Impact of Indo-US Agreement on Indian Strategic Weapon program:

Will it make available more indigenous Uranium reserve for Indian Weapons Program?

Introduction

On July-18,2005 President Bush and Prime Minister Singh in a major breakthrough announced an agreement on 'Global Strategic Partnership' involving many sub-agreements, including civil nuclear energy cooperation, whose details were further agreed on March 2, 2006. The civil nuclear power cooperation envisages United States to remove sanctions legislated by US Congress in 1978 on nuclear fuel and power-plant technology, and work with US lead NSG to accommodate nuclear fuel supply for Indian civilian nuclear plants. India in turn will separate its strategic facilities from civilian facilities and put all current & future civilian nuclear power plants and facilities under site specific IAEA safeguards.

Some opponents of this agreement have argued that India has small Uranium reserve thus letting India purchase nuclear fuel supply for civilian power plants from NSG will somehow help Indian nuclear weapons program by making available greater fraction of indigenous Uranium reserve for military nuclear weapons program.

Assessment

Let us look at facts to understand merit of this argument.

1. Indian strategic nuclear weapons use approximately 3 Kg Plutonium.
2. India has large un-safeguarded Plutonium stockpile (conservatively estimated to between 3,000 Kg and 6,000Kg), a fraction of that will suffice to make hundreds of nuclear weapons if India choose to exercise the option.
3. Indian PHWR reactors that are outside IAEA safeguard when operated for efficient power generation would have cumulatively required just 5,842 tonnes. India is estimated to have mined about 9,200 tonnes[I] of natural-uranium, indicating that about 55%[II] of the fuel and 8% of its reactor capacity was used in low fuel burn mode, generally associated with operating the reactors in mode optimized to generate weapon grade Plutonium. This corresponds to about 2,400Kg weapon grade Plutonium enough for 800 strategic nuclear weapon.
4. Current Indian reserves of uranium estimated between 77,500 – 94,000 metric tonnes, enough to support 12,000 MWe power generation for 50 years[III].
5. Current Indian PHWR reactors that are outside IAEA safeguard annually require 116 tonnes of natural-uranium when operated in a mode optimized for power generation. When operated in a mode optimized to generate weapon-grade Plutonium they require just 747 tonnes of natural-uranium annually, in the process they generate 745 Kg weapon grade Plutonium, which is enough for 248 nuclear weapons per year.

From above one can clearly see that there is no merit in the argument that US-India civilian nuclear agreement will be of any consequence to Indian nuclear weapons programs.

Conclusion

In conclusion the Indo-US agreement on civil nuclear reactors does not help Indian military program:

1. India already has fissile material enough to make more than 800 warheads.
2. Its Fast Breeder Reactors can generate limitless fissile material for weapons or civilian applications.

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Appendix: Analysis details

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U235 required / MWe-Year (For Light Water Reactors)	1.348 Kg
U235 required / MWe-Year (For Heavy Water Reactors)	1.000 Kg

Today's date: 3/30/2006

	Reactor	Type	Power MWe	In-Service Date	Status	IAEA Inspection	Number of years running	Plant Capacity Factor: Power Mode	Plant Capacity Factor: Weapon Grade Mode	Uranium Burn Level MWt.d/Tonne: Power Mode	Uranium Burn Level MWt.d/Tonne: Weapon Grade Mode	Spent Fuel / Yr (Kg): Power Mode	Spent Fuel / Yr (Kg): Weapon Grade Mode	Fissile Plutonium output / Yr (Kg): Power Mode	Fissile Plutonium output / Yr (Kg): Weapon Grade Mode	Accumulated Pu (Kg): Power Mode	Accumulated Pu (Kg): Weapon Grade Mode	Cumulative Spent Fuel (Tonne): Power Mode	Cumulative Spent Fuel (Tonne): Weapon Grade Mode
Proposed Civilian Power Reactors	1 Tarapur 1 (2.66%)	BWR	160	1-Apr-69	Operational	Yes	37.0	85%	-	-	-	9,163	-	58.0	-	2,146	-	339	-
	2 Tarapur 2	BWR	160	5-May-69	Operational	Yes	36.9	85%	-	-	-	9,163	-	58.0	-	2,140	-	338	-
	3 Rawatbhata 1	PHWR	100	30-Nov-72	Operational	Yes	33.4	75%	-	7,500	-	15,097	-	39.6	-	1,319	-	503	-
	4 Rawatbhata 2	PHWR	200	1-Nov-80	Operational	Yes	25.4	75%	-	7,500	-	30,193	-	79.1	-	2,011	-	768	-
	5 Kaiga 1	PHWR	220	12-Oct-00	Operational	Will be in	5.5	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	507	879	194	1,172
	6 Kaiga 2	PHWR	220	2-Dec-99	Operational	future	6.3	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	587	1,018	224	1,357
	7 Rawatbhata 3	PHWR	220	10-Mar-00	Operational		6.1	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	562	974	215	1,299
	8 Rawatbhata 4	PHWR	220	17-Nov-00	Operational	under US-	5.4	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	498	863	190	1,151
	9 Rawatbhata 5	PHWR	220	30-Jun-07	In construction	India Civil	0.0	85%	80%	7,500	1,162	37,641	228,658	98.6	171.5	0	0	0	0
	10 Rawatbhata 6	PHWR	220	31-Dec-07	In construction	Nuclear	0.0	85%	80%	7,500	1,162	37,641	228,658	98.6	171.5	0	0	0	0
	11 Kaiga 3	PHWR	220	31-Jan-07	In construction	Agreement	0.0	85%	80%	7,500	1,162	37,641	228,658	98.6	171.5	0	0	0	0
	12 Kaiga 4	PHWR	220	31-Jul-07	In construction		0.0	85%	80%	7,500	1,162	37,641	228,658	98.6	171.5	0	0	0	0
	13 Koodankulam VVER-1000	BWR	1,000	31-Oct-07	In construction	Yes	0.0	85%	-	-	-	57,271	-	362.2	-	0	-	0	-
	14 Koodankulam VVER-1000	BWR	1,000	31-Oct-08	In construction	Yes	0.0	85%	-	-	-	57,271	-	362.2	-	0	-	0	-
Proposed Military/Research Reactors	15 Kalpakkam FBTR	FBTR	13	18-Oct-85	Operational	No	20.5	75%	75%	-	-	-	-	14.5	14.5	296	296	222	222
	16 Kalpakkam PFBR	PFBR	500	1-Sep-10	In construction	No	0.0	80%	75%	-	-	-	-	440.2	440.2	0	0	0	0
	17 Tarapur-CIRUS	HWR	12	10-Jul-60	Operational	No	45.8	80%	80%	7,500	1,162	1,932	12,472	5.1	9.4	232	428	88	571
	18 Tarapur-DHRUV	HWR	30	1-Apr-88	Operational	No	18.0	90%	90%	7,500	1,162	5,435	35,078	14.2	26.3	256	474	98	632
	19 Tarapur 3	PHWR	540	30-Sep-06	In construction	No	0.0	80%	75%	7,500	1,162	86,956	526,173	227.8	394.6	0	0	0	0
	20 Tarapur 4	PHWR	540	4-Jun-05	Operational	No	0.8	80%	75%	7,500	1,162	86,956	526,173	227.8	394.6	187	323	71	431
	21 Narora 1	PHWR	220	29-Jul-89	Operational	No	16.7	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	1,548	2,682	591	3,576
	22 Narora 2	PHWR	202	5-Jan-92	Operational	No	14.2	80%	75%	7,500	1,162	32,528	196,828	85.2	147.6	1,214	2,102	463	2,803
	23 Kakrapar 1	PHWR	220	24-Nov-92	Operational	No	13.4	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	1,239	2,147	473	2,863
	24 Kakrapar 2	PHWR	220	4-Mar-95	Operational	No	11.1	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	1,028	1,781	393	2,375
	25 Kalpakkam 1	PHWR	170	23-Jul-83	Operational	No	22.7	80%	75%	7,500	1,162	27,375	165,647	71.7	124.2	1,628	2,820	621	3,760
	26 Kalpakkam 2	PHWR	220	20-Sep-85	Operational	No	20.5	80%	75%	7,500	1,162	35,427	214,367	92.8	160.8	1,906	3,302	728	4,402
												853,318	4,091,935	3,183	3,524	19,306	20,088	6,519	26,611
	Military material from operating in Power mode											675,161		2,224		11,690		4,571	
	Military material from operating in Weapon Grd Pu mode												4,091,935		3,524		20,088		26,611
	After Proposed US-India Civil Nuclear											382,890	2,319,837	1,458	2,195				

Power from all 15 operational power reactors (MW)	4,045
Power from reactors under construction(MW)	3,920
Total Power in 2010	**7,965**
After US-India Civil Nuclear Cooperation agreeemnt power from all Military reactors in 2010 (MW)	**2,887**

Minimum Indian Uranium reserve (Kg)	77,500,000
Number of weapons possible	**18,328**

Legend	-	Not Relavent

[I] WEC Survey of Energy Resources 2001 - Uranium Resources : http://www.worldenergy.org/wec-geis/publications/reports/ser/uranium/uranium.asp

[II] Assuming 650 tonne fuel is set aside for inventory and fuel fabrication WIP. Also factors in reduced plant load factor and fuel for weapon grade Pu stays in reactor only 15% of the normal time.

[III] Nuclear negotiations -India has the upper hand - Feb 02, 2006: http://www.thehindubusinessline.com/2006/02/02/stories/2006020201431000.htm

AMD, DAE, Government of India http://www.amd.gov.in/work/uranium.htm

Uranium Information Centre Ltd, Australia http://www.uic.com.au/nip45.htm