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The Eightfold Path to India's Nuclear Fuel Supply Security[1]

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EXECUTIVE SUMMARY

This document presents eight principles to help India secure its nuclear energy infrastructure. The eightfold path outlined below will allow India to exploit the nuclear option to achieve its goal of energy security.

1. **Invest in diversity across the board**
   Be agnostic to any source of affordable energy in the short term.
2. **Trade with suppliers, buy from trading partners**
   Diversify trade relations with existing suppliers and/or substitute them with countries that already have significant trade relations with India.
3. **Purchase preferably from competitive markets**
   Manage political risks by purchasing fuel supplies in all processing stages, from markets which have multiple players.
4. **Make markets more competitive if they are not**
   Work with cartels like Nuclear Suppliers Group (NSG) if the opportunity costs are manageable. If not, dismantle them.
5. **Fuel is fungible, so use it wisely**
   Use price sensitivity as a purchasing principle.
6. **Share the risks between plant communities and user communities**
   Price and distribute the risks of plant communities.
7. **Secure supply routes**
   Factor in the sea/land route availability and safety.
8. **Invest in domestic industry**
   Hedge against the prospect of trade restrictions or transport disruptions affecting its supply security by investing in a domestic industry.

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[1] This document reflects the views presented by Nitin Pai at the International Conference on Energy Security Challenges 2014 organised by the Centre for Public Policy Research, Kochi.

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BACKGROUND

Energy security is a critical determinant of India's growth story. The Union government's attempts to resuscitate India's growth narrative will be accompanied by rising energy demand. This rise will be manifested in the form of an increased demand for electricity consumption. India's per capita electricity consumption is one of the lowest among the developing countries. An economically resurgent India will aim to reduce this deficit in electricity consumption. Higher electricity consumption will improve lives at the individual, household and commercial levels by enabling better connectivity, efficiency, productivity and equity. Just as broadband internet has become an indispensable part of the urban middle class in India, the supply of 24x7 electricity will soon become a sine qua non for a dignified life anywhere in India.

Ensuring this dream of "uninterruptible availability of energy sources at an affordable price" is known as energy security[3] by the International Energy Agency (IEA). This search for a reliable, affordable and accessible mode of energy led Indian policymakers to invest in nuclear power for civilian use as early as the 1960s. However, the Non-Proliferation Treaty (NPT), which came into force in 1970, isolated India from obtaining overseas fuel and technological assistance. As a result, the Department of Atomic Energy (DAE) had to develop an independent nuclear fuel cycle. Despite operating under such constraints, India has done exceedingly well in becoming the 13th largest nation in terms of nuclear capacity in the world. In absolute terms however, India has been able to add only 5780 MW[4], which is a mere 3.5% of India's total electricity generation. The indigenous nuclear power industry also suffered as a result of global fear mongering in the aftermath of the nuclear emergency in Three Mile Island in the United States and the disaster at Chernobyl in the Soviet Union.

There has been a renewed interest in nuclear power in the last decade, prompted by the projected shortage of fossil fuels, coupled with environmental concerns. Uranium, the primary nuclear fuel, can be sourced from various countries (both geographically and politically diverse), which gives it a very high rating in terms of energy security. It also comprises a very small part of the cost of power generation, so is a more affordable fuel to stockpile than fossil fuels[5]. The 1991 economic reforms also helped to underscore the need for upgrading India's energy infrastructure. After the US-India nuclear deal in 2005, the Indian civilian nuclear

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[3] "What is Energy Security?", International Energy Agency goo.gl/t9KxGR

[4] "India ranks 13th in terms of electricity generation from nuclear source", Press Information Bureau, Government of India, 30th April 2015 goo.gl/uujFXK

[5] "Energy Security", World Nuclear Association, April 2014 goo.gl/inTqN4

sector is no longer closed to foreign investment nor is the Indian scientific establishment locked in by international sanctions. This positive turn of events presents a strategic opportunity for India, not only to expand the scope of nuclear energy to boost its energy security, but also for Indian companies to become international players in this sector.

With this vision of utilising nuclear power as a significant pathway towards energy security, this paper focuses on what India can do to secure the vital supplies for its nuclear energy infrastructure. An eightfold path is outlined below for achieving supply security of nuclear fuel, which in turn can substantially boost the contribution of nuclear power to India's energy mix.

THE EIGHTFOLD PATH

The eightfold path presents eight principles to help India secure its nuclear energy infrastructure. These eight guidelines will allow India to exploit the nuclear option to achieve its goal of energy security.

0. National energy supply risk assessment and management framework

There are geopolitical, economic and availability implications for any country relying on energy imports. The 'oil shocks' of the early 1970s showed that fuel supplies from international sources could not be taken for granted[6]. Hence the primary rule for securing energy supplies of any kind is the formation of an energy supply risk assessment and management framework. This is especially crucial for India which imports a significant portion of its net energy requirements. Domestically, the supply of coal, India's primary energy contributor[7], has been crippled due to an unclear policy on coal mining thereby raising the risks of inadequate energy supply. Thus, a framework which assesses and then manages the risks from each of the fuel sources is imperative for energy security. This framework will build redundancy in the overall energy supply chain so that perceptible risks can be managed without any significant impact on energy availability.

1. Invest in diversity across the board

An essential feature of energy risk management framework is to acquire different fuel types from varied suppliers through different routes. The diversity in fuel sources is needed both at the macro and micro levels. At a macro-level, India should be agnostic to any source of affordable energy in the short term, whether

[6] Ibid.

[7] 54.5% of 595 Mtoe in 2013 — "Statistical review of world energy 2014 workbook", BP goo.gl/zmitzm

coal, natural gas, oil, nuclear or renewable energy. This is because fuel is so crucial to its economic growth revival that the country cannot afford to pick and choose its energy sources. At the micro nuclear power level, India should be ready to develop capabilities for handling different nuclear fuels regardless of its past experience and expertise. For example, India should utilise domestically available low-grade uranium along with imported enriched uranium even while targeting self-sufficiency through the use of abundantly available thorium reserves. This diversity leads to a loss in the economies of scale, but that is the price India must be willing to pay for energy security. An advantage stemming from this diversity is that operating and integrating diverse systems gives our talent pool a competitive advantage akin to the expertise developed by the Indian Air Force (IAF) and Information Technology (IT) fields from their continued exposure to a variety of platforms.

2. Trade with suppliers, buy from trading partners

To increase its nuclear capacity rapidly, India will have to engage with other countries extensively. This process of bilateral nuclear cooperation received a major boost after the Nuclear Suppliers Group (NSG) agreement of 2008 ended India's pariah status, opening up trade in fuel and reactors. Thereafter, civil nuclear cooperation agreements have been signed with the United States, Russia, France, United Kingdom, South Korea, Czech Republic and Canada, as well as Argentina, Kazakhstan, Mongolia and Namibia. On the basis of the 2010 cooperation agreement with Canada, a bilateral safeguards agreement was signed in April 2013 between the Department of Atomic Energy (DAE) and the Canadian Nuclear Safety Commission (CNSC), allowing trade in nuclear materials and technology for facilities that are under IAEA safeguards. A similar bilateral agreement with Australia was signed in 2014. Both apply essentially to uranium supply[8]. Given these new possibilities for engagement, there are broadly two principles for securing India's nuclear fuel infrastructure from other nation-states:

- India can seek to diversify its trade in multiple sectors with countries that are providers of reactors, fuel or other allied infrastructure. This will ensure that India has appropriate levers to hedge against changing geopolitical equations with the supplier nation.
- India can seek to buy nuclear fuel and reactors largely from its existing trading partners. This is because countries having robust economic relations with India are less likely to block supplies.

[8] "Nuclear Power in India", World Nuclear Association, May 2015 goo.gl/jUehaQ

3. Purchase from open and competitive markets

Instead of buying through closed bilateral deals, India should obtain nuclear fuel from the open market. This gives the country strategic autonomy as it factors in political risk in the total cost. Being tied down by bilateral commitments gives the suppliers an undue advantage.

4. Make markets more competitive if they aren't

The DAE has managed to hold its own in the face of a hostile international sanctions regime, but has suffered from the limitation of having only one investor —the Union government. Even at the best of times, public funds for atomic energy R&D and production come at high opportunity costs for a welfare state like India. Despite this practical limitation, the Atomic Energy Act of 1962 prevents private sector investment in nuclear power generation. India should allow markets to operate freely so that the DAE is able to tap investments from outside the government. Security-related threats can be managed by tight safeguards instead of banning private players from this sector altogether.

A similar problem persists with exploiting domestic uranium reserves. Opponents of uranium mining fall into two camps: those opposed to nuclear power, nuclear weapons and mining in general, and those who argue that mines and processing plants must be adequately safeguarded. Attempting to convince those in the first camp is a fruitless exercise. However, it is important to address the concerns of the second camp under whose practical objections the anti-nuclear lobby has long masked its own ideological arguments. Under existing laws, the government is not obliged to pay adequate compensation to land-owners sitting on reserves of uranium ore. Hence, they not only lack incentives to permit mining on their lands, but faced with the state's power to nationalise their property, are likely to find anti-nuclear political agitation a useful tool to protect their interests.

5. Use domestic fuel prudently

Although India has reserves of uranium ore, it is not necessarily the cheapest. Most of the limited uranium available in India is low-grade. Since fuel is fungible, it makes sense to use this scarce resource for India's nuclear weapons programme, while using the imported uranium for energy needs.

Similarly, the country should not bind its nuclear power future to thorium alone. Though abundantly available in India, putting thorium into operation as a nuclear power fuel has very high opportunity costs.

6. Share risks between plant and user communities

Given India's democratic setting, opposition from resident communities in the vicinity of nuclear power plants is a major challenge. Often, the Fukushima Daiichi nuclear accident is cited as an illustration of the dangers posed by nuclear plants, even though not a single casualty has been recorded as a result of radiation exposure.

One way to manage the risk to communities is to design a public health insurance scheme with a co-payment model. This will help to price the risk appropriately. The government could allow states and local communities to set a risk premium. Such an insurance scheme must be implemented, even while nuclear plants need to be designed to meet the highest safety and environmental standards.

7. Secure supply routes

The risk management framework for energy security must factor in the sea/land route availability and safety. India needs to ensure land routes, seaports and terminals that will allow fuel passage. There should be no scope for theft and proliferation during transit. Some of the crucial issues to be dealt with are: access to sufficient tankers, effective safeguard against theft & proliferation and providing commercial guarantees (based on the World Nuclear Association's 3-level proposal: supplier, government/IAEA; government stocks of Uranium).

8. Invest in the domestic industry

India would do well to hedge against the prospect of trade restrictions or transport disruptions affecting its supply security by investing in a domestic nuclear industry which can handle all verticals of nuclear power generation: from extraction of indigenous sources of uranium (and other fuels) to transforming uranium into reactor fuel. Such investment must boost innovation, talent, technology, prospecting, extraction and security. So little uranium is needed to produce a large amount of electricity that a few years supply can easily be stockpiled and nuclear fuel can thus be viewed effectively as an indigenous energy source. Uranium can very readily be stored long-term, and with only about 200 tonnes of natural uranium (or less than 30 tonnes of fabricated fuel) a 1000 MWe power plant can be operated for one full year[9].

As a multi-pronged strategy, this eightfold path can be instrumental in realising India's vision of becoming a world leader in nuclear technology and ensure that its potential growth trajectory is not impeded by energy insecurity.

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[9] "Energy Security", World Nuclear Association, April 2014 goo.gl/inTqN4