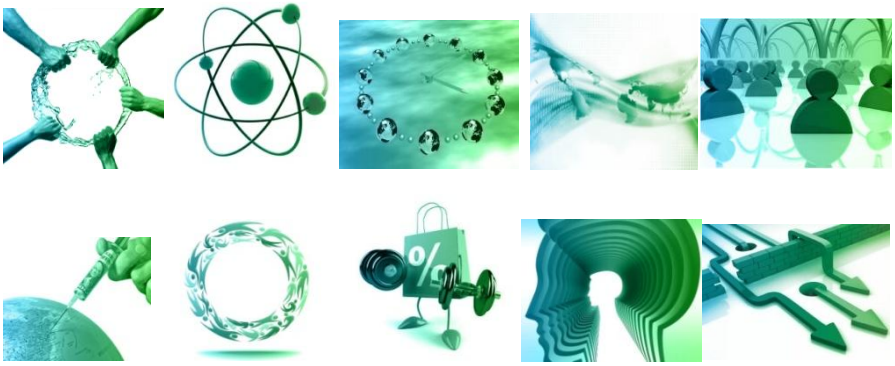
Clean Tech: Are we serious?



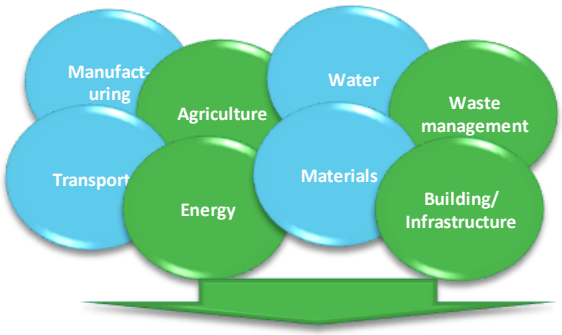
July/August 2011: Twenty-five years since the Chernobyl nuclear disaster, radiation continues to leak at Fukushima and the world continues to look for cleaner answers to future energy needs. But it's not just energy in focus – climate change and resource scarcity, including food and water, mean we need cleaner and better ways of using (and reusing) the resources the planet can provide. Clean technologies are no longer "alternative" – they have significant impacts on the future viability and sustainability of businesses globally and applications are growing, driving new markets, new business models and new solutions to customer and consumer needs. We have come a long way – many clean technologies are now available and affordable. A recent IPCC (Intergovernmental Panel on Climate Change) report on the Potential of Renewable Energy emphasizes this point – the scenarios run by the panel suggest that close to 80% of the world's energy supply could be met by renewables by 2050 if backed by the right enabling public policies. Yes, that is not a typo: 80%. But the lower-case scenario, without the enabling policies, is that only 15% of the world's energy use in 2050 would be provided by renewables. That's a huge difference which clearly highlights the choices we have as societies, industries and individuals.

The question is: Are we serious about implementing them? Yes, there are upfront costs and benefits will be recouped over time – are we willing to invest now for the long-term, whether governments businesses or individuals, or are we using the economic crisis as an excuse to pass the burden on to the next generations? At the Wired Business Conference in New York in May 2011, Bill Gates emphasized the need for big, radical investments in clean energy, dismissing smaller scale technologies like residential solar installations as *cute* but ineffective. A July report by the UN's Department of Economic and Social Affairs argues that US$1.9 trillion of investment annually, of which US$1.1 trillion in developing countries, is needed for the next 40 years to create a "fundamental technological overhaul of production processes worldwide" and avoid "a major planetary collapse." The lead author of the report, Rob Vos, states "Business as usual is not an option… Even if we stop the global engines of growth now, resource depletion and pollution of our natural environment would continue because of existing production methods and consumption habits. Without drastic improvements in and diffusion of green technologies, we will not reverse the ongoing ecological destruction and secure a decent livelihood for all of humankind, now and in the future."

Yet, very little of the money pledged at the 2009 Climate Conference in Copenhagen to address the challenges of climate change and to diffuse clean technologies worldwide has been forthcoming. It appears action is low on the priority list for many governments, particularly in the developed world.

But bear in mind that it is much easier to make the right choices on clean tech when you are investing in growth anyway, as are many of the rapidly developing economies. The risk for governments, societies and businesses in developed markets is being left behind by not upgrading infrastructure, processes and technologies. So what are the organizations, businesses and consumers at the forefront of applying these technologies doing? And what benefits are they seeing? Let's take a look at three of the key clean tech application areas.

A Quick Overview: Key Clean Technology Areas of Application



- More efficient use of resources
- Reduce environmental impact
- Integrate end to end processes
- Provide superior performance at lower cost
- Give customers/consumers greater control of usage

Clean Energy

The demand for energy is rising rapidly. According to the International Energy Agency's (IEA's) International Energy Outlook 2010, total world consumption of energy is projected to increase by a staggering 49% from 2007 to 2035 with the largest projected increase in demand in the non-OECD economies. This represents an average increase in energy consumption of about 1.4% per year, with demand projected to rise from 495 quadrillion Btu in 2007 to 739 quadrillion Btu in 2035. Adding this vast amount of electricity production capacity will in itself be an enormous challenge; doing so in a sustainable way raises the bar significantly. Renewables are the fastest-growing source of world energy, increasing output by 2.6% annually, driven by concerns over the environmental impacts of fossil fuel use and strong government incentives for increasing renewable energy use in many countries. For example, China, the world's biggest energy consumer, is installing wind power at a faster rate than any nation in the world, and manufactures 40% of the world's solar photovoltaic (PV) systems. However, the IEA has estimated that global CO2 emissions rose by 5.9% to 30.6 billion tonnes in 2010, mainly driven by booming coal-reliant emerging economies. China accounted for a quarter of the global emissions (8.33 billion tones) and the United States was the second largest emitter, showing a 4.1% rise in emissions last year to 6.14 billion tonnes. Global CO2 emissions are widely seen as a major factor for the increase in world temperatures. (Source: Reuters)

In Action!

Solar energy: The cost of solar photovoltaic (PV) cells has fallen 21% so far in 2011 and the cost of solar power is now about the same as the rate utilities charge for conventional power in the sunniest parts of California, Italy and Turkey. Boosted by the efficiency of the newer thin-film solar panels, solar power may be cheaper than electricity generated by fossil fuels and nuclear reactors within three to five years. Helping boosting efficiency in installations, a new company called Geostellar pushes solar PV planning into the 21st century, using data. Geostellar sends low-flying aircraft over regions to create a *virtual world* of buildings, shadows, and slopes which together with data including weather, property values, land use, electricity rates, and proximity to transmission lines means it is possible to make more efficient solar decisions. (Source: Bloomberg & Good Environment)

Wind Power: Global wind power installations have increased by 35.8 GW in 2010. This brings total installed wind energy capacity up to 194.4 GW, a 22.5% increase on the 158.7 GW installed at the end of 2009. The new capacity added in 2010 represents investments worth US$ 60.5 billion. For the first time in 2010, more than half of all new wind power was added outside of the traditional markets in Europe and North America. It has mainly been driven by the continuing boom in China, which accounted for nearly half the new wind installations (16.5 GW). China now has 42.3 GW of wind power, and has surpassed the US in terms of total installed capacity. But other developing countries are also expanding their wind capacity, including India, which added 2.1 GW in 2010, Brazil (326 MW), Mexico (316 MW), and 213 MW were installed in North Africa (Egypt, Morocco and Tunisia). Wind power (new installation capital costs) is projected to expand from $60.5 billion in 2010 to $122.9 billion in 2020 (Source: GWEC and Clean Edge Trends 2011)

Biofuels: Scientists are focusing on solutions that will yield a new generation of renewable fuel—a source that doesn't divert food into energy, and is abundant enough to make a significant dent in the oil market and the work is picking up steam. This new generation of biofuels uses non-food crops such as jatropha trees, wood chips, grasses, and algae to produce non-ethanol biofuels. Companies are also working on making hydrocarbons, molecules very similar to those used in automobiles in place of ethanol. Some biofuels have been named *drop in* fuels, because they can be used in fuel tanks, as a substitute for diesel and aviation fuel, without any adjustments. Moreover, drop in fuels work in the existing infrastructure of pipelines and blender pumps, unlike ethanol which cannot be transported in gasoline pipelines or used in tanks without being blended. Startups like Amyris , LS9, and Solazyme are researching ways to produce new biofuels that are sustainable and ready for use in our cars and planes. (Sources: The Economist, IEA)

Solid state lighting: Technological advances in the last two decades mean light emitting diodes (LEDs) can now be used in lighting applications including aviation, automotive (e.g. brake lamps and indicators) as well as in traffic signals. Cutting-edge research suggests a bright future for solid-state lighting as the next generation of light sources for general illumination, from homes to commercial applications. Lighting is the single biggest user of electricity and LEDs can provide 50,000 hours or more of life compared with an incandescent light bulb that lasts approximately 1,000 hours. LEDs are getting more and more attention from corporates such as Micron Technology, Samsung Electronics, Taiwan Semiconductor Manufacturing Co., and United Microelectronics Corp., who compete in a market dominated by Cree Research, General Electric, Nichia, Philips and Osram. Since the end of 2007 at least 37 nations have adopted policies to phase-out incandescent lightning and many more are considering such moves. (Source: Lightning Research Center & IEA). According to Bloomberg it is believed that within five years, the use of LEDs for general lighting purposes may grow to more than 50% of the market from less than 1% today. The global lighting product market is estimated at US$ 40 billion to US$ 80 billion a year.

Asia embracing environmentally-friendly technologies: China is the world's biggest emitter of CO2 but China is also spending tens of billions of dollars every year on renewable energy projects - almost twice as much as the next biggest spender in this field, the US. In addition, South Korea's clean energy capacity more than tripled in 2009. Contrary to what many people in the West believe Asia is not just the big bad polluter. The global clean tech market is currently worth about US$ 500 billion, of which Asia already accounts for US$ 100 billion. According to the Asian Development Bank, there is a thirst for new technologies (or at least new to the region). The three major drivers behind the push for green technologies in Asia are energy security, environmental degradation and, perhaps most importantly, the need for new industries to create new jobs. (Source: BBC)

Look Out For...

Solar Thermal: Whereas solar PV panels directly convert sunlight into an electric current, concentrated solar (Solar Thermal or CSP) uses the sun's heat energy itself to generate power. Solar thermal products come in all sizes -- from rooftop panels that absorb the sun's rays to heat swimming pools and provide hot water for homes to huge mirror arrays that heat liquids to create steam to drive electricity-generating turbines at solar power plants. So just how big is the potential for concentrated solar? A recent study found that 1,000 square miles of the Mojave Desert devoted to CSP could produce enough energy to power the entire USA. In April 2011, the United States took one giant step closer to plugging in the world's largest concentrated solar power plant—Brightsource's Ivanpah plant—which will pump out a massive 392 megawatts of clean, solar energy in the Mojave Desert as soon as 2013. (Source: Good Environment)

Kinetic energy: Kinetic energy (or energy of an object, human or otherwise, due to motion) is a reliable and cost effective alternative power source. Businesses, governments and academics are experimenting with a huge range of ideas to make what we do every day, like walking or exercising, work for us and for the planet. Take Stockholm's Central Station. The body heat of the rush-hour throng moving to and from the underground station is captured and converted to produce hot water, which is then pumped to the heating system in a nearby building to keep it warm. Not only is the system environmentally friendly but it also lowers the energy costs of the office block by as much as 25% (BBC). Piezoelectric sidewalks and dance floors are being pioneered in the US and Japan, to harvest energy from our footfalls and dancing to power anything from public and commercial lighting to cell phones. Scientists, harnessing the potential of nanotechnology, are even working on self-illuminating shoes. If we can generate enough energy to charge our ever-increasing array of gadgets with our feet or body heat this lends a whole new meaning to people power. (Source: Global Trends)

Smart Grids: These allow power companies and consumers to understand how power is being used in near-real time and manage the change in the generation mix (e.g. if the wind does not blow then the oil pump starts). The U.S. has awarded US$435 million to sixteen different smart grid pilot projects but the U.S. transition to a full smart grid will likely take many years and realizing the full potential will take even longer. Such a complete smart grid would consist of millions of next-generation meters installed in businesses and homes, appliances that adjust their energy use when prices change, and advanced software to help utilities control electricity flows. GE plans to introduce the *Nucleus* in 2011, a device for consumers to track their household electricity use via personal computers and smart phones. (Source: Bloomberg). A just developed smart grid chip can reportedly manage defects on a power grid network, e.g. generator problems, power cuts, power line failures, a thousand times faster than current software. When renewables are available – which isn't all the time – it can also automatically prioritize them. While not quite ready for commercialization, the first full-scale trials may happen in the United Arab Emirates by next year and commercialization could happen within the next five years. (Source: Fast Company)

Next generation batteries: Storing electricity can help smooth out variability in renewable power while also improving the reliability of transmission grid, e.g. flow batteries can hold renewable power until it needs to be used. Flow batteries have existed for some time, but have used liquids with very low energy density (the amount of energy that can be stored in a given volume). Because of this, existing flow batteries take up much more space than fuel cells and require rapid pumping of their fluid, further reducing their efficiency. Now a new semi-solid flow battery is developed by researchers at Massachusetts Institute of Technology (MIT). It could provide a lightweight and inexpensive alternative to existing batteries for electric vehicles and power grids. The technology could even make "refueling" such batteries as quick and easy as pumping gas into a conventional car. (Source: Energy Harvesting Journal) Another team at MIT is also working on next generation batteries: rechargeable fabric batteries which can be incorporated into clothing – one way to charge your devices on the go, for civilian and military use.

Manufacturing

Every manufacturing process involves the use of energy – and lots of it depending on the industrial process. The manufacturing sector is also one of the water utilities' largest customers. In 2008 the manufacturing industries and construction accounted for about 20% of the world's CO2 emission and 20% of the world's water consumption. In industrialized nations, however, industries consume more than half of the water available for human use. In a world that struggles to keep pace with increasing demand for water and energy, plus vocal demands for reduced CO2 emissions, one solution has been increasing regulation of consumption. However, there is a lot to be said for using fewer resources and creating fewer emissions rather than just trying to regulate them. Industry is stepping up to this challenge with more companies than ever proactively pledging to reconsider their manufacturing methods and reduce environmental impact. Leading companies are tackling water, energy and climate change issues in ways that reflect their relative locations and footprints. For example, Sony's new headquarters in Tokyo uses waste heat from a public sewage treatment plant resulting in a reduction of approximately 3,500 tons of CO2/year and 92% less water used compared to a typical office building. IBM found a way to improve the precision of metal deposition in the semiconductor manufacturing process. This reduced water use in this step by 14% (90,000

liters per year), chemical use by 28%, and cycle time for metal deposition and CMP by 42%. The reduction in cycle time produced a corresponding reduction in energy use. Unilever has designed the Sustainable Living Plan,with key targets including: Halve the greenhouse gas impact of the firm's products across the lifecycle by 2020, halve the water associated with the consumer use of Unilever products by 2020, and halve the waste associated with the disposal of the firm's products by 2020.

In Action!

Water footprinting: Worldwide we use lots of water for drinking, cooking and washing, but even more for producing *things* whether food, paper, clothes, etc. So this is a prime focus for manufacturers looking to implement clean technologies. Intel's environmental goals include reducing water use per chip below 2007 levels by 2012. It has invested US$100 million in water conservation since 1998 and saved 36 billion gallons of water. One of the world's biggest consumers of water, beer and beverage company SABMiller, is working with the 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 liter 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 its water use ratio, 89% of its facilities were in compliance with its wastewater treatment standards and the company was replenishing about 22% of water used in finished beverages, through approximately 250 community programs in 70 countries.

Alternative (local) energy sources: More and more manufacturers are looking to local energy sources. 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. A new IKEA store in the Denver area will employ 500-foot-deep holes in its cooling and heating system. Temperatures in the holes hover around 55 degrees year round, so air inside them can be pumped up into the cooling and heating system to reduce energy costs by up to 50%. In the U.S. – and worldwide – geothermal has the potential for saving billions of dollars in energy costs (Source: Care2). As of June 2009, Staples is hosting 24 active rooftop solar systems on its stores, distribution centres and offices throughout the U.S. and has more than 100 more systems under development.

Local sourcing: Driven by consumer demand smart companies are moving from 'merely' neutralizing and offsetting their undesirable eco-effect to actually boosting the environment by doing something extra. Think Local – Buy Local – Be Local movements help reduce the environmental impact of long-distance transportation of goods. Companies including Nestle, Honda and Unilever are choosing to manufacture and produce some products locally to reduce CO2 emission and boost local economies. But it's not just the giants of manufacturing; smaller businesses are also encouraging local manufacture – LocalHarvest in the U.S. offers services to find nearby farmers' markets, family farms, and other sources of sustainably grown food. *Bought locally, ordered online and delivered to your door* pretty much sums up Poptotheshops which offers products and services of independent retailers to South Wales residents in the UK. It serves four high street areas, with the retailers in each selling between 3300 and 4500 products using service.

Look Out For...

More cradle to cradle: Companies (and consumers) have created massive amounts of waste over years and years. It worked fine the globe's resources and capacity for waste disposal seemed to be infinite but not any longer. Closed loop or cradle-to-cradle systems share the goal that materials – including metal, paper, plastic, and even food – are (as far as possible) completely recycled or find their way back into the natural environment. A true closed-loop system in which materials are reused indefinitely is not yet a reality but could be within a few years. Examples of these processes now exist in many industries. One cradle-to-cradle leader is DSM, the Dutch plastic giant. The company has worked with suppliers and MBDC to develop programmes that would allow its plastics to be recycled with minimal effects on quality. The office furniture company Herman Miller uses materials that can be recycled or composted. Even Rungis, Paris's

largest wholesale market, avoids sending waste to landfill and uses it to fuel its operations and part of the energy needs of Orly airport. (Source: Guardian)

Integrated, sustainable supply chains: For many companies sustainability starts with making the supply chain greener: Replace materials in products, reduce packaging materials, eliminate supply chain steps, implement more efficient or cleaner processes, improve energy efficiency of facilities and equipment. Successful green supply chain management companies include many profitable firms such as Hewlett Packard, Timberland, and Xerox. For these companies, going green is not just a slogan, it is an integral part of their business strategy; they link sustainable programs to reducing costs, increasing revenue, and mitigating risks. Timberland for example has led its industry in developing a Green Index for its products, which takes into account a product's climate impact, chemical content and resource consumption. HP has set specific packaging reduction goals and product content targets, and is working with the Carbon Disclosure Project to measure supply chain carbon footprints. (Source: Awareness into Action.com)

Rice, straw and coconut – the new alternatives to wood: Could one of the world's most ubiquitous staples hold the key to saving tropical hardwood trees? A new product from Resysta may look like wood, and be used like wood, but the main ingredient is rice husks. This recyclable material has won awards for its sustainability credentials by using a widely available agricultural by-product to conserve hardwood stocks. Straw as a building material may have a bad reputation, but Kirei has developed a technology to challenge that assumption. Kirei board is made from sorghum stalks, another renewable agricultural by-product that would otherwise be burnt or make its way to landfill. It is a material designed for its aesthetic appeal and customers globally include Starbucks, McDonald's, Hilton and Google. In terms of cost it is comparable to mid-range hardwoods. The company also produces a wheat-based MDF alternative, hemp panels, coconut mosaic tile, and a range of bamboo products. (Source: BBC)

Tackling the plastic problem: Plastic is ubiquitous – light and able to be processed into multiple forms and colours, it dominates our packaging in many countries. The problem is disposing of it. Think landfills full of plastic that does not degrade – and also think oceans. In February 2011 the UNEP sounded growing concern over the impact of billions of pieces of plastic, both large and small, on the health of the global marine environment. Our oceans are starting to resemble plastic soup, with small fragments absorbing chemicals and then ingested into the food chain potentially causing significant health risks, as well as harming the environment. There are technologies to help address plastic pollution, which are making their way into the manufacturing supply chain, including improved recycling processes, biodegradable plastics (e.g. Pampers disposable diapers) and plastics to fuel. In addition, the EU unveiled an innovative initiative in May 2011 to tackle two issues in one go – plastic pollution and fishing quotas. Fishermen will be paid to fish for plastic as well as fish – hopefully with the former being recycled.

Transportation

In 2008 (latest number) the transport sector accounted for 22% of global carbon dioxide emissions, remaining stable between 2007 and 2008 but down from 23.3% in 2005. According to the IEA the global demand for transport appears unlikely to decrease in the foreseeable future. In fact it is projected to grow 45% by 2030! It is therefore extremely important to limit emissions from the transport sector with regulators and policy makers worldwide encouraging or at best requiring improved transportation efficiency to lower emission. Measures include encouraging a shift from cars to public transportation and the use of greener vehicles and fuel. The environmental issues created by transport extend well beyond emissions, e.g. in the U.S. transportation infrastructure accounts for 20% to 40% of all urban land use, as well as representing an outsize 30% of all U.S. greenhouse gas emissions. With this in mind The American Society of Landscape Architects has come up with a great idea showing how to reuse streets, underpasses, and rail lines to encourage more pedestrian travel. It offers advice on transforming underused streets and sidewalks into *parklets* – mini parks filled with trees, plants, chairs, and tables where weary urbanites can rest and recuperate. This persuades more people to travel by foot (in San Franscisco, one parklet bolstered pedestrian traffic by 37%), which, in turn, can promote shopping and boost the local economy. The up-front cost: Less than US$ 20,000. For more on this visit Fast Company.

In Action!

Alternative Energy Vehicles: Green cars are the cars of the future and the world's automobile companies are developing, producing and selling more. As of early 2011 more than 43 million alternative fuel and advanced technology vehicles have been sold worldwide, compared to around 900 million cars and light trucks in use in 2010. Green cars running on alternate fuels such as electricity, solar cells, or biodiesel are becoming more attractive in a world where people worry about worsening pollution, smog, and global warming (Source: Plunkett Research). China has developed a draft plan to invest US$17 billion in central government funds in fuel economy, hybrids, plug-in hybrids, electric and fuel cell vehicles, with the goal of producing 5 million new energy vehicles and 15 million fuel-efficient conventional vehicles by 2020. By 2015, the US Navy has established a target of halving its petroleum use in its non-tactical commercial fleet (some 50,000 vehicles) by using hybrid, flex-fuel, and electric vehicles. (Source: Treehugger) And don't forget alternative vehicle fuels – from solar power, to next generation biofuels.

Carbon credits on airlines: The aviation sector contributes about 2% of total global CO2 emissions and from January 1, 2012 around 4,000 operators flying in and out of Europe will be forced to enter the emissions cap-and-trade scheme. Exceeding the number of allowed emission allocated for free (set by EU) requires these airlines to pay for the extra carbon dioxide they emit. Airlines in Europe are likely to pay about €1.4bn next year for carbon permits under the European Union's emissions trading scheme. (Source: Guardian). The International Air Transport Association (IATA) is also running a carbon offset program under the United Nations' Clean Development Mechanism (CDM), in which firms investing in such projects receive credits called certified emissions reductions. This year they expect 10 airlines to join the carbon offset program and about five are from Asian countries. (Source: Reuters)

More public transport: More and more people are living in cities, so what about making public transport a part of the modern urban lifestyle? The benefits: reduction of an individual's carbon footprint, alleviating traffic congestion, more efficient land use and of course saving CO2 emissions. The concept of *combined mobility* could change citizens travel behavior and offer a genuine alternative to the car, based on flexibility and a high level of convenience. Combined mobility is about designing public transportation to work in synergy with other modes like car-sharing, taxis and shared taxis, bicycle and bike-sharing, car-pooling, demand-responsive transport and car-rental services. Together this could complement the classic fixed line- and timetable-bound public transport services and, together with walking, form a more complete and coherent mobility solution. (Source: UITP)

Sharing/renting transport: Residents of Barcelona use their personal Bicing card to rent and pay for use of one of the service's 6,000 bicycles, which can be picked up from and returned to any of 400 stations throughout the city. Inspired by other bike-sharing programs WhipBikes is a self-service sharing system at Newcastle University, that charges a one-time fee, for use of one of 150 bikes across the campus whenever needed. Go520 is a program from Avego that helps match drivers and riders in real time as they travel, making it possible to rideshare whenever and wherever you want. According to the company, the technology is already used by thousands of commuters in more than 65 countries around the world. For those who aren't satisfied with a bike or a car ride, go to US based SocialFlights that now enables users to outline their proposed flight plans to the website. Other users intending on making a similar trip can then express an interest in sharing an aircraft. For other great sharing sites take a look at NuRide in the US, Mega Car Pool in New Delhi India, and Ridekicks in the UK. (Source: Springwise).

Look Out For...

Next generation fuels for shipping: Shipping, like other means of transportation, is a huge emitter of CO2 and pollutants – and as such in the sights of regulators, who will soon be demanding cleaner fuels in ships and/or pollution reduction. On a top 10 list of suggested marine fuels of the future you'll find (in debatable order of expected future market share): LNG; Heavy Fuel Oil with exhaust cleaning; Distillate fuels; LPG; GTL; CNG; Biogas; Hydrogen (as energy carrier); Battery (as energy carrier); Nuclear (Source: DNV). LNG is increasingly seen as one of the most viable - and green – options, and is already being used in some areas of shipping, such as short sea shipping and LNG cargo transportation. However, significant operational,

procedural and regulatory challenges still remain to be overcome before LNG can gain acceptance by players in the tanker, dry bulk and container sectors. (Source: Petrospot)

Next generation fuels for aviation: Hydrogen, nuclear-powered planes, solar and electric powered commercial aircraft have all been shelved for the short- to mid-term, in favour of focus on alternative jet fuels. Airlines won in June 2011 the backing of a U.S. based technical-standards group to power their planes with a blend of traditional fuel and biofuel from inedible plants (organic waste or non-food materials, such as algae or wood chips) and it may comprise as much as 50% of the total fuel burned to power passenger flights. Under the Burnfair project, Airbus and Lufthansa (the first airline to use biofuel), plan to fly using so-called hydrotreated renewable jet fuel every day, four times a day, from Hamburg to Frankfurt. Lufthansa is aiming to blend clean fuel with kerosene at up to 10% of the total by 2020. Airbus estimates airlines may consume 30% of their fuel from plant-derived sources by 2030. Airbus and Boeing, which together manufacture about 80% of the world's passenger planes, are planning to set up biofuel production chains across the world. (Source: Bloomberg) And it is not just these pionners: KLM successfully tested biofuel from used cooking oil in combination with traditional aviation fuel, on the first flight with passengers to use such a mix in 2009. In addition, Virgin, Air New Zealand, Air Japan and Continetal Airlines have completed successful demonstration flights using biofuel mixes.

Next generation cars: Governments and the auto industry are pouring billions into hydrogen vehicle research and development. Fuel cell cars are considered long-range alternatives to electric cars, and they are also similar to hybrids. These cars all use electric motors to drive wheels, batteries to store energy, regenerative braking to conserve it, and may in time use composite bodies that are lighter. Toyota expects to have fuel-cell cars on the market by 2015. Daimler Chrysler thinks competitive fuel cell cars will be on the road by 2012-2015. But there are more obstacles: technology is limited because methods for extracting hydrogen are still not yet clearly defined nor commercially feasible; there are possible environmental issues if, as some scientists warn, hydrogen from fuel cells leaks into the atmosphere and disrupts the ozone layer**;** infrastructure will have to change dramatically; and the reliability of fuel cells have not yet been tested beyond much more than 200 hours of use on cars (Source: Techcast). It is believed that China may emerge as a world leader in fuel cell cars due to government-driven investments. (Ecoworld)

Lightweight materials: BMW is building a carbon fiber factory, the first carmaker to do so, to secure supply of the lightweight material and lower expenses. The material will reduce the weight of its electric cars which have heavy batteries. Daimler AG (DAI)'s, Mercedes-Benz and Volkswagen AG (VOW)'s Audi have joined BMW's pursuit of the material, which is 50% lighter than steel and costs 20 times as much, as they strive to meet tighter environmental rules. Demand for carbon-fiber components will probably rise nine fold to US$94.1 million by 2017. However, cost and difficulties in use will continue to be a hurdle for mainstream adoption. (Source: Bloomberg). Perhaps carmakers could in future turn to graphene? Flexible, extraordinarily light and transparent, graphene is also extremely strong, and can be embedded into other materials such as epoxy or plastic to make very light yet incredibly strong composite materials. Its mechanical properties could dramatically change the designs and materials used in industries such as aerospace and automotive, with huge positive effects on fuel consumption and emissions if vehicles and aeroplanes become lighter. Yet to be commercially produced, a number of companies are actively researching and testing manufacturing – it could be a game changer… (Source: Global Trends)

Reducing transport by smarter placement of services: Childcare is being started in French railway stations by SNCF to reduce trips for parents and to help its users solve the daily challenge of childcare. Two nurseries have already opened their doors within a year in Paris. Open from 6:45 a.m. to 7:00 p.m., the service is intended primarily for users of the TER, Roanne living and working in nearby towns: Saint-Etienne, Clermont-Ferrand or Lyon. But all parents, clients of the station or not, are eligible. A dozen cases are pending to date, and no room is be free for six months. Based on this experience, SNCF now wants to extend all the service over France. A report from REAAP reveals that between 300,000 and 500,000 places are needed nationally. (Source: Le Figaro*)*

In September: Look out for trends in action on a multipolar world.