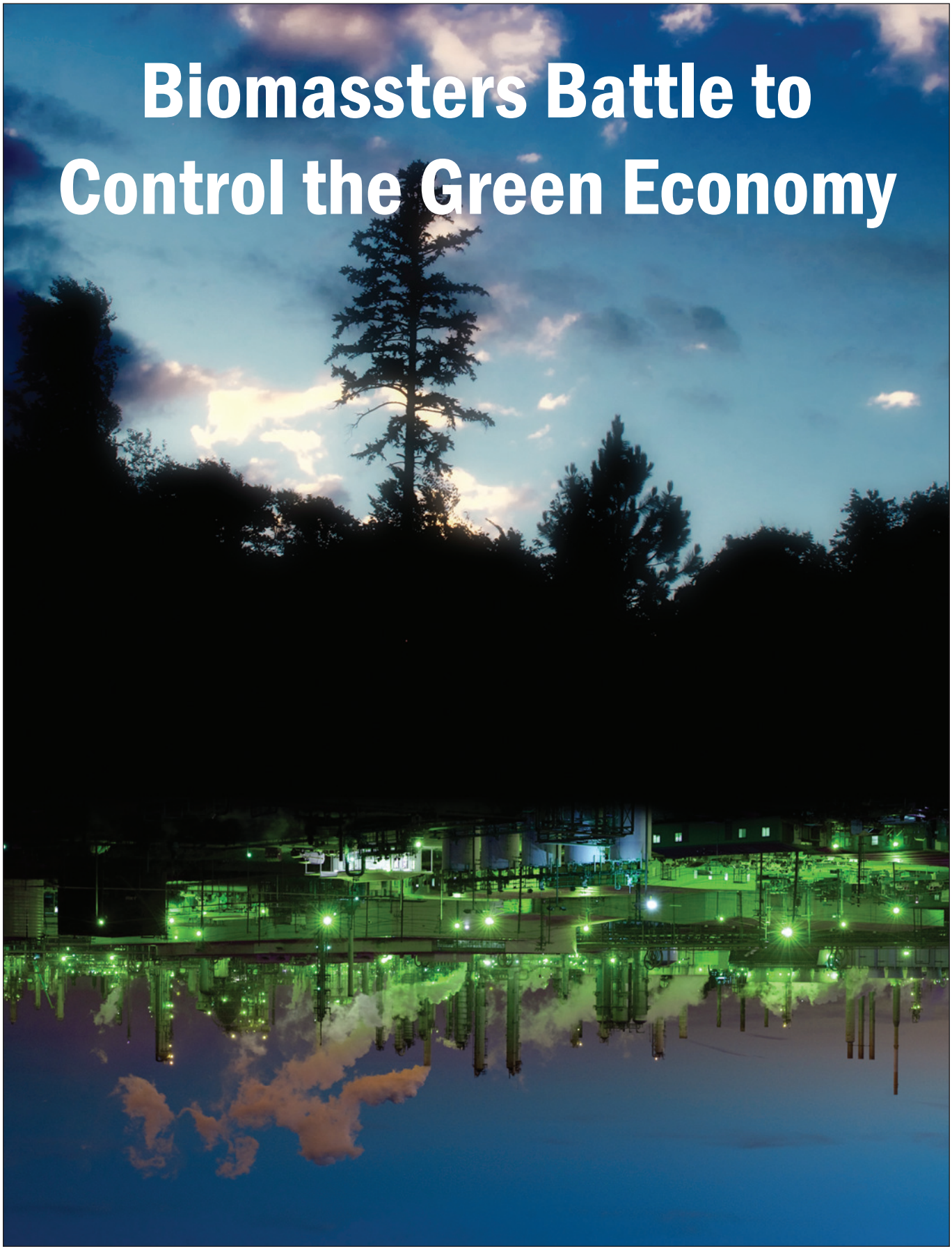
Biomassters Battle to Control the Green Economy



HEINRICH BÖLL STIFTUNG

June 2012

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Published by ETC Group and Heinrich Böll Foundation

Copy-edited by Leila Marshy

Design and illustration by Shtig (.net)

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This report is also available in Portuguese and German.

Biomassters Battle to Control the Green Economy

Introduction: Going Green, from Rio 1992 to Rio 2012

Around the turn of the millennium, the vision of an environment-friendly, post-petroleum future began taking shape. Industrial production would depend on biological feedstocks transformed through high technology bioengineering platforms: the capture and conversion of living (or recently-alive) matter, referred to as biomass – food and fibre crops, grasses, forest residues, plant oils, algae, etc. – into chemicals, plastics, drugs and energy. This nascent bio-based economy quickly acquired a patina of 'green' and promised to solve the problem of Peak Oil, to arrest climate change and to usher in an era of sustainable development. More recently, in the lead-up to the June 2012 Earth Summit (Rio+20), the notion of a "great green technological transformation" enabling a "green economy" is being widely – though not universally – accepted.[1]

Some governments, corporations, venture capitalists and NGOs are also promoting the technologies – including genetic engineering, synthetic biology and nanotechnology – that make (or will make) it possible to transform biomass into commercial products. The quest to secure biomass for feedstocks is creating new configurations of corporate power. Major players in all sectors are already involved: Big Energy (Exxon, BP, Chevron, Shell, Total), along with the US military; Big Pharma (Roche, Merck); Big Food & Ag (Unilever, Cargill, DuPont, Monsanto, Bunge, Procter & Gamble); and Big Chemical (Dow, BASF).

The push for a bio-based economy comes with a call for market-based mechanisms for the financialization of the Earth's natural processes, re-branded as 'ecosystem services' (the cycling of carbon, soil nutrients and water, for example), which also encourage land and water grabs.[2] Companies are no longer focused narrowly on the control of genetic material found in seeds, plants, animals, microbes and humans; they've widened their scope to include the reproductive capacity of the entire planet.

The 1992 Earth Summit produced a Book of Promises called Agenda 21 that included combating desertification, safeguarding forests, confronting climate change and committing the North to transfer sustainable technologies to the South. In addition, the South agreed to a Biodiversity Convention to halt species loss and ecosystem destruction. As part of this last and most celebrated agreement, however, Summit leaders agreed that governments would have sovereignty over all of the biodiversity within their borders at the time of treaty ratification.

The push for a bio-based economy comes with a call for market-based mechanisms for the financialization of the Earth's natural processes, re-branded as 'ecosystem services,' which also encourage land and water grabs.

Some critics called the Rio deal "Amazonian amnesia." Five hundred years of colonial history forgotten. Anything living (species samples that the colonial powers had already squirreled away in their own botanical gardens, zoos, aquariums, herbariums and gene banks from everywhere in the tropical and subtropical world) was to be considered property of the former colonizers.

1 United Nations, *World Economic and Social Survey 2011: The Great Green Technological Transformation,* Department of Economic and Social Affairs, New York, 2011. While the notion of a "green economy" has received much airtime in policymaking (and investment) circles – getting a big boost from the release of the UN Environment Programme's report in February 2011 *(Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication)* – the concept is still controversial. The G77, in particular, has questioned the appropriateness of the term, noting that the "green economy" should not replace or redefine sustainable development and highlighting the need for a better understanding of the green economy's scope, benefits, risks and costs.

2 For an uncritical yet useful explanation of ecosystem services, see the web site of the Australian-based Ecosystem Services Market Project: www.ecosystemservicesproject.org.

The South's diplomats in Rio didn't realize that the North had not only 74% of the world's zoos and aquariums but 93% of the world's known terrestrial and aquatic animal species and that samples of perhaps 85% of all documented plant species were already thriving in the North's botanical gardens and herbariums.[3] Directly and indirectly, the North also controlled well over two thirds of the crop species and genetic diversity in agricultural gene banks. In sum, at least 70% of the world's quantified biodiversity was already tucked away in the North.

The 1992 coup was so complete that a patent lawyer working for what was then called Ciba-Geigy (a pharmaceutical, seeds and chemical company that shortly afterward merged with Sandoz to form Syngenta) described the Rio treaty as a victory for intellectual property because governments also agreed that biological materials could, in theory, be patented –including all of the biological specimens scooped up by the North's collectors. Of course, the South still had in its rivers, forests and savannas the same species that were sequestered in Kew Gardens or Brooklyn or Berlin, but the North had the 'know how,' the 'know what,' and the means to monopolize.

Twitter will take care of the Democratic Deficit and climate change can be calmed with geoengineering. Policymakers no longer need policies; they simply have to subsidize the private sector's technologies.

Twenty years later, the single most important statistic for venture capitalists contemplating the financialization of nature is that since only 23.8% of the world's annual terrestrial biomass has been appropriated – or has entered the global marketplace – there is 76.2% remaining waiting to be monopolized by somebody. The big difference between 1992 and 2012 is technology. Whereas only the part of nature that was known to have value in 1992 – especially to the agriculture or pharmaceutical industries – was worth capturing, today synthetic biology and a host of surveillance and computational technologies can size up, seize and modify even the parts of nature not yet entered into taxonomy's ledgers.

Throughout Brazil's 20 years of military dictatorship, and through to the Earth Summit a few years later, the rallying theme for Brazil's social movements was the notion of "Liberation Theology" – the idea that social problems should be addressed with social policies backed by the people. Today, the rallying cry is for "Liberation Technology."

This is the notion that every social problem has a technological fix: hunger can be sated via biotechnology; the key to health is genomics; the answer to waning supplies of fossil carbon is synthetic biology; the solution to the Limits to Growth is nanotechnology; Twitter will take care of the Democratic Deficit and climate change can be calmed with geoengineering. Policymakers no longer need policies; they simply have to subsidize the private sector's technologies.

Industrial techno-fixes come from above and below. New technologies such as nanotechnology and synthetic biology allow industry to control the fundamental building blocks of nature. We are told, for example, that there are 10 billion different products for sale in cities like New York or Berlin. All of these products, however, come from relatively few materials: just 100,000 chemical compounds that, in turn, are reducible to fewer than 100 elements in the periodic table. Products derived directly from nature are thought to be simpler still – fewer than a dozen 'metabolic pathways' lead to virtually every commercially significant biological product, and just four nucleic acids – A, C, G, and T – pair up to form DNA. Industry sees the control of these fundamentals as the key to controlling all of nature.

Patents have been granted, ceding control over about one-third of the elements of the periodic table to patent holders when they use them at the nano-scale, and some nanotechnology patents apply to virtually every sector of the industrial economy from aerospace to agriculture and from pharmaceuticals to plastics. Likewise, patents are being granted to cover segments of DNA found in virtually every higher-order plant and in life processes and metabolic pathways critical to everybody from algae to oligarchs. In 1992, ownership over such things was almost entirely theoretical and thought by most to be fanciful. Now, it is commonplace.

This new ability to control from the bottom up – to gain monopoly over the fundamental building blocks of living and non-living nature – is changing the corporate landscape. When a single patent can apply to radically different sectors of the economy or lock up biomass that can be processed to make everything from petrol and paints to plastics and pasta, new corporate alliances become vital.

3 ETC Group (RAFI) *Communiqué,* "The Geopolitics of Biodiversity: A Biodiversity Balance Sheet," January/February 1996. Available online: www.etcgroup.org/en/node/470.

The Great Green Convergence

The struggle to control the Green Economy will be heavily influenced by three convergences not in play at the time of the 1992 Earth Summit: first is the convergence of the sciences; second is the convergence of industrial sectors; and third, is the convergence of financial power.

Since the turn of the millennium, the European Commission, along with the US and Japanese governments, has led other nations in conceptualizing the convergence of biology, physics and chemistry (supported by mathematics) into a single science whose common denominator is the atom.

All of nature, living and inert, is composed of atoms. The control of nature, then, means going 'upstream' to the source – the atom; or, depending on your perspective, going 'down' to the fundamental – the atom. The manipulation of inert nature has been interpreted as nanotechnology while the manipulation of living nature is most accurately described as synthetic biology. Both deal with atomic structures at the nano-scale. One focuses on the elements of the periodic table and the other focuses on base pairs of DNA. Industry now eyes everything of known economic value from these two starting points. In 1992, all this would seem reductionist and irrelevant, but today, the existence of the hardware (tools that allow nano-scale manipulations), the software (super-computing capacity) and the magnanimity of patent offices have made reductionism both possible and profitable.

Which leads, in turn, to the second-grade convergence: the coming together of historically diverse industrial sectors. DuPont, for example, is the world's sixth largest chemical company. It is now also the world's second largest seed company and sixth largest agrochemical enterprise. DuPont has still bolder plans to control biomass. Over the last few years it has built a web of relationships with such diverse enterprises as BP, Bio Architecture Lab, General Mills and Tate & Lyle to commercialize biofuels, maize-derived plastics, enzymes and specialty food ingredients.

Close to the other end of the power spectrum is a neonate company like Solazyme, using its convergence capacities to network with the US Navy and Defense Department, as well as with fossils like Dow Chemical and Chevron to produce renewable oils from algae. It is also working with food processors and traders like Bunge, Unilever, Roquette Frères, and Japan's San-Ei Gen to conjure up algae-based food ingredients.

A third potential "BioMasster" is a Swiss synthetic biology start-up called Evolva that is working to synthetically produce vanilla and another "key flavoring ingredient" with International Flavors & Fragrances, Inc. Among its other partners: the world's largest chemical maker, BASF, the world's fifth largest pharmaceutical enterprise, Roche, and the US Army Research Office.

Perhaps the most notable example of industrial biomass convergence is Amyris, a California company with ties to fossil carbon captains like Chevron, Shell and Total, car veterans like Mercedes-Benz do Brasil and Michelin Tire, and other agricultural, plastics and oil titans like Bunge, Guarani, Gruppo M&G and Procter & Gamble. Amyris began as a UC-Berkeley spinoff developing pharmaceuticals and has expanded to sugarcane-based biofuels and high value compounds for multiple purposes. Driving into converging lanes is not always safe, however. In early 2012, the company surprised its stockholders and investors by announcing that it was exiting the biofuels freeway because scale-up proved too difficult.

The third convergence contributing to the financialization of nature is the grandest of all. A 2011 study published by researchers at Switzerland's ETH Zurich, based on an analysis of 43,060 transnational corporations (TNCs) located in 116 countries, reveals that just 737 firms account for 80% of the value of all TNCs.[4] Most shockingly, 147 companies controlled nearly 40% of the monetary value of all transnational corporations in 2007, with the majority being financial intermediaries (investment banks, brokerage firms, insurance companies).

...the same 'sub-primates' who couldn't manage mortgages are, with the financialization of nature, being invited to go out and play in the garden.

On the Road to Rio, as governments assess the market value of every part of nature – from plants and animals to river basins, forests and ecosystems – they must bear in mind these three convergences. The convergence of science and industrial technologies benefit those with the scientific muscle to use it. The stunning concentration of financial power means, quite simply, that the same 'sub-primates' who couldn't manage mortgages – who quite literally trashed our houses – are, with the financialization of nature, being invited to go out and play in the garden.

4 Stefania Vitali, James B. Glattfelder, and Stefano Battiston, "The Network of global corporate control," arXiv:1107.5728v1, arXiv.org, 28 July 2011.

The Big Fossils Partnering with Synthetic Biology Companies

Company	Energy Sector Ranking, 2009	Chemicals Sector Ranking, 2009	Synthetic biology partner(s)
Royal Dutch Shell	1	8	Amyris, Codexis, Iogen
ExxonMobil	2	5	Synthetic Genomics, Inc.
BP	3	-	Synthetic Genomics, Inc., Verenium, Dupont, Amyris, Qteros
Chevron Corporation	5	-	Solazyme, ls9, Catchlight, Mascoma
Total SA	6	10	Amyris, Gevo
Petrobras	9	-	KL energy, Amyris, Novozymes
BASF	-	1	Evolva, Verenium, Allylix (with BASF Venture Capital)
Dow	-	2	Solazyme, Sangamo, Opx Biotechnologies, Algenol
DuPont	-	6	Bio Architecture Lab, Butamax

Source: ETC Group

Synthetic Biology: Bringing the Green Economy

New surveillance technologies, including satellite or aircraft-based 3-D hyperspectral imaging and numerous 'lab on a chip' technologies, are combining with cloud computing and database management technologies to make biological diversity (from industry's perspective) into nothing more than biomass. If, for example, the environmental stresses/opportunities in a specific place can be defined, then it follows that most or all of the plants or microbes there will have in common the DNA sequences that let them survive/thrive under those conditions. Equally, if a company is looking for certain traits then they need only look in places where the environmental stresses/opportunities would welcome those traits.

According to 'corporate think,' species and genetic diversity – while interesting – have decreasing commercial value since it is possible to corral, cypher and cyber away DNA sequences in company databases. It is no longer necessary, some believe, to collect or conserve the source species. Companies like Pacific Biosciences and Oxford Nanopore Technologies claim to be on the verge of decoding a complex genome from a single cell in 15 minutes for a few hundred dollars. Once decoded, the digital map can be beamed up to a data cloud, downloaded somewhere else, synthesized, tweaked (or not) and patented from anywhere in the world. The best way to monopolize biomass is via synthetic biology.

Synthetic biology companies are engineering synthetic DNA to custom-build microorganisms to behave as tiny 'biological factories' that can manufacture high-value products. While it's not the first time that researchers have tried to apply new biotechnologies to displace natural commodities (ETC Group – then RAFI – reported on similar efforts a few years before the first Earth Summit),[5] the level of current research and investment activity suggests that commercial viability could be near. In the past five years, synthetic biology has moved from being a 'fringe' science to an area of intense industrial interest and investment. The world's largest energy and chemical companies – the New BioMassters – are now buying, making strategic investments in or partnering with synthetic biology (synbio) companies, which are, generally, start-ups operating in stealth mode (few are publicly traded).

The BioMassters see synthetic biology as the route to an additional revenue stream – a 'green' complement to petroleum-based production, or possibly even its replacement in the distant future. Early adopters DuPont and ADM are already selling bio-based plastics derived from maize sugars. Genencor, which DuPont bought for $3.6 billion in January 2011, and Metabolix were the synbio brains behind the Sorona (DuPont) and Mirel (ADM) plastics. Genencor also has an ongoing agreement with Goodyear to produce synbio rubber for tires.

5 ETC Group (RAFI), *Vanilla and Biotechnology,* 1987. Available online: www.etcgroup.org/en/node/541.

In addition to the conventional sources of industrial biomass (e.g., maize, sugarcane), algae are getting attention as a source because they are plentiful, extremely fast growing, and high-yielding.

The BioMassters are looking seaward for new sugars and oils to fuel the bio-based economy, and maritime states already promote the green economy's aquatic equivalent: the so-called blue economy, in which natural products from the ocean are 'sustainably exploited' to drive economic growth. Small island states may not have much land, but some view their long coastlines and broader EEZ (exclusive economic zones) as potential wealth for biomass production. As the representative from Fiji reminded delegates at a Rio+20 preparatory meeting in 2011, "we are not 'small island' nations, but 'large ocean' nations."[6]

Synthetic Genomics, Inc. is engineering algae to produce a palm oil substitute and recently snagged a high-profile $600 million deal with ExxonMobil.[7] In March 2011, Monsanto announced it would both invest in and collaborate with US-based Sapphire Energy, another algal oil producer.[8] Monsanto is interested in the research because of what it might reap for agricultural applications in the form of crop traits.[9] Sapphire's CEO Jason Pyle explains the appeal of the partnership: "The biggest thing Monsanto brings is that it solidifies our hypothesis, that [in order to solve the problem of fossil fuels] you have to expand the resource base. It can't be about simply changing one thing into another. You have to create a new commercial agriculture."[10]

6 Statement by H. E. Mr. Peter Thomson, Permanent Representative of Fiji to the United Nations on behalf of the Alliance of Small Island States, Rio+20 Second Preparatory Committee Meeting, New York, 7 March 2011.

7 Katie Howell, "Exxon Sinks $600M into Algae-Based Biofuels in Major Strategy Shift," *The New York Times,* 14 July 2009.

8 Monsanto news release, "Monsanto Company and Sapphire Energy Enter Collaboration to Advance Yield and Stress Research," 8 March 2011. Available online: http://monsanto.mediaroom.com/index.php?s=43&item=934.

9 *Ibid.*

10 Jim Lane, "Monsanto invests in Sapphire: goes hunting for yield traits in the wild, wild wet," *Biofuels Digest,* 9 March 2011.

Today's (and Tomorrow's) BioMassters

In this section, we survey the industrial sectors poised to profit from the new 'green revolution.' We rely heavily on financial results from 2009,[11] which clearly reflect the global crisis of capital; several sectors saw flat growth or even sharp declines in revenue from 2008. While financial transactions slowed in 2009, market trends didn't change: all sectors remained highly concentrated, profits increased (companies touted their ability to 'do more with less'), and a top priority was the aggressive pursuit of new customers in emerging markets – particularly in the global South.

The table below provides a snapshot of how tightly the Top 10 companies control the markets that will be most affected by the green economy's marriage of agriculture and energy (with synthetic biology presiding). The company names and their 2009 revenues are provided in ETC Group's full report, *Who Will Control the Green Economy?*

11 We've used 2009 figures to allow for lag time in corporate reporting and variances in fiscal year calendars.

Concentration in 'Green Economy' Markets

Sector	Size of Global Market, 2009, US$ billions	% of market controlled by the top 10 companies
Food Retail	7,200	41 (of top 100's market share)
Energy	~7,000	25
Chemicals	~3,000	10
Food Processing	1,375	28
Animal Feed	N/A	52 (by volume)
Pharmaceuticals	837	37
Forestry	318	40
Biotech	92	62
Fertilizer	90	56
Pesticide	44	90
Seeds	27	73
Animal Pharma	19	76

Source: ETC Group, *Who Will Control the Green Economy? w*ww.etcgroup.org/en/node/5296

Sowing the Green Economy: Seeds, Biotechnology, Pesticides and Fertilizers

Commercial seeds, the first link in the agro-industrial food chain, are the starting place for crop-based feedstocks that will be used to produce energy and high-value chemical and consumer products. Major seed/pesticide enterprises are already hopping on the green economy bandwagon and fertilizer companies (with mining companies) are poised to profit. With skyrocketing demand for high-yielding plant biomass, the three macro-nutrients in chemical fertilizers – potash, phosphorus, and nitrogen – are hot commodities.

After gaining control of the commercial seed market, the world's six largest seed/agrochemical/biotech firms (BASF, Bayer, Dow Agrosciences, DuPont, Monsanto, Syngenta) now determine the current priorities and future direction of agriculture research worldwide. Together, these six companies account for almost $50 billion *per annum* in sales of seeds, biotech traits, and agrochemicals; they spend about $4.7 billion annually on agriculture R&D.

The Big Six firms are not just competitors; they're collaborators in tightly concentrated markets and are forging unprecedented alliances that render competitive markets a thing of the past. By agreeing to cross-license proprietary germplasm and technologies, consolidate R&D efforts, and terminate costly IP litigation, the world's largest agrochemical and seed firms are reinforcing their top-tier market power. For example: Monsanto has cross-licensing agreements with all the other Big 6 companies; Dow has cross-licensing agreements with four of the other five, and DuPont and Syngenta have entered agreements with three of the other companies.[12]

Private-sector seed companies supply an estimated two-thirds of all crop seed sales globally.[14] Worldwide market share of the three largest seed firms (Monsanto, DuPont, Syngenta) shot up from 20% of the proprietary seed market in 2002 to 53% in 2009.[15]

The Joy of Six: The World's Largest Seed, Biotech & Agrochemical Corporations, 2009

Company	Crop seed and biotech sales, US$ million	Ranking by global seed sales (% global market share)	Agrochemical sales, US$ millions	Ranking by agrochemical sales (% global market share)	Estimated % of crop R&D devoted to ag biotech
Monsanto	7,297	1 (27%)	4,427	4 (10%)	80%
DuPont	4,641	2 (17%)	2,403	6 (5%)	50%
Syngenta	2,564	3 (9%)	8,491	1 (19%)	15%
Bayer	700	7 (3%)	7,544	2 (17%)	85%
Dow	635	8 (2%)	3,902	5 (9%)	85%
BASF	-	-	5,007	3 (11%)	100%
Big 6 Total	$15,837	58%	31,744	71%	70%
Top 10 Total	20,062	73%	39468	89%	-

Source: ETC Group, Fuglie *et al.* [13]

12 Keith O. Fuglie, Paul W. Heisey, John L. King, Carl E. Pray, Kelly Day-Rubenstein, David Schimmelpfennig, Sun Ling Wang, and Rupa Karmarkar-Deshmukh. *Research Investments and Market Structure in the Food Processing, Agricultural Input, and Biofuel Industries Worldwide.* ERR-130. U.S. Dept. of Agriculture, Econ. Res. Serv., December 2011.

13 *Ibid.,* p. 38.

14 *Ibid.*

15 The 2009 figures come from ETC Group, *Who Will Control the Green Economy?*, December 2011. Available online: www.etcgroup.org/en/node/5296. The 2002 figure comes from ETC Group, *Oligopoly Inc. Concentration in Corporate Power 2003.* Available online: www.etcgroup.org/en/node/136.

By design, the commercial seed sector is inextricably linked to the agrochemical market. Five of the top 6 agrochemical companies also appear on the list of the world's biggest seed companies, and the one that doesn't – BASF – has significant partnerships with the biggest players in seeds. BASF's long-term collaborations involve every major crop and include a project with Bayer CropScience to develop high-yielding hybrid rice varieties, and a $2.5 billion R&D deal with Monsanto on stress-tolerance and yield in maize, cotton, canola, soybeans and wheat. In 2009, the global market share of the Top 10 pesticide companies topped 90% for the first time.

While global sales of pesticides were down in 2009 and 2010, the good news (for companies) / bad news (for the environment and human health) is that pesticide use in the developing world is rising dramatically. Bangladesh, for example, increased its use of pesticides by an astonishing 328% over the last 10 years.[16] Between 2004 and 2009, Africa and the Mideast posted the biggest increase in pesticide use. Central and South America are expected to experience the biggest increase in pesticide use to 2014.[17]

According to Datamonitor, the global fertilizer market withered by an astounding 37% in 2009, but the sector is on the rebound and the market will be worth more than $140 billion by 2014.[18] Almost half of the world's population lives on food produced with nitrogen fertilizers.[19] As the raw material resource grab intensifies, the fertilizer industry is undergoing rapid consolidation. In recent years, the biggest buyers have been the world's major mining companies. It's logical that mining companies – which already have the tools and technology to extract in-the-ground resources – would be scooping up fertilizer assets. Amid soaring food prices, companies are jockeying to have their shovels digging in the right rock at the right time to make the most profit.

Old Guard Green: Forestry/Paper and Grain Processors/Traders

The world's biggest forestry/paper companies represent the Old Guard BioMassters, with most tracing their corporate roots at least as far back as the 19th century. But that doesn't mean the forest giants aren't looking for new ways to increase profits, especially in the wake of a global recession that saw demand for building materials plummet. However, in a back-to-the-future move, forest companies are now selling wood and wood by-products to help meet 'renewable-energy targets' in the EU and USA.

Also veterans of the bio-based economy, most of the world's largest oilseed, grain and sugar processors have been buying, processing and selling biomass for decades (in the case of Dreyfus, Cargill and ADM, for more than a century). Just three giant enterprises, US-based grain traders/processors, Cargill, ADM and Bunge, handle the majority of grain that moves between nations.[20] These BioMassters are also looking for additional revenue streams in a green economy: six of the top 10 grain traders have partnerships with synthetic biology companies.

Food in the Green Economy I: Industrial Livestock

The effect of the **livestock industry** – the animals and the inputs used to produce them (feed, pharmaceuticals, livestock genetics) – on food security, the climate, human health and the bio-based economy is massive. By one estimate, livestock and their byproducts account for more than half of annual worldwide GHG emissions.[21] It takes 2500 litres of water to produce one industrial-raised hamburger, for example.[22]

16 Anon., "Pesticide use in Bangladesh tripled in 10 years," *AgroNews,* 22 September 2010. Available online: http://news.agropages.com/News/NewsDetail---3862.htm

17 According to a brochure for The Freedonia Group's report, *World Pesticides.* Available online: www.freedoniagroup.com/brochure/26xx/2664smwe.pdf.

18 Datamonitor, *Fertilizer: Global Industry Guide 2010;* highlights. Available online: www.datamonitor.com/store/Product/fertilizer_global_industry_guide_2010?productid=D84AF0F1-936C-42A1-8B54-EFAEB88F0485.

19 Yara International ASA. Available online: www.yara.com/doc/28899Yara_Financial_Report_2009.pdf.

20 Mary Hendrickson, John Wilkinson, William Heffernan and Robert Gronski, *The Global Food System and Nodes of Power,* August 2008. Analysis prepared for Oxfam America.

21 Robert Goodland and Jeff Anhang, "Livestock and Climate Change," *World Watch,* November/December 2009.

22 Arjen Y. Hoekstra, "Understanding the water footprint of factory farming," *Farm Animal Voice,* 180, 2011, pp. 14-15.

The **animal pharmaceutical industry** underpins the industrial livestock industry. In 2009, the top 10 companies controlled more than three-quarters of the animal pharmaceutical market, but the 2009 figures do not reflect the most recent consolidation trends. In March 2010, Sanofi-aventis (owner of Merial) and Merck & Co., Inc. (owner of Intervet/Schering-Plough) announced a joint venture to create the largest seller of animal drugs and vaccines in the world – overtaking number one ranking Pfizer.[23]

The **livestock genetics industry**, which controls breeding stock for commercial poultry, swine and cattle, is tightly concentrated in the hands of a few global players. Just three or four breeders dominate the market in livestock genetics for each major industrial livestock species. With control of livestock genetics so highly concentrated, the number of commercial breeding lines has diminished significantly. In sharp contrast to the centralized control of industrial livestock genetics, an estimated 640 million small farmers and 190 million pastoralists raise livestock. Over centuries, livestock-keeping communities have developed thousands of genetically diverse animal breeds, the source of traits such as disease resistance, high fertility and the ability to thrive in harsh conditions – essential resources for adapting to climate change. Yet, one-fifth are at risk of extinction, primarily due to growth of industrial livestock production.[24] We are losing one livestock breed per month.

Food in the Green Economy II: Food Processing and Retailing

The world's biggest buyers, sellers, and processors of bio-based products are the agro-industrial food manufacturers and retailers. According to Planet Retail, the global market for global grocery spending topped $7 trillion in 2009, which means people spent more on feeding themselves than they spent on anything else, including energy.[25]

The top 3 supermarket retailers – Walmart, Carrefour, Schwarz Group – account for almost half of the revenues earned by the top 10 companies, with Walmart's grocery sales accounting for one quarter. In 2009, for the first time, Walmart's grocery revenues accounted for over half (51%) of the company's total sales.[26]

The biggest trend in grocery retail is no surprise: rapid growth in emerging markets outpacing sagging sales in the North. By the end of 2011, China had out-consumed the United States to become the world's largest grocery market.[27] Brazil recently overtook France to become the fifth largest grocery market. The combined grocery markets of Brazil, Russia, India and China will be worth an estimated $3 trillion in just 4 years.[28] That's why supermarket titans are accelerating efforts to penetrate faster-growing markets in the South.

...global grocery spending topped $7 trillion in 2009, which means people spent more on feeding themselves than they spent on anything else, including energy.[25]

In May 2011, Walmart got a green light from South African authorities to acquire a controlling interest in Massmart Holdings Ltd. The chain is Africa's third largest retailer and operates in 14 sub-Saharan countries. Massmart is the first major acquisition by a top 10 retailer in sub-Saharan Africa. South African trade unions vigorously opposed the deal, referring to Walmart as "notoriously anti-union."[29]

23 Intervet news release, "Sanofi-aventis and Merck to create a Global Leader in Animal Health," 9 March 2010. Available online: www.intervet.com/

24 FAO, *The State of the World's Animal Genetic Resources for Food and Agriculture,* Rome, 2007. Available online: www.fao.org/docrep/010/a1250e/a1250e00.htm.

25 Planet Retail claims that it monitors over 90% of the world's "modern grocery distribution," in over 200 countries.

26 Anon., "Wal-Mart's grocery sales hit 51 percent," *Supermarket News,* 7 April 2010.

27 IGD news release, "China's grocery market overtakes the US as biggest in the world," 2 April 2012: Available online: www.igd.com/index.asp?id=1&fid=6&sid=25&tid=90&cid=2327.

28 IGD news release, "Walmart set to reach $0.5 trillion by 2014 – Tesco's global growth to outpace rivals," 17 February 2011. Available onlin: www.igd.com.

29 Anon., Times Live, "Cosatu Western Cape opposes Walmart," 28 September 2010. Available online: www.timeslive.co.za/business/article679659.ece/Cosatu-Western-Cape-opposes-Walmart.

Today, Walmart operates 338 shops in China, with 90,000 employees and annual sales of approximately $7 billion. Sounds impressive, but it amounts to less than 3% of the company's US-based sales. Meanwhile, however, Walmart is China's sixth largest export market, with more than 12% of China's exports to the United States ending up on Walmart shelves.[30]

Analysts predict that Russia's grocery retail market will double in value over the next four years – taking it from seventh to fourth position worldwide. Today, Russian grocery chains account for only 40% of food sales across Russia. The world's number-two grocery retailer – Carrefour – opened its first Russian hypermarket in June 2009. Just four months later, despite plans to open a chain of giant stores, Carrefour decided to abruptly pick up stakes and leave Russia. The reason? The company's strategy was to invest only in countries where it could be a market leader – and prospects in Russia were not promising.[31]

In 2009, 15 of the top 25 US-based food & beverage giants reported decreased sales, but 18 saw higher profits.[37]

India is under intense political pressure to scrap its national law that prohibits foreign firms from owning multi-brand retail chains. In the meantime, Carrefour, Walmart and Tesco are jockeying for top spots in India's giant consumer market – second only to China's – by establishing wholesale operations as joint ventures with local partners. Tesco is partnering with Tata, a national conglomerate; Walmart has a joint venture with Bharti Enterprises. What's India got to lose? After agriculture, retail is India's second-largest employer.[32] With an estimated 12 million small shops, mostly mom-and-pop (kirana) stores employing some 33 million people, India has the highest retail density in the world.[33]

With combined food revenues topping $1 trillion in 2009,[34] the top 100 food & beverage firms accounted for more than three-quarters of all packaged food products sold worldwide in 2009.[35] The top 3 companies, Nestlé, PepsiCo and Kraft, together control a 17% share of the revenues generated by the top 100 firms.[36]

Despite stagnant consumer demand in the North, volatile markets, and extreme weather events, less turns out to mean more for food & beverage giants during the prolonged economic downturn. In 2009, 15 of the top 25 US-based food & beverage giants reported decreased sales, but 18 saw higher profits.[37]

In 2009, the food & beverage sector saw 1,005 M&A transactions valued at $43 billion, but that was 73% less than the value of M&As in 2008.[38] In 2010, Kraft Foods bought British candy maker Cadbury. Nestlé picked up Kraft's frozen pizza business in North America, and PepsiCo became Russia's largest food & beverage firm when it acquired Russian juice and dairy company Wimm-Bill-Dann in 2011.

Foreign direct investment activity in the food and beverage sector is also flowing North. For example, in 2009, Mexico's largest dairy, Grupo Lala, acquired National Dairy Holdings from Dairy Farmers of America, Inc. In 2009, Brazilian beef processing giant JBS swallowed the country's third-largest beef company Bertin SA, and took a majority stake in Texas chicken company Pilgrim's Pride. After acquisitions in the USA, Australia, Europe and Brazil, JBS is the world's largest meat and poultry company. The company has the capacity to slaughter 90,000 cows every day.[39]

30 Dorinda Elliott, "Wal-Mart Nation," *Time,* 19 June 2005, and Ted Fishman, "The Chinese Century," *The New York Times,* 4 July 2004.

31 Matthew Saltmarsh and Andrew E. Kramer, "French Retailer to Close Its Russia Stores," *The New York Times,* 16 October 2009.

32 Ben Arnoldy, "Obama aims to deepen US economic ties with India. But what about Wal-Mart?" *Christian Science Monitor,* 5 November 2010. Available online: www.csmonitor.com.

33 Amrita Nair-Ghaswalla, "Plan panel allows FDI in retail before Obama's visit," *Tehelka,* 27 October 2010.

34 Personal communication from Leatherhead Food Research to ETC Group.

35 *Ibid.*

36 According to Leatherhead Food Research, the top 100 food & beverage firms had combined food revenues of $1,061,405 million ($1.06 trillion) in 2009. In 2009, the global packaged foods market was worth an estimated $1,375,000 million ($1.37 trillion).

37 Dave Fusaro, "After preparing for the worst, most food & beverage companies saw decreases in sales and increases in profits in 2009," FoodProcessing.com, 10 August 2010.

38 IMAP, "Food & Beverage Industry Global Report 2010," p. 5: www.imap.com/imap/media/resources/IMAP_Food__Beverage_Report_WEB_AD6498A02CAF4.pdf..

39 Steve Kay, "Acquisition Goals," MeatPoultry.com, 1 November 2009. Available online: www.meatpoultry.com.

A 'Healthy' Green Economy: The Pharmaceutical and Biotech Industries

Big Pharma and its little brother, the biotech industry, are purveyors of proprietary products that have always been steeped in green, being dependent on biological diversity and indigenous knowledge. It is conservatively estimated that at least 50% of the pharmaceutical compounds marketed in the United States are derived from plants, animals and microorganisms. It comes as no surprise, therefore, that six of the top 10 pharma companies have partnerships with synthetic biology start-ups.

Recent trends – Big Pharma's big bet on biotech; blockbuster drugs going off-patent; a clogged drug pipeline; a new focus on emerging markets and on personalized medicine – are all still in play.

Between 2010 and 2014, Big Pharma will lose patent protection on drugs that contribute more than $100 billion to its revenue – representing almost one third of the top 10 companies' combined pharma revenues.[40] Plummeting off the patent cliff doesn't spell certain death for Big Pharma, however. Tweaking drug formulations and patenting the 'new' drug can buy time; suing generic drug companies is an option, as is marketing "authorized" generics (i.e., putting its name and logo on generic formulations that fetch a higher price than non-branded generics). Biologics – biotechnology-based drugs – are more difficult to copy and a generic version may end up just 20% cheaper than the original. By contrast, sales of a conventional, proprietary drug drops 80% within the first year once a generic version comes to market. Most often, though, Big Pharma simply opts to 'pay-to-delay' – that is, they make cash payments to generic drug-makers for *not* bringing cheaper versions to market.

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No rising stars are waiting in the drug-development wings. In 2009, sales of new drugs (drugs entering the market within the last five years), accounted for less than 7% of total drug sales.[41] One study found that less than 10% of drugs reaching early-stage clinical trials today eventually make it to market.[42] In December 2010, Europe's top drug regulator cited the pharmaceutical industry's low level of successful drug innovation as a major public health concern as well as an enormous waste of money.[43]

Emerging markets are still the great hope for Big Pharma. Historically, 'the global pharmaceutical market' referred to markets in the United States, Europe and Japan; by 2025, those markets will account for less than half of the global market.[44] By 2015, China's drug market is expected to surpass Japan's to become the second largest market.[45]

With Big Pharma continuing to acquire biotech companies, biotech as a distinct sector is fading fast.[46] Big Pharma spends an estimated $65-$85 billion a year on R&D, and 25-40% of that is devoted to biotech.[47] In 2011, Big Pharma scooped up two more of biotech's top 10: Teva Pharmaceutical bought out Cephalon, and Sanofi-aventis acquired Genzyme for more than $20 billion.

Green Economy or Greed Economy?

Wall Street describes the energy industry as the "Mother of all Markets." Until about 200 years ago, however, the energy industry and the biomass industry were essentially one. We heated our homes with firewood; fueled our horses and oxen with hay; and lit our pathways with whale blubber. The steam engine and, later, the internal combustion engine turned the energy market from living carbon to fossilized carbon as coal. Then petroleum and natural gas took centre stage in our anything-but green economy. Whatever our fields and forests could do, we discovered, could be done by dinosaurs and the food they once ate (i.e., ancient carbon).

40 Burrill & Company, *Biotech 2011 Life Sciences: Looking Back to See Ahead,* San Francisco, CA: Burrill & Company LLC, 2011, p. 20.

41 *Ibid.,* p. 28.

42 *Ibid.*

43 Sten Stovall, "Europe's Drug Regulator Says Innovation Must Pick Up," *The Wall Street Journal,* 15 December 2010.

44 Burrill & Company, *Biotech 2011 Life Sciences: Looking Back to See Ahead,* San Francisco, CA: Burrill & Company LLC, 2011, p. 19.

45 Ben Hirschler, "China seen as No. 2 drugs market by 2015," *Reuters UK,* 8 November 2010. The prediction comes from IMS Health.

46 Anon., "Wrong Numbers?" *Nature Biotechnology,* Vol. 28, No. 8, August 2010, p. 761.

47 *Ibid.*

But the energy industry (including petrochemicals) never lost interest in living carbon and 'alternative' energy sources. ExxonMobil (then Standard Oil of New Jersey) positioned itself to control agricultural inputs by turning petrol stations into farm supply centres and producing fertilizers and chemicals. With the oil crisis of the early 1970s, Shell Oil, Occidental Petroleum, Atlantic Richfield and Union Carbide all moved into seeds. In the late '70s and early '80s, Shell bought more than 100 seed companies and briefly became the world's biggest multinational seed enterprise. In the early days of biotechnology, petrochemical and pharmaceutical companies sought new ways to monopolize living carbon – less through the control of crops than through biofermentation processes that, they theorized, would move agricultural production from fields to factories. Galvanized by the oil crises and the Club of Rome's Limits to Growth predictions, the energy market also moved to wind and nuclear power.

By the mid-1980s, the bloom was off energy's first Green Economy. Oil prices fell; biofermentation proved either premature or impossible; wind power failed to scale up; and nuclear power ran aground at Three Mile Island and Chernobyl. The oil majors dumped seeds and went into deep-sea drilling. Only chemical companies like Monsanto and DuPont (and, later, Syngenta) stayed to reap the monopoly profits from using biotech to merge their pesticides and seed sales.

But now they're back. The combination of Peak Oil and alarm over greenhouse gases and climate change have made the future profitability of fossil carbon more challenging and so the dinosaurs are returning to their historic habitat. Whatever fossil carbon can do, they assure us, living carbon can do as well. Instead of biotech and biofermentation, there is now synthetic biology promising to convert any kind of biomass into any kind of plastic, chemical, fuel or (even) food. It is not so much the Green Economy 2.0 as it is the Greed Economy x 2. The potential profits from merging fossil carbon and living carbon are huge. The energy market weighs in at about $7 trillion per year but the agricultural/biomass economy rings up at least $7.5 trillion in annual sales. Wall Street got it wrong: if energy is the Mother of all Markets, agriculture (or biomass) is the Fodder.

Geoengineering the Green Economy 1.0

The ultimate extension of Green Economy control is to dominate planetary systems – even the planetary thermostat. A year after the 1992 Earth Summit, the United States launched what became the first of a dozen ocean fertilization experiments in international waters. The United States was immediately joined by a number of self-proclaimed 'green entrepreneurs' hoping to sell carbon credits by sequestering greenhouse gases. Other governments also got involved, including Germany, Japan, UK, Canada and a half-dozen other states or institutions whose proximity to ocean test sites made their participation diplomatic.

The goal of each experiment was to dump iron particles into the ocean, nurturing a phytoplankton bloom that would ultimately sequester carbon dioxide at the sea bottom and, presumably, lower the Earth's temperature. Although successive experiments got larger, none was clearly successful and, in 2008 at the meeting of the UN Biodiversity Convention in Bonn, the world's governments called for a moratorium on ocean fertilization. The following year, Germany attracted international outrage when it went ahead with the world's twelfth major ocean fertilization test. The experiment was both a scientific and diplomatic disaster that served to reinforce the UN moratorium. Then, the London Convention on ocean dumping supported the moratorium and banned commercial experimentation altogether. The green entrepreneurs looked for greener pastures.

The ultimate extension of Green Economy control is to dominate planetary systems – even the planetary thermostat.

Geoengineering's greener pastures are mostly land-based. Scientific entrepreneurs and venture capitalists have come together to explore ways to suck GHGs out of the atmosphere via artificial trees or GM tree plantations. Each initiative claims to be the green economy's answer to global warming. To date, none of the mechanical approaches to carbon dioxide removal have made practical or financial sense and all of the so-called natural land-based initiatives require so much land (and so many resources) spread over so many boundaries that they are, at least currently, politically nonviable.

But the UK's Royal Society, the US National Academies, the UK Parliament, and the US Congress are taking geoengineering seriously and have shifted the scientific focus to so-called Solar Radiation Management (SRM), which proposes to lower the planet's temperature by blocking or deflecting sunlight. This can be done, theoretically, by whitening clouds with blasts of ocean salt spray or by blowing sulfate particles into the stratosphere, most probably via 20 to 30 km-high tubes held aloft by enormous helium balloons. These artificial volcanoes, scientists surmise, could keep particles in the stratosphere for up to two years at a time. However, it would require a continuous funneling of toxic dust (acid rain) from perhaps 50 or even several hundred pipes around the world.

Although costly, SRM, if it worked, would lower temperatures and could still be less expensive than global warming. Its big advantage for governments that have either ignored or denied climate change for decades is that they wouldn't have to change their industrial economies or irritate their voters with lifestyle modifications. At its next global meeting in 2010, two years after the Bonn decision to stop ocean fertilization, the UN's Biodiversity Convention broadened its moratorium to include all forms of geoengineering. But just as Germany tested the ocean fertilization moratorium with its 2009 dump, the UK, in 2011 – exactly one year after the UN decision – proposed to test the hardware needed for SRM by hoisting a hose above an old airbase to blow water into the sky. Civil society reacted both locally and globally and the European Parliament added its voice in a strongly-worded resolution opposing geoengineering.[48] In May 2012, the UK Research Councils involved announced the cancellation of the field trial.

...what some powerful governments felt entitled to do in the Cold War, they may also feel entitled to do tomorrow in climate's Hot War.

Despite international opposition, private companies, some scientific organizations and several governments continue to fund geoengineering research. As a result, the World Social Forum held in Brazil in early 2012 called on governments at Rio+20 to ban all forms of geoengineering. In negotiations leading up to the summit, governments have been reminded of the parallels to nuclear testing (and to test ban treaties) and to the 1977 UN Environmental Modification Treaty (ENMOD) that prohibits military manipulation of Earth systems.

The comparison is not fanciful: there is an alarming resemblance between the scientific hubris implied by today's climate quick fix and that of the geopolitical hubris of the Cold War. The Cold War's self-appointed guardians of global democracy launched 459 nuclear tests in the atmosphere and then another 685 subterranean atomic explosions, compromising groundwater, aquifers and soils, all the while asserting that there was no radioactive risk.[49] The testing grounds were the islands and atolls of the Pacific. The radiation did everything the scientists said it would not: ocean currents swept it from the southern Pacific to the shores of the Philippines, Japan and Taiwan, contaminating fisheries and food; the rice harvests of Asia became overloaded with strontium-90, and radioactive rain circled the globe.

The bottom line is that what some powerful governments felt entitled to do in the Cold War, they may also feel entitled to do tomorrow in climate's Hot War.

48 *European Parliament resolution of 29 September 2011 on developing a common EU position ahead of the United Nations Conference on Sustainable Development (Rio+20):* www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2011-0430&language=EN.

49 Toshihiro Higuchi, "Atmospheric Nuclear Weapons Testing and the Debate on Risk Knowledge in Cold War America, 1945-1963" in R. McNeill and Corinna R. Unger, eds., *Environmental Histories of the Cold War,* Cambridge University Press, 2010.

The Sorrow of Six – Green Technologies

'Clean green' technologies are at the center of the many special reports leading up to Rio +20. The question, "Who will control the Green economy?" is answered with, whoever controls the Green Economy's technologies. Understandably, governments have focused on access to know-how. Since 1992, however, costly, resource-wasting experience has taught that know-how must be accompanied by 'know-what' – assessment of the technology choices available – and 'know-why' – a participatory analysis of the socioeconomic and environmental needs a technology is to address. Technology transfer without technology assessment – even and especially under the intense pressure to respond to climate change and environmental deterioration – is dangerous. Here are six recent examples of where ostensibly clean green technologies may be wasting time and resources:

1. **Nuclear energy:** Governments spent $56 billion on the commercially unproven theory of nuclear fusion (1974-2008) but spent only $40 billion to improve energy efficiency.[50] Following Fukushima, many governments are abandoning nuclear technologies, but the costs of decommissioning power plants and storing radioactive wastes will be with us for millennia.[51]

2. **Synthetic fuels:** US synthetic fuel research in the 1980s assumed that the new technology would replace 25% of US oil imports. The program was cancelled after 5 years and almost $5 billion, reaching only 2% of its production target.[52]

3. **Biofuels:** Despite governments spending $20 billion annually subsidizing the development of second- and third-generation biofuels,[53] chemical giants such as Dow and heavily funded start-ups such as Amyris are jumping ship. According to *The Wall Street Journal,* the United States is unlikely to produce the 16 billion gallons of cellulosic fuel the government targeted for 2022.[54]

4. **Genetically Modified (GM) crops:** R&D in agricultural biotechnology has exceeded $16 billion but has impacted only four commercial crops – with highly-disputed results. For example, more than 130 types of herbicide-tolerant 'superweeds' have infested an estimated 60 million acres in the motherland of GM herbicide-tolerant crops, the United States.[55] Biotech has made plant breeding vastly more expensive – the cost of a genetically modified plant trait averages $136 million[56] compared to less than $1 million for a conventional variety. Across all biotech fields, the number of biotech start-ups receiving funding and private investment has dropped by almost one-third since 2007, and start-up shares last year sold almost a third below expectations. Some venture capitalists have stopped funding new biotech altogether.[57]

50 Charlie Wilson and Arnulf Grubler, *Lessons from the history of technology and global change for the emerging clean technology cluster,* International Institute for Applied Systems Analysis, Interim Report IR-11-001, January 2011.

51 Fred Pearce, "How to dismantle a nuclear reactor," *New Scientist,* 16 March 2012.

52 L.D. Anadon and G.F. Nemet, "The U.S. Synthetic Fuels Program: Policy consistency, flexibility, and the long term consequences of perceived failures." in A. Grubler and C. Wilson, *Energy Technology Innovation: Learning from Success and Failure,* Cambridge, UK: Cambridge University Press, 2012.

53 IEA, *World Energy Outlook: 2010,* Executive Summary, p. 9.

54 Angel Gonzalez, "BASF Backs Cellulose Start-Up," *The Wall Street Journal* electronic edition, 3 January 2012.

55 Carey Gillam, "Super Weeds Pose Growing Threat to U.S. Crops," *Reuters,* 20 September 2011; Emily Waltz, "Glyphosate resistance threatens Roundup hegemony," *Nature Biotechnology,* Vol. 28, No. 6, June 2010, pp. 537-538; Jack Kaskey, "Monsanto, Dow Gene-Modified Crops to Get Faster U.S. Reviews," *Bloomberg News,* 9 March 2012.

56 Phillips McDougall Consultancy, "The cost and time involved in the discovery, development and authorisation of a new plant biotechnology derived trait," *A Consultancy Study for CropLife International,* September 2011.

57 Jonathan D. Rockoff and Pui-Wing Tam, "Biotech Funding Gets Harder to Find," *The Wall Street Journal* electronic edition, 19 March 2012.

5. Wind energy: The oil crisis of the 1970s brought on intense interest in wind power, along with hefty government subsidies. The USA and Germany poured money into gigantic (and hurried) high-tech, top-down wind research programs. In contrast, Denmark took it slow, bottom-up, and continually adjusted designs to reflect experience. Between 1975 and 1988, the US and German governments together spent more that a half-billion dollars on wind power R&D – 25 times Denmark's investment – yet Danish manufacturers made better turbines, supplying 45% of total worldwide wind turbine capacity by 1990.[58] To be clear, the potential to use wind power is substantial, but it will be important to proceed slowly, carefully, and locally.

6. Nanotech: Since 2001, more than $50 billion has been invested in nanotechnology R&D with 'very little' to show for it. There is still neither an inter-governmentally accepted definition of nanotechnology nor agreed-upon methods for measuring or evaluating nanoparticles. Literally every week, scientific studies are published that raise concerns about the health and environmental impacts of nanoparticles. The only certainty is that nanotechnology is virtually unregulated anywhere in the world. If nanoparticles turn out to be – as some researchers have suggested – the "new asbestos," governments will have jeopardized taxpayer money – *and* the taxpayers. In 2009, private investment plummeted 40% and dropped another 21% in 2010. According to industry analysts, last decade's nano-buzz is being quickly replaced by 'cleantech' hype, with companies shifting emphasis to try to profit from governments' (renewed) focus on green energy.

No government can afford to waste its scientific and financial resources on bad science or sloppily-executed technologies. Few governments can afford to undertake their own technology assessment. The pace and power of technological change requires a capacity within the UN for technology assessment. Sadly, the world's experience with nuclear, nanotech and biotech shows that technology does not have to be scientifically-sound in order to be financially-profitable. Corporations and their investors need only persuade governments that they are in danger of missing out on 'the next big thing.'

Sadly, the world's experience with nuclear, nanotech and biotech shows that technology does not have to be scientifically-sound in order to be financially-profitable.

58 Matthias Heymann, "Signs of Hubris: The Shaping of Wind Technology Styles in Germany, Denmark, and the United States," 1940-1990, *Technology and Culture,* Vol. 39 No. 4, 1998.

Conclusions

In 1992, the Earth Summit's secretary general, Maurice Strong, proudly shipped the conference's documentation to delegates on a compact disc (CD). It was, as Summit leaders told one another, the beginning of the Knowledge Economy (as if economies were ever based on anything else). Several chapters of Agenda 21 picked up the theme and one chapter specifically championed the need to promote sustainable development through both the transfer – and the assessment – of technologies.

One year after the Earth Summit, however, the two organs in the United Nations system with a mandate to assess technologies were virtually eradicated. The UN Centre on Transnational Corporations (UNCTC) – the only international body capable of monitoring private-sector technologies and practices – was shut down entirely.

At the same time, the UN Center for Science and Technology for Development (UNCSTD) was dismantled and its remnants shipped from New York to a back office in Geneva. Shortly afterward, the US government closed down its respected Office of Technology Assessment. So, on the eve of the Knowledge Economy – as ICTs, the biosciences and nanotechnology were making their way into government budgets – the member states of the United Nations gave themselves a frontal lobotomy.

> ***It's time to restore social policy to socioeconomic and environmental problems and to make sure that technological 'know-how' is accompanied by our capacity to 'know what' and 'know why.'***

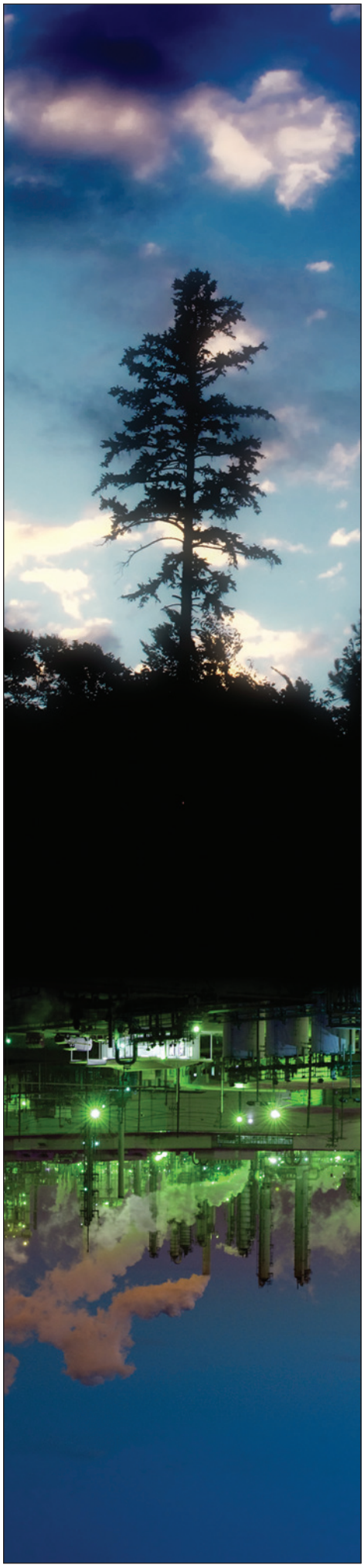
Rio+20 offers a real opportunity to strengthen democracy and peoples' participation within the UN system, and to take a crucial step forward by establishing a pathway for precautionary, inclusive technology evaluation. It's time to restore social policy to socioeconomic and environmental problems and to make sure that technological 'know-how' is accompanied by our capacity to 'know what' and 'know why.'

While the need to develop a multilateral mechanism for technology evaluation is urgent, it will take some time to make it properly and to make it function. In the meantime, extremely risky and dangerous technologies must be stopped or be subject to meaningful moratoria. Geoengineering is a case in point. Civil society organizations are urging governments at Rio+20 to oppose geoengineering and proclaim a comprehensive test ban across all sectors.

Much of the data used in this report comes from ETC Group's longer report, *Who Will Control the Green Economy?,* published in December 2011 and available online here: www.etcgroup.org/en/node/5296.

ETC Group has published several reports on issues related to Rio+20, including *Tackling Technology: Three Proposals for Rio* (Submission to Zero Draft) and *Moving Beyond Technology Transfer: The Case for Technology Assessment.* They are available online here: www.etcgroup.org/en/rio.

ETC Group's world map of geoengineering is available online here: www.etcgroup.org/geoengineeringmap.



Biomassters Battle to Control the Green Economy

The notion of a "great green technological transformation" enabling a "green economy" is now being widely promoted as the key to our planet's survival. The ultimate goal is to substitute the extraction and refining of petroleum with the transformation of biomass. Who will be in control of the future green economy?

In this joint report, the Heinrich Böll Foundation and the ETC Group reveal the new "Biomassters" and argue that in the absence of effective and socially responsive governance, the green economy will perpetuate the greed economy.

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