April–June 2013

ENERGY FUTURE

The Complete Energy Magazine

Volume 1 • Issue 3 • Annual-₹800

AN OVERVIEW OF BIOENERGY

WHERE DO WE GO FROM HERE?

The IT Crowd: How Silicon Valley is Looking to RE for its Energy Needs

The Trans-Caspian Gas Pipeline: The Energy Gordian Knot

VIEWPOINT

Darrel Webber
Secretary-General,RSPO

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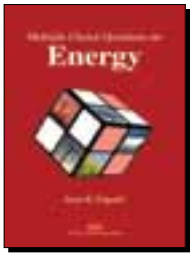
BOOKS ON ENERGY

TERI Energy Data Directory & Yearbook (TEDDY) 2011/12
(with a complimentary CD)

A TERI Publication

TERI Energy Data Directory Yearbook, or TEDDY, is an annual publication brought out by TERI since 1986. TEDDY is often used as a reference in other peer-reviewed books and journals for energy and environment-related data. It gives an annual overview of the developments in the energy supplying and consuming sectors as well as the environment sector. It also provides a review of the government policies that have implications for these sectors of the Indian economy.

2012 • 500 pages • Hardback • 220mm x 280mm • 9788179933787 • ₹1995.00



Multiple Choice Questions on Energy

Arun K Tripathi

Multiple Choice Questions on Energy contains about 1300 multiple choice questions covering various sectors of energy, including mechanical energy, electrical energy, chemical energy, nuclear energy, thermal energy, magnetic energy, sound energy, energy from coal, petroleum oil and natural gas, renewable energy, and energy conservation. An introduction to energy has been presented in a comprehensive yet simplified form. This book is useful for academicians, students pursuing engineering or agriculture-related courses, aspirants of various competitive exams, professionals, and stakeholders in the energy sector. It can also be a tool for various quiz programmes organized in schools, universities, and engineering institutions.

2011 • 354 pages • Hardback • 150mm x 240mm • 9788179933053 • ₹295.00

Handbook on Energy Audit and Environment Management

Y P Abbi and Shashank Jain

This book deals at length the energy audits and takes a closer look at the concept of environment management. TERI endeavour to bring its experience of over two decades in the field of energy audits provide methodology and guidelines to those involved in this field. Energy audits may be considered as the first step towards understanding how energy is being used in a given facility. It indicates the ways in which different forms of energy are being used and quantifies energy use according to discrete functions. The Handbook on Energy Audit and Environment Management offers an overview on industrial energy conservation.

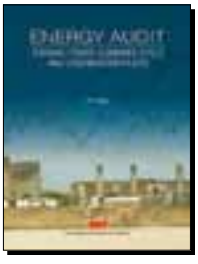
Reprint 2012 • 302 pages • Hardback • 180mm x 240mm • 9788179930920 • ₹1500.00

Energy Security and Economic Development in India: a holistic approach

Bala Bhaskar

This book attempts to construct an appropriate definition for the concept of energy security. The evolution of energy security is traced at both the global level and in the Indian context. This book elaborates on the concept of energy security, highlights its linkages, enumerates India's indigenous energy resources, examines the status of energy security in the country, and makes policy suggestions to ensure energy security in the country.

2012 • 376pages • Hardback • 160mm x 230mm • 9788179934609 • ₹795.00



Energy Audit of Thermal Power, Combined Cycle, and Cogeneration Plants

Yash Pal Abbi

Energy Audit of Thermal Power, Combined Cycle, and Cogeneration Plants attempts to refresh the fundamentals of the science and engineering of thermal power plants and establishes its link with the real power plant performance data through case studies, further developing techno-economics of the energy efficiency improvement measures. It is hoped that the book will rekindle interest in energy audits and analysis of data for designing implementation measures on a continuous basis.

2012 • 260 pages • Hardback • 210mm x 297mm • 9788179933114 • ₹1500.00

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From the editor's desk...

If one looks at the contents of the current issue of Energy Future, a wide spectrum of energy supply options along with associated challenges are evident. These are also indicative of increasing complexities as we delve into the questions of providing universal energy access and meeting growing energy needs.

As we all know, majority of populace in the developing countries, including India, is dependent of traditional biomass for its energy substance. There are issues concerning the competing usages of the very same biomass/agricultural residues, land availability, and food-versus-fuel aspects. Therefore, when we talk of bioenergy as a promising option, it becomes necessary to take the bigger picture in to account and look at the complete value chain of biomass. This in turns implies a range of local and decentralized bioenergy solutions as opposed to `one solution fits all' approach. It is interesting to note the vigour with which the oil and gas rich counties in the Middle East are chalking out their ambitious programmes on renewable energy. While one reason for this shift is the fact that the governments are putting climate changes issues on the top of the list of priorities in the process of economic and social development; the other reason could be attributed to the fact that to feed the growing economies, these countries would like to resort to even more exports of oil and gas.

Certainly an exciting energy future!

Amit Kumar

Amit Kumar
Director, TERI

Editor: Amit Kumar Radheyshayam Nigam
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As an avid reader of The Solar Quarterly, I found the announcement of the impending metamorphosis to Energy Future slightly disconcerting at first. However, three issues in, I am extremely relieved to note that the new magazine is far superior to its predecessor on almost every conceivable count. Your first quarter issue with its focus on Africa was spot on. I too believe that Africa's extensive base of untapped natural resources in terms of conventional energy resources as well as in renewable energy resources in the form of solar, wind, geothermal, biomass, and hydroelectric make it an extremely attractive proposition for the prudent energy investor. I am firm in the belief that Africa is the future of energy, be it from the limitless solar potential of the northern half of the continent – home of the vast dunes and bright sunshine of the Sahara – to the geothermal energy potential in the rift valley, the cradle of humanity. South Africa would be prudent to look the opportunities accorded by offshore wind near the Cape of Good Hope. All in all, I think that by looking at the energy opportunities prevalent in Africa, Energy Future has shown itself to be ahead of the curve.

Lijo John
Kottayam

I was very impressed by the January-March 2013 issue of Energy Future magazine. I found the story on the European Supergrid to be particularly fascinating, the idea that diverse and varied resources can be shared across the continent to create a bottom-up surge of energy is the anti-thesis of what western development ideology has always been. I believe that if we nations in the sub-continent can put aside our political, social, and religious differences and approach the problem in a manner similar to the Europeans, we can do incredible things. The Europeans have been fighting each other for over a thousand years, yet in the interest of peace and prosperity, they put aside those differences and have begun to work together to build a better society. Of course, the experiment has not been perfect but the effort is certainly very admirable. In addition, the Supergrid is another example of where the Europeans are working on a level different from our own. It is about time we South Asians start working together and with each other rather than against each other. I am sure that if we work together, we will be more than a match for the wealth and splendour that is Europe.

Mridul Dang
New Delhi

I have been a regular reader of Energy Future from when it was 'The Solar Quarterly'. The previous issue on Africa was good as always, but I was especially impressed with the insightful and analytical presentation of the story on Japan. The Fukushima disaster has certainly put Japan on the road to harvesting clean energy and the developments taking place are absolutely fascinating! I look forward to seeing a lot more of your magazine and would love to see Energy Future change from a quarterly to a monthly in the near future. Renewable energy is a dynamic field and I believe that by publishing more frequently, you would make your readers very happy.

Poorvi Dahra
Chandigarh

Thank you very much for your encouragement. The editorial team of Energy Future will ensure that the magazine caters to your information and knowledge needs. We welcome your suggestions and comments to further improve our content and presentation.

Email: teripress@teri.res.in

Editor
Energy Future

CONTENTS

TATA POWER'S MUNDRA UMPP BECOMES FULLY OPERATIONAL

Tata Power's 4,000 MW Ultra Mega Power Project (UMPP) at Mundra has become fully operational with the synchronization of the fifth unit of 800 MW. The company had commercialized the first unit of Mundra UMPP in March 2012. 'With the synchronization of the fifth unit, the thermal power generation capacity of Tata Power stands at 7647 MW and the generation through clean sources such as hydro, wind, and solar stands at 852 MW', a release from the company stated. 'The synchronization of Unit #5 of Mundra UMPP marks a milestone in India's history as the first Ultra Mega Power Project setting execution excellence benchmark for Indian power sector', Anil Sardana, Managing Director, Tata Power was quoted in the release. 'Tata Power commissioned a total of 3,200 MW at a single location in a year. This is a new record. The average gap taken between synchronization of two units has been 3.5 months, which is better than the baseline schedule of 4 months', the release added.

Source: www.indianexpress.com

€ 150 MILLION LOAN TO MITIGATE CLIMATE CHANGE IN INDIA

The European Investment Bank (EIB) and Exim Bank signed a €150 million loan for financing investments that will contribute to the mitigation of climate change. The EIB loan will make long-term financing available for investments that contribute to climate change mitigation through projects in renewable energy and energy efficiency in India implemented by public and private sector companies. The operation will contribute to the EU–India Strategic Partnership and cooperation with India, which foresees, inter alia, energy sustainability, and combating climate change. The framework loan comprises a series of investments dedicated to renewable energy projects for the production of electricity and heat (small hydro, wind, solar, geothermal, sustainable biomass), energy-efficiency projects (cogeneration, district heating, industrial modernization), and other climate change mitigation projects. EXIM will on-lend the loan to small, medium-scale, and some large projects to private and public companies. Lending operations outside the EU are part of the EU's cooperation policy with third countries. The EIB has been providing loans in Asia and Latin America since 1993 under three successive mandates. Under the current mandate 2007–13, it can lend up to €3.8 billion. In 2011, the EU established a dedicated €2 billion Climate Change Mandate, for the period 2011–13, for the Bank to support climate change mitigation and adaptation projects across the regions. Furthermore, in order to supplement its traditional external lending mandates, the EIB established in 2007 a €4.5 billion financing facility to support investments in renewable energy and energy efficiency, as well as climate change mitigation and adaptation projects in other sectors in emerging countries. There are no amounts allocated per country in any of the above mandates and facilities.

Source:www.cospp.com

₹16.25 CR FOR SOLAR CITY PROJECT: CHANDIGARH

A sum of ₹16.25 crore has been allocated to union territory administration for implementation of the Model Solar City Programme. The Ministry for New and Renewable Energy (MNRE) has already chosen Chandigarh as one of the cities to be developed into a solar city. Six rooftop solar photovoltaic power plants have been set up with power generation capacity of 975 KW. However, The Energy and Resources Institute (TERI) had chalked out a broad outline in 2009; work on ground could not begin as the proposal was pending with the MNRE for allocation of funds. According to the plan, a 25 MW solar photovoltaic (PV) plant would also be set up. As of now, the union territory has no electricity generation of its own. In its pre-feasibility report, TERI has identified 24 of the total 900 small and big parks being maintained by the municipal corporation, which could be looked as potential locations for tapping solar power.

Source: www.timesofindia.indiatimes.com

INDIAN ENERGY FIRMS CONCERNED ABOUT VENEZUELAN INVESTMENTS

State-owned ONGC Videsh Ltd (OVL), Indian Oil Corporation Ltd (IOCL), and Oil India Ltd (OIL) are concerned about their investments in oil-rich Venezuela in the aftermath of President Hugo Chavez's death. These companies, which have invested billions of dollars in the South American country, have little option but to wait and watch whether the post-Chavez regime continues its hydrocarbon policy. 'We have asked our people to carefully watch the situation and advise us', said TK Ananth Kumar, Director, Finance, at OIL. Vice-President Nicolas Maduro is expected to contest the next presidential election against Henrique Capriles, Governor of Miranda state, who lost to Chavez in last October's poll. Some significant investments made by the Indian firms in Venezuela include the one as part of a global consortium that is developing the Carabobo 1 Norte and Carabobo 1 Centro blocks in the Orinoco region. OVL, IOC, OIL, Spain's Repsol YPF SA, and Malaysia's Petroliam Nasional Bhd (PETRONAS) are partners in the $13.63 billion project, where OVL, Repsol, and PETRONAS each hold an 11 per cent stake, while IOC and OIL hold 3.5 per cent each. The remaining 60 per cent stake is owned by Corporación Venezolana del Petróleo (CVP), a unit of state-owned Petróleos de Venezuela SA. Initial production has started at this project. In addition, OVL has a 40 per cent stake in San Cristobal project along with CVP, where it has made an investment of $355.7 million. Private sector refiners such as Mukesh Ambani-owned Reliance Industries Ltd (RIL) and Essar Oil of the Ruias are the largest importers of Venezuelan crude oil. Supplies from India's domestic energy sources are limited and the country depends heavily on imports—as high as 80 per cent for crude and 25 per cent for natural gas. India's energy demand is expected to more than double by 2035, from less than 700 million tonnes of oil equivalent (mtoe) today to around 1,500 mtoe, according to the oil ministry. An Indian government official said Venezuelan supplies to India were unlikely to be affected. He declined to be named.

Source: www.livemint.com

INDIA SETS NEW TARGET OF 15,000 MEGAWATTS OF WIND ENERGY BY 2017

The government has set a new target of producing 15,000 MW of wind energy during India's 12th Five Year Plan, which runs from 2012 to 2017. The Indian government's Ministry of New and Renewable Energy announced the target in a statement, where it also highlighted the current success of wind power in India, which totals 18,551 MW. This figure makes up 9 per cent of the total installed power capacity in India. States that are dominating India's wind power installations are Tamil Nadu with 7,154 MW and Gujarat, which has reached 3,093 MW. The ministry statement claims that growth has been driven by government incentives that have encouraged private sector investment. To maintain this growth, loans to install wind turbines are available from financial institutions such as the Indian Renewable Energy Development Agency. The government has also carried out wind resource surveys to identify the best sites for projects. Aditi Dass, Director of Technology Programs India, The Climate Group, said: 'The government's latest commitment to wind power offers concrete evidence of India's drive to deliver cleaner, more stable energy for its people. Coupled with the small but clear measures announced in the Union Budget last week, India is again stepping up a gear towards a thriving low carbon economy, led by states like Gujarat. However, we must see greater installed capacity in wind and other renewable resources from all states if India is to overtake other emerging economies in the global clean revolution race.'

www.theclimategroup.org

ALL NEW CONSTRUCTION FROM CPWD WILL BE 3-STAR GRIHA COMPLIANT

Central Public Works Department (CPWD), as a trendsetter has pioneered the initiative to make all its new construction at least 3-star GRIHA (Green Rating for Integrated Habitat Assessment) compliant and certified. GRIHA is the National Rating System of India, and had been conceived by TERI and developed jointly with the Ministry of New and Renewable Energy, Government of India. It is a green building 'design evaluation system', and is suitable for all kinds of buildings in different climatic zones of the country. The latest technical publications of CPWD comprising green norms and features were released by Shri Kamal Nath, Hon'ble Union Minister of Urban Development recently at in an event organized by the CPWD at Vigyan Bhawan. The publications have incorporated various green building norms required for GRIHA, Energy Conservation Building Code (ECBC), and NBC compliance, based on the recommendation of TERI which recently concluded a project on 'Review and revision of CPWD documents to incorporate green parameters' with CPWD teams. The deliberations held shall go a long way in mainstreaming adoption of GRIHA, the indigenous green building rating system of India, in both public and private sector and help creation of sustainable habitats in the country.

Source: www.energynext.in

BUDGET 2013: WASTE TO ENERGY TO GET A BOOST, BENEFITING COMPANIES SUCH AS JINDAL SAW

Finance Minister, P Chidambaram promised to incentivize waste-to-energy projects that would come up through public–private partnership mode with city municipalities and are neutral to different technologies. The government will support municipalities that will implement waste-to-energy projects through different instruments such as viability gap funding, repayable grant, and low cost capital, said the Finance Minister. 'This is a much needed welcome step. India's waste-to-energy potential is enormous and the country has solid waste of around 55 million tonnes besides 38 billion litres of sewage every year barring the industrial wastes,' says Indresh Batra, Managing Director, Jindal SAW Ltd. The OP Jindal Group company is the first to run a waste-to-energy plant. Its plant at Okhla has been running for the past 14 months. Delhi's other waste-to-energy plant planned for Ghazipur is being put up by IL&FS Environmental Infrastructure and Services Ltd (IEISL). Such projects have had run in with environmentalists. 'Impetus given to waste-to-energy projects undertaken by municipalities by giving them viability gap funding will encourage more cities to adopt waste-to-energy projects. This will further boost more schemes to allow the cities and municipalities to take up waste-to-energy projects on PPP mode will encourage more waste-to-energy projects, a move Jindal ITF welcomes', says Mr Batra. According Delhi-based Kuick Research, Class I cities contribute 72 per cent to municipal solid waste in urban area and by 2021 towns will contribute 60 per cent.

Sanjay Chakrabarti, Partner and National Leader, Cleantech, Ernst & Young says, 'The FMs unambiguous provisioning of ₹800 Cr as GBIs for the wind industry is a big positive that is likely to further spur Cleantech investments in India. While the extension of 80IA was on expected lines, the provisioning of concessional loans from IREDA through NCEF and Grants for waste-to-energy projects to municipalities is also likely to further up the investor sentiment. Even as the details of the IREDA scheme are awaited it will be a significant boost if the same is made available for larger renewable energy projects.'

Source: www.economictimes.indiatimes.com

SITE SELECTION FOR NUCLEAR PLANT IN BIHAR SOON: RATAN KUMAR SINHA, ATOMIC ENERGY COMMISSION CHAIRMAN

Rajauli in Nawada district, Bihar, and three other sites were under consideration for establishment of nuclear power plant in Bihar, Atomic Energy Commission Chairman, said Ratan Kumar Sinha. The centre had proposed establishment of a 2,800 MW power plant at Rajauli but when the state government expressed its inability to supply water for the project, the site could not be finalized. 'Talks on Rajauli is on, it is not rejected', Sinha said addressing a function at his alma mater Bihar College of Engineering-NIT. The final decision would be announced soon, he said. Sinha was speaking at Alumni Golden Jubilee function of 1963 batch of the college. Chief Minister Nitish Kumar, who studied electrical engineering from the same college, participated in the function. After approval of standing site selection committee of Nuclear Power Department and Environment ministry, the site would be finalized, he said. Issues like availability of water seismic activity, movement below earth, and tectonic activity are important for finalization of a site for nuclear power plant, he added. Sinha said that after the selection of the site, its development would take at least two years. A proposal for land at Pirpainti in Bhagalpur is also under consideration, he added.

Source: www.economictimes.indiatimes.com

SIEMENS' 6 MW OFFSHORE WIND TURBINE RECEIVES CERTIFICATION

GL Renewables Certification (GL RC) has awarded Siemens Wind Power offshore prototype certification for the testing of its new 6 MW offshore wind turbine at DONG Energy's Gunfleet Sands III demonstration project, located in the UK. This will be the first offshore test of this new wind turbine. The prototype certificate confirms the wind turbine design's compliance with the requirements of the GL guideline for offshore wind turbines, edition 2005. Siemens developed the SWT-6.0 turbine specifically for the demanding conditions in offshore locations. The first unit, which features a 120-meter rotor, was installed in 2011 at the Hovsore test site in Denmark. The turbine has now operated for well over a year, setting new production records during testing, Siemens notes. The second, 6MW, prototype, which has a 154-meter rotor, was installed in 2012 at the new national test centre at Osterild, Denmark. In January, Siemens installed two additional SWT-6.0 prototypes at DONG Energy's demonstration project Gunfleet Sands III. Both machines for this project are equipped with the 120-meter rotor. GL RC has also been contracted to carry out the type certification of the offshore turbine and is currently involved in the design evaluation process. Type certification is required in many countries around the world and is often a condition necessary to apply for international wind power plant tenders.

Source: www.nawindpower.com

COOLING SOLUTION FOR SUPERCOMPUTER HERALDS NEW AGE IN RENEWABLE ENERGY

In what will be an Australian first, the CSIRO Geothermal Project will deliver a novel solution for cooling the Pawsey Centre supercomputer, an $ 80 million facility currently under construction in Kensington, south Perth. 'The system is known as groundwater cooling, and works by pumping cool water from a depth of around 100 metres through an above-ground heat exchanger to cool the supercomputer, then re-injecting the water underground again', said CSIRO's Project Director, Steve Harvey. 'Although the water returned to the aquifer is a few degrees warmer than the surrounds, the groundwater cooling system is engineered to prevent negative impacts to the surrounding environment.' With zero net use of groundwater, the system is also environmentally friendly. CSIRO estimates that using groundwater cooling to cool the Pawsey Centre supercomputer will save approximately 38.5 million litres of water every year, in comparison to using conventional cooling towers. That is enough to fill more than 15 Olympic-sized swimming pools. If deployed more widely, the technology also has the potential to replace cooling towers in buildings all over Perth. Drilling work to implement the groundwater cooling system has recently got underway at the Australian Resources Research Centre (ARRC) in Kensington's Technology Park. The challenge of cooling the new petascale computing system, which will provide expertise to support the world's largest-ever radio telescope (the Square Kilometre Array) and other high-end science, was one of the driving forces behind the CSIRO Geothermal Project. 'Computers generate lots of heat, as anyone who has sat with a laptop on their knees will know', said Steve Harvey. 'Supercomputers, as you can imagine, use large amounts of electrical power, almost all of which is turned into heat and requires cooling. Recent global changes in the cooling requirements for supercomputers, however, means that we can now use water of an ambient temperature, as opposed to chilled water. That's where groundwater cooling comes in.' As well as using a shallow geothermal solution to cool the supercomputer, the CSIRO Geothermal Project will also investigate a potentially deeper geothermal energy resource located beneath the ARRC site by constructing a 3 km deep exploration well later this year. The initiative is part of the Sustainable Energy for the Square Kilometre Array (SKA) project supported by the Federal Government's Education Investment Fund.

Source: www.nanowerk.com

VAYUGRID SIGNS AGREEMENT FOR BIOFUEL ZONES IN ZAMBIA

India-based VayuGrid and Zambia-based BetterWorld Energy have inked an agreement to collaborate on VayuSap(TM) biofuel development zones in Zambia. The development zones, based on Elite VayuSap(TM) trees, will produce sustainable energy, local jobs, and reforest and rehabilitate degraded lands that will, in turn, raise living standards for the local communities and replace imports of petroleum fuels across the country. The Energy and Environment Partnership in Southern and Eastern Africa (EEP-SEA), funded by the governments of Finland, Austria, the UK, and hosted by the Development Bank of Southern Africa, recently selected the VayuSap(TM) project for a phase 1 grant as the only project out of 168 projects submitted in this sector in Zambia. The VayuSap(TM) project is based on a sustainable-networked model to enable rural communities to plant VayuSap(TM) trees on degraded and deforested land, and to link these plantations to central commercial plantations and processing hubs. "Over 70 per cent of Zambia's energy needs currently come from forest biomass", said Dr Benjamin Warr, the Founder and Managing Director of BetterWorld Energy. 'The VayuSap(TM) tree together with our development zone business model are excellent solutions to drastically turn-around the environmental degradation while reducing poverty and increasing energy access.' 'Zambia is going through a dramatic transformation as the country looks at economic diversification', said Doug Peterson, CEO of VayuGrid. 'Our partnership with BetterWorld Energy will address the needs of sustainable energy in an ROI based model to benefit all players in the value chain, including the rural communities, the energy consumers, and the government.' The Phase 1 grant will lead to over $1M in grant funding, and serve as a pilot for expected over 20,000 acres of VayuSap(TM) Biofuel development zones over the next 5 years.

Source: www.elp.com

ANDEAN COUNTRIES PLAN FOR GEOTHERMAL FUTURE

Latin America's Andes mountain countries could produce thousands of megawatts of clean energy from underground heat and are asking countries and organizations with geothermal energy experience the best ways to do it. Experts from Iceland, Mexico, New Zealand, and France shared their lessons and expertise with Andean representatives at a geothermal development workshop on 4–5 March 2013 in Reykjavik, the Icelandic capital renowned for heat and power from thermal springs and geysers. The International Renewable Energy Agency (IRENA) held the workshop to launch the Geothermal Initiative in the Andes, in collaboration with the Latin America Energy Organization (OLADE) and the International Geothermal Association (IGA). Latin America holds some of the world's richest geothermal resources, with total potential estimated at 35,500 megawatts (MW). A significant portion of this is concentrated in the Andean sub-region, consisting of Bolivia, Chile, Colombia, Ecuador, and Peru, all with vast potential yet limited development in geothermal energy. The energy ministries of all five countries took part in the meeting. The discussions covered regulatory frameworks, capacity-building, and methods of financing for geothermal projects, including how to structure risk-mitigation funds. Along with the participating states, participants cited examples of best practices in the sector from Kenya and the Philippines. Andean governments are working with IRENA to prepare a roadmap for the development of geothermal energy in the sub-region, which could provide a template for wider regional clean energy strategies, including in the Eastern Caribbean.

Source: www.irena.org

HOW JAPAN'S 'FLAMMABLE ICE' BREAKTHROUGH COULD REVOLUTIONIZE THE ENERGY INDUSTRY

Japan has become the first country to ever successfully extract natural gas from underwater deposits of methane hydrate, a frozen gas sometimes referred to as 'flammable ice'. The breakthrough could be a boon to the energy-poor nation, which imports almost all of its energy. And if the technology proves commercially viable, it could benefit other countries — including Canada, the US, Norway, and China — that are seeking to exploit methane hydrate deposits. Japan has reportedly spent hundreds of millions of dollars in pursuit of flammable ice, a Holy Grail that could satisfy the country's future energy demands as Japan weans itself off nuclear power in the aftermath of the leak at the Fukushima Daichii plant. According to *The New York Times*, 'Methane hydrate is a sherbet-like substance that can form when methane gas is trapped in ice below the seabed or underground.' There are at least 1.1 trillion cubic meters of the stuff in the trough where it is currently drilling, just off the Pacific Coast. If Japan can perfect its extraction technique, the area would provide the country with enough natural gas to last 11 years. Japan's waters reportedly contain a total of 7 trillion cubic meters of flammable ice, which would supply the country with natural gas for many, many decades to come. The technology, however, is still in its infant stage. At the moment, it is far too expensive to be sustainable, though Japan hopes to have a commercially viable model in place by 2019. Furthermore, flammable ice remains something of a mystery, which could result in technical glitches and setbacks in the future.

Source: www.theweek.com

OHIO'S RESURGENT NATURAL GAS INDUSTRY SPENDS MILLIONS TO SET UP SHOP

Petroleum from Ohio had once supplied John D Rockefeller's Standard Oil refineries in Cleveland. More than 6,500 conventional oil and gas wells that had been drilled in Stark County over the decades, no longer yield enough fuel to market. But natural gas buried in shale thousands of feet below the surface is attracting more than $1 billion in private investment and rapidly reviving the area as an energy producer. To prepare, market, and transport the natural gas, companies are building an expansive network of regional field offices, processing plants and other infrastructure. For example, the Chesapeake Energy Corporation is the largest developer of the shale formation — known as the Utica Shale — is building a field office on a 291-acre site here that it bought here last year for $7.11 million. Chesapeake's development plan, approved last year by this city of 9,200 residents, also calls for a second phase of construction to build a rail spur and eight storage silos to move sand from rail cars to trucks. With all this energy-related construction, industry executives believe that Ohio will produce two billion to three billion cubic feet of processed gas daily within the decade. Even so, fracking has attracted some opposition in eastern Ohio. The Utica Shale yields 'dry' natural gas, which is nearly pure methane and so plentiful in the United States that the market price, just more than $3 per thousand cubic feet, is near a record low. The shale also contains the more valuable 'wet gas', which is methane permeated with ethane, propane, pentane, and butane that can be separated and used to manufacture chemicals, plastics, and liquid fuels like gasoline. The first of the three processing plants planned for the project, which is capable of processing 600 million cubic feet of gas daily, is under construction near Kensington in Columbiana County. It is scheduled to be completed in early summer. Construction of a second plant, to store wet gas, will start in Harrison County in the spring. A third plant, with capacity to process 200 million cubic feet of gas daily, will start later this year in Carroll County, and production is scheduled to start in 2014.

Source: www.nytimes.com

BUILDING THE CHACAYES HYDROPOWER PLANT AND CONTRIBUTING TO CLEANER ENERGY IN CHILE

A year has passed since Pacific Hydro started operation of its 111-MW Chacayes run-of river plant in Chile. The US$450 million hydroelectric facility plays an important role in the country's energy supply mix, as Chile is facing the need to increase its energy in the context of the country's development and economic growth. The Chacayes plant is able to generate 560 GWh of electricity each year, which is expected to supply clean energy to more than 300,000 homes. In addition, in 2012 the project was approved by the United Nations Framework Convention on Climate Change to issue and trade in carbon credits under the Kyoto Protocol's Clean Development Mechanism (CDM). Renewable energy generation at Chacayes will abate 357,000 tonnes of greenhouse has pollution every year — the equivalent of taking more than 155,000 vehicles off the road. Located in Chile's sixth region, Chacayes is the first of a number of run-of-river hydropower projects Pacific Hydro plans to develop in the Alto Cachapoal Valley, where it has water rights to develop up to 600 MW of hydro capacity.

Source: www.renewableenergyworld.com

FRANCE STEPS INTO RING TO BUILD TURKEY'S SECOND NUCLEAR PLANT

French company GDF Suez has officially placed a joint bid with Japanese companies Itochu and Mitsubishi to construct Turkey's second nuclear power plant, which is expected to cost around $25 billion. Japan, South Korea, China, and Canada have been the short-listed contenders for constructing the 5,000MW nuclear power plant, which is slated to be built in the Black Sea province of Sinop. France had also expressed its intention to step into the ring during French Trade Minister Nicole Bricq's visit to Turkey recently. The talks to reach an intergovernmental agreement for the plant took place in Ankara, the Turkish Energy Ministry and GDF Suez representatives told Reuters. 'Japanese International Affairs Ministry and Trade Ministry officials continue on talks', a representative from the French company said. 'If Turkey's Energy Ministry can't reach an agreement over the Sinop power plant, the same consortium will make an offer for the third nuclear plant that Turkey plans to build also', the representative said. The discussions over the consortium's offer have begun and the proposals are being evaluated, a Turkish Energy Ministry official said. Turkish Energy Minister Taner Yıldız said that they were about to finalize the decision process but added that two countries recently stepped up their attempts in the competition. Offers by the French-Japanese partnership and China appear to be the front-runners at the moment, Reuters reported ministry officials as saying. Two French companies expressed their desire to participate in Turkey's nuclear power plant project offer process, but Turkey denied the attempts amid political disputes between two countries stemming from French parliamentary bills recognizing Armenian genocide claims from 1915. Turkey also refused to allow French companies to join the Nabucco project in the aftermath of the bills.

Source: www.hurriyetdailynews.com

AN OVERVIEW OF BIOENERGY

WHERE DO WE GO FROM HERE?

As the age of fossil fuel reaches its conclusion, mankind is in a rush to find the next major energy source to power forthcoming ages in our global economy and civilization. One such energy source under consideration is bioenergy. But bioenergy, which is something humanity has been used to for thousands of years, brings with it questions of its own that need immediate answering: What kind of fuels can be used? How can we make sure that the greed for biofuels does not lead us to tear down forests to build fuel farms? And what happens to the poor, the farmers, the rural downtrodden when an apathetic non-caring government puts cash crops ahead of food crops in their plans for the nation? *Nitesh Bhasin* looks at where we stand on bioenergy, what are the fuels that can be used, how this will affect our civilization, and examples of bioenergy in action around the world.

The last hundred years have seen humankind progress in an extraordinary manner. We have gone from steam power to oil power in a big way and as a consequence, our global civilization has grown enormously. The negative consequences of this power, of course, is that we have released vast amounts of dangerous gases into the atmosphere, affecting global climate, have almost exhausted certain natural resources, have multiplied until we have essentially turned into a plague on the planet, and have polluted the water we drink, the air we breathe, and the land we live on. So technological progress has been, at best, a mixed blessing. However, in the last couple of decades, humanity has become aware of the impacts we have had on our planet and is consequentially trying to change its ways. It is a telling reminder of how much we have consumed in the last hundred or so years when we realize that the oil-based economy that we depend on today is merely a little more than a century old and yet in this extraordinarily short time frame, we have used up almost all the oil our planet had to offer and are now using more and more desperate techniques to extract the vaunted "black gold" from the ground, be it by having to drill under sea beds or by utilizing such dangerous methods like fracking which risks triggering earthquakes and causing widespread destruction across a large area. Thus, the cry has gone out far and wide to try and develop new, renewable, clean, and safe techniques to generate energy and try and rid our global economy of its dangerous and ultimately unsustainable addiction to fossil fuels such as coal and oil. Certain technologies being looked at include solar power or wind power, both of which, in theory have the advantage of being nearly limitless in potential and can be harnessed with little or no ecological, environmental, or social harm whatsoever, but are held back by the very serious limitation of being transient sources of power, i.e., they cannot be relied on to provide consistent energy twenty-four hours a day, seven days a week. And unless we see large scale breakthroughs in energy storage technologies, we cannot replace oil in the current global economy with solar or wind power. That leads to explore other alternatives. In this essay, we are going to look at an alternative source of energy that is straddling the line between being a potentially renewable, clean form of energy, or one that could cause its own forms of environmental and ecological degradation to large segments of the

planet's population. In this essay, we shall look at Bioenergy, is it a viable fuel to power our global civilization's future, or will it too, like and coal and oil before it, lead to more harm than good at a time when we have to be extremely careful about how we wish to take human progress forward.

What is Bioenergy?

Bioenergy can be defined as any form of energy where the fuel source is something that is biological in nature, i.e., which has been grown organically. This can include a wide variety of products, which lends to bioenergy one substantial advantage of having a diverse base range of fuels from which they can attempt to extract energy.

This is useful as it lends to any energy economy built upon it the advantage of being able to change and alter the fuel being used if it is discovered to have negative side-effects with regards to the environment or society at large without having to alter the infrastructure of the energy economy, nor have to incorporate large scale changes in how the energy economy of that society works. Bioenergy from different biofuels utilize essentially similar kinds of energy-extraction technology, which is a major bonus for the longevity of energy generating centres. As biofuels can be easily stored, and can be stored in large quantities, the energy storage aspect of bioenergy offers it a significant advantage over other energy sources such as solar and wind where storage is the single biggest — hurdle preventing their widespread proliferation — or nuclear — where storage of the fuel and the waste generated isn't merely important, it is an issue of national security. Bioenergy is the oldest form of energy used by mankind. From thousands of years ago, we have relied on the energy provided by organic sources in the form of food, either for ourselves or for beasts of burden that did our work for us.

In fact, since the dawn of civilization until the industrial revolution, all human civilizations across the world were powered entirely by bioenergy. Great monuments and feats in engineering were accomplished using the power of thousands of men and animals, who are instead powered by food — a biofuel. So for modern civilization to return to bioenergy wouldn't be a very difficult proposition, the only major difference would be that instead of biofuels powering men of toil and beasts of burden, these biofuels would instead power machines — either to generate electricity for home, commercial, and industrial use — or machines such as automobile engines. There are currently many different biofuels used to generate bioenergy — either in the form of electricity or otherwise.

Biomass

The first time human beings used biomass to generate energy was

a million years ago, when the first humans used wood to create fires. Biomass refers to any kind of plant or organic matter that can be used to either generate energy or to create other biofuels. Most biomass are usually the byproducts of another organic industry, such as farming, which is a very useful trait as it does not disturb any existing agricultural process in order to extract the energy source, and makes the existing process more energy efficient in the long-term, which is a critical point for the future of any energy source we might consider using to power the global economy. Around 35 GW of installed electricity capacity worldwide comes from biomass, making it an established form of energy in widespread use already. Biomass can be converted into fuel forms in all three states of matter, i.e., solid, liquid, and gas.

Solid Biomass

Solid biomass covers a wide and extensive series of fuel sources that are utilized around the world in order to generate electricity or energy. Most solid biomass is the waste product of some other biological process such as farming, or the rearing of animals, or from forestry. Some solid biomass fuel sources used across the world include from animal waste, cow-dung is a popular fuel for fires in impoverished parts of rural India. Using such waste to generate electricity would solve two issues simultaneously as it would help uplift poor sections of rural India to a level where they have houses with a consistent supply of electricity, and would as a bonus also help clean up neighbourhoods where cow dung is a serious pollutant and a cause of numerous health problems. Other forms of solid biomass include the leftovers of agricultural processes, such as rice husks or other waste

products such as grass trimmings, wood, charcoal, sawdust, and the left-over portions of a food crop. This solid biomass can be converted into energy either by converting it into other forms of biofuel or by using it directly to generate electricity. The raw solid biomass can exist either in a form that allows it to be used to generate fuel readily (such as wood for fires) or in an inconvenient form that would make extracting the energy from it a laborious process (such as agricultural residues, chippings or shavings). If the latter case is the instance – and more often than not, it is the case – a process known as densification takes place, where the solid biomass is converted into dense, easy-to-use solid biomass format. This is done either by compacting the energy source (in the case of chippings or sawdust or grass trimmings) or by shaving the energy-rich portions of the fuel source and using them to create tiny pellets or cubes that are anywhere between a 1 and 5 cm long. These wood pellets are very popular in temperate climates such as Europe and North America, their production and usage have doubled between 2006 and 2010 and it is expected that this will double once again by 2017. Concerns about wood pellets include that they might not be an energy efficient solution and a lack of clear data about their impacts either on the local ecology or on the climate. Compacted wood pellets made from agricultural residues and trimmings are currently very popular in Nordic countries such as Sweden, Denmark, and Finland, apart from which they are also used extensively in Italy, Germany, Austria, Canada, and the United States.

Gasification

Another way in which solid biomass is used to generate electricity is through the process of gasification, which involves the conversion of solid biofuel (which can come from literally any organically produced source) into a gaseous substance such as syngas or producer gas, which is then used to generate electricity through combustion. Gasification is essentially a process that causes a chemical reaction between the organic, solid biomass with a controlled amount of oxygen and steam at very high temperatures. The reason gasification utilizes the extra stage of converting the solid fuel into syngas or producer gas is because electricity generation from syngas and producer gas is a far more efficient process. There are a complex series of chemical reactions involved in gasification which are essentially designed to convert the hydrocarbons of solid biofuels into carbon dioxide, carbon monoxide, and hydrogen. The first stage is called dehydration, which removes all traces of water from the biomass, leaving it prepared for the

second phase, which is called pyrolysis. The second stage of the gasification process involves the separation of the "char" from the biomass. This process can be used to generated activated carbon or charcoal. During the pyrolysis process, volatiles are released into the air, which are then combusted with a controlled amount of oxygen, forming carbon dioxide and small amounts of carbon monoxide. And finally, the gasification process itself occurs at the end when the char reacts with steam and carbon, producing carbon monoxide and hydrogen. There are many different types of gasifier that are in use throughout the world, such as "up draft" and "down draft" gasifier as well as fluidized bed reactor, entrained gas flow, plasma, and free-radical gasifier. The initial solid biomass that is fed into a gasifier is referred to as feedstock, and a wide range of potential solid biomass energy sources are utilized as feedstock ranging from wood pellets, waste wood material and chips, municipal solid waste, agricultural and industrial wastes, sewage sludge, switch grass, discarded seeds, and other crop residues.

Liquid Biofuels

Liquid biofuels are a growing alternative to fossil fuels in the minds of many people, especially for use in automobiles, where liquid biofuels such as bioethanol and green diesel are already popular alternatives for petrol or diesel. Alcohols are produced when microorganisms begin acting on organically produced compounds such as sugars or starch or cellulose. This process is, of course, similar to fermentation, which creates alcohols that are consumed by people. The alcohols produced for liquid biofuels, alternatively, are consumed by car engines or by biofuel powered fireplaces. One of the major advantages of liquid biofuels such as bioethanol is

that they can be used in existing car engines. Most existing car engines can utilize a blend of petroleum and bioethanol; up to a 15 per cent dilution in some, whereas other engines can use much higher blends. The advantages include lower emissions and a higher octane number which would help the performance of the vehicle. Some local governments in high-altitude hilly regions (particularly in South America) mandate the use of a certain amount of bioethanol while driving in high-altitude and mountainous regions, so as to protect the environment in the area and also as a means of ensuring the smooth running of the engine, as biofuels such as bioethanol can help in increase thermal efficiency.

Another pretty famous liquid form of biofuel is biodiesel. Biodiesel utilizes long-chain hydrocarbons that can be used in standard diesel engines, and are made in a reaction between a lipid, such as animal fat or vegetable oils, with an alcohol. Biodiesel can be blended with regular petroleum-based diesel in any blend, or it can be used 100 per cent on its own. Biodiesel is already in widespread use in Europe, and particularly in South America where Brazil's revolutionary biofuel policy makes biodiesel a necessity. The feedstocks considered for biodiesel vary according to the countries which are planning to produce it. While the feedstock considered in the United States is largely rapeseed or soya bean oil (soya bean oil on its own accounts for nearly half the total biodiesel produced in the US), other plant options include mustard, jojoba, flax, sunflower, palm oil, coconut, and hemp. Another potential way to extract biodiesel from a feedstock involves the use of algae, which poses the advantages of being easy to grow and whose growth would find a useful alternative use for waste materials such as sewage and the production of biodiesel would not require land that could otherwise be used for the production of food crops. Proponents of algae-based biofuel production claim that substituting all world-wide biofuel production for algae-based biodiesel production would see large amounts of land that go back to being either devoted to growing food crops or developed as forests, and the more efficient utilization of waste products from other agricultural purposes. The detractors say that as an economic model, algae-based biodiesel is still a good 20-30 years away from being economically feasible and hence should not, at the present, be treated as a seriously viable alternative

production option. One of the most likely candidates for future biodiesel production from India is the Jatropha plant. While it has occasionally been controversial with fears that it has been hyped beyond its actual capabilities or perhaps it has been proliferated too soon, in 2007 Goldman Sachs stated that the Jatropha curcas plant is in all likelihood, one of the best candidates for future biodiesel production. The source of biofuel in the Jatropha plant comes from the oil in its seeds, which produces a very high quality variety of biodiesel. What is truly remarkable about the variant of biodiesel produced by the Jatropha curcas plant is that it is of such high quality and has such a high octane number that it can be used for jet aircraft as well. Honeywell and its partner company, UOP LLC, demonstrated the use of biodiesel in jet aircraft in 2012, by flying a Boeing aircraft owned by China Airlines around Beijing while being completely powered using biodiesel created from the Jatropha plant.

Issues Concerning the Use of Biofuels

Of course, there are some very important concerns when it comes to the use of biofuels, either in solid biomass form or in the form of liquid biofuels such as bioethanol or biodiesel. The impact of biofuels on the global economy would be substantial, especially if they are used in greater and greater quantities as an alternative to the established energy model built on conventional fossil fuels such as coal and oil. These impacts have been discussed repeatedly in scientific journals, across national and international conferences and seminars, in government discussions, and in popular media. There is still yet to be some sort of conclusive, comprehensive consensus achieved regarding whether biofuels offer the kind of alternatives that offset the negative consequences of their adoption. The proponents of biofuels maintain that they do while the advocates of other renewable energy sources say that biofuels are an incomplete answer. In this section, we will take a brief look at some of the biggest issues surrounding the usage and adoption of biofuels across the world.

Food vs Fuel

The Food vs Fuel argument hypothesizes that biofuels and bioenergy would lead to governments having to enforce laws dictating farmers to grow bioenergy cash crops over food crops, the repercussions of which could be absolutely and utterly devastating. In the 18th and 19th centuries, similar problems occurred when the British East India Company forced farmers in Bengal and Bihar to grow cash crops such as Opium (which the East India Company were supplying covertly to China in an effort to weaken the internal security of the nation and make it more prone to trading with the British on their terms)

in the place of food crops.While in years of good harvest, this system worked out fine, it prevented the farmers from growing enough food to store for potential disasters. In years of bad or sub-standard harvests, there were devastating droughts and famines in the region, some of which rank as among the world natural calamities ever seen by man, with deaths that ran into the tens of millions. Could the preponderance of biofuels result in another such situation where the greed for cash crops over food crops could see devastating famines that lead to even bigger death tolls than those seen a century or two ago? The food vs fuel argument posits a very simple and dangerous argument, and is still the biggest setback to the widespread adoption of biofuels, especially in developing countries such as India, and in famine-prone nations in Africa. Food security is emerging to be as big a global threat as energy security and the advocates of the food vs fuel objection to the expansion of biofuels state that by trying to impose the growth of crops used for biofuel is to merely conduct a trade-off for energy security over food security, which does not solve either problem. The advocates of biofuel usually counter by stating that the feedstock for many forms of bioenergy are either the residue or waste from agricultural processes, thus the industry does not hamper the growth of food crops, but in fact provides the farmer with an alternative revenue source of selling these hitherto waste products to bioenergy plants that would use them as feedstock, or point out that plants such as Jatropha are grown in land that cannot be used to grow food stock, and can in fact help prevent desertification of large stretches of land where the soil has been eroded from excessive intensive agriculture. As stated before, however, there has been no clear consensus about food vs fuel, and there is still doubt over the impact of biofuel production from this vantage point.

Deforestation

Another major argument used against the implementation of widespread biofuel policies by governments, specifically in tropical rainforest zones, is the ecological impact of biofuel production on the forests of the

region. The large scale deforestation of trees would be a problem as forest trees are far more effective at removing atmospheric carbon dioxide using photosynthesis than the plants grown to be used as feedstock in biofuels. In South America, Brazil's landmark biofuel policy – where it is government-mandated for all cars in Brazil to run on some sort of blend of biofuel and conventional petroleum or diesel, it is feared by some could precipitate deforestation in the delicate and extremely important Amazon rainforest region of Brazil, the impacts of which could be devastating worldwide. On the other side of the planet from Brazil, there are concerns about the impact of deforestation for the sake of growing biofuels in Malaysia and Indonesia. While there have been evidence of some environmentally-unfriendly activities in the region, companies today generally agree on the importance of maintaining the forest ecology as being above that of profit generated from the growth and proliferation of biofuels.

Other Concerns

Other concerns when it comes to the impact of biofuel production on the environment, ecology, and energy security of a nation range from its role in resource efficiency, the impacts of farming cash crops for biofuels on the soil and the potential for large scale soil erosion, and specifically, the utilization of precious fresh water resources by biofuel production. This is an extremely serious concern specifically for the growth of Jatropha, where it has been shown by studies conducted by the Friends of the Earth foundation in 2009, that the amount of water required will be considerably higher for Jatropha than that for sugar cane. Similarly, there are concerns that the water debate will lead us back to food vs fuel where water resources will have to be shared between food and cash crops, and that this would once again improve energy security at the cost of water security.

Conclusion

Bioenergy, along with solar, wind, tidal, and perhaps even nuclear is touted as the energy source of the future. However, there are concerns, and legitimate ones about the impact of a bioenergy based global economy, and whether that would be any better than the fossil fuel based one we are living

in now. Would the impact of large scale biofuel production result in the sacrifice of food and water security at the altar of energy security? This is an extremely important question for citizens in tropical third-world nations. Would that mean that since bioenergy is not likely to be a viable substitute for fossil fuels, we should end all research immediately? Of course not; humanity and this global civilization we have constructed over the last couple of centuries or so, are in a very precarious position, and now is not the time to think in absolutes. Bioenergy possesses numerous and considerable advantages, advantages that one does not see, not only in its rivals in the renewable energy camp such as solar and wind, but also advantages not seen in the Zeitgeist, in conventional energy sources such as coal and oil. Since the carbon stored in bioenergy has been formed from plants that had absorbed carbon dioxide in the air already, the environmental impacts of bioenergy are not as bad as the consequences of an oil-powered economy, while still not being as clean as solar or wind. However, bioenergy and biofuels can be stored, either as wood pellets or as bioethanol or biodiesel. Storage technology is not complex, especially in the case of solid biomass, where one can find large mountainous piles of wood pellets and feedstock just lying around under a rain-protective roof at any bioenergy electricity generation plants, be they in Sweden or Brazil or the United States or Malaysia or even India. Thus, the future, as it has hopefully become obvious, lies not in entirely replacing the existing oil or coal powered global economic infrastructure for a similar one powered by some other fuel, but rather in diversifying the energy sources that we intend to use while maintaining and updating the infrastructure already available to us to power the next century of global civilization. And bioenergy will have a crucial role to play in this, alongside solar, wind, and fossil fuels. A diverse energy mix is ultimately the key; hedging our bets for the energy future of human civilization and the world as we know it today that we may take a much more cautious and rational step into the next great age of mankind. ■

The author is a Freelance Writer and Business Developer based in New Delhi.

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THE IT CROWD

How Silicon Valley is Looking to RE for its Energy Needs

Few people may realize it, but the IT industry is one of largest consumers of energy in the world. Server farms, data centres, and the need to be constantly prepared make the IT sector's energy consumption constitute 2 per cent of that of the world. *Karthikeya Ramesh* looks at how some of the world's biggest names in information technology are now trying to ensure that the energy they consume comes from renewable sources.

One would expect IT companies, with their slick Earth-friendly marketing campaigns, technology leaders who are part businessman part hippie guru, and youth-friendly organizational set-up to be amongst the most environment-friendly businesses out there. However, according to CNN Money and a report released by Greenpeace, the internet in the United States of America consumes more electricity than the entire US automobile industry takes to produce cars and trucks. While this may be seen as an indictment of the fall of the US auto industry in the last few decades, it also goes to show that the cost of keeping the internet up and running twenty-four hours a day, seven days a week has a genuine and substantial energy cost. To explore how this energy cost is being minimized we have to first look at the internet, something which most people perceive as being this ethereal non-physical entity, and which actually exists via a series of server farms, most of which are found in the United States. These server farms are, as the name indicates, a vast collection of computer servers that process, store, and transfer data from one computer to the other on a global scale. These server farms consume vast quantities of energy seeing how they have to keep running at almost full capacity for every minute of every day of the year. The advent of "Cloud Computing", where vast quantities of data are now stored permanently on the mystical-sounding "cloud" has made matters more delicate, as server farms are now growing even faster and require more and more memory capabilities in order to be able to keep up with the demand for storage space on the internet. Of the energy consumed by a server farm, only two-thirds is actually utilized in running the servers, the remaining third is required to cool the servers, which can otherwise overheat very quickly. That implies that for every 100 watts of power consumed by a server, an additional 50 watts is needed just to keep it cool. And as the world goes online, with greater speeds, more content, and more data stored on the cloud, the need for server farms is only going to increase. Estimates say that server farms already account for 2 per cent of all the electricity consumed in the United States, and the world. However, unlike traditional businesses that were slow to realize the environmental impact of their business practices, the IT industry prides itself on being environmentally friendly. Moreover, companies that are successful in the information technology realm are those that have proven themselves to be quick at figuring out ideas and solutions to problems. Thus, when it emerged

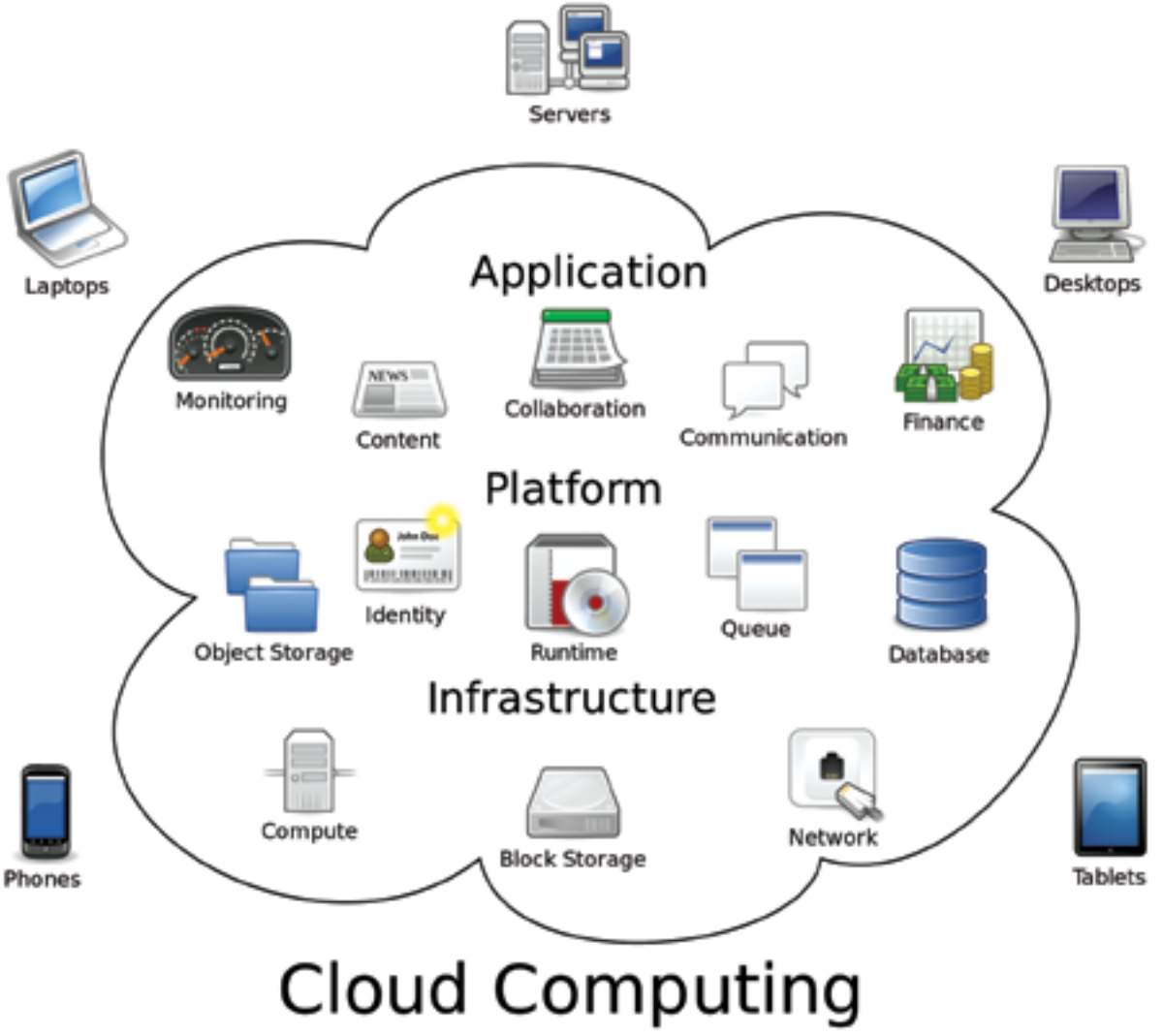
that server farms were becoming a serious issue to the environment, not to mention to the reputation of silicon valley investors and professors as arbiters of new-age thinking that treats the Earth as one of their companies' major shareholders, IT companies have been quick to acknowledge and try and address the situation.

Virtual Presence, Physical Consequences

Many of the world's most successful information technology companies do not physically produce anything, rather their creations exist as software that one can see and interact with on a computer, or a service one uses online. One might think that this would reduce the company's carbon footprint by a substantial degree, but the fact is that in the year 2010, Google was responsible — through its server farms, and other activities — for emitting 1.5 million tons of carbon dioxide into the earth's atmosphere, which makes their goal of becoming a zero carbon company look very difficult, if not unlikely. However, recent advances by Google showcase a company vigorously attempting to go green. For example, Google's charitable arm, Google.org, as part of its RechargeIT initiative, is attempting to foster greater amounts of energy efficiency in all its processes as well develop an energy management software to help other corporations to do the same. The auto park at Google's corporate headquarters at the Googleplex Campus in Mountain View, California, now features 395 electric car charging stations and is serviced by a fleet of 70 electric buses with built-in free Wi-Fi as part of initiatives to inculcate the culture of sustainable development in its employees. Google's forays into the renewable energy sector have also attracted attention, particularly with people focussing on their subsidiary, Google Energy. Founded in 2009, Google Energy has seen the expansion of Google's corporate energy policy, making substantial investments in the RE sector. Google invested nearly $40 million in two wind farms in North Dakota, $75 million in wind energy in Iowa, and has been expressing their interest in exploring and developing the offshore wind capabilities of the east coast of the United States, as well as the exploring the solar potential of the Mojave Desert in California with a $168 million thermal solar project that is speculated to produce nearly 400 MW of power. So far, the Google corporation has spent over $1 billion investing in clean and renewable energy with a total capacity of 2 GW. In 2011, Google claimed that it hopes to increase the share of renewable energy

in its energy mix to 35 per cent by the end of 2012. The figures for last year are not in yet, but the smart money says Google has clearly surpassed its goal.

Other information technology companies working towards building a clean energy future include Facebook, who claim that their new data centre, located in Prineville, Oregon, utilizes unique technology and design techniques that will increase the energy efficiency of the centre by close to 40 per cent. Facebook has also spoken of the "cold storage" technology in place at the data centre, which stores files and photos that aren't accessed very often by users on Facebook. An in-house Facebook study revealed that 82 per cent of all photo views go to only 8 per cent of the photos being stored. The cold storage facility allows the not-so-commonly accessed photos to be stored on servers that are used less and thus require fewer cooling and operational costs. In 2011, Facebook famously shared the design plans for the Prineville data centre and for the servers being used there. Now, Apple Computer is also planning to construct and open a data centre at Prineville. On the other hand, in November 2012, Microsoft announced its intention to build a zero-carbon off-grid data centre that would be run on bioenergy. The "Data Plant" as Microsoft is calling it, plans to generate electricity at the data storage centre itself, thus nullifying any need for the data centre to be on the grid, while selling off any extra electricity generated. The plan works by collecting the waste from the houses of the ten thousand or so Microsoft employees and locals at Cheyenne, Wyoming, as well as the waste generated at the data centre



itself and treating it to produce biogas, which will then be used to generate electricity, and that electricity will then be used to power Microsoft's data centre. The project at Cheyenne is still a pilot, and on the results of the pilot will the future of further such data plants depend, but it remains an exciting and ingenious prospect nevertheless.

Land of Ice, Lava, and Data

An emerging data destination for all major players in the information technology arena from around the world are the cold, wind-swept, geologically volatile, and visually stunning vistas of the tiny island nation of Iceland in the North Atlantic Ocean. Iceland is known as much for its geological features as it is for its strange and sometimes inhospitable geography, and even stranger and more inhospitable food. But the island's strange geology is a consequence of its location on the border of two massive tectonic plates, namely the European and North American continental shelves. As a consequence, the island of Iceland, while cold and harsh from its northerly position and isolated vantage point in the Atlantic Ocean, which leaves it prone to very high winds, is kept warm through a series of geothermal vents and geysers. In the last century or so, Iceland has been very successful at turning these geological oddities into an almost entirely carbon-free energy economy. Indeed, nearly all electricity generated in Iceland comes from the country's geothermal power stations and companies across the information technology spectrum are starting to take notice. Iceland is now emerging as a preferred destination for the construction of data centres. The advantages are numerous, one saves cooling costs by merely keeping the server rooms well-ventilated, after which the local climate will take care of the rest. In addition, the electricity utilized for running the servers themselves comes from the environmentally friendly and renewable source of a geothermal power plant. With the construction of a series of underwater cables to connect Icelandic data centres to the

two continents on whose border it rests (Europe and North America), it will be possible for the information technology industry to substantially lower their carbon footprint on a global scale. UK-based information technology company Verne Global showcased this through their zero-carbon data centre at an abandoned NATO air field near the town of Keflavik, Iceland. With the need for greater connectivity and data storage for cloud and mobile applications as well as data exchange between Europe and the Americas, the Icelandic data centre had to recently import a new series of data modules and servers to keep up with demand, showing that clean energy can be about good business sense too.

The Future

Information technology is a domain where staying two steps ahead of the rest of the world is a necessity for basic survival and not a distinct advantage. Companies such as Google, Facebook, Apple, and Microsoft have reached the peaks of success through a keen ability at being able to find opportunities where others didn't know one existed. Their investments in renewable energy is not limited to merely technology, it extends to something far more significant than that; yes, Google may have invested over $1 billion in renewable energy power plants to provide energy to run their data centres, and Facebook and Microsoft are trying to synergize the functions of their data centres with locations that allow these functions to occur with minimal external energy input while keeping energy sources ready. But the lesson to take away from these actions is that this is how futurists and visionaries see the future of physical communities, have visions of future economic modalities, and ways in which business in the 21st century can be conducted. By melding necessity with opportunities, such as going to the resource rather than bringing the resource to us, it will be possible to ensure that the wheel of progress does not come to an abrupt halt and that the advancements we have witnessed will not need to be artificially constrained. It will be a singular vision, as espoused by such companies that will see the emergence of new and interesting practices and communities that aid towards a sustainable future, and in the end it is those who think ahead who shall prevail. ■

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MIDDLE EAST LOOKING AT RENEWABLE ENERGY TO MEET ITS GROWING DEMANDS FOR POWER

As the world focuses on political developments in the Middle East, a gradual energy revolution is underway in the region. *V L Srinivasan* sheds light on the alternative energy movement that is gaining ground in oil-rich sheikhdoms throughout West Asia and neighbouring nations.

Quite different from Tahrir Square, nations in the Middle East are witnessing a different kind of revolution as far as sustainable development is concerned. Caught between environmental issues like industrial pollution, water scarcity, unsustainable energy consumption, and depleting fossil fuels; oil-rich nations in the Middle East are increasingly looking at renewable energy (RE) as an alternative to meet their growing energy demands. These RE sources are usually from solar, wind, ocean, hydel, biomass, and geothermal resources, and are looking to replace conventional fuels in the area of power generation, heating, and transport fuels. According to research by the Dubai-based International Renewable Energy Agency (IRENA), Gulf Cooperation Council (GCC) countries could save up to $200 billion (₹1,077,300 crore) until 2030 by investing in RE projects, saving three billion barrels of oil that can then be diverted to world markets instead of wasting them for electricity generation. The Clean Energy Business Council has claimed that as many as 150 RE projects were being implemented in the Middle East and North Africa (MENA) region and a bulk of them were in various stages of progress in the Middle East.

Among the various RE sources, Concentrated Solar Power (CSP) is arguably the most abundant, untapped, viable, and eco-friendly as the density of solar energy is very high in the region. Due to the abundant availability of sunlight as a resource in the Middle East, more emphasis is being placed on solar power as a viable energy source to meet

the region's emerging needs while some nations are also exploring the possibility of setting up nuclear power projects. In fact, many countries in the region feel that time is ripe for taking up RE projects, with Saudi Arabia planning to invest a whopping $109 billion (₹587,100 crore) — $17 billion (₹92,500 lakh-crore) this year alone — into solar energy with a target of 41 GW, with which they aim to meet one third of its electricity demands by 2032. Saudi Arabia plans to produce 54.1 GW (25 GW through CSP, 16 GW through photovoltaic and 13.1 GW through non-solar sources) of renewable energy by 2030. This investment is expected to save Saudi Arabia half a million barrels of oil used for energy generation. In the United Arab Emirates (UAE), Abu Dhabi has set a target of meeting 7 per cent, and Dubai 5 per cent, of their renewable energy needs by 2030. The two Emirates aim to attract an investment of $77.45 billion (₹545,100 crore). The UAE enjoys reasonable renewable energy resources, with an average vertical solar irradiance of 2,120 kWh per sq. m per year and an average monthly wind speed of 4.2 to 5.3 m/s in coastal areas. This is in addition to the UAE generating 12 per cent of their energy from nuclear power, 12 per cent from clean coal, and 71 per cent from gas. Dubai is already producing solar power to the extent of 4.5 MW in Jebel Ali, Palm Jumeirah, Al Maidan, and some private entities. Abu Dhabi has built a world-class renewable energy research centre in Masdar and is setting up a 100-MW CSP project, Shams-1, at Shams, which — covering an area of 2.5 sq. km — will be the largest plant in the world at the time of commissioning.

Another Gulf state, Qatar, has announced its plan to install 1.8 GW of solar capacity by 2020. If the planned project comes online as per schedule, renewables will power nearly 16 per cent of Qatar's electricity demands. The banks in Qatar, in tune with the government's policy decision, are funding the construction of the first

$1.1-billion (₹5,900-crore) solar-grade polysilicon production plant at Ras Laffan Industrial City. The plant is a joint venture between the Qatar Foundation, Qatar Electricity and Water (QEWC), and Qatar Solar Technologies (QSTec) and is expected to be ready by June 2013. In the Sultanate of Oman, the government is extending all efforts to ensure 10 per cent of its total electricity requirements are met by renewable energy resources by 2020. At present, Oman is investing $2.9 billion (₹15,600 crore) in 13 new power, water, and energy projects that are scheduled for completion by 2014. The capacity of the majority projects, which are based on CSP technology, range between 10–50 MW with larger facilities producing as much as 200 MW. Two wind energy based pilot projects, each with a capacity of 3 MW, are underway at Masirah and Thumrait in Oman. A study on Renewable Energy Resources, conducted by the Authority for Electricity Regulation in Oman, said that Concentrating Solar Power plants, with storage for continuous supply of electricity as conventional power plants, required one sq. km of land to generate 10 MW. "Theoretically speaking, it would be possible to meet the entire electricity demand in Oman by utilizing about 280 sq. km of desert area for solar collectors, corresponding to around 0.1 per cent of the Sultanate's land area," the study said. "The demand for power in the six member states of the Gulf Cooperative Council alone is expected to be 100 GW over the next 10 years, and they are looking for the best way to do that," IRENA's Director General Adnan Z Amin said. Renewable Energy offers a compelling alternative. The same geography that made the Gulf countries rich in hydrocarbons has made them richer in another never-ending source of energy: solar power. According to him, the vast majority of the region's electricity is provided by oil and gas. "But every barrel of oil burned — at a cost of around $10 a barrel — is a barrel of oil not exported at a price of $100", he pointed out. With an estimated wind power potential of almost 25,000 MW throughout the country and plenty of sunshine, Morocco has targeted approximately 42 per cent of the installed electrical power in the form of renewables by 2020.

Sun-drenched Kuwait too has set a target to generate 10 per cent of its electricity demand from RE by 2020, and 15 per cent by 2030. The country is planning to meet one per cent of its power demand, which is growing at the rate of 8 per cent each year, from solar and wind energy by 2015. This would save $3.9 billion (₹21,000 crore) for the country in five years. At present, Kuwait has approximately 70 MW of installed RE capacity. Of this, photovoltaic solar

and wind accounts for 10 MW each while the remaining 50 MW comes from CSP projects. While the UAE and Saudi Arabia are talking to the United States for setting up nuclear power plants, Oman has no such plans, and the Fukushima nuclear plant mishap in Japan in 2011 has skewered Kuwait's nuclear intentions.The nation dissolved its National Nuclear Energy Committee and announced that it has abandoned the pursuit of civil nuclear power. Citing a shortage of water, even Jordan has suspended its nuclear programme with the country's Parliament voting against it nine months ago. Jordan plans to have seven per cent of its energy from RE by 2015 and 10 per cent by 2020, for which an estimated $14 to 18 billion (₹75,000 to 97,000 crore) is needed. Even strife-torn Iraq is planning to spend up to $1.6 billion (₹8,600 crore) on solar and wind power stations over the next three years to add 400 MW to the national grid to help curb daily blackouts. As against a demand of 14,000 MWs, the supply has been around 8,000 MW indicating how desperate the Iraqis are to beat the sizzling summer heat every year.

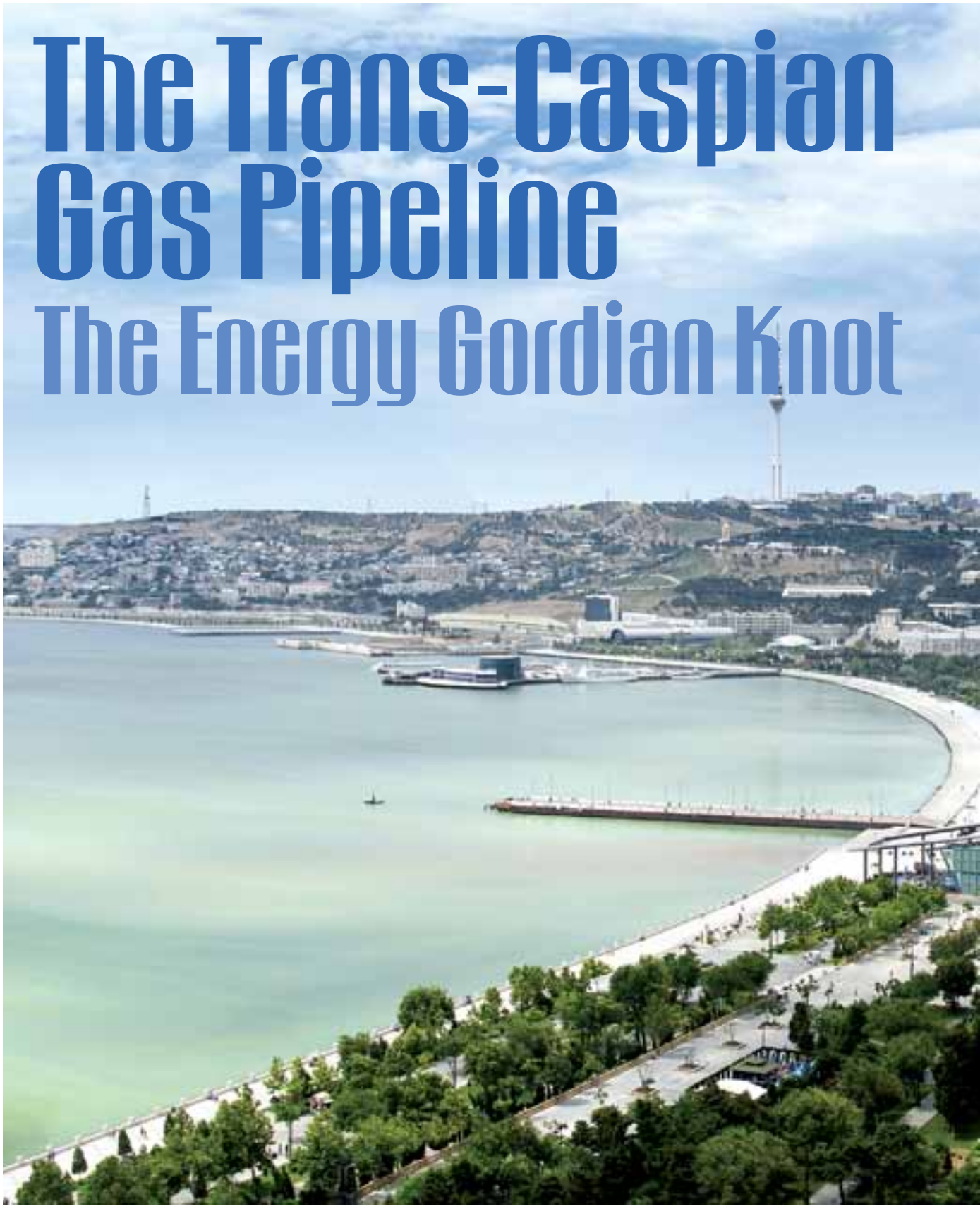
Bahrain has announced plans to construct a solar smart grid in Awali, which will have a 5-MW solar capacity operated by a wireless smart grid network. Syria is another country, which is exploring renewable energy options, but its plans have been hit hard due to the on-going conflict in the country, which began nearly two years ago. The country had even prepared plans to add over 3,000 MW of RE by 2030, but whether the rulers would stick to the target will depend upon restoration of normalcy in the country. Even the country's nuclear energy aspirations are put on hold for the same reason. Yemen, which is also facing insurgency problems, has one of the windiest corridors on its western coast, from Bab al-Mandab to Al-Mokha, and its azure skies are ideal for solar power generation. Yemen's Ministry of Electricity and Energy has estimated that as much as 50,000 MWs of RE can be generated, which is 50 times the current production levels, but the problem is to get the investors to the country. The electricity generation in Yemen is believed to be around 1,000 MW as against an estimated demand of 3,000 MW at present. Egypt, which is among the sun belt nations in the region, has established a New and Renewable Energy Authority (NREA) and wants to have at least 20 per cent of the total electricity generation to come from RE by 2020. The NREA has developed and operated RE projects through concessional financing from donors, which include 550 MW of wind power plants with 140 MW integrated solar combined cycle power plant, with solar share of 20 MW. The electricity generation expansion plan for Egypt from solar energy includes

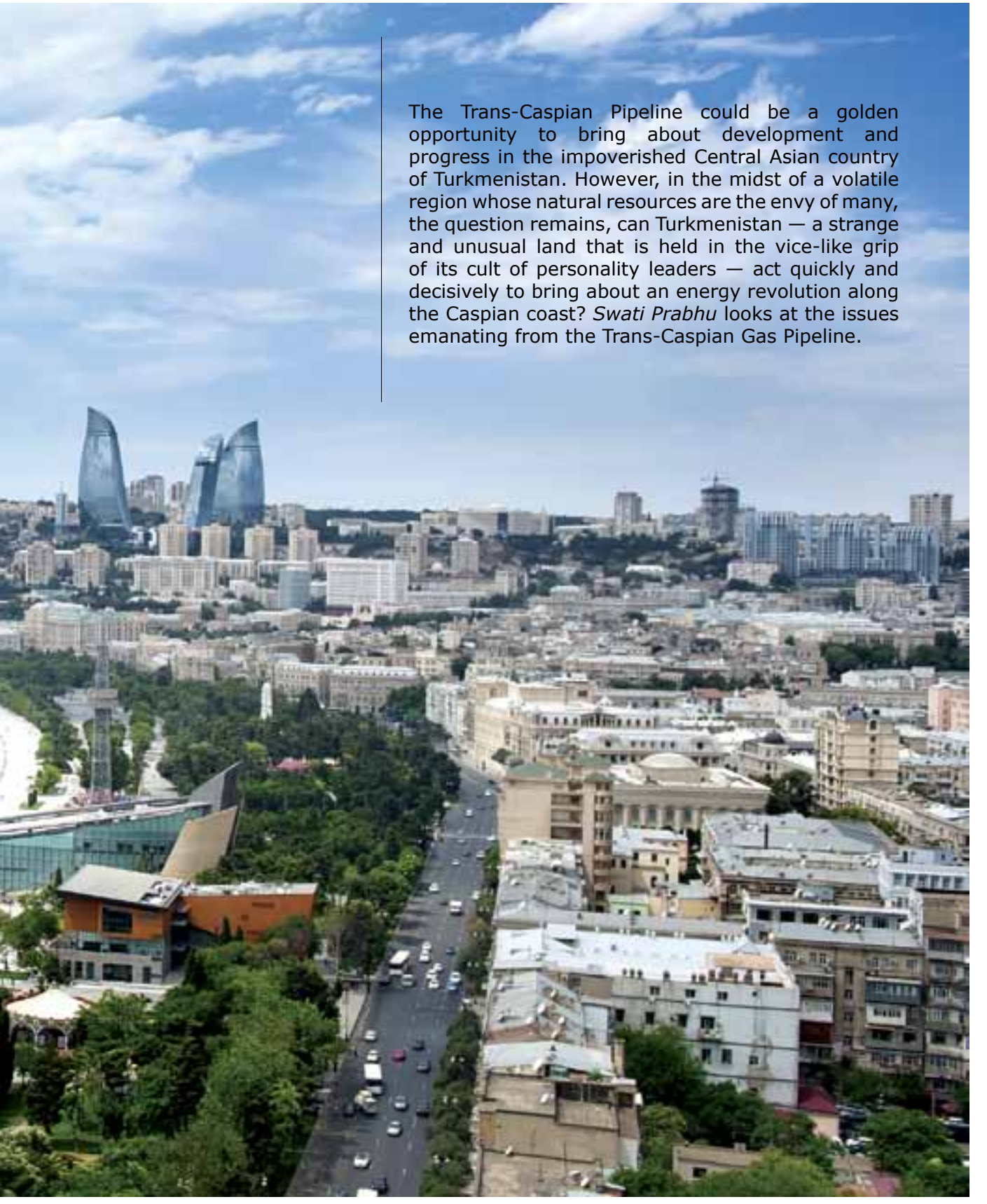
implementing a total solar capacity of 100 MW solar thermal power plants and 40 MW photovoltaic grid-connected power plants by 2017. Some of the world's best wind power resources are located in Egypt, especially in the areas of the Gulf of Suez, and the West and East Nile Valleys where at least 7,200 MW could be potentially developed by 2020. "The region has so much solar potential that it could generate more energy than it needs, and export that to Europe, or Africa. This is an extraordinary opportunity, both, to meet local demand and also to increase trade. And leaders across the Gulf, quite wisely, are seizing it", Adnan Z Amin said. For many years, the region was considered as an exporter of energy. Today, however, an increasing amount of the region's oil and gas is meeting domestic demand, fuelling rising populations, economic growth, and rapid industrialization. The GCC region recently surpassed the USA as the top per capita energy consumer in the world, and that demand is expected to double again by 2020. According to a study conducted by the Saudi Arabia-based Arab Petroleum Investment Corporation (Apicorp), an affiliate of the ten-nation Organization of Arab Petroleum Exporting Countries (OAPEC), the investments in RE in the Middle East and North Africa region was to the tune of $5.5 billion (₹29,789 crore) in 2011, which was 2.1 per cent of the total investments around the world, and a decline of 18 per cent over 2010. The decline in the RE sector in the Arab region is seen against a 17 per cent surge worldwide to $257 billion (₹1,390,884 crore) in 2011. This is six times the amount invested in 2004 and 93 per cent higher than the total in 2007, the year preceding the global financial crisis, the report said. In view of the change in the Middle East strategy, the private sector will have plenty of opportunities in promoting clean technology for renewable energy which, in turn, would generate more "green" jobs in the long run across the region. With several countries in Europe imposing cuts on RE subsidies, investors in Spain, Germany, Italy, and the UK are looking at opportunities outside Europe. Investments on a large scale in new sustainable development projects will transform the Middle East into a hub of clean energy technologies, which will not only lower the region's carbon footprint, but also encourage more nations to adopt solar, wind, and other renewable energy systems. ■

The author was a journalist in Oman and Bahrain, and is currently based in Hyderabad

The Trans-Caspian Gas Pipeline

The Energy Gordian Knot





The Trans-Caspian Pipeline could be a golden opportunity to bring about development and progress in the impoverished Central Asian country of Turkmenistan. However, in the midst of a volatile region whose natural resources are the envy of many, the question remains, can Turkmenistan — a strange and unusual land that is held in the vice-like grip of its cult of personality leaders — act quickly and decisively to bring about an energy revolution along the Caspian coast? *Swati Prabhu* looks at the issues emanating from the Trans-Caspian Gas Pipeline.

As the world inches towards socio-economic development and political growth, natural resources continue to decline at an alarming rate. Such resources these days have become extremely precious, not only for the Third World but also for the developed blocs. The region of Central Asia has always been rich in natural resources, mainly gas and oil. Before the disintegration of the Soviet Union, the entire region's natural gas reserves were unilaterally owned by a single establishment. However, with the fall of the USSR in 1990, the area broke up into several small countries, dividing the gas reserves into the different states. Our focus in this article is the Trans-Caspian Gas Pipeline which originates in Turkmenistan. Figures suggest that there exist nearly 101 trillion cubic feet of gas reserves which, if explained in monetary terms, can amount to unimaginable capital. After the breakup of the Soviet Union, Turkmenistan found it hard to form its own energy outlets. It exports energy with the help of its gas reserves to Russia and Iran. With the Trans-Caspian Gas Pipeline a third route was established in 1997 through Azerbaijan and Georgia to Turkey. Despite the highly rich gas reserves, many issues cripple the economic development of Turkmenistan, especially those concerned with this pipeline. On top of it, the involvement of Europe and USA has also made it a universal bone of contention. The pipeline is touted to be one of the biggest sources of alternate energy in the coming years for Turkmenistan.

Turkmenistan and its Tryst with Energy

As a country, Turkmenistan inherently boasts of a rich oil and gas industry. With a population of about 5 million, their gas reserves are the fifth largest in the world. Apart from this, agriculture too plays an important role in their home economy. Experts say that the country is sitting on 600 barrels of oil and natural gas which has not been effectively utilized yet. After the disintegration of the Soviet Union, their economy has steadily dwindled. In 1997, their GDP dropped by approximately 24 per cent owing to unsteady gas exports. Many people in the country are also against privatization of the economy, especially of the oil and gas sector, leading to fewer foreign investments. This also highlights the inefficiency of the government in implementing market-oriented mechanisms to make their economy vibrant and more forward looking. Lack of foreign investments and inadequate pipeline infrastructure, scarce capital, political motivation, and technical know-how are some of the reasons why Turkmenistan lags behind in the Central Asian energy market. The country also faces acute poverty despite its vast stores of natural gas and oil. There are various pipelines in and around the Central Asian region that transport natural gas to different countries. These include the Central