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From the **editor's** desk...

As the month of July was coming to a close, the electricity grids covering 21 States of the North, East and North-East regions of India collapsed, plunging half of the country into darkness. Just before that, the northern grid had collapsed and it took nearly 15 hours to restore the same. These consecutive incidents underscored the grim power situation that the country is facing today. During those periods many of the power plant units were not operating owing to shortages of coal and gas. The situation was particularly significant given that conventional wisdom is to assume that India has an abundance of coal. Effectively, this was a case of shortage of electricity coupled with the grid indiscipline. However, these unfortunate incidents helped bringing in to focus the crucial role that the future energy technologies like renewables and the intelligent grids can play in averting such situations in future. Indeed, renewables energy technologies can play an important role in making India not only energy-secure but also in accelerating its move towards energy independence. And the ever-expanding horizon of these innovations is not limited to large-scale grid connected plants but more importantly, a number of smaller, embedded generation systems connected to grid via smart networks, using interventions that also help maintain the grid-integrity.

Amit Kumar

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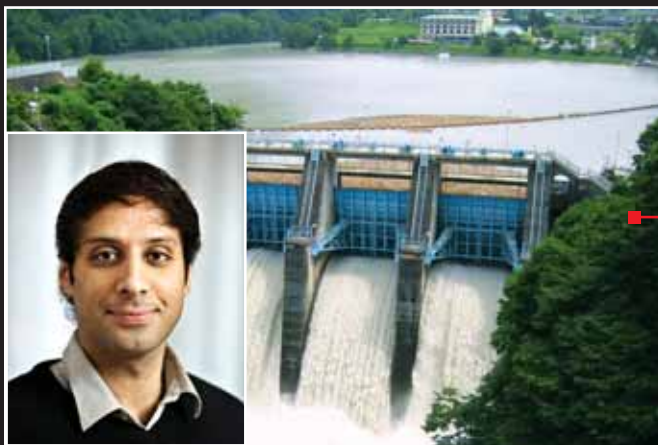
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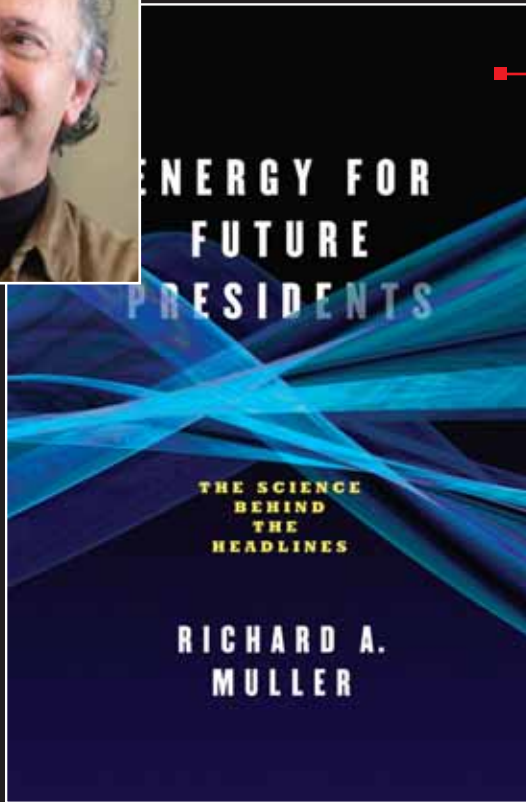
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INDIA INVESTING IN CANADA'S ENERGY ASSETS

India's national oil companies have jointly bid for the energy assets in Canada's northern Alberta region, currently controlled by ConocoPhillips' Canadian division and valued at US\$5 billion. India's major government-run oil companies have shown interest to invest in Canada's oil sands and have been speculating on the topic for at least a decade. Many analysts found India's hesitancy to invest in Canadian oil sands perplexing, as China has been making several multi-billion dollar investments—through various Chinese government-run oil companies—in the unconventional oil potential of Northern Canada's bituminous sands. Indian oil companies, however, have stayed mostly on the sidelines. Analysts say, it is a simple matter of lack of resources. Indian oil companies lack the same capital as the Chinese, the Koreans, the Japanese, and even the Malaysians, all of whom have made substantial investments in Canadian oil sands.

Some analysts say that it could also be because Indian companies might be less motivated, or less focused on long-term investments. Others believe that India is unaware of the potential in Canadian oil sands, or believe that the potential benefits to India are not nearly as much as the benefits to China or Malaysia. Recent reports show that a consortium comprising ONGC, Oil India Limited, and Indian Oil Corporation have bid for the energy assets available in the ConocoPhillips oil sands. This would imply that Indian oil companies have managed to generate sufficient capital to invest in Canada. Other motivating factors might be the fact that Alberta's oil sands are one of the last places where substantial oil deposits are in a stable jurisdiction, unlike the politically volatile nations where nations must import oil in the modern economy. In the meantime, ONGC's overseas division has stated its intention to invest around US\$20 billion in foreign oil deposits by 2030.

Source: Financial Post

DELHI TO USE SOLAR ENERGY TO LIGHT UP MONUMENTS

As one of the oldest cities in the world, and the epicentre for Northern India's political spectrum for the last millennium, Delhi is a city that basks in numerous historic landmarks and monuments that span various reigns and periods in history. Now, according to the Delhi Government, these monuments will play a part in shaping India's future by adopting and promoting the message of clean and sustainable energy. The government plans to set up solar plants in six major historic landmarks around Delhi, thereby allowing them to be powered by a clean, abundant, and renewable source of energy. This follows a successful trial run with the setting up of two solar power plants in 2009 at the Jantar Mantar and Safdarjung's Tomb, which produce 9 KW and 10.4 KW of power respectively.

Buoyed by these successes, the Delhi government has expanded the scope of this project to six new historic monuments, namely, the Qutub Minar, Red Fort, Humayun's Tomb, the Lotus Temple, Jama Masjid, and the Old Fort (Purana Quila). The government is also in talks with the Gurudwara Bangla Sahib to install a similar solar PV plant

to provide lighting at that site as well. Each solar PV plant's estimated cost is around INR 25 lakh (US\$47,000) each; with the estimated cost of INR 2 lakh (US\$3750) per installed KW. The plant can light up each site for more than four hours a day. It is hoped that such measures will provide relief to the city, which is currently grappling with the issue of a serious shortage in energy available for use by the common man, as evidenced by the recent collapse of the Northern India electricity grid.

Source: IANS





DEBT-RIDDEN DISCOMS BAILED OUT BY GOVERNMENT

The government bailed out power distribution companies after the cabinet approved a plan that would restructure their debt and implement new reforms that are intended to make the discoms more accountable and efficient. India's power distribution companies are hosts to an extensive list of debilitating problems ranging from crumbling and highly outdated infrastructure to corruption, gross mismanagement, and losses from inefficient transmission

and theft, among others. Years of these issues, compounded and multiplied on each other led to unmitigated losses, leading to discoms being INR 1.9 lakh-crore (US\$35.5 billion) in debt by the end of FY 2010-2011. India's state-owned distribution companies were already bailed out once in the last decade, back in 2002 when power sector reforms introduced the notion of privatization into the field. Clearly, the intended benefits of the move never materialized.

The cabinet announced that under the regulations of the bailout plan, state governments will take over half of the outstanding loans of state electricity boards and convert them into bonds that will be issued to the lenders and backed by state government guarantees. The lenders are to restructure the remaining 50% and provide a three-year moratorium on principal repayments. State electricity boards have also been informed that they will have to issue periodic and regular tariff revisions that are in correlation with their costs, and additionally work towards reducing theft, and transmission and billing losses from the present levels of 27%. The plan is not mandatory and state governments and their electricity boards have been given a deadline of 31 December to avail of the bailout package—if they so choose.

Source: Business Standard / Reuters India

ISRAELI COMPANY SDE TO HELP INDIA DEVELOP WAVE POWER PLANTS

A consortium of major Indian automobile manufacturers visited the offices of SDE in Tel Aviv, Israel to sign cooperation agreements on the construction of sea wave power generation plants along the Indian coast. SDE received letters of intent from the governments of Gujarat—the state with the longest coastline in India—and Maharashtra. In the coming months, after the July grid failure led to an unprecedented 670 million people being left without power, the move is an attempt by India to boost its energy security and add the thousands of MW that are lacking from the Indian grid. SDE is an Israeli company whose unique method of generating electricity from sea waves was recently ranked by a team of independent scientists on PESWiki—an extension of Wikipedia—as one of the world's 100 leading green technologies. The technology is noted for having zero emissions, and being completely renewable.

SDE Israel claims that electricity generated from its sea wave power plant comes at a production cost of 2 cents per kilowatt-hour (KWh), which is around INR 1 per unit, as compared to 12 cents per KWh for solar power and 16 cents per KWh for wind energy. The construction of a sea-wave power plant, according to the company costs around US\$1 million per MW. SDE is already in the process of building three seawave power generation plants in China, and had recently signed an agreement to help build a seawave power plant capable of generating 100 MW of power in India.

Source: PR Newswire / SDE



INDIA'S SOLAR REC MARKET SET TO FLOURISH, SAYS STUDY

According to a study conducted by Bridge To India, a New Delhi-based solar market consulting firm, India is set to witness a boom in the trading of solar renewable energy credits (RECs). A total of 480 million solar RECs are expected to be traded in India by 2016, according to the analysis, which might take some by surprise seeing that the common consensus view is that India's REC market is generally sluggish. Though the overall REC market in India has been active since February 2011, Solar RECs were first traded in India in May 2012. At the same time, REC demand was 1,637 nearly ten times the 149 RECs that were actually available on the supply side. However, finally there were only five RECs actually traded, at a price of approximately 200. Analysts say that this is indicative that the selling price bid was far too high.

According to the analysis released by Bridge To India, the enforcement of Renewable Purchase Obligations (RPOs) remains the Achilles heel of India REC trade mechanism. The Central Electricity Regulatory Commission (CERC) in India, has assuaged the concerns of lenders by indicating that RPOs will be strictly regulated. According to the report, there is an ongoing effort by the CERC, through the Forum of Regulators, to convince various state electricity regulatory commissions to comply with RPO regulations. In the event that the CERC is able to enforce RPO compliance, Bridge To India's analysis states that the total capacity of projects being

traded through RECs could be 868 MW by 2016. Thus, going with the assumption that only 25% of RPO requirements will be fulfilled through the REC mechanism, Bridge To India calculated that the total number of solar RECs traded is likely to reach 480 million by 2016.

Source: Solar Industry Magazine



HARYANA SIGNS PACTS TO SET UP 51 MW IN BIOMASS POWER PROJECTS

The Haryana government signed Memorandums of Understanding (MoUs) with four independent power producers for the establishment of five biomass power projects, totalling 51 MW in generating capacity, with an investment of INR 230 Crore. The funds for the project come from Haryana's energy conservation fund, which had been created for the purpose of executing energy conservation programs in the

state. Of the planned renewable power projects in the state's energy conservation fund, a 6 MW small hydro project with an investment of INR 58 crore at Dadupur, a 2 MW project with an investment of INR 22 crore at Karnal, a 1.4 MW small hydro project with an investment of INR 16 crore at Musapur, and a 1.4 MW small hydro project with an investment of INR 16 crore at Khukni have already started generating power. The biomass plants follow a spate of investments in renewables made by the government of Haryana, both for the development of power generating facilities and to spread awareness. The state has set up 21 district-level energy parks with a total investment of INR 1.8 crore to create awareness among students and general public about renewable energy and energy conservation technologies. Additionally, Haryana has implemented a project to install over 5,000 solar photovoltaic street lighting systems in 369 villages, with an investment of INR 12.11 crore. Their work was commended by the central authorities when Haryana was awarded the first prize for the best performance in installation of solar water heating systems in the North India Region for 2011-2012 by the Ministry of New and Renewable Energy.

Source: Times of India



ALIGARH MUSLIM UNIVERSITY SETS UP WIND ENERGY CENTRE

The Aligarh Muslim University's (AMU) special centre at Malappuram, Kerala, with the support of the state government, announced its intention to start a wind energy generation project. AMU Malappuram plans to set up windmills across its 300-acre campus in the immediate future. A turbine would be installed on the campus, to be followed by more after analyzing the wind strength at the centre. The proposal to try and harness the potential of wind energy at the centre was submitted a year ago by a local level organization, the Chelamala Development Society, to Kerala's Power Minister, Aryadan Muhammad. The idea was seconded by university officials during a later visit by the minister to the AMU campus. Following a feasibility study by a team from the Centre for Wind Energy Technology (C-WET), commissioned by the Kerala State Electricity Board (KSEB), the campus site was deemed suitable for the execution of such a project.

The C-WET team is currently in the process of experimenting with a trial run of one turbine on the campus, in order to gauge the quantifiable amount of power that can



be generated from the campus. Based on the wind flow, the C-WET team will be responsible for selecting the locations around the campus to place the wind turbines. Additionally, the team is also studying the impact of this project on the environment, and changes in climate.

Source: Times of India – Kozhikode

GUJARAT PLANS TO GENERATE GEOTHERMAL ELECTRICITY

The Gujarat state government has shown a genuine interest to invest extensively in extracting electricity renewable sources of energy. After potential investments in solar, wind, and sea wave energy, the Gujarat state government is now considering harnessing the potential of geothermal energy. The state of Gujarat possesses a geothermal zone—located in the Cambay region of the state, between the Narmada and Tapi rivers—and can be seismically active, as evidenced from the devastating Republic Day earthquake that struck the state on January 26, 2001. Cambay has, in a sense, the infrastructure required to begin harnessing geothermal energy. Several bore holes were dug for oil exploration and can be used in the short term to produce geothermal energy.

The Director of Gujarat Energy Research and Management Institute (GERMI), has indicated that the state government is considering geothermal energy as a source of electricity for the state, and are consulting the government of Norway for assistance, starting with an imminent feasibility study. Government officials from Narendra Modi's administration have expressed that if the pilot project is successful, the state may plan the construction of facilities to aid and abet the generation of an incredible 10,000 MW in a decade, which is equal to all the geothermal electricity produced worldwide currently. However, a sobering factor is the high value of the production cost of geothermal electricity.

Source: Power Engineering / narendramodi.in



MECCA LEADS SAUDI SOLAR GROWTH

The Saudi Arabian city of Mecca, the holiest place on Earth for the followers of Islam and the site of an annual pilgrimage from millions of people worldwide, is being targeted by the Saudi government as the epicentre for their expansion into the renewables sector. Osama al-Bar, the Mayor of Mecca, believes that Mecca will be the first Saudi Arabian city to own power-generating facilities, a significant portion of which, the authorities plan, will come from renewable energy sources. In January 2013, the authorities at Mecca will commission the construction of a power plant that the city hopes will be capable of producing 385 GWh of electricity per year of power, 100 MW of that will come from solar energy. These plans are an indication of Saudi Arabia's emerging shift towards building capacity for renewable energy technology, which currently plays almost no role in their energy portfolio.

The Saudi Arabian central government is pursuing US\$109 billion in investment to build a solar industry from scratch, aiming to get a third of Saudi Arabia's power requirements from solar power by 2032, compared to almost nothing now. According to Adnan Amin, Director General of the International Renewable Energy Agency in Abu Dhabi, part



of the reason behind choosing Mecca as the starting point for this may be an effort to inculcate the use of renewables amongst neighbouring Muslim-majority nations in the Middle East. Saudi Arabia receives more than twice the sunshine of any place in Europe in a year, and with 86% of their annual revenue dependent on oil, solar power seems the most logical avenue to explore to meet the nation's energy demands, thus preserving more crude oil for export.

Source: Bloomberg



CHINA SUBSIDIZES ENERGY-EFFICIENT DESKTOP COMPUTERS

As part of the latest efforts by Chinese authorities to reduce demand for imported crude oil by conserving energy, China will provide subsidies to buyers of energy-saving desktop computers, the Ministry of Finance said. Consumers will receive 260 Yuan (INR 2,200) in subsidies on purchases of desktop computers that meet certain energy-saving requirements. The subsidy program will start in October 2012 and last for one year. Earlier, the ministry said it will earmark 14 billion Yuan in subsidies to encourage the purchase of six types of energy-saving products, including desktop computers, air conditioners, fans, water pumps, compressors, and transformers. The ministry has introduced a slew of incentives this year to lift domestic consumption amidst a slowing economy. While China's economy grew at 7.6 per cent in the second quarter of this year, it is still much lower than the record-breaking rates of growth seen in the last few years preceding the recession.

Source: Global Times, China

JAPAN EXPERIMENTS WITH OFF SHORE FLOATING WIND TURBINES

A trial run of a floating wind turbine is under way off the Goto Islands in Japan's Nagasaki Prefecture. Offshore wind turbine technology has yet to be proliferated for practical use in the world, and this trial run is an effort by Japan to maximize its technological prowess at this yet untapped potential source of energy. Offshore wind power generation is suitable for an archipelago like Japan. As the turbines are offshore, there would be no noise pollution either. While the transformer substation is located on Kabashima, one of the Goto Islands, the floating wind turbines revolve slowly about two kilometres off-shore, powered by sea winds that flow uninterrupted in the region. The turbines rise about 35 metres above the surface of the sea, the height of a 10-storey building. Installed by the Japanese Environment Ministry, the full-fledged operation of the floating wind turbine started in late August. The structure uses innovative weight-distribution techniques in its design, while the cylindrical tower above sea-level is hollow to give it buoyancy; the lower half of the section below the sea's surface is filled with 130 tonnes of concrete to hold it in place. The turbine being used for the current trial run has a maximum output of 100 KW, enough to meet the average power requirements of 40 Japanese households.

A 2,000 KW capacity turbine will be tested around April 2013. After studying the turbine's power generation efficiency and environmental impact, the Environment Ministry has stated that it wished to establish practical offshore wind power generation technology by around 2016. Before the test run, the turbine faced one of its biggest challenges a typhoon that passed near the Goto Islands mere days before the trial was scheduled to begin. Hurricane winds churned up waves eight-metres high. However, the technologists at the Toda Corporation, the firm that built the turbine's platform, were confident in their technology. Eventually, the turbines suffered no physical damage.

Source: The Daily Yomiuri, Japan



CHINA-CONSTRUCTED HYDROELECTRIC SCHEME COMMISSIONED IN FIJI

The Nadarivatu Hydroelectric Scheme, a project being constructed in the Pacific nation of Fiji under the stewardship of China, has been officially commissioned in Fiji. A ceremony was held at the dam site in the mountains surrounding Nadarivatu; attended by Fiji's Prime Minister Voreqe Bainimarama, high-ranking officials from the government Fiji, and the Chinese Ambassador to Fiji Huang Yong, together with hundreds local people and Chinese migrant

workers. During the commissioning of the new hydroelectric scheme, Bainimarama expressed his government's thanks to the People's Republic of China for funding the project, as he highlighted the importance of the scheme, stating that it will help meet the government's primary objective of lifting the standards of living for all Fijians. The hydroelectric project is expected to save the tiny nation, around US\$24 million per year in importing diesel fuel to run generators. The Nadarivatu hydroelectric project will be constructed by the Sinohydro Corporation Limited at a cost of around US\$150 million. Funding for the project has come from China as well, in the form of loans from the China Development Bank and other sources.

Present at the event was Liu Mingjiang, Deputy General Manager, Sinohydro Corporation Limited, who described the successful completion of the Nadarivatu Renewable Energy Project as "a typical example of the cooperation between China and Fiji". Adding that as China's leading corporation in hydropower construction, the Sinohydro Corporation relies on its abundant technical strength and rich experience in energy and infrastructure, hoping to further expand the areas of cooperation with the Fijian side on the basis of win-win solutions and co-development to improve the bilateral relations to a new stage.

Source: China Radio International – English





STUDY CLAIMS WIND CAN POWER THE EARTH 100 TIMES OVER (IN THEORY)

A paper published in *Nature Climate Change* this year claims that wind energy has sufficient potential to generate 100 times the power consumed by the entire planet. The paper, *Geophysical limits to global wind power*, was authored by Kate Marvel, from the Programme for Climate Model Diagnosis and Intercomparison at the Lawrence Livermore National Laboratory, and Ben Kravitz and Ken Caldeira of the Carnegie Institution of Science's Department of Global Ecology.

The team used models to quantify the amount of power that could be generated from both surface and atmospheric winds. Surface winds were defined as those that can be accessed by turbines supported by towers on land or rising out of the sea. High-altitude winds were defined as those that can be accessed by technology merging turbines and kites. The study looked only at the geophysical limitations of these techniques, not technical or economic factors.

Turbines create drag, or resistance, which removes momentum from the winds and tends to slow them. As the number of wind turbines increase, the amount of energy that is extracted increases. But at some point, the winds would be slowed so much that adding more turbines will not generate more electricity. This study focussed on finding the point at which energy extraction is highest. Using models, the team was able to determine that more than 400 terawatts of power could be extracted from surface winds and more than 1,800 terawatts could be generated by winds extracted throughout the atmosphere.

Source: Nature Climate Change



BILL CLINTON OFFERS ENCOURAGEMENT, EXPRESSES ADMIRATION FOR SOLAR COMPANIES

Addressing a gathering of solar energy companies at the Solar Power International 2012 conference at Orlando, Florida, USA, Former US President Bill Clinton offered words of encouragement and admiration for solar companies in America and around the globe. Referring to the crowd, President Clinton said that they are "people who represent what I believe in," and advocated "creative cooperation" as the only way to help the United States succeed in the renewable energy sphere, stating, "There is not a single successful example on Earth of a country that is succeeding who does not have shared cooperation". Former President Clinton emphasized the need for the solar industry to dispel myths about the non-profitability of the solar sector in order to aid the proliferation of solar energy. Believing that the environmental and economic benefits offered by solar power and other renewables are under-represented in the popular consciousness, Clinton gave the example of Germany where the solar energy sector has helped create over 300,000 new jobs and the benefits of their efforts to re-align their energy infrastructure—both in energy production and distribution—to better suit renewable energy. He spoke of clean energy as being more than just a race between the United States and China, stating that it is the priority among those who are looking at the future.

Source: Renewable Energy World

HONEYWELL'S UOP METHANOL-TO-OLEFINS TECHNOLOGY SELECTED TO CONVERT COAL TO HIGH-VALUE PETROCHEMICALS IN CHINA

UOP LLC, a Honeywell company, announced a licensing arrangement with China's Jiutai Energy (Zhungeer) Co. Ltd for use of UOP's Methanol-To-Olefins (MTO), technology that converts the methanol found in coal into key plastics building blocks. The process allows for the conversion of methanol from gasified coal or natural gas to produce high yields of ethylene and propylene, building block materials used in the production of films, packaging, plastics, and other petrochemicals. The breakthrough technology allows industries in countries such as China to produce petrochemicals by tapping their abundant coal resources, rather than have to look at more expensive petroleum. China is the world's largest producer of coal, accounting for nearly half of the world's production, according to the US Energy Information Administration, making it an attractive alternative feedstock for in-country production of plastics building blocks. Jiutai will produce 600,000 metric tonnes per year of ethylene and propylene at its facility in Ordos City, Inner Mongolia Province, China. In addition to technology licensing, Honeywell's UOP will provide basic engineering, catalysts, adsorbents, specialty equipment, technical services, and training for the project, which is expected to start in 2014. The MTO process, jointly developed by Honeywell's UOP and INEOS, converts methanol from crude oil and non-crude oil sources, such as coal or natural gas to ethylene and propylene. The process, based on proprietary UOP catalysts, is proven to provide high yields with minimal by-products. MTO also offers flexibility in the quantity of propylene and ethylene produced, so producers can adjust plant designs to most effectively address market demands.

Source: Honeywell/UOP

HAVE SCIENTISTS FOUND AN INEXPENSIVE PROCESS TO PRODUCE HYDROGEN FOR FUEL CELLS?

Scientists at the University of Cambridge claim to have discovered an inexpensive process to produce Hydrogen, which if true, could see the rapid development of fuel cell technology. Hydrogen fuel cells are regarded by many as the most likely replacement for fossil fuel technology in the immediate future in sectors such as automobiles, where Honda's FCX Clarity has already made a name for itself as the world's first hydrogen-powered road car. Interestingly, scientists claim that the process can be carried out under standard laboratory conditions, i.e., in the presence of atmospheric oxygen, at room temperature, and through the use of an inexpensive catalyst.

Dr Erwin Reisner, research fellow with the British Engineering and Physical Sciences Research Council (EPSRC), and head of the Christian Doppler Laboratory at the University of Cambridge, co-authored a study with Fezile Lakadamyali, Dr Nicoleta Muresan, and Dr Masaru Kato—all scientists at the Christian Doppler Laboratory for Sustainable Chemistry at the University of Cambridge—which believes that an inexpensive catalyst that features the easily available element cobalt (Co) could be the answer that could allow industries to extract hydrogen in a clean and green way from water. Currently, industrial hydrogen can only be obtained from fossil fuels, in a process that releases a substantial amount of greenhouse gases. If the research of Dr Reisner and team turns out to be financially and economically viable, we might be able to see the emergence of a clean energy economy powered by hydrogen fuel cells in the immediate future.

Source: Science Daily



TEA PARTY FACTION IN UK POLITICS SCARING OFF GREEN INVESTMENTS, SAYS UK CLIMATE SECRETARY

UK Secretary of State for Energy and Climate Change, Ed Davey, has said that the opposition to green-friendly policies coming from an emerging “Tea Party tendency” among its conservative partners is undermining investment confidence. The Tea Party, of course, is a right-wing conservative American movement defined by its opposition to government taxation, which demands greater autonomy for businesses in the free market. Many members of the conservative right, especially in the United States, are rejecting the scientific evidence in favour of climate change, and those who do accept that the climate is changing, refuse to acknowledge that anthropogenic greenhouse gas emissions have anything significant to do with it. According to Secretary Davey, this ideology is now spreading across the Atlantic Ocean as a faction of conservative MPs in the United Kingdom are also rejecting evidence in favour of climate change, or the existence of an impending energy shortage. The United Kingdom’s current coalition government consists of an unsteady alliance of the Conservative Party and Liberal Democrats. Despite UK PM David Cameron’s pledge to lead “Britain’s greenest government ever”, there are factions within the conservative section of the coalition that seem vehemently opposed to the idea of a green economy, most notably climate sceptic sympathizer George Osborne, the UK Finance Minister. The lack of clarity over the policies of Britain’s Electricity Market Reform (EMR), is hindering investment in green technologies; Spanish wind energy giant Gamesa, which has been eyeing a project to develop an offshore turbine factory in Scotland, has expressed concerns over the same question. Secretary Davey stated that he would make a “strong case for a carbon limit for Britain’s energy grid for 2030”, despite opposition from his conservative coalition partners. He added that “Energy is always a long term investment. So if we are to create greater investor confidence in Britain’s low carbon energy future, a long-term target is best”.



Source: Recharge News

SOLAR PANEL DISPUTE ESCALATES AS EU-CHINA TRADE WAR LOOMS

The European commission has announced an investigation into allegedly unfair exports of solar panels worth more than 20bn (£15.85bn) a year in an issue that could escalate into a potential trade war with China. Leading European solar panel manufacturers have been alleging since July 2012 that China was exporting solar panels at a loss, creating a price war that European manufacturers could not keep up with. “In terms of import value affected, this is the most significant

anti-dumping complaint the European commission has received so far,” the commission said. China accounts for two-thirds of global production in solar panels, and in 2011 it exported 21bn worth of panels to the EU, accounting for 80% of its exported panels. In a matter of few years, China has emerged as the world’s biggest solar panel producer, while the EU is the biggest market for these products by a significant margin.

Though, the complaint to the EU was spearheaded by German solar firms, the government of Germany enjoys a trade and export-based “special relationship” with China, and would not want to ruin that. Thus, on a recent visit to Beijing, German chancellor Angela Merkel sought to defuse the situation by stating that dialogue and not an EC investigation is the best way to deal with the issue. Beijing’s official English-language newspaper, China Daily, retaliated that China would react with trade curbs on the EU, if Brussels went ahead with the investigation. The US has already slapped tariffs on Chinese solar panel exports. The complaint lodged with the EU headquarters in Brussels, Belgium, came from a consortium of over 20 European producers who are responsible for a 25% of the EU’s solar panel manufacturing industry.

Source: The Guardian, UK





OAXACA WIND FARM PROJECT RECEIVES \$76 MILLION IN FUNDING FROM IDB

The Inter-American Development Bank (IDB), approved a loan of upto \$76 million to the Impulsora Nacional de Electricidad S de R L de C V, a subsidiary of Enel Green Power SpA, to support its investment in a 74 MW wind farm located in the Isthmus of Tehuantepec, in the Mexican State of Oaxaca. The wind farm, known as Bii Nee Stipa II, is Enel Green Power's first wind farm in Mexico, and projected to be the largest wind farm in Latin America. The project supports growing efforts by the government of Mexico to harness wind energy in the "La Ventosa" region of Oaxaca—one of the world's best regions for wind resources –and to reduce its reliance on fossil fuels to generate electricity. Currently, 75 per cent of Mexico's 60 GW of total installed electricity generation capacity is derived from fossil fuels. Oaxaca's wind industry development began in the 1990s but it is only now that it is approaching its real potential. By the end of 2012, wind-based installed capacity in the state will reach around 1.5 GW. With this latest loan, the IDB has approved more than \$240 million in financing for wind farms in Oaxaca since 2009. The wind farm will also contribute substantially to Mexico's goal of reducing carbon emissions 50% by 2050 as compared to their 2002 level. Mexico's Congress in 2010 enacted the National Energy Strategy proposed by the Energy Ministry (SENER), which establishes a goal of reducing the percentage of electricity Mexico generates from fossil fuels to 65% by 2024, 60% by 2030 and 50% by 2050.

Source: Clean Technica



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NORTH INDIA GRID COLLAPSE

PORTENT OF THE IMPENDING ENERGY CRISIS?

Early on the morning of July 30, 2012, and once again in the afternoon of July 31, 2012, North India was plunged from light into darkness. Nearly 700 million people were cut off from lights, fans, televisions, radios, computers, and air conditioners, that some (but not many) of them had come to take for granted. This was, without a shadow of a doubt, the biggest and most devastating blackout the world had ever seen since the invention of the electrical grid. To be honest, however, not all of those 700 million people originally had power at all in the first place. Over 300 million people were people who were not a part of the northern grid. India's electricity problems are not a new concern, in fact among most developing nations; India stands out due to its deficiency between demand and supply, with gaps of up to thousands of MW in production. The Indian grid suffers from a myriad of problems, which range from expected ones like operating inefficiencies, to small-scale theft by consumers, to transmission and distribution losses from the antiquated and highly out-dated infrastructure that comprises India's energy grid. No one was willing to take responsibility for their inaction that led to a day like this. But interestingly, the power outage was merely a taste of what our future might be like in the event of an energy crisis that could mean blackouts like the one we were witness to might be far more regular features in our daily lives. The blackouts across Northern India in July 2012 affected nearly a tenth of the world's population. While this particular incident was caused by a case of indiscipline by state electricity boards – some of whom overdraw so much power from the grid that it collapsed – what is perhaps more important to look at are the underlying causes that led to the event in the first place, and more importantly, what do those causes foretell about the status of India's electricity grid, and by extension, India's energy future. *Hemant Saini*, Science Writer, investigates the cause further.

Trapped in old grids

India might be a nation on the rise, striding forth confidently into the modern world; but our infrastructure is still from another century. It is not possible to reasonably expect one's nation to become a global economic or technological superpower when over 30% of the people living in it do not have basic access to electricity, and where the country's power generating capacity is still thousands of MW in deficit of what is required. While the collapse on 30 July was fixed by that evening thanks to the northern grid borrowing some power from the north-eastern and western grids, and also purchasing power from Bhutan; the 31 July collapse was even worse, as the overdraw was so much that it caused the four out of five regional grids in India to collapse. The grid collapse was a wakeup call for India, and indeed the world. China's party-run English language newspaper, *Global Times*, was keen to learn from the lessons of India, saying that other developing countries can use the incident to reflect on their own problems—including how



to avoid development bottlenecks and ensure electricity access for all—before concluding that electricity powers a country's modernization. In 2011, China exceeded the United States as the largest producer of electricity in the world, while China surpassed the United States as the largest consumer in the world in 2010. In comparison,

India is the fifth-largest producer and third largest consumer of electricity in the world. However, if we look at per capita electricity consumption, the United States of America consumes over 1,300 W of electricity per person per capita; the European Union consumes close to 700 W of electricity per person per capita, China has a



per capita electricity consumption of around 400 W of electricity per person per capita, and in fact the global average electrical energy consumed is 300W of electricity per person per capita. India's average electricity consumption is 85W per capita per person. Thus, despite being the third largest consumer of electricity in the world, India has one of the lowest per capita electricity consumption rates in the world.

An emerging superpower first needs power

As in most statistics, we are misled due to the skewing of data by our population; a large number of Indians perpetually live in the darkness that some of us experienced on those two days in July. If India had the same per capita electricity consumption as China, there would only be enough energy in India to provide access to electricity to a fifth of our population. Yet, even all people in China do not have access to electricity. People living in Indian cities such as New Delhi, Mumbai, Bangalore, and Hyderabad have lifestyles that might seem to be beyond the wildest dreams of their brethren in India's villages, and is similar in many ways to the lifestyles of people living in developed countries, such as the United States, Japan, or Europe. Yet, for the amount of electricity produced in India every year can only sustain around 130 million Indians (or 10% of our population) on that kind of energy lifestyle. And that fundamental dichotomy is the true cause of the grid collapse in July. The country is getting more prosperous, people in major cities have houses with two or three air-conditioners, people in smaller cities have houses with one air-conditioner, and people in villages might own the odd light bulb or fan, but the grid that provides them with the power to run these appliances is not designed to withstand such

loads, and even if it can, there is not enough energy to send into the grid in the first place. So the question India ought to ask itself is where will it get its electricity from? And if it does manage to successfully answer that question and earmark a certain amount of electricity for the general population, it still has to answer the question of how will it ensure that electricity reaches the masses?

It has to answer these questions ironically or perhaps appropriately enough, in the International Year of Sustainable Energy for All. How it will plan to harness and collect energy from diverse sources using both, conventional and alternative, fuel sources to generate enough electricity to feed the demand of a nation of 1.2 billion is what the future of India as a nation will depend on. We do not need an increase by a percentage of our current value of electricity production, what we need is an increase by multiple factors of our current value of electricity produced. The United States of America produces five times the electricity that India produces, despite having a quarter of the population. This implies that developed countries tend to have, on average, twenty times the energy that we have. Before India can expect to make the jump into the realm of developed nations and superpowers, it needs to find a solution to the question of where and how it will provide its people with, on average, twenty times the energy access they have now. Plans to reform India's power sector have been a dime a dozen since independence, and India has missed every single annual target for adding to its electricity production capacity since 1951. Prime Minister Manmohan Singh has been advocating a plan that aims to attract US\$ 400 billion in investment in order to completely restructure the nature of electricity in India, and would bring the Indian power sector into the 21st century. The plan aims at installing



a further 76,000 MW to the grid by 2017 (India currently has an installed capacity of 180,000 MW). And where will this 76,000 MW come from? That's not defined, but one can assume it will be from a mix of Thermal Power Plants, and Renewable Power Plants. This power will of course be transmitted through India's archaic grid, a relic that is plagued with problems right from very high transmission costs to rampant theft. It is quite likely that India's long history of not being able to meet infrastructure targets, coupled with the prospect of having to invest in an antediluvian transmission system would hinder the chances of investors injecting US\$ 400 billion into India's power sector.

Decentralized Power: A solution?

Assuming that a capital injection is not the answer, there might be a better way to reach the target of energy access for all while ensuring an efficient and green growth. While most of India was trapped without electricity during the



blackout in July, there were a few cases of light scattered amidst the darkness. These were communities of people or organizations that were not a part of the grid. Thus, while the rest of the country languished in the electricity-less wastelands of the cities, the North Indian hinterland bore witness to the advantages of an off-grid power generation and distribution system. Oil refineries, critical research

laboratories, and experimental townships and villages that had their own power generation and transmission grid did just fine while cities such as Delhi and Kolkata succumbed to darkness. The town of Meerwada in rural Madhya Pradesh is part of a flagship project by US solar energy company SunEdison (currently owned by MEMC Electronic Materials), to showcase the potential and power of renewable-energy powered micro-grids. During the North India blackout, when cities and towns surrounding Meerwada struggled with no power, the people there watched events unfold in the village's one television owned by the village's leader, Ms Sampat Bai—interestingly, social progressiveness can be correlated with the presence of such innovative use of alternative energy technology. Meerwada exploits the over 300 sunny days a year it receives to generate power at a local level through a 14 KW solar plant in the village. Towns in villages, in the hills, and valleys of Himachal Pradesh, Arunachal Pradesh, Uttarakhand, or Sikkim can look at the options offered by small or even micro

hydroelectric power generation, for example. States in India are already investing substantially in renewable energy, but the power plants are only half the problem. It is imperative for India to get out of the 1950s Soviet mentality that power generation and distribution are the domains of large, government projects (or even large private projects). By combining the potential offered by small-scale renewable energy, micro-grids, and smart grids; India could be an example of a bottom-up grass roots approach to economic and energy development. Of course, it is imperative that one will have to explore the financial and environmental implications of such an approach before we can think of moving ahead, but there is a substantial and significant amount of research that has been done on the topic already. Numerous NGOs and renewable energy firms have invested in research or pilot projects or even full-fledged acts of social entrepreneurship such as SunEdison in Meerwada, that we have an extensive database of information about the potential and hazards of small-scale decentralized





power solutions. As renewable energy technology improves with time, which it is bound to—panel price was \$2.60 per watt 2009, it is 75 cents a watt today—the high initial investment that has traditionally scared off potential investors will reduce considerably, and the advantage of solar photovoltaic technology in India is, of course, that after installation, operational, and maintenance costs tend to be quite insignificant. Coupled with innovative government financing incentives as part of the Jawaharlal Nehru National Solar Mission, it would perhaps be easier and more practical in the long-term to attract investment towards decentralized power generation and distribution facilities in rural and peri-urban India; rural India because their utter lack of electricity is a major issue that needs immediate remedial action, and peri-urban India, as it would help ease the load on major cities.

Conclusion

The grid collapse in July was merely symptomatic of a larger, more deeply engrained affliction on India's energy scene. An out-dated transmission grid, a lack of policy clarity towards how a nation of 1.2 billion aims to provide energy access to its poorest and most vulnerable citizens and insufficient electricity generation facilities are holding back the true potential of the nation. Ensuring clean, sufficient, and efficient energy growth should be among our nation's top priorities. Transmission and distribution losses account for nearly a quarter of all the lost energy in the national grid and power theft is a serious issue. By implementing a strategy of small-scale decentralized power generation and distribution utilities, it is possible to address all these issues. The opportunities for private players to enter the market and offer such

solutions is immense, and with capital costs in the renewable sector heading downwards over the long-term, it is a risk worth taking, for the rewards on offer—both financially and in terms of social development—are plentiful. As seen in Meerawada, economic progress breeds social progress that comes for free. In a land of such enormous geographic, economic, and cultural contrast as India, energy solutions that are designed to take advantage of local energy resources and can cater to the specific needs of local communities would by their very nature tend to be more energy efficient. Renewable energy technology, smart grids, and decentralized power are the cornerstones on which India's energy future can be built; the blackouts were a final requiem for an era of energy history that it's approaching its end; and are a clarion call for the next stage in our energy development. ■



ELECTIONS FOR ENERGY

The 2012 US Presidential Election will not merely decide whether a Democrat or Republican will occupy The White House, it will also dictate whether the President of the world's most powerful economy will be someone who believes the future lies with solar and wind power, or someone who is confident that global oil reserves are sufficient for the next 100 years; whether the next Commander-in-Chief of the world's most powerful army will be a man who thinks climate change is a myth and the Kyoto Protocol can be ignored or will it be someone who aims at cutting greenhouse gas emissions by half in the next decade. Discussions about the views of the two candidates for the Presidency, Republican Mitt Romney and Democrat President Barack Obama, have focussed on their backgrounds, their views on gay marriage and abortion, their religious beliefs, their economic ideals, and their stance on healthcare; but their differing opinions on where and how the world's biggest industrial superpower will manage its energy security could be the deciding factor. *Harish Alagappa, TERI*, looks at the contrasting views of the two Presidential candidates and what this can mean for the energy future of not just the United States, but the world.

Introduction

November 2012 will see the return of one of the most important and significant practices undertaken in the world today. A practice whose repercussions, one can argue, have the potential to alter the course of human destiny. I speak, of course, of the United

States' Presidential elections. As the leader of the world's largest economic, military, scientific, and cultural superpower, the President of the United States of America is easily the single most powerful and influential individual in the international political arena. The decisions of his

administration can have a ripple effect on the global economy, can alter the balance of international military stability, and can influence the ebb and flow of the tide of history on numerous nations across the world. Never before in human history have the decisions of a single administrative authority had



the power to so immediately influence the course of geopolitical stability with such potency, and never before in human history has the power of such a governing authority been so dependent on the will of the people – as opposed to some supposed divine right, or to some sort of hereditary game of chance. The true power of the US Presidential election lies in its essential democratic roots—in the belief of the enfranchisement of the masses, regardless of economic class, ethnicity, creed, religious belief, or learning. While the rulers of global superpowers in history before the United States—Rome, the Mongols, the United Kingdom—have been kings and queens whose source of power came from their privileged birth, the leader of the United States is dependent on the will, satisfaction, and contentment of the 150 million people who will vote him into power this November.

Barack Obama's audacious hope

The 2008 US Presidential elections were a landmark in American history.

The eight-year administration of President George W Bush had the support of the conservative American hinterland and corporate America, but was despised by most of America's media, the largely liberal base of well-educated Americans, and the youth. Barack Obama's message and promise of hope and change resonated with a population who were exhausted of unnecessary involvements in expensive and questionable foreign policy engagements and a significant drop in the global standing of the United States in the eyes of their peers from across the world. Barack Obama's infectious energy, his optimism and youth stood in contrast to the established order of ageing senior citizens that his opponents seemed to be the guardians of. Barack Obama's election to the office of the President of the United States would have been deemed an impossible task even a decade prior, and can be seen as a sign of a changing America. Born in Hawaii to an African, Muslim father and Caucasian mother, Barack Hussein Obama is not the name one would expect can win you a presidency. He had the support of the liberal side of the American electorate, but doubts existed whether he could sway the

swing voter, and his ability to be able to deal with smear campaigns launched in particularly right-wing fundamentalist parts of the United States were a major electoral issue in 2008. His astonishing landslide victory, by a margin of over 10 million votes, and his capture of over twice as many electoral votes as his competitor, Senator John McCain, was seen as a historic moment in the cultural evolution of the United States as a truly race-independent society. Obama was voted into office on the power of Change—a campaign slogan that he reinforced through a shrewd and path-breaking marketing campaign that connected him to his voter base by utilizing the latest technologies and social media outlets. In the last 4 years, the Obama Administration has been instrumental in attempts to negotiate peace in the Middle East, in the attempt to institutionalize universal healthcare for all American citizens, and in efforts towards clean energy—an area where President Obama has shown greater resolve than any previous United States Presidential Administration.

As the world's largest industrial economy, as the base of the world's largest energy consumer market, and as the world's second largest source



of greenhouse gas emissions, the energy policy of the United States of America sets the standard that the rest of the world follows. The Obama Administration had clearly defined objectives of shifting the American economy to more renewable, sustainable, and clean sources of energy, and in the last four years, it has tried to accomplish the same in the face of opposition from his rivals and vested business interests. As the 2012 United States Presidential elections loom ahead of us, it is an interesting and sobering exercise to analyze the energy policy of America's candidates for President. This article aims to look what's in store for the energy industry post the November elections; the candidates are a contrast in terms, and the decision of the American electorate can have substantial ramifications for the global energy arena.

Two sides of the coin

Before analyzing the energy policy of the candidates, we must begin with a look at the candidates themselves. American democracy follows a two-party system, as opposed to the soup of competing political parties that we find in democracies such as India. While these generalizations are not entirely accurate, for our present purpose it would suffice to describe



the parties as roughly representing the liberal and conservative sides of the American electorate. The Democratic Party was formed around the 1820s, as a faction of American politicians who believed in the principles of Thomas Jefferson, the author of the American Declaration of Independence, and believed in strict adherence to the principles of the United States Constitution. Ironically, while it had started as a largely conservative party that believed strongly in states' rights and was opposed to the abolition of slavery in the 1850s and early 1860s, the Democratic Party underwent an ideological shift in the 1950s, emerging as a largely centre-liberal political party that has fought for issues of labour rights, environmentalism, and expanding healthcare programs.

Barack Obama's election as President in 2008, was a significant victory for the Democratic Party (or the Democrats, as they are commonly known) and has further entrenched the values and principles of the political party in the ideas of a secular, liberal state, where individual freedoms are paramount. Standing for re-election in 2012, Barack Obama and the Democratic Party are aware that the fight this year might be their toughest yet.

In contrast, the Republican Party emerged around the 1850s, formed by the conglomeration of the remnants of many of the United States of America's now defunct political parties, such as the Federalists and the Whigs. Its first major victory was the election of Abraham Lincoln to the office of the President in 1861. Its strict anti-slavery stance and leadership during the American Civil War led to a substantial rise in its popularity in the 19th century among the United States of America's more liberal pockets of voters in the North-east, in cities such as New York, Philadelphia, and Boston. Much like the Democratic Party, the Republican party too underwent a change in political outlook towards the end of the second world war, and in a cruel twist of fate, the same political party that had valiantly led the United States of America in a war to end the unjust and inhuman practice of slavery in the



1860s, was, a century later in the 1960s, opposed to the civil rights of coloured Americans—the very descendants of the slaves for whose freedom their greatest President, Abraham Lincoln, had given his life. Though they could not stop the civil rights movement, the Republican Party has built up an extensive and powerful voter-base among conservative, white Americans. The Republican party is known for its highly conservative stance on numerous issues, for occasionally dabbling in right-wing fundamentalism—such as their refusal to accept scientific theories such as evolution and climate change—and their stance on issues such as abortion (which they wish to outlaw entirely), secularism (they believe that the United States is a Christian nation and not a secular one) and their close connections with the business world. After enjoying eight years under the Presidential Administration of George W Bush between 2000 to 2008, the Republican Party suffered a drop in popularity, largely as a consequence of their highly conservative and insular stance on issues alienating them to the more liberal and open-minded youth of the United States. Their candidate for election in 2012 is Senator Mitt Romney, a man known for being extremely pro-business and pro-capitalism, whose liberal-leaning, but nevertheless highly-effective, policies while in his tenure as Governor of the state of Massachusetts was seen as a liability in the party, before it was reworked post hoc to represent the values and belief systems of the Republican Party.

Energy in the USA

Energy has always played a crucial role in the political discourse of the United States, as it does in the discourse of any nation. However, as the world's premier industrial superpower, the USA's energy development require

far greater attention from its policy makers. Strangely, while per capita energy consumption figures for the rest of the world have grown substantially over the last few decades, the United States has remained oddly consistent, with a per capita energy consumption of around 330 million BTUs (British Thermal Units) per person from 1980 to 2010. In comparison, the world average has increased from 63 million BTUs in 1980 to 75 million BTUs per person in 2008, a growth of around 15%. Some analysts attribute this increase to greater energy efficiency in the appliances being used by the average American household, whereas others state it is due to transferring of most of the United States' manufacturing capabilities to other nations, such as China. In recent years, the rhetoric has shifted dramatically in the favour of intensive research on new energy sources that will allow the US to overcome its dependency on imported oil. Foreign Policy experts have often accused the United States of making questionable alliances and involving themselves in dangerous engagements with dictatorships in the Middle East out of a necessity to safeguard their energy interests in the form of oil imports. It can be said

without exaggeration that global security and the United States' energy security are deeply entwined, and it is in the best interests of all parties for the United States to be able to formulate an energy policy that does not require periodic engagements with regimes that violate the principles the USA claims to champion. In 2010, a think tank of some of the United States most accomplished business and political leaders, known as the America Energy Innovation Council – which consists of luminaries such as Bill Gates, General Electric Chief Executive Jeffrey R Immelt, Former Lockheed Martin chairman Norman Augustine, and Chairman and CEO of the Xerox Corporation, Ursula Burns—urged that it is imperative for the US government to triple its current spending on energy research and development. Currently, military research and development receives over US\$80 billion in funding from the federal government, whereas energy research receives less than US\$5 billion. Bill Gates stated that the United States' goal of reducing greenhouse emissions by 80% before 2050 could not possibly be achieved with current technology and political deadlocks.





Promises of hope and change

While all sides of the United States of America's political spectrum are in agreement about the issue of energy security, that's pretty much the only thing they agree on. The tactics, political strategy, policy decisions, and technologies that each side believes has the potential to offer the United States independence from foreign oil are varied and cover the entire scale of energy technologies and policies. While it has been the tendency of Presidents of the United States to promise to deliver the country from the grip of oil imports since the time of President Jimmy Carter in the late 1970s, none of the five Presidents who followed have been able to deliver. However, now the issue is so acute that it is no longer merely about promising to deliver America to the promised land of energy independence; the question is simply about how this can be accomplished. President Barack Obama has often and strongly expressed his belief in clean energy, and has been responsible for what is described as "a new era in energy

exploration in the United States." President Obama's focus on energy efficiency and proliferating renewable energy technology has been critical in efforts to bring the debate on the United States of America's energy future to the forefront. President Obama's administration aggressively pursued energy policy reform that aimed at reducing greenhouse gas emission by employing a cap and trade program, which stimulated research into cleaner, renewable, and sustainable sources of energy. The phrase most commonly used to describe President Obama's approach to energy policy in the United States was an "all-of-the-above" energy approach. By investing in all possible forms of energy that could power the future of the United States, Obama was seen by his critics as gambling and by his supporters as hedging the bet on the United States' energy future. Obama described his approach to the United States of America's energy future as one "that will allow us to take control of our energy future, one where we safely and responsibly develop America's many energy resources." The

resources included staples of America's energy diet such as natural gas, crude oil and coal, while also increasingly moving towards such alternative and unconventional energy sources such as wind, solar, oil, clean coal, and biofuels.

Another area that President Obama believed was critical to the safeguarding the United States' energy security was efficiency. In March 2009, less than six months into his Presidency, President Obama announced the Energy Efficiency and Conservation Block Grants, as part of the American Recovery and Reinvestment Act, his recovery plan for the US economy that is under crippling debt and in the middle of a serious recession. The act authorized funding of over US\$ 3.2 billion towards increasing energy efficiency and stimulating energy conservation in the form of grants aimed at projects that could energy usage, greenhouse gas emissions, fossil fuel use, and improve the standards of energy efficiency in the US economy. President Obama often stated that the nation that manages to most quickly, efficiently, and successfully manages

to harness the power of clean and renewable energy would be the new world leader of the global economy, a position that the United States has held for the last century. President Obama has set the United States a steep and almost bordering on the impossible target known as the Clean Energy Standard, which proposed that by 2035, the United States will be generating 80 per cent of its energy requirements from clean, renewable and sustainable energy sources such as wind, solar, clean coal, and natural gas. President Barack Obama's track record in the clean energy spectrum is by and far the most committed amongst all past Presidents and Presidential candidates. Since taking office, President Obama's policies on energy and efficiency saw the widespread adoption of renewable energy technology by individuals and companies. Electricity production from wind and solar energy sources doubled and bio-ethanol's feasibility as a replacement for gasoline was seriously investigated, with increases in the level of ethanol that can be blended into gasoline resulting in a renewable fuel standard that analysts predict would save nearly 14 billion gallons of petroleum-based gasoline by 2022.



The re-election of Barack Obama would have a substantial impact on the United States' renewable energy sector, but perhaps a greater impact on their conventional energy sector. Barack Obama was not open to the idea of Arctic drilling and issued fewer permits for off-shore drilling in his term than his predecessor, George W. Bush. Though most of his opposition to off-shore drilling could stem from the crisis his administration faced from the BP Gulf of Mexico oil spill, the fact remains that Barack Obama's re-election would not be good news for oil corporations looking to drill off the coast of Florida, California, and

Alaska. Additionally, his hesitance on the issue of the Keystone Pipeline from Canada, and talk of a second-term Presidency putting greater restrictions on oil speculation on the commodities market imply that Obama is quite keen to rein the bulging and very powerful American oil lobby in. US Presidents tend to exhibit greater courage in their second term, as they are no longer bound by a fear of re-elections, and this might be visible in the policy decisions of President Barack Obama too.

Conclusion

It is rare to find an election where the two candidates are so diametrically opposed to each other in their opinions on the energy future of their nation. Perhaps stranger is the fact that the nation happens to be the largest and most powerful industrial, economic, and military power in the world today. The emergence of rigidly partisan lines in US politics is a trend that many political analysts have been commenting on with no misplaced trepidation over the last few elections, and in November, we will perhaps bear witness to a spectacle of where the choice of the American electorate could have dire consequences for the energy and climate change movement across the world. ■



RACING WITH ENERGY

Energy efficiency means not only conserving energy smartly but also utilizing it judiciously as far as possible. Professional sports (like Formula One) engineers are trying their best to use energy by developing competent mean machines. *Divyanshi Chadha, freelance writer*, explores this fresh environmental streak creating waves in the sports industry.



Introduction

The cars are turned on, the batteries are charged and there is no way that you can lose the race. These days, speed talks. Every individual in today's age is in a hurry to win some kind of race or the other. Then what do we say about Formula One. With F1 making headway in the Indian circuit, it has become quite popular among the young guns. However, it is not only about speed and thrill. There is more to it. The creators of F1, European auto makers seem to be turning pro-environment and are finding ways to reduce pollution

in order to conserve the nature. How do they intend to this? Well, the gas-guzzling Formula One mean machines. Rotating mechanical devices called flywheels developed for these speed machines could make everyday cars more powerful and efficient. The technology is among several methods vehicle-makers are testing to make better use of kinetic energy otherwise wasted when the car brakes. The auto makers are racing against each other—and increasingly tougher emission standards—to make future models burn less fuel and produce

less greenhouse gases. It has been observed that by 2020, the European Union plans to limit passenger cars' average carbon dioxide emissions to 95 grams per kilometre, off 27% from the 130 grams set for 2015. Last year, numbers say that the cars emitted an average of 135.7 grams of carbon dioxide per kilometre.

Once the regulation is in effect, car makers will be levied a penalty of \$117 for every car and every gram above the regulated level. At present, three technologies are being developed that are likely to be adopted by car makers

later this decade, and, taken together, could have far-reaching consequences both for the automobile industry and environmental protection. One system from this draws heavily from Formula One racing. The engineers have developed a system for F1 cars based on a flywheel that spins when the driver brakes, storing the energy and then releasing it when the vehicle accelerates. Flywheels have been around since the Industrial Revolution, when they were widely used in steam engines. Mounted on a crankshaft, these spinning discs provide a steady flow of energy when the energy source is not constant, as is the case with piston-driven engines in cars. Flywheels can range from about a metre in diameter to less than three centimetres, depending on the amount of energy required. The larger and heavier the flywheel is, the more inertial energy it delivers when spinning.

Flywheel in F1

If taken in a miniature form, they show up in friction toy cars that are driven by a flywheel and speed up when the toy is rolled quickly across a surface. When the car is let go, it is the flywheel that speeds the car across the floor. Until

recently, flywheels—known in the auto industry as Kinetic Energy Recovery Systems, or KERS—have been too heavy or too bulky to use on road vehicles. But that is changing, thanks to new, lighter materials, high-tech engineering and power-management systems. The interesting part is that now even Formula One has begun allowing race cars to use flywheels during the 2009 season, giving them a short burst of extra power when overtaking an opponent. Earlier this year, a Formula One team using a hybrid flywheel system developed by the UK company Williams Hybrid Power, won the Barcelona Grand Prix, and Audi AG's Williams-equipped R18 e-tron quattro made history as the first hybrid vehicle to win the iconic Le Mans 24-hour endurance race. Several people from leading giants have varied opinions about this new-found flywheel.

What do the experts say?

The Chief Executive of Williams Grand Prix Holdings PLC, parent company of Williams Hybrid, said the flywheel system is ideally suited for urban stop-and-go vehicles, especially heavy buses and delivery trucks that brake often. Williams has planned to start road trials



on six London buses operated by the Go-Ahead Group of the UK and is also working with Jaguar Land Rover PLC to adapt its system for the new Jaguar C-X75 plug-in hybrid supercar.

Ian Foley, Chief Executive of Williams Hybrid Power, reckons that a bus company could get a payback on a flywheel system for its buses in five years thanks to a 20% reduction in fuel consumption. Buses typically have a useful life of up to 18 years. Volvo's vice president for powertrain engineering says that one advantage of flywheels is that they eliminate the annoying second-long lag of response from turbocharged engines when a driver needs to suddenly accelerate, while increasing an engine's power by as much as 20%. The other main advantage is that they help to reduce fuel consumption and thus exhaust gas emissions substantially, while costing less than existing battery-based hybrid systems.

Christian Chapelle, Head of powertrain and chassis development at French automotive group PSA Peugeot-Citroën SA, UG FR said it is still too bulky to be slotted into the engine compartments of small cars. At the same time, the extra cost might



make it uneconomical for use on small vehicles that offer thin profit margins. A second type of kinetic energy recovery system generates electricity from braking to recharge batteries or power up ultracapacitors. Japan's Toyota Motor Co. pioneered this technology for mass-produced vehicles several years ago, notably for its Prius hybrid compact sedan that can run for several kilometres on battery power alone. However, this system requires batteries that can weigh 100 kilograms or more and take up valuable space. And electrical systems run the risk of battery fires and electric shocks. "To be able to sell enough cars producing 95 grams of CO2 per kilometre or less by 2020 means we have to start selling them by 2016 or 2017," said Chapelle. "Since it takes about four years to develop a car, clearly the race to get there has already begun."

Another aspect which is closely connected to this is greening of professional sports, most importantly Formula One. Many popular sports persons have happily embraced energy efficiency, water conservation, recycling, healthier food and the role it plays in spreading the environmental message. Through their nonpartisan leadership on the field, court or rink, professional and collegiate sports and their sponsors are showing their many fans practical and cost-effective solutions to some of our planet's most dire ecological issues. It goes without saying that sports is a hugely popular,

economically influential industry. Hundreds of millions of people watch sporting events each year, and 61 per cent of the world population identified themselves as sports fans in a poll conducted last year. Moreover, the global supply chain of the sports industry includes many of the largest and most influential corporations on earth. And we need to consider how culturally influential sports can be.

Green professional sports

There is no single business undertaking or law that can solve our ecological crises alone. It takes a combined effort by individuals and businesses alike to create change. The actions taken by professional sports are starting to add up. Fifteen professional stadiums or arenas have achieved LEED certification for green building design and operations, and 17 have installed on-site solar arrays in the US. Millions of pounds of carbon emissions have been avoided, and millions of pounds of paper products have been shifted toward recycled content or not used at professional sports sites. Recycling and composting programs have been developed or are planned at virtually all professional stadiums and arenas, and the large concessionaires, which collectively feed tens of millions of people each year, have all developed environmentally preferable menus for at least some of their offerings. One formidable example is of James Allison, technical director of the Lotus

team since 2009. He clearly said in an interview that making the sports sustainable in the long term was his main goal. Even though the sports maybe called professional but it surely needs to have a healthy future. "We have to try to keep technological excellence, keep looking forward, keep ensuring that efficiency is driving us, and make sure that we are still as fast, and exciting and colourful as we are today," he said. Using solar panels on the trailers in the paddock, Allison made sure that the output remains the same when they use electricity. It requires around 30 kilowatts of constant energy. It was heartening to hear him say that the sport as a whole is trying to ensure that it has a future by being responsible about the way that it is forming the rules.

In conclusion...

Certainly, much work remains to be done, but it is heartening to note that dozens of teams across the country are adopting energy efficiency measures, renewable energy, recycling, water conservation, safer chemicals, and healthier food. Tens of millions of fans are being educated about environmental stewardship by teams and leagues throughout the world. Lessons from previous cultural shifts that have moved our society forward suggest that the change needed today in our thinking about the environment will not be led by government. To instigate this, few sectors can be as influential as the sports industry. There is a reason some of the largest industries on earth pay millions of dollars to affiliate with professional sports. They know it is an effective way to influence the culture of the marketplace. And professional sports like Formula One recognize that it is time to take the lead once again for a cleaner, more sustainable future. ■

Sources: *International Herald Tribune*, *The Wall Street Journal*



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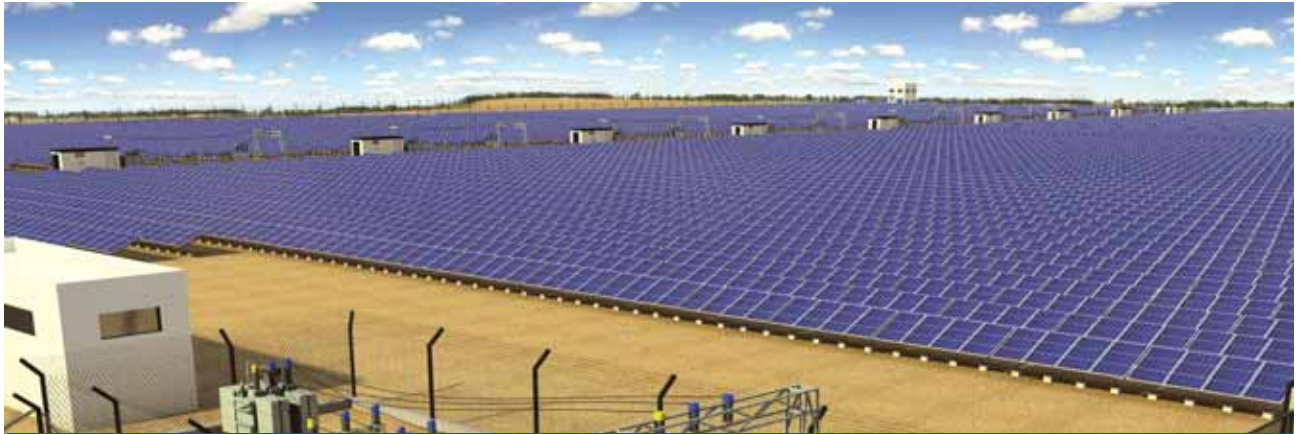
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Integrated Renewable Energy Resource Assessment for Gujarat

Alok Kumar Jindal, Renewable Energy Technology Applications, TERI

INTRODUCTION

The conventional sources of energy like coal, oil, and natural gas, etc., are limited in quantity and at the present rate of consumption, they will be exhausted in the coming few decades. In such a scenario, to ensure energy security, one of the options is to look at renewable (RE) resources of energy such as solar, wind, biomass, tidal, and geothermal. Energy security has assumed more importance for a country like India that heavily depends on the imports for meeting its energy demand. Thus, the Government of India is putting a lot of emphasis on increasing RE share. Indeed, the target of 20 GW by 2022, under Jawaharlal Nehru National Solar Mission for 2022, clearly shows government's commitment to this.

Proper estimation of potential of any renewable energy resource is essential for proper planning and policy formulation. Unfortunately, in the country, most of RE assessment studies are quite dated, and they do not take benefit of the latest tools

and techniques. Thus, TERI undertook reassessment of RE potential in Gujarat due to the following reasons:

- Earlier potential assessments were based on old data and technology parameters.
- The existing potential assessment did not take in to account the wasteland data/specific category of land.
- Technology developments have happened since last potential assessment, which enables optimal land utilization and higher energy capture.
- The earlier studies assessed different RE resources separately rather than taking an integrated view.
- These studies did not provide information about potential of all the RE resources at the district level.
- Integration of other infrastructural resources like evacuation facilities, water availability, and natural gas network was absent.

Gujarat was chosen as a case study because while on one hand it is one of the biggest states of the country

having a large amount of wasteland alongwith good solar radiation and wind flow for most of the year (biomass, tidal, geothermal resources are also available in the state) but on the other hand it is very aggressive on renewable energy development.

Furthermore, this exercise also used Geographical Information System (GIS) for analyzing Land Use Land Cover (LULC) and for the identification of wasteland for RE projects and mapping the RE potential over the state.

The study was supported by Shakti Sustainable Energy Foundation, India.

Objectives of study

The broad objectives of the study were

- To carry out the Integrated Renewable Energy potential assessment for the state of Gujarat.
- To develop a renewable energy atlas, which can give the user a holistic view of relative potential of the RE sources at the district level along with information about the relevant infrastructure.

SALIENT FEATURES

- Wasteland based potential assessment of all renewable energy resources at district level
- Separate assessment of potential for solar PV and Concentrating Solar thermal Power (CSP) projects
- Potential assessment for solar PV projects integrated with wind farms
- Assessment of wind repowering potential
- Since water availability is a concern for the concentrating solar thermal power projects, the study also assessed the water availability apart from the grid infrastructure availability
- For estimating combined wind and solar PV power projects, detailed shadow analysis was carried out to see the effect of wind turbines on solar panels
- Biomass potential from both, cropland as well as forestland considered for estimating biomass power potential
- Integration of infrastructure like grid infrastructure, existing power network, canal and river network, and gas distribution network with RE resources
- Development of an interactive RE resource atlas on a GIS as well as open source platforms

ESTIMATED RE POWER POTENTIAL

FIGURE 1 gives a comparative picture of the previous potential estimates and new estimates. This upward revision of RE potential can be attributed to two major factors, described below:

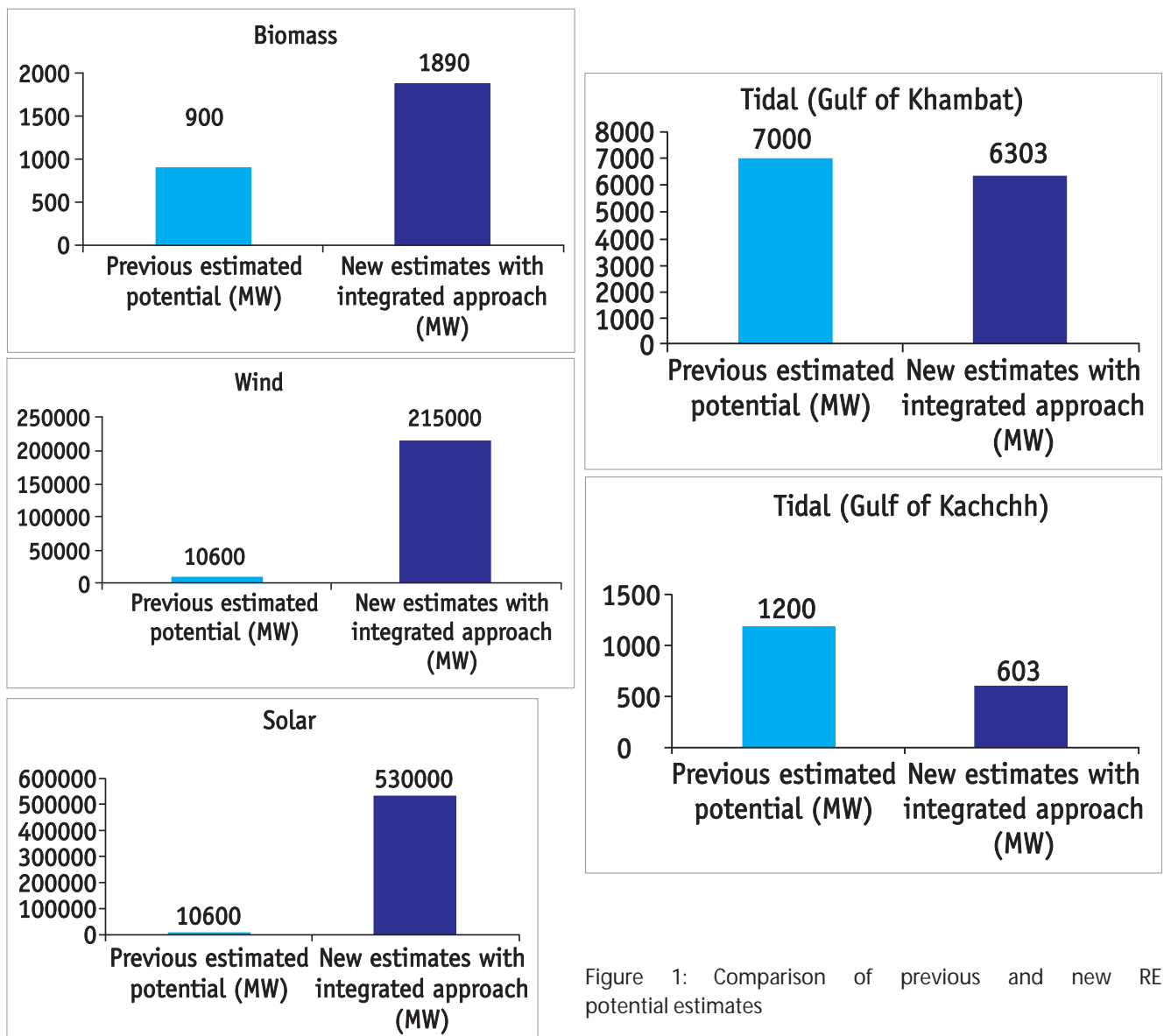


Figure 1: Comparison of previous and new RE potential estimates

Technological developments

- There have been continuous improvements in the efficiencies/ performance of solar PV and solar concentrators, resulting in to more output.
- In case of wind energy, now there are wind turbines that are designed for low-wind regimes. These new machines have higher rated capacities, large rotor diametres, and higher hub heights. Larger rotor diameter helps in capturing

higher energy from wind and as the wind speed increases with height above the ground, the higher hub height enables capturing this high wind speed. Moreover, the overall land requirement also comes down with larger capacity wind machines.

Wasteland availability

- Previous potential assessment was based on an assumption of a certain percentage of total land area for renewables. The scientific approach

of classifying land, taking into account land use and land cover pattern, and then looking at different categories of lands for RE was not adopted.

- TERI's analysis is based on the availability of wasteland with further categorization (eg wasteland with a slope of 3% or less). Since Gujarat has a flat terrain, much higher proportion of the wastelands has been found suitable for solar and wind power development.

TABLE 1 GIVES DISTRICT-WISE RE RESOURCE POTENTIAL IN GUJARAT UNDER DIFFERENT SCENARIOS OF LAND UTILIZATION FOR VARIOUS RE TECHNOLOGIES.

District	CSP (where water is available) (GW)	Integrated Solar PV- Wind (excluding land suitable for CSP) (GW)	Only Solar PV (excluding land suitable for wind and CSP) (GW)	Only wind (excluding land suitable for solar) (GW)	Biomass potential (GW)	Total integrated potential (GW)
Ahmedabad	1.61	1.45	1.01	0.00	0.06	4.13
Amreli	5.87	6.91	0.00	0.11	0.14	13.03
Anand	0.00	0.00	0.00	0.00	0.02	0.02
Banaskantha	7.74	5.87	0.27	0.95	0.08	14.90
Bharuch	22.74	1.84	0.00	0.24	0.04	24.86
Bhavnagar	3.93	9.04	0.00	0.01	0.19	13.17
Dahod	24.96	5.34	0.00	0.00	0.02	30.32
Gandhinagar	0.80	0.07	1.00	0.00	0.03	1.90
Jamnagar	37.11	12.67	0.41	1.04	0.21	51.44
Junagadh	3.94	5.26	0.38	0.00	0.19	9.77
Kachchh	87.76	148.13	8.92	133.26	0.07	378.14
Kheda	5.48	2.72	0.00	0.00	0.04	8.24
Mehsana	0.33	0.39	0.76	0.00	0.05	1.53
Narmada	17.76	1.69	0.00	0.00	0.03	19.47
Navsari	0.48	0.59	0.14	0.10	0.01	1.32
Panchmahal	7.21	3.39	0.00	0.00	0.01	10.61
Patan	7.03	1.20	0.00	1.87	0.04	10.14
Porbander	0.00	0.94	0.00	0.00	0.04	0.98
Rajkot	17.61	11.19	2.46	0.08	0.23	31.57
Sabarkantha	14.49	5.83	5.27	0.00	0.09	25.68
Surat	25.88	3.70	0.60	0.01	0.03	30.23
Surendranagar	4.26	4.29	0.00	1.11	0.14	9.79
The Dangs	0.00	0.51	0.00	0.00	0.02	0.54
Vadodara	44.00	5.34	0.00	0.00	0.10	49.45
Valsad	4.71	2.24	0.13	0.43	0.02	7.53
Total (GW)	345.71	240.60	21.36	139.21	1.89	748.77

REPOWERING POTENTIAL FOR WIND ENERGY SYSTEMS IN GUJARAT

Gujarat is one of the states where the very first demonstration wind power projects were set up. Since then there are many wind turbines installed by the private sector. As in the earlier times the wind turbines of smaller capacities (less than 500 kW rating) were installed, which have been operating since long, their performance might not be optimal as compared to the real wind power potential in those good windy sites. Thus, there exists a good potential for the re-powering of the wind energy systems in Gujarat, using state-of-the-art wind turbines. Assuming that each of these smaller capacity wind turbines

can be replaced by the modern wind turbine of 1500 kW rating on an average at the same location, the total wind energy re-powering potential is estimated to be about 978 MW (i.e., an enhancement of 830 MW in the installed capacity).

INTEGRATED RENEWABLE ENERGY RESOURCE ATLAS

To represent the estimated RE potential and other resources geographically in the state the 'Integrated Renewable Energy Resource Atlas for Gujarat' has been prepared, which contains following information on interactive platforms.

- District wise Land Use Land Cover details

- District wise average annual solar irradiation
- Wind power density map
- Potential land areas for Solar PV systems
- Potential land areas for Concentrated Solar Thermal Power systems, considering water availability
- Potential areas for solar-wind hybrid grid connected power systems development
- Ground and surface water including Narmada canal and river routes
- Electricity grid network
- Gas distribution network

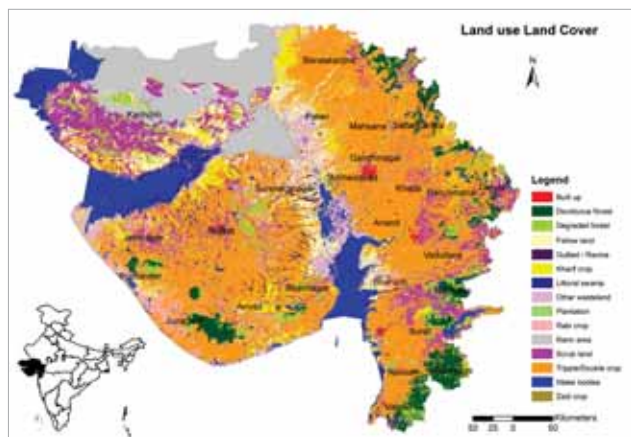


Figure 1: Land use land cover of Gujarat

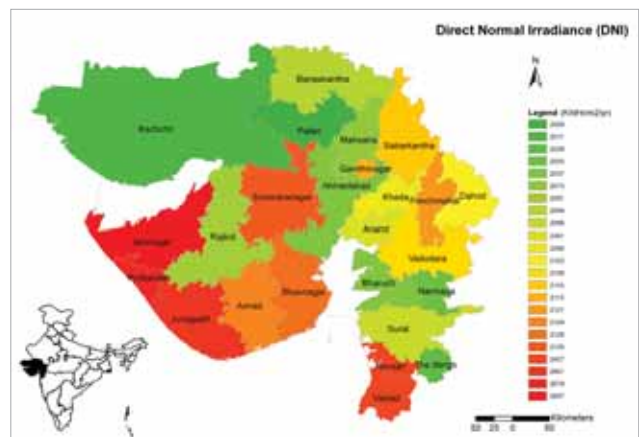


Figure 3: District wise DNI values in Gujarat

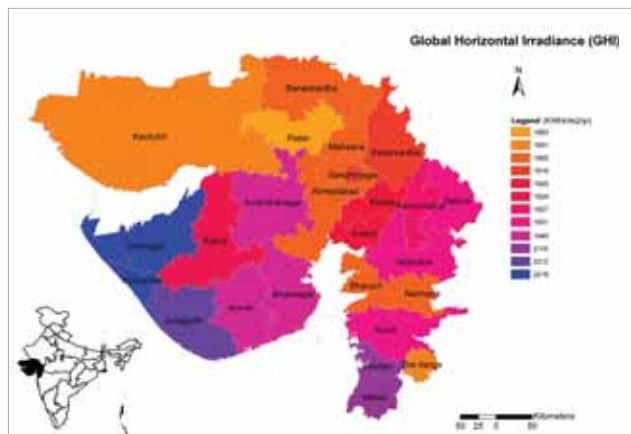


Figure 2: District wise GHI values in Gujarat

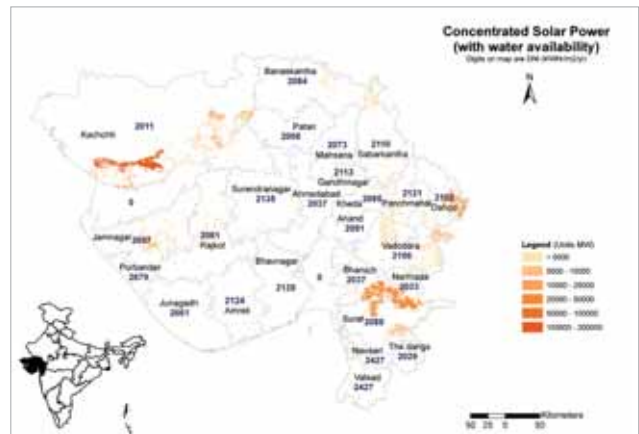


Figure 4: CSP potential sites with water availability

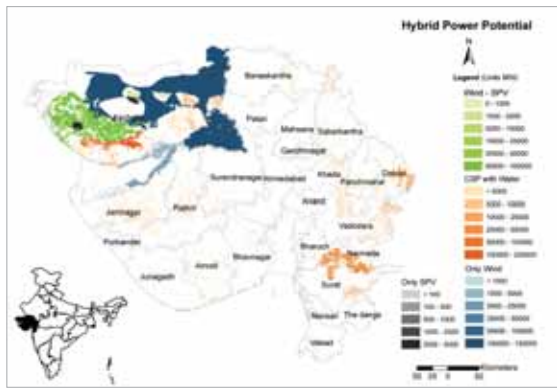


Figure 5: SPV potential areas

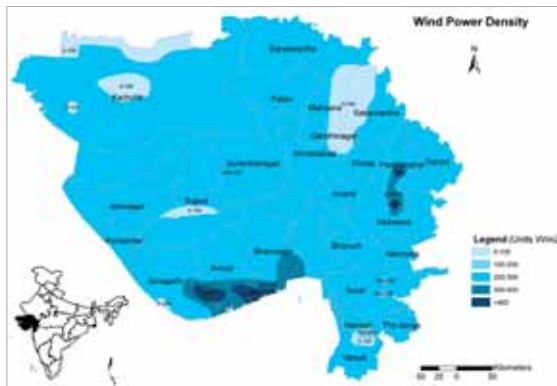


Figure 6: Wind power density map for Gujarat

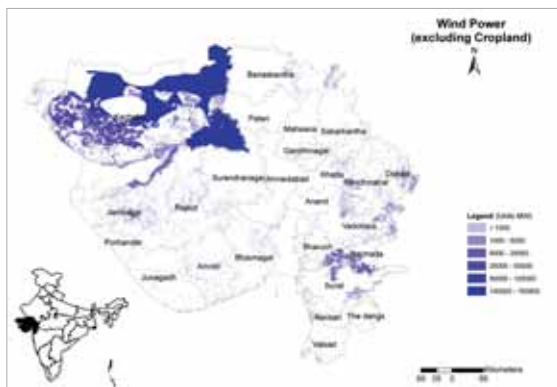


Figure 7: Wind power potential sites (non-agricultural lands)

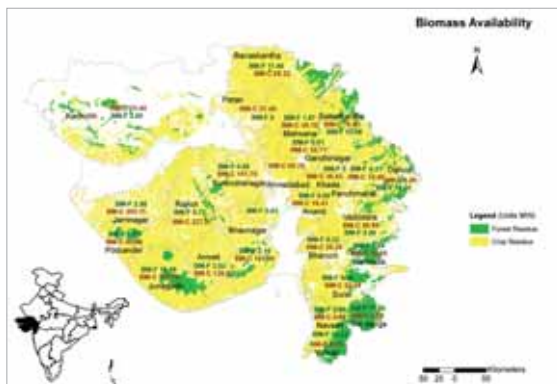


Figure 8: Biomass potential (both forest and crop lands) in Gujarat

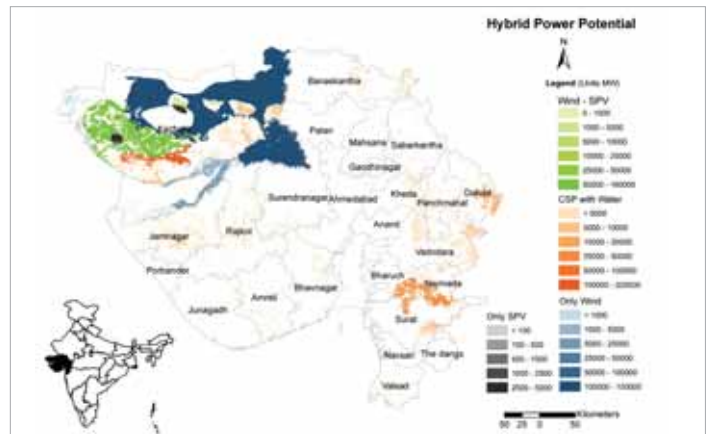


Figure 9: A snapshot of overall integrated RE potential map in Gujarat

The figures 1 through 9 show some representative maps. All the above maps have been developed on a GIS platform, which is proprietary software. However, to ensure that these interactive maps can be used by all, the atlas has also been developed on an open source platform.

LIMITATIONS OF THE STUDY

Though the study attempted the estimation of RE potential with highest accuracy, the actual estimated potential may vary as the renewable energy resource data used for the study are the mesoscale data representing the average resource data at district level (the long term measured data for all the locations are not available) and not at the micro level.

WAY FORWARD

The overall RE potential in Gujarat is estimated to be much higher than previously assessed potential. The GIS-based land use land cover study gives an idea about the land areas, which are suitable for RE projects. This study also helps in identifying the districts where the good potential exists for the standalone CSP, solar PV, wind power, biomass power, and for combined solar PV-wind projects. Besides, the RE industrial development efforts too could be focussed on those districts that meet the required criteria the most.

For a planned exploitation of this potential, the following steps are needed:

- Formulating an enabling policy framework for large-scale deployment of renewable energy.
- Prioritisation of the land utilization.
- Enabling single-window clearance for the renewable energy

From the national perspective, such an exercise needs to be undertaken in all the key states, such as Andhra Pradesh, Karnataka, Maharashtra, Rajasthan, and Tamil Nadu, in order to provide a comprehensive picture to both, the decision – makers as well as potential investors in renewable energy field. ■

Offshore Olympics

By Lewis Smith

Towards the end of the year, the UK is due to become the first country in the world to boast two gigawatts of installed offshore wind capacity. But some problems are looming on the horizon. Despite what the government is saying, the Electricity Market Reform doesn't suit anybody on the developer side of the industry or the supply chain."

It is a memorable year for the UK. It has celebrated the diamond jubilee of Queen Elizabeth II, the Olympics are taking place in London, and it is close to installing the second gigawatt (GW) of offshore wind power.

Sometime towards the end of 2012, a series of turbines should be switched on making UK the first country to boast 2 GW of installed offshore wind capacity. It has installed more offshore wind capacity than any other country, maintaining a comfortable lead over its rivals, and with such a record it might be expected that there would be little but optimism in the industry.

However, there are concerns within the industry that the sector's expansion could stall and allow other countries to catch up with and overtake the UK. Worse still, they fear, the development of the supply chain that is seen as crucial to allowing the UK

to play a leading role in offshore wind manufacturing and servicing, could be lost to Germany, the Netherlands, and Denmark.

The fears primarily have their roots in the UK government's Electricity Market Reform (EMR) proposals and the planned replacement of the Renewable Obligation funding mechanism with a new system, Contract for Difference (CfD). Fears that the depressed economic climate in Europe would destroy investment in the wind industry have largely failed to be realized.

A report titled, "The colour of growth. Maximizing the potential of green business", by the Confederation of British Industry published early in July 2012, even emphasized the importance of green industries to the UK economy when it found that

they account for 8 per cent of Gross National Product (GNP) and increased their share of the global green market by 2.3 per cent.

But investment in the offshore wind sector is threatened by the uncertainty that has been prompted by the government's proposed reforms. Stephen Thomas, of RWE Npower Renewables, said: "The CfD can be made to work but the entire industry is in agreement that in its current form, the proposals legislated in the Energy Bill are too vague. There is not enough certainty for investment decisions to be made and there is a lot of work to be done over the rest of the year.

"We must have a long-term, stable regulatory framework to provide the confidence and certainty of returns to attract third party investors. The timeline for EMR is on the critical path





for new investment in the UK.” At Vattenfall, the Swedish-based energy company which has invested GBP 2 billion in UK on and offshore wind since 2008, including construction of the 100-turbine, 300-MW Thanet offshore wind farm, there is a similar preoccupation with certainty. A spokesman said: “Our CEO spoke about the three criteria for investing in renewables recently. He said to make an investment Vattenfall needs to be confident that there is a route to market through networks, wholesale markets, and support mechanisms; a resource (that is, it is windy enough) and a smooth planning process that delivers predictable and positive decisions in a timely manner.

“Broadly, Vattenfall believes that in offshore wind these criteria are in place but we must watch the development of EMR and the Planning Inspectorate very closely. The greater or the longer the uncertainty remains is obviously negative for wind development.”

Another issue that threatens to slow down the roll-out of enough offshore turbines to ensure the UK meets the government’s target of supplying at least 17 per cent of the nation’s electricity by 2020 from renewable sources is the shortage of skilled workers.

The sheer scale of the UK’s ambitions for offshore wind with the government’s Renewable Energy Roadmap calling for 18 GW to be ready by 2020—has meant that, demand threatens to outstrip the availability of trained personnel. This ‘skills gap’ has been recognized by the industry and measures have started to be put in place to solve it. In October 2011, the creation of the Renewables Training Network was announced, with GBP 600,000 funding from the industry and GBP 580,000 from the government. Its focus is on the transfer and upgrading of skills, especially for the most senior and skilled jobs in the sector for which the shortfall is particularly acute.

More qualification needed

Training colleges and individual companies have been involved in creating apprenticeships to help ensure a flow of adequately trained personnel. One company involved in such projects is Offshore Marine Management (OMM), which has set up its own academy. David Martin, the director of the Offshore Marine Academy, said such programmes can train people in skills that did not exist previously, such as cable engine drivers. But he warned that the industry needs to address the issue of training standards: “The problem I see with training across the industry is standards. There’s a lot of training but there are very few industry standard recognized qualifications.” Despite the potential for UK offshore wind to run into difficulties in the future if impending problems aren’t solved or tackled, it is nevertheless in rude health in many ways. By the end of last year, it had more than half of Europe’s entire offshore capacity and

more than double that of its nearest rival Denmark—and it is continuing to expand rapidly.

Of all the offshore turbines installed in 2011, according to the European Wind Energy Association, the 200 erected by the UK had a capacity of 752 MW and provided 87 per cent of the capacity installed across Europe for the year. The market retains its appeal for energy companies, such as the French-based Alstom, which is among the companies to have developed one of the 6 MW turbines expected to bring economies of scale to the offshore sector.

Mike Griffith, the company's UK Head of Business Development, said: "The UK offshore sector is very attractive for Alstom—both for our offshore wind turbine business and our grid connection business. The UK is targeting 15 per cent electricity generation from renewables by 2020, and this could mean 18 GW of installed offshore wind by 2020. This represents a significant increase on what is currently installed, and so Alstom intends to play an important role in this marketplace." The London Array, which is expected to be the world's biggest and first 1 GW offshore wind farm when it is completed, is among the Round 2 projects under construction. It is being built in two phases, the first of which is expected to be finished this year. Joanne Haddon, of the London Array, said the first phase of 175 turbines and 630 MW of capacity is on schedule: "We're on track to complete construction by the end of 2012 when the last turbine will have been installed. We are expecting to hand over to operations and maintenance sometime in the spring next year."

London Array: Electricity this summer

As is a common practice in UK waters, there is a rolling programme of putting in the foundations, erecting the

turbines laying the cables, and liaising with the National Grid to ensure connections are in place at the right time. In the London Array's case, this means electricity generation can start this summer, long before the last of the turbines is up.

Construction of the onshore substation at Swale is close to completion, two export cables are in place, a third is being put in and the fourth will be finished by the end of the year. Many of more than 200 kilometres of inter-array cables are also already in place. "We aren't waiting for all 175 turbines to be installed to start generating," adds Haddon. "We start generating power this summer. The substation needs to be up and ready for them to start generating."

The London Array is considered to be the prototype for the Round 3 offshore wind farms, which will mostly be on a much bigger scale than the Round 1 and 2 projects. It covers about 245 square kilometres of the sea in the outer Thames Estuary off the Kent and Essex coasts. By contrast, the Round

3 projects could cover thousands of square kilometres and count capacity in gigawatts rather than megawatts. The Dogger Bank development, for example, is expected to be the equivalent of nine London Arrays. Licences for Round 3 schemes were awarded by the Crown Estate in 2010 and are in the pre-application process of data gathering and consultation. The scheme that is closest to being realized is one of the smaller projects, Eon's 700-MW Rampion wind farm planned for the English Channel off the Sussex coast.

"You have to wonder if the government is listening"

The UK risks losing its global lead in offshore wind if it fails to offer certainty to the markets as a matter of urgency, a leading industry figure has warned, Andy Kinsella. CEO of Mainstream Renewable Power said the uncertainty caused by the British government's Electricity Market Reform (EMR) proposals risks putting off vital investors not just in renewables but also in the wider energy sector.



Kinsella was Co-Chairman of a Crown Estate committee which last year advised Charles Hendry, the Minister of State for Energy and Climate Change, that of the GBP 60 billion investment required to install 20 gigawatts (GW) of offshore wind capacity by 2020, up to GBP 30 billion would need to come from sources other than the existing big companies within the energy industry. Raising this GBP 30 billion, he said, looks to be increasingly challenging if the government does not revise its EMR and Contract for Difference (CFD) proposals because these are "bringing huge amounts of uncertainty" into the industry, "EMR is the big issue, as is Contract for Difference. Despite what the government is saying it doesn't suit anybody on the developer side of the industry or the supply chain," he said.

"It would appear the government is going to go through with it anyway— you have to wonder if it is listening. It is consistently getting the message from the developers, it is getting the same message from the finance community." He said it does not help that the level that CfD will be set at and the price developers can expect to get for their electricity remains unstated and unclear. Financing is made harder for the independent energy companies, as opposed to the 'Big Six' energy-generating companies that also supply customers, because of the need to get Power Purchase Agreements (PPAs). These agreements with the suppliers need to be in place if the independent generating companies are able to sell their electricity—the Big Six generate and supply so can sell electricity to themselves. But with CfD due to replace Renewable Obligation Certificates in 2017, and businesses allowed to use the system from 2015, the Big Six are reluctant to enter into new PPAs until they have a better idea of what can be expected from the new system of government funding.

"This is an industry that's lining up to spend money but it's slowing down, who is going to make these commitments if you don't know what your revenue stream will be? You have to sell your power, you can't sell it if you don't have a PPA. The only place you can get a PPA is with one of the Big Six.

We are at the mercy of the Big Six and they aren't open for business," said Mr Kinsella.

Eon began a formal consultation exercise with the public in February and expects to submit an application for planning consent this summer. If successful, it hopes to complete the wind farm by the end of 2017. While preparations are being made for Round 3 developments to be put in the water, Round 2 projects are still coming to fruition. At the beginning of July two large projects—the 580-MW Race Bank and the 560-MW Dudgeon wind farms off the UK east coast—won planning consent from the government.



Ports gearing up

Which wind farm will reach the second gigawatt milestone first is uncertain, but the Greater Gabbard, Lines and Sheringham Shoal projects are considered to be the main contenders. Ports are also gearing up for offshore wind, with energy companies creating bases in coastal towns.

Centrica has built a facility at Grimsby to serve its operations in the

Greater Wash area. Other bases have been created by companies according to where their wind farms are - the Lonlion Array, for example, uses both Harwich and Ramsgate but no port has as yet established itself enough to lay claim to being the UK's central hub. There is no doubting, though, the determination of ports to profit from wind. Liverpool, historically one of the UK's major ports, is among those intent on becoming a hub "superport". "Our vision is for Liverpool City Region to become a global centre of excellence for the offshore wind industry," a brochure declares.

All of which leaves RenewableUK, the industry trade organization, confident that the offshore sector will continue to be buoyant for the foreseeable future, especially if costs come down as forecast.

In June, reports by the Offshore Wind Cost Reduction Task Force and the Crown Estate calculated that the cost of generating electricity could be reduced by more than 30 per cent from GBP 140 per megawatt-hour to GBP 100 by 2020. Nick Medic, Renewable UK's Director of Offshore renewables, believes a key reason for the sector's success in the UK has been the regulatory framework which has allowed a liberalized marketplace that encourages investors, a factor that is unlikely to be changed by the EMR and cm. "The UK has an extremely ambitious carbon-reduction programme through to the 2050s. How do we ensure these targets are delivered and that we have long-term investments? We need a new system that works at least into the middle of the century, one with a long-term accommodation that does not overburden the electricity user."

Already 35 per cent from renewables." ■

This article has been reproduced from the New Energy magazine.

Empowering India

Village Electrification using SPV Off-Grid Systems

By Sapan Thapar
Deputy Manager, IREDA



Background

Electrifying rural areas has been regarded as a vital need towards the more equitable development of our country. However, policy makers generally prefer centralized power solutions. Their inclination prompts them to extend grid lines over thousands of kilometres from the central power plants to un-electrified villages. Typically, a village is deemed electrified if the power supply is made available for just a few hours every day. However, this option, besides being cost exorbitant, is at complete variance with the fast emerging concept of sustainable development.

The policy makers seem to be less oriented towards harnessing locally available renewable resources, which are environmentally benign as well as competitively priced when compared with conventional systems, taking into consideration the related environmental externalities. This article highlights a business model of installing solar photovoltaic based off-grid distribution plants (working in island mode) within the existing cost limits of conventional grid-based village electrification. It

is basically under a PPP model with community partnership (contribution through sweat equity and run by VEC franchisees) for energizing the lives of rural folk.

The possible gains in sight

The above model can cater to the energy requirements of rural households, besides supporting a number of revenue generating commercial activities and community services within a village. Importantly, it will obviate the need of extending the grid and the associated technical and commercial losses. This shall result in a number of other advantages too like the following:

- GHG mitigation
- Enhanced energy security
- Savings in fossil fuel consumption
- Local employment generation
- Assured supply of quality power (without any dependency upon fuel availability)

In case the grid line already exists in a village, the same can be optimally utilized by the SPV plant for distribution of power in a village. It will thereby, reduce the overall cost of the project. Additional revenue streams from sale

of Renewable Energy Certificates, CER/ CDM, and deployment of CSR funds by large profit-making companies can also be explored. Solar generation can also be used to meet the RPO mandates as stipulated by the respective regulatory commissions. Further, a synergy has been visualized wherein support from on-going rural development programmes can be obtained to lower the cost of project installation. Business viability has been established with practical and workable tariff models (monthly expenditure of INR 120 per household and INR 600 per commercial establishment).

Scheming an old initiative

For the electrification of rural areas of India, the Government of India, from time-to-time, has launched many rural electrification programs. For instance, to accelerate the pace of village electrification programme, the Ministry of Power launched the 'Rajiv Gandhi Grameen Vidyutikaran Yojana' (RGGVY), in April 2005. Significant objective of the scheme was providing access of electricity to all households in a five year time-frame. The RGGVY scheme was launched as a panacea to the endemic levels of non-electrified villages in the country.

Gaining too little

There has only been a small increase in overall rate of rural household electrification, from 43% in 2001 to 55% despite massive investments under RGGVY scheme. Even for the households which have been electrified, the daily availability of power is only for a few hours and the quality of power is abysmally poor. Further, there is a heightened reluctance on the part of state distribution utilities to extend grid to rural areas. It is mainly on account of the following few factors:

- Poor economic viability due to high cost of grid extension coupled with low demand





- T&D losses (more prominent at lower voltage levels)
- Commercial losses on account of non-metering, irregular payments, and pilferage

Even for such consumers as are metered, the task of taking metre readings on a regular basis is difficult and an expensive proposition too.

The mismatched numbers

The RGGVY scheme document gives a thumb rule figure of INR 13 to 18 lakh (US\$ 24,000 to 34,000) for electrification of a village. However, the actual cost incurred is far higher than this figure after accounting for the cost of drawing grid lines and building substations for taking power from centralized power stations to remote villages. As of now, more than 117,000 villages have been declared electrified, with a total expenditure of INR 28,500 Crore (US\$ 5.34 billion), which results in the cost of electrification per village coming to as high as INR 24.5 lakh (US\$ 46,000). It has been further established that the cost of extending grid lines to a village is INR 1/ kW/ km and the cost of grid electrification is INR 5/kWh. Moreover,

the unmetered connections in a village also keep the poor efficiencies under veil (State discoms usually attribute high AT&C losses to large unmetered consumption in rural areas).

Solution in sight

Let us now ponder over the option of energizing villages using locally available renewable energy technologies. With most of the Indian landmass is abundantly blessed with ubiquitous sunlight, solar-based technologies can play a seminal role in providing energy to our villages under a decentralized format, with several accompanying benefits.

Existing schemes

There is a provision for 'Decentralized Distributed Generation' (DDG) under the RGGVY scheme, wherein, use of Renewable energy sources is advocated. However, the same can be adopted only as a last resort for village electrification and is prescribed only for remote villages located beyond a certain distance from the existing grid network. The other scheme of 'Remote Village Electrification' (RVE) supports

harnessing of renewable sources for powering village activities, but it is only till the time the grid line reaches the village. It is, therefore, a 'temporary' measure (Village Lighting Programme recommends O&M support up to 5 years from installation of RE based off-grid plant, or, till the time grid reaches the village, whichever is earlier).

The solar solution

As against the budgeted provision of INR 13 Lakh (US\$24,000) for electrification of a village under RGGVY, a Solar PV based off-grid distribution system of 10 kilo-watt peak (kWp) capacity can be installed in a village (90% budgetary support and 10% equity contribution as explained below). This shall be supported by storage battery system (eight 12 V 140 Ah), with an autonomy of two days to take care of non-sunny days.

A substantial component of the total cost of solar plant is attributed to the modules, the prices of which have dropped by around 60% during the last 2 years. Further cost reduction is expected mainly due to fast declining price of processed silicon feedstock—a key ingredient for solar cell fabrication.

On the contrary, the price of power transmission equipment (including wires and substation transformers) is increasing year after year mainly on account of rising cost of copper and aluminium. So, the viability of solar PV based power plant shall definitely improve in the years to come.

Cluster approach

A cluster based approach may be followed wherein a group of villages in physical proximity can be identified for setting up solar PV plants. This shall make the project implementation and system upkeep efficient, reliable as well as cheaper due to economies of scale.

Break-even grid distance

It is generally observed that the per unit power generation cost from an off-grid system is higher when compared to the rates paid by villagers for accessing grid-connected power (often subsidized). However, the viability of the off-grid power improves with the distance from the grid and there is a point when the parity happens, known as break-even grid distance. Based on the type of renewable technology involved, this distance lies in the band of 5 - 20 km. Though Solar Photo Voltaic (SPV) based power generation has been touted as one amongst the most expensive RE systems, these are competitive when compared with the current grid powered supply systems, which involve extending the lines from the centralized power stations and suffer from large T&D losses as well. It has been estimated that the cost of grid extension to 12 km and beyond is broadly comparable with solar power. Further, for villages beyond 3 km from the grid (in hills) and 7 km (in plains) solar is a cheaper option on Net Present Value (NPV) basis. In fact, the solar option is definitely cheaper than the power generated from localized diesel generator systems.

Meeting village electrification norms

The proposed 10 kWp solar plant can cater to the power requirements of over 50 households in a village. It can simultaneously support a number of other revenue generating activities within a village (such as small scale agro-based industries), besides enabling community services like computer systems, primary health centre, and street lights. This means that the PV based off-grid distribution systems can support over 25% of village (average of 266 HH per village). This shall suffice to meet the basic definition of village electrification as per Ministry of Power guidelines, as under:

- Basic infrastructure, such as distribution transformer and distribution lines are provided in the inhabited locality
- Electricity is provided to public places like Schools, Panchayat Office, Health Centres and Community Centres etc.
- 10% of total households in a village should be electrified

Village selection criteria

The villages may be identified so as to benefit under the proposed scheme based on the following few parameters -

- Current electrification level ($\leq 10\%$)
- Distance from grid (≥ 5 km)
- Solar insolation (≥ 5 kWh/m²/day)
- Load requirements (≤ 10 kW)

Low-carbon growth strategy

An important point to be noted here is that India is the world's third largest greenhouse gas (GHG) emitter (next only to China and the US), even though its per capita emissions is amongst the lowest in the world. An important reason for our low per capita emission is the low-carbon lifestyle of our rural population.

In a typical village environment riddled with carbon emissions of the type mentioned above, the extension of the grid via coal-based thermal power plants may lead to significant increase in our per capita emission levels. Moreover, the impact of global warming is more pronounced on the rural population, and this mode of powering villages by extending the grid shall promote a non-sustainable development format.

Enabling regulatory provisions

Section 14 of the Electricity Act 2003 allows the generation and distribution of power in rural areas without obtaining any license at all. Going up a step further, the Forum of Regulators (FoR) has recently come out with a discussion paper on electrifying villages using Renewable Energy technologies titled 'Policy and regulatory interventions to support community level off-grid projects'. CEA also has released the draft Technical Standards for Connectivity of the Distributed Generation Resources, Regulations, 2012. However, SPV off-grid systems as proposed in this article shall be under an off-grid distribution dispensation, operating in island mode, thus obviating the requirement of grid connection.

Showcasing the business viability

Let us look at the business viability of the proposed solar solution.

Presented below is the demand-supply position as well as cash-flow analysis of a 10 kWp PV off-grid system with an all-inclusive cost of INR 13 Lakhs (US\$24,000) (panels, batteries, inverter, wiring, and monitoring systems).

Demand and supply

a) *Daily Power Generation*

10 kW X 5 hours = 50 kWh (Average Insolation of 5 sun-hours per day)

b) Power Requirement

Load type	Load Points	Running Hours per day	Total Load	Daily Consumption (kWh)
50 Nos Households	Two 11 W CFL lamps/ HH + Two 50 W sockets*	CFL – 5 Load – 4	6000 W [50 X (22 + 100)]	25.5 kwh 50 X [(22 X 5) + (100 X 4)]
10 Nos Commercial entities	CFL lamps - Two 11 W 500 W load	CFL – 6 Load – 4	5220 W [10 X (22 + 500)]	21 kwh 10 X [(22 X 6) + (500 X 4)]
Public Services	PC systems. 2 X 50 W each 250W Public Health Centre	PC – 4 PHC – 4	350 W [2 X 150 + 500]	1.5 kwh [350 X 4]
Street Lights 14 Nos	14 x 11 W CLF lamps		154 W [14 x 11]	1.2 kwh [154 X 8]
TOTAL				50 Units

(*)can include mobile charging point, TV etc.

Cash flow analysis

a) Earnings

Consumer	Monthly tariff	Expected earnings per annum
Households (50 Nos.)	INR 30 per light point- 2 INR 30 per load point- 2	INR 72,000
Commercial entities (10 Nos.)	INR 50 per light point -2 INR 500 per load point - 1	INR 72,000
Public Services	INR 250 Computer -2 INR 500 for PHC -1	INR 12,000
Street Lights (14 Nos.)	INR 50 per Street Light -14	INR 8,400
TOTAL		INR 164,400

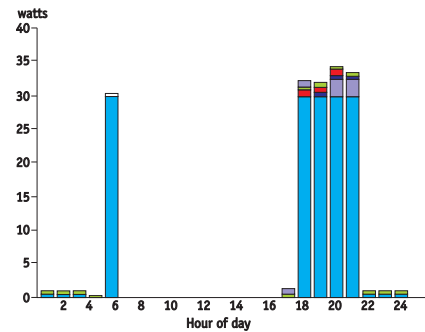
b) Expenditure details

Item	Cost	Expenses p.a.
Battery replacement	INR 2 lakh every 5th year	INR 40,000
O&M	INR 5000 per month	INR 60,000
Security	INR 5000 per month	INR 60,000
TOTAL		INR 1,60,000

The PV power system should be designed to handle the maximum anticipated load based on demand projections. It may be noted that the demand from different consumer segments shall occur at different periods of a day, with the commercial loads and public services running during the day with domestic loads during evenings and street lights during the night.

Household consumption patterns

- 2x CFL bulbs
- 1x Ce II phone
- 65 kWh/year
- Annual peak 30 W



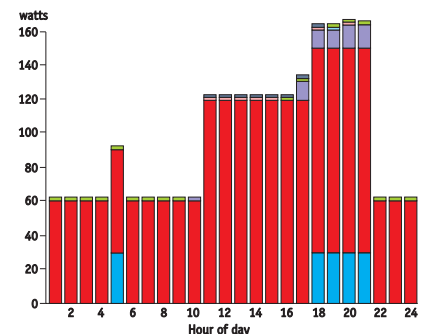
Courtesy: Greenpeace International

The calculation shows that the expenditure can be conveniently met under the proposed tariff schemes, thus making the overall scheme viable.

Modular systems

As the villagers experience the benefits of electricity, the demand for power shall increase with the course of time. With Solar PV modules being modular in nature, the capacity of the plant can easily be augmented based on the following type of load requirements.

- TV / radio
- Cooling / heating
- 500-1,000 kWh / year
- Annual peak 150-500 W



Courtesy: Greenpeace International



Community participation

People usually value such things as involve some kind of their resource investment, be it in the form of money, time, land or labour. In order to involve the village community as owners of the project, they can be asked to contribute from their end in whatever manner it becomes possible. For instance, they can share Panchayat Land to set up the plant and can also contribute up to 10% of the system cost (@ INR 2,000 per user family/ commercial establishment) which can be in form of low quantum of instalments. They can also work as labour during the installation of plant and work towards maintaining the same, (can be on a revolving basis to elicit support from all the stakeholders). Further, there is a proven concept of Village Energy Committee (VEC), which involves participation of the local youth, who are inclined to better the lot of fellow citizens via their entrepreneurship acumen. The VEC members can also support and maintain the system, once equipped with the desired skills and training.

These entrepreneurs can run the plant under a franchisee business model as permitted under the EA 2003. Importantly enough, an arrangement of this type will bring forth a sense of ownership for the plant amongst the village community and thus lead to its better upkeep. Necessary synergies can well be drawn with other rural

development schemes. In fact, the updated scheme of NREGA (version 2.0) allows construction of household biogas plants and the same type of encouragement can be extended for construction as well as routine maintenance of Solar PV village off-grids.

REC as additional revenue source

An additional source of revenue can be under the Renewable Energy Certificate (REC) scheme. Though under the current regulations, off-grid projects are not directly eligible to get REC, CERC is contemplating extending the REC scheme to the off-grid sector as well. With annual generation of 9000 units, the solar PV off-grid plant shall be eligible to receive nine Solar RECs (1 REC = 1000 units). The current price band of Solar REC is in the range of INR 9,300 – 13,400. Taking the sale price @ INR 10,000 per REC, this shall make a solar plant collect INR 90,000 per annum from the sale of REC's. This income shall be over and above to what is available from the tariffs charged (as explained above), which act as a buffer in case of sudden capital requirements. It is also for augmenting the capacity of the SPV plant in case of any sudden increase in demand.

- Solar power generated p.a. = 9000 kWh
- 1 REC = 1000 kWh
- No of RECs generated per system p.a. = 9
- REC Price Band = INR 9.3-13.4/ kWh
- REC Price Assumption = INR 10 / kWh
- REC Revenue per system p.a.= INR 90,000

RPO compliance

In case the solar PV off-grid decentralized power plants are not eligible to receive REC certificates, the host state distribution utilities

responsible for setting up and running these plants may be allowed to offset a part of their Solar RPO mandates from the generation made by these plants. It may be noted that most of the State electricity regulatory commissions (SERC) have earmarked Solar RPO for the obligated entities under their area of jurisdiction.

GHG savings & CER revenue

Plant Wise Calculations

- Daily Generation = 30 Units
- Annual Generation = 9000 Units (with 300 sunny days)
- GEF = 0.79 kg/ unit
- T&D Losses = 25%
- Savings in Carbon Emissions = $[0.79 \times 9000 / (1 - 0.25^*)] = 9500 \text{ kg}$
- Savings in Coal = $0.7 \times 9000 \text{ units} (700 \text{ gm/ kWh}) = 6300 \text{ kg}$

(*) T&D losses can be appropriated for computing CER in case of decentralized power generation projects

The above calculations show that even a single project would lead to huge savings in terms of GHG emissions and usage of coal, besides reducing the requirement of extending grid wires (made up of copper and aluminium).

CER Revenue

- No of CERs generated = 9.5
- CER Price = US \$5
- CER Revenue = INR 2,500 p.a.

Though there is uncertainty regarding CDM benefits (post-2012), CER's generated from Solar PV based off-grid decentralized plants would definitely attract voluntary buyers from the international market. Some of the smaller solar (grid-tied) projects have recently got CDM registration under a programmatic (POA) model. ■

The author, a certified Energy Manager, has a decade long experience in energy efficiency-renewable energy areas. The views and opinions expressed in this article are those of the author and do not necessarily reflect the views of the organization he works with.

Popularizing Solar Energy

By Dr Suneel Deambi
Consultant, TERI

Background

Picture yourself constructing your dream house amidst the serenity of the hills somewhere in India. You choose this location to be away from the normal humdrum of those hill-stations that have lately been turned into concrete jungles. The icy winds of winter have passed and given way to the early onset

of summer, and people of all hues are thronging to this locale to draw out their enjoyment of winter. This fantasy of this new kind of construction is not isolated. It is a common sight today to see high-rise apartments on the horizon just as we leave the busy streets of the NCR region, for example. It may also be an ambitious entrepreneur planning

some big construction for his shop floor. There is a long list of such projects, with a definite common factor amongst them. You may be wondering what the solar sector has to do with all these dream ventures of brick and cement. Well, the following section brings out the novel use of solar power associated with them.





Bringing up the sunny need

Traditionally, be it an individual or a real estate giant beginning a new construction anywhere in the country, the need for power is normally high from early stages of construction work. However, long hours of undesired power cuts play havoc with the construction schedule, which effectively translates to some delay or the other in timely completion. It is equally true that whenever construction takes off, a temporary electricity connection is applied for and granted within varying periods. If we take a quick look at what the electricity is really required for, we see it is for activities such as lighting, water pumping, welding, grinding, and polishing. Some of you may be thinking of a roaring or a silent diesel generator as an obvious solution. Well, some builders do take recourse to its use but it is not a trouble-free operation, more so at distant locations. It is often a battle to ensure fuel stocks and do not deplete while one operates and maintains a diesel generator. That simply compels one to go beyond these customary solutions in order to reduce the construction delays to a bare minimum.

The solar solution

The Sun shines with its full vigour on most parts of our country. Coming at no fuel cost, what stopped it in its wings was the exorbitant cost of converting incident solar radiation into useful electricity. The device which does this trick is more commonly known as a solar cell and a powerful assembly of cells woven together in a weather-proof unit known as a solar module. Yes, you are quite right; I am now referring to a solar assisted construction activity. So, what makes it click now more than ever before, defying all the cost arguments thrown at it before? Well, the cost of solar modules is now at an all-time low, selling as cheap as INR 40 per watt. It was not so till just a couple of years back at around INR 225 per peak watt. An obvious enough indication of this is a growing favour towards the use of solar modules on construction sites, as well as a solar power system making its way in a plush apartment.

What can solar constructing help us with?

Well, the following few uses seem to be placed in some direct preference with a building developer for example:

- Portable lighting
- Stationary lighting (both indoor and outdoor)
- Water pumping

As the construction progresses, it may become necessary to move within the semi-constructed areas of a building. There is a high chance of not striking any gold in dark but the area can be lit up under the steady cool white light made available by a solar lamp.

Water pumping-case specifics

Solar activity generally peaks around the noon time. The solar to electric conversion efficiency of a solar system is generally high between

11 am to 3.30 p.m. Water is a critical requirement at any construction site right from an early preparation of cement slurry. It is quite possible to pump water right from 7 a.m. to while using the free flowing solar energy. Solar pumps of varying capacities could be installed at the site in accordance with the available water body, water table depth and importantly, the daily requirement of water. There are several variants of solar pumps available in the market like for example a DC surface pump to an AC submersible pump. The estimated capacities of these pumps could well be up to 5 hp. Solar PV array of just a few kW is suitable enough to energise the motor-pump unit. Once the construction is complete; the pump can well be moved to a different location as well.

Lighting the area

The work force employed for a major construction activity normally sets up temporary shelters around the area of construction. There is no regular arrangement of lighting for them to undertake their daily chores. A small capacity solar power pack can be put up to illuminate these residences via LED based lighting. It can also be relocated to another construction site later on. Portable units of light such as solar lanterns and solar torches are expected to facilitate smooth movement within the construction site at night.

Purifying the water

It is often a huge challenge to make safe drinking water available to a floating population engaged in construction activities at locations like in the hills. One or many solar powered water purification units of a desired scale can well be put up so as to meet the specified purpose.

Miscellaneous functions

Other operations like grinding, polishing and welding, etc., are also to be carried out at a construction site. These types of loads are not normally catered to via solar power use. However, a builder is at liberty to consider such load operations too by using some PV capacity.

Indicative means of financing government schemes

The investment cost can be recovered by a builder for example in a few years' time. It is possible to avail of a subsidy and depreciation benefit, thus optimizing the economic gain further. Alternately, soft loans can be made available for this type of PV application with a mobile enough arrangement of asset relocation

Corporate social responsibility

Presently a large number of companies are engaged in CSR activities via one form or the other. As and when any construction activity of a philanthropic type is in progress, a CSR interested company can well have a handshake with a builder. The plain enough idea is to adopt the bare minimum energy needs of temporary type of habitations. Importantly, it may very well serve the following few purposes:

- a) Avoid the need for use of kerosene oil lamps
- b) Eliminate the risk of fire
- c) Keep the surroundings clean

Incidentally, major users of PV lighting systems for example have been those from the remote rural areas. A prior exposure of the type indicated above is sure enough to drive them towards adopting solar lights for example in their own homes later on. Perhaps the application of the principle of seeing is believing may finally help to expand the market demand for sheer need based applications of this type.

Capacity building

Solar systems have been deployed across a large number of geographical areas right through the inception of a large scale demonstration programme in the country. However, a weak link of sorts has been the poor operation and maintenance at times. A solar company in association with a CSR unit can think of undertaking capacity building measures at a construction sites. Easy to understand material in a vernacular language can well be prepared and circulated in the desired numbers. It could also involve familiarization of basic O&M needs amongst those interested.

Scope assessment for PV use in construction sector

As per the reliable estimates, buildings in the country use water and electricity in quite high proportions. For example, they use up to around 40% of the available energy and 30% of the

raw material. Incidentally, these also account for as much as 30% of the carbon emissions and a near equal amount of solid waste generation besides around 15-20% of effluents. These figures point to a definite scope for energy saving beginning from the initial stages of construction itself. More efficient means of architectural designing, lighting (for example, LED based), ventilation and air conditioning too are expected to result in noticeable energy savings. This for sure calls up for policy cum planning formulations along the desired levels of overall programme implementation and strong compliance too. According to a McKinsey report from 2010, it is possible to bring down the country's energy demand to the tune of around 25% by 2030 via use of energy-efficiency measures in buildings alone. Further the Bureau of Energy Efficiency (BEE) also feels that energy saving potential even within the existing buildings is to the tune of 30%-50%.

Quite clearly, mere technology introduction measures cannot enable such energy savings. Instead it will be a fair mix of both, conventional and unconventional technology based interventions. Solar energy technologies can well be used as a passive architectural feature too alongside solar lighting and water pumping systems.

New buildings in the offing

There is another area of concern as far as upcoming constructions are planned. According to IDFC's India Infrastructure report 2009, more than 95% of the new buildings are going to come up in such suburbs and new townships, as are already resource hungry. As per IDFC, the size of private integrated townships ranges from 40 ha to over 400 ha. More than 200 townships of this nature are at different stages of project approval more so around the four metros. ■



Experts call for sustainable expansion of India's Power Industry

Indian policymakers, business leaders, subject experts and other stakeholders strongly advocate the need to tap effective low-carbon sources to generate sustainable and clean energy at the Power Industry India 2012.

Reflecting on the perceived travails in the Indian energy sector, policy makers, business leaders, experts and stakeholders from across the spectrum rooted for low-carbon sources to generate sustainable power at the Power Industry India 2012 held from 30 to 31 August, 2012 at New Delhi.

The two-day conference was jointly endorsed by The Energy and Resources Institute's Business Council for Sustainable Development (TERI-BCSD), UK Trade and Investment, Indian Wind Energy Association (InWEA) and the Indian Power Producers Association of India, and enjoyed the support of the Ministry of Coal and Ministry of Power, Government of India.

Executive Director, TERI, Dr Leena Srivastava during her keynote address, presented an overview of the Indian energy sector and shed lights on the challenges posed by the growing policy paralysis at the government's end. "While the present energy situation is

grim, it can turn worse in the coming years if we continue business as usual and do not introduce radical changes in the system. We need to work at a faster pace because 289 million people in India are without electricity and we need to take immediate steps to realize our dream of being a global superpower."

Identifying key sectoral challenges, Former Secretary, Ministry of Power, Mr Anil Razdan, provided insights on the challenges faced by power producers in the current scenario. He also stated that "Smart grids today are not a luxury but a necessity. India needs 130 million smart meters by 2020."

Speakers further underscored the crucial role played by India's power sector in meeting national growth targets and realizing global aspirations. A popular view that emerged from the discussions was that owing to rising demand and threat to environment, it was pertinent to effectively utilize low-carbon sources to generate clean

energy. Exploring the potential for India to emerge as a solar-based economy, delegates also exchanged views on developing energy ecosystems to enhance efficiency while reducing the environmental impact.

Some of the main themes featured at the event were the 'Impact of privatization, price, reliability of supply and competition in the national power market,' 'Developing India's Domestic Nuclear Technology,' and 'An Investor's Perspective of the Opportunities in the Indian Power Market.'

Power Industry India 2012 was the first in the series of conferences scheduled to be organized across the Asian Continent. It seeks to build consensus on the need for sustainable power by providing a platform to institutions to hold extensive discussions while creating awareness on the issue of energy security among diverse stakeholders.

Initiated by TERI (The Energy and Resources Institute), the TERI-BCSD (Business Council for Sustainable Development) is a network of motivated and environmentally conscious corporate addressing issues related to sustainable development and promoting leadership in environmental management, social responsibility, and economic performance. TERI-BCSD's endeavour is to create a synergy for the corporate sector as a whole to move towards sustainability by bringing together thought leaders and industry specialists under a single forum. ■



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- Market development and effects on project costs
- Research and development in solar
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- Domestic & International Solar Industry
- Banking Sector, Investors & Capital Markets
- Consultants & Solutions Providers
- Solar Equipment & Construction Companies
- Manufacturers & Project Development Companies
- Solar Technology Companies & R & D Chiefs

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“HYDROELECTRIC POWER MORE MATURE, RELIABLE”

Unlike its counterparts solar, wind or probably even geothermal power, which have gained a steady foothold in the renewable energy sector, hydropower is still finding its feet and its bearings. In such a scenario, a recent study on how it plays an expanding role in integrated power systems and can enable increased use of intermittent renewable energy sources such as wind and solar power, assumes immense significance. *Sapna Gopal* spoke to Andreas Lindström, Programme Officer and Research Analyst, at the Stockholm International Water Institute.



Andreas Lindström, who along with Jakob Granit released a paper entitled, ‘Large-scale water storage in the water, energy, and food nexus: Perspectives on

benefits, risks and best practice; this year, believes that well-designed water storage and hydropower systems can enhance both climate change adaptation and mitigation.



In what way does electricity generated from hydropower contribute to large-scale grid-based electrification? Also, how does it boost industrial output and help in economic growth and human development?

In many regions of the world, Hydroelectric Power (HEP), plays a central role in electricity provision. There is a huge suppressed demand for energy services in the world today and hydroelectric power can be one tool to mitigate that. Large scale hydroelectric power projects have the ability to generate substantial, often reliable (in terms of delivery) quantities of electric power. In countries where water resources are abundant and where hydroelectric power potential is capitalized on, not only can the demand for domestic electricity be catered for, but surplus energy can be exported on common energy markets to meet regional demands as well. The Scandinavian example is proof of this. Sweden, with few of its own energy assets besides hydroelectric power, started developing its HEP resources in the 1890s. The power plants in the north were connected to growing industrial centres and cities in the south. Supported by this, Sweden could break its poverty and become among the more rich nations in the world with developed industries powered to a substantial degree by hydroelectric power.

In other parts of the world, we see the same patterns; in Southern Africa, the small nation of Lesotho is a regional water tower. By deals with South Africa on utilizing this hydroelectric power potential and water resources, both nations benefit (Lesotho Highlands Water Project). Lesotho receives revenue, work opportunities and electric power for its own needs and the Gauteng region in Republic of South Africa (the country's major economic engine), gets additional water from the

Lesotho highlands to power its mining and industrial industries. The Itaipu dam on the border between Paraguay and Brazil provides both nations with power. It supplies almost the entire electricity demand in Paraguay while also supporting Brazil's rapidly growing economy.

A key finding of your study has been that hydropower plays an expanding role in integrated power systems and can enable the increased use of intermittent renewable energy sources such as wind and solar power. Please explain how this is possible.

In present times, the world is looking to increase the share of Renewable Energy (RE) to the energy mix as these are considered more sustainable, from many perspectives, than the conventional fossil fuel based technologies. The development of integrated power systems/smart grids can offer the opportunity to provide electricity from different sources to the grid. This can allow for a greater supply from renewable energy technologies on the grid. There might however be one problem tied to this as preferred renewable energy technologies such as wind and solar power are intermittent, that is, its continuity cannot be guaranteed. Back up capacities are needed when the wind is not blowing or when sunlight is not available, in other words there is a need to "store" energy for times when it is needed. This is typically difficult as this cannot be done with solar and wind, but it can be done with hydropower, by way of stored water in reservoirs that can be released at times when there is a deficit from other sources.

Hydropower and natural gas are possibly and presently the two feasible options which can provide for both base load demand as well as peak demand (times of extra strong demand



for electricity). Hydropower is more efficient than natural gas as it can be deployed more quickly and it is also cleaner in terms of emissions. In other words, it can be said that if an expansion of renewable energy can take place to replace some of the more "dirty" fuel types in the energy mix; it needs back up security which can possibly best be supplied by hydroelectric power.

Water shortage and paucity are a problem that confront almost every country now, more so the developing nations. In such a scenario, how do you think hydropower can be tapped? Is the scope as immense as say solar, for a country like India?

Hydropower with storage is a water consuming activity. The actual amount of water that evaporates from reservoirs is site specific, with very low evaporation from schemes that utilize no storage, and greater amounts in schemes that use large storage functions and are located in hot climates. Storage functions may also reduce flows downstream of the reservoirs. With many competing demands for precious water resources, this is of course, something that needs to be taken into serious consideration. However, a major message from the report is that today, there is considerable knowledge and developed best practices on how to go about these types of projects in the right way in order to minimise negative impacts. Every project needs to be thoroughly evaluated at the



initial stage and assessed based on its potential benefits and environmental and social impacts, in order to determine if a hydropower project is the best way to go. This of course also goes for other energy developments, including for instance, solar power. Some forms of solar power such as Concentrated Solar Power (CSP) are also a water demanding form of electricity generation. There are also of course opportunities with hydroelectric power as benefits from projects can be shared or traded. Hydroelectric power can favourably be developed in places where competing demands for water is less of an issue and then linked or traded to places with scarce water and energy resources through extended transmission networks. When compared to solar power, hydroelectric power is still a more mature technology and as such, often more cost-effective. It is also more reliable in terms of power generation. Additionally, water storage functions often included in hydropower schemes, can be used for a wider range of functions (multi-purpose) which can be very important from a development stand-point, all issues which could be relevant for India, a country that also has considerable potential for solar and wind power. In short though, to avoid stress on existing water resources, all energy development alternatives

must be assessed and evaluated in any given context. The existing mitigation measures and best practices must be deployed and incorporated accurately and without exception in order for them to be more sustainable.

In what way can hydropower be developed to mitigate climate change through wider use of renewable energy sources? Please elucidate.

Hydroelectric Power (HEP) is a renewable source of electricity which works in many ways and is a better choice than fossil fuelled energy as it emits far less carbon dioxide to the atmosphere. This is also true for other renewable energy technologies such as wind and solar (those are emission free). So in order to combat climate change and minimise carbon dioxide emissions, a wider use of renewable energy is needed. Hydroelectric power plays the double part as it is a not just the renewable energy source itself, but also an enabler for other renewable energy sources as elaborated upon above. The reservoir capacity is often tied to hydroelectric power schemes, and can also serve adaptation purposes as more extreme weather and rainfall might increase the risks of floods, which can be prevented by storage infrastructure (it should be stated however that the combination

of storage for hydroelectric power and storage for flood control is not optimal) Hydroelectric power needs full reservoirs to produce electricity, and flood control structures need storage space to serve its purpose best.

In the report, it has been stated that hydropower dams exceed the target set for economic returns and development outcomes more than any type of other water storage. So, would it be a viable proposition, for say, a country like India?

India is a country where water storage has been deployed since long for many purposes, possibly mostly for irrigation. If conducted sufficiently, hydroelectric power schemes can provide many benefits. India is a nation struggling to meet growing energy demands from its huge population and growing economy and as such, many options needs to be considered and existing energy assets tapped. India is today a major producer of hydroelectric power and there is still major potential to be tapped, in that regard (sustainable) hydroelectric power development is one viable option to be explored.

Please explain the ways in which existing hydropower electricity generation capacity can be improved through technical upgrades during the project's life-cycle.

There are several ways to improve hydroelectric power plant efficiency over time. As hydroelectric power plants have long life spans, there are measures to keep up efficiency over time. Some options to explore when it comes to plant rehabilitation were provided by the World Bank in 2011; "upgrade generating capability and availability (to yield greater outputs where one example can be to install

additional generating units), repairing or replacing components and improve the management of water resources to enhance ecosystems as well as realigning services to meet market opportunities and new market requirements”.

In a country like India, which has been tapping solar and wind power, what is the scope for hydropower?

According to the International Renewable Energy Agency (IRENA), 2012, India has a gross theoretical hydroelectric power potential of 2,638 terawatt hours (TWh) of which 660 TWh is considered technically exploitable. This can be considered as a rather sizable potential. In 2009, some estimates put India's current hydroelectric power generation to approximately 116 TWh each year. In other words, there is room for expansion in terms of potential. Many of India's water systems where hydroelectric power could be developed are however sensitive both from an ecological standpoint and also from a geo-political standpoint, with transboundary implications. As

such, it is very important (as for any establishment of hydroelectric power schemes) that options and impact assessments are carried out sufficiently and that considerations, regional and local, are taken into account involving all relevant stakeholders that might be impacted by hydroelectric power development on Indian rivers.

Recently, large parts of India experienced power failure. Do you feel that hydropower could help in the future, should a situation like this arise again?

Power shortages in India and in other countries are a major challenge to continued development and economic growth. One explanation among others for electric power failures in India seem to stem from excessive demand, at times put on the electric grid, due to variability in precipitation. The lower than expected rainfall causes farmers at times to pump excessive water for irrigation to their fields to safeguard agricultural outputs thus causing electric power deficits. As deliberated earlier, hydroelectric power can be one opportunity to mitigate this as it is one of the most feasible ways to

“store” energy in the shape of water in reservoirs. In times of higher than expected demand this ‘stored’ energy could be released with very short notice to ensure stable loads on the grid.

About Andreas Lindström

With a background in civil and environmental engineering and a focus on land and water management and sustainable infrastructure, Andreas Lindström is a programme officer and research analyst at the Stockholm International Water Institute (SIWI). He holds several wide-ranging responsibilities in SIWI Knowledge Services’ applied research and advisory services. Examples include exploring water, energy, and security linkages (in collaboration with CSIR and IAGS), co-developing the Kaliningrad water resource management project and being a central team member in SIWI’s Regional Water Intelligence Reports (RWIR).

In the field of water and energy, Lindström has co-authored and provided research to a number of reports/projects aimed at assessing the potential of different regions to cooperate on and develop hydropower assets and water storage to sustain shared benefits. This has also entailed developing research on water related implications of various kinds of energy generation as well as providing recommendations on best practice.

Furthermore, Lindström has contributed to developing a methodology which assesses environmental statuses of transboundary water systems for the Transboundary Waters Assessment Programme (TWAP) supported by the Global Environment Facility (GEF). His experience of water management issues has also led him to work with water strategy development for private sector actors through evaluative and strategic advisory services. ■



ENERGY MARKETS

How did things like oil, coal, solar energy, and 230V AC enter banks and the stock exchange?

Human beings have devised some very innovative ways to manage risk, and create wealth and economic opportunities, while facilitating the exchange of valuable natural resources. Knowledge of these techniques is an essential requirement for people interested in the financial and policy machinations that dictate the future of energy. The Energy Markets and their associated Energy Commodities are a manifestation of this innovation. Through the power of the energy market, it is possible for one to make financial gains by trading barrels of oil on the New York Mercantile Exchange while sitting in India—without traveling to the USA, without actually catching a glimpse of the barrels of oil, and without actually trading oil! Confused? That is the power of finance—in particular, the power of commodities, derivatives, futures, and financial instruments based on the energy sector. But how and why are financial products created from physical energy assets?

Through this article, Dr Ashok Awasthi, science writer, aims to give you a quick, yet comprehensive perspective on energy markets – from conventional energy trading to specialized ‘instruments’ for mobilizing finance and meeting global objectives.



Back to the 'Futures'!

Before we delve into the working of Energy Markets it is important to familiarize ourselves with some important financial terms like derivatives, futures, swaps, and options.

There are different types of energy derivatives like futures, options or swap agreements, among other things. These derivatives can be based on any physical commodity (agricultural produce, natural resources, etc.) or financial assets (stocks, corporate bonds, etc.). Energy derivatives are derived from energy assets like oil, natural gas, electricity, renewable power etc. The value of the derivative is determined from the value of the energy asset it is based on. These derivative values are only valid for specific time intervals.

In simple terms, derivatives are just a bet that the value of something will increase or decrease at some point in the future. Derivatives were created to help banks, investors, and companies to manage risk.

Recent times have also seen the creation of specialized financial instruments to meet goals for climate change mitigation, clean energy, and energy-efficiency targets in the energy sector.

Financial Instrument For practical purposes, it can be understood as a real or virtual document that represents a legally binding contract and has a monetary value. The instrument may be equity-based, i.e.,

representing asset ownership, or debt-based, for representing a loan agreement. There are further subcategories of different financial instruments.

Futures contract In such a contract, two entities (or more) enter into an agreement to trade a physical commodity or financial instruments at a set price. The delivery of the commodity or the instrument in such a contract is set for a date in the future. Such derivatives are typically used to reduce the risk of price volatility in the future or to earn money from speculation (similar to the stock markets) rather than physical transaction of goods.

Swaps Are the exchange of one type of security for another between two entities. Typically, a swap involves two entities exchanging their rate of interest, payment terms or exchanging currency. They are not traded on an exchange, instead over the counter between two private parties. Swaps are purely a financial transaction.

Option An option gives the buyer the right, but not the obligation, to buy or sell something at a predefined price, until a specific date. This option normally costs a fraction of the cost of the asset.

Source: Investopedia – <http://www.investopedia.com/>

Conventional Energy Markets

The concept of trading energy and energy related financial products is not exactly a brand new idea. In fact, contracts for trading energy have been around for many decades, and they are also an inherent part of the modern energy supply setup. The first successful energy futures' contract was for the delivery of heating oil in the year 1978. Just after the US government had deregulated the buying and selling of heating oil, a man by the name of Michel Marks was astute enough to initiate trade by drawing up a new future contract.

Over the years, such contracts have grown to become increasingly

complex. As far as energy is concerned, there are many different grades and forms of petroleum, natural gas, and other fuels. These different physical resources have different purposes and hence, have become distinct commodities in futures trading. This availability of different assets has spurred the growth of Energy trading as an important economic activity, and over different geographies.

However, Energy Markets are still sensitive markets. The variability and uncertainty emerges because of the characteristics of the underlying commodity or asset. The physical nature of sources of energy makes the pricing of energy futures inherently

volatile. There are various factors that influence the availability of energy on a day-to-day, even minute-by-minute basis. Energy supply is sensitive to demand-supply pressures, political considerations, wars, natural disasters, and environmental concerns, among other things.

Hence, the prices of energy derivatives, specifically futures contracts, vary on a daily and weekly basis. For example, consider a hypothetical situation where oil is available at 105 dollars a barrel during September 2012 and a futures contract between two companies promises delivery of 100 barrels of crude oil in December 2012, at 90 dollars a barrel.



If the market price remains at 105 dollars a barrel in December 2012, the buyer stands to earn 15 dollars a barrel. However, in the intervening period, if new oil deposits are discovered or renewable sources of energy become more efficient or simply if oil demand drops, the market price may fall below 90 dollars a barrel. Conversely, climatic events, political crises in oil producing countries, and a sharp rise in demand will increase prices further.

As compared to energy based financial products, some derivatives and options are inherently easier to trade. Consider foreign exchange futures as an example. The Internet age has made trading currency very easy. It is easy to check prices, make conversions, staying updated on contracts and making online bank transfers for settlements.

So is trading energy commodities difficult? For starters, if you sign an energy futures' contract, you are actually agreeing to deliver or receive a certain physical quantity of oil, natural gas, coal, or electricity depending on the type of contract. Theoretically, as a buyer or seller of a derivate you are expected to make provisions to receive or deliver the physical quantity on the

given date. I am certain that you would agree, that it is probably easier to convert euros to dollars, but the same cannot be said about converting a barrel of oil to currency!

In reality, however, futures contracts are rarely ever executed for the actual physical exchange of the commodity. Settlements are made through cash transfers, a cash settlement, or through offsets, i.e., signing a new futures contract. The two major exchanges for trading energy contracts are the New York Mercantile Exchange (NYMEX) in New York City, and the International Petroleum Exchange (IPE), which is located in London. The table below shows the different types of oil traded on these two exchanges and the delivery points for the physical execution of the contracts.

Futures Contract for	Exchange	Delivery Point
Crude Oil	NYMEX	Cushing, USA
Natural Gas	NYMEX	Henry Hub, USA
Brent Crude Oil	IPE – London	Cash Settlement
Gas Oil	IPE – London	ARA Area

Sources: NYMEX (CME Group), IPE, Bloomberg

The prices of derivatives are usually reached after a highly competitive auction process on the commodity exchange. Traders or companies bid for the contracts till they are eventually awarded.

Why trade energy through derivatives and markets?

Energy trading is done for long term security, for making quick profits through speculation, or for meeting immediate needs. Risk reduction and security is largely achieved through Energy futures. These contracts are long-term, typically stretched over multiple years. The rationale behind entering such long-term contracts is simple, the seller gets an assured price for the energy produced and the buyer has an assured supply for the

desired duration. The commitment to deliver the energy could be in any of the 12 months in a year. The prices of derivatives are usually reached after a highly competitive auction process on the commodity exchange. Traders or companies bid for the contracts till they are eventually awarded.

For immediate energy requirements trading is done in short-term markets or 'spot markets'. In many countries, electricity suppliers purchase power from energy producers. This is done through contracts of varying durations. Some of these contracts are short-term for the immediate purchase of power to meet a supply-demand deficit. Such buying and selling is done through 'spot markets' or directly between the agencies involved. For example, in extremely hot and long summers

the power demand in a country is likely to increase substantially. The electricity suppliers are usually then forced to buy expensive power from private producers or other state agencies. This is facilitated through such short-term trading. Another among the most important functions of the futures markets is 'price discovery'. Commodities like crude oil are traded across the globe. The prices and products vary with quality and geographical accessibility. The futures markets consist of dedicated exchanges or locations for trading specific types of energy assets. These exchanges act as central marketplace for a specific type of commodity for example Brent Crude Oil (that is a type of crude oil). Hence, they offer a centrally determined reference price.

This plays a role in determining prices in different parts of the world. This is called 'price discovery'. Hence, the futures trading marketplace serves to provide stakeholders with commodity pricing information. The markets are highly efficient and the prices are an accurate estimate of factors influencing the true cost. The Internet age and derivatives have made the commodities markets, which were traditionally large centralized markets, a more global trading platform.

Evolving energy markets – emerging instruments

Like many sectors in the Indian economy today, Energy Markets are also an area with immense growth potential. Apart from conventional energy futures contracts, swaps, and short-term trades, new instruments have also emerged. During the past few years, terms like 'PAT scheme', ESCerts (Energy Saving Certificates), RECs (Renewable Energy Certificates), RPOs (Renewable Purchase Obligations) etc. have become somewhat common

currency in the 'Economics and Finance' section of daily newspapers. For the uninitiated, these are examples that represent or describe some of the 'instruments' derived from, and for, the energy sector. The use of the term 'instruments' here can be understood as mechanisms or products that are used to raise finances, create wealth and stimulate the growth of the energy sector while meeting certain policy objectives – like energy efficiency or clean energy targets. Hence, they serve as 'instruments' for creating value, facilitating trade and meeting societal goals. Hence, this implies that the instruments are derived from actual physical quantities of energy generated, energy available or energy saved, depending upon the type of instrument.

India's energy trading platforms

As of September 2012, the Energy markets in India only have two platforms for trading energy in short-term markets. These platforms or

power exchanges are IEX, promoted by Financial Technologies (India), and PXIL that is promoted by the National Stock Exchange. A fact that proves the fledgling nature of the power trading market in India is the volume of trades. The entire country generates close to 800 billion units of electricity. Only about 2% of this volume is traded on these platforms. The recent recovery in rainfall over the past two months has led to a fall in short term power demand. This is due to improved hydropower generation and reduced agricultural demand. As a result power is available at record low prices on power exchanges in short term markets. In the month of September 2012, the price per unit on the IEX fell to as low as INR 1.20 per unit. This has increased the number of participants, like power intensive industries – cement, iron and steel etc., on the exchange. Unsurprisingly, the average daily sale bids for power have doubled between July 2012 and September 2012. The recent announcement to allow upto 49 per cent foreign investment in power exchanges in India signals positives for this market. This option will facilitate the injection of capital, collective knowledge, and global standards in the power exchange setup. These exchanges have the capability to bring buyers and sellers of electricity to a common platform, thereby making the market more competitive.

The importance of energy markets

The energy industry has assumed increasing significance in the recent years. A recent trend that provides evidence for the scramble to corner the last cake of coal and the dwindling streams of petroleum is the advent of specialized training in Energy Finance. Some of the leading universities in the world offer specialized training in Energy Finance. These courses train professionals in understanding the



working of Energy futures markets, hedging techniques, and creating and managing energy derivatives, among other things. Insights into local and global Energy Markets are vital for making informed policy decisions. This creates the need for various energy statistics covering economic and environmental data, energy production, consumption, taxation, and prices across geographies. In Europe, a body called the 'Market Observatory' serves this function. The observatory uses the Energy Market Observation System (EMOS) which hosts and analyzes data relevant to the energy markets. It was created by the European Commission to serve the purpose of generating insights into the European and International Energy Markets. Entities similar to the EMOS exist for almost every country or group of nations with common interest. For example, the USA has the very well developed US Energy Information Administration (EIA) to provide insightful energy statistics for policy makers, companies, and the public.

The statistics and information provided through government agencies is proliferated and complemented by the volumes of analysis provided by market analysts, trading firms, private companies, as well as research institutions. Take a look at the screen shot of the 'Energy

Markets' page on Bloomberg—an agency that provides financial news and data services.

Clearly, energy news is of global interest. Energy emerges as one of the most critical considerations in daily markets, as well as in all short to long-term strategies.

Energy 'futures' are not always bright

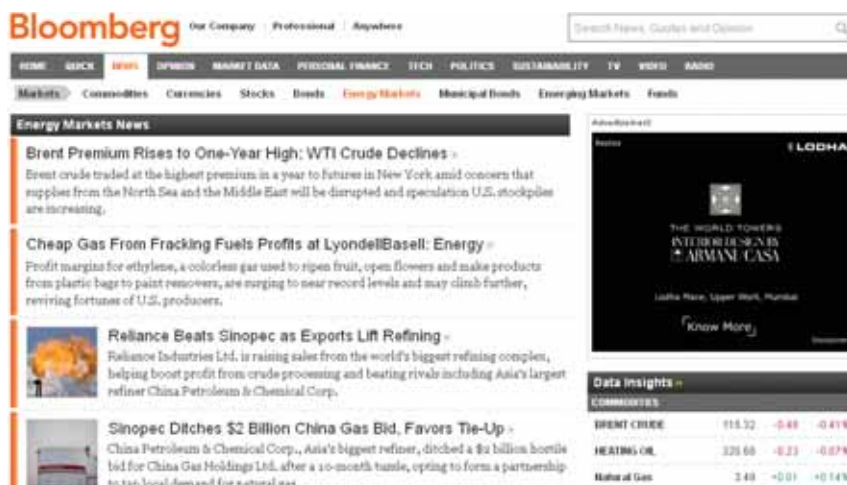
The basic rationale for trading in futures is to reduce the risk and uncertainty associated with open markets while generating economic prosperity. Companies, whether they sell or just use energy, can buy or sell energy derivatives to hedge against fluctuations in the movement of underlying energy prices. However, like most financial products these days, energy futures also have their shortcomings, and fair share of criticism. Private or deregulated financial markets and their products have been responsible for severe financial losses. We are well aware that the financial industry is increasingly being viewed with suspicion and resentment. This is because of many instances of greed, and fraud, by individuals or groups, negating common benefits of financial products, and precipitating economic losses. For example, firms have been known to sell derivatives that are almost certain to fail, to unsuspecting buyers. The products that are

designed to fail are backed by debts and insurance. In the case of failures, insurance companies are forced to pay high pay-outs thereby going bankrupt.

Critics also point out that excessive speculation on the prices of energy in the future distorts the actual cost of energy for the average consumer. At times prices are driven to levels well beyond the real cost of producing that energy. This can increase economic strain by hampering the pricing, and functioning, of essential services. Most of the times, the high costs may only serve to create profits for traders and their corporations, while compromising energy-dependent aspects of society. It is easy to get carried away in making profits while forgetting that energy resources are actually limited and critical for the smooth functioning of society.

But energy is the future

Irrespective of the nature of financial products, energy will continue to remain an indispensable and valuable requirement. It is important to ensure proper regulation of markets that were originally designed to maintain robust supply chains with economic continuity. The importance of investment in science and technology to develop more efficient technology, alternative energy sources, and to reduce environmental impacts cannot be denied. Financial products can serve as important vehicles to channel the flow of resources for such needs. The creation of new financial concepts with the objective of addressing energy security challenges – through energy efficiency and renewable power – are an example of the innovative and creative human spirit that strives to create value and economic opportunities. The test of our intelligence lies in our ability to continue creating these gains without compromising the quality of environmental resources available today, and in the future. ■



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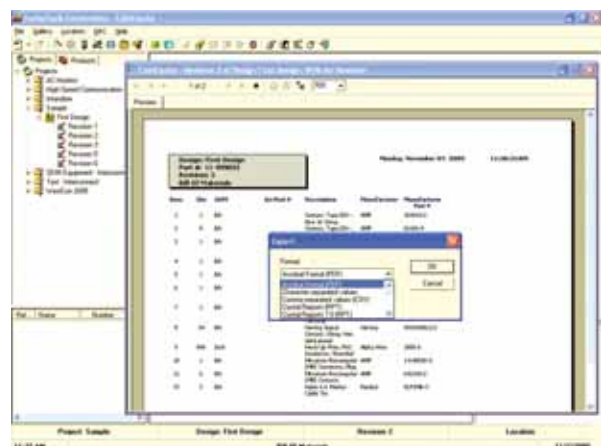
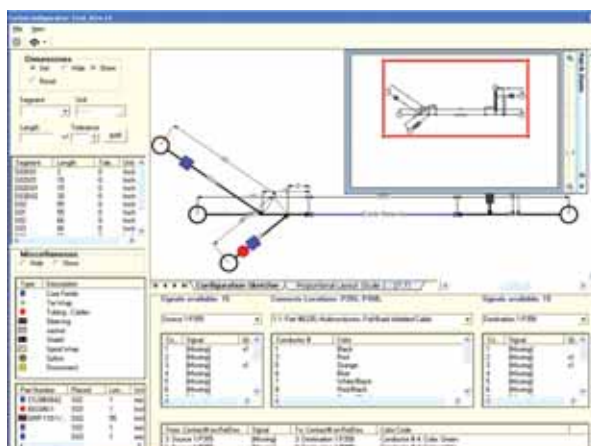
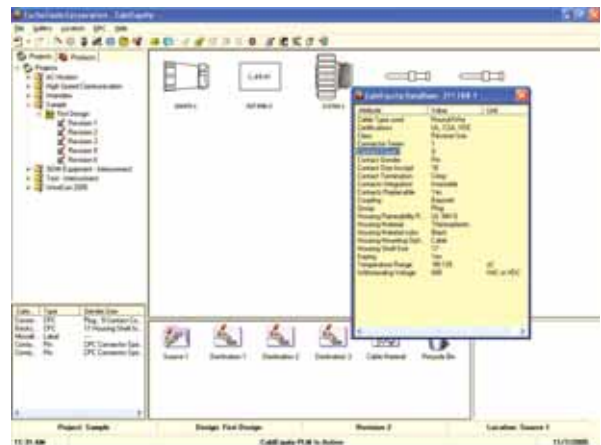
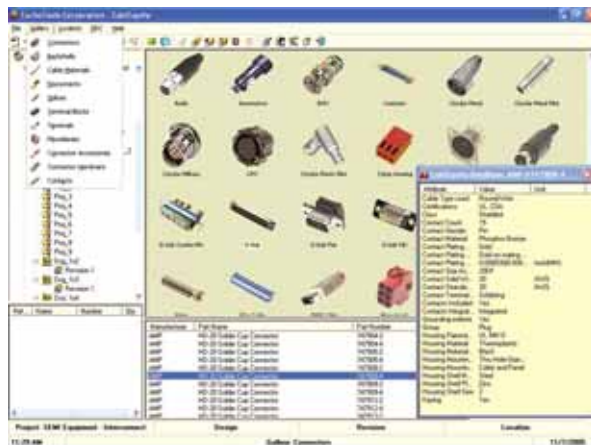
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PRODUCT UPDATE

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Variety of components in embedded relational database (DB) – delivers by searchable and cross-reference engine	up to 200	up to 1,000	over 10,000
Database (DB) Components Utility tool		Limited	Advanced
Custom connectors, cables and other components database			✓
Design Rule Checking (DRC)		✓	✓
Automatic Generation of: BOMs, assembly drawings, schematics	✓	✓	✓
Automated Run List/Wire List and Nail board	✓	✓	✓
Input data from different ECAD schematic capture and/or layout			✓
System Schematic Capture			✓
Copy and Paste of components “design-to-design”		✓	✓
Copy/Clone of revisions, designs, projects “project-to-project”			✓
Import and Export of revisions, designs, projects, products “computer-to-computer”			✓
Drag and Drop Sketcher	✓	✓	✓
Embedded libraries		✓	✓
Multiple output file formats support			✓
Internal Part Numbers (IPN)			✓
Search and Archive		✓	✓
3D MCAD integration			✓
Academic version	✓	✓	✓
License	Node-locked	Node-locked	Node-locked Floating
Price, Application	Free	Call	Call
Price, DB (Price varies based on quantity of components. Required to run CablEquity application)	Call	Call	Call
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CURRENT R&D SOLAR

Optimization methods applied to renewable and sustainable energy: A review

Renewable and Sustainable Energy Reviews, Volume 15, Issue 4, May 2011, Pages 1753-1766

R Baños, F Manzano-Agugliaro, FG Montoya, C Gil, A Alcayde, J Gómez

Energy is a vital input for social and economic development. As a result of the generalization of agricultural, industrial and domestic activities the demand for energy has increased remarkably, especially in emergent countries. This has meant rapid growth in the level of greenhouse gas emissions and increase in fuel prices, which are the main driving forces behind efforts to utilize renewable energy sources more effectively, i.e., energy which comes from natural resources and is also naturally replenished. Despite the obvious advantages of renewable energy, it presents important drawbacks, such as the discontinuity of generation, as most renewable energy resources depend on the climate, which is why their use requires complex design, planning and control optimization methods. Fortunately, the continuous advances in computer hardware and software are allowing researchers to deal with these optimization problems using

computational resources, as can be seen in the large number of optimization methods that have been applied to the renewable and sustainable energy field. This paper presents a review of the current state of the art in computational optimization methods applied to renewable and sustainable energy, offering a clear vision of the latest research advances in this field.

Developing renewable energy supply in Queensland, Australia: A study of the barriers, targets, policies and actions

Renewable Energy, Volume 44, August 2012, Pages 119-127

Nigel J. Martin, John L. Rice

The Australian Government has set an ambitious target that at least 20 per cent of Australia's electricity needs will be met by Renewable Energy (RE) sources by 2020. Given the limited use of RE sources for electricity generation, this national Renewable Energy Target (RET), leaves state, territory, and municipal governments in a challenging policy position. In this article, we examine the Australian state of Queensland where RE provides approximately 4 per cent of the region's electricity supplies. The research utilizes stakeholder theory

to examine the developmental barriers, targets, policies, and actions identified by firms and stakeholder organizations in the RE industry sector. The results from our analysis show that RE developments face a range of socio-technical barriers that require timely actions in the areas of financial incentives, infrastructure enhancement, regulation reform, community-centred developments, technology and workforce investments, and information and education programs. Also, in the context of RE planning, while the national RET is the preferred setting, the differences between Queensland's RE installed generation capacity and electricity supply targets require clarification and agreement.

Renewable energy policy in Turkey with the new legal regulations

Renewable Energy, Volume 39, Issue 1, March 2012, Pages 1-9
Mine Tükenmez, Erhan Demireli

Since the energy crises in the 1970's, public and private decision makers are considering how to achieve a sustainable transition from fossil fuel-based energy to sustainable and clean energies—namely renewable energies. Combined with the improvement of energy efficiency and the rational use of energy, renewable energy can provide everything fossil fuels currently offer in terms of heating and cooling, electricity generation, and transportation. Renewable energy technologies possess many long-term benefits including energy security, job creation, business opportunities, sustainable development and prevention of global warming. Turkey's population is growing at an annual rate of 1.04%. If Turkey uses only traditional energy sources, it simply will not have enough energy capacity for its population. Renewable energy sources have the potential to make a large contribution to Turkey's sustainable and independent energy future.

Turkey aims to utilize its energy potential, including from renewable sources in a cost-effective manner. Turkey targets the share of renewable resources in electricity generation to be at least 30% by 2023 as in its 2009 Electricity Market and Security of Supply Strategy. Positive achievements have been obtained in renewable energy development and manufacturing in Turkey over the past decade. The renewable energy related legislation has been intensified. To meet its 30% target, the current promotion mechanism for renewable sources of electricity relies on feed-in tariffs for different renewable energy sources. Large hydropower is already competitive to conventional fossil-based electricity, so feed-in tariffs in the new RE Law are set to facilitate expanding the deployment of other, less mature renewable energy technologies.

Economic welfare impacts from renewable energy consumption: The China experience

Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 5120-5128
Yiping Fang

Over the last years renewable energy sources have increased their share on electricity generation of China due to environmental and security of supply concerns. In this work author assesses the role of both the amount and share of renewable energy consumption in economic welfare using Cobb–Douglas type production functions. This assessment is carried out by multivariate OLS and SPSS software for China from 1978 to 2008. Results indicate that a 1% increase in renewable energy consumption (REC) increases real GDP by 0.120%, GDP per capita by 0.162%, per capita annual income of rural households by 0.444%, and per capita annual income of urban households by 0.368% respectively; the impact of renewable energy consumption share on economic welfare is insignificant, and an increasing share of REC negatively affects economic welfare growth to a certain extent. In this paper, the cost, structural demand, accounting mechanism and policy reasons of renewable energy development are interpreted. Marginal effects analysis show that the shape of sound and robust renewable energy institutions and policies would matter for increasing the standards of economic welfare in the context of speeding up renewable energy development and increasing share of renewable energy consumption, especially the goal-oriented policy refinement should be addressed efficiently in improvement households income while increasing share of renewable energy consumption.

Overcoming problems in Turkey's renewable energy policy: How can EU contribute? Renewable and Sustainable

Energy Reviews, Volume 16, Issue 7, September 2012, Pages 4917-4926
Selahattin Murat Sirin, Aylin Ege

Fossil fuels cover most of the energy demand in the world, and this creates significant social, economic, and environmental problems. Many countries have taken measures to increase the share of renewable energy sources (RES), especially in electricity generation, and the review of literature shows that the success of a country in RES diffusion depends on a comprehensive renewable energy policy which combines political commitment with stable and long-term support measures that stimulate technological innovation. As the largest economy in the world, EU has also taken steps to increase RES usage in electricity generation in member

states. Similar to other developing countries, Turkey is learning lessons from EU experiences regarding RES policies, and Turkey is also reforming its legal framework in line with *acquis communautaire* as a candidate country. As a result, EU has a multiway impact on Turkey's renewable energy policy. An overview of Turkey's renewable energy policy showed that EU has significantly contributed to Turkey in shaping its renewable energy policy, and Turkey should increase cooperation with EU in order to utilize its renewable energy potential.

Opportunities and challenges for renewable energy policy in China

Renewable and Sustainable Energy Reviews, Volume 13, Issue 2, February 2009, Pages 439-449

Zhang Peidong, Yang Yanli, Shi jin, Zheng Yonghong, Wang Lisheng, Li Xinrong

Renewable energy is the inevitable choice for sustainable economic growth, for the harmonious coexistence of human and environment as well as for the sustainable development. Government support is the key and initial power for developing renewable energy. In this article, an overall review has been conducted on renewable energy development policy (including laws and regulations, economic encouragement, technical research and development, industrialized support and government model projects, etc.) in China. On this basis, a systematic analysis has been conducted on the disadvantages of renewable energy development policy. On the point of long-term effective system for renewable energy development, a series of policy advice has been offered, such as strengthening the policy coordination, enhancing regional policy innovation, echoing with clean development mechanism, implementing process management, constructing market investment and financing system. It is expected that the above advices could be helpful to ever-improvement of renewable energy development policy.

A social marketing mix for renewable energy in Europe based on consumer stated preference surveys

Renewable Energy, Volume 39, Issue 1, March 2012, Pages 30-39

Angeliki N Menegaki

Regardless their high potential, renewable energy resources are insufficiently exploited in Europe. This paper examines the potential of social marketing for renewable energy sources. It uses acceptability and willingness to pay results from existing surveys on renewable energy sources and generates a marketing mix for the state, organizations,

businesses and consumers. These surveys typically claim to produce results that will be useful for policy-making or marketing purposes. However, after they distinguish the parameters that affect acceptability or choice and willingness to pay, they do not go deeper to demonstrate the ways for the exploitation of the results. Therefore, this paper gauges the gap between the results from consumer stated preference studies and the insights generated for social marketing.

Strategies for renewable energy applications in the Organization of Islamic Conference (OIC) countries

Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 4706-4725

Kamaruzzaman Sopian, Baharuddin Ali, Nilofar Asim

Presently, the demand of energy is met by fossil fuels. Combustion of fossil fuels has caused negative impacts to the environment globally. The most significant ones are acid precipitation, stratospheric ozone depletion, and global climate change. To overcome it, sustainable, clean and safe energy policies that would satisfy the energy demand of the 21st century have to be implemented. Renewable energy resources appear to be the one of the most efficient and effective solutions, therefore be key energy sources for the future. There is an intimate connection between renewable energy and sustainable development. Current status of renewable energy applications, its implementation strategies and their obstacles for some of the selected Islamic countries has been presented. Several strategies for enhancing of widespread application of renewable energy technology are described. The strategies include establishing education and capacity building programs, creating renewable energy market and financing mechanism, improving appropriate energy policies and establishing database and international collaboration to promote renewable energy technologies.

Current situation, trends and potential of renewable energy in Flanders

Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 4400-4409

A Tolón-Becerra, XB Lastra-Bravo, T Steenberghen, B Debecker

The current European Union (EU) energy policy seeks to reach a balance between sustainable development, competitiveness and secure supply. In this sense, the EU energy policy sets the target of a 13% share of Renewable Energy Sources (RESs) for Belgium. Several instruments have been implemented to reach this target. The objective of this study is analyzing those instruments and its effectiveness and efficiency. To tackle this objective, we first analyze the

current status of RES in Flanders. Second, we compare the situation in Flanders to the national situation in Belgium and to the other EU member states. Then, we analyze the potential of each type of RES. Finally, we discuss the opportunities and problems of RES related to spatial planning. In Flanders, the main application of renewable energy is electricity production, of which the main source is biomass. An aspect of the Flemish energy policy worth mentioning is the green certificate system, which has stimulated the development of renewable energies. However, a greater effort to regulate this market and to decrease the cost of kWh produced has proven to be necessary. The RES-electricity share of total consumption has increased by 3.2% between 1994 and 2008. But, compared to others EU countries, the share of RES to gross inland consumption in Flanders is small. Large-scale facilities are necessary to reach the EU targets. The development of large wind, biomass and solar projects is suggested as the preferred option for Flanders.

Renewable energy policy in the UK: Problems and opportunities

Renewable Energy, Volume 9, Issues 1–4, September–December 1996, Pages 1308-1311
David Elliott

The privatisation of the UK Electricity Supply industry in 1989/90 was expected to provide an opportunity for novel energy technologies to develop. This paper reviews the experience of renewable energy technologies, following the introduction, as part of the privatization programme, of a cross subsidy system paid for by consumers designed to provide interim market support and stimulation for selected non-fossil fuel based technologies—as part of the so-called Non-Fossil Fuel Obligation.

While the NFFO levy certainly stimulated some renewable energy developments which might not otherwise have been successful, it is argued that the Governments decision in 1994 to cut back on R&D on renewable energy technology will mean that there will be fewer candidate technologies for selection for subsequent rounds of the NFFO. Market pull has clearly been effective at helping some renewable energy technologies to become established commercially, but, it is argued, there is also a need for continued technology push to support the next wave of technologies.

Proposal for territorial distribution of the EU 2020 political renewable energy goal Renewable Energy, Volume 36, Issue 8, August 2011, Pages 2067-2077

A Tolón-Becerra, X Lastra-Bravo, F Bienvenido-Bárcena

This article first analyzes the situation of indicators related to

renewable energies in the reference year (2005), used by the European Union (EU), for its goal of a 20% share of energy from renewable sources in the gross final consumption of energy in 2020. Non-linear distribution of dynamic targets is suggested for increasing the energy from renewable sources in gross final consumption of energy. This methodology is then applied to European Union member countries, the NUTSO territorial aggregation level according to the EUROSTAT Nomenclature of Territorial Units for Statistics (NUTS), in the year 2020. Weighting was done based on share of energy from non-renewable sources in gross final consumption of energy, energy from non-renewable sources per capita, energy from non-renewable sources per GDP, and GDP per capita in the EU-27 scenario. Finally, a multicriteria formula was applied to weigh the variables used in this study.

New directions in renewable energy education

Renewable Energy, Volume 34, Issue 2, February 2009, Pages 435-439
Philip Jennings

The renewable energy industry is growing rapidly amidst rising concerns about oil depletion and climate change. Renewable energy is seen by many as part of the appropriate response to these concerns and some national Governments have put programs in place to support the wider use of sustainable energy systems. This has led to a rapid increase in demand for renewable energy specialists who are able to design, install, and maintain such systems. Most engineers are not trained to use these renewable energy technologies and most are not aware of the principles of sustainability. There is therefore an urgent need to develop and implement new courses that prepare engineers, scientists and energy planners to work with renewables to produce sustainable energy generation systems.

Renewable energy education is a relatively new field and previously it formed a minor part of traditional engineering courses. These days it has an identity of its own, with special techniques, standards, and requirements which are not normally encountered in other disciplines. Attempts to add one or two units of study on renewables into traditional science and engineering degrees are unlikely to produce graduates with sufficient knowledge or understanding to use renewables effectively. Modern renewable energy education includes a study of the technology, resources, systems design, economics, industry structure, and policies in an integrated package. This prepares the graduates to design sound systems from amongst the range of options available. There are more pitfalls in the use of renewables than there are in using the more mature conventional technologies and

systems. Designers, installers, and service personnel need to be particularly aware of the industry and the characteristics of the various firms and their technologies.

Over the past decade several new approaches have emerged to renewable energy education that seek to address the needs of the 21st century for sustainable energy supply systems.

This paper will describe the aims, philosophy, structure, and outcomes of several of these initiatives. It includes courses in renewable energy science, renewable energy engineering, renewable energy policy and planning, and renewable energy technician training. The paper will also describe some aspects of the training of researchers in cooperation with the renewable energy industry.

Comparison of renewable energy policy evolution among the BRICs

Renewable and Sustainable Energy Reviews, Volume 15, Issue 9, December 2011, Pages 4904-4909

Huiming Zhang, Lianshui Li, Jie Cao, Mengnan Zhao, Qing Wu

Renewable energy policy evolution of the BRICs is analyzed and assessed quantitatively based on the Bai and Perron' structure breaks test. Results indicate no break for time series of renewable production in Russia, while series of renewable production and consumption are characterized as segmented trend stationary processes around one or two structural breaks in Brazil, India, and China. Renewable policies in Brazil and China have long-term positive effects on renewable energy production and consumption, improving the two variables' growth rate. The time series structure change of Indian renewable energy production is complicated and the long-term impact of energy policies on renewable production is contradictory at the two breakpoints. Russian renewable policies are not working, reducing renewable energy consumption growth in the long-term. Empirical analysis suggests policy implications that China should mandate the promotion of renewable energy, develop biomass energy on the base of comparative advantage and enhance renewable energy industry chain integration.

Control strategies for single-phase grid integration of small-scale renewable energy sources: A review

Renewable and Sustainable Energy Reviews, Volume 16, Issue 7, September 2012, Pages 4982-4993

Mohammad Monfared, Saeed Golestan

Small-scale renewable energy sources, such as small hydro turbines, roof-mounted photovoltaic, and wind generation systems and commercially available fuel cells are usually

connected to the single-phase distribution grid through a voltage source converter. To regulate the power exchange with the single-phase grid, and at the same time, reduce the harmonic distortions in the ac current, different current control structures have already been proposed, among which the current hysteresis control, the voltage oriented control, and the proportional-resonant based control have found more attentions. This paper provides an overview of the main characteristics of these control strategies. Also, some implementation aspects such as the fictitious signal generation and the single-phase grid synchronization techniques are discussed. Finally, through extensive simulations a comparative study of the presented control strategies is presented. The simulations are supported by experiments.

On the physics of power, energy and economics of renewable electric energy sources – Part I

Renewable Energy, Volume 35, Issue 8, August 2010, Pages 1729-1734

Mats Leijon, Annika Skoglund, Rafael Waters, Alf Rehn, Marcus Lindahl

Environmental concerns have increasingly led to the installation of Renewable Energy Technologies (RETs) despite the fact that they are recognized as expensive. Innovative efforts within the area are beset with difficulties, and they are at risk of producing misdirected or insignificant improvements in terms of the cost effectiveness of total energy conversion systems. This paper investigates how RETs can be evaluated, in terms of economy and engineering solutions, by studying the fundamental physics of renewable energy sources and how it matches with the RETs. This match is described by the "Degree of Utilization". The findings indicate that new innovations should focus on the possible number of full loading hours. RETs that are correctly matched to their energy source generate a higher amount of electric energy and have a higher potential of becoming more competitive. In cases where this aspect has been ignored, leading to relatively small degrees of utilization, it can be understood as an engineering mismatch between installed power, converted energy, and the fundamental physics of the renewable energy sources. Since there is a strong and possibly biased support for so-called mature RETs and already existing solutions, a clarification of how fundamental physical laws affect the cost of investments and payback of investments is needed. The present paper is part I out of II and it focuses on the difference between power and energy and the physics of different energy sources and their utilization.



ENERGY FOR FUTURE PRESIDENTS

THE SCIENCE BEHIND THE HEADLINES



Author: Richard A Muller

Year: 2012

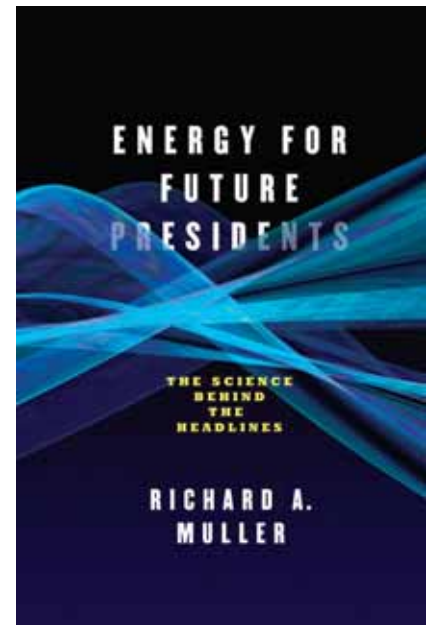
Pages: 368 pp.

Publisher: WW Norton & Company

Richard A Muller is a Professor of Physics at the prestigious University of California Berkeley, and has previously authored the books *Physics for Future Presidents: The Science Behind the Headlines* and *The Instant Physicist*. He first became known to American television-viewing audiences due to an appearance on MSNBC's 'The Rachel Maddow Show,' where he spoke of his conversion from a climate change sceptic to a convinced scientist. An advocate of reason and the objective application of the scientific method, his oeuvre has been largely dedicated to explaining complex ideas in the field of physics to the common man in an engaging, entertaining, and easy-to-grasp manner. In his latest book, the former MacArthur Fellow decided to address the issues of energy and the environment from a scientist's perspective and offers advice to future policy-makers and administrators (one assumes they are the collegians who take his highly popular course intended for non-science students). Using the clever approach of acting as the energy advisor to the future president (a role fulfilled by the reader), Professor Muller addresses the issues of energy catastrophes, the energy landscape, alternative energy, and new technologies in an enlightening and

objective manner by calling to his aid a myriad facts, data, and analyzes that are well-represented through cleverly designed charts.

The book is divided into five sections, each of which is intended to familiarize and sensitize the reader to a particular issue in the realm of energy, and aid to the future president's policy-making. He begins with 'Energy Catastrophes,' a discussion of the recent difficulties caused by two substantial disasters in the energy arena, viz. The earthquake and tsunami-induced damage at the Fukushima Nuclear Power Plant in Japan was, according to Professor Muller, a tragedy and the damage caused to not merely homes and communities, but to human lives as a consequence of the disaster, will take a long time to repair and lay to rest. However, Professor Muller warns against using Fukushima as a clarion to broadcast a message against nuclear power. He joins the ranks of numerous advocates and environmentalists, including Robert Swan among others, who have abandoned their hitherto anti-nuclear stance and accepts that while it is not a perfect technology, recent technological innovations in safety and efficiency have made nuclear power plants preferable to conventional thermal power plants as sources of electricity generation. Also



discussed is the Deep water Horizon oil spill, which Professor Muller—whose effects he states were grossly exaggerated—and compliments efforts made to clean up the mess. Many views in this book might take people on both sides of the energy debate by surprise. Scientific reasoning is not prejudiced by political ideology and is not biased to a conclusion based on popular support or divine intervention; science works from objective analyses of cold, hard evidence and a dispassionate study of facts. And Professor Muller's deep respect and understanding of the scientific method allows his to lift the veil from facts that are otherwise obscured by political manoeuvring around them. Thus, his support of nuclear energy might irk people on the left-liberal side of the debate;

whereas his conviction that climate change is a reality and an essential crisis in the making that requires a united, concentrated effort from people across the globe to solve, will definitely rustle feathers in the more right-wing and conservative parts of the global establishment and among his potential readers.

In the second part of his book, entitled, 'Energy Landscapes', Professor Muller elucidates on the different kinds of energy resources available at our disposal, including shale oil and natural gas, and addresses the issues of recycled energy, energy security, liquid energy security, energy productivity, and fracking. Delving into the topics of whether electric cars are ready as substitutes for petrol and diesel cars, he produces persuasive and often unconventional arguments borne from in-depth research and some very intense number crunching. Luckily for the reader however, these

statistics are expressed in a manner that does not require a college degree to comprehend. In the section entitled, 'Alternative Energy', Professor Muller enamours to elucidate the essentials of new and renewable energy resources, the current state of technological advancement they are at, and the potential they contain to power our future. He understands the importance of an all-of-the-above energy mix as a means to be able to achieve energy security, and advocates a policy of mixed energy sources as a means to eliminate dependence on fossil fuel based power supply. In the final section of the book, he proceeds to advise the future president on the decisions that it would necessary for him or her to take in order to secure the United States' Energy Independence. Professor Muller believes that fracking in order to get to the large and extensive deposits of natural gas prevalent in the United States is an effective solution to the

issue of energy security, provided there are strong regulatory mechanisms in place to ensure that clean drinking water and seismic stability are not affected.

Energy for Future Presidents: The Science Behind the Headlines is a noble effort on behalf of the author, who is clearly an expert and has the credentials and data to back up his substantial claims. Though targeted at a largely American audience, the issues it addresses are global in their scope, and is a required reading for people planning to get into the field of energy policy or even policy-making in general. It is essential for the public administrators of the future to be well-versed with, if not the science, but at least the major issues in the energy sphere currently in the world. It is highly recommended as a guide to the major matters of concern and dispute in the energy arena. ■

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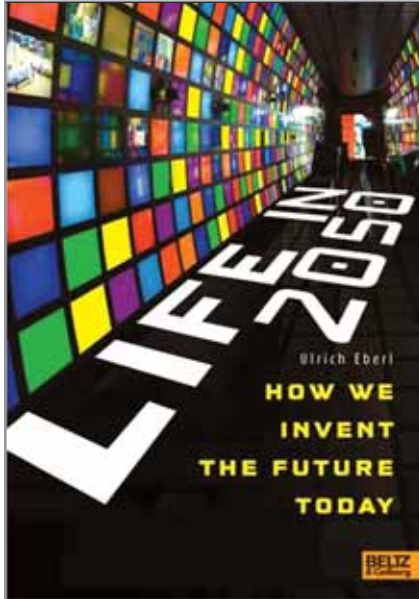
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NEW BOOK INFORMATION



Dr Ulrich Eberl
Beltz & Gelberg • 2011 • 240pp

Life in 2050

Available in English and German, *Life in 2050* is a stark and exciting look at the directions the world seems to be heading in. Noted German scientist, writer, and self-described 'Futurist', Dr Ulrich Eberl, paints the picture of a world in 2050 that is strange and alien to us in 2012, and yet one that is disquietingly familiar. Describing a future of households with robotic servants and computerized medical services that all but eliminate the need for human doctors sounds quite similar to predictions of the year 2000 by people in the 1950s, except that Dr Eberl's predictions can possibly be matched by the march of modern technology. In the economic sphere, he depicts China as a global economic superpower (possibly even a military one); with economic resurgence in India, Russia, and Brazil ensuring that wealth is redistributed with greater equality. On the energy front, he describes solar photovoltaics as the chief source of power in the world of 2050, with areas such as the Sahara Desert and the Mojave Desert in California as the major energy centres of the world. Predicting future technological trends is notoriously difficult; in 1950, it was a given that by 2012 we would see casual space travel, flying cars, and hover-boards. Despite rigorous researching and guarded optimism, Dr Ulrich Eberl's *Life in 2050* makes a few predictions that one can assume will look silly in the cruel light of hindsight, but in 2012, make for a fascinating read.

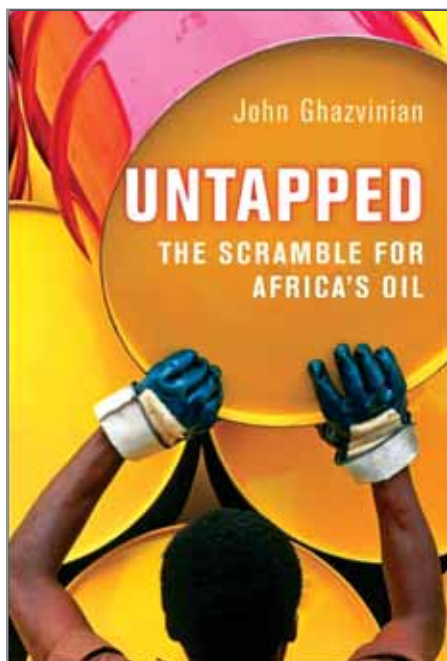
Ten Technologies to Fix Energy and Climate

Chris Goodall, with degrees from Cambridge University and the Harvard Business School, is an unlikely candidate to be a best-selling writer of books on energy and climate change. Yet in 2007 his debut non-fiction book, *How to Live a Low-Carbon Life*, won the Clarion Award for non-fiction. In his second offering, Goodall tackles issues of energy security and climate change from the perspective of technologies that have the potential to solve the issues that the world is facing today. Divided into ten chapters, each of which deals with a particular type of technology; Goodall discusses the nature of each technology, their advantages and disadvantages, and their scientific and economic viability. He identifies energy efficiency, and transmission and distribution losses as two significant drawbacks—particularly for wind and solar power, both of which he believes have the potential to single-handedly provide all of the planet's energy needs. Goodall identifies technologies such as tidal energy as evidence of the "enormous untapped potential of the oceans", though he admits that are currently a few improvements underway in R&D projects. *Ten Technologies to Fix Energy and Climate* intends to inform and educate the reader about the latest developments in diverse and varied areas of clean technology and renewable energy, so while approach might appear too simplistic to someone more well-versed with the nuances of the energy sector, it is a noble attempt that makes for essential reading nevertheless.



Chris Goodall
Profile Books • 2008 • 292pp

NEW BOOK INFORMATION



John Ghazvinian
Houghton Mifflin Harcourt • 336 pp • 2007

Untapped: The Scramble for Africa's Oil

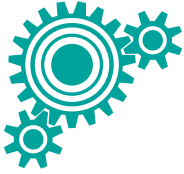
John Ghazvinian is an Oxford-educated American journalist and historian who normally writes for such upmarket and respected publications, such as *The Boston Globe*, *GQ*, and *Newsweek*. Here, however, he travels through twelve African nations that are in the middle of the African oil boom and explores the consequences of a second colonization of Africa. Knowledge of Africa's oil wealth is not new, people have known about the billions of untapped barrels buried underneath the cradle of humanity. The reason Africa was never really tapped for its potential oil was that it was an economic and social gamble, the process of extracting it was too expensive, and the risks posed by political instability and the difficult terrain on the ground compounded the process of extraction. With the prices of crude oil from the Middle East skyrocketing, and improvements in technology that allow for more efficient and extensive extraction of oil from difficult places—added with the fact that African oil requires less refining than Arab oil—developing nations such as India and China, and global superpowers such as the United States, are looking to Africa as a solution to their energy security issues. The book explores the power play and cartels at play, and how the emergence of Africa as a centre of crude oil production and export could help alleviate the continent from the rampant poverty it currently experiences, or negatively, intensify existing inequalities.

Greenhouse Solutions with Sustainable Energy

Written by Australian academic and former CSIRO research scientist Dr Mark Diesendorf, *Greenhouse Solutions with Sustainable Energy*, is an attempt at tackling the issues of implementation in the renewable energy arena. In his professional experience Dr Diesendorf has worked with numerous governmental, private, and bilateral organizations in the areas of sustainability, energy, and economics. In this book, he outlines what he believes are the best methods in which to implement a variety of clean technologies. The book is primarily aimed at Australia—ranked 17th in gross greenhouse gas emissions with 572.1 megatons of CO₂ equivalent, but 5th in per capita greenhouse gas emissions—but the policy decisions and strategies mentioned in it are applicable in most large or industrial nations. Divided into three sections, the book begins with an introduction to the basic concepts and ideas of sustainable energy and provides scientific evidence for climate change before moving on to the second that part, which looks at various energy technologies currently available. The third part of the book discusses various policy measures and strategies that could aid the development of energy efficient and clean technology. Diesendorf does not use elaborate descriptions or narrative techniques to explain his ideas a technique that can sometimes backfire and leave the reader more confused and misinformed than before. This book has a no-nonsense approach to science and energy, and is clearly aimed at making a point rather than being just informative.



Mark Diesendorf
University of New South Wales Press
• 2007 • 432 pp



RENEWABLE ENERGY TECHNOLOGY DEVELOPMENT



Gardens that grow gigawatts

A solar garden, also called community-shared solar, is a photovoltaic array that takes from the ideas of community vegetable plots, crowd source funding and energy aggregations. The garden is built near or within a community, where it is visible to its members. Local households and businesses come together to fund the projects through subscriptions, ownership of shares, or some other form of investment, sometimes using utility on-bill financing. Models vary, but the harvest usually comes in the form of electric bill credits, guaranteed utility rates, or some other type of financial compensation for the gardeners.

Beyond the symbolism, the solar garden offers a sophisticated financial model that can leverage virtual net metering, bulk purchasing, solar power purchase agreements (PPAs), and tax equity credits to reduce solar costs and ensure all parties benefit from the deal. Moreover, solar gardens offer a way to attract investment from property owners who are otherwise disenfranchised from the solar boom.

Often solar gardens are built on public land, depleted agricultural plots, airports, school rooftops and other inexpensive pieces of property that are highly visible to the community. But it's not just neighbourhoods that can benefit; the concept also can serve retail operations with multiple stores, as well as municipalities that pay electricity bills for schools, fire houses, water treatment plants, and other facilities.

The results say its backers, could soon be gigawatts of new photovoltaic installations. So far individual solar gardens have tended to be in the 1 MW range, but that appears to be changing, as existing gardens expand and new ones are proposed.

Solar gardens overcome one of the biggest obstructions to mass PV installation. While 90% of the US population says it wants to take advantage of solar energy, only 25% actually can, according to Masterjohn. The remaining 75%

are precluded because of various obstacles: trees share their roofs, they don't own the building, or they lack the capital or financing.

Using a community-shared model, households and businesses can participate in solar, and do so by taking advantage of the economies of scale offered through bulk purchase and aggregation. This reduces the already falling cost of PV installation.

Many solar garden programmes bring savings to customers through virtual or aggregate net metering, a concept modelled after conventional net metering, but able to spread the financial benefit of distributed generation beyond the building that hosts the solar panels. Virtual net metering provides bill credits for buildings not actually connected to the solar panels.

<http://www.renewableenergyworld.com/rea/news/article/2012/10/gardens-that-grow-gigawatts>

Geothermal heat pumps are renewable and our most efficient HVAC technology

The question arises from time to time in building industry blogs about whether or not geothermal heat pumps (GHPs) are a source or renewable energy. GHPs, or ground-source heat pumps, don't fit neatly into any box, but suffice it to say that their appeal is for their efficiency and the abundant renewable energy that they provide.

GHPs use the ground as a moderate temperature heat source during the winter and a heat sink during the summer. They draw renewable (yes, renewable) thermal energy from the ground during the winter to heat buildings, and reject heat from buildings back into the ground in summer, thus replenishing the heat drawn from the ground during the previous season.

As for efficiency, it's a lot easier to reject heat from the building to the ground (~55°F) compared to outside air that can be in excess of 100 deg. F on a hot summer day. And in winter, it's easier to recover heat from the ground

(~55°F) compared to outside air that can be <40°F. Consider the ground as a readily available renewable storage battery for heat that thin air (in the case of standard air-to-air heat pumps) simply cannot provide.

GHPs do have higher installation costs than traditional air-to-air heat pumps, because of the cost of excavation for a horizontal system or drilling vertical boreholes (not “wells”) for closed loop systems for the pipework of the ground heat exchanger. They also require expert, qualified design and installation of the ground loop to achieve their full energy efficiency and savings potential.

But that ground loop is guaranteed to last over 50 years, posting a small fraction of life cycle cost. Indeed, in many cases it is projected that the ground heat exchanger will outlive the building it serves.

Woodruff provides an excellent analysis of GHP efficiencies, citing an example of a 5-ton air-to-air heat pump, “which would move 5 x 12,000 BTU/hour, which equals 60,000 BTUs per hour. If the air-air Seasonal Energy Efficiency Ratio (SEER) is 10, that means we use ~6 kW every hour we run the air-air heat pump. In contrast, a GHP would have a SEER of 20 during the summer, which means you would only need 3 kW. Thus, the GHP reduces demand by ~3 kW, reducing emissions and helping the utility shave peak demand during the summer.”

Most people think of renewable energy as easy-to-measure electricity (kilowatts) for the grid. But GHPs produce renewable energy measured in BTUs that are consumed without the transmission grid.

GHPs can provide both renewable energy and dramatically raise the efficiency of our power grid while reducing energy consumption in buildings of all kinds in most locations around the country.

<http://www.renewableenergyworld.com/rea/news/article/2012/10/geothermal-heat-pumps-are-renewable-and-our-most-efficient-hvac-technology>

High-tech tools tackle wind farm performance

The wind, though it can seem consistent, often has varying degrees of turbulence that impact wind turbine performance. Heating and cooling change the wind over the course of the day. A wind farm's turbines interact in ways that reduce performance and add to structural loads on the turbines, increasing maintenance costs and the overall cost of wind energy.

Researchers at the US Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) are learning how to better understand these issues and are working towards effective solutions for the wind industry. Their goal is to maximize turbine performance and minimize structural

loads, which will ultimately result in lower-cost wind energy. Toward that goal, NREL researchers are leveraging the lab's supercomputing resources and have developed high-tech modeling and simulation capabilities.

The market for wind energy continues to grow — and so do the wind turbines and farms themselves. Unfortunately, the power production of these energy plants has, in many cases, been lower than initially predicted. Wind plant underperformance has become a concern throughout the wind industry and could potentially cost developers millions of dollars over the life of a wind plant because of reduced power generation and increased maintenance costs.

Models Enhance Understanding of Performance Issues

Wake turbulence is a type of instability in the wind flow and is the result of wind flowing through the rotor of a wind turbine. Its effects and how they impact the wind turbine and plant performance have not been well understood. To better understand these issues and move towards effective solutions, NREL researchers have developed sophisticated simulation tools to perform large-eddy simulation models that are designed to predict the performance of large wind plants with greater accuracy than any previous models.

Wind plant developers have used design tools going back to the 1980s, which are generally effective for basic optimization of the layout of a wind farm. However, none have been able to simulate with consistent accuracy how wakes propagate and how wind turbines interact with one another.

Good models need good data. Data from operating wind farms provide validation for the models. So the project has been collecting data from offshore and onshore wind farms in both Europe and the United States to compare the simulations.

Big computers facilitating big ideas

The backbone of this new modeling capability is the high-performance computing resources that run the simulations. Researchers are currently using RedMesa, NREL's most powerful high-performance computing system, located at DOE's Sandia National Laboratories and managed in collaboration with Sandia. Peak computational capability of RedMesa is about 180 teraflops, which means it can process 180 trillion floating point operations (flops) per second. For comparison, a basic calculator requires only 10 flops.

Building a Better Wind Farm

One anticipated outcome of this enhanced simulation and modeling capability is improved understanding by wind plant developers of how to lay out their projects to achieve

maximum performance from individual turbines. Issues to consider include placement of turbines in a wind farm, spacing between turbines, and how terrain and other location-specific conditions might impact turbine performance. Improved tools for wind plant design will enable improved physical understanding of turbine interactions and ultimately lead to plant designs with higher energy production and lower maintenance costs.

A wind turbine getting beat up by wakes may have higher maintenance costs. This increases costs for the wind plant operator as well as the cost of wind energy in general.

The Wind Farm as a System, Not the Sum of its Parts

Another benefit to using these tools is in the area of 'wind farm controls.' This concept — a hot topic of discussion in the industry today — involves looking at a wind farm as a total system rather than just a collection of wind turbines. It explores how to best operate that system in a manner that leads to maximum efficiency for the wind farm as a whole.

Studies have shown that if the front row of wind turbines extracts less energy from the wind in an array than the turbines would by themselves, more potential energy would be available for all turbines downstream. In this scenario, the total energy capture of the entire wind plant would be increased. Another consideration is the slight turning of upstream turbines to steer wakes away from downstream turbines, maximizing the efficiency of the other turbines around them.

The concept is to view wind farms from a global controls perspective and to seek ways to operate the wind farm as a total system. These types of controls and improvements hold great potential for making wind farms more efficient and more productive. Modelling capabilities can be used to study how to operate a wind farm to optimize the energy capture of the entire plant instead of just looking at individual turbines. This capability could be applied to both onshore and offshore wind plants already in operation, as well as new developments.

<http://www.renewableenergyworld.com/rea/news/article/2012/10/high-tech-tools-tackle-wind-farm-performance>

New processes for cost-efficient solar cell production

The photovoltaic industry is pinning its hopes particularly on high-efficiency solar cells that can achieve efficiencies of up to 23 per cent. These 'HIT' cells (Heterojunction with Intrinsic Thin layer) consist of a crystalline silicon absorber with additional thin layers of silicon. Until now, manufacturers used the plasma-CVD process (short for Chemical Vapor Deposition) to apply these layers to the substrate: the

reaction chamber is filled with silane (the molecules of this gas are composed of one silicon and four hydrogen atoms) and with the crystalline silicon substrate. Plasma activates the gas, thus breaking apart the silicon-hydrogen bonds. The now free silicon atoms and the silicon-hydrogen residues settle on the surface of the substrate. But there's a problem: the plasma only activates 10 to 15 percent of the expensive silane gas; the remaining 85 to 90 percent are lost, unused. This involves enormous costs.

The researchers have now replaced this process: Instead of using plasma, they activate the gas by hot wires. "This way, we can use almost all of the silane gas, so we actually recover 85 to 90 percent of the costly gas. This reduces the overall manufacturing costs of the layers by over 50 percent. The price of the wire that we need for this process is negligible when compared to the price of the silane," explains Dr. Lothar Schäfer, department head at IST (Fraunhofer Institute for Surface Engineering and Thin). This is possible since the silicon film grows up at the surface about five times faster than with plasma CVD -- and still with the same quality of layer. At this point, the researchers are coating a surface measuring 50 by 60 cm²; however, the process can be easily scaled up to the more common industry format of 1.4 m². Another advantage: The system technology is much easier than with plasma CVD, therefore the system is substantially cheaper. Thus, for example, the generator that produces the electric current to heat the wires only costs around one-tenth that of its counterpart in the plasma CVD process.

In addition, this process is also suitable for thin film solar cells. With a degree of efficiency of slightly more than ten per cent, these have previously shown only a moderate pay-off. However, by tripling the solar cells (i.e., by putting three cells on top of each other) the degree of efficiency spikes up considerably. But there is another problem: Because each of the three cells is tied to considerable material losses using the plasma CVD coatings, the triple photovoltaic cells are expensive. So the researchers see another potential use for their process: the new coating process would make the cells much more cost-effective. Triple cells could even succeed over the long term if the rather scarce but highly efficient germanium is used. However, germanium is also very expensive: in order for it to be a profitable choice, one must be able to apply the layers while losing as little of the germanium as possible—by using the hot-wire CVD process, for instance.

[http:// www. sciencedaily. com/ release/2012/09/120919082933. htm](http://www.sciencedaily.com/release/2012/09/120919082933.htm)



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NATIONAL AND INTERNATIONAL EVENTS

Global Clean Energy Forum

2nd to 3rd October 2012

Barcelona, Spain

Website: <http://www.ihtcleanenergy.com>**SGVU-C3W 2012**

10th to 12th October 2012

Jaipur, Rajasthan, India

Website: <http://www.c3w.in>**The Carbon Show**

23rd to 23rd October 2012

London, United Kingdom

Website: <http://www.thecarbonshow.com>**The Solar Future Italy '12**

11th October 2012

Milan, Italy

Website: <http://www.thesolarfuture.it/>**Infocast's Military & Commercial Microgrids Summit**

7th to 9th November 2012

Del Mar, California, United States of America

Website: <http://utm.to/3ub>**Sustainable Business Leadership Forum**

11th October 2012

New Delhi, India

Website: <http://sblf.sustainabilityoutlook.in/annual-summit-2012/program-agenda>**National Seminar on Sustainable Energy Development-Opportunities and Challenges**

13th to 14th December 2012

Palayamkottai, Tamil Nadu, India

Website: <http://www.sxcbotany.com>**3rd Annual Electric Energy Storage**

8th to 10th January 2013

Phoenix, AZ, United States of America

Website: http://www.marcusevansch.com/EnergyStorage_Event**The 2nd International Conference on Green Buildings Technologies and Materials (GBTM 2012)**

27th to 28th December 2012

Wuhan, Hubei, China

Website: <http://www.gbtm2012.org/webSiteindex.asp>**Global Clean Energy Forum**

2nd to 3rd October 2012

Barcelona, Spain

Website: <http://www.ihtcleanenergy.com>**Power Generation and the Environment: Choices & Economic Trade-Offs**

1st to 2nd October 2012

Jackson Hole, Wyoming, United States of America

Website: <http://www.uwyo.edu/ser/conferences/power-generation-conference/index.html>**Clean Air Through Energy Efficiency (CATEE) Conference**

9th to 11th October 2012

Galveston, Texas, United States of America

Website: <http://catee.tamu.edu>**Infocast's 5th Annual Utility Scale Solar Summit**

9th to 12th October 2012

Del Mar, CA, United States of America

Website: <http://utm.to/34r>**The Solar Future Italy '12**

11th to 11th October 2012

Milan, Italy

Website: <http://www.thesolarfuture.it/>**Climate Change: Security, Resilience and Diplomacy**

15th to 16th October 2012

London, United Kingdom

Website: <http://www.chathamhouse.org/climatechange2012?campaign=confalerts>**4th International Renewable Energy and Energy Efficiency Forum**

16th to 17th October 2012

Kyiv, Ukraine

Website: <http://www.ref-ua.com>**2012 2nd International Conference on Petroleum and Sustainable Development (ICPSD 2012)**

27th to 28th October 2012

Hong Kong, China

Website: <http://www.icpsd.org/>**2012 International Conference on Power and Energy Systems (ICPEs 2012)**

17th to 18th November 2012

Pune, India

Website: <http://www.icpes.org/>**Future World of Biogas: Europe 2012**

21st to 22nd November 2012

London, United Kingdom

Website: <http://www.wplgroup.com/aci/conferences/eu-ebg2.asp>**3rd Annual Electric Energy Storage**

8th to 10th January 2013

Phoenix, AZ, United States of America

Website: http://www.marcusevansch.com/EnergyStorage_Event

RENEWABLE ENERGY AT A GLANCE

New and Renewable Energy Cumulative deployment of various Renewable Energy Systems/ Devices in the country as on 31/08/2012				
Renewable Energy Programme/ Systems	Target for 2012-13	Deployment during August, 2012	Total Deployment in 2012-13	Cumulative achievement up to 31-08-2012
I. POWER FROM RENEWABLES:				
A. GRID-INTERACTIVE POWER (CAPACITIES IN MW)				
Wind Power	2500	92.10	614.50	17967.15
Small Hydro Power	350	12.56	38.76	3434.07
Biomass Power	105	17.50	59.50	1209.60
Bagasse Cogeneration	350	30.00	124.50	2109.73
Waste to Power -Urban -Industrial	20	-	4.00	93.68
Solar Power (SPV)	800	3.50	102.88	1044.16
Total	4125.00	155.66	944.14	25858.39
B. OFF-GRID/ CAPTIVE POWER (CAPACITIES IN MWEQ)				
Waste to Energy -Urban -Industrial	20.00		4.59.	106.34
Biomass(non-bagasse) Cogeneration	60.00	2.25	15.90	398.40
Biomass Gasifiers -Rural -Industrial	1.50 10.00	- 0.86	0.128 3.56	16.248 137.65
Aero-Generators/ Hybrid systems	0.50	-	0.10	1.74
SPV Systems (>1kW)	30.00	-	11.40	96.61
Water mills/micro hydel	2.00(500 Nos.)	(33 nos)	(68 nos)	2121 Nos.
Total	126.00	3.11	35.68	756.99
II. REMOTE VILLAGE ELECTRIFICATION				
No. of Remote Village/ Hamlets provided with RE Systems	-	-	-	-
III. OTHER RENEWABLE ENERGY SYSTEMS				
Family Biogas Plants (No. in lakhs)	1.25	-	-	45.45
Solar Water Heating - Coll. Areas (Million m2)	0.60	0.10	0.37	5.83
MW- Megawatt, KW- Kilowatt, MWp- Megawatt peak, m2- square metre, km2- kilometre square				

Source: www.mnre.gov.in