2014 Green Transition Scoreboard® Report: Plenty of Water!

Ethical Markets®

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Cover: NASA satellite Aqua MODIS, May 21, 2009
Phytoplankton bloom in ocean off New Zealand

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Executive Summary

For 2014, the Green Transition Scoreboard® (GTS) is focused on water, which added $484 billion to the overall total of $5.3 trillion of private investments tracked since 2007 in Q4 of 2013, 9% of the overall total and more than either the Green R&D or Cleantech sectors. Global policy makers, businesses and civic society are realizing that water is critical to environmental, social and human capital, and must be integrated into financial markets rather than overlooked as an externality.

In addition to Water, the GTS tracks Renewable Energy, Green Construction, Energy Efficiency, Green R&D and Cleantech, representing broad areas of investment in green technologies. Including Water, each covers an area of substantial capital investment in technologies which Hazel Henderson's years of research as a science advisor and which the Ethical Markets Advisory Board expertise indicate are continuing to contribute to the growing green economy.

Sector	Amount (USD, nearest billion)	
Renewable Energy	$	2,587,000,000,000
Energy Efficiency	$	1,103,000,000,000
Green Construction	$	512,000,000,000
Water	$	484,000,000,000
Green R&D	$	363,000,000,000
Cleantech	$	258,000,000,000
Grand Total	**$**	**5,309,000,000,000**

The upward trend we've reported since 2009 aligns with our recommendation that investing at least 10% of institutional portfolios directly in companies driving the global Green Transition appropriately updates strategic asset allocation models both as opportunities and as risk mitigation. This transition strategy is recognized in the 2012 report by Mercer which suggested 40% of portfolios should be in Green Transition sectors. This consensus validates models indicating that investing $1 trillion annually until 2020 can scale green innovations and reduce costs in material and energy efficiencies; wind, solar, geothermal and other renewable energy; sustainable land-use and forestry; smart infrastructure, transport, building and urban re-design.

Even omitting government and institutional investments, increasingly focusing on growing greener economies, $5.3 trillion in private investments and commitments puts private investors growing green sectors globally on track to reach $10 trillion in investments by 2020.

Our definition of 'green' is quite strict, omitting areas such as nuclear, clean coal, carbon capture & sequestration, and biofuels from feedstock other than sea-grown algae. We look closely at nanotech, genetic engineering, artificial life-forms and 3D printing on a case by case basis. Fossilized sectors are becoming increasingly stranded assets as their perverse subsidies are targeted, as low-carbon regulations are implemented and as oil, coal and gas reserves become more costly and harder to exploit. Green technologies and systems investments are the next evolution in finance as we learn more from earth systems science and the satellites tracking the condition on planet Earth.

GTS data sources include, among many others, well-respected Cleantech, Bloomberg, Yahoo Finance, Reuters; new UN and other international studies; NASA and individual company reports. Sources of financial data are screened by rigorous social, environment and ethical auditing

standards. They can be found in indexes such as Calvert, Domini and Pax World, the PowerShares Cleantech Portfolio, Dow Jones Sustainability Indexes, London's FTSE4GOOD, NASDAQ OMX Green Economy Global Benchmark Index, ASPI Eurozone and the many newsletters and stock reports from around the world we post daily at www.ethicalmarkets.com.

Renewable Energy – As installation costs decrease, growth in megawatts brought online continue to increase, out-pacing most conventional energy sources.

Energy Efficiency – The lowest hanging fruit and a "hidden energy source," efficiency includes lowering energy needs, using less energy than comparable products/processes or more efficiently using or lessening materials use.

Green Construction – Even as definitions tighten and this sector continues to be conservatively under-reported, only counting green construction materials and excluding labor, Green Construction continues to grow steadily.

Water - Despite being the most important commodity of life on this planet, investment opportunities in water are often overlooked, and the bulk of water on the planet, being saline, is largely ignored. Even so, those paying attention are funding steady growth.

Green R&D - Significant Green R&D shows sustainability integrated into a company's core strategy, a strong futures indicator for investors. A global commitment to sustainability is shown in the up-swell in green patents as those for fossil-fueled technologies remain flat.

Cleantech – One of the best performing sectors in private markets globally, extreme pollution in China, Korea's play for supply chain leader internationally and Japan's energy transition creating a demand for homeland solutions are driving cleantech as a high priority in Asia.

Part One – Overview

Water in a Global Context
By Hazel Henderson

The issue of providing water for our still growing human population is reaching crisis levels. Water is vital for agriculture and also key in energy production, as well as thousands of industrial processes worldwide. Floods and droughts in every region from Asia and Latin America to Europe and the USA accompanied unprecedented typhoons and winter storms. While none of these specific events could be linked directly to climate change, the debate surfaced as mainstream media began to cover these issues from a broader perspective. Accelerating the global transition to green economies, agreed to at Rio+20 by 191 countries in 2012, not only protects human health and the environment, but also can ease many geopolitical tensions over fossil fuels, including in the Middle East, China, India and recent crises in Ukraine involving Russia, the EU and the USA.[1] Multiple research reports confirm that renewable energy can continue growing even as subsidies are withdrawn and continue to favor fossil and nuclear power.[2] Influential NGOs pressured the World Bank and the European Investment Bank to phase out their coal plant financing, and also influenced similar restrictions on fossil fuel financing by the US Export-Import Bank, OPIC and the Nordic countries. Recently, ECA Watch's NGO campaign on Export Credit Agencies nudged the OECD to phase out its subsidies to fossil fuels.[3] Even ExxonMobil has acceded to shareholders and agreed to disclose the risks associated with its fossil fuel reserves.[4]

In this 2014 Green Transition Scoreboard® Report: "Plenty of Water!", we focus on water so vital for humans and all life on Earth. In our latest total of $5.3 trillion now privately invested in green sectors since 2007, 9% of these investments are in water management and conservation, well ahead of Green R&D and Cleantech. To date, most of the world's attention has focused on supply, protecting water sources from pollution, curbing wasteful use, and recycling the 3% of fresh water on our planet. Yet 97% of the water on Earth, which is saline, our oceans as well as salty lakes and brackish wetlands have been ignored in most policy, finance, business and public debates. At last, long unnoticed research on the 10,000 salt-loving halophyte plants which can grow in deserts and thrive on seawater is coming to light. Our Green Transition Scoreboard® (GTS) has reported frequently on the research and promise of saline agriculture,[5] noting that

[1] Cole, Juan. "Ukraine crisis shows urgency of green energy," Resilience, www.resilience.org, March 2014.

[2] "Let the Sun Shine," Clean Energy, The Economist, March 8, 2014, p. 29.

[3] Letter to Angel Gurria, Secretary General of the OECD, ECA Watch,March 25, 2014.

[4] Cardwell, Diane. "In Shift, Exxon Mobil to Report on Risks to Its Fossil Fuel Assets," The New York Times, March 20, 2014.

[5] Green Transition Inflection Point: Green Transition Scoreboard® 2013 Report, Ethical Markets Media, March 2013; Ho, Dr. Mae-Wan and Prof. Joe Cummins. "Saline Agriculture to Feed and Fuel the World," www.i-sis.org.uk, Feb. 18, 2013; Bushnell, Dennis. "Seawater/Saline Agriculture for Energy, Water, Land, Food and Warming," ed. Gad-el-Hak, Mohamed, Large-Scale Disasters: Prediction, Control and Mitigation, Cambridge University Press, 2008, p. 212; Glenn, Edward P., et al. "Irrigating Crops with Seawater," Scientific American, August 1998.

halophyte plants can provide humans with food, fiber, edible oils and biofuels. Indeed, the only biofuels that meet our GTS criteria are those based on algae grown on seawater.

Which Biofuels?

While many early biofuels start-ups in the US have failed, new companies with new methods and feedstocks have emerged. Some are using genetically engineered organisms and enzymes; others have gone public or linked up with old oil company giants. Most still overlook the most abundant resources available for producing biofuels as well as edible oils, food and fiber for humans: desert lands, sunlight and seawater!

AltEnergyStocks's report "10 Hottest Trends in Algae" lists India's Reliance Industrial Investments in Algae Tec, Algenol and Aurora Algae, while noting Sapphire Energy's joint development agreement with Philips 66 and Synthetic Genomics' agreement with ExxonMobil.[6] Solazyme's fermentation process is hooked up with Archer-Daniels-Midland to produce a variety of biofuels products. Heliae licenses its production technology to generate fuels, chemicals, nutraceuticals, proteins and enzymes for use in agriculture, retail and other markets. French firm Sofiproteol teamed up with Fermentalg to produce nutraceuticals including Omega-3 oils. In the US, Kentucky-based Martek Bioscience, now owned by Alltech, is also producing nutraceuticals and 1,800 tons of algae per year. Aurora Algae's commercial-scale plant in Australia grows an optimized strain of saltwater algae. This deep, well researched report includes how algae is used for scrubbing toxics out of wastewater, to utilize CO_2 and is highly recommended. Highlights from NASA's Dr. Dennis Bushnell's comments: "converting biomass into fuels is not the major issue; the major issue is raw capacity and interference with effects on arable land, fresh water, food, fodder, etc. Cyanobacteria and halophytes solve these concerns affordably and quickly."

Indeed, under-utilized, overlooked plants also mine more metals than all human mining activities, as I pointed out in *Creating Alternative Futures* in 1978. Today, plants' abilities to mine metals, phytomining, while simultaneously cleaning land polluted by toxic mining operations are finding new promoters. For example, some 400 known plants capable of hyper-accumulating nickel and other metals are being commercialized for water-saving production of metal and remediation of lands. Patents which locked up such phytomining expire in 2015, allowing new facilities to begin operation.[7]

Water-Energy-Food Links

Today, as water-related risks reach crisis levels, they are changing traditional risk analysts' focus on financial risk. In the World Economic Forum's "Global Risk in 2014", water rose to third place behind fiscal crises in key economies and structurally high unemployment/underemployment.[8] The UN General Assembly Open Working Group on Sustainable Development Goals (SDGs) cited water and drought issues high on its agenda while many countries' delegates voted to make oceans a stand-alone focus of the SDGs.[9] The International Renewable Energy Agency (IRENA) provides a welcome global focus on the needed

[6] Lane, Jim. "The 10 Hottest Trends in Algae," AltEnergyStocks, March 2, 2014.

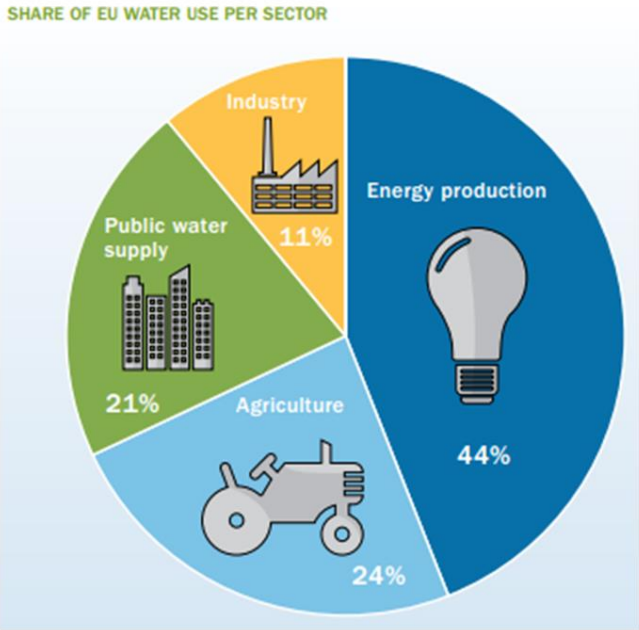
[7] Moskvitch, Katia. " Good to grow," NewScientist, March 22, 2014.

[8] Global Risks 2014, Ninth Edition, World Economic Forum, 2014.

[9] "Summary of the Eighth Session of the UN General Assembly Open Working Group on Sustainable Development Goals," Earth Negotiations Bulletin, IISD, February 10, 2014.

transition to renewable energy,[10] many forms of which will conserve water as well as provide electricity and better methods of desalination and treatment. Fossil-fueled and nuclear power plants are prodigious gulpers of water[11] – another reason for the shift to renewables. Additional risk factors focus on rising ocean levels and acidification as CO_2 emissions are absorbed by oceans which are heating faster than previous models predicted. This has led to renewed interest in ocean thermal energy conversion (OTEC) differentials as a source of electricity[12] along with ocean currents and wave energy technologies.

Embracing this broader view, the 14th Delhi Sustainable Development Summit connected the dots in February 2014: "Attaining Energy, Water and Food Security for All."[13] The International Conference on Sustainability in the Water-Energy-Food Nexus, May 19-20, 2014, in Bonn, Germany, takes the same systems approach. A NASA-backed research project at the US National Socio-Environmental Synthesis Center (SESYNC) presents an even broader view of a new post-carbon era based on analysis of the rise and fall of past civilizations.[14]



(from EWEA's *Saving water with wind energy*)

The Earth System Science program at NASA is the most comprehensive approach to understanding how our planet processes the daily free photons from the Sun, through the atmosphere and ocean currents, which combined with geothermal energy from Earth's core, create the conditions for life. A breakthrough in direct tapping of geothermal from high-temperature magma has been achieved in Iceland, feeding this energy directly into existing power facilities.[15] We have covered the recent rise in use of geothermal energy, and now reports show growing adoption in emerging economies.[16] This daily real-time data on how our planet functions and our human effects on it must now be cranked into all financial and business risk-analysis models, as I outline in *Mapping the Global Transition to the Solar Age: from Economism to Earth Systems Science*, with Foreword by NASA Chief Scientist Dr. Dennis Bushnell, who is also an expert on halophyte plants and saline agriculture.

[10] "Summary of the Fourth Assembly of the International Renewable Energy Agency: 17-19 January 2014," Earth Negotiations Bulletin, IISD, January 21, 2014.

[11] Sanders, Kelly T. and Michael E. Webber. "Evaluating the energy consumed for water use in the United States," Environmental Research Letters, 7 (2012) 034034 (11pp).

[12] Knight, Helen. "20,000 megawatts under the sea: Oceanic steam engines," New Scientist, March 1, 2014.

[13] 14th Delhi Sustainable Development Summit: Attaining Energy, Water and Food Security for All, February 6-8, 2014, http://dsds.teriin.org/2014/index.php.

[14] Ahmed, Fafeez. "The global transition tipping point has arrived – vive la révolution," The Guardian, March 18, 2014.

[15] Ayre, James. "Iceland: Major Green Energy Breakthrough Using Magma for Geothermal," CleanTechnica, February 5, 2014.

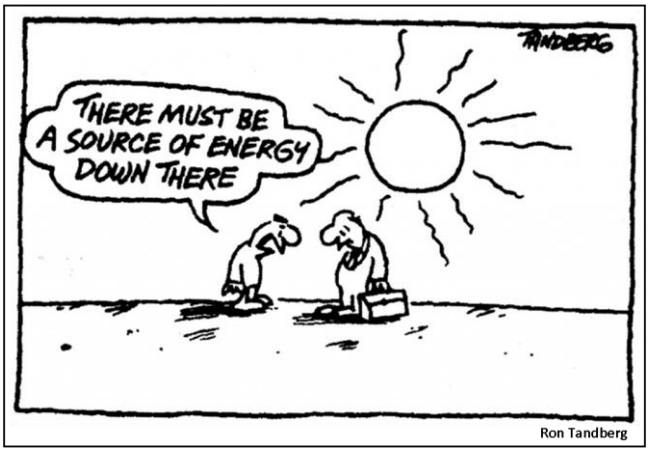
[16] Cichon, Meg. "Geothermal 2014 Outlook: As US Market Slows, A Global Focus Grows," Renewable Energy World, February 18, 2014.

Salt-water Agriculture

Bringing desert areas into food, fiber and fuel production by employing saline agriculture and thousands of salt-loving plants is now the lowest hanging fruit along with energy efficiency for humanity to address its myriad crises of tunnel vision: inequality, poverty, pollution, food, water, energy and political conflicts. Desert-greening science has been quietly maturing for decades with experiments in many countries in the Middle East, as well as in China, Mexico, and arid areas in the USA. Today, business plans are emerging, such as DESERTCorp's, initiated by the Planck Foundation in Amsterdam, as well as the work of Dr. Carl Hodges in Egypt and the USA[17]; Dr. Allan Savory's Savory Institute in Zimbabwe and Australia and the Grasslands Project in South Dakota, USA, with the Capital Institute[18]; the research of Dr. Mae-Wan Ho of ISIS in Britain; Dr. Wes Jackson's Land Institute in Kansas, USA; Janine Benyus at Biomimicry 3.8; Gunter Pauli at ZERI; physicist Fritjof Capra, with whom I co-authored *Qualitative Growth* (2009), and many other projects. We are proud that these scientists serve on Ethical Markets® Advisory Board.

A biofuels breakthrough was announced, January 2014, in Abu Dhabi that Boeing, partnering with the United Arab Emirates (UAE), is producing biofuel for jet aircraft from algae grown on desert land, irrigated with seawater. This Sustainable Bioenergy Research Consortium (SBRC) is affiliated with the MASDAR Institute. Director Dr. Alejandro Rio states, "The UAE has become a leader in researching desert land and seawater to grow sustainable biofuel feedstocks with potential applications in other parts of the world."[19] Other airlines are researching less sustainable forms of biofuel, but all seem to find that oils from tar sands and shale are too dirty for jet fuel and that oil companies seem unwilling to refine these dirty oils to the standards needed for aviation since they see the market as too small.[20]

Meanwhile, worries about shale fuels, their huge water requirements, methane emissions, pipeline leaks, earthquakes and other environmental problems include the multiple explosions of oil-carrying railcars.[21] The much-promoted US shale boom requires constant drilling, such as the 25,000 new wells a year needed in North Dakota's Bakken field to maintain output.[22] Even more hazardous are plans to set fire to huge amounts of buried coal and release its methane content in underground coal gasification for power plants.[23] The sheer destruction caused by digging in the earth for our energy, instead of harvesting the Sun's free photons, is matched by



[17] http://www.seawaterfoundation.org/index.html

[18] "Field Guide to Investing in a Regenerative Economy: Grasslands," Field Study No. 1, Capital Institute, 2010.

[19] "Boeing, United Arab Emirates Partners Look to Harvest Biofuel from Desert Plants," Masdar Institute, January 22, 2014.

[20] "Exclusive report – Boeing reveals 'the biggest breakthrough in biofuels ever,'" www.energypost.eu, February 8, 2014.

[21] Philips, Matthew. "Trains That Go Boom," BloombergBusinessweek, February 17, 2014.

[22] "Saudi America: the economics of shale oil," The Economist, February 15, 2014.

[23] Pearce, Fred. "Beyond Fracking," NewScientist, February 15, 2014.

the damage caused by industrial mining of metals and minerals rather than employing plants in phytomining enterprises, as mentioned in Water-Energy-Food Links.

Fragmented Industry Responses

Industrial responses to the water, food and energy dilemma have been incremental. We reported on some creative projects to substitute and reduce water use in our 2013 GTS report.[24] Big beverage companies Pepsi, Coke, Dr. Pepper, pushed back against new restrictions on sugary drinks proposed on health grounds in California. Coca-Cola is helping to repair national watersheds that also supply its own bottling factories, announced September 2013 by President Steve Cahillane and US Agriculture Secretary Tom Vilsack.[25] These water restoration projects in New Mexico, Michigan, California and Colorado all also provide water to Coke bottlers. Meanwhile, Governor Jerry Brown of California declared a drought emergency in January 2014, and President Obama announced $183 million in aid on February 14, 2014.[26] Brazil's 80% hydro-powered electricity is facing reservoirs 37% below capacity due to severe drought and rising consumption.[27] All of these efforts still focus, as do all water technology companies and projects, on that 3% of fresh water – while still ignoring the huge possibilities of desert greening using 97% of our planet's saline water.

At the same time, the oceans are being over-heated, by absorbing CO_2, over-fished and polluted by huge "gyres" of discarded plastics while acidity is killing coral reefs. So far, NGOs and voluntary efforts lead in addressing these issues, such as Vancouver-based Upcycle The Gyres (www.upgyres.org) and EU-based groups including Waste Free Oceans (www.wastefreeoceans.eu). The world's oceans are not only our life-giving resource, providing 40% of the planet's oxygen and more protein than beef, but also provide an inexhaustible supply of renewable energy as the planet's major solar "battery". Tapping wave-motion and ocean currents to produce electricity is now the business of many companies including Pelamis Wave Power, Verdant Power, Ecomerit and others. Oceans now warming from this CO_2 absorption[28] have revived interest and new companies in ocean thermal energy conversion (OTEC) and producing electricity from the temperature differential between warm surface and deep ocean water. The US Office of Technology Assessment reported on OTEC in 1978 during my tenure on its Advisory Council. [29]

Outside-the-box business models include Keurig Green Mountain's (KGM) $11 million grant to NGOs to help meet targets of providing clean water to a million people worldwide by 2020.[30] The University of Florida's new WaterFootprint tool allows farmers worldwide to measure

[24] Green Transition Inflection Point: Green Transition Scoreboard® 2013 Report, Ethical Markets Media, March 2013.

[25] Ward, Jennifer Inez. "Coca-Cola's new formula for water stewardship: government partnership," The Guardian, February 5, 2014.

[26] Onishi, Norimitsu and Davenport, Coral. "Obama Announces Aid for Drought-Stricken California," The New York Times, February 14, 2014.

[27] "Rain-checked," The Economist, February 15, 2014.

[28] "Globa Warming: Who Pressed the Pause Button?", The Economist, March 8, 2014, p. 81.

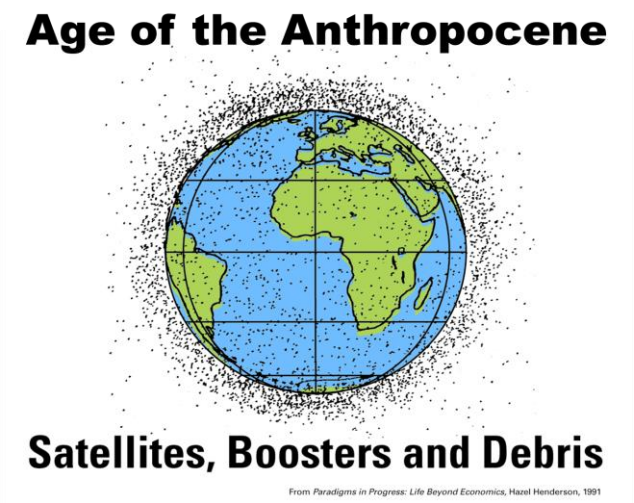
[29] Renewable Ocean Energy Sources: Ocean Thermal Energy Conversion, Office of Technology Assessment, Congress of the United States, May 1978.

[30] "Keurig Green Mountain Pledges $11M to NGOs Working to Solve Global Water Crisis," Sustainable Brands, March 21, 2014.

and reduce their water use.[31] Another approach is Free Is Better which distributed free water in recycled bottles which take 10 years to degrade (compared with PET plastic bottles which degrade in 1,000 years). The free bottles are distributed widely in Australia, displaying advertisers' logos. Their Project O seeks to make public water fountains more beautiful and available, backed by advertising giant M&C Saatchi. In cooperation with several city councils in Melbourne, Yarra Valley Water (YVW), a water utility company, launched their "Choose Tap" campaign in 2011.

Whole-systems Approaches Needed

Today's still fragmented "silos" of human attention and knowledge must be reintegrated with systems approaches. We can now see our global problems from the perspective of Earth and the Sun as two linked interactive planetary bodies – whose real-time interactions are visible by our satellite "eyes in the sky." These earth observing satellites, 120 of which are from many countries, orbit in space – beaming to policy-makers, finance and business the real conditions of humanity and all life on Earth. These broader perspectives illuminate investment decisions at Ethical Markets research conferences on "Finding Ethical Alpha" for asset managers co-sponsored by Endobility.[32]



Thus, many business groups now admit that the biggest risks to our common future are not financial risks, but the real world risks humans are creating in this Age of the Anthropocene, evidenced by the space junk orbiting the earth, as well as failures of leaders and the current business culture.[33] Corruption was a main driver of the 2008 financial collapse, and the LIBOR and similar benchmark-rigging scandals of today, together with high frequency trading (HFT), still overhang global financial markets with enormous risks.[34] Similar risks came from the uncertainties created by gridlocked politicians, many inept negotiators inexperienced in diplomacy. Others are busy battling ideologies with financial war chests from special interests, clinging to their subsidies or blocking legislative progress toward more equitable, cleaner, energy-efficient green economies.

BusinessWeek editorialized on these blockages to progress on renewable energy and climate change by describing the USA as "The Petro States of America."[35] Deeper analysis of macroeconomic models in US national accounts such as GDP illuminate the error I described in *The Politics of the Solar Age* (1981, 1988): the omission of energy as a basic factor of production, along with land and labor. This has allowed generations of investors and policymakers to overlook the basic laws of thermodynamics, and treat energy only as secondary, within this flawed price

[31] "Web tool successfully measures farms' water footprint," Science Daily, March 20, 2014.

[32] Finding Ethical Alpha, May 12-13, St. Augustine, FL, http://www.endobility.com/#!fea-home/c2058.

[33] Bonime-Blanc, Andrea. "The GlobalEthicist – The biggest risks nobody talks about," Ethical Corporation, February 5, 2014.

[34] Henderson, Hazel. "Global Finance Lost in Cyberspace," Interpress Service, November 2011.

[35] Hertsgaard, Mark. "The Petro States of America," Bloomberg BusinessWeek, February, 27, 2014.

system. I have continued to draw attention to this basic error, now highlighted by John A. "Skip" Laitner in his report of July 2013.[36] This report lays to rest the so-called "Jevon's Paradox" which was based within the faulty price system, as we have noted in the 2013 GTS report. A 2014 report from ACEEE finds that 50% energy savings in the residential sector can be achieved through deep energy retrofits.[37]

Breakdowns Drive Breakthroughs!

However, since breakdowns generally drive breakthroughs in human affairs, we find the outlook for renewable energy in 2014 and beyond is optimistic. We at GTS predicted this "tipping point" in our August 2013 Update. New financing has led the way, driven by the self-inflicted losses of centralized, fossil-fueled electric utilities we covered. The vulnerability of grids to sabotage is now recognized even by the Federal Energy Regulatory Commission (FERC) as requiring more dispersed energy, exactly what local micro-grids and decentralized solar, wind and efficiency provide.[38] An OECD-IEA report in 2014 finds that utilities need not block renewable power, but can integrate up to 45% without significantly increasing systems costs.[39] Energy storage is getting more attention, particularly by the US Department of Defense which has spent $145 million annually on energy storage programs since 2009.[40] Special Master Limited Partnerships (MLPs) and REITS, together with crowdfunding such as that of MOSAIC[41], along with tax credits, are now mainstreaming renewable energy finance, led by solar PV and CSP models, now cheap enough to be competitive with coal and nuclear.

Energy expert Jigar Shah sees extraordinary growth in solar through 2016 projecting between 7,000 to 8,000 megawatts in 2016, "which could easily double to 14,000 megawatts in 2016 alone," says Shah (i.e. 14 gigawatts).[42] Institutional Investor reports in February 2014 on the explosive growth of solar rooftop securitization worldwide. [43] SunEdison's Yieldco IPO represents a financial innovation that can capture value increases by retaining solar projects rather than selling them off, such as the added $158 million it added to its Q4 results in 2013. Such "Yieldcos" are

[36] Laitner, John A. "Skip". "Linking Efficiency to Economic Productivity, Recommendations for Improving the Robustness of the American Economy," American Council for an Energy Efficient Economy (ACEEE), Washington, DC, July 2013.

[37] Cluett, Rachel. "50% Energy Savings In The Residential Sector?", ACEEE, March 12, 2014.

[38] Wood, Elisa. "How Do We Really Protect the Grid from the Bad Guys?", RenewableEnergyWorld.com, March 24, 2014.

[39] The Power of Transformation -- Wind, Sun and the Economics of Flexible Power Systems, OECD-IEA, 2014.

[40] "Grid Energy Storage," US DOE, December 2013.

[41] Runyon, Jennifer. "Renewable Energy Outlook for 2014 Is Decidedly Optimistic," Renewable Energy World Magazine, February 11, 2014.

[42] Font, Vince. "The Solar Energy Outlook for 2014," Renewable Energy World, February 14, 2014.

[43] Stone, Nicholas. "Seeing the Light," Institutional Investor, February 2014.

gaining more investments for renewables, such as that issued by Pattern Energy for Wind Farms in 2013, and those of Brookfield Renewable Energy Partners and Hannon Armstrong. SunPower, Canadian Solar, Jinko Solar and Fist Solar are also planning "Yieldcos".[44] Other models include cooperatives such as Iowa-based Farmers Electric Cooperative (FEC) with 640 owners, rated the most reliable utility in Iowa.[45] New financial models are covered in the Cornerstone Journal of Sustainable Finance and Banking.

Even former US Treasury Secretary Robert Rubin now at Citi, nicknamed "Mr. Leverage," stated that "climate change is the issue of our day" at the UN Summit on Climate Risk, attended by former New York Mayor Michael Bloomberg, former Treasury Secretary Hank Paulson and a group of hedge fund and private investors, January 2014.[46] Carbon sequestration of power plant emissions is still costly and reduces output by 20%.[47] Calls for geo-engineering projects are gaining a hearing, such as Solar Radiation Management (SRM) to release thousands of tons of sulfur dioxide into the Earth's atmosphere.[48,49] These projects are highly risky and pose unknowable threats. We at GTS show all the easier, safer alternatives now available in our *Principles of Ethical Biomimicry Finance*™, citing many such companies providing investment opportunities. Research on the efficiencies of solar cells is advancing rapidly, based on biomimicry designs. New approaches to more efficient rechargeable batteries include breakthroughs in flow batteries and other designs based on using viruses[50] – not so far out now research has shown that viruses are key in producing fusion of multi-cell organisms and thus the evolution of many life-forms.[51] Battery advances, coupled with distributed solar and wind power as well as efficiency gains continue to challenge utilities and their profits.[52] Existing grids can be used in parallel to conduct DC (direct current) electricity much more efficiently and with less losses than existing AC (alternating current).[53]

Further evidence that the fossil-fueled Industrial Era is waning comes from an outrageous proposal by Daniel Abbasi of Game Change Capital, Stamford, CT, a private equity firm. Abbasi proposes that if one-fifth of fossil fuel reserves must remain in the ground, then governments could collect carbon taxes and instead of returning them to taxpayers, they could give them to investment firms to "incentivize" them into shifting their portfolios to green sectors[54] such as we track in the GTS. Another indication that the shift to the Solar Age I have predicted is now well underway! Many leaders now agree that the risks we humans have created for ourselves can be addressed by

[44] Montgomery, James. "SunEdison Launches Yieldco to Unearth, Leverage Solar Asset Values," Renewable Energy World, February 19, 2014 (disclaimer: Principals of Ethical Markets Media are invested in Hannon Armstrong.).

[45] Farrell, John. "The #1 Solar Utility is in … Iowa?," Renewable Energy World, February 19, 2014.

[46] Rose-Smith, Imogen. "People in the News: Risky Business: Risk Committee," Institutional Investor, February 2014.

[47] Bahic, Catherine. "Lock up your carbon," NewScientist, March 8, 2014.

[48] Civil Society Meeting on Geoengineering, Washington Geoengineering Consortium, November 4, 2013.

[49] Van Calmthout, Martijn. "Earth warms up quickly as artificial cloud disappears," Climate Change, February 18, 2014.

[50] "Saunders, Pete. "Going with the Flow Battery," Institute of Science in Society, http://www.i-sis.org.uk/index.php, March 12, 2014.

[51] Moskvitch, Katia. "Grow your power source," NewScientist, March 1, 2014; Slezak, Michael. "No viruses? No skin or bones either," NewScientist, March 1, 2014.

[52] "Devolving Power," The Economist, March 8, 2014, p. 69.

[53] "Can Parallel Lines Meet?" Technology Quarterly, The Economist, March 8, 2014, p. 6.

[54] Abbasi, Daniel. "A Call for Alternatives," Institutional Investor, February 2014.

shifting from unsustainable technologies and overuse of resources to investing in the global transition to cleaner, more equitable, knowledge-rich green economies. We welcome CERES "Clean Trillion" campaign,[55] as well as the Natural Capital Leaders Index (NCLI) from GreenBiz and UK-based Trucost.[56] We rejoice that the OECD, with 34 advanced country members, is fully on board with this global transition we cover with its global Green Growth Knowledge Platform.[57] My *Mapping the Global Transition to the Solar Age*[58] provides a broader planetary context based on earth systems science (downloadable from www.icaew.com and www.ethicalmarkets.com).

[55] http://www.ceres.org/issues/clean-trillion/clean-trillion

[56] Makower, Joel and Mattison, Richard. "Natural Capital Leaders Index: Identifying Corporate Sustainability Leaders," Green Money Journal, March 2014.

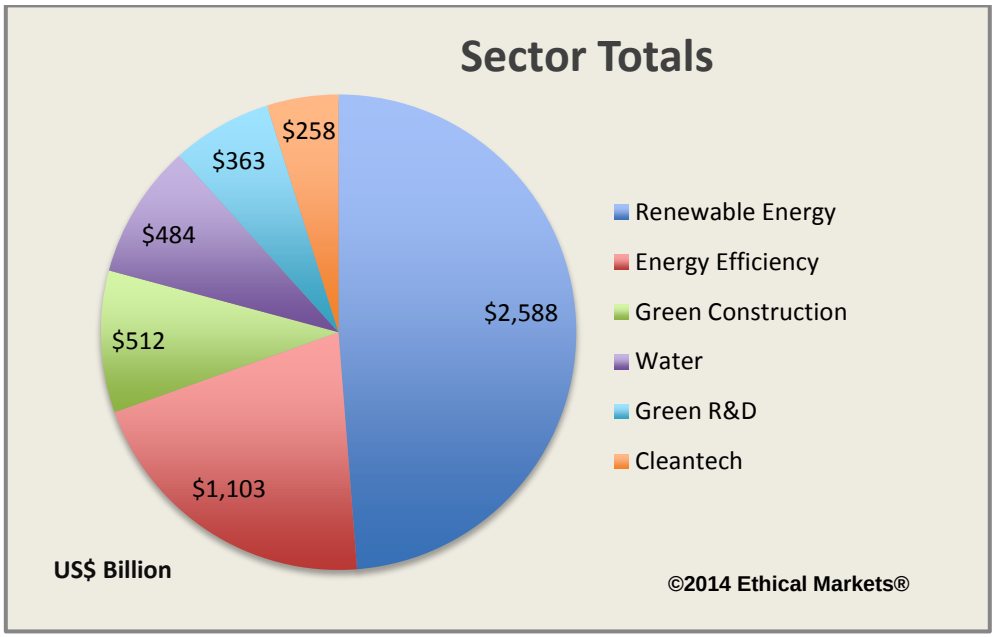
[57] Green Growth Knowledge Platform, www.greengrowthknowledge.org; One of its advisors is Simon Zadek, also on the Judges Panel for our EthicMark® Awards for Advertising.

[58] Henderson, Hazel. Mapping the Global Transition the Solar Age: From Economism to Earth Systems Science, ICAEW and Tomorrow's Company, London, February 2014.

Part Two – Sector Data

Sectors Covered

The Green Transition Scoreboard® (GTS) tracks private investments growing the green economy worldwide since 2007, totaling in Q4 of 2013 $5.3 trillion. The Green Transition Scoreboard® tracks six sectors: Renewable Energy, Green Construction, Energy Efficiency, Corporate R&D, Cleantech and this year adding Water. Of the top ten global trends for 2014, "inaction on climate change" and "persistent structural unemployment" are positively affected by growth in green sectors, as well as addressing the remaining eight such as "diminishing confidence in economic policies" and "widening income disparities".[59]



Governments and investors at all levels are turning their focus to growing greener economies as evidenced by the increasing number of conferences geared toward investing in green ventures, whether they name investments impact investing, values investing, alternatives investing or socially responsible investing. Focusing on the institutional level, we have long recommended investing at least 10% of institutional portfolios directly in companies driving the global Green Transition which provides a way to update strategic asset allocation models both as opportunities and as risk mitigation. For example, we recommend institutional investors shift from fossilized sectors which include increasingly stranded assets as low-carbon regulations are implemented and oil, coal and gas reserves become harder and more expensive to exploit.

[59] "Outlook on the Global Agenda 2014," World Economic Forum, 2013.

CERES is leading in this shift with its "Clean Trillion" campaign to invest $36 trillion, in addition to current investments, in clean energy—an average of $1 trillion per year for the next 36 years. The Clean Trillion focus from the business side is on supply chains and from the finance side on managing climate risk in investor portfolios.[60]

Internal (direct effect)	**Emergent Risk**	Climate change poses a potential future issue
	Reputation	A positive stance on climate change is important
	Sustainability	Eco-efficiency entails dealing with climate issues
	Security	Ensuring business continuity
	Cost Efficiency	Reducing energy use to save money
	Carbon Footprint	Attention to in-house emissions
External (indirect effect via clients or clients' assets)	**Hurricane**	Client exposure to this peril in particular
	Other Extremes	Client exposure to specific perils
	Other Impacts	Climate change seen as a general risk to clients
	Liability	Possibility of liability claims against clients
	GHG Regulations	GHG-related regulations may affect clients/assets
	Behavior Change	Carbon intensity of activities may mitigate or elevate risks

Insurer Climate Risk Disclosure Survey: 2012 Findings & Recommendations
CERES, March 2013

This transition strategy was recognized in the 2012 report by Mercer which suggests 40% of portfolios should be in Green Transition sectors.[61] This growing consensus includes several "fossil-free" portfolios[62] and validates models indicating that investing $1 trillion annually until 2020 can scale wind, solar and other renewables, energy and material efficiency, green construction, cleantech, corporate R&D, sustainable land-use, smart infrastructure, transport and urban re-design to accelerate the Green Transition globally, scale these innovations and reduce their costs. While the GTS tracks highly targeted sectors within the green economy, there is $13.9 trillion of assets under management incorporating environmental, social and governance factors in investment selection.[63]

What's Included

The Green Transition Scoreboard® sectors: Renewable Energy, Green Construction, Energy Efficiency, Corporate R&D, Cleantech and Water represent broad areas of investment in green technologies, many overlapping. Each covers an area of substantial capital investment in technologies which Hazel Henderson's years of research as a science advisor and which the Ethical Markets Advisory Board expertise indicate have contributed and are continuing to contribute to a sustainable future.

Companies, organizations and the sources of financial data included in the GTS are screened by rigorous social, environment and ethical auditing standards. They can be found in indexes such as Calvert, Domini and Pax World, the PowerShares Cleantech Portfolio, Dow Jones Sustainability Indexes, London's FTSE4GOOD, NASDAQ OMX Green Economy Global Benchmark Index, ASPI Eurozone, *Principles of Ethical Biomimicry Finance®,* as well as the many newsletters from around the world we post daily at www.ethicalmarkets.com. GTS data sources include the highly respected Cleantech, Bloomberg, Yahoo Finance, Reuters and many UN and other international studies, reports such as the Roen Financial Report, StockSmart and findings

[60] http://www.ceres.org/issues/clean-trillion/clean-trillion

[61] "Through the Looking Glass: how investors are applying the results of the climate change scenario study," Mercer, LLC, New York, 2012.

[62] "Beyond Fossil Fuels: The Investment Case for Fossil Fuel Divestment," Impax Asset Management, London, UK, July 2013; www.gofossilfree.org.

[63] "Global Sustainable Investment Review 2012," Global Sustainable Investment Alliance, January 2013.

from CSRHub, as well as individual company reports. Also tracked are the latest auditing standards for sustainability, including IIRC, SASB, ICAEW, Tomorrow's Company, Long Finance and others.

New to the GTS is inclusion of green bonds. Traditionally, green bonds have been issued by international financial institutions for governments and, hence, could not be included in the GTS. Green bonds now have entered the corporate bond market, showing phenomenal growth, with leaders such as Toyota and Unilever. SEB forecasts green bonds will represent 10-15% of the corporate bond market by 2020.[64] Emergence of green bonds can facilitate improvements in infrastructure as banks back away from long-term loans creating an opportunity for new entrants such as insurers, endowments, pension funds and sovereign wealth funds.[65] Opportunities are opening for smaller investors as green bonds become available in sufficient quantity and liquidity to generate retail options such as Exchange Traded Funds.[66]

What's Omitted

The GTS focuses on private sector investments, thus government funded projects and initiatives are purposefully omitted. Sustainable technologies suffer from the misperception that they cannot stand alone, reinforced by campaigns by fossil fuel companies that miscast the percentage of subsidies to renewable energy, which in reality go to fossil fuels.[67, 68] The GTS purposefully omits government funded projects and initiatives so as to bypass the continuing political debate over the allocation of subsidies. When government funding is part of a larger project, the research team has removed, in as far as is transparent, the portion of investments from government funds. In sectors for which separating out government investments is a challenge, an appropriate amount of the capital expenditure has been left out of the total. Even with the removal of government investments, the GTS still exceeds $5.3 trillion, proving that green technologies are competitive in today's market and are already cheaper than nuclear power,[69] as well as coal and oil when their external costs are included.

Our definition of 'green' is quite strict, omitting clearly unsustainable sectors as well as certain technologies having unsubstantiated claims, negative EROI or unexplored or untested consequences.

Despite arguments made that nuclear energy is a sustainable option, EROI from mining, enrichment, processing, transportation, and waste disposal and decommissioning costs are infrequently counted. Nuclear has enormous taxpayer subsidies, showing that nuclear is neither environmentally sound or sustainable. In the US, President Obama and Congress continue to secure loans to nuclear power by the Price-Anderson insurance provision of government underwriting, again because the market cannot internalize the risk. [70] China still hopes to become a global exporter of new designs, but its experimental projects introduce new concerns. Construction

[64] "Spring in the air," The Economist, March 22, 2014.

[65] "A long and winding road: Infrastructure financing," The Economist, March 22, 2014.

[66] Kidney, Sean. "First Green Bonds Index launched by Solactive," Climate Bonds Blog, March 17, 2014.

[67] Renewables Global Futures Report , REN 21, Paris 2013.

[68] Sills, Ben. "Fossil Fuel Subsidies Six Times More than Renewable Energy," Bloomberg News, Nov. 9, 2011.

[69] Blackburn, John (former chancellor of Duke University). "Solar and Nuclear Costs – the Historic Crossover," NC WARN, July 2010.

[70] "Price-Anderson Nuclear Industries Indemnity Act," Title 42 U.S. Code, Ch. 23.A.XIII (2006).

on a pebble-bed model reactor must go beyond Germany's abandoned pebble-bed prototype which cost $7.3 billion to decontaminate.[71] China's efforts in clean energy continues to capitalize on the country's lead in solar cell production. Their new 5-year plan moves further in this direction, embracing the "circular economy" model discussed by the World Economic Forum and the Ellen MacArthur Foundation[72] and by Dr. Mae-Wan Ho, ISIS.[73]

We omit coal carbon sequestration (CCS) due to its major government subsidies and huge costs, according to an MIT CCS study which projects costs would rise from the current 5 cents a Kwh to 8 cents (not including coal subsidies and externalities) from conventional energy sources.[74, 75] Still unproven, CCS would reduce the efficiency of coal-fired plants by as much as 40%.[76,77] The rush to shale-fractured natural gas in the USA can reduce use of coal since its burning emits 50% less CO_2, but these shale-gas deposits incur risks to water supplies and methane releases that increase their CO_2 emissions. Recent efforts to set fire to underground coal deposits to capture their methane are even more hazardous.[78]

Biofuels are omitted even though their use worldwide is growing, and our Part One – Overview puts their use in a broader planetary context. While local use of biomass recycled sustainably on small farms and other traditional uses in developing countries will continue, too much is invested in industrial-scale facilities and exporting, as well as in genetically modified microbes to produce fuels – dubious propositions for long-term sustainability. Research indicates that increasing production of crops, even inedible grasses, still requires water and land better suited for range or agriculture food production. Many corn-based ethanol plants have closed, and some $50 billion of US subsidies have been reduced but should be phased out along with mandates for 10% ethanol in US gasoline. The future of transport is more likely to be electrically powered as super capacitors which store electricity differently from batteries are used in electric and hybrid cars to store braking energy.[79] As noted in Water in a Global Context and the Water sector, exceptions are made for biofuels from algae or halophyte plants grown on seawater.

Several emerging technologies have been purposefully omitted either because of controversy or lack of consensus that they will make a long-term contribution to sustainability. Most proposals for "geoengineering" such as the so-called Solar Radiation Management are critiqued in the Part One – Overview as risky and speculative. Nanotechnology may be appropriate in particular projects if further research concludes it is sustainable, without detrimental effect to life. Particularly worrying are the nanotech particles already present and untested in our food supply, cosmetics and household products.[80] 3-D printing has enormous potential, however its use to manufacture destructive products such as weapons and the toxicity of its many chemical

[71] "China's Nuclear Muscle," Bloomberg Businessweek, Feb. 25-March 3, 2013, p. 11.

[72] "Towards the Circular Economy," Ellen MacArthur Foundation Report, vol. 3, 2014.

[73] Ho, Mae-Wan. "Circular Economy at Davos," Science and Society, April 2013.

[74] Hamilton, Michael, Howard Herzog and John Parsons. "Cost and U.S. public policy for new coal power plants with carbon capture and sequestration," Energy Procedia 1 pp. 4487-4494, 2009.

[75] "Dig Deep." The Economist, June 21, 2008.

[76] Hamilton, Michael, et al., op. cit.

[77] US Budget FY 2012.

[78] Pearce, New Scientist, op. cit.

[79] "Exploring Super Capacitors to Improve Their Structure," www.sciencedaily.com, Feb. 18, 2013.

[80] Belli, Brita. "Eating Nano," E-The Environmental Magazine, vol. XXIII, no. 6, December 2012.

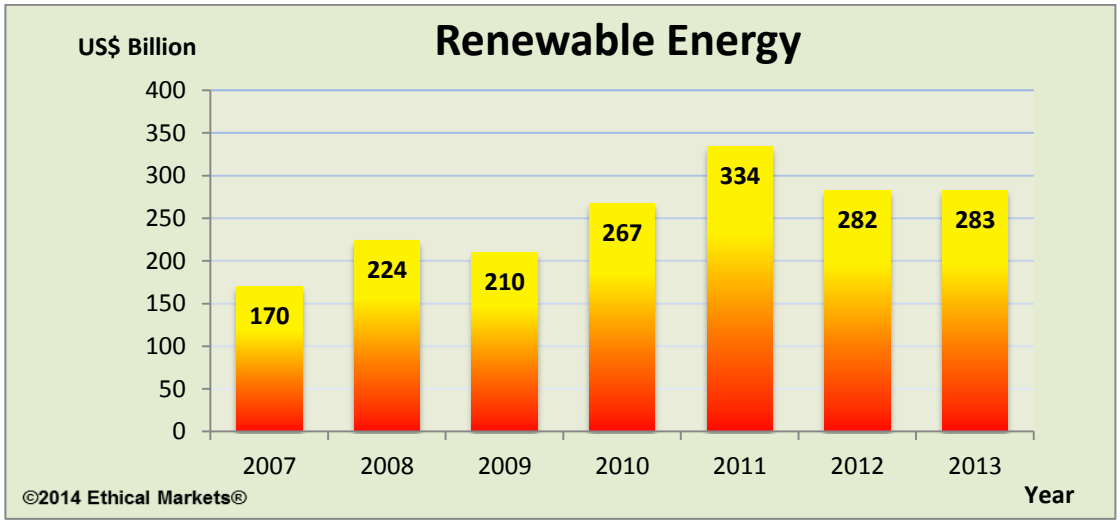
components require prudent observation and inclusion only on a case by case basis. For similar reasons, we exclude genetic engineering and artificial life-forms.

Notes

- International investments are reported in US dollars, subject to fluctuating exchange rates.

Renewable Energy

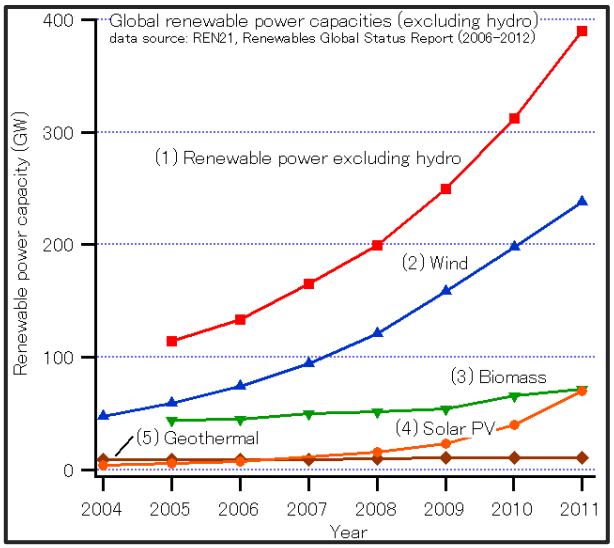
Investments in **Renewable Energy** include private technology development, equipment manufacturing, project finance and M&A activity. The sector is divided into current investments by year of funding and future commitments. Many of the current investment numbers are based on global trends reporting by Bloomberg New Energy Finance under contract with UNEP[81] as well as other international studies. This is the largest sector in this report which from 2007 to 2012 reached $2.6 trillion in investments and commitments.



Perceived declines in the Renewable Energy sector are due to changes in commitments as projects come online with lower-than-budgeted installation costs or are abandoned. For example, the $542 billion Desertec project (a Club of Rome initiative to provide 15% of energy needs to the European Union from the Sahara) is included in the commitments section even as work is now proceeding in Saudi Arabia, Morocco, Tunisia and the "Asian Supergrid" promoted by Japan, and will be modified as projects come to fruition.

[81] McCrone, Angus, Eric Usher, Virginia Sonntag-O'Brien, Ulf Moslener, Jan G. Andreas and Christine Grüning. "Global Trends in Renewable Energy Investment 2011," United Nations Environment Programme, Frankfurt School UNEP Collaborating Center and Bloomberg, 2011.

Total installation of renewable energy by megawatt continues with an upward trajectory.[82]

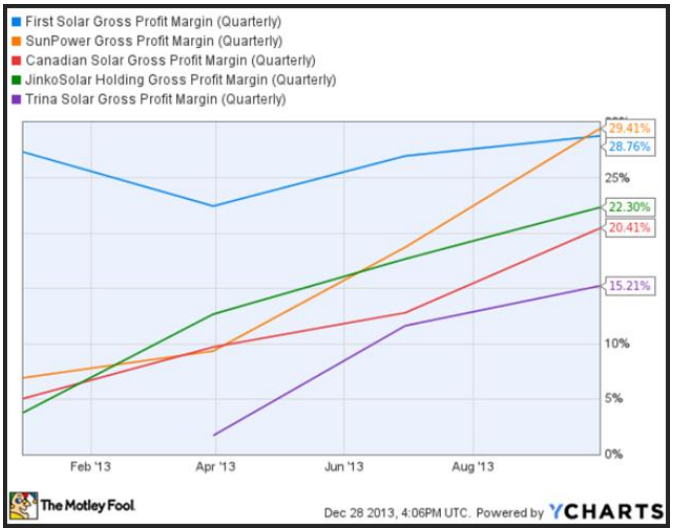


Commitment numbers have been compiled project by project from daily monitoring by Hazel Henderson, online research and other sources, posted at www.ethicalmarkets.com on our Green Prosperity, Energy Efficiency, GreenTech, SRI News, Trendspotting and Earth Systems Science pages. Future commitments include those from big US banks such as Bank of America, Goldman Sachs and Wells Fargo which have committed $50, $40 and $30 billion respectively.[83]

Good News for Growth

Important to the Renewable Energy sector is the growth of renewable energy in developing countries, as the percentage of investments in Europe and the US steadily decline.[84] A huge number of renewable energy auctions in emerging economies support the growth trend. For example, in countries and regions such as Brazil, South Africa, Japan, the Caribbean and the Middle East, a government will commit to a certain capacity, say 200MW of offshore wind, and accept the most competitive bid.[85]

Particularly for solar, the Green Transition is having the affect predicted by the models used in our research. While dollar amount investments in solar have declined, the number of installed megawatts has increased significantly because installation is significantly cheaper. In the US, for example, more solar has been installed in the last 18 months than in the previous 30 years. Installed solar PV in 2013 was up 41% over 2012 and nearly fifteen times the amount installed in 2008.[86] Globally, two-thirds of solar PV capacity worldwide has been installed since January 2011, and the price for solar PV modules has fallen 62%.[87]



[82] Renewables 2013 Global Status Report, Ren21 Secretariat, Paris, 2013.

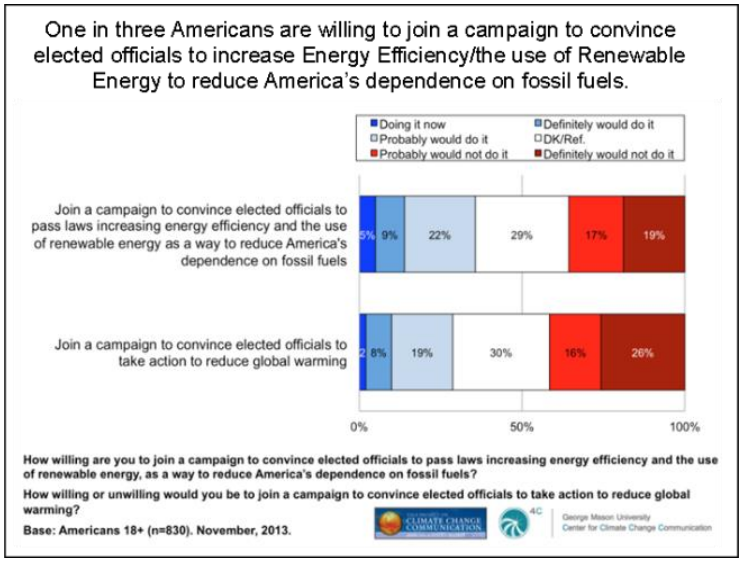
[83] "Bank of America Announces New $50 Billion Environmental Business Initiative," Bank of America Newsroom, June 11, 2012; "Goldman set $40 bln clean energy investment plan," Reuters, May 23, 2012; "Wells Fargo: $30 Billion in Green Economy Loans by 2020," SustainableBusiness.com News, April 23, 2012.

[84] "Renewable energy country attractiveness indices," Ernst & Young, Nov. 2012, Issue 35.

[85] See for example, Nielsen, Stephan. "Jamaica Gets 85 Inquiries for Renewable Energy Auction," Bloomberg.com, Jan. 18, 2013.

[86] "US Solar Market Insight Year in Review 2013," SEIA, Washington, DC, March 2014.

[87] Lacey, Stephen. "2/3rds of Global Solar PV Has Been Installed in the Last 2.5 Years," GreenTechMedia, August 13, 2013.

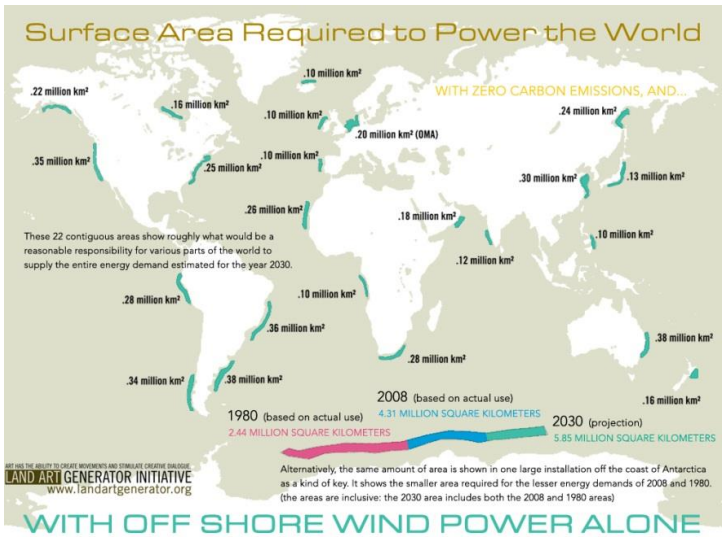


A Zogby Analytics poll of US homeowners in January 2014 found 88% believe renewable energy is important to America's future; 69% want more options; while 75% disagree that electric utilities should be able to block customers from installing solar power, energy storage and other onsite systems.[88] Corroborating these findings, 91 communities in Illinois provide 100% renewable electricity to their residents.[89]

Asset managers, particularly at pension funds are being stressed by labor unions and student movements to redeploy their portfolios from big fossil-fuel and nuclear projects to renewable energy companies. Retraining for such portfolio managers in ESG and "triple bottom line" analyses is now offered at Scotland's St. Andrews University and other courses. Ethical Markets-Endobility research conferences, Finding Ethical Alpha, deepen information for asset managers in earth systems science and biomimicry.

Fossil Fuels Slow Decline

Despite support for reducing subsidies voiced by David Lipton of the IMF noting "subsidy reform can lead to a more efficient allocation of resources, which will help spur higher economic growth over the longer term,"[90] mal-investments in petroleum, coal and gas continue, which the IMF estimates at $1.9 trillion worldwide through direct subsidies, consumer rebates and avoided taxes on pollution.[91] Concentrated mostly in the Middle East, Asia, Central Europe and countries of the former Soviet Union, subsidies have risen 40% in the Ukraine since 2007. The IMF projects that removing energy subsidies will "strengthen incentives for research and development in energy-saving and alternative technologies," allowing private investments to "crowd-in."[92] The tremendous waste of capital to fossil-



[88] "US Homeowners on Clean Energy: a clean energy briefing for the C-Suite," SolarCity, CleanEdge, NASDAQ, March 2014.

[89] "Leading from the Middle: How Illinois Communities Unleashed Renewable Energy," Englum, Lynn, et. al., editors, WWF, ELPC, Sierra Club, ISEA, GW Solar Institute, LEAN Energy US, Go Clean Go Local Coalition, March 2014.

[90] Lipton, David. "Energy Subsidy Reform: The Way Forward," International Monetary Fund, March 27, 2013.

[91] Clements, Benedict, et. al. "Energy Subsidy Reform: Lessons and Implications," IMF, January 28, 2013.

[92] Ibid.

fuel subsidies due to theory-induced blindness will continue until energy efficiency and exergy are included in economic models (see Water in a Global Context), pollution taxes, including on carbon, take hold and external costs are fully reflected in financial models, corporate balance sheets and national accounts, as is happening in Indonesia and Malaysia and being considered in Egypt and India.[93]

Metrics are slowly changing at all levels as science-based research replaces theoretical models based on outdated economic assumptions. Coal faces encroachment from hydroelectric, solar PV, onshore wind, biofuels and geothermal which, together with other renewables, provide 20% of global power generation and are predicted to provide 25%, according to the International Energy Agency, by 2018.[94] BP predicts that renewables will continue to be the fastest growing energy sector, outpacing natural gas, the fastest growing fossil fuel, and supplying more of the world's demand than nuclear will by 2025.[95] Geothermal technologies are being redesigned to respond to the need for flexibility, addressing the question of intermittency, without imposing significant cost.[96]

Investments in renewable energy are expected to grow significantly in the next several years, in large part thanks to the inherent financial, manufacturing and functionality flaws of fossil fuels. Corporations are acknowledging the hit to the fossil fuel industry. Goldman Sachs cautions that coal mining and infrastructure "projects will struggle to earn a positive return," based on environmental regulations discouraging coal-fired generation, energy efficiency improvements and strong competition from gas and renewables, for example, recognizing onshore wind power as a mature technology.[97] Cloud Peak Energy recently passed on the lease to an estimated 149 million mineable tons, stating that "in combination with prevailing market prices and projected costs of mining the remaining coal, we were unable to construct an economic bid."[98] Existing nuclear infrastructure is threatened, less due to often mentioned safety concerns, but because many nuclear reactors face "economic abandonment."[99] In the US, four nuclear reactors have been retired: one for lack of competitiveness and three others because of excessive costs of repair.[100]

The promise of "100 years" of shale gas is based on misrepresentation of recoverable shale gas, much of which is only **potentially** recoverable. Shale gas production has plateaued since December 2011. According to energy industry expert Bill Powers, cheap gas, the increase in industrial, commercial and residential demand and the electric power industry's switch from coal to natural gas as feedstock will send shale gas prices soaring, leading renewables to "grow substantially as technology improves and gas prices rise."[101] Other analysts see US shale gas as

[93] "Fuelling controversy: the economic case for scrapping fossil-fuel subsidies is getting stronger," The Economist, January 11, 2014.

[94] "Renewable Energy 2013: Market Trends and Projections to 2018," International Energy Agency, 2013.

[95] "Energy Outlook 2035," BP Plc., January 2014.

[96] Trabish, Herman. "California Grid Operator Asks Geothermal to Help 'Feed the Duck,'" GreenTechMedia, June 28, 2013.

[97] "Window for thermal coal investment is closing," Rocks & Ores, Goldman Sachs, July 24, 2013.

[98] "Cloud Peak Energy Inc. Confirms It Did Not Bid on Maysdorf II North Tract LBA," press release, Cloud Peak Energy, August 21, 2013.

[99] Cooper, Mark. "Renaissance in Reverse: Competition Pushes Aging US Nuclear Reactors to the Brink of Economic Abandonment," Institute for Energy and the Environment, Vermont Law School, July 18, 2013.

[100] Ibid.

[101] Powers, Bill. Cold, Hungry and in the Dark, New Society Publishers, 2013.

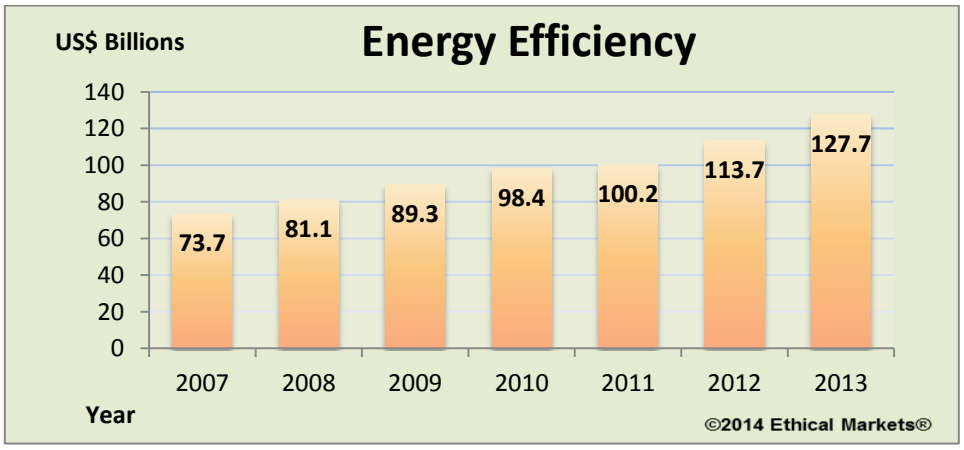
a bubble.[102] An example is the Bakken field in North Dakota where 25,000 new wells must be drilled annually to maintain production levels (see Part One – Overview). The US military is opting for solar over shale gas as often as possible, as life-saving (deadly convoys), back-saving (solar cells embedded in backpacks) and cost saving measures,[103] and major players BP, England's BG Group and Canada's Encana have taken write-downs on their assets.[104]

Notes

- Biofuels are omitted, as mentioned in What's Omitted, because biofuel production competes with food production and because studies, such as that from Cornell and Berkeley, show that biofuels have a negative EROI.[105] Yet biofuel production still proliferates as noted in our Part One – Overview, much of this unsustainable due to subsidies. However, amounts for 2010, 2011 and Commitments (see Appendix 1 – Investment Totals) are aggregates from industry and company press releases, limiting our ability to remove all Corporate R&D or biofuels.
- As a rule, Corporate R&D is omitted here and reported in Green R&D to avoid double-counting.
- Government R&D is omitted in our practice of removing public investments.

Energy Efficiency

Investments in **Energy Efficiency** include conservation efforts and initiatives and products focused on lowering energy needs or using less energy than a comparable product. Widely considered the lowest hanging fruit for investors, efficiency provides ROI in less than 2 years in most cases. Investments in efficiency reached $1.1 trillion in total Green Transition investments, appropriately second only to Renewable Energy.



[102] Hodge, Nick. "Peak Oil: It's Baaaack," Energy and Capital, March 12, 2014.

[103] Evans-Pritchard, Ambrose. "Solar power to trump shale, helped by US military," The Telegraph, August 14, 2013.

[104] Engdahl, F. William. "The Fracked-up USA Shale Gas Bubble," Global Research, July 14, 2013.

[105] Pimentel, David and Patzek, Tad W. "Ethanol Production Using Corn, Switchgrass and Wood; Biodiesel Production Using Soybean and Sunflower." Natural Resources Research, vol. 14, no. 1, March 2005.

As with Green Construction, definitions are in flux, leading us to use discretion to avoid double-counting when comparing different reports. Energy Efficiency broadly counts: heat, power, waste to energy; improvements in construction materials such as windows, insulation and lighting; hybrid vehicles and charging stations; biomass (see What's Omitted) and waste management, and smart grid.

Citizens' demand for energy efficiency is increasing, as they recognize its importance to energy independence.[106] In some cases, as with public transportation, individual behavior is driving the change. In the US, there were a record-breaking 10.7 billion trips taken on public transportation in 2013.[107] While a challenge to quantify as an investment, avoided costs can be enormous. According to the IEA, increasing the energy efficiency of transportation systems in urban centers around the world could save as much as $70 trillion in spending on vehicles, fuel and infrastructure by 2050.[108] Maria van der Hoeven, executive director of the IEA, calls energy efficiency the "hidden fuel."[109]

Contrary to mistaken belief, renewable energy is not the main culprit in rising utility bills – higher wholesale cost of gas is the largest contributor. One way to mitigate what consumers are paying is greater investment in reducing and managing consumer energy demand. If less energy is used, less carbon is released, consumers pay lower energy bills and fewer power stations need to be built, lowering the construction costs often added to utility bills.[110]

Investments in efficiency can also push a country's competitiveness in international markets when cost of energy is accepted as only one factor coupled with improved labor productivity, innovation and quality.[111] According to McKinsey Global Institute, energy efficiency will be key to renewed growth in employment and recovery of economies.[112] Turning trash into treasure is one method to achieve higher efficiency goals. Waste Management, Inc, estimates it could sell sorted and clean product from landfills for $12 billion, and the company is working on a project to create pelletized fuel which burns like coal but produces only 10% of the particulates.[113]

Companies now recognize efficiency investments' rapid payback periods from 12-24 months with revenues for pure-play energy efficiency companies seen as expanding by 13% annually through 2020.[114] For the overall economy, energy efficiency has a net benefit beyond direct impact – to indirect impacts among businesses which supply directly affected businesses and enhance the overall economy purchasing power, generating induced (consumption-driven)

[106] Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., & Rosenthal, S. "Americans' actions to limit global warming," Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication, November 2013.

[107] "Record 10.7 Billion Trips Taken On US Public Transportation in 2013," Transit News, APTA, March 10, 2014.

[108] "A Tale of Renewed Cities," Policy Pathways, International Energy Agency, 2013.

[109] "Energy-Efficient Transport Could Save Cities $70 Trillion," Environment News Service, July 15, 2013.

[110] Platt, Reg. "The real cost of 'green crap'," NewScientist, March 15, 2014.

[111] "European competitiveness and energy efficiency: Focusing on the real issue," European Council for an Energy Efficient Economy, May 2013.

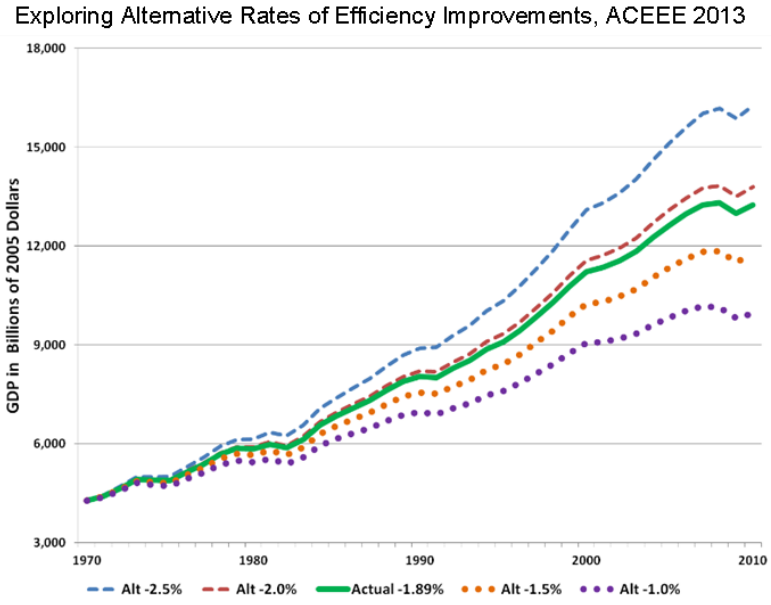
[112] "Investing in growth: Europe's next challenge," McKinsey Global Institute, December 2012.

[113] Lashinsky, Adam. "Turning Trash into Dollars," Fortune, June 10, 2013.

[114] "A Bright Outlook for Energy Efficiency Plays," Bloomberg Businessweek, p. 53, Feb. 7, 2011.

impacts.[115] More fundamentally, energy expert Skip Laitner, ACEEE Visiting Fellow, highlights a still uncorrected error in economic models which subsumes the fundamental role of energy in all economies, also pointed out by Hazel Henderson in *Politics of the Solar Age* (1981, 1988). This error has allowed generations of economists to mis-price energy and efficiency gains.[116]

According to WWF and ECOFYS, by 2050, maximum energy efficiency will become central to all economic activity, saving nearly £4 trillion a year through reduced costs.[117] What may become even more important to efficiency metrics is **exergy efficiency** - availability or work potential used to calculate system optimization. Lost exergy represents energy which could have been converted into work but was wasted instead.[118] By measuring and cutting the waste that it takes to complete a task, there is greater opportunity for more useful work which can then in turn increase economic activity. Skip Laitner found that exergy efficiency has slowed from a 1.4 percent growth per year from 1950 to 1980, to a 0.4 percent growth per year from 1980 to 2010, weakening economic productivity. If the rate of exergy efficiency increased, the total energy needed to power the economy would decrease even as work continued to grow.[119] An efficiency improvement of 2.5% rather than the 1.9% experienced to from 1970 to 2010 could have added $3 trillion to US GDP. As a glaring example, ACEEE estimates $80 billion of the $156 billion dollars' worth of energy used in production was lost through inefficient conversion.[120]



Smart grid technologies are included in Energy Efficiency and refer to anything used on the grid that enhances use of renewable energy, largely electrical components and equipment. Although it is possible that smart grids are serving industrial-era utilities rather than the green economy, the GTS continues to count investments which include smart meters and 2-way power transmission (crucial for large-scale deployment of renewable energy) from firms such as Itron, Hitachi and Legrand. Also expanding are net-metering by large electric utilities and new programs like CLEAN LA allowing customers to sell their excess power into grids.[121]

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[115] Koson, Matthew, et. al. "Beyond the Payback Period: Measuring the Economic Impacts of Energy Efficiency Programs," ACEEE Study on Energy Efficiency in Buildings, 2012.

[116] Laitner, op. cit.

[117] The Energy Report: 100% Renewable Energy by 2050," WWF, ECOFYS, OMA, 2011.

[118] Okamoto, Nicole. "Exergy Analysis," Lecture, San Jose State University, 2010.

[119] Laitner, op. cit.; Tweed, Katherine. "Forget Energy Efficiency, Think Exergy," GreenTechMedia, August 7, 2013.

[120] "Evaluating the Market for Industrial Energy Service Outsourcing," press release, ACEEE, March 19, 2014.

[121] Minott, Christopher. "Boulder steps closer to creating clean energy-based municipal utility," www.renewableenergyworld.com, Feb. 25, 2013; Bernhardt, John. "A Bright Future for the CLEAN LA Solar Program," www.renewableenergyworld.com, February 22, 2013.

This sector also includes investments in batteries for electric vehicles and charging infrastructure, and other new storage technologies as they develop, such as passive green off-grid buildings which store solar energy[122] to super capacitors which store electricity differently from batteries.[123] New materials are being researched at MIT, Chicago's Joint Center for Energy Storage Research (JCESR) and Argonne National Laboratory.[124] Giant batteries are in development for Texas wind farms by Xtreme Power.[125] Morgan Stanley predicts falling costs of batteries and solar PV will present a tipping point encouraging huge numbers of households and businesses to go off grid.[126] Clean Edge agrees the tipping point is being driven by residential and commercial opportunities to move to distributed generation.[127]

Rather than past use of massive dams and pumped storage of water for power-plants, flexible and smaller-scale storage is receiving focus, for example, every electric vehicle is also a storage battery. There is also movement to make better use of DC current which works well with solar and also carries data, increasing efficiency and can be incorporated parallel to AC lines in existing transmission grids[128] (see Part One – Overview). DC networks can also set priorities between what to run, what to charge and when to charge, and being able to pool supply, demand and storage among multiple buildings, creating a smart grid.[129] Ethical Markets TV Series explored such scenarios in its "Green Building and Design" and "Renewable Energy" programs.[130]

Green Construction

The term **Green Construction** has changed and continues to evolve since the GTS first began reporting on green construction. Originally, green construction investments broadly included new building construction and existing building retrofits, as was widely reported by financial analysts. Now, research reporting is getting stricter with some research only counting LEED building. We do not limit the green construction figure solely to LEED buildings in order to give credit for effort. Amounts are calculated using the value of the green construction market, defined as construction built to LEED standards or that incorporate multiple green building elements. Since public-sector information is not recorded, the total includes some government buildings. From 2007 to 2012 Green Construction reached nearly $512 billion in investments and commitments.

[122] "Green Building Outlook Strong for Both Non-Residential & Residential Sectors Despite Soft Economy," www.construction.com, November 12, 2012.

[123] "Exploring Super Capacitors to Improve Their Structure," www.sciencedaily.com, February 18, 2013.

[124] "The future of energy: Batteries included?" The Economist, February 2, 2013.

[125] "Greening the grid," New Scientist, February 2, 2013.

[126] Parkinson, Giles. "Morgan Stanley: Tipping point nears for going off grid," RenewEconomy.com.au, March 26, 2014.

[127] Pernick, Ron, Clint Wilder and James Belcher. "Clean Energy Trends 2014," CleanEdge, March 2014.

[128] "Can Parallel Lines Meet?" Technology Quarterly, The Economist, March 8, 2014.

[129] "Edison's revenge," The Economist, October 19, 2013.

[130] www.ethicalmarkets.tv. The series is available for college use at www.films.com.

In refining the definition, the focus has turned to structural materials such as timber, steel and other metals, concrete, glass, insulation and green rooftops. Using a stricter definition, this year's green construction number of $511.8 billion is down from 2013's report of $837.6 billion. The sector is divided into current investments by year of funding.

Another reason green construction figures remain low is because we only count green construction materials, not including labor, making this the most conservatively under-reported sector of the GTS. For example, the US Bureau of Labor Statistics tracks green jobs, listing careers in green construction to include construction, specialty trades and design occupations such as architects, civil, mechanical and electrical engineers, landscape architects and urban planners.[131] McGraw Hill Construction News reported 661,000 jobs in green design and construction with 35% of architects, engineers and contractors reporting having green jobs in 2011.[132]

Figures for the Green Construction section are based on Transparency Market Research's Green Building Materials Market Report.[133] It includes the broad categories of framing, insulation, roofing, exterior siding and interior finishing. More specifically, these figures include spending on green roofs, eco-friendly carpets, recycled tiles, and VOC-free glues and paints.

North America is dominating the global market for green building materials, accounting for over 35% of the global market share by volume in 2012. Europe was close behind at 32%. Overall, green building materials are expected to keep growing at a compounded annual growth rate of 12.5%.[134]

[131] Liming, Drew. "Careers in Green Construction," Bureau of Labor Statistics, June 2011.

[132] "Greenbuild: Growing Green Building Market Supports 661,000 Jobs in the U.S.," press release, McGraw Hill Construction, Oct. 4, 2011.

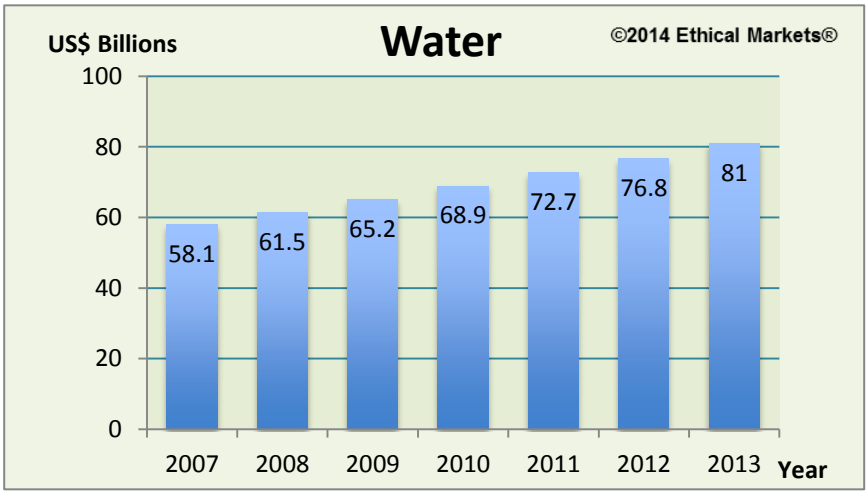
[133] Green Building Materials Market - Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2013 – 2019, Transparency Market Research, January 2014.

[134] "Green Building Materials Market is Expected to Reach USD 234.77 Billion Globally by 2019," press release, Transparency Market Research, January 13, 2014

Green Construction figures are also derived from revenues of larger equipment and material providers in OECD countries. Similar data for other countries has been a challenge to compile (to provide country-specific sources on green construction and efficiency not included here, please contact our research team).

While this sector has been the most challenging to quantify, we expect steady growth. The most innovative buildings now produce their own energy onsite, while advanced designs make buildings producing enough energy to feed into grids or local areas.[135]

Water



Just as information is the lifeblood of the economy, **Water** is the single most important commodity for life on this planet. Global Water Intelligence has identified a global water market worth more than $500 billion annually. Our GTS total is $484.2 billion in private investments since 2007.

Investments in water infrastructure are not sexy. Most of them will live their life hidden away and, if they work well, will not be seen for decades. We include pipes, valves, filters, membranes, meters, and even biological systems. We omit anything involved with bottled water, privatization, large-scale hydroelectric dams, and chemicals used by dirty industries to clean up their mess. Instead, we only count investments by utilities in water and wastewater systems. Since so many utilities are owned and operated by various levels of government, a 60% discount has been applied. Despite what the GTS omits and the discount applied, **Water** is larger than Green Construction and Cleantech.

Most people assume that water is abundant and plentiful on Earth. However, fresh water accounts for only 3% of water on the planet, and it is unequally distributed. Regions in California,[136] China,[137] and Australia[138] have experienced significant droughts this year, and climatologists are

[135] Makower, Joel. "State of Green Business 2012," GreenBiz Group, 2012, p. 49.

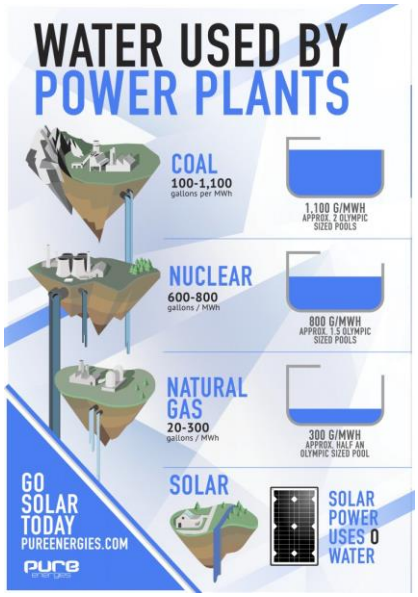
[136] "The Drying of the West," The Economist, February 20, 2014.

[137] "All dried up," and "Desperate measures," The Economist, October 12, 2013.

[138] "Australia's Queensland hit by record drought," BBC News Asia, March 7, 2014.

telling us that it's just the beginning.[139] These droughts cost billions in lost economic activity, and taxpayers often end up footing the bill for insurance.

Even in regions normally abundant in water such as Florida, municipalities are in conflict as water is taken from upstream to deal with population growth downstream, with disputes arising over environmentally sound options versus options with more "favorable" costs,[140] often ignoring alternatives such as storm water reclamation or desalination – accepting environmentally damaging saltwater intrusion to rivers while again missing opportunities with the 97% of saline water available. Mexico City's water table drops about a meter per year which could be mitigated using cisterns to harvest rainwater for use during the rainy season.[141] Sufficient but contaminated water is leading to creative solutions such as using fruit peels to absorb heavy metal ions, dyes, pesticides and nanoparticles from gold and silver.[142]



As fresh clean water becomes increasingly scarce, we are forced to examine how our water is being used. In Europe, 44% of fresh water consumption is being used in energy production, mostly to cool thermal and nuclear power plants. In the US, **190,000 million gallons PER DAY** are used to produce the steam to create electricity from coal, nuclear and natural gas plants.[143]

Usage for power plants seems foolish, especially in comparison to the priorities of drinking water and agriculture. It creates difficult choices in the water-energy-food nexus. Farmers in Kansas are voluntarily cutting back to insure there is sufficient for future generations of farmers.[144] Vietnamese fishermen, put out of work by the BP oil spill are using a water-fish-bacteria soup to raise hydroponics.[145] Meanwhile, over 8,000 US farms have installed on-site solar energy to reduce their costs of food production. Fortunately, solar energy uses comparatively little and wind energy uses virtually no water. As we continue the green transition, an added benefit is the reduced demand for water to meet our energy needs.

Many municipalities in the developed world have been woefully underfunding their water infrastructure and are experiencing huge losses due to leaks. The US Environmental Protection Agency has said that $384 billion is needed over the next 20 years to ensure the safe delivery of drinking water to Americans.[146] Further north, the Federation of Canadian Municipalities has suggested that it will cost $80 billion to upgrade water infrastructure that is currently in "fair" to "very

[139] Romm, Joe. "Leading Scientists Explain How Climate Change is Worsening California's Drought," ThinkProgress.org, January 31, 2014.

[140] Guinta, Peter. "Central Florida wants St. Johns River water," St. Augustine Record, January 18, 2014.

[141] LaMonica, Martin. "Innovators: Under 35," MIT Technology Review, vol. 116, no. 5, 2013.

[142] Carson, Biz. "Purifyng Water With Fruit Peels," Wired, December 2013.

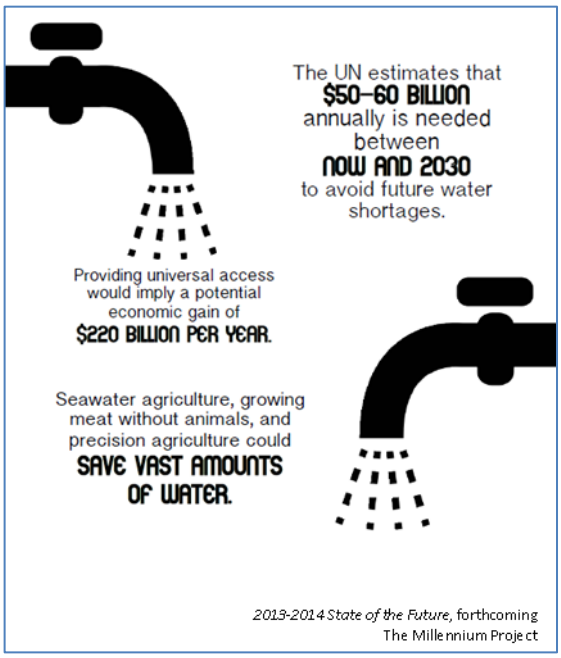
[143] Zerrenner, Kate. "Why water and energy policies do mix, or should," GreenBiz.com, August 6, 2013.

[144] "Sip it slowly," The Economist, September 28, 2013.

[145] Perkins, Cory. "Ultra Fresh Produce," Wired, December 2013.

[146] Cart, Julie. "US water infrastructure needs $384-billion upgrade," Los Angeles Times, June 4, 2013.

poor" condition.[147] Not only does faulty plumbing result in wasted water, it also wastes the energy required to filter, treat and pump all of the water that ends up wasted.



Access to water remains a crucial issue in many poor parts of the world. At the most basic level, solar-powered pumps provide water to drought-affected communities in Kenya.[148] To improve water and sanitation services, the World Health Organization suggests that an annual investment of only $22.6 billion would be needed. To provide access for all to regulated in-house piped water supply with quality monitoring and in-house sewerage connection with partial treatment of sewage would require a total investment of US$136.5 billion per year. These investments would result in huge economic benefits, with estimates that every US$1 would yield an economic return of US$3 to US$4 depending on the region.[149]

As explained in Water in a Global Context, the 97% of saline water found in oceans and lakes is largely ignored by significant investors. Even so, examples can be found. Tankers are being manufactured which are environmentally friendly, not only because of increased fuel efficiency but also because of better standards for water treatment systems. The Inventory of Hazardous Materials allows tankers to be better able to comply with OHSAS and ISO standards for health, safety, environment and quality.[150] There is also work being done to mine the ocean's plastics to turn into fuel by UpCylce The Gyres and University of Illinois.[151] We can also turn to the seas to provide wave tidal energy and ocean thermal energy conversion, rather than energy production consuming water. Energy from the marine sector in Europe provides 5.4 million jobs with a gross added value of nearly €500 billion a year.[152]

Increasingly, green investors are paying attention to opportunities in water as highlighted by MaxImpact's focus on water in impact investing and spotlighting deals for water, sanitation and hygiene (WASH) and opportunities for SMEs.[153]

Overall, water is a crucial component of the growing green economy which is why we include Water as part of Green Transition Scoreboard®.

[147] "Canadians' water attitudes hurting infrastructure," The Canadian Press, March 14, 2013.

[148] PracticalAction.org, 2013.

[149] "Costs and benefits of water and sanitation improvements at the global level," World Health Organization, 2004.

[150] "DSME Delivers Pair of Environmentally-Friendly Suezmaxes for Almi Tankers," Lloyd's Register, March 11, 2013.

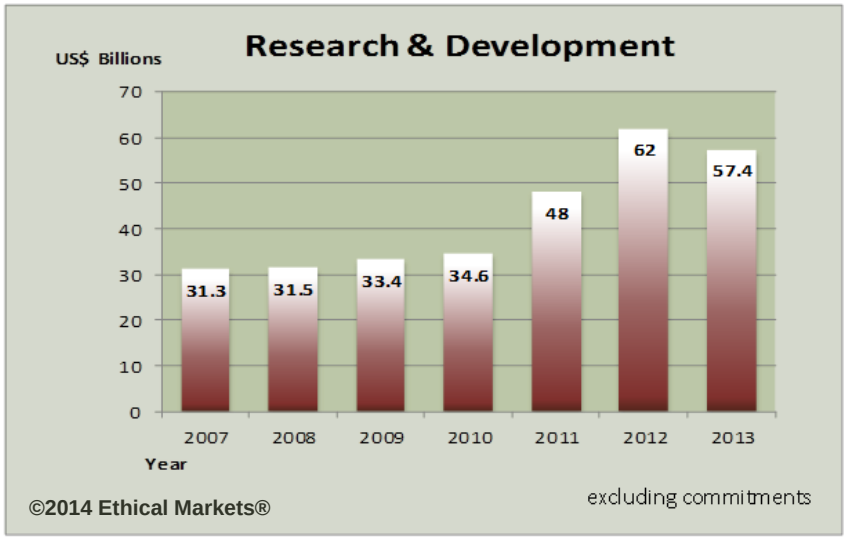
[151] Upcycle the Gyres, www.upgyres.org.

[152] McAdam, Martin. "Ocean Energy Development: Now Is Not the Time to Be Faint-hearted," RenewableEnergyWorld.com, December 2, 2013.

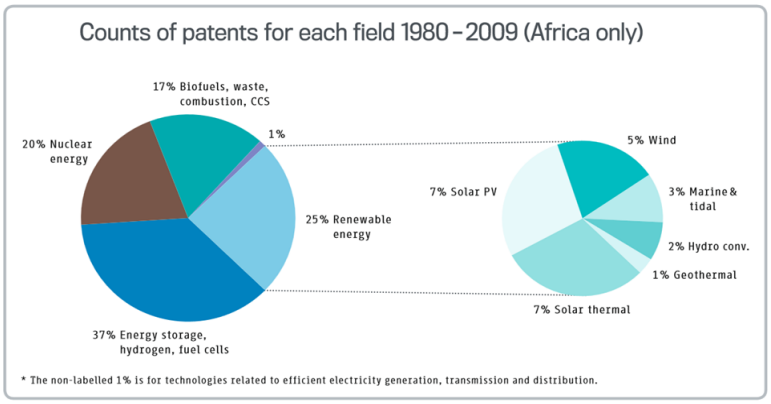
[153] "Liquid Assets: Impact Investing in the Water Sector," MaxImpact E-News, focus of Issue 10, March 2014.

Green R&D

From 2007 to 2012, Green R&D reached over $363 billion in investments and commitments.



The data collected for the GTS is the most comprehensive assessment of corporate green R&D performed to date. Our research team scours press releases, sustainability reports, and financial statements. We have identified nearly 200 companies responsible for green R&D tallied in this report. We believe $363 billion understates by half actual global Green R&D, considering how much goes unreported for competitive reasons. International companies' R&D does not make it into the media. In most countries, companies are not required to report, and tens of thousands of middle-market and smaller companies have R&D budgets below our reporting thresholds of $1 million. Corporate green bonds, such as those issued by Unilever and Toyota, fund research and innovation in waste reduction and efficiency.



Patents and clean energy technologies in Africa
UNEP and European Patent Office, 2013

Significant investments in green R&D show that a company has integrated sustainability into its core strategy, serving as a strong indicator for investors betting on increasing consumer demand for green products. Additionally, this data helps identify innovative companies who are ahead of the curve in responding to heightening environmental risks and regulations.[154]

Another metric to measure green R&D is the number of patents emerging from the research. A study from MIT and the Santa Fe Institute shows that investments in R&D for energy technologies, combined with the growth of markets for products, reveal a sharp increase in patents over the last decade, "a marked departure from historical trends." [155] The increase in

[154] See for example, "Through the Looking Glass: how investors are applying the results of the climate change scenario study," Mercer, LLC, New York, 2012; Deutsche Bank, "Sustainable Investing: Establishing Long-Term Value and Performance," DB Climate Change Advisors, June 2012.

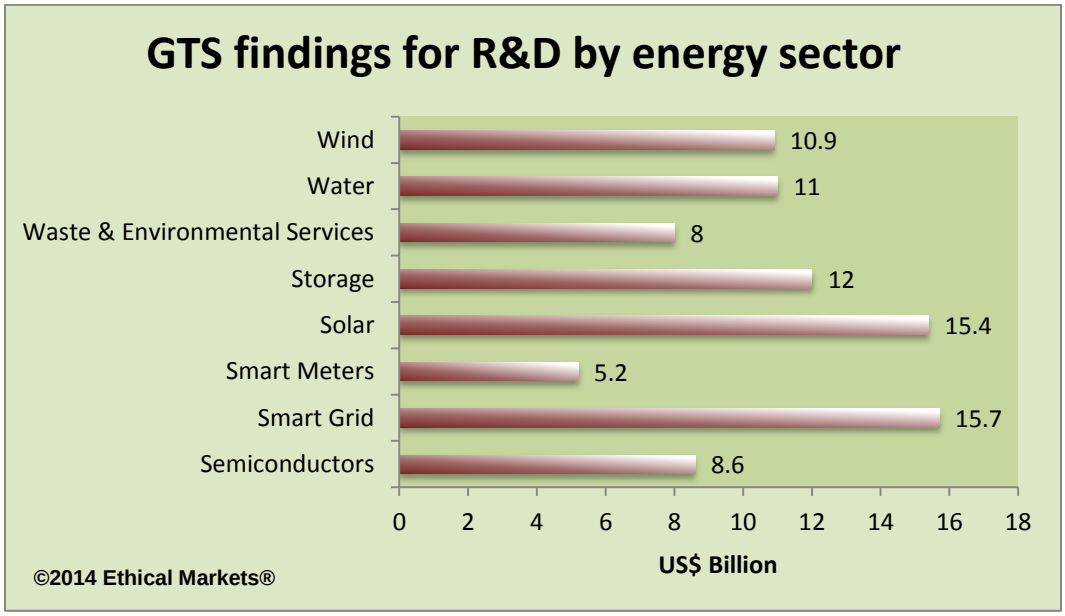
[155] Bettencourt LMA, Trancik JE, Kaur J. "Determinants of the Pace of Global Innovation in Energy Technologies," PLoS ONE 8(10): e67864. doi:10.1371/journal.pone.0067864, October 2013.

patents was most dramatic related to renewable energy, particularly solar energy and wind, while patents in fossil-fuel technologies showed a modest increase, and those for nuclear technology were flat.[156]

Sector Data

As the GTS data shows, the automotive industry is the largest investor in green R&D. Toyota, first in worldwide sales, was the earliest adopter, spending billions developing their Prius line of hybrids. The Renault / Nissan alliance announced a €4 billion push towards zero-emission mobility that started with the Nissan Leaf.[157] Volkswagen announced that they will invest upwards of €84.2 billion in R&D of efficient vehicles and greening their production sites by 2018.[158] The sector total of $228 billion does not capture the entire global investment. Many automobile companies, such as GM and Daimler, do not publicly disclose how much of their R&D is directed towards hybrid and/or electric vehicles.

It's clear that companies are embracing a new vision of the electrical grid that is powered by renewable energy and are racing to innovate new solutions in these areas. Companies have invested more than $15.7 billion into smart grid R&D, with an additional $15.6 billion for R&D categorized as electrical components and equipment. R&D in energy storage is rising quickly, currently sitting at $12 billion. R&D in wind is still high at just under $11 billion, but solar has more than caught up with 40 companies investing more than $15.4 billion.

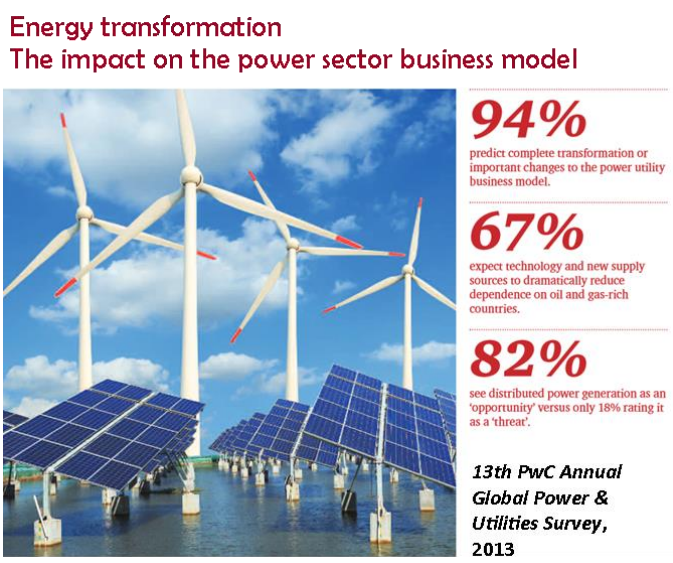


[156] Chandler, David L. "Innovation in renewable-energy technologies is booming," MIT News Office, October 10, 2013.

[157] Squatriglia, Chuck. "Renault-Nissan CEO Pledges $5.6 Billion for EVs," Wired, June 16, 2011.

[158] Mihalascy, Dan. "W Group Pledges to Invest €84.2 Billion in New Models and Technologies by 2018," CarScoops.com, Nov. 26, 2013.

Large firms such as Samsung are investing billions in developing organic light emitting diodes (OLEDs).[159] Many small companies investing in developing non-toxic coatings – like Natcore Technology for solar panels and Pantheon Chemical for aircraft, spending 3-5% of revenue on R&D[160] – have products yet to come to market.



Notes

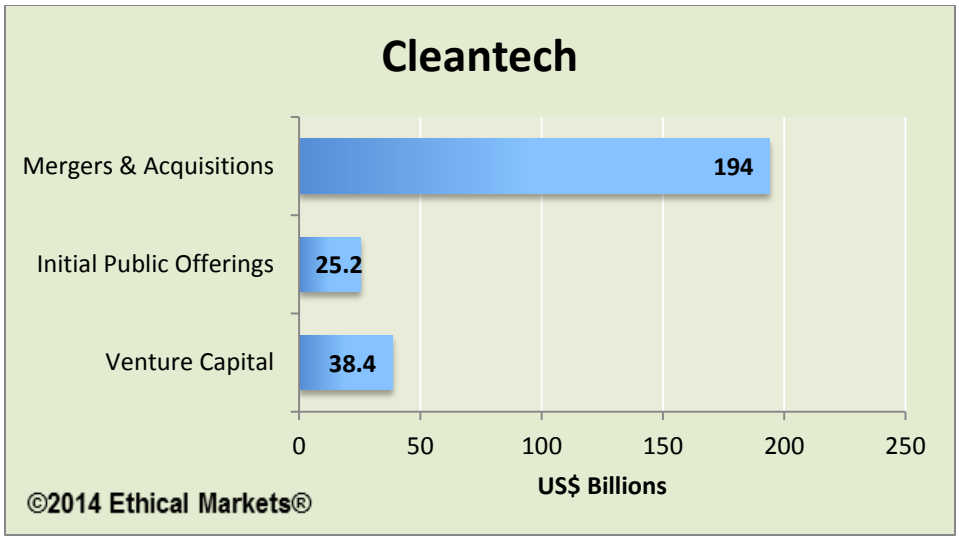
- Also, the data for 2013 is not a full representation of global Green R&D because many companies have not released 2013 financials or sustainability reports.
- For more depth on Green R&D, see the August 2012 GTS update focused on Corporate R&D.

Cleantech

Cleantech is a broad sector and includes companies in the following areas: agriculture; air quality and environment; energy efficiency, lighting, infrastructure and storage; materials; recycling and waste; transportation; and water/wastewater. This sector is divided into Venture Capital, Initial Public Offerings and Mergers & Acquisitions, avoiding overlap with the Green Construction and Energy Efficiency sections which only count revenues. Where these kinds of investments are included in the Renewable Energy category, they are omitted here. From 2007 to 2012, Cleantech has reached well over $257 billion in investments and commitments.

[159] "LEDs Without Heavy Metals, Silicon Nanocrystal Multicolor LEDs Created," www.cleantechnica.com, February 23, 2013.

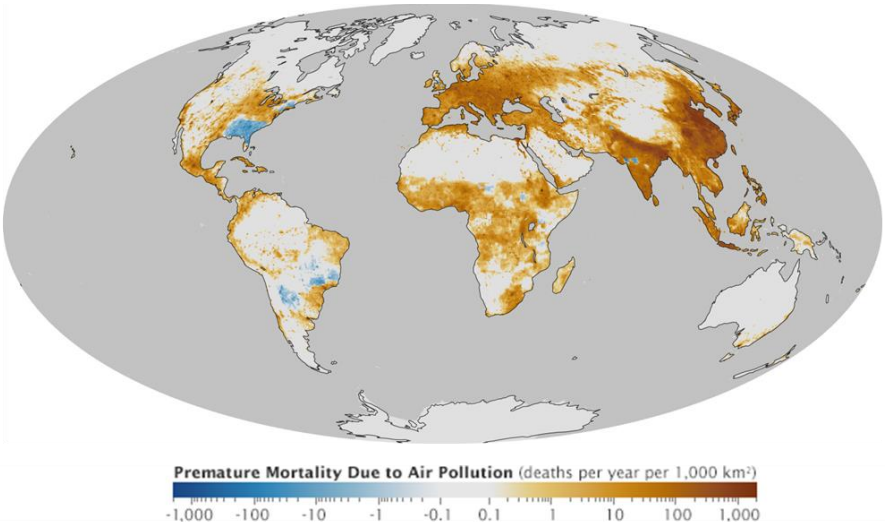
[160] Lehan, Brad. CFO, Pantheon Enterprises, personal communication, August 27, 2012.



Cleantech figures are derived in cooperation with The Cleantech Group, LLC, based on their quarterly reporting. For this report, Cleantech Group removes those investment categories which we have chosen not to include in the GTS such as biofuels, clean coal and carbon offsets discussed in What's Omitted. Breakdown of investments by value chain, sector and geography are available from the Cleantech Group (research.cleantech.com).

According to Colin le Duc, partner at Generation Investment Management (founded by Al Gore and David Blood), cleantech is one of the best performing sectors in public markets. Rather than focusing on tech innovation, le Duc emphasizes looking at innovative business models, such as SolarCity, which use clean tech to disrupt markets.[161, 162]

Cleantech is emerging as a high priority in Asia due to extreme pollution driving China to find and deploy cleantech solutions; Korea's play for supply chain leader globally and Japan's energy transition creating a demand for home market solutions.[163] In 2013, 90% of Japanese PV remained in the domestic market, and manufacturers are moving beyond only providing PV modules to expand downstream as contractors, project developers and independent power



Global Toll of Fine Particulate Matter
Earth Observatory, NASA, September 19, 2013

[161] Fehrenbacher, Katie. "7 lessons for successful cleantech investing," GIGAOM, March 13, 2014.

[162] For full disclosure, principals at Ethical Markets Media have holdings in SolarCity.

[163] "Australasian Cleantech Review 2014: Asia Drives Investment and Trade," Australian CleanTech, March 2014.

producers.[164] In Australia, cleantech represents 2% of GDP, employees over 58,000 with companies in this sector having a combined revenue of $32.5 billion.[165]

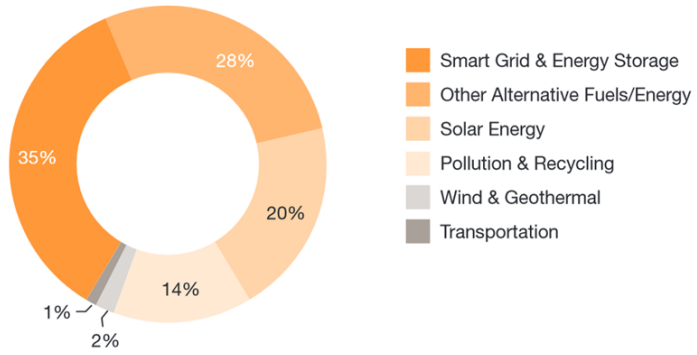
Sequestering Carbon Naturally:

- **Biochar, used in Latin America for centuries**
- **Sustainable management of grasslands, Savory Institute restoring land in Africa, Australia and, with Capital Institute, the US.**
- **Seawater farming**
- **Organically-grown food, Rodale Institute, competes with industrial agriculture while preserving soils**
- **Restoring perennial prairie grasses, Land Institute**
- **Clone reseeding forests with strongest native trees of a region, Archangel Ancient Tree Archive**

We omit clean coal, as the technology would be a palliative fix for fossil fuel consumption, has yet to be implemented to scale and would not contribute to the green transition. Delays and cost overruns have made the closest-to-completion clean coal plant in the US "one of the most expensive fossil-fuel projects ever." [166] The technology greatly reduces efficiency and the cost of carbon capture and storage (CCS) could price coal out of many markets.[167] According to the EPA, CCS could increase wholesale electricity prices by 70 to 80 percent.[168] In addition, we must remember that carbon is only one pollutant from coal, along with many other emissions, including mercury and particulates damaging to health and the environment.

We omit investments in nuclear because of its lack of EROI, environmentally damaging mining and waste, high risk to dispose and dismantle and lack of competitiveness as discussed in What's Omitted.

Cleantech funding by subsector first quarter 2013*



* "Other Cleantech" subsector has been omitted from this figure.

Cleantech MoneyTree™ Report: Q12013
PricewaterhouseCoopers, 2013

As national legislation, global agreements and increased cost come into play, coal as well as oil and other fossil fuels will become stranded assets and will need to be written down. Responding to a shareholder resolution, ExxonMobil has agreed to publish a Carbon Asset Risk report, providing for shareholders information on the risks stranded assets pose to the company's value.[169]

[164] Movellan, Junko. "The Skies are Brightening as Manufacturers Resume Spending to Improve Efficiency," AltEnergyStocks.com, June 19, 2013.

[165] Ibid.

[166] Smith, Rebecca and McWhirter, Cameron. "Mississippi Plant Shows the Cost of 'Clean Coal'", Wall Street Journal, October 13, 2013.

[167] "Carbon Capture and Storage: Trouble in store." The Economist, March 5, 2009.

[168] Friedman, Julio. Testimony, Preliminary Transcript, Hearing on "Department of Energy Oversight: Status of Clean Coal Programs," Subcommittee on Oversight and Investigations (February 11, 2014).

[169] Makower, Joel. "Exxon, stranded assets and the new math," GreenBiz.com, March 24, 2014.

Appendices

Appendix 1 – Investment Totals

Sector	Amount (USD, nearest billion)
Renewable Energy	$ 2,587,000,000,000
Energy Efficiency	$ 1,103,000,000,000
Green Construction	$ 512,000,000,000
Water	$ 484,000,000,000
Green R&D	$ 363,000,000,000
Cleantech	$ 258,000,000,000
Grand Total	**$ 5,309,000,000,000**

RENEWABLE ENERGY	Amount (USD)
2007	$ 170,200,000,000.00
2008	$ 224,200,000,000.00
2009	$ 209,500,000,000.00
2010	$ 267,300,000,000.00
2011	$ 334,700,000,000.00
2012	$ 282,100,000,000.00
2013	$ 283,000,000,000.00
Commitments	$ 817,556,555,104.00
Total	**$ 2,588,556,555,104**

ENERGY EFFICIENCY	Amount (USD)
2007	$ 73,675,781,343.00
2008	$ 81,140,728,352.00
2009	$ 89,362,035,630.00
2010	$ 98,416,338,800.00
2011	$ 100,283,850,000.00
2012	$ 113,653,500,000.00
2013	$ 127,731,200,000.00
Commitments	$ 64,277,498,560.00
Smartgrid	$ 354,799,062,880.00
Total	**$ 1,103,339,995,567.00**

SMART GRID	Amount (USD)	
2007	$	17,152,000,000.00
2008	$	21,440,000,000.00
2009	$	26,800,000,000.00
2010	$	35,240,000,000.00
2011	$	39,920,000,000.00
2012	$	47,920,000,000.00
2013	$	55,600,000,000.00
Commitments	$	110,727,062,880.00
Total	**$**	**354,799,062,880.00**

GREEN CONSTRUCTION	Amount (USD)	
2007	$	50,464,262,052.50
2008	$	56,701,418,036.52
2009	$	63,709,458,468.00
2010	$	71,583,661,200.00
2011	$	80,431,080,000.00
2012	$	90,372,000,000.00
2013	$	98,600,000,000.00
Total	**$**	**11,861,879,757.00**

WATER	Amount (USD)	
2007	$	58,102,067,200.00
2008	$	61,548,800,000.00
2009	$	65,200,000,000.00
2010	$	68,851,200,000.00
2011	$	72,706,867,200.00
2012	$	76,778,451,763.00
2013	$	81,078,045,062.00
Total	**$**	**484,265,431,225.00**

Green R&D		Amount (USD)
2007	$	31,352,432,730.10
2008	$	31,541,995,458.72
2009	$	33,420,953,892.67
2010	$	34,638,201,503.29
2011	$	48,024,178,775.62
2012	$	62,022,161,033.53
2013	$	57,439,604,063.53
Commitments	$	$65,006,557,233.33
Total	**$**	**$363,446,084,690.78**

CLEANTECH		Amount (USD)
Venture Capital (2007 - 2013)	$	38,416,825,940.00
Initial Public Offerings (2007 - 2013)	$	25,153,429,284.00
Mergers & Acquisitions (2007 - 2013)	$	194,080,833,649.00
Total	**$**	**257,651,088,873.00**

Appendix 2 – Positions Held By Principals of Ethical Markets Media, LLC, a Certified B Corporation

For full disclosure: members of the GTS research team and other principals of Ethical Markets Media, LLC, are invested in companies supporting the green transition, many of which are privately held, early stage, pre-IPO companies.

As of January 31, 2014

3D Systems Corp
Acuity Brands
Autodesk
Comverge
CREE
Domini Social Investment Fund
Enernoc
Entech Solar
EnvisionSolar
Equal Exchange
FirstSolar
GrainPro
Green Garmento
Google
Hannon Armstrong
Innergex Renewable Energy
Johnson Control
LightPath Technologies
Lindsay Corporation
NASDAQ OMX CleanEdge Smart Grid Infrastructure Index
Natcore Technology
Nevada Geothermal
Ormat
Pax World Fund
PowerShares Cleantech Portfolio
Seimens
Solar City
Solaria
Suntech
Tesla Motors
Unilever
US Geothermal
Waterfurnace Renewable Energy
Whole Foods
ZBB Energy

Appendix 3 – Research Team

Research and Writing

Hazel Henderson, D.Sc.Hon., FRSA, president of Ethical Markets Media (USA and Brazil), is a futurist, evolutionary economist, author of *Mapping the Global Transition to the Solar Age*, of award-winning *Ethical Markets: Growing the Green Economy* and many other books. She founded the EthicMark® Awards for Advertising, created the Green Transition Scoreboard®, co-developed with Calvert the Ethical Markets Quality of Life Indicators and with Biomimicry 3.8 developed the Principles of Ethical Biomimicry Finance™. In 2012, she received the Award for Outstanding Contribution to ESG & Investing at TBLI Europe; was inducted into the International Society of Sustainability Professionals Hall of Fame in 2013, and in 2014 was again honored as a "Top 100 Thought Leader in Trustworthy Business Behavior" by Trust Across America.

Rosalinda Sanquiche, MA, Executive Director of Ethical Markets Media and Director of Ethical Biomimicry Finance®, began her environmental career with the American Wind Energy Association in Washington, DC, in research and communications. She has written and is a public speaker on the construction industry, the environment, sustainability and the media. She has taught environmental policy and team-taught field classes combining ecology and policy. Rosalinda's childhood hiking through Puerto Rico's *El Yunque National Forest* informed her belief that we must preserve the world we inhabit for generations to come. At the North Florida Land Trust, she focused on protecting environmentally significant places through B2B, educational and private/public easements. She serves as treasurer for the Northeast Florida Green Chamber.

Timothy Jack Nash, MSc, Strategic Leadership Towards Sustainability, Blekinge Institute of Technology, Sweden, is a senior advisor for Ethical Markets Media, and, as director of sustainability research, lead researcher for this report. He is the principal of SSI – Strategic Sustainable Investments in Toronto, Canada.

Special Advisors

Leslie Danziger co-founded and is the former Chairman of Solaria Corporation. She is co-founder and former Chairman/CEO of Lightpath Technologies, TX, USA, which she took public.

Peter Lynch has worked for 37 years as a Wall Street security analyst, an independent security analyst and a private investor in small emerging technology companies. He has been actively involved in following developments in the renewable energy sector since 1977 and is a highly regarded expert in this field.

Claudine Schneider served in the US House of Representatives (R-RI), 1980-1990. She is an independent consultant, Boulder, CO, focusing on transformative technologies.

Praise For the Green Transition Scoreboard®

"Over twenty years ago, Hazel Henderson talked of a most implausible goal: to both encourage Green investing and to track its growth worldwide. The remarkable $5.3 trillion now invested in Green still challenges the imagination. The world needs to know of this triumph and its significance to all our futures." **– Carson E. Beadle, former Director, Mercer; Executive Committee Chairman, Security Mutual Life Insurance of NY**

"No leader, from the CEO of the smallest of corporations to the president of the largest of nations, could do better than internalizing the principles of Ethical Markets and always keeping a sharp eye on the Green Transition Scoreboard." — **Ashok Khosla, Chairman, Development Alternatives and pioneer social entrepreneur.**

"The GTS adopts a much more comprehensive and therefore effective working definition of a green economy than is usually the case, and provides a robust and consistent framework for measuring our progress towards it." — **Matthew Kiernan, founder, Innovest; CEO, Inflection Point Capital Management; author, Investing in a Sustainable World**

"We usually do manage what we measure; so the GTS is an important contribution from Ethical Markets Media in getting to the future our polling suggests people intend for their children." **— Doug Miller, Chairman, GlobeScan Inc.; President, GlobeScan Foundation**

"Wonderful initiative. Finally an overview of the amount of private money invested and committed to Impact Investing." – **Robert Rubinstein, CEO, TBLI GROUP™**

"Because it enables tracking of the global macro-shift from the Industrial Era to the emerging sustainable economies of the 21st century The GREEN TRANSITION SCOREBOARD® is an important innovation. Check it out!" **Don Tapscott, author of the bestsellers Wikinomics and Macrowikinomics**

"Since 1987, we have guided our investors towards companies leading the growing green economy: the Sustainability Sector. The GTS is an important milestone in measuring the increasing economic viability of this CleanTech universe." – **Stuart Valentine, Founder, Centerpoint Investment Strategies**

Our turnkey manual, *Principles of Ethical Biomimicry Finance™* - co-developed with our partner, Biomimicry 3.8, is available for licensing to socially responsible asset managers.

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