



Date : 04th March ' 2008

Kind Attn : Mr. Murali Deora
Minister Of Petroleum & Natural Gas
Government of India

cc : Mr. M S Srinivasan (Secretary , MOPNG)
Mr. K M Chandrasekhar (Cabinet Secretary)
Mr. P Chidambaram (Finance Minister)
Mr. Montek Singh Ahluwalia (Dy. Chairman , Planning Commission)

Sir,

Subject : Project Proposal for a Government of Indian Sponsored Public Private Partnership (PPP) Project in respect of the Crude Oil Strategic Storage Mega Project

Attached is the concept paper for the creation of a large underground crude oil strategic storage facility on the Indian west coast (Ideally near Mangalore) . The paper was published in the Indian Defence Review in Feb ' 2008.

The unique feature of this project is that while it provides market access insurance to oil exporters in the Persian Gulf, it will also result in the Government of India getting access to a large strategic crude oil reserve at almost Zero Cost. The design of this project therefore solves the critical problem of financing the construction of large storage facilities and the huge inventory in the reserve.

Conceptually, the plan is to provide a means for countries such as Saudi Arabia , Kuwait, Iran and the UAE to store their oil outside the Persian Gulf (In India), thereby allowing them to supply the global market even when the Straits of Hormuz are blocked due to conflict / war in the region.

This project will, in the main, remove the risk premium in oil price (\$ 12-15/ bbl) as the storage at **600 million barrels** is large enough to cap global oil price at \$ 60 / bbl. Since most energy alternatives become viable at an oil price > \$ 60 / Bbl , the project will help OPEC and GCC states to retain their long term market share in the energy business. It is therefore in the strategic interests of GCC states to take part in this project.

While the reserve itself will come at almost zero cost, the pipeline infrastructure that will connect the storage facility to all Indian refineries will have to be financed wholly by Indian companies under a specially structured taxation regime. The attached document goes into every detail of this project and is an example of the planning / thought process that goes into the design of specialized infrastructure projects.

Oil prices right now are irrationally high as the full effects of the US subprime crisis have not yet hit the commodity markets. The global equity markets have partly factored in a recession and commodity markets will do so with a lag of 3 – 4 months. In addition we can expect Republican compulsions in the matter of the US presidential election to take benchmark WTI crude south of **\$ 65 / Bbl** by June - July 2008 and keep it there till Nov - Dec 2008 till the American voters make their choices known.

While oil prices will fall by almost \$ 30 / Bbl as recession effects get factored in, we still have a situation in India where our total crude oil & product inventories would last us for just **23** days and **37** days respectively. This is an extremely alarming situation to be in especially since the Indian economy is targeting an **8 %** plus GDP growth rate.

Since the enclosed proposal solves the critical problem of financing a large reserve and has several other advantages as well, It will be very timely if your ministry initiates this project as a Government of India sponsored Public Private Partnership (PPP) Project. We need large projects like this not only in Energy but also Urban development, Education and Healthcare.

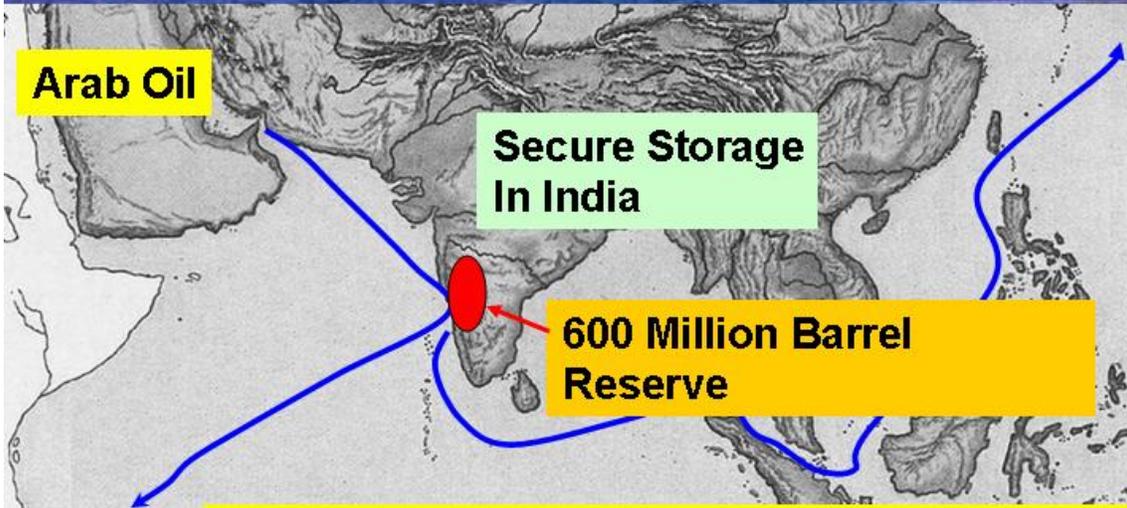
Thank you for your time.

Sincerely,



Ashish Puntambekar
Indian Citizen
Project Visualizer
(Energy , Urban development, Education & Healthcare)

Concepts In Collective Energy Security



Towards Indian Energy Security

1.1 Setting the right priorities

Talking about energy security has become a fashion. Every now and then there is a conference on the subject or someone writes a scholarly article. The flavour of the season could be “ equity oil ” (buying stakes in oilfields overseas) or it could be “ renewables ” such as Solar / Wind energy. Sometimes the discussion is about high oil prices (WTI crude just touched \$ 100 / Bbl) being a threat to our energy security. As far as conferences go , there usually is a big function , a nice lunch and then everyone goes home. The scholarly studies on their part present the reader with voluminous sets of data and they make detailed comparisons of various options. As the reader approaches the last page, however , he / she is usually left wondering whether there was anything worth implementing in what was just read. In that respect , this paper is very different ... hence the title “ Concrete Measures ”.

Achieving Energy security is a serious issue. It is projected that by 2020 India's dependence on imports will rise to 92 % from the 70 % levels we are at today. The Indian economy is therefore getting increasingly vulnerable to supply disruptions and this has serious implications on our sovereignty from a military and economic standpoint.

The only notable, large scale, policy initiative of the government that has led to tangible energy security is the **NELP** (New exploration & Licensing Policy). This initiative which was flagged off in 1997-98 has already yielded good results and has led to the discovery and development of large scale gas reserves on the east coast of India. The Reliance Industries promoted KG D6 project for instance will lead to nearly doubling of indigenous natural gas supplies in the country from 88 MMSCMD currently to almost 166 MMSCMD by mid 2008. More oil and natural gas discoveries by others are expected under the NELP and this will lead to enhanced energy security and a reduction in the energy intensity of the GDP. It is to be noted that NELP has succeeded because it was based on the principles of free markets which attracted investment.

The recent successes in discovering indigenous natural gas reserves however do not provide any security in the supply of critical transportation fuels and feedstock inputs to Indian refineries. There is therefore a very urgent need for a government promoted PPP (Public Private Partnership) project which encourages the private sector to work with government companies to deliver a large project that can guarantee National energy security. This will bring new ideas to bear on the issue and lead to the construction of the necessary secure infrastructure in the area of transportation fuels.

For the purposes of this paper , energy security has the conventional meaning which countries like the US , Japan, some within Europe and more recently China have adopted which aims to create a large buffer stock of not only crude oil (to feed refineries) but also petroleum products.

There has been a small move in the direction of strategic reserves , by the Government of India, which ,acting through the Oil Industry Development Board (OIIB) has set up “ The Indian Strategic Petroleum Reserves Limited (ISPRL) ” . ISPRL's initial mandate is to set up a strategic crude oil reserve of 5 Million metric Tonnes , equivalent to 19 days

of imports (basis demand in 2006–07) . The company has since proposed 3 different locations for the setting up of the reserves.

Sl. No.	Location	Capacity (Million Barrels)
1.	Mangalore (Karnataka)	10.95
2.	Visakhapatnam (Andhra Pradesh)	7.30
3.	Padur (Karnataka)	18.25
	Total	36.50

As this paper goes to press, The Ministry of Petroleum & Natural Gas, is all set to award the first contract to construct **2** underground oil storage caverns at Vizag. The site selected for the reserve has already received environmental clearance and land acquisition is almost complete. The site will store high and low sulphur crudes in a 70:30 ratio. This reserve however is smaller than those planned at Mangalore and Padur (which is 40 Km from Mangalore).

The government of India has so far approved a total investment of US \$ **2.85** Billion for the creation of the **36.5** Million barrel reserve which is expected to be built over the next 9 years. Annual operating costs for the programme are estimated to be US \$ **20** Million. The government has been planning the emergency reserve since the mid-1990s, but disputes over funding and ownership have hampered progress. So , in effect as the strategic oil storage available currently is zero , the only real buffer capacity that India has is the oil inventory that is maintained with the individual Indian refineries to support their normal operations.

Existing commercial storage available with oil companies in India

	Million Barrels	Import Basis (days)	Demand Basis (days)
Crude	54.75	34	23
Products	55.30	54	37
Total	110.05	88	60

Basic Data : 2004 -05 in Million Barrels

Source : ISPRL/ OIBD

1 Tonne Crude	: 7.3 Barrels
1 Tonne of Products	: 7.9 Barrels

As can be seen from the table above, India has just 23 days of crude oil inventories and 37 days of product stocks at any point in time. This is an extremely alarming situation to be in.

This paper will therefore examine the options that ensure the availability of crude oil and finished petroleum products to meet the needs of the country and its surface transport requirements in the event of the occurrence of any of the following :

1. An international event like the closure of the Suez canal (July 1956) or a 9 / 11 kind of event that disrupts markets
2. An export facility outage in a major supplier country or a closure of the Straits of Hormuz for any reason **or**
3. A large import terminal / port outage within India

To cater to the needs of India as dictated by the above possibilities, there is a need for conceptualizing and designing a project which ensures that a disruption on account of any of the above factors does not harm the growth prospects for the economy which is currently registering an **8 %** plus GDP growth rate. To be feasible, the solution must be based on current global energy industry realities, exporter country strategic needs and the unique needs of India given its current financial position and growth plans over the next 20-30 years.

1.2 The Answers ? Do we have any ?

Yes we do. A possible answer, as spelt out in this paper matches the opportunities in the global energy industry and the worlds economic surpluses among oil exporting countries with a need which is specific to India. In doing so it devises an innovative financial structure and a funding mechanism that while addressing market realities and the current geopolitical context generates a solution that meets the needs of all market participants in a unique way. Central to this solution is financing the storage facilities, pipelines and the massive crude oil inventories (valued at US \$ **36 Billion** @ at a crude oil price of \$ 60 / Bbl) in a manner that distributes ownership and risk in a fair and transparent manner.

1.3 Current Global Energy Market Realities

Commodity prices suddenly started shooting up towards the middle of 2003, driven in the main, by demand from China as that country moved to dramatically expand its economy. The patterns were seen first in metals like tin and zinc and in oil. It's a trend that has continued as demand from other countries including India and several in the middle east started picking up. This demand acceleration, has been accompanied by enhanced geopolitical risk in oil producing countries in the Persian Gulf and in countries such as Nigeria where production has dropped sharply due to ethnic conflict. High oil prices have also been driven by a weakening in the US dollar (which is the invoicing currency for a majority of production) and the actions of speculators in the financial markets who have been actively involved in playing the entire forward curve.

The massive increase in the price of oil (basis WTI) from \$ **31** / Bbl as an average for 2003 to \$ **100** / Bbl at the beginning of 2008 has resulted in huge surpluses in producing nations. The GCC countries alone have earned a windfall US \$ 600 Billion in 2006. Going by the fact that the Saudi government is able to balance its budget at an oil price of approximately US \$ 35 / Bbl, it is therefore quite believable that the GCC states have finished the year with a net investible surplus of US \$ **170** Billion in 2006 alone.

Since oil prices have been rising since 2002, the investible surplus has been accumulating at an increasing rate and is now looking for suitable destinations both within the middle east and in other geographies.

1.4 Exporters Paradox

Ever since Churchill, as First Lord of the Admiralty, took the crucial decision to switch all the ships of the Royal Navy to oil fired furnaces from coal which they were using, the middle east has been an area of conflict. Today , there are clear signs that the conflict will escalate as Iran seeks to develop its nuclear capability. This has given rise to legitimate fears that the Persian Gulf might be closed to shipping , every now and then , due to a possible blockage of the Straits of Hormuz due to a war in the region. This is a big worry for all countries and not just those in the Persian Gulf.

While the current high oil prices are good for the exporting countries concerned in the short term , they do however create long term problems of market share as other energy alternatives become viable at an oil price over US \$ 60 / Bbl. It is therefore not in the long term interests of oil producing countries to have the market trade at current levels. It is thus to be expected that these countries will take executive measures that remove the risk premium (related to geopolitical incidents) and the resulting volatility out of the oil market so as to ensure price stability and long term market share for their production. There might even be a need for OPEC to collectively evolve a strategy which while giving members an adequate surplus caps oil price at a level of \$ 60 / Bbl.

To secure its energy infrastructure , Saudi Arabia has been spending close to US \$ 2 Billion a year to guard its oil terminals in the Persian Gulf as also its giant central oil processing plant at Abqaiq. The Kingdom has also spent huge amounts in building backup pipelines to an export terminal located at the Red Sea port of Yanbu. All this money however still has not provided the Saudi's with a viable alternative to their main trade route via the Straits of Hormuz. Other Persian Gulf countries do not have any such alternative. So, going forward , high oil prices and a possible prolonged blockage of their main trade route are the main risks that Persian Gulf states will be very keen to mitigate.

1.5 The Indian Need

India is growing fast. Last year , a survey of some 600 companies by the NCAER found that an astonishing **96 %** of them were operating at close to their optimal levels of capacity utilization. Demand is surging and therefore over the next 5 - 6 years , we can expect an investment in excess of US \$ 450 Billion in the creation of world class infrastructure across the country. These investments are not an option , they are required to prevent the economy from hitting major roadblocks and heating up. While most of this money will be generated within the country by the expansion of the banking sector and the capital markets, some of it will come in from overseas investors interested in taking part in the action on the ground.

Growth of the kind described above cannot happen through small projects. A market of **1.2 billion** people is opening up at a rapid pace and India is setting itself up as a regional superpower. So, while a majority of the investments will be in infrastructure sectors like roads, ports , urban development schemes and social infrastructure projects such as hospitals and schools , the energy business will also see huge sums being invested in power plants and oil & gas infrastructure such as refineries, oil storage facilities , LNG terminals and pipelines. For the energy industry planner, a crucial question to be

answered will be “ How do we raise the living standards of 400 million people at the subsistence level to middle class status without ruining the environment.”

100 % availability of energy resources is necessary to deliver robust growth. This kind of availability needs a large project that guarantees energy security . .As described earlier, there has been only one small attempt at building strategic storage facilities in Vizag and Mangalore but the initiative has not really delivered a meaningful solution due to the inadequacy of resources that are required to fund the extensive storage infrastructure as well as the inventory which as current oil prices would be worth close to \$ 90 million for every million barrels of a crude cocktail.

The need for large strategic storage of crude oil is not the dispute. What is missing is a dedicated effort aimed at finding innovative financial solutions that could make the reserve a reality.

2.0 Project Concept :

Given the need of GCC countries and others in the Persian Gulf to ensure access to market even in times of conflict (which now appears likely) and to maintain long term market share in an era where energy alternatives could predominate (Crude Price > \$ 60 Bbl) , it might make sense to marry the needs of GCC states with India’s need to have a strategic reserve to create a project that meets the needs of all the stakeholders. In addition , as the Indian west coast lies close to the shipping lanes of most GCC markets, there would be a minimal need to alter course for moving cargoes in and out of storage.

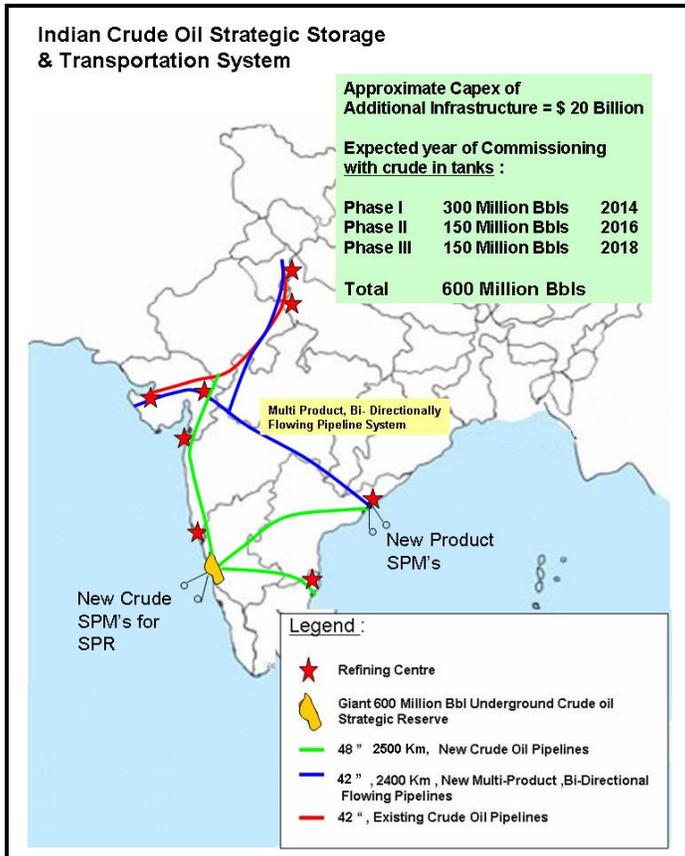


Fig 1. Proposed Reserve and its transport System.

GCC countries with their huge investible surpluses might be open to the idea of a large reserve outside the region located in a neutral and stable country such as India from which they could continue to supply the oil market globally even at times when the Persian gulf is blocked to traffic. The idea, itself “ of storing Persian Gulf crude in India “ is not new as it has been mooted earlier by others. Its only now , however that it could be the right time for the oil industry to think in terms of a large Middle East strategic production reserve located on the Indian west coast , 700 Km south of Mumbai. The rationale for this project is compelling and the argument for its construction is simple. Such a project will be of immense benefit to Persian gulf producers and their customers all over the world.

3.0 Financing

The classical strategy on reserves in consuming countries up to the year 2002 had been to build them in the \$ **16** / Bbl - \$ **25** / Bbl range. We are clearly out of that territory now and the US has been building reserves even at \$ 65 + / Bbl .

But this particular project is a producers reserve and not a consumers reserve. This subsumes that the current oil price would make no difference to oil producers as they would simply be moving oil out of one storage tank (the oil field) to another storage tank outside the Persian gulf. The only additional thing they will be doing is taking a forward view on the freight rate between the oil field and the south India based storage which anyway lies close to their direct trade route to destinations in the US or the far east. Saudi Arabia and Kuwait with spare capacities could then keep pumping into the reserve and always operate at full capacity (but especially during the second quarter of each year when global oil demand drops by close to 1.5 Million Bbls / day) till their self determined levels of reserves are attained.

If demand comes off for whatever reason ... be it a US housing sector led slowdown or an Avian Flu pandemic , oil producers could use the period of demand hiatus to fill up the producers reserve. This is clearly a very long term plan but as we look at an ever more volatile market it appears to be an idea whose time has come.

The financing of a large project such as the one being proposed is always challenging. Any financial structure, to work, must be equitable in its distribution of risk . To achieve this , it is being proposed to split the entire project into two Special Purpose vehicles or SPV's so as to clearly demarcate ownership and the boundaries at which price risk and title to the crude oil passes between project participants . The project documents must also clearly spell out the conditions under which oil in the reserve can be used by Indian companies and the rights and responsibilities of all parties to the project agreements. This also needs to be tied into a clear and transparent enforcing mechanism which is seen as fair to everyone involved.

The two SPV's that are being proposed are :

- The Petroleum reserve SPV 600 Million Bbls (built in 3 phases) + Marine evacuation system
- The Transportation system SPV ... 2500 Km of crude oil pipelines + 2400 Km of multiproduct , bi – directionally flowing pipelines

3.1 Petroleum reserve SPV

SPV1 will consist of the petroleum reserve and will be wholly owned by the GCC states and any other supplier country which wants to participate . The Indian government will take a token equity stake in this project company to provide comfort to investors.

There are a few defining features for this reserve :

1. It will be owned by the national oil companies of the Gulf Cooperation Council plus any other producer country that they invite to join them ... The reserve however will be operated by a local arm (Indian entity) set up specifically for the purpose. The entire reserve, for Tax purposes can be treated as an SEZ or a bonded warehouse where no Indian taxes will be payable.
2. The main objective of the reserve for the GCC states would be to stabilize GCC member states revenues from oil sales and allow them to sell oil to their customers even when the Persian Gulf is closed to traffic for any reason. The first phase of the project will be accelerated and will be commissioned by 2014 with 300 Million Barrels in its tanks.
3. The reserve will also provide security of supply to refiners around the world . It will put in place an effective price cap on oil price at a level acceptable to GCC / OPEC and its constituents (say \$ 60 / Bbl). Such a cap will help maintain OPEC market share which is bound to get eroded at prices in excess of \$ 60 / Bbl crude (it is well known that at this level almost all alternate energy sources become viable).
4. The arrangement while meeting GCC country needs must not compromise Indian energy security. There should be a clear understanding that oil from the reserve will be supplied to Indian refineries / oil companies in the event of a national emergency at market prices. On the occurrence of specified events, the arrangement should provide a mechanism which results in shared ownership rights to the government of India for the specific period of the disruption or till the Force Majeure continues.
5. The reserve will serve as a stabilizer of last resort in the event of a major market upset. In this regard , the reserve could function like the International bank of settlements in that one crude producer may borrow oil from another producer and supply crude from that producers tanks provided API gravity and sulphur content / TAN are compatible with their client refiners needs.
6. A unique feature of the reserve would be that it could help increase availability of Brazilian / Mexican and African crudes to Asia as producers in these countries could store crude oil in India in times of slack demand and ship it out to consumers in Asia at short notice. The reserve will also help to even out the fluctuations in the Light – Heavy differentials.
7. The reserve could be filled by member states utilizing their spare capacity and also by others at times when global demand dips as in the **2 nd quarter of every year** . Member countries will also have the option of pumping at full capacity all year round as long as there is capacity in the tanks to accommodate their crude oil. The reserve can also be augmented when there is a fall in demand triggered by a possible coming off of the US housing market and other such causes. This could result in the reserve getting filled up very quickly.

8. Project site will be spread over 30,000 – 45,000 acres . Preferred location is degraded forest land with natural gullies / small valleys. Once constructed , a lush forest cover will be built above the tanks using modern forest management methods.

3.2 The Pipelines SPV

The pipelines Special Purpose Vehicle (SPV 2) will be a consortium of Indian energy companies and strategic investors some of whom will be investing primarily for tax purposes. This SPV will therefore be owned primarily by Indian companies while SPV 1 which will be the storage SPV will be owned by oil exporting countries.

There will be two broad categories of pipelines within SPV2.

The first network will consist of crude oil pipelines which will connect the strategic storage to all Indian refineries.

The second network of pipelines will be product pipelines , but with a difference. Unlike conventional product pipelines , these will be multiproduct , bi-directionally flowing lines. Under normal or steady state conditions , they will carry petroleum products from Indian refineries to target markets all over India . All these product pipelines will operate under the common carrier principle and investors will receive dividends which will be exempt from incidence of tax.

The special feature of these pipelines will be that they will be enabled for bi-directional flow and will be configured to enable imports from the Indian east coast in the event of either a process upset in any Indian refinery or if any west coast port / import terminal for petroleum products gets damaged for any reason. By throwing a single switch it will be possible for a remote operator sitting hundreds of miles away to enable the pipeline system to accept petroleum products at a designated terminal (to be decided) on the east coast and move products in the reverse direction to markets all over India. This system is necessary because in times of a national energy crisis , the immediate need is for transport fuels like petrol and diesel and not crude oil.

The overall financial structure and the basis for the project documents is given below.

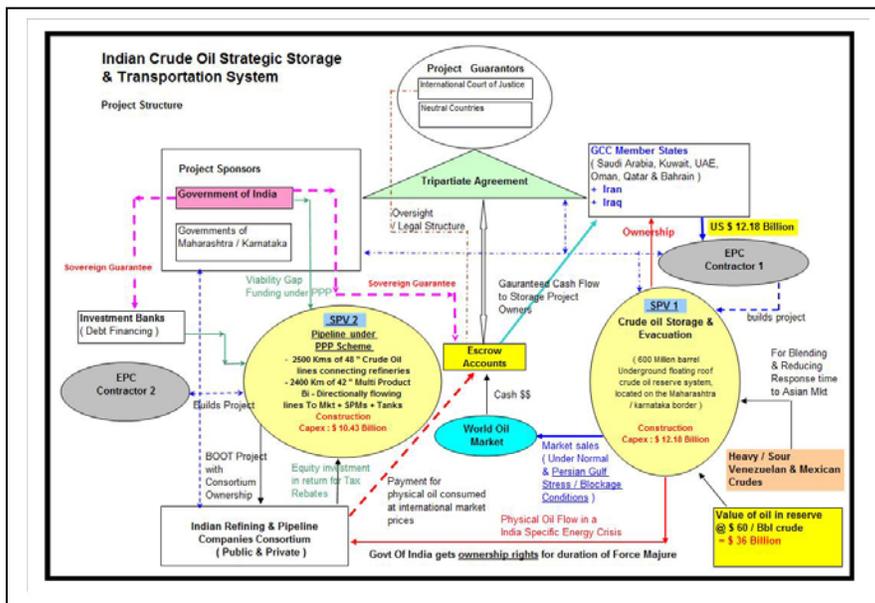


Fig 2.

Overall project structure with two distinct SPV's .

3.3 International Institutional / Legal Framework

For the scheme to work and to guarantee the transactions leading to the creation of the reserve, its operation as also the payments into and from the Escrow accounts , it might be necessary to provide investor comfort by way of involving organizations such as the International court of Justice in the Hague or some other organization having sufficient credibility to guarantee the agreements. Alternately it could be a committee of nations with shared interests outside of the OECD (The IEA already has huge reserves and could constitute a monopoly) who can act as guarantors acceptable to all concerned parties.

3.3 Tax Incentives needed to encourage investment in this Project

Since the storage facilities and pipelines are extremely capital intensive and require massive upfront investment which by itself is not economically sustainable, the central government should provide tax and policy incentives to facilitate investment in this essential national energy security infrastructure besides providing some minimum viability gap funding under the PPP route. Government should provide strong policy support for this project as it lays the foundation for a robust economy and also constitutes an essential step towards making India a de-facto regional superpower.

The entire project (Storage SPV + Transportation SPV) needs to be notified as an infrastructure project for the purposes of tax under :

- a. Section 80 IA ... 10 year Tax holiday on revenue. In addition the SPV 1 Project area needs to be notified as an SEZ or a bonded warehouse of some sort where no Indian taxes will be payable.
- b. Section 10 (23 G) read with Section 115-O ... Allowing exemption of dividend distribution tax to domestic companies
- c. Exclusion from the incidence of MAT (minimum tax on book profits @ 7.5 %) by removal of section 115 JB for companies eligible for 100 % tax holiday under sections 80 – 1B.
- d. Exemption of sales tax / work contract tax / services tax for vendor provided goods and services
- e. Both the project companies should also be allowed accelerated depreciation and 100 % depreciation of asset values in the first year itself for tax purposes as a one time write off.

In addition to the above, both project SPV's need to be notified as infrastructure projects to enable them to seek exemption from customs duties by issuing appropriate customs notifications for project related imports. Purchases from the domestic tariff area (DTA) should also be freed from the incidence of excise duties. Entry tax which is applicable on project material in some states needs to be exempted as well.

Indian entities will be greatly encouraged to participate in this project if there is a special provision that enables them to take an equity stake in this particular project by

implementing a tax optimization structure which allows equity in the pipeline / storage SPV to qualify for deduction from corporate tax to the tune of 100 %. For example if an Indian company were to invest Rs. 100 crores in either project company, it will also get a Rs. 100 crore deduction in its corporate income tax besides equity rights in the project company.

4.0 Conceptual Engineering / Design Issues

It is necessary to understand the engineering issues involved in the construction of the reserve as these will have an impact on the cost which needs to be kept as low as possible.

4.1 Comparative Construction Costs

The Strategic Petroleum Reserve (SPR) of the United States currently holds approximately 727 million barrels of crude oil in massive underground salt caverns. The 62 cylindrical tanks have been carved out of huge salt mounds that are located approximately 2000 ft below the surface and have an average height of 2000 feet and width of 200 feet. Warm fresh water was used to leach out the salt which was then discharged into the gulf of Mexico. Using a simple water hose and nozzle as a construction tool greatly reduced construction costs and this resulted in the lowest possible construction cost of US \$ 7 / Bbl.

Unfortunately , we in India, have not as yet found large salt deposits (except maybe in Rajasthan where a huge salt formation is believed to exist. This however needs to be investigated further) in which we can store crude oil or petroleum products. We however do have natural gullies / small valleys and undulating landscapes which could be used as natural storages which require minimum soil and rock excavation. When done on a large scale the costs could be very low.

The engineering solution chosen usually depends on the storage method selected (land based / sea based). For the purpose of this project however only land based storage is being considered as the life cycle costs and maintenance expenditure required is considerably lower.

For land based projects again the optimum design will depend on the geology, permeability and settlement of in – situ soils, ground water levels and size and type of tank. The design will also depend on the type of product to be stored.

The engineering schematics below pictorially convey what is involved. **Schematic A** appears best suited to Indian conditions and might be the lowest cost option available especially if done on the large scale that is envisioned. If built on degraded land, after construction , we can cover the site with soil and build 30,000 – 45000 acres of rich forest cover on it. The concrete storage tanks also provide large scope for innovation as instead of steel we could use carbon fibre, which has far greater tensile strength than steel as reinforcing material in the concrete. It also has zero corrosion problems. The site could also use recycled plastic as fill material on a truly massive scale. This could therefore be the largest environmentally friendly project globally.

Earthquake risk is minimal since the tanks have a special long lasting polymer fabric lining both the inside and the outside which provides effective containment.

4.2 Engineering Solutions for Strategic Storage

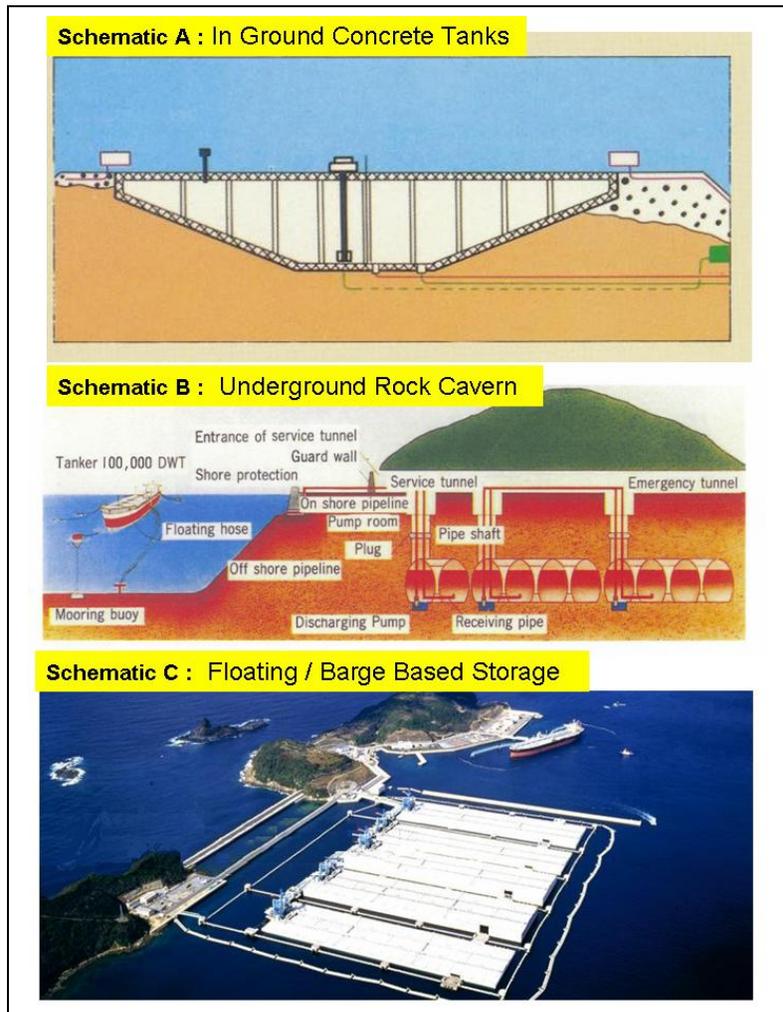


Fig 4.

Schematic A is recommended for India.

Schematic B is rock cavern storage and very expensive.

Schematic C is the Kamitogo giant floating storage facility in Japan which can store up to 1 week of Japanese demand. This option however is not suitable for India and is shown here for academic interest.

4.3 Project Cost Estimates

Approximate project costs calculations below exclude the cost of land.

Sl. No.	SPV 1 : Storage Project	Capex (US \$ Billion)	SPV 2 : Pipelines Project	Capex (US \$ Billion)
1	<u>Phase I</u> Concrete In Ground Storage Tanks to store 300 Million Bbls of oil	5.48	<u>Phase I</u> 2500 Km of 48 " Crude Oil Pipelines + 2400 Km of 42 " Petroleum Product Bi - Directionally Flowing Pipelines	9.80
1a	<u>Marine Systems (West Coast)</u> 3 Crude SPM's + 400 Km, 48 " onshore Pipelines + 60 Km , 48 " , Offshore Pipelines	1.21	<u>Marine Systems (East Coast)</u> 3 Product SPM's + 8 Million Barrels of Steel Buffer Storage + 45 Km, 48 " onshore Pipelines + 60 Km , 48 " , Offshore Pipelines	0.63
	Total Cost	6.70	Total Cost	10.43
2	<u>Phase II</u> Concrete In Ground Storage Tanks to store 150 Million Bbls of oil	2.74	No Phase II	
3	<u>Phase III</u> Concrete In Ground Storage Tanks to store 150 Million Bbls of oil	2.74	No Phase III	
4	Total Capital Cost SPV 1 (Phases I + II + III)	12.18	Total Capital Cost SPV 2 (Phases I + II + III)	10.43
5	Total Cost of Crude Stored @ US \$ 60 / Bbl (Phases I + II + III)	36.00		

Notes :

- Rs / US \$ rate @ 39.2 ... 11th Jan ' 2008
- Cost of Concrete Storage = Rs 4500 / KL (US \$ 114.79 / KL or US \$ 18.28 / Bbl)
- Cost of 90 Mts diameter steel tanks = Rs 4000 / KL (US \$ 102.03 / KL or US \$16.24 / Bbl)
- 1 KL = 158.76 Bbls : (There are 6.28 barrels in 1 KL)
- Cost of 48 " above ground pipeline = Rs 8 Crores / Km
- Cost of 48 " underwater pipeline = Rs 24 Crores / Km
- Unit Costs of SPM = US \$ 17 Million
- Price of crude oil taken as \$ 60 / Bbl for the purposes of planning the reserve
as current oil price levels may not be sustainable.

Costing has been done based on a smaller project. Costs are therefore approximate and actual costs could vary depending on project scale.

5.0 Project Protection

The project is proposed to be located near Mangalore on the west coast of India. Advanced naval ordinance including naval aviation units working out of the large Indian naval base at Karwar, 270 Km to the north will be responsible for the protection of the strategic reserves marine assets. Missile units of the Indian Army will secure the underground facility which will be located in the hinterland .

6.0 Environmental Issues

Since the storage itself is going to consist almost completely of underground storage tanks , it will have no adverse impact on the environment as the containment is secure against even earthquakes. The marine part of the project (SPM's and underwater pipelines) are standard equipment and have a proven safety record.

The project overall will be designed to be net – net positive to the environment as some 30,000 – 45,000 acres of new forests will be grown at different locations based on where large tracts of degraded forest / land is available.

7.0 Forward Path

There are no major show stoppers that could come in the way of making the reserve as conceptualized above a reality. Getting the initiative off the ground quickly is important and for this it is essential for the Ministry of Petroleum and Natural Gas to work with the Finance Ministry and the Prime Ministers office to get a high level team of energy industry experts to visit countries in the Persian Gulf to get their oil ministers on board. The role of the Ministry of Finance in this project is critical and it is hoped that since the financial outflow and budgetary impact of the project (especially SPV1) is extremely low , they will find the project worth supporting as the scheme has solved the fundamental problem of financing the reserve.

“ Determine that a thing can and shall be done , and then , we will, find a way ”
– Abraham Lincoln