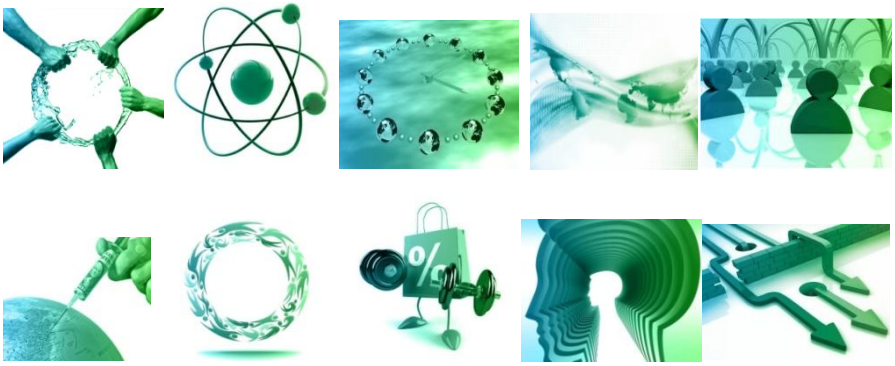
Food, Water and Electricity Security

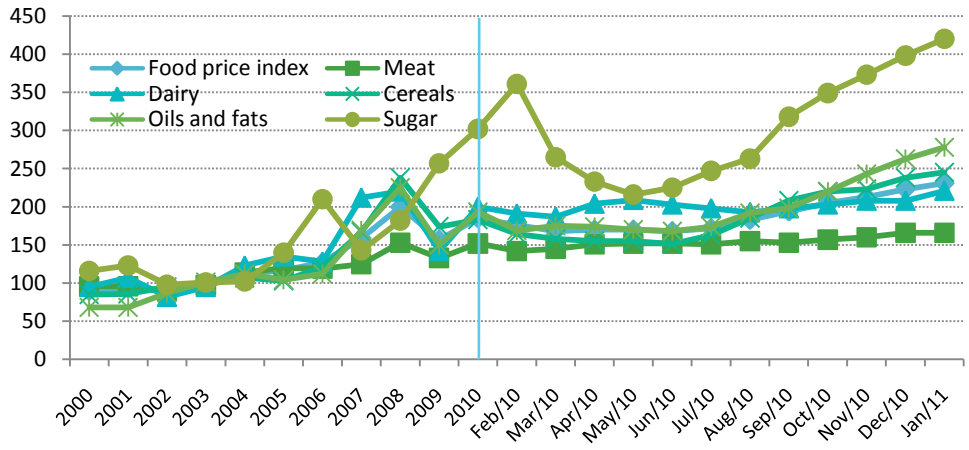


March 2011: Globally, we are facing more and more challenges in meeting our basic needs for food, water and electricity. As the world's population hurtles towards the 7 billion mark, the pressures will increase – but it's not just population which is increasing the challenges. In 2010 natural disasters, which the UN estimates cost US$ 109 billion (three times more than in 2009), damaged crops, cut access to clean water and affected over 207 million people, killing approximately 375,000. Climate change is leading to desertification of large parts of the world. The results: Increased poverty, starvation and civil unrest – food prices have been a factor in the revolutions and unrest in North Africa and the Middle East, while last week thousands of Indians protested increasing food prices. Food security is understandably high on Nicolas Sarkozy's G20 agenda. What does this new age of basic resource scarcity look like in practice? What innovations could help us overcome the challenges? Here we look at these questions and ask: What can organizations do?

Food Security

We need food for survival and for mental and physical development. In 2010, a billion people worldwide were over-consuming contributing to health epidemics of diabetes and heart disease. At the other end of the scale for 925 million people – the World Bank suggests this will be 1 billion by the end of 2011 – hunger and lack of critical nutrients including carbohydrates, fats and proteins is an everyday experience. A further billion people suffer from *hidden hunger*, lacking access to important micronutrients like vitamins and minerals. To feed 9 billion people by 2050 global food supplies may need to increase by 50-70% in the next 40 years – a target scientists say is feasible.

Primary Food Commodity Price Indices



Source: FAO

In Action!

Crop failures due to drought: Drought due to reduced rainfall resulted in major crop failures around the world in 2010, forcing those who could not cultivate enough food or earn enough to move from rural to urban areas to seek employment to sustain themselves. Among drought-hit regions, South-East Asian countries experienced heat waves, sending water levels in some places to their lowest levels for 50 years. A severe four-year drought continued to devastate Syria's rural communities. Russia and Ukraine experienced their worst droughts and heat waves in over a century, leading to Russia banning grain exports which sent wheat prices to a two-year high. The latest drought in Argentina, the world's second-largest exporter of the grain, increasing expectations of crop losses has caused corn prices to surge to 29-month highs at a time when global supplies already are tight. (Source: The Wall Street Journal)

Flooding: For weeks, the flooding in eastern Australia was a slow-motion disaster, with drenching rain devastating wide swathes of farmland and small towns. The resulting US$2.5 billion loss of farm production in 2010/11 will exert significant pressure on food prices. Two months of devastating floods in Pakistan have resulted in US$9.5 billion damage to public and private property, affected 20 million people, making millions homeless and killing almost 2,000 people along with 70 million cattle. These countries are not alone: Sri Lanka, Indonesia, China, Bangladesh, Brazil, Columbia, Peru, Mexico, Romania, Ukraine, France, Spain, Portugal, Hungary, Serbia, Argentina, Kenya, Singapore, US and Canada all experienced major flooding in 2010, resulting in greater poverty and food insecurity for millions.

Demand for biofuel: 110 advanced biofuels projects are now in development around the globe, which by 2015 could offer us 4 billion gallons of fuel. Renewable gasoline, renewable diesel, and biobutanol will contribute 59% of planned capacity by 2015 (Source: Biofuels Digest). While demand for biofuel is rising, first generation biofuels continue to receive negative press those made from food crops such as corn and sugar contribute to increasing food prices, hitting the poorest hard and exacerbating food insecurity. Add to this, our demand for alternative energy has led to forest clearance to plant energy crops, negatively impacting biodiversity, the local forest communities and, of course, carbon emissions.

Look Out For...

Biofuels from sources other than food staples: The focus on more advanced forms of biofuels that reduce the food security challenges is picking up steam. Second generation biofuels primarily use non-edible biomass such as plants and wood waste, while the third generation is algae-based. Now fourth generation biofuels technologies are under development, including: Pyrolysis, gasification, solar-to-fuel, and genetic manipulation of organisms to secrete hydrocarbons, all of which use non-food sources. GTM Research suggests that by 2022 biofuels will account for almost 8% of global fuel volumes used for transportation, representing a market worth hundreds of billions of dollars.

Improvements in genetically-modified foods: Arguments over genetically modified (GM) food crops and genetically-modified organisms in food production have been raging for years among biotechnology companies, government regulators, NGOs, scientists and the public. Public concern has been most intense in Japan and Europe but lower in the US where GM crops are more widely grown. IGD Research in UK suggests that public opinion around GM foods is relatively constant over the past 5 years. While a substantial proportion of consumers believe it can provide benefits, particularly in helping to feed a growing world population, significantly concern remains around food safety and environmental impacts. How these attitudes will change as food security issues become more widespread remains to be seen.

Vertical, urban farming: The finite (and shrinking) supply of arable land is a major constraint in growing more food to meet increasing demand – but what if you did not need it? Dr. Dickson Despommier of Columbia University is spreading his vision of vertical farms in urban areas, where vegetables, fruit and crops can be grown hydroponically – without soil, in water containing fertilizer – in urban areas close to customers in "fields" stacked on top of each other. Not only does it reduce waste, allow recycling of water and avoid weather-related and pest problems, it allows year-round farming and increased productivity as there is no shipping wastage. The goal: Clean, cheap food, in abundance – plus more land for other uses.

Artificial meat: Meat production (and consumption) is getting an increasingly bad press from those concerned about the environment and growing human health issues, partly attributed to over-consumption of food including meat. Scientists are working on the answer in the shape of in-vitro meat, which is cultured meat produced in a cell culture, rather than in an animal. While many labs have succeeded in growing artificial meat, the next step is to translate this into commercially viable production – and to ensure the taste and concept are acceptable to consumers, who may not immediately take to chicken without the egg. The other major hurdle to be overcome is the impact on agribusiness.

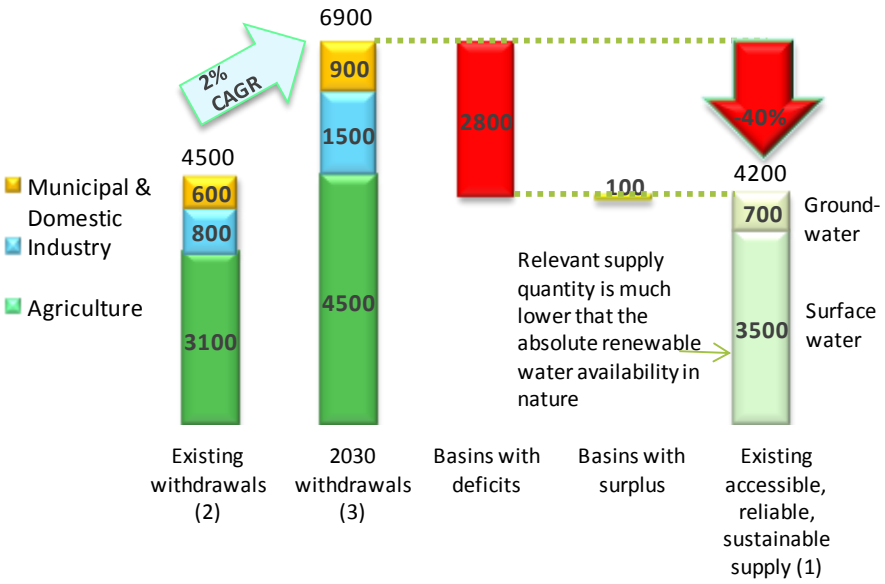
How businesses are responding…

- In January 2011, a coalition of business, governments and farmers launched a strategy to significantly increase food production while conserving environmental resources and spurring economic growth. The approach is already being implemented in two countries, Tanzania and Vietnam. Led by 17 global companies (Archer Daniels Midland, BASF, Bunge Limited, Cargill, The Coca-Cola Company, DuPont, General Mills, Kraft Foods, Metro AG, Monsanto Company, Nestlé, PepsiCo, SABMiller, Syngenta, Unilever, Wal-Mart Stores Inc., and Yara International), the strategy sets ambitious targets for collective action to increase production by 20%, decrease greenhouse gas emissions per tonne by 20%, and reduce rural poverty by 20% each decade.
- Food giant Unilever's Sustainable Living Plan is designed to deliver three key outcomes by 2020: (i) Help more than a billion people take action to improve their health and well-being; (ii) Decouple the company's growth from its environmental impact across the product lifecycle, with the goal of halving the environmental footprint of the making and use of Unilever products; (iii) Enhance the livelihoods of hundreds of thousands of people in the company's supply chain. In doing so, it will help enhance the sustainability of agriculture and food security in the future.
- Farnell has won another award for its unique biodegradable packaging - the packaging is capable of breaking down in an industrial composter, or dissolving simply in hot water, uses patented technology to fully biodegrade without releasing any harmful chemicals into the environment, while offering the same level of component protection as standard bags.
- Leading food companies are working with industry associations and NGOs to actively measure the sustainability of their products – to improve the performance of the industry and their own resource footprints, according to a recent report from Pulse Canada. Interviews with companies including Tesco, Unilever, Dole, McCain, General Mills, McDonalds, Carrefour, PepsiCo suggest that improving the sustainability of food production from farm to fork is a top priority – and all are taking action. For example, Ghislain Pelletier, Corporate Vice President for Agriculture at McCain says, *"We've found that when we make a french fry, 40% of our carbon footprint is from agriculture. That means our agronomists have a very important role to play in actually delivering sustainable change. For example, in India, a partnership with local farmers has reduce water usage for irrigation by 50% by helping them access drip technology."*

Water Security

In 2010 1.8 billion of us could surf the Internet, yet 1 billion others were unable to access an adequate supply of freshwater. Only 3% of the world's water is freshwater; less than 1% of this is accessible and adequate for human usage. Water is unique – we can't replace it. It's a local product that is hard to transport, and due to the inconstant nature of floods and droughts, one whose geographic availability is constantly changing. But we are using more and more of it per capita: Global freshwater consumption rose at twice the rate of population growth in the 20th century. Worldwide, 71 countries are already experiencing stress in surface and ground water resources. The UNEP estimates that by 2025 about 2.8 billion people will face severe water stress or scarcity, while up to half the world's population could face some water stress, threatening the health of ecosystems, food production and human wellbeing. By 2030 we could be facing a gap between water supply and demand of 40%.

Aggregated Global Gap Between Existing Accessible, Reliable Supply [1] and 2030 Water Withdrawals, Assuming No Efficiency Gains(Billion m3, 154 basins/regions)



Notes: 1. Existing supply which can be provided at 90% reliability, based on historical hydrology and infrastructure investments scheduled through 2010; net of environmental requirements. 2. Based on 2010 agricultural production analyses from IFPRI. 3. Based on GDP, population projections and agricultural production projections from IFPRI; considers no water productivity gains between 2005-2030. Source: Water 2030 Global Water Supply and Demand model; agricultural production based on IFPRI IMPACT-WATER base case; Charting Our Water Future, The 2030 Water Resources Group, 2009.

In Action!

Aral Sea drying up: Bordering Uzbekistan and Kazakhstan and once the world's fourth-largest lake, the Aral Sea is now described as one of the planet's *most shocking environmental disasters*. It has shrunk by 90% since the 1960s when the rivers that fed it were largely diverted to boost cotton production in the arid region. Towns that once stood on the coast are now more than 70 km from the sea. High concentrations of minerals and a 400% increase in salinity have killed most fish and wildlife – local people are not immune. Mortality rates have increased by 15 times in ten years, with child mortality in the region now the highest among former Soviet states. A critical cause: Medical studies have linked the ecological disaster to diseases of blood, cancer, asthma, and heart malfunction. (Source: Wikipedia)

Desertification: Deserts devour more than 20,000 square miles of land worldwide every year and threatens a third of the Earth's land surface, or over 4 billion hectares. Each year we lose an estimated US$ 42 billion in agricultural production worldwide and spend US$ 2.4 billion fighting land degradation. Desertification directly affects over 250 million people and threatens the livelihoods of some 1.2 billion people in 110 countries, including the world's poorest who depend on land for their needs. Often portrayed as a developing world problem, it also threatens countries including China, Spain and North America, where factors including global warming, urbanization, unsustainable farming techniques, and the overuse and diversion of water sources, have degraded huge areas of land. (Source: FAO)

Water pollution: Globally, we discharge two million tons of sewage, industrial and agricultural waste into the world's waterways a year. At least 1.8 million children under five years-old die every year from water related disease, or one every 20 seconds. Contaminated and polluted water now kills more people than all forms of violence including wars. (Source: UN Habitat) It also threatens the health of all living species and habitats. Coral reefs are in crisis. 25% have already disappeared and an estimated two-thirds are at risk. Plastic waste in water remains in our ecosystem for years – killing up to 1 million sea birds, 100,000 sea mammals and countless fish each year. (Source: Save the Sea) Beyond human and environmental damage, the economic costs of pollution are huge: Death and disease due to polluted coastal waters costs the global economy US$12.8 billion a year, US$7.2 billion of which is due to hepatitis from tainted seafood.

Look Out For...

Water from the sea: Will water become the new oil? Huge demand, plus new more efficient desalination technologies, could create enormous business opportunities and bring new life to arid regions. Over a 100 countries already have desalination operations, numbering over 13,000 facilities in total, and creating a global market worth over US$8 billion. Traditionally, a high energy-consuming thermal process powers most desalination but now new technologies are forging ahead, including membrane-based techniques and solar-powered desalination processes that lower both costs and emissions. Scientists are also working on salt tolerant crop breeds, including barley and wheat, although with little success as yet. The downside of using salt water? Marine biologists warn that widespread desalinization could inadvertently take a heavy toll on ocean biodiversity and the marine food chain. (Source: Scientific American)

Water disputes: There are more than 276 transboundary river basins and hundreds of transboundary aquafiers shared by over 3 billion people, a foundation for potential conflicts within and between nations. More than 50 countries on five continents risk water disputes unless they move quickly to establish agreements on how to share reservoirs, rivers, and underground water acquifers. Current interstate disputes include those in the Middle East (Euphrates and Tigris Rivers, Jordan River) where the recent revolutions and unrest could exacerbate the situations, as it could in Africa where access to the Nile is in dispute. In Asia, India and Pakistan are in a dam building race and without a water treaty relations could be even further strained. As water scarcity grows, we are likely to face increasing water conflicts globally.

Water footprinting: Worldwide we use lots and lots of water for drinking, cooking and washing, but even more for producing things such as food, paper, cotton clothes, etc. Water footprinting is a new approach to assessing direct and indirect water use of a consumer or producer, allowing us to better see inefficiencies and potential areas of tension. In China the water footprint is about 700 cubic meters per year per capita, with only about 7% of the total water used coming from outside China. The Japanese footprint is 1,150 cubic meters per year per capita with about 65% of the country's total water footprint outside its borders. The US has the largest water footprint globally at 2,500 cubic meters per year per capita. It's also time to think about the footprints of what we consume: 1kg of beef requires 15,500 liters of water to produce and 1 kg of rice requires 3,000 litres. Read more about water footprints here.

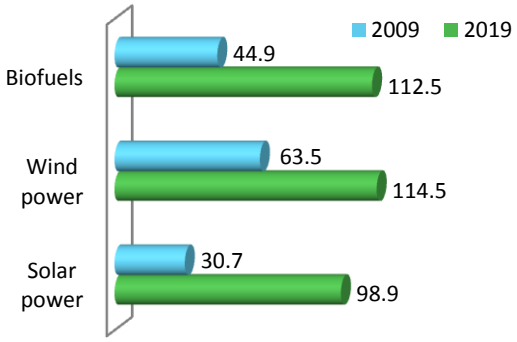
How businesses are responding…

- One of the world's biggest consumers of water, beer and beverage company SABMiller, is working with the World Wildlife Fund (WWF) on water footprinting. The aim: To better understand the quantity, efficiency and geographical context of water used so it can be better managed. And it's paid off. In SABMiller's businesses in Peru, Tanzania, Ukraine and South Africa the use of water for brewing one litre of beer has improved between 7 and 11% since 2008.
- Coca-Cola has been working with The Nature Conservancy (NC) to reduce, recycle and replenish the water used in producing the company's products, within a comprehensive water stewardship framework. Against aspirational goals set in 2007, by 2009 Coca-Cola had realized a 12.6% improvement in water use ratio, 89% of their facilities were in compliance with its wastewater treatment standards and Coca-Cola was replenishing about 22% of water used in finished beverages, through approximately 250 community programs in 70 countries.
- Last year IBM kicked off four major projects focusing on water issues, using the World Community Grid's computing power to assist: Modelling the effects of agriculture, commerce and industry on Chesapeake Bay (US); improving water filtering practices by harnessing computing capabilities at Tsinghua University's newly launched Centre for Novel Multidisciplinary Mechanics in China; developing a cure for schistosomiasis, a parasite-based disease that thrives and spreads in dirty water, particularly in tropical areas (based in Brazil); and partnering with NC on the Rivers for Tomorrow project to map, analyze and share information on the health of local river basins.
- Intel's environmental goals include reducing water use per chip below 2007 levels by 2012. It has invested $100 million in water conservation since 1998 and saved 36 billion gallons of water. Water efforts include: Including water resource sustainability in site selection, improving efficiency in production and use of ultra-pure water (critical to the industry) and recycling.

Electricity Security

Primary energy demand is projected to increase by 40% from 2007 to 2030 under the International Energy Authority's (IEA's) Reference Scenario and electricity demand by 76%, requiring 4,800 gigawatts (GW) of capacity additions – almost five times the existing capacity of the US. The capital required to meet this demand is estimated in cumulative terms at US$26 trillion (in year-2008 dollars) — equal to $1.1 trillion (or 1.4% of global GDP) per year on average. Producing electricity is one huge challenge; getting it to where it is needed, at the right time and cost is another. 25% of people worldwide, over 1.5 billion mainly in Africa and Asia, have no access to electricity. The electricity divide between rich and poor countries is stark. A majority of Africa's billion inhabitants survive with little or no electricity; in 11 countries more than 90% of people are without electricity. Yet each day New York City consumes the same amount of electricity as all sub-Saharan African nations combined, excluding South Africa. Energy wastage is also a significant challenge. In 2009 the US generated a total of 94.5 Q BTU (quadrillions of British Thermal Units), of which about 58% was wasted just over half through transport, industrial, commercial and residential uses and the rest at source. (Source: Good Infographics) Meeting future energy and electricity challenges will require a radical rethink of how the power grid is organized and managed, as well as where investments are made – geographically as well as in terms of the mix between traditional and renewable sources.

Global Clean Energy Projected Revenue Growth 2009 to 2019 (US$ billions)



Source: Clean Edge

In Action!

Domestic power outages: China needs energy – and lots of it – to make its vast economy run. Just to keep pace with consumption growth, China needs to build about a dozen new 1,000-megawatt power plants every year (versus I or 2 for the US). Despite building new plants, China's power transmission system still remains under-developed resulting in regular power outages. Pakistan has also faced shortages of electricity for years – in 2010 the government banned neon signs and the official weekend was extended from one to two days in an attempt to conserve electricity. South Africa had its first electricity crisis in 2007, as technical problems with old plants led to cuts for residents and businesses in major cities. Even though new power stations and lines are being built, the margin between national demand and available capacity is still low resulting in some outages. Elsewhere countries including Venezuela, Vietnam, Argentina, and India are also facing the realities of actual and potential power shortages. But it is not just rapidly developing nations: The US and many European countries also face urgent needs for new capacity.

Creative energy use: Rising energy costs are forcing some companies to shorten their operating hours, while others have had to become creative and smarter to cut energy costs. For example, companies that make large numbers of daily deliveries have been reducing the number of delivery runs each day, using GPS software to shorten routes, and making sure vans and trucks are filled to capacity. Other energy-intensive businesses are buying contracts ahead of time to avoid price volatility, investing in more energy-efficient machinery or switching heating systems to alternative fuels from oil or gas. A side benefit of creative approaches to energy use is that firms are becoming more environmentally friendly.

More energy pipelines: The first oil pipeline linking the world's biggest producer, Russia, and the world's biggest consumer of energy, China, has begun operating. Running from Siberia and the northeastern Chinese city of Daqing, it will allow a rapid increase in oil exports between the two countries. Until now Russia's pipelines for oil and gas exports have largely flowed towards Europe, with more to come. In April 2010 workers began building a 1,220-kilometer pipeline that will run under the Baltic Sea between Russia and Germany, to help meet an EU demand for gas that is predicted to more than double by 2030. Still, Europe is wary of overdependence on Russian energy; the EU is seeking an agreement on a natural-gas pipeline between Turkmenistan and Azerbaijan to facilitate imports of Caspian fuel. How this will play out remains to be seen as Russia intensifies its efforts to connect key Caspian producers to its own gas pipeline projects to maintain control of critical energy flows.

Look Out For...

Energy politics: The disruptions of natural gas to Ukraine and Georgia in January 2006, of oil to Lithuania and Belarus in 2006, and of gas to Georgia again in January 2007 were only an intensification of Russia's energy politics that have impacted these countries and Europe since as early as 1990. Five years ago the European Union launched plans to diversify energy sources and transport routes. But Europe's growing dependence on Russia remains: Today a quarter of the EU's gas comes from Russia, 80% through Ukrainian pipelines; Russia's share of EU gas imports is projected to rise from 40% in 2008 to 60% by 2030. The EU remains vulnerable to Russian energy politics, hampered by a need for EU-wide agreements, and in the face of some cold truths about alternative sources including renewable and nuclear: There aren't many options and change is expensive. Worldwide, it is also becoming clear that the revolutions and growing civil unrest in North Africa and the Middle East have the potential to impact supplies from key oil exporters. How the regimes transition will impact the nature of future energy politics on a global scale.

More and more risky fuel retrieval: The Deepwater Horizon oil rig disaster graphically illustrates the risks of energy industry's push to drill ever deeper in search of oil and natural gas. About 80% of the oil and 45% of the natural gas in the Mexican Gulf comes from deepwater exploration. In other parts of the world deep-water drilling is also continuing at a frenetic pace, for example in the Gulf of Guinea, the Mediterranean and the Turkish Black Sea. Nowhere is the trend more apparent than in Brazil, where state-run Petroleo Brasileiro SA in October 2010 began deep-water production in one of the largest oil fields discovered in the Western Hemisphere in 30 years. Together with a recently discovered field nearby this operation could yield almost two-thirds of the total proven deposits of crude in the US.

Clean energy: China officially surpassed the US as the world's biggest energy consumer in 2010, a factor that has helped drive its lead in the race for clean energy dominance. In 2009 China became the largest installer of new wind farms, adding more than one-third of total new global installations. It also leads in solar hot water heater manufacturing and installations and manufactures more solar photovoltaic cells than any other country. Iceland is helping China expand its use of geothermal resources. Denmark is another clean energy leader, home to a vast wind energy network and now to a vast waste-to-energy plant burning thousands of tons of household garbage and industrial waste. Across Europe, there are about 400 such plants, with Denmark, Germany and the Netherlands leading the pack – but none planned in the US. Clean energy technologies are also continuously evolving to meet the world's pressing needs. For example, Cella Energy is working on new micro-beaded storage technology for hydrogen that can be used in an existing gasoline or petrol vehicle to replace oil-based fuels (Source: Benzinga).

The smart, distributed grid: The market potential of renewable energy will only be fully realized if smart grid technologies and services are successful. Smart grids utilize digital technology to integrate the generation, transmission, distribution and consumption of electricity. They allow power companies and consumers understand how power is being used in near-real time, manage the change in the generation mix (e.g. if the wind does not blow), and promote the decentralization of electricity production. The promise of the smart grid: Lower energy usage, costs, waste, energy imports and emissions; higher efficiency, reliability and security. The earliest and largest example is the Italian system installed by Enel S.p.A. of Italy, completed in 2005 and widely regarded as the first commercial scale use of smart grid technology to the home. It's a focus globally – in 2009, the Department of Energy awarded US$435 million to sixteen different smart grid pilot projects in the U.S. Read more about smart grid projects here.

How businesses are responding…

- In the US, on-site renewable energy generation is taking off in a big way. In 2009, Wal-Mart's on-site green power production and wind power purchases are expected to total more than 240 GWh of electricity. Looking forward, the company plans to nearly double its solar energy use in California by installing solar panels at up to 20 additional Wal-Mart facilities by 2011.
- Automaker BMW pipes methane gas 15.3 km from a landfill site to serve the electric and thermal needs of its manufacturing facility in Greer, South Carolina. By recovering the waste heat from turbines the heat and power project satisfies more than 60% of the facility's thermal needs, as well as nearly 20% of its electricity use.
- Fitness centers and gyms across North America are using energy converters on equipment such as stationary bikes and ellipticals to generate electricity for the gym. According to Time, there are over 80 locations in North America that generate electric power from the sweat of their customers.

In April: Look out for trends in action on InfoWars.