Emerging Energy Challenges in the Indian Navy and Response Strategies
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Introduction

The Indian Navy (IN) is completely dependent on petroleum products for operation of its ships, submarines and aircraft which has resulted in an ever increasing energy bill for the IN. Extensive use of energy, directly, by combustion of fuel in ships and indirectly, by use of electricity in dockyards also leads to Green House Gas (GHG) emissions, causing irreversible environmental damage. Diminishing global fossil fuel reserves, sustained increase in the real price of oil along with its accompanying volatility, and India's increased oil import dependency is of critical concern to India. In 1990, India imported only 37 per cent of its oil demand. However, oil imports were expected to reach 2.7 million barrel/day (mb/d) or 75 per cent of demand in 2012, and 6.8 md/d or 92 per cent in 2035.1 But the strategically most significant impact of this excessive dependence on oil is the lack of suitable energy alternatives, in the immediate future for the IN. Coupled with this is the long lead time necessary for the introduction and adoption of new technologies, which makes the emerging energy challenges, a major cause of concern for the IN.

Aim

The aim of this paper is to identify the emerging energy and environmental challenges for the IN as also to highlight IN's recent bid to adopt 'Green Initiatives' with a view to chart the response strategies in order to overcome the emerging challenges.

Emerging Energy Challenges

There are three major emerging energy challenges for the IN:–

(a) The burden of increasing energy expenditure;

(b) The environmental aspects of unrestricted energy usage and;

(c) The growing risk associated with fossil fuel dependence.

The Burden of Increasing Energy Expenditure

Table 1 shows the break-up of the Indian Navy's revenue budget into expenditure on stores and under other revenue subheads which includes works, pay and allowances, transport, refit and other miscellaneous expenses. The naval stores budget which accounts for procurement of various spares, new machinery and fuel has grown from INR 2,967 crores in 2008-09 to an estimated INR 4,527 crores in 2013-14.

Table 1 : Break-up of Revenue Budget2

Year	Total	Stores (INR Crores)	All others
2008-09	7949	2967	4982
2009-10	9587	2957	6630
2010-11	10145	3437	6708
2011-12*	12146	4251	7894
2012-13*	12548	4391	8156
2013-14*	12934	4527	8407

*** Breakup for these years are estimates3**

A detailed analysis of the IN's stores budget (after segregating the amount spent on fuel and other spares) reveals that the expenditure on fuel for the IN is increasing at a rapid pace. This increase can be explained as follows. The expenditure on fuel is a function of the quantity of the fuel consumed and the price of fuel. Assuming that the total quantity of fuel consumed by the IN remains the same over the years, the total expenditure will still continue to increase due to increase in international price of crude oil. The increase in the market price4 of diesel is shown in real and nominal terms (indexed to 01 Apr 2007) in Figure 1.

Figure 1 : Real and Nominal Price of Diesel 5

The real price of diesel shows an approximate increase of 22 per cent from 01 Apr 2008 to 01 Apr 2013. As this price increase is in real terms (over and above the inflation rate), rising crude oil prices leads to an increase in the

share of expenditure on fuel, as a percentage of stores.

This increasing fuel expenditure is placing an additional stress on the already stretched revenue budget for the IN. Further, the percentage expended on energy is likely to increase in the coming years due to additional number of operational platforms (including INS Vikramaditya) and likely increase in their deployment. Hence, it is evident that energy expenditure as a percentage of stores are bound to rise further, leaving lesser room for the procurement of other store items such as critical machinery spares.

The Environmental Aspects of Unrestricted Energy Usage

Environmental Sustainability is gaining significant attention and is becoming increasingly relevant in today's world. Apart from actual burning of fuel which emits Green House Gases (GHG), inadequate measures for controlling emissions and unsafe disposal of used by-products of fuel also increases the environmental footprint of ships. Apart from emissions from direct burning of fuel onboard ships, emissions from burning of fossil fuels (for conversion to electricity) will also have to be accounted for by the IN.

In order to lower the environmental footprint of shipping, efforts have been made in the commercial shipping industry. International Maritime Organisation (IMO), on 15 July 2011, adopted a new chapter to MARPOL Annexure VI (Chapter 4, Regulations on energy efficiency of ships) which is aimed at improving the energy efficiency and reducing GHG from international shipping. These measures, which have been enforced from 01 January 2013, are now mandatory and comprise Energy Efficiency Design Index (EEDI) (which is applicable to new ships) and the Ship Energy Efficiency Management Plan (SEEMP) (which is applicable to all ships). It is expected that implementing EEDI will continuously improve the energy efficiency of a ship, thereby reducing oil consumption and achieving lower CO2 emissions. On the other hand, the SEEMP which is a management tool will assist the crew in managing and thereby lowering the energy consumption onboard ships.

While these guidelines may not be applicable to naval ships by law, implementation of measures similar to EEDI and SEEMP will definitely benefit the IN by reducing the energy consumption and emissions, in the long term. However, the challenge is to implement these measures onboard naval ships in the face of stringent performance criteria. The limited technical expertise in this area, a general lack of understanding of the need for making design changes, and the unavailability of equipment which meet the technical specifications is a major hurdle in attaining this goal. Lowering the environmental impact of ships at sea and at harbour, without lowering the operational readiness of the IN, therefore presents a significant challenge to the IN.

The Growing Risk Associated with Fossil Fuel Dependence

The expenditure on fuel for the IN is budgeted in the beginning of the year based on the current price of fuel and the approximate number of platforms which are available in the year. Based on this budgeting, operational deployments are planned and executed. While, a small deviation in expenditure is acceptable, a large variation in energy expenditure has been observed in the past few years, which impact the entire budgeting and planning process. In such a case it is evident that the IN has to absorb the increase in the expenditure, internally, either through reallocation of funds amongst various revenue sub-heads or has to cut down the sailing of ships to stay within the allotted budget. This financial risk due to the fluctuations in the price of oil supplied to the IN would continue to impact the budgeting and hence is detrimental to the operational planning process in the IN.

Currently, the IN is 100 per cent dependent on refined petroleum products for its platforms such as ships, naval aircraft and submarines. Hence, the IN is extremely vulnerable to the uncertainties and disruptions in oil supply and distribution chain. Hence, IN will have no option but to restrict the usage of its entire fleet in case of an oil crisis. This scenario is a threat to the operational efficiency of the IN and makes it vulnerable to supply side shocks.

The IN is completely dependent on public sector and state owned companies for supply of petroleum products and electricity respectively and there are no fall back options (except for a limited power back- up on batteries and diesel based generators) in case of physical failures in the energy distribution chain which may have serious consequences for the IN. Further, the entire Command, Control, Computers, Communications, Intelligence, Surveillance and Reconnaissance (C4ISR) backbone and repair infrastructure in naval dockyards is totally dependent on the civilian electricity grid as a primary source of electricity and is therefore susceptible to physical and cyber attacks, natural disasters and malfunction.

In the face of the evolving energy scenario, energy experts conclude that there is no immediate solution to the growing energy problems and the only rational way out is to reduce the energy consumption, diversify the fuel mix, develop alternate technologies for harnessing renewable sources of energy and undertaking a conscious shift in energy policy to reduce dependence on fossil fuels.

Indian Navy's Bid to Adopt 'Green Initiatives'

In order to address the emerging energy and environment challenges, the IN has announced a slew of green initiatives6 on the eve of World Environment Day, which was celebrated on

05 June 2014. These initiatives stressed on the need to implement various measures for protecting the environment in various functional domains of the IN. The four domains7 across which these initiatives will be implemented are operations, administration, maintenance and infrastructure and community living. Exhaustive guidelines in the form of an 'Energy Conservation Roadmap'8 have been drawn up to implement the initiatives and various units and formations of the IN have been directed by the Naval Head Quarters to closely monitor the progress.

Following directives have been issued under the green initiatives:–

(a) Measuring energy consumption level;

(b) Incorporating energy efficiency from ab-initio stages in all future acquisition and infrastructure projects;

(c) Identifying Key Result Areas for infrastructure and community living projects such as green buildings, waste recycling, water conservation and harnessing of renewable energy;

(d) Conducting awareness drives and programmes on energy conservation and environment protection.

While the initiatives were adopted as 'green initiatives', the intention is clearly to address environmental as well as energy challenges. Hence IN has rightly linked the environmental concerns with the root cause of the problem, which is excessive and suboptimal energy usage and proposes to tackle both issues together. This is also evident in the press release9 which stated, "there is a compelling need to optimally utilise energy resources while ensuring that each rupee is stretched to the maximum". While IN's bid to adopt green initiatives is extremely laudable and deserves all appreciation, the issue deserves a deeper analysis.

Response Strategies

Energy Conservation, Energy Efficiency and Renewable Energy (RE) are a triad, which can support the transition to a green IN. While Energy Conservation can be implemented by behavioural and managerial changes, Energy Efficiency is the cheapest, fastest and the surest way to address energy and environmental concerns. Increasing generation of RE at various distributed locations and integrating it with the electricity grid in the regions endowed with alternative energy resources is also a viable solution. This idea has also gained traction due to the falling costs of solar power, which has led to an exponential increase in the installed capacity of solar PV plants in the last couple of years. The above three aspects can, therefore, be applied in various domains in the IN, according to the degree of ease of implementation and availability of technical expertise after carrying out a cost-benefit analysis.

'We cannot reduce what we cannot measure'. Hence the first step towards reducing energy use is to measure energy consumption. This aspect has received specific attention in the present proposal, and a framework to measure energy consumption levels has been initiated, based on which future energy reduction goals would be identified. Although measuring energy use in various facets of operations in the IN is a time-consuming task, which is cost intensive, recording energy usage over time is essential to benchmark energy consumption. This is more so as most of the operations in the IN are tailor-made and do not have one to one correspondence in the commercial industry. Notwithstanding the initial hurdles, once the right technology is in place to monitor energy consumption, the task of recording energy use becomes automatic and yields a large amount of data, which can be analysed both online and offline for implementing an energy management programme effectively.

Energy efficiency, which is driven by advances in technology, is also called as the fifth fuel after coal, oil, natural gas and renewable energy. Energy efficiency is, therefore, the cornerstone of any energy reduction programme. Energy efficiency can be achieved onboard ships by hydrodynamic ship design, incorporating energy efficiency in the design of main propulsion system, selecting optimal sized engines/generators and efficient auxiliary systems such as air conditioning /refrigeration systems onboard ships. In fact, energy efficiency standards are now mandatory in commercial shipping which includes adoption of EEDI (which is applicable to new ships) and the SEEMP (applicable to all ships). Both these measures have been enforced from 01 January 2013.

There will also be the 'easy to implement measures' such as use of energy efficient lighting, installation of automatic power factor correctors, managing peak loads in industrial establishments etc which can be implemented at low cost without much effort. These measures need to be adopted first, as they have short payback time and will reap rich dividends over their entire lifetime. Success in these programmes will also help in streamlining the administrative processes and will impart momentum to implement the remainder of the programme.

Way Ahead

Cost savings, increasing the strategic reach of sea-going platforms (as opposed to mid-sea refuelling), increased operational efficiency, demonstrating environmental stewardship, and developing a robust and resilient energy architecture are a few benefits that will accrue to the IN by adopting the 'Green Initiatives'. While the framework is in place, a lot depends on how effectively these steps will be implemented in the near term. Although energy accounting and accurate monitoring is the key to the success of the programme, capacity building and allocation of financial resources from the existing budget of the IN remains a key challenge, which needs to be addressed for demonstrating long term commitment to the programme.

Though a beginning has been made, the next logical step for the IN is to adopt an integrated energy policy. Such a policy should integrate energy management with demand side reduction with energy efficiency as the cornerstone of the policy. An integrated energy policy will also provide an overarching framework under which, various interrelated energy and environmental issues can be addressed in the future.

Conclusion

Energy is a precious commodity and a key enabler of military combat power, which should, therefore, be considered a strategic resource10 by the IN. Hence, it is crucial that the risks associated with energy supply disruption should be mitigated by strengthening the energy supply chains and effectively managing the demand of energy. While IN's bid to adopt green initiatives is laudable and deserves appreciation, much more needs to be done to fast track the implementation of these steps which will go a long way in overcoming the energy and environment challenges for the IN. Adopting the 'Green Initiatives' is, therefore, a landmark step which clearly demonstrates that the IN is preparing to tackle energy and environmental challenges head-on, and is on the right path to transition into a navy that is energy conscious and environmentally responsible.

Endnotes

1. International Energy Agency (IEA), Understanding Energy Challenges in India, IEA, Paris, 2012, pp. 62.

2. Budget spending and its detailed breakup over the past few years have been reconstructed from the following reports:

DR Mohanty, Defence Spending Trends in India, 2013 available at http://orfonline.org/cms/export/orfonline/modules/analysis/attachments/defence_1333106028570.pdf

Cowshish A, India's Defence Budget 2013-14, available at http://www.indiastrategic.in/index.htm

Joshi S, Defence Budget 2013,available at http://www.stratpost.com/graphic-defense-budget-2013

Behera LK, India's Defence Budget 2013-14: A Bumpy Road Ahead, available at http://www.idsa.in/idsacomments/IndiasDefenceBudget2013-14_lkbehera_040313

Standing Committee on Defence (2011-2012), Ministry Of Defence, Lok Sabha Secretariat, Demands For Grants (2012-2013), Fifteenth Report, 2012, New Delhi

3. As the detailed breakup of the expenditure under the various sub-heads for the FY 2011-12 to FY 2013-14 was not available, a figure of 35% (in line with earlier trends) has been used for projecting the estimates of expenditure under the stores sub-head for FY 2011-12 to FY 2013-14.

4. Diesel price is taken as a proxy for price of fuel which is used in the IN and market price of diesel is taken as on 01 Apr of the respective year in Delhi.

5. Price of diesel available at http://www.mypetrolprice.com/diesel-price-chart.aspx GDP deflator available at, World Bank Data, http://data.worldbank.org/indicator/NY.GDP.DEFL.KD.ZG

6. IANS, Indian Navy embarks on 'green initiatives' , June 4, 2014, http://www.business-standard.com/article/news-ians/indian-navy-embarks-on-green-initiatives-114060401736_1.html

7. Economic Times, Navy to take steps to cut its carbon footprint, 05 June 2014, http://economictimes.indiatimes.com/environment/global-warming/Navy-to-take-steps-to-cut-its-carbon-footprint/articleshow/36083657.cms

8. Zee News, Going green, Indian Navy adopts energy conservation measures, 04 June 2014, http://zeenews.india.com/news/nation/going-green-indian-navy-adopts-energy-conservation-measures_937242.html

9. Press Information Bureau, Government of India, Ministry of Defence, Green Footprint of A Blue Water Navy, 04 June 2014, http://pib.nic.in/newsite/PrintRelease.aspx?relid=105422

10. Kapil Narula, Energy Strategy for the Indian Navy: Need, Scope and a Roadmap, Strategic Analysis, 2013, Vol. 37, No. 3, 310–321.

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