 nations accounting for 43.9% of world's carbon dioxide emissions. The protocol will enter into force 90 days after countries accounting for at least 55% of emissions have ratified the agreement. The most prominent members of countries not on the list of current signees are Australia, the Russian Federation and the United States of America, the latter accounting for one quarter of world's CO₂ emissions alone and more than any other country in the world per capita and per year. Ratification by either Russia or the US would render the consensus legally binding. Russia has indicated willingness to back the protocol in the near future.

The current Bush Administration is reluctant to ratify this protocol and chooses instead to invest in research and development. It would rather wait until scientists have an even better understanding of our changing Earth before signing a protocol of this type and to negotiate for the right to buy emissions from developing countries. This is of course a legitimate point of view. Similarly understandable are fears of yet another slow-down in economic growth caused by the initial investment needed to change infrastructure after ratification. However, the fact remains that the Earth is currently at risk, and in my opinion, action should be taken as soon as the possibility of these changes becomes apparent – waiting for certainty could be more harmful than the consequences of the present concerns. And regarding these concerns, there is a previous example when industry was faced with the challenge of phasing out chlorofluorocarbons (CFCs) according to the Montreal Protocol on Substances That Deplete the Ozone Layer in 1987. Despite the initial reluctance of industry lobbyists, in a short time industry came up with new, better and even less costly alternatives to using CFCs, which ultimately will save our protective stratospheric ozone layer.

There is evidence that the potential already exists for a shift to sustainable and renewable energy sources. A fleet of hydrogen-powered cars and buses is on the road in California, laptops and cellular phones can be powered by hydrogen fuel cells, and techniques to

harness solar and wind energies are at our disposal. However, without the encouragement of law or governmental incentives, this potential remains untapped to a great extent. When forced by the Montreal Protocol to find an alternative to using CFCs, mankind proved itself to be creative, and the same would be true if we were forced to cut CO2 emissions. These climatic challenges present a great opportunity to establish new and better technologies that could ultimately revive the market and help developing countries grow in a more sustainable way than the presently developed countries did.

Dr. Thomas Lörting is an award-winning Austrian scientist in the Group of Professor Mario Molina, the winner of the 1995 Nobel Prize for chemistry, at the Department of Earth, Atmospheric and Planetary Sciences (<http://www-eaps.mit.edu/>), MIT Boston. He can be contacted at loerting@mit.edu.

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Public Education Reform, Governance and the Daunting Task of Leaving No Child Behind: School Vouchers as a Remedy for the U.S. Public School System?

by Jutta Kern

In 2001, after only three days in office, President George W. Bush announced that education policy would be "the cornerstone" of his Administration. One year later, on January 8, 2002, hoping to tackle the public school system's reform head-on, the President signed the "No Child Left Behind" (NCLB) Act of 2001 into law (<http://www.nochildleftbehind.gov>). The NCLB Act mainly assumes to close what is referred to as the "achievement gap" in mandatory education for children in grades 1 through 12, also known as "K-12" education. Considering that K-12 public education is provided free-of-charge, the NCLB Act is aimed at enacting measures to promote equality in educational opportunities for all children regardless of their (financial, racial or other) backgrounds. The NCLB Act re-authorizes the Elementary and Secondary Education Act (ESEA) of 1965, albeit with fundamental changes ("Overview of Programs and Changes Included in the No Child Left Behind Act of 2001" <http://www.ed.gov/offices/OESE/esea/progsum/>).

While Republicans and federal education officials praise a new era of education in the U.S., the Democratic support of this bipartisan bill is withering with its implementation. Opponents worry that the main pillars of the Bush Administration's education reform – the concepts of "accountability", "flexibility" and "choice" – are not as adequate as presented in the beginning to achieve the demanding goal of "leaving no child behind" in public education. Critics believe that rather than improving the existing public school system, the NCLB-Act steers federal money towards religious and private institutions, while substantially withdrawing federal responsibility from the public school system, thereby leaving the responsibility of selecting appropriate provision of basic education to parents but still assuming strong federal governance all the same.

One of the most touted benefits among all the federally financed measures under the NCLB Act is the expansion of choice options for parents. In the case that a public school fails to meet set performance criteria, parents are issued "school vouchers" that allow them to choose among different schools in which to enroll their children. School vouchers literally represent the amount of money in public per-district spending on education appropriated per pupil. If parents decide to exercise their right of school-choice, the public dollar, in the form of a voucher, goes to wherever the pupil chooses to enroll. This means that the money is directed away from the public school to which the pupil was originally assigned. Therefore, school vouchers can be seen as an instrument for allocating federal funds in a public education system that is predominantly financed by the states and local entities.

A school's performance is referred to, by the term of "accountability" under the NCLB Act of 2001. Every state is required by the new law to annually submit an accountability plan to the U.S. Department of Education that summarizes the performances of all students enrolled in public schools. The White House issued a presidential statement on June 11, 2003 on the progress of this far-reaching reform initiative for America's public education system. The statement conveyed to the public that all 50 states and the District of Columbia, as well as the commonwealth of Puerto Rico have now submitted their required accountability plans (President's Remarks: <http://www.whitehouse.gov/news/releases/2003/06/20030610-4.html>). Together with the new possibilities presented by a more flexible utilization of federal money across different U.S. government-authorized programs, vouchers play a pivotal part in the overall endeavor of reforming the U.S. public education system by making public schools accountable for their student's performances.

School Vouchers And The Freedom To Choose

Overall, about 89% of America's children attend public schools for their K-12 education. Enrollment in private schools remained stable at 9-11% between 1993 and 1999. Private schools have long been the only other choice parents have had in determining their offspring's basic education. Which school to attend is determined by the school district the family lives in. Apart from choosing to pay high tuition fees for private schooling, relocation to a different school district has been the only other option parents have to get children enrolled in a different public school. Considering that the U.S. public school system is to a large degree financed through property taxes, and to a lesser amount through income taxes, it is no surprise that high-performing public schools are mostly found in wealthier districts. The National Center of Educational Statistics' (NCES, <http://nces.ed.gov/>) report (<http://nces.ed.gov/pubs2003/2003031.pdf>), "Trends in the Use of School Choice 1993 to 1999," shows that the percentage of students enrolled in public schools they chose increased from 11% in 1993 to 14% in 1999, while the percentage of students enrolled in public schools to which they are assigned decreased from 80% to 76% during the same period. The trend of enrollment in chosen public schools was most evident in low-income families, which are characterized by an income below \$10,000. The link between poverty-ridden neighborhoods and low-performing schools is obvious.

Beginning in the late 1980s, public school choice began to spread as a reform movement across the U.S.. There are still suggestions lingering for the total de-regulation of the schooling system according to a free-market model based on vouchers. This model was conceived by economist Milton Friedman and suggests transferring all educational funding into vouchers to be issued to the individual; at the same time, institutions would no longer be funded directly at all.

School-choice options, or voucher programs, were implemented for a variety of reasons among the 50 states. For example, Vermont implemented a voucher program to counteract the states' inability to provide public schools in every community due to its sparse population. Vermont's school vouchers provide about \$6,000 per child for education. Maine has instituted a similar kind of program while the city of Cleveland/ Ohio endorses vouchers for children in the amount of about \$2,500. In Milwaukee, Wisconsin, a full educational choice program is in place and school vouchers are issued to students at the amount of the state per-pupil expenditure.

Most of the voucher programs already implemented before the enactment of NCLB have been challenged in the courts for including religious schools in their school choice options. The First Amendment of the U.S. Constitution upholds a strict separation of church and state and thus usually is interpreted as a prohibition of federal funding for religious matters. Non-religious schools account for only 2% of the total enrollment in private schools. However, in June 2002, the U.S. Supreme Court ruled that the school voucher program in Cleveland, Ohio does not infringe upon the constitutional separation of church and state. The NCLB Act of 2001 fully integrates religious and sectarian schools in the school-choice program.

The U.S. Education System: Decentralization and Governance as Cornerstones

Laws and regulations of the individual states and local districts predominantly are responsible for organizing education in the United States. The Tenth Amendment of the U.S. Constitution prohibits federal laws such as the "No Child Left Behind" Act of 2001 from prescribing curricula. Federal education policy provides, however, a framework to foster and enhance certain educational goals and endeavors. Despite having no authority to establish a national education system, the federal government must safeguard the right of every U.S. citizen to have equal access to, and equal opportunity for, education. To do so, federal money is assigned to special programs and the maintenance and improvement of educational quality. Beyond this requirement, the U.S. Department of Education defines the federal government's role as the one of an "emergency response system." The Department of Education currently oversees the attendance of about 53 million pupils nationwide in the U.S. of which 92,000 are enrolled in public schools, 27,000 are enrolled in private schools throughout nearly 15,000 school districts.

Despite this highly decentralized system, education in the 50 states and the District of Columbia is characterized by many similarities. National accreditation procedures and testing systems guarantee minimal shared standards in the provision of curricula and the educational goals that must be achieved. In most states, a State Board of Education, run under the leadership of a Chief State School Officer and the state-level Department of Education, determines the main education requirements. Additionally, schoolbook publishers have a strong interest in streamlining curricula, since the U.S. education market is characterized by a high concentration: As few as four states, namely California, Texas, New York and Illinois, represent almost 30% of the market. Moreover, certain cohesion is achieved through educational policy on the federal level. Congress mandates the conditions under which federal funds are assigned to local and state institutions and programs. The concept, by and large, is meant to exercise governance by setting financial incentives, and also by creating penalties. In NCLB Act-speak, this means encouraging improvement in under-achieving districts by using the NCLB Act of 2001. Within this new market-oriented approach, school vouchers bear strong leverage in the U.S. elementary and secondary public education system.

Financing K-12 Education: Property Assets, Pork Barrels And The States' Troubled Budgets

Since public education is a responsibility of state legislation, its funding comes predominantly out of the states' budgets. More than 90% of the estimated overall \$770 billion spent on education for the 2002/2003 school year came from State, local and private sources. The federal share in financing the U.S. education system is less than 7% of the overall expenditure. President Bush's 2004 Budget assigns \$53,137 million to be administered by the Department of Education (<http://a257.g.akamaitech.net/7/257/2422/03feb20030900/www.gpo.gov/usbudget/fy2004/pdf/budget/education.pdf>). In 2003, the Department of Education's budget is about 2.9% out of the overall U.S. budget. Not included in the Department of Education's budget are programs run by other federal agencies, such as the Department of Agriculture's "School Lunch" program. In the Department of Education's budget, \$75 million are included for the new "Choice Incentive Fund" that finances the voucher program. Another \$25 million are reserved for "Voluntary Public School Choice" grants that encourage states and school districts to establish statewide and inter-district public school choice programs. A major part in the education reform is reserved for charter schools. Charter schools operate independently of the state school system, but do receive public funding. They are designed and operated by educators, parents, community leaders or educational entrepreneurs. Sponsored by designated local or state educational organizations, they are monitored in quality and effectiveness. The federal budget reserves \$320 million to support charter schools.

Funding systems across the states (Description of Funding Systems arranged by State: http://nces.ed.gov/edfin/state_finance/StateFinancing.asp) vary, although most of them operate with earmarked tax revenues. That means - bluntly stated - that taxes not earned cannot be redeemed by the education system. If K-12 education is not recognized as a fixed expenditure in the budget, but rather is financed through earmarked revenues, missing funds cannot be substituted with other financial sources out of the States' budgets. Thus, U.S. elementary and secondary public education highly depend on the overall development of the federal and state's economy.

The State of California, for example, has seen a substantial shift in financing away from the local level to the state level in the last 20 years. In the 1999/2000 school year, the state's share amounted to 60%. Additionally, California has a specific regulation ("Proposition 98" passed in 1988) that guarantees minimum state funding for K-12 education that amounted originally to about 40% of the overall general fund. In 1990, a new formula was invented to adjust the allocation to education in years when there were large changes in the state revenues. Out of the overall Californian education budget, 55% of funds are reserved for general purposes and 45% are earmarked for special programs or groups of students. The latter share has steadily increased over the past few years. On the local level, property taxes are the main source of financing. Generally, one fourth of the state and local revenues are generated by local property taxes. However, California exercises a system that bases taxation of

property mainly on the date of purchase. This serves the 6 million students currently attending public schools. School districts do not receive money garnered from income or sales taxes.

In 1999, California spent an overall amount of \$40.095 billion on the public K-12 school system. Weighed to the Average Daily Attendance (ADA), this amount appropriates \$5,752 to each of California's 5.44 million pupils. About \$120 in funding per pupil is generated through the California State Lottery, which is required to stipulate a minimum of 34% to education funds. Lottery revenues never exceeded 2% of the total school revenues.

In the State of Maryland, Governor Robert J. Ehrlich, the first Republican to hold that office in a long time, is trying to lure lawmakers into passing legislation that would legalize slot machines with the decoy of earmarking a portion of its revenues earned to the financially challenged public education system. Ever since Ehrlich took office in 2002, legalizing slot machines has been one of the centerpieces of his first legislative agenda. So far, Gov. Ehrlich has not yet succeeded in this endeavor. California numbers show that the funds possibly generated by such a measure could not really safeguard Maryland's educational system with its estimated 846,000 public school children.

The State of Texas, in turn, runs a financing system, which is predominantly based on property taxes. Texas does not at all impose personal or business income taxes. On the state level, the education budget is primarily financed through the General Revenue funds, which is supported by many different taxes and fees, such as motor fuel taxes, natural gas and oil taxes and "sin" taxes. However, 55% of the funds are provided through collected sales tax. Generally speaking, Texas' funding system is a multi-tiered system that defines state and local funding levels through a system of formulas known as the "Foundation School Program" (FSP). Forty-seven percent of the public education is funded on the local level. Texas is also one of the states that runs many charter schools. In 1999, there were 66 charter schools in operation, and by 2000, another 80 opened up. In the 2002/2003 school year, almost 185 charter schools are operating. Texas' public schools currently serve an estimated 4 million pupils.

As the home-state of President Bush, Texas has in many respects become a model state for education reform policy as picked up by the Bush Administration's "No Child Left Behind" initiative. Pro-school choice, charter schools, alternatives to affirmative action university admission policies and, of course, the voucher system were all implemented at an early stage. However, questionable conduct in the Lone Star State's charter school development was recently discussed by the New York Times (Re-educating the Voters about Texas' Schools, NY Times, June 3rd 2003, <http://www.nytimes.com/2003/06/03/opinion/03TUE3.html>): nepotistic staffing, false academic records and unchecked criminal backgrounds completed the portrait of educational reform in Texas with a charter school's principal leaving town in the middle of the night while taking the school's furniture with him. Pupils, suddenly without learning facilities, had to be accommodated back in the public school system. Under rigorous testing requirements imposed on schools under the NCLB Act, forty-six schools in Texas were classified for improvement. Significantly, about two thirds of those were charter schools, initially invented to improve the public school system.

The State of Florida is a good example to show that funding for public education received from the state fluctuates annually depending on revenues earned and the state's expenditures. Nonetheless, in the 1999/ 2000 school year, Florida's public education was financed almost at 50% through state funds. The system is based on the Florida Education Finance Program (FEFP) of 1973/74, which allocates funds, by and large, on the basis of the number of pupils participating in a particular educational program multiplied by cost-factors. On the level of school districts, which are congruent with counties boundaries, revenues for the school system are almost exclusively based on property taxes. On the state level, Florida also utilizes 38% of the gross income of its lottery for the Educational Enhancement Trust Fund. In 1999, legislation set the base student allocation (BSA) at \$3,223. The concept of this system already takes the per-pupil cost ratio into account, which is necessary to exercise a school-choice system on the basis of vouchers. Florida currently has 2.3 million children enrolled in its public schools.

Interestingly, Florida's Gov. Jeb Bush, brother of President Bush, was the first one to base the choice-program on a rating system for schools in 1999. Students of under-performing schools were eligible to attend higher-rated schools on the basis of vouchers and "over-performing" educational institutions received financial incentives of about \$100 per pupil.

With funding based on earmarked tax revenues, the public school system is immediately affected in case a state's budget falls short. This can be observed all over the U.S. in the current fiscal year. The outlook for the upcoming year is not rosy either. Schools either had to shut down earlier than usual this year or impose furloughs so that at least basic programs could be maintained until the end of the school year. California's education system had to deal with severe shortfalls in the state's budget. Gov. Gray Davis (D) proposed to cut about \$1.6 billion in direct financing for the state's 1,000 school districts. The massive shortfall is attributed to the high-technology crisis and the overall sluggish economy in the U.S.. In April 2003, an estimated 25,000 teachers received pink slips, as required by state law if school districts are considering letting teachers go. Since most districts have not yet settled on their upcoming budgets, it is unclear how many of those teachers will actually lose their jobs. Some annual teacher's recruitment fairs in California's school districts have been canceled.

President Bush's federal budget proposal for 2004 went along with a massive tax cut that according to critics favors the wealthy. The child tax credit, saving a poor family \$1,000 per child per year, was eliminated at the last moment from the bill by the Republicans and could only after major partisan arguments be passed by Congress. However, most of the financial pressure seems to rest on the middle-class. Taxes will decline for all income groups, except for those earning more than \$28,000 and less than \$337,000. The "middle-income" groups falling within these income brackets will end up paying an even greater share of taxes than they did before. In addition, already troubled state budgets have to make up for the federal cuts.

An analysis by the "Chronicle of Higher Education" projects that "even if states experience normal economic growth over the next eight years, all but a handful of states will find it impossible, given their existing tax policies, to continue funding their current level of public services" (State Shortfalls Projected Throughout the Decade, http://www.highereducation.org/pa_0203/index.html).

The Specific Case of the U.S. Capital Washington, D.C.: Taxation Without Representation

When members of the educational community wish to express the problematic sides of the public school system in the U.S., they usually sum up the array of challenges in one phrase: inner-city schools. Whether it be low performance, poverty-ridden or unsafe schools, or drug-abuse, these factors seem to be ever-present in the struggle of inner-city schools' administrative and academic lives. The case of the capital's inner city schools is particularly interesting. Washington, D.C. is neither a state nor part of one. Because of this specific designation as a political district and not a state, D.C. does not send a congressperson with actual voting rights to the U.S. House of Representatives or a Senator to the U.S. Senate. D.C. lately added the slogan "taxation without representation" to its license plates to express this political under-representation in spite of full taxation. Additionally, the District's tax base is impacted by the presence of the federal government which creates tax exemptions such as the one on federal real estate buildings that cut down the effective levies on property tax by 42%. The District is partly offset by the federal government for this loss. In education, the teacher retirement fund is financed federally.

Washington, D.C. collects income and sales taxes, but in contrast to other financing systems, no specific D.C. tax revenues are earmarked for schools. Instead, D.C. operates with a "D.C. Public Schools" (DCPS) budget that is subject by law to a public hearing before it is placed into effect. The annual appropriations are made from the general fund to DCPS, public charter schools, teacher retirement funds and school transportation.

In his second term, Mayor Anthony Williams (D) even caught his own staff off-guard when he agreed in May 2003 to adopt the voucher program for the District of Columbia's public schools (DCPC). Parents of an estimated 5,000 to 10,000 of 77,000 children in D.C.'s public

schools will be eligible to receive school vouchers. Senior officials of the Board of Education confronted Williams with opposition to this move and accused him of selling-out home rule with the goal of receiving additional funding from the federal government for the city's budget.

Arguments opposing the voucher system included that Washington already has enough school-choice options with its growing charter school movement. In the District of Columbia, more than 14,000 students are currently enrolled in charter schools. The voucher system gives parents the right to choose for their children not only among charter schools, but also among religious and parochial schools. Private schools in Washington, D.C. usually charge five-figure annual tuition rates. The new school vouchers to be endorsed to parents will be far from covering those costs. Consequently, observers expect that the biggest beneficiaries will most likely be those who want to attend Catholic schools, which typically ask lower tuition fees. Currently, in Washington, D.C., 7,924 of the 67,500 students are enrolled in Catholic schools. According to a Washington Post report (Washington Post, May 2, 2003; Page A01), the Archdiocese of Washington can offer another 1,200 slots in those schools.

However, in presenting the city's 2004 \$5.6 billion budget request to a U.S. House Appropriations Panel on June 5th – one month after welcoming vouchers to his city – Mayor Williams warned that the city's fiscal future is in jeopardy. The District has cut services and capital spending and has rolled back tax cuts to close a budget gap of approximately \$457 million for fiscal year 2003. Even if the economy improves, the District will need federal financial aid of several hundred million dollars. During the hearing, Mayor Williams explicitly demanded that any money the District receives through the Bush Administration's school voucher initiative should be in addition to, and not in place of, other federal aid. How large D.C.'s share of the \$75 million financing for the school voucher pilot initiative will be is still uncertain. Opponents to the mayor's voucher decision earlier this year clearly see the trade-off taking shape on the city's financial horizon. Federally-funded school vouchers for the District had already been approved by the Republican-controlled House years ago, but were vetoed by then-President Bill Clinton.

Despite all the different methods to allocate funds for public education across the U.S., property taxes remain the predominant source of funding. If revenues are collected and distributed on the local school district level and are not subject to re-allocation on a county or state administrative level, then educational provisions would correlate with the geographical distribution of wealth. Such a system creates largely homogenized school districts in terms of the available funding for schools. As a consequence, low funding creates magnets for poverty-ridden educational institutions not capable of providing sufficient, quality education. According to the No Child Left Behind Act, this is exactly the eligible target group for school enhancement and school voucher programs.

Education Reform With NCLB: Closing In On The Achievement Gap With Flexibility and Accountability

The interdependence among poverty-ridden districts and students' poor performances was already recognized by the "Elementary and Secondary Education Act" (ESEA) of 1965, NCLB's predecessor with provisions under "Title 1." This legislation is now referred to as "the foundation of the NCLB reforms" in the education budget proposal for 2004 and requests funds of \$12.4 billion. Being ESEA's and now NCLB's largest program, Title 1 grants federal money to local school districts based on their enrollment of poor students. Title 1 is especially popular because it allocates federal funds to almost every Congressional district. However, studies showed that in some cases, Title 1 funds defeated their purpose because they were used to supplant, instead of supplementing, local funds. The NCLB Act of 2001 bases the entire school-choice program, and therefore its voucher system, on the definition of low-performing schools and poor students.

American education relies throughout the system on standardized testing instruments to assess performance. One of those instruments for K-12 education is the National Education Assessment Program. Its results showed in 2001 that only 32% of American fourth-graders could read proficiently or better, whereas 63% of African-American fourth-graders, 58% of Hispanics, 60% of children in poverty and 47% in inner-city schools have tested "below basic"

in reading comprehension. Results like those lead many policy-makers to assume that the school system has not improved a lot since the famous "A Nation at Risk" report of 1983. Critics of this much-debated report complained in the aftermath of its release that increasing tests would make schools rather tougher than better.

Gerald Holton, Professor Emeritus at Harvard University and one of the accomplished authors of "A Nation at Risk," reminded readers of the Chronicle of Higher Education that it was then-President Ronald Reagan who, during his first year of the Presidency, made the political mission for the report-to-be clear to the authors at the inaugural meeting: "Bring God back into the classroom. Encourage tuition tax credits for families using private schools. Support vouchers. Leave the primary responsibility for education to parents." (An Insider's View of 'A Nation at Risk' and Why It Still Matters, <http://chronicle.com/weekly/v49/i33/33b01301.htm>). With its 20th anniversary, the concussive report "A Nation at Risk", which was based on two years of research across schools throughout the United States, bears witness to the fact that priorities in Republican education policy apparently have remained unchanged since President Reagan's time in the White House.

The NCLB Act requires statewide "accountability systems" covering all students and public schools. It rates schools' performances using the annual standardized test results of students in grades 3 through 8 in reading and mathematics (in the future, also science). The standards are based on annual statewide progress objectives set to ensure that all pupils reach proficiency in the tested areas within 12 years of public education. Schools and school districts that fail to meet those objectives will be subject to improvement, corrective action and also restructuring. The law requires every state to release a list of its schools classified for improvement before the start of the school year. A school remains on this list for two years. Since schools are held accountable for their performances, parents of children enrolled in under-achieving schools are eligible to choose a different school within the same district. If the school fails to make "adequate yearly progress" (AYP) as determined by annual testing performances, parents are given enlarged choice options through school vouchers and supplemental teaching programs. The school district will be responsible for providing transportation to that new school. Twenty-five million dollars are assigned for 'Voluntary Public School Choice' grants to build new intra- and inter-school district choice options within states. Moreover, the NCLB Act explicitly encourages the founding of charter schools by reserving an additional \$320 million for that purpose alone.

In the school year 2002/2003, almost 2,700 charter schools are operating in 36 states, including the District of Columbia, and about 685,000 students are enrolled in them. A recent study titled "Impact of Charter Schools on School Districts" (<http://www.ed.gov/pubs/chartimpact/>) analyzed the challenges and opportunities of this system. The results showed that charter schools forced public schools to become more competitive in the services they offer. However, it seems interesting that the opening of charter schools mainly had a positive impact on public schools in districts that already showed a decent performance in their school system. Conversely, school districts that were already troubled by declining enrollment, increasing class-sizes, lay-offs, school closings and having to downsize their central offices reported that charter schools had a very negative impact on their budgets. Charter schools in these challenged districts are meant to supplant public schools rather than enlarge the options parents have to send their children to better performing schools, as promised by the No Child Left Behind Act.

Voucher options are complemented by additional incentives through "State-Flex" and "Local-Flex" mechanisms that allow States, local educational agencies and schools to consolidate federal funds. This new flexibility allows federal funds that were originally dedicated to specific programs to be used for other authorized purposes in exchange for a broader commitment to improving student achievements. Additional flexibility in the use of federal money is granted through the new "transferability" provisions, which allow the use of up to half of the amount received through different programs or under Title 1 provisions.

With the NCLB Act, the Bush Administration takes a highly individualistic and market-driven approach towards tackling the education systems' weaknesses and challenges. In his educational reform, George W. Bush chose to bring the leverage to bear on the general concept of

how to federally finance public education. Rather than creating sustainable and reliable base financing systems to prevent the immediate reflection of a state's economy on the public school system and integrating measures of equalizing local disadvantages, NCLB takes the approach of holding individual schools accountable and parents responsible. Vouchers, and the increase in choice by substantially promoting charter schools, are key elements of President Bush's education reform. One concern about this putative freedom of choice for families who come from disadvantaged backgrounds still remains: How will these families be adequately provided with sufficient information on their choices, and how will they be brought to make suitable decisions about their children's educational future when federal policy indicates it will take on less responsibility for public education?

Eugene W. Hickok (<http://www.ed.gov/offices/OUS/hickok.html>), Under-Secretary of Education, who recently announced his resignation, called the No Child Left Behind Act a non-regulatory guidance in his statement of witness to the House Subcommittee on Education. However, it substantially de-regulates, privatizes and de-institutionalizes the U.S. public education system by setting massive financial incentives. In doing so – as contradictory as it may sound – the NCLB Act and, therefore, the federal government assumes strong governance for K-12 education, despite the Bush Administration's narrow reading of the Tenth Amendment.

Political observers predict education policy will remain on top of the political agenda in the President's 2004 election campaign. It also seems that in 2004 President George W. Bush will most likely begin work at reshaping what follows K-12: it will be the year when the Higher Education Act comes up for re-authorization.

Resources:

- ❑ *President George W. Bush remarks on the progress in Education Reform* (<http://www.whitehouse.gov/news/releases/2003/06/20030610-4.html>)
- ❑ *In Focus – Education* (<http://www.whitehouse.gov/infocus/education/>)
- ❑ *Education Reform per State* (<http://www.whitehouse.gov/infocus/education/edmap.html>)
- ❑ *Department of Education (DOE): Office of Non Public Education* (<http://www.ed.gov/offices/OIIA/NonPublic/index.html>)
- ❑ *Department of Education (DOE): FAQ's for NCLB* (<http://www.nclb.gov/next/faqs/choice.html#1>)
- ❑ *Glossary Term Index at the Department of Education website* (<http://www.nclb.gov/start/glossary/index.html#13>)
- ❑ *President's 2004 Budget: State Fact Sheets* (<http://www.nclb.gov/next/states/>). These fact sheets highlight what President Bush's \$53.1 billion budget request for the Education Department in 2004 means for your state.
- ❑ *The State Education Office of the District of Columbia* (<http://seo.dc.gov/information/websites/index.shtml>)
- ❑ *The Consortium for Policy Research in Education (CPRE) provides an excellent source of studies and research papers ready to download* (http://www.cpre.org/index_js.htm)
- ❑ *Assessment and Accountability Systems: 50 State Profiles* (http://www.cpre.org/Publications/Publications_Accountability.htm)
- ❑ *The Federal Role in Education: Overview* (<http://www.ed.gov/offices/OUS/fedrole.html>)
- ❑ *Graph: the structure of education in the United States* (http://www.ed.gov/pubs/Prog95/pt1_fig1.html)
- ❑ *Progress of Education in the United States of America: 1990 through 1994* (http://www.ed.gov/pubs/Prog95/pg_6toc.html)
- ❑ *Department of Education: Policy Overview* (<http://www.ed.gov/topics/topics.jsp?&top=Policy>)
- ❑ *Trends in the Use of School Choice: 1993 to 1999* (<http://nces.ed.gov/pubs2003/2003031.pdf>)
- ❑ *Description of Funding Systems arranged by State* (http://nces.ed.gov/edfin/state_finance/StateFinancing.asp)

- ❑ *Re-educating the Voters about Texas' Schools, NY Times, June 3rd 2003*
(<http://www.nytimes.com/2003/06/03/opinion/03TUE3.html>)
- ❑ *2004 education budget*
(<http://a257.g.akamaitech.net/7/257/2422/03feb20030900/www.gpo.gov/usbudget/fy2004/pdf/budget/education.pdf>)
- ❑ *Families See Two Sides to Tax Cuts: Oregon. 'How do we think it's OK to make our children second-class citizens...?'* (<http://www.latimes.com/news/education/la-na-taxore18may18,0,2460592.story?coll=la%2Dnews%2Dlearning>)
- ❑ *State Shortfalls Projected Throughout the Decade*
(http://www.highereducation.org/pa_0203/index.html)
- ❑ *Supreme Court affirms school voucher program. June 27, 2002* (<http://www.cnn.com>)
- ❑ *www.uscharterschools.org* (<http://www.uscharterschools.org>)
- ❑ *Challenge and Opportunity: The Impact of Charter Schools on School Districts*
(<http://www.ed.gov/pubs/chartimpact/>)
- ❑ *A Nation at Risk* (<http://www.ed.gov/pubs/NatAtRisk/>)
- ❑ *Middle Class Tax Share Set to Rise - Studies Say Burden Of Rich to Decline. Washington Post, June 4, 2003; Page A01* (<http://www.washingtonpost.com/wp-dyn/articles/A10323-2003Jun3.html?referrer=email>)
- ❑ *Williams Pushes for Aid. City's Fiscal Future in Jeopardy, Mayor Tells House Panel. Washington Post, June 5, 2003; Page B01* (<http://www.washingtonpost.com/wp-dyn/articles/A14978-2003Jun4.html?referrer=email>)
- ❑ *Mayor Endorses Vouchers in D.C.. Norton Criticizes Statement as 'Selling Out' Home Rule. Washington Post, May 2, 2003; Page A01.*
- ❑ *National Center for Educational Statistics: Revenues and Expenditures for Public Elementary and Secondary Education* (<http://nces.ed.gov/ccd/stfis.asp>)
- ❑ *Brown Center on Education Policy* (http://www.brook.edu/gs/brown/brown_hp.htm)
- ❑ *An Insider's View of 'A Nation at Risk' and Why It Still Matters*
(<http://chronicle.com/weekly/v49/i33/33b01301.htm>)

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Celebrating the 60th anniversary of the Los Alamos National Laboratory

Commentary by Achim Seifert, Los Alamos National Laboratory

In 1938, nuclear fission was accomplished by German scientist Otto Hahn. As a result of his success many physicists immediately realized the enormous energy stored in the atomic nucleus, and the potential this energy had if it were to be applied to weapons. As it became evident that Germany was collecting all the uranium that was available during World War II, Leo Szilard together with Edward Teller, both outstanding physicists of Hungarian origin, urged Albert Einstein to write his famous letter to U.S. President Roosevelt to warn him about the dangerous situation which Adolph Hitler would present if Hitler possessed nuclear weapons. Roosevelt took Einstein's letter to heart and embarked on exploring the feasibility of such an "atomic weapon." He put J. R. Oppenheimer, then a leading expert in nuclear physics and a professor at UC Berkeley, in charge of the so-called Manhattan Engineering Project. Together with the military leader of this project, General Leslie R. Groves, Oppenheimer decided to locate the main facility of this project in Los Alamos in the mountains of northern New Mexico. Hence, the Los Alamos National Laboratory was born in April 1943.

Oppenheimer recruited the best-and-brightest minds available, including Hans Bethe, Enrico Fermi, Richard Feynman, Leo Szilard, Eugene Wigner and Edward Teller just to name a few. After two years of intense work, the \$2 billion dollar top-secret project's outcome was the first atomic bomb which was successfully tested at the Trinity test site in southern New Mexico on July 16th, 1945.

In the meantime, Germany capitulated and lost the war on the European front, but the war was still in motion in the Pacific Theatre with no end in sight. A multitude of reasons existed in support of ending the war there as fast as possible: to save the lives of U.S. soldiers fighting Japan, to prevent the Soviet Union from expanding their influence in the Far East, etc... President Roosevelt's successor, Truman, decided after much deliberation to drop the first atomic bomb over Hiroshima, Japan. The bomb was a uranium-powered, gun-type bomb nicknamed "Little Boy."

On August 6th 1945, approximately 140,000 inhabitants of Hiroshima were killed while thousands more were severely injured in a city that was laid to waste. Japan's refusal to surrender resulted in a second bomb, a plutonium-powered, implosion-type bomb nicknamed "Fat Man," being dropped on August 9th, 1945 over Nagasaki. Another 70,000 people were killed.

The decision to drop two bombs over Hiroshima and Nagasaki finally effected Japan's surrender. World War II was officially over, but another war began: the armament race between the U.S. and the Soviet Union known as the "Cold War." Just four years after the first successful U.S. nuclear test at Trinity, the Soviet Union exploded their first nuclear device on August 29th, 1949 at their test site. The "Cold War" was fought under the imminent threat of nuclear disaster. Again, Los Alamos scientists were urged to develop better and more powerful nuclear weapons.

When the Soviet Union collapsed in the early 1990s, the Cold War ended, but there were other challenges to the scientific community. For example, how was it possible to control the proliferation of nuclear weapons, and how could the use of nuclear weapons by terrorists or dictatorial regimes be prevented? Now, one of the great challenges is how to guarantee the effectiveness of the nuclear weapons stockpile without being allowed to perform live nuclear tests. This challenge, in particular, is mitigated by running computer simulations of the behavior of nuclear weapons. To do this properly, outstanding computer hard- and software needs to be developed and improved. Only then can the necessary material data be

effectively measured. These developments and measurements will take a significant amount of time before they come to full fruition. As work continues, it is necessary to consider other projects tackled by the Los Alamos National Laboratory in the last 60 years.

The Los Alamos National Laboratory has not been idle, and it does not only stand for big contributions to modern weapons technology. Many other scientific achievements have been made including the development of nuclear rocket propulsion systems as well as the ability to generate short, powerful light pulses by excimer lasers. Another main effort was (and still is) to explore alternative sources of energy like geothermal-, solar- and nuclear fusion energies. Geological studies to predict earthquakes and computer models to understand the Earth's climate change have been performed and developed. When the LANSCE linear particle accelerator was built in 1972, the results of this facility did much to contribute to 'particle physics' ever since.

Other major contributions to science have been made by various Los Alamos scientists. For example, the first experimental proof of the existence of the "neutrino" was delivered in Los Alamos by Fred Reines. He was awarded the 1995 Nobel Prize in Physics for his work in this matter. From the beginning, Los Alamos scientists including J. von Neuman and R. Feynman, later followed by Stan Ulam and Nick Metropolis, led the way in developing computers and performing computations of complex mathematical problems. Other scientific disciplines besides physics and mathematics, such as biology and medicine, have been explored. The best example that illustrates Los Alamos' broad scientific identity is the human genome project which was recently completed. It was largely conceived in 1986 in Santa Fe by Los Alamos scientists. Since then, the human genome project came to signify the dedication of the Lab to modern science.

These days, systems and techniques to detect explosives, nuclear, biological, and chemical hazardous materials are being developed in Los Alamos in support of the Department of Homeland Security. The intent is to prevent further terrorist attacks like that of September 11th, a day which will never be forgotten.

Today almost 14,000 people, including contractors from all over the world, are working at, or in conjunction with, the Los Alamos National Laboratory. With an annual budget of approximately \$2 billion dollars to support the Los Alamos population and its facilities, modern science can be assured of its progress through an intense and consistent effort. When of the 60th anniversary celebrations commenced on April 7th, 2003, this effort was best summarized by interim director Pete Nanos: "Science is the value the Laboratory brings to the nation."

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AAAS from the inside

Commentary by Sabine Herlitschka

The American Association for the Advancement of Science (AAAS) is the world's largest general scientific society and also publishes its own magazine, *Science*. AAAS and its magazine report to nearly 140,000 individual and institutional subscribers, including 272 affiliated organizations in more than 130 countries. It is estimated that a total of 10 million individuals benefit from AAAS.

AAAS seeks to "advance science and innovation throughout the world for the benefit of all people." To fulfill this mission, the AAAS Board of Directors has set the following (broad) goals with the intent to:

- Foster communication among scientists, engineers and the public,
- Enhance international cooperation in science and its applications,
- Promote the responsible conduct and use of science and technology,
- Foster education in science and technology for everyone,
- Enhance the science and technology workforce and infrastructure,
- Increase public understanding of and appreciation for science and technology,
- Strengthen support for the science and technology enterprise

To accommodate these goals, four primary program areas have been defined in order to better fulfill the AAAS mission, including:

- Science and Policy
- International Programs
- Education and Human Resources
- Project 2061

The Directorate for Science and Policy Programs (SPP) serves society and the government and research communities through various activities. SPP addresses several objectives of the AAAS. These objectives include furthering the work of scientists, improving the effectiveness of science in the promotion of human welfare and fostering scientific freedom and responsibility.

Four units, that operate at the intersection of science and engineering with federal and state governments, comprise the Directorate's Science and Engineering Policy and Practice Group (PPG). PPG is concerned with the aspects of science and technology policy that directly affect the research environment and the practices of scientists and engineers. It is similarly concerned with the ways in which science and engineering expertise and knowledge are represented in public policy issues. These four units include:

- Fellowship Programs that offer opportunities for scientists and engineers to help shape science and technology policy in Washington, DC, in the context of a one-year term for participants.
- The R&D Budget and Policy Program analyzes research and development funding trends in the federal budget and hosts the annual AAAS "Science and Technology Policy Colloquium" each spring.
- The Center for Science, Technology, and Congress conducts briefings for congressional staff, publishes *Science & Technology in Congress* for every month Congress is in session, and sponsors regional meetings on the impacts of federal R&D funding.
- The Research Competitiveness Program assists universities and other R&D institutions in enhancing their research capabilities.

The Directorate's three other groups are distinguished by the broader societal dimensions of their activities that transcend the role of governments. The Science and Human Rights Program has been a pioneer in the application of scientific methods and techniques to the promotion of human rights worldwide; it is a leader in defending the rights of scientists, engineers, and health professionals throughout the world who have experienced persecution or infringements of academic freedom. Through its Dialogue on Science, Ethics, and Religion, the Directorate develops workshops and provides training seminars, organizes forums and conferences, and sponsors multidisciplinary research and study projects to foster meaningful communication between the scientific and religious communities.

The Scientific Freedom, Responsibility and Law Program works to uphold high ethical standards for science and engineering. It is designed to monitor ethical, legal, and social issues related to science and technology and to improve the relationship between science and law.

The International Program(s) seeks to achieve the Association's goals through enhanced cooperation between scientists and engineers in the U.S. and those of other countries. The activities of the international Office (INT) at AAAS are designed to strengthen the role of scientists and engineers in developing countries and to increase the contribution of science and technology (S&T) to the solution of regional and global problems. For example, AAAS administers a small grants program to encourage more women to participate in international scientific collaboration. Products of these collaborative efforts include strengthened relationships with the scientific communities of other countries, and progress in resolving issues of international concern.

INT has been active in numerous regional activities in Africa, Europe, Central Asia, Latin America, the Caribbean and the Pacific Rim. Additionally, the Science for Sustainable Development initiative examines global science-based issues pertaining to population, consumption, development and environment, while the Consortium of Affiliates for International Programs (CAIP) is a network of scientific societies and academies that have active international programs. INT also participates alongside the AAAS Directorate for Science and Policy Programs in the Science, Engineering, and Diplomacy Fellowship Program.

Recent international AAAS news:

- The 2003 Round One Winners of the Women's International Science Collaboration (WISC) travel grant program have been announced.
- The 3rd APEC Youth Science Festival, originally scheduled for July 29-August 4, 2003 in Beijing, China has been postponed until next year. The purpose of the conference is to increase interest in science and technology among youths of the Asia-Pacific region, to promote science and technology exchanges and interactions, including science education among young students and science teachers and to raise public awareness of science and technology.
- The Canon National Parks Science Scholars Program is pleased to announce its 2003 competition. The program is a collaboration between Canon U.S.A., Inc., AAAS and the U.S. National Park Service. Thanks to a generous commitment by Canon U.S.A., Inc., the program will be awarding eight US \$78,000 scholarships to Ph.D. students throughout the United States to conduct research critical to conserving the nation

Education and Human Resources has set-up more than 50 programs devoted to promotion of science, technology, engineering and mathematics education. Activities focus on reaching out to schools, teachers and librarians, children, families and communities. There are also initiatives geared towards higher education research, resources and policy in the context of education research, science for the general public, career and workforce development.

Project 2061 is a long-term initiative designed in 1985 to help advance American awareness and literacy in science, mathematics and technology. Its work has earned the project a reputation as the "single most visible attempt at science education reform in American history" (Organization of Economic Cooperation and Development, 1996). As journalist Julia Steiny recently described it in the Providence Journal, "Project 2061 is the ultimate science project."

With its 1989 landmark publication, *Science for All Americans*, Project 2061 set out recommendations for what all students should know and be able to do in science, mathematics and technology by the time they graduate from high school. *Science for All Americans* laid the groundwork for the nationwide science standards movement of the 1990s. *Benchmarks for Science Literacy*, published in 1993, translated the science literacy goals in *Science for All Americans* into learning goals or benchmarks for grades K–12. Many of today's state and national standards documents have drawn their content from *Benchmarks*.

With nearly 200,000 copies of *Science for All Americans* and more than 100,000 copies of *Benchmarks* sold, Project 2061 has "changed the national climate for science education reform" (SRI International, 1996). These AAAS publications are the foundation for Project 2061's ongoing efforts to reform curriculum, instruction and assessment. With recent publications such as the *Atlas of Science Literacy* and *Designs for Science Literacy*, Project 2061 continues to influence the direction of science education reform.

Whether evaluating textbooks and assessments or creating conceptual strand maps for educators, Project 2061 staff use their wide-ranging expertise as teachers, researchers and scientists to help make science literacy a reality for all students. Through groundbreaking research and innovative books, CD-ROMs and professional development workshops, Project 2061 is changing the way educators and members of the public think about the priorities and purposes of science, mathematics and technology education.

This article is based on the information provided on the AAAS web-page.

For Further Information:

American Association for the Advancement of Science (<http://www.aaas.org>)

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