Energy Security Challenges:

Non Traditional Security Planning in India

CPPR® Centre for Public Policy Research

CPPR-Centre for Strategic Studies

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In keeping with these traditions, CPPR launched its focus study centre in the arena of security and strategy, the CPPR-Centre for Strategic Studies in August 2013. The CSS is an interdisciplinary academic study centre focusing on strategic positioning and policy making in the South Asian region. Special attention is given to the relationship between politics, geography and natural resources, economics, military power, and the role of intelligence, diplomacy, and international cooperation for security and defence.

Important fields of research include energy and maritime security, strategy, terrorism, inter-state and inter-country cooperation and extremism, developing resources and building expertise on matters relating to national security, Centre-State relations and responsibilities, surveillance and security systems are also key areas of focus. The Centre has been hosting eminent experts in the strategic domain and have been organising national and international seminars, workshops and conferences on the emerging themes within its domain. CPPR CSS aims to develop a niche in the area of strategy through these knowledge building process and assist the state in its activities.

Published in 2015 by the CPPR-Centre for Strategic Studies, Kochi
Centre for Public Policy Research (CPPR)
Door No.28/3656, 1st Floor, Sonoro Church Road,
Elamkulam, Kochi, Kerala State, India-682020

http://www.cppr.in/;

e-mail: css@cppr.in

Distributed by the Centre for Public Policy Research, Kochi

ISBN (e-book edition): 978-81-930004-1-0

Foreword

The International conference on *Energy Security Challenges–Non Traditional Security Planning in India* was yet another attempt by the Centre for Public Policy Research (CPPR), to focus on one of the most challenging themes of current times. Given its global outlook and ramifications, energy security demands an integrated approach and strategic positioning, especially for a country such as India.

Several factors have contributed to the unprecedented predominance that the energy security debate has achieved in international dialogue and diplomacy: the growth of new economic power centres; the fluctuating price of fossil fuels over the last three years; global warming due to climate change; the threat of terrorism, instability in some exporting nations; power blackouts and chronic shortages of power in several countries. Power blackouts have occurred on the east and west coasts of the United States, in Europe and in Russia while chronic shortages of electric power are being faced by China, India and other developing countries. Given the fundamental need for energy to fuel a country's economic growth[1], these power crises have caused concern not only about the reliability of electricity supply systems, but also raised fears of a scramble for energy supplies and heightened geopolitical rivalries.

Thus the situation at the global level does not seem very positive. However, there have been attempts by several countries to streamline and reassert state control by installing new transportation channels and pipelines, hoping to offset the stark scarcity of their domestic resources through diversification, trade and investment in the energy sector.

“Energy independence" is a phrase that has become a mantra since it was first articulated by Richard Nixon four weeks after the 1973 oil embargo was put in place. This national aspiration had long been at odds with reality for the United States. The real mood and the state of the nation was captured by President Obama in 2009 when he stated, “At a time of such great challenge for America, no single issue is as fundamental to our future as energy” In recent years, new energy suppliers, technological developments like hydraulic fracturing and the US shale gas boom have redrawn the global energy scenario and caused significant geopolitical shifts.

That energy issues are fundamental to India's future is an undeniable fact. The country's energy imports come at the cost of 7% of its GDP and is more often ruptured by the country's balance of payment, which takes an ugly turn with the fluctuations in the energy market. India, the world's fourth largest energy consumer, imports 80% of its crude oil and 25% of its natural gas requirements. Around 600 million Indians do not have access to electricity and about 700 million Indians use biomass as their primary energy source for cooking, according to Indian Government sources.

India's energy demand is expected to become more than double, from below 700 million tonnes of oil equivalent (mtoe) in 2013 to around 1,500 million tonnes of oil equivalent by 2035[2], according to estimates made by the oil ministry. Hence, the issue of energy security is undoubtedly a major concern for India as well as the United States.

It is in this context that the CPPR-Centre for Strategic Studies, organized this international conference with the support of the United States Consulate in Chennai. Petronet and the Indian Oil Corporation were the two associate sponsors that took an active interest in this conference and extended their sponsorship. Petronet LNG Ltd is one of the fastest growing world class companies in the Indian energy sector. The Indian Oil Corporation and its group of companies is India's largest commercial enterprise, operating ten of India's twenty refineries.

Distinguished panelists spoke on various energy-related themes during the conference. There was also excellent participation from practitioners, academicians, activists, security agencies, especially the Indian Navy, representatives of the departments of energy and public sector undertakings (PSUs) dealing with power, as well as entrepreneurs and students.

Public interest in energy security was so high that this conference was oversubscribed and CPPR was forced to limit registrations due to its own constraints. The active interest evinced by various quarters put additional responsibility on both organizers and participants and the conference witnessed animated interactive discussions on key issues pertaining to India's energy security quest.

As more and more nations recognize the importance of non-traditional security planning and focus increasingly on issues such as energy to enhance national security, it is worth recalling the words of US Founding Father Benjamin Franklin, who observed in a letter written in 1783: "*...in my opinion, there never was a good War, or a bad Peace. What vast additions to the Conveniences and Comforts of Living might Mankind have acquired, if the Money spent in Wars had been employed in Works of public utility!*"

Indeed the time has come to turn away from big-budget spending on weapons and military hardware and focus on non-traditional aspects of security such as energy. Investing heavily in that most vital public utility of the 21st century will not only fuel economic growth and boost prosperity levels but also strengthen national security significantly.

[1]Foreign affairs, http://www.foreignaffairs.com/articles/61510/daniel-yergin/ensuring-energy-security

[2] IDSA, NTS Newsletter, Vol 1, No.4, 2013

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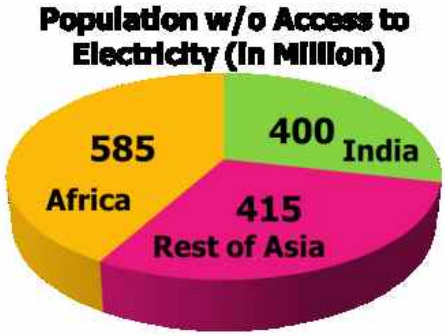
Sustainable Energy Access and Security for Rural India

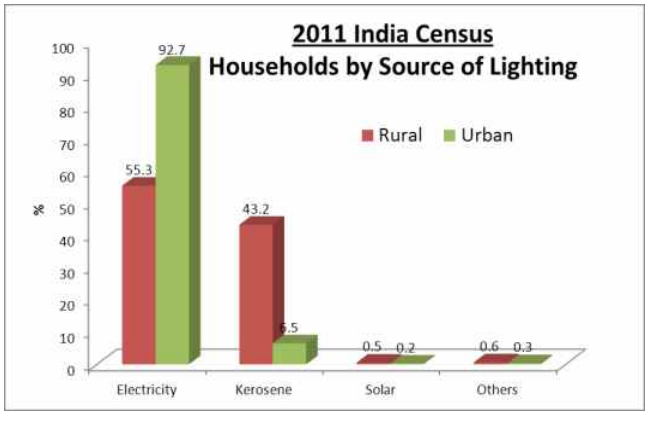
Dr. Ashok K. Das

According to the IEA's report[1] on *World Energy Outlook 2011*, one-fifth of the world's population, (1.4 billion people) do not have access to electricity. Of this number, 80% live in rural areas. While 585 million reside in Sub-Saharan Africa, the majority of 815 million live in Asia, with India alone accounting for 400 million. The Indian census data of 2011[2] reveals that only 53% of the rural population has access to grid electricity and 43% still use kerosene for lighting. Worldwide, the situation is considered so grave that the United Nations has declared 2014-24 as a *Decade of Sustainable Energy for All!*



Source: World Energy Outlook, 2011, IEA

According to Chandrabhan Sharma, Pradhan of Vidhuni in Shrawasti, Uttar Pradesh, people pay between Rs.100-150 per month for kerosene. However, the use of kerosene leads to several ill health effects, and fails to address other needs such as power for mobiles, fans, TV/Satellite, irrigation pumps, agriculture machinery and school computers. Local entrepreneurs have long exploited this situation, particularly in Bihar and UP by providing just enough diesel generator power to light one CFL bulb for Rs.100 per month. A shopkeeper at Mansahi in Katihar, Bihar, said he pays Rs.60 per month for one CFL bulb for 3 just hours of light every night! Our ground studies in Jharkhand and Odisha reveal similar realities.



Source: India Census Data 2011

Most of India's rural economy revolves around agriculture. However, most farming activities are focused on growing food, which often does not fetch sufficient earnings. Little effort has been made to implement post-harvest processing of crops, and to create appropriate storage facilities to increase the life and value of rural agricultural produce. Establishing local micro-enterprises in rural areas is imperative to improve the socio-economic status of the rural populace, and lead to 'Gram Swaraj'.

Access to energy plays a key role, not only in promoting rural development but also in enabling employment and education. A 2010 study[3] by the World Energy Council confirms that “energy poverty is the main reason for rural poverty which in turn gives rise to health issues” and “restricts the income level and industrial and commercial activity leading to economic stagnation or slow growth.” The socioeconomic development of rural India thus revolves around the nexus of Education, Employment and Energy, and achieving these three goals will lead to Empowerment of the community. Access to energy is the crucial element in this strategy as it enables both employment and education. For a secure energy future, India must intensify energy security at an accelerated pace for the rural masses. The efforts made over the past decade have not yielded the desired results, leaving rural India aspiring and hungry for power! The question is how can this huge latent demand be met?

Source: SunMoksha Power Pvt. Ltd.

Increasing Energy Access to Achieve Security

The obvious option is to expand grid-electrification to villages. The pace of grid-electrification in India has increased manifold since the launch of the Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY[4]) scheme in 2005 by the Ministry of Power. As of April 2012, about 93.8% villages are electrified leaving some 36,700 villages un-electrified out of a total of 593,700 villages. However, electricity generation has not kept pace with increased grid-access under RGGVY, whereas demand has been increasing rapidly. The Load Generation Balance Reports[5,6] by the Central Electricity Authority (CEA) of India, shows that the gap in average supply and demand varied from 8 to 11% between 2007 and 2012, while the gap during peak demand varied from 9 to 18%. There has been a general decrease in the deficit, but there is still a long way to go. However, grid expansion raises several other issues and challenges. The grid incurs 30-40% transmission and distribution (T&D) losses and requires massive investments. Moreover, due to the generation deficit, almost 45% of the grid stays un-energized and idle almost 80% of the time. This is a colossal waste of investment. Furthermore, even if there is impetus on large-scale power generation, rural areas remain the last priority, except in the case of irrigation.

Over the past decade, several attempts have been, and are still being made to address the energy

deficit and improve energy access by the poor and rural populace. In this context, decentralized renewable energy technologies are playing a significant role, as summarized in a recent article[i7]. Rural micro-grids with renewable power generation have gained popularity over the past few years. For socio-economic development, the creation of jobs and micro-enterprises are paramount and this calls for electrical power and thermal energy. Micro-grids are the best option to supply electrical power for these economic activities, and decentralized renewable energy is ideal for power generation and for thermal applications. Several solutions have been and are being implemented to make the micro-grid model succeed in the rural hinterland. However, these solutions have been unable to achieve scale, due to several challenges:

Micro-Grids for Rural Electrification: Issues and Challenges

1. *Focus on supply not demand management:* The traditional approach is to generate power to meet the peak demand, whereas normal demand keeps changing throughout the day, and shifting over the seasons. Generation is geared towards providing power to the customers as per *their* demand and schedule. Very little consideration has been given to energy efficiency of the end appliances to manage demand. All this results in overdesign, lower efficiency, and lower plant load factor.
2. *Single-source power generation:* Most efforts are focused on supplying power through a single source of renewable energy. This has resulted not only in limited scope to meet all types of demands, but also limited scalability.
3. *Operational issues:* The operational cost of collecting fees for electricity supplied to customers and issues of non-payment are also high due to manual operations and collection methods.
4. *Field support and skill gap:* Difficulties are faced in getting skilled personnel and transferring the technology nuances to rural personnel. The need for hand-holding of local personnel has hindered scaling.
5. *Inadequate business models and lack of access to finance:* Lack of appropriate business models and access to finance to make these decentralized solutions self-sustaining and scalable has been an impediment.

A Holistic Solution: *NanoPower*

The SunMoksha[8] company has invested years of effort to understand the challenges of energy access and develop solutions to meet these challenges. It has focused particularly on issues hindering the scaling of micro-grid solutions. *SunMoksha* has adopted the 'systems' approach to energy access in rural areas for socio-economic development, instead of the piecemeal component approach followed by several other players. It has developed and patented[9] a holistic solution, *NanoPower,* to address these challenges. The word "*Nano*" signifies small, modular, and affordable for the masses. *NanoPower* provides sustainable and scalable energy solutions through seven key innovative interventions:

1. IT-based automated remote monitoring, management and maintenance of the micro-grid operations and demand-supply management (*NanoSoft Remote)* over cloud server and mobile devices such as tablets and smartphones (*NanoMobile*);

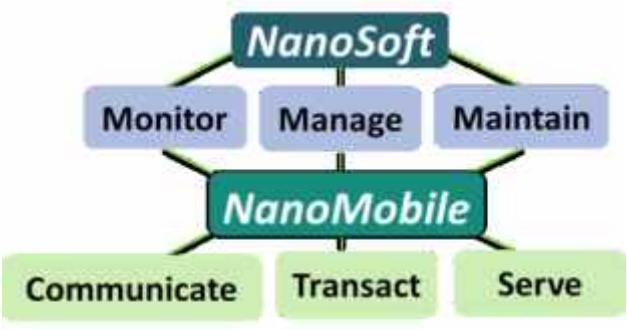
2. Dynamic balancing of integrated hybrid renewable power generation (*NanoGen*) including solar, wind, bio and hydro sources and varying energy efficient demand loads (*NanoAppliance*) in a closed mini/micro-grid system (*NanoGreenGrid*);
3. Customer interface for all energy services over mobile devices such as tablets and phones (*NanoMobile*);
4. Utilization of existing grid infrastructure, where available, to improve efficiency and reduce cost (*NanoGreenGrid*);
5. Innovative energy business models, access to finance and close partnerships with grassroots organizations for scalable and sustainable operations and socio-economic development (*NanoBiz*);
6. Integrated partnership with technical, vocational, and business institutions to develop skill sets and entrepreneurial capacity (*NanoSkills*) for socio-economic development;
7. Development and testing of solutions at a living laboratory within an academic institution to leverage research and training (*NanoLivingLab*).

Key technical interventions

NanoSoft Remote and *NanoMobile* form the brain and veins of the system and utilize state-of-the-art telecommunication, information and mobile technologies, communicating over Ethernet, WiFi, GPRS, ZigBee, and integrating SCADA, GIS, SGIP and WSN protocols for universal compatibility and security. *NanoSoft Remote* monitors, manages and maintains the micro-grid and its components.

- It actively schedules and controls the demand to meet supply constraints in a decentralized micro-grid.
- It makes data available to experts in real time for a timely intervention, in case of failures or malfunctions, thus bridging the skill gaps. It disseminates expert knowledge through digital libraries to remote local personnel, as well as brings the villages in touch with experts who are not physically present.
- It includes a complete software package to manage the entire operations of a micro-grid: generation, distribution, delivery, collection and control. Personnel and clients also receive training and education through *NanoSoft Remote*.

NanoMobile is the main interface between *NanoSoft*, the customer & field operators – through mobile tablets and phones. It performs three major functions: communication, transactions and service delivery. It also serves as a training device for the operators & entrepreneurs and educational services for the farmers, women and children.



Source: SunMoksha Power Pvt. Ltd

Key social interventions

Creating viable business models, understanding consumer behaviour, access to finance and creating a skilled workforce are the keys to scaling energy solutions. *NanoBiz* develops business models based on the creation of micro-enterprises not only to sell electricity to village consumers, but also to move the villagers up the agricultural value chain by creating micro-enterprises addressing post-harvest processes and trades.

- SunMoksha provides value-added technology services, business partnership and access to finance to these microenterprises to improve their socio-economic status.
- *NanoBiz* develops diverse micro-enterprises in the villages not only to make them self-sufficient, but also to stimulate local economic growth and move the villagers up the economic value chain.

NanoSkills creates a skilled workforce through a holistic ecosystem to address gaps in skill-sets, enabled by *NanoSoft* and *NanoMobile.* Its institute partner and incubator, the National Institute of Science and Technology (NIST[10]), provides the physical infrastructure for training engineers as well as technicians and entrepreneurs for rural energy and other micro-enterprises. In a worldwide first-of-its-kind endeavour, *NIST* is uniquely incubating *SunMoksha,* not only to emulate the entire village on the campus in a "living laboratory," *NanoLabs*, but also to help develop and test *NanoPower*. *NanoSoft/NanoMobile* is the virtual training media. *NanoSkills* also helps to create entrepreneurs who can implement viable business models (*NanoBiz*) for scaling *NanoPower* solutions, with technology and finance as supporting pillars.

Source: SunMoksha Power Pvt. Ltd.

Ecosystem for Rural Electrification and Socioeconomic Development

SunMoksha has thus sought to address the challenges of rural electrification and social development by creating an *ecosystem* encompassing all key components of technology, business, skills and social development. The solutions have been developed by engineers from villages in Odisha, Jharkhand and Bihar, for the villagers and their development. *NanoPower* has been developed not only to implement model smart villages by SunMoksha, but is also available to anyone interested in implementing such projects in villages.

Notes

1 IEA World Energy Outlook, 2011. http://www.worldenergyoutlook.org/publications/weo-2011/

2 India Census Data 2011. http://www.censusindia.gov.in/2011census/hlo/HLO_Tables.html

3 Energy Access through Rural Electrification and Renewable Energy, A report by World Energy Council's Indian Member Committee (WEC_IMC), APRIL 2010.

4 Rajeev Gandhi Vidyutikaran Yojna, RGGVY, http://rggvy.gov.in/rggvy/rggvyportal/index.html

5 Load Generation Balance Reports, Government of India, Ministry of Power, Central Electricity Authority. http://www.nrpc.gov.in/reports/lgbr.html

6 Power Shortages in India's Southern Region: Challenges for Growth, S Narayan, ISAS Insights No. 168 – 13 June 2012. http://www.isas.nus.edu.sg

7 Tamaso Maa Jyotirgamaya – Energizing Rural India, Ashok K. Das, SunMoksha, October 2012. http://www.sunmoksha.com/publication_ashok.html

8 SunMoksha Power Pvt. Ltd., Bangalore, India. http://www.sunmoksha.com/rural.html

9 SunMoksha Provisional Patent Application: Method and system for building smart micro/macro/nanogreengrid for generation, transmission and distribution of electricity and other energy forms with zero emission.

10 National Institute of Science and Technology, http://www.nist.edu

Dr Ashok K. Das

Dr. Ashok K. Das is the founder CEO of SunMoksha, a Clean Technology Solutions company. Das has over 22 years of experience in semiconductor equipment and clean energy that includes solar PV, solar thermal, bio-energy, waste-to-energy, smart grids and energy efficiency. He has extensive experience in decentralized rural electrification and has developed a complete technology-cum-business solution that includes automation for operations, remote monitoring, controls and demand-supply management. His consulting expertise includes technology & business solutions, market research, feasibility studies, and advisory services to micro, small & medium enterprises (MSMEs). He has offered consultations to several national and international organizations such as the World Bank, the Department for International Development, UK (UK-DFID), the German Development Bank (KfW), Asian Development Bank (ADB), Small Industries Development Bank of India (SIDBI), CII-Sohrabji Godrej Green Business Centre (CII-GBC), and USAID/CTI sponsored Private Financing Advisory Network. As founding-chair of The Indus Entrepreneurs Clean Tech Special Interest Group (TiE Clean Tech SIG), he is also very active in developing the entrepreneurial ecosystem for clean technologies across India. Prior to founding SunMoksha, Das worked for semiconductor equipment manufacturer Applied Materials in California, and later headed the India Operations of a fab automation start-up Aquest Systems. Prior to Applied Materials, he worked at Manufacturing & Technology Corporation Inc. (MTCI) on technology development to convert waste to energy. Das holds a B.Tech. degree from the Indian Institute of Technology (IIT), Kanpur and a Ph.D. from the University of Southern California, Los Angeles. (e-mail: info@sunmoksha.com).