

3. CORE CHARACTERISTICS

- 3.1. Reference number of core
3.2. Fissile material content of a core

Experimental Fast Reactors

Plant	Reference number of core	Fissile material content of a core (kg)		
		²³⁵ U	²³⁹ Pu	Total plutonium (all isotopes)
Rapsodie (France)	-	79.5	31.5	-
KNK-II (Germany)	-	312	28	39
FBTR (India)	MK II	0.7	85.6	124.4
PEC (Italy)	-	79	175	310
JOYO (Japan)	MK III	110*	-	160*
DFR (UK)	-	247	3	3.5
BOR-60 (Russian Federation)	-	95	53**	58
EBR-II (USA)	Run 128	229	4.5	5.0
Fermi (USA)	-	484	0	0
FFTF (USA)	-	14	516	587
BR-10 (Russian Federation)	-	113	-	-
CEFR (China)	equilibrium	235.4	0.41	0.414

Demonstration or Prototype Fast Reactors

Phénix (France)	-	35	717	931
SNR-300 (Germany)	-	57	1058	1536
PFBR (India)	-	17.3	1361	1978
MONJU (Japan)	-	13.5	870	1400
PFR (UK)	equilibrium	50	760	950
CRBRP (USA)	equilibrium	7.6	1468	1705
BN-350 (Kazakhstan)	-	1220***	75	77
BN-600 (Russian Federation)	equilibrium	2020***	110	112
ALMR (USA)	-	14	-	2283
KALIMER-150 (Republic of Korea)	-	20.48	1090	1519.78
SVBR-75/100 (Russian Federation)	-	1470	-	-
BREST-OD-300 (Russian Federation)	equilibrium	-	-	2260

* MK- III; (175 and 100 in MK-I, -II). MK III; (²³⁹Pu + Pu²⁴¹Pu): 160 and 150 in MK-I, II)

** ²³⁹Pu and ²⁴¹Pu

*** for cores with UO₂ fuel

3. CORE CHARACTERISTICS (cont.)

- 3.1. Reference number of core
- 3.2. Fissile material content of a core

Commercial Size Reactors

Plant	Reference number of core	Fissile material content of a core (kg)		
		²³⁵ U	²³⁹ Pu	Total plutonium (all isotopes)
Super-Phénix 1 (France) 1 st core	-	142	4054	5780
Super-Phénix 2 (France)	-	-	-	-
SNR 2 (Germany)	-	210	4800	8000
DFBR (Japan)	-	40	2430	4130
CDFR (UK)	reference	60	3000	3400
BN-1600 (Russian Federation)	equilibrium	80	5400**	7900
BN-800 (Russian Federation)	equilibrium	30	1870**	2710
EFR	-	81	-	8808
ALMR (USA)	-	30	-	2800
SVBR-75/100 (Russian Federation)	-	1470	-	-
BN-1800 (Russian Federation)	equilibrium	-	-	12070
BREST-1200 (Russian Federation)	equilibrium	-	6060	8560
JSFR-1500 (Japan)	-	-	-	-
Breeding core	equilibrium	110	7560	13630
Break even core	equilibrium	110	7570	13680

** ²³⁹Pu and ²⁴¹Pu

3. CORE CHARACTERISTICS (cont.)

3.3. Core volume fractions averaged over whole core (excluding experiments)

Experimental Fast Reactors

Plant	Core volume fractions averaged over whole core (excluding experiments)			
	Fuel	Coolant	Steel	Void or fission gas space
Rapsodie (France)	0.425	0.396	0.136	0.023
KNK-II (Germany)	0.32	0.43	0.21	0.04**
FBTR (India)	0.374	0.354	0.238	0.034
PEC (Italy)	0.346	0.376	0.248	0.030
JOYO (Japan)	0.37*	0.37*	0.23*	0.03
DFR (UK)	0.40	0.40	0.20	0
BOR-60 (Russian Federation)	0.48	0.29	0.23	0
EBR-II (USA)	0.318	0.487	0.195	0
Fermi (USA)	0.279	0.472	0.249	0
FFTF (USA)	0.31	0.39	0.26	0.04
BR-10 (Russian Federation)	0.445	0.287	0.218	0.05
CEFR (China)	0.374	0.376	0.190	0.06

Demonstration or Prototype Fast Reactors

Phénix (France)	0.37	0.35	0.25	0.03
SNR-300 (Germany)	0.295	0.50	0.19	0.015
PFBR (India)	0.297	0.410	0.239	0.054
MONJU (Japan)	0.335	0.400	0.245	0.020
PFR (UK)	0.35	0.41	0.21	0.03
CRBRP (USA)	0.325	0.419	0.234	0.022
BN-350 (Kazakhstan)	0.380	0.33	0.22	0.07
BN-600 (Russian Federation)	0.375	0.34	0.215	0.07
ALMR (USA)	0.378	0.366	0.257	0
KALIMER-150 (Republic of Korea)	0.376	0.3747	0.249	0
SVBR-75/100 (Russian Federation)	0.55	0.285	0.14	0.025
BREST-OD-300 (Russian Federation)	0.30	0.60	0.10	0

* 0.36, 0.40, 0.21 in MK- I, respectively

** volume fraction of moderating material

3. CORE CHARACTERISTICS (cont.)

3.3. Core volume fractions averaged over whole core (excluding experiments)

Commercial Size Reactors

Plant	Core volume fractions averaged over whole core (excluding experiments)			
	Fuel	Coolant	Steel	Void or fission gas space
Super-Phénix 1 (France)	0.37	0.34	0.24	0.05
Super-Phénix 2 (France)	0.37	0.37	0.24	0.02
SNR 2 (Germany)	0.364	0.39	0.22	0.026
DFBR (Japan)	0.39	0.33	0.23	0.05
CDFR (UK)	0.25	0.51	0.18	0.06
BN-1600 (Russian Federation)	0.415	0.306	0.229	0.05
BN-800 (Russian Federation)	0.340	0.390	0.220	0.05
EFR	0.361	0.329	0.235	0.075
ALMR (USA)	0.378	0.366	0.257	0
SVBR-75/100 (Russian Federation)	0.55	0.285	0.14	0.025
BN-1800 (Russian Federation)	0.446	0.294	0.228	0.032
BREST-1200 (Russian Federation)	0.26	0.635	0.105	0
JSFR-1500 (Japan)	-	-	-	-
Breeding core	0.36	0.30	0.26	0.08
Break even core	0.36	0.30	0.26	0.08

3. CORE CHARACTERISTICS (cont.)

- 3.4. Power density
- 3.5. Mean length of reactor run
- 3.6. Mean length of routine shutdown for refuelling (excluding long maintenance periods)

Experimental Fast Reactors

Plant	Power density (kW/litre of fuel) [fuel volume defined by space within cladding]		Mean length of reactor run (days)	Mean length of routine shutdown for refuelling (excluding long maintenance periods) (days)
	Maximum	Average over core		
Rapsodie (France)	3060	2210	80	10
KNK-II (Germany)*	1280/886	985/599	-	-
FBTR (India)	2344	1806	45-60	7
PEC (Italy)	1384	930	60	15
JOYO (Japan)	2500 (2350)	1600 (1225 MK-II)	60**	16
DFR (UK)	1250	900	55	-
BOR-60 (Russian Federation)	2300	1900	100	45
EBR-II (USA)	2704	1610	49	7
Fermi (USA)	2774	1642	14	-
FFTF (USA)	1857	1114	107	***
BR-10 (Russian Federation)	2182	1588	100	12
CEFR (China)	1867	1132	73	14

Demonstration or Prototype Fast Reactors

Phénix (France)	1950	1200	90	7
SNR-300 (Germany)	1613	1016	588****	-
PFBR (India)	1763	1247	240	22
MONJU (Japan)	-	-	148	30
PFR (UK)	1720	1160	90	21
CRBRP (USA)	1983	1023	275	90
BN-350 (Kazakhstan)	1995	1155	105	10
BN-600 (Russian Federation)	1587	940	160	15
ALMR (USA)	1070	708	310	55
KALIMER-150 (Republica of Korea)	342.9	240.4	547	to be determined
SVBR-75/100 (Russian Federation)	382	140	2200	60
BREST-OD-300 (Russian Federation)	835	510	300	25

* test subassembly/driver subassembly

** (45 in MK-I, 70 in MK-II)

*** 1 at 46 days and 2 at 25 days

**** 588 days or 441 equivalent full power days

3. CORE CHARACTERISTICS (cont.)

- 3.4. Power density
- 3.5. Mean length of reactor run
- 3.6. Mean length of routine shutdown for refuelling (excluding long maintenance periods)

Commercial Size Reactors

Plant	Power density (kW/litre of fuel) [fuel volume defined by space within cladding]		Mean length of reactor run (days)	Mean length of routine shutdown for refuelling (excluding long maintenance periods) (days)
	Maximum	Average over core		
Super-Phénix 1 (France)	1250	785	640	120*****
Super-Phénix 2 (France)	1200	755	270	15 or 45
SNR 2 (Germany)	800	500	365	30
DFBR (Japan)	-	-	456	60
CDFR (UK)	2400	1750	270	28
BN-1600 (Russian Federation)	1130	670	330	35
BN-800 (Russian Federation)	1796	1152	140	13.7-17
EFR	1100	670	425	20
ALMR (USA)	950	610	595	105
SVBR-75/100 (Russian Federation)	382	140	2200	60
BN-1800 (Russian Federation)	925	536	500	to be determined
BREST-1200 (Russian Federation)	690	550	300	to be determined
JSFR-1500 (Japan)	-	-	-	-
Breeding core	630	390	800	45
Break even core	650	400	800	45

***** whole core refuelling

3. CORE CHARACTERISTICS (cont.)

3.7. Mean residence time for subassemblies

Experimental Fast Reactors

Plant	Mean residence time for subassemblies (full power days)					
	Internal blanket	Inner core	Outer core	Row 1 radial blanket	Row 2 radial blanket	Row 3 radial blanket
Rapsodie (France)	-	400	-	720	1350	1690
KNK-II (Germany)	-	455	455	1700	-	-
FBTR (India)	-	225	-	-	-	-
PEC (Italy)	-	330	-	-	-	-
JOYO (Japan)	-	358	439*	none**	none	none
DFR (UK)	-	110	110	-	-	-
BOR-60 (Russian Federation)	-	730	900	1450	1800	2200
EBR-II (USA)	-	395	480	-	-	-
Fermi (USA)	-	75	-	-	-	-
FFTF (USA)	-	720	600	-	-	-
BR-10 (Russian Federation)	-	880	-	-	-	-
CEFR (China)	-	240	320	-	-	-

Demonstration or Prototype Fast Reactors

Phénix (France)	-	600	800	600	900	1400
SNR-300 (Germany)	-	441	441	613	1728	-
PFBR (India)	-	567	641	780	-	1825
MONJU (Japan)	-	740	740	740	740	740
PFR (UK)	-	300	400	800	1200	1200
CRBRP (USA)	-	328	328	328	878	1153
BN-350 (Kazakhstan)	-	525	525-735	630	1050	1470
BN-600 (Russian Federation)	-	480	480	640	960	1280
ALMR (USA)	-	1241	1241	-	-	-
KALIMER-150 (Republic Korea)	1395	-	2790	-	-	-
SVBR-75/100 (Russian Federation)	-	2200	-	-	-	-
BREST-OD-300 (Russian Federation)	-	-	-	no radial blanket		

* MK-III; (250 and 270 in MK-I, II, respectively)

** MK- III; (300 for row 1-4 in MK-I)

3. CORE CHARACTERISTICS (cont.)

3.7. Mean residence time for subassemblies

Commercial Size Reactors

Plant	Mean residence time for subassemblies (full power days)					
	Internal blanket	Inner core	Outer core	Row 1 radial blanket	Row 2 radial blanket	Row 3 radial blanket
Super-Phénix 1 (France)	-	640	640	320***	640***	640***
Super-Phénix 2 (France)	-	1350	1350	1620	-	-
SNR 2 (Germany)	-	1100	1100	2200	-	-
DFBR (Japan)	-	1370	1370	1370	1610	-
CDFR (UK)	-	550	550	1000	1500	1500
BN-1600 (Russian Federation)	-	1320	1320	1320	-	-
BN-800 (Russian Federation)	-	420	420	420	-	-
EFR	-	1700	1700	2720	-	-
ALMR (USA)	-	1189	1784	-	2379****	-
SVBR-75/100 (Russian Federation)	-	2200	-	-	-	-
BN-1800 (Russian Federation)	-	1500	2000	-	-	-
BREST-1200 (Russian Federation)	-	no radial blanket				
JSFR-1500 (Japan)	-	-	-	-	-	-
Breeding core	-	3200	3200	3200	-	-
Break even core	-	3200	3200	no radial blanket		

*** anticipated radial blanket unloading

**** cumulative, including residence time in internal blanket before shuffling to radial blanket

3. CORE CHARACTERISTICS (cont.)

3.8. Burnup

Experimental Fast Reactors

Plant	Burnup (MWd/t of heavy metal)			
	Maximum achieved	Average achieved	Maximum target	Average target
Rapsodie (France)	102000	-	-	-
KNK-II (Germany)	172000	75000	-	-
FBTR (India)	-	-	50000	38000
PEC (Italy)	-	-	65000	57000
JOYO (Japan)	86900*	68500**	200000***	90000
DFR (UK)	3000	2500	-	-
BOR-60 (Russian Federation)	176000	73000	260000	140000
EBR-II (USA)	80000	66000	-	-
Fermi (USA)	4000	3000	10000	8000
FFTF (USA)	155000	70000	-	-
BR-10 (Russian Federation)	62300	45500	-	-
CEFR (China)	-	-	100000	75000

Demonstration or Prototype Fast Reactors

Phénix (France)	150000****	100000	170000	125000
SNR-300 (Germany)	-	-	86000	57000
PFBR (India)	-	-	113000	77000
MONJU (Japan)	-	-	940000	80000
PFR (UK)	200000	150000	250000	-
CRBRP (USA)	-	-	74200	50000
BN-350 (Kazakhstan)	97000	58000	120000	70000
BN-600 (Russian Federation)	97000	60000	120000	72000
ALMR (USA)	-	-	125000	90000
KALIMER-150 (Republic of Korea)	-	-	120670	87610
SVBR-75/100 (Russian Federation)	-	-	106700	71500
BREST-OD-300 (Russian Federation)	-	-	91700	61450

* MK-III, pellet peak; (143 900 in an irradiation test assembly)

** MK-III, average core discharge burnup, (118 500 in an irradiation test assembly)

*** MK-III, limit average burnup for fuel pin, in irradiation test assembly)

**** these levels were reached with 8 cores of fuel which was 166 000 fuel pins

3. CORE CHARACTERISTICS (cont.)

3.8. Burnup

Commercial Size Reactors

Plant	Burnup (MWd/t of heavy metal)			
	Maximum achieved	Average achieved	Maximum target	Average target
Super-Phénix 1 (France)	90000	60000	113000	70000
Super-Phénix 2 (France)	-	-	136000	85000
SNR 2 (Germany)	-	-	150000	120000
DFBR (Japan)	-	-	110000	90000
CDFR (UK)	-	-	170000	115000
BN-1600 (Russian Federation)	-	-	170000	115000
BN-800 (Russian Federation)	-	-	98000	66000
EFR	-	-	190000	134000****
ALMR (USA)	-	-	150000	100000
SVBR-75/100 (Russian Federation)	-	-	106700	71500
BN-1800 (Russian Federation)	-	-	118000	66000
BREST-1200 (Russian Federation)	to be determined			
JSFR-1500 (Japan)	-	-	-	-
Breeding core	-	-	220000	150000
Break even core	-	-	220000	150000

**** average core discharge burnup

3. CORE CHARACTERISTICS (cont.)

3.9. Neutron flux

Experimental Fast Reactors

Plant	Neutron flux ($\times 10^{15}$ n/cm ² s)	
	Maximum	Average
Rapsodie (France)	3.2	2.3
KNK-II (Germany)	1.9	1.3
FBTR (India)	3.4	2.5
PEC (Italy)	4.0	2.6
JOYO (Japan)	5.7*	3.5**
DFR (UK)	2.5	1.9
BOR-60 (Russian Federation)	3.7	3.0
EBR-II (USA)	2.7	1.6
Fermi (USA)	4.5	2.6
FFTF (USA)	7.0	4.2
BR-10 (Russian Federation)	0.86	0.63
CEFR (China)	3.1	2.1

Demonstration or Prototype Fast Reactors

Phénix (France)	6.8	
SNR-300 (Germany)	6.7	4.9
PFBR (India)	8.1	4.5
MONJU (Japan)	6.0	3.6
PFR (UK)	7.6	5.0
CRBRP (USA)	5.5	3.6
BN-350 (Kazakhstan)	5.4	3.5
BN-600 (Russian Federation)	6.5	4.3
ALMR (USA)	4.5	2.9
KALIMER-150 (Republic of Korea)	3.01	2.2
SVBR-75/100 (Russian Federation)	1.7	1.15
BREST-OD-300 (Russian Federation)	3.8	2.35

* MK I-II; (4.9 in MK-II)

** MK-III, (2.7 in MK-II)

3. CORE CHARACTERISTICS (cont.)

3.9. Neutron flux

Commercial Size Reactors		
Plant	Neutron flux ($\times 10^{15}$ n/cm ² s)	
	Maximum	Average
Super-Phénix 1 (France)	6.1	3.6
Super-Phénix 2 (France)	5.0	-
SNR 2 (Germany)	5.4	-
DFBR (Japan)	to be determined	
CDFR (UK)	10	5.9
BN-1600 (Russian Federation)	5.5	-
BN-800 (Russian Federation)	8.8	5.6
EFR	5.3	3.5
ALMR (USA)	3.3	2.3
SVBR-75/100 (Russian Federation)	1.7	1.15
BN-1800 (Russian Federation)	to be determined	
BREST-1200 (Russian Federation)	3.8	2.4
JSFR-1500 (Japan)	-	-
Breeding core	3.2	2.0
Break even core	3.2	2.0

3. CORE CHARACTERISTICS (cont.)

3.10. Percentage of subassemblies changed at each shutdown

Experimental Fast Reactors

Plant	Percentage of subassemblies changed at each shutdown (refuelling plan at equilibrium condition)			
	Inner core fuel	Outer core fuel	Control rods	Radial blanket, innermost row
Rapsodie (France)	20		20	-
KNK-II (Germany)	100	100	100	-
FBTR (India)	selective removal of subassemblies			
PEC (Italy)	20	-	16.7	-
JOYO (Japan)	17.6	13.8*	-	-
DFR (UK)	50	50	33	0
BOR-60 (Russian Federation)	12-16	-	-	5-7
EBR-II (USA)	remove fuel at 8% burnup			
Fermi (USA)	change 1-2 subassemblies every 14 days			
FFTF (USA)	15	18	20	-
BR-10 (Russian Federation)	1-3	-	-	-
CEFR (China)	33	-	25	-

Demonstration or Prototype Fast Reactors

Phénix (France)	15	13	25	10
SNR-300 (Germany)	25	25	100	6
PFBR (India)	33	28	4	25
MONJU (Japan)	20	20	100	20
PFR (UK)	30	25	20	6
CRBRP (USA)	all fuel and inner blanket assemblies replaced every two cycles (2 years)			
BN-350 (Kazakhstan)	20	15	25	15
BN-600 (Russian Federation)	33.3	33.3	50	25
ALMR (USA)	25	25	33	-
KALIMER-150 (Republic of Korea)	33.3	-	-	-
SVBR-75/100 (Russian Federation)	100	-	-	-
BREST-OD-300 (Russian Federation)	20	-	20	none

* MK-III; (16.7 in MK-I, 75 MWth)

3. CORE CHARACTERISTICS (cont.)

3.10. Percentage of subassemblies changed at each shutdown

Commercial Size Reactors

Plant	Percentage of subassemblies changed at each shutdown (refuelling plan at equilibrium condition)			
	Inner core fuel	Outer core fuel	Control rods	Radial blanket, innermost row
Super-Phénix 1 (France)	**	-	-	-
Super-Phénix 2 (France)	20	20	-	17
SNR 2 (Germany)	33.3	33.3	50	16.7
DFBR (Japan)	33.3	33.3	100	33.3
CDFR (UK)	33	30	20	12
BN-1600 (Russian Federation)	25	25	-	25
BN-800 (Russian Federation)	33.3	33.3	50	25
EFR	20	20	33.3/20****	12.5
ALMR(USA)	33	33	33	25
SVBR-75/100 (Russian Federation)	100	-	-	-
BN-1800 (Russian Federation)	31.2	-	-	-
BREST-1200 (Russian Federation)	20	to be determined		none
JSFR-1500 (Japan)	-	-	-	-
Breeding core	25.0	25.0	100	25.0
Break even core	25.0	25.0	100	no radial blanket

** not completely defined

**** control and shutdown rods / diverse shutdown rods

3. CORE CHARACTERISTICS (cont.)

- 3.11. Total breeding gain*
3.12. Breeding gain (core regions only)

Experimental Fast Reactors

Plant	Total breeding gain*	Breeding gain (core regions only)
Rapsodie (France)	configuration not for breeding	
KNK-II (Germany)	configuration not for breeding	
FBTR (India)	configuration not for breeding	
PEC (Italy)	configuration not for breeding	
JOYO (Japan)	0.03 (MK-I)	-
DFR (UK)	configuration not for breeding	
BOR-60 (Russian Federation)	configuration not for breeding	
EBR-II (USA)	configuration not for breeding	
Fermi (USA)	0.16	-
FFTF (USA)	configuration not for breeding	
BR-10 (Russian Federation)	configuration not for breeding	
CEFR (China)	configuration not for breeding	

Demonstration or Prototype Fast Reactors

Phénix (France)	0.16**	-
SNR-300 (Germany)	0.10 (MK II)	-
PFBR (India)	0.05	negative
MONJU (Japan)	0.2	-
PFR (UK)	-0.05	-
CRBRP (USA)	0.24 (0.29 for initial core)	-
BN-350 (Kazakhstan)	0	-
BN-600 (Russian Federation)	-0.15	-
ALMR (USA)	configuration not for breeding	
KALIMER-150 (Republic of Korea)	0.05	-
SVBR-75/100 (Russian Federation)	-0.13 (UO ₂)	0.04 (MOX)
BREST-OD-300 (Russian Federation)	0.05	-

* Breeding gain is defined as: $BG = \sum W_i(C_i - D_i)/F_i$
 C_i and D_i - respectively rates of creation and destruction of atoms of i
 W_i - the worth of atoms of i , relative to ^{239}Pu atoms
 F_i - the total fission rate

** A total breeding gain 1.16 was experimentally defined at the time of reprocessing of the fuel evacuated from the plant. The fuel cycle, based on mixed oxide fuel and PUREX reprocessing, has been closed and the first fuel subassembly made with reprocessed plutonium was loaded in the reactor in January 1980

3. CORE CHARACTERISTICS (cont.)

3.11. Total breeding gain*

3.12. Breeding gain (core regions only)

Commercial Size Reactors		
Plant	Total breeding gain*	Breeding gain (core regions only)
Super-Phénix 1 (France)	0.18	-
Super-Phénix 2 (France)	-	-
SNR 2 (Germany)	0.12	-
DFBR (Japan)	0.2	-
CDFR (UK)	0.15	-
BN-1600 (Russian Federation)	0.1	-
BN-800 (Russian Federation)	-0.02	-
EFR	0.02	-0.2
ALMR (USA)	0.23	
SVBR-75/100 (Russian Federation)	-0.13 (UO ₂)	0.04 (MOX)
BN-1800 (Russian Federation)	to be determined	
BREST-1200 (Russian Federation)	0.05	-
JSFR-1500 (Japan)	-	-
Breeding core	0.10	-0.16
Break even core	0.03	-0.15

* Breeding gain is defined as: $BG = \frac{W_i(C_i - D_i)}{F_i}$

C_i and D_i - respectively rates of creation and destruction of atoms of i

W_i - the worth of atoms of i, relative to ²³⁹Pu atoms

F_i - the total fission rate

3. CORE CHARACTERISTICS (cont.)

3.13. Reactivity coefficients

Experimental Fast Reactors

Plant	Reactivity coefficients		
	Isothermal temperature coefficient at full power (pcm/°C)	Total power coefficient of reactivity (pcm/MWth) at full power, constant inlet temperature	Maximum coolant void effect (dollars), including only regions with a <u>positive</u> coolant reactivity worth
Rapsodie (France)	-4.5	-6.0 (equilibrium)	-
KNK-II (Germany)	-5 (-4.7*)	-8 (-7.9*)	-2.4 (-3.2*)
FBTR (India)	-4.8 (-4.5*)	-19 (-35*)	-20.57
PEC (Italy)	-3.5 (-3.3*)	-2.5 (-4.3*)	+0.022
JOYO (Japan)	-3.1**	-4.2***	-4.1
DFR (UK)	-5.4	-6.7	0
BOR-60 (Russian Federation)	-4.0	-6.5	-8.0
EBR-II (USA)	-3.6	-4.2	-
Fermi (USA)	-0.39	-0.20	-
FFTF (USA)	-1.08	-0.4	-13
BR-10 (Russian Federation)	-2.2	-8.2	-6.1
CEFR (China)	-4.57	-6.54	-4.99

Demonstration or Prototype Fast Reactors

Phénix (France)	-2.7	-0.5	-
SNR-300 (Germany)	-2.3	-0.3	+2.9
PFBR (India)	-1.8/-1.2 (fresh/equil.)	-0.64/-0.57 (fresh/equil.)	+4.3
MONJU (Japan)	-2.0	-09.4 to 1.1	-
PFR (UK)	-3.3	-1.7	+2.6
CRBRP (USA)	-0.63	-0.2	+2.29 (end of cycle 4)
BN-350 (Kazakhstan)	-1.9	-0.7	-0.6****
BN-600 (Russian Federation)	-1.7	-0.6	-0.3****
ALMR (USA)	-	-	4.0
KALIMER-150 (Republic of Korea)	-	-	2.6
SVBR-75/100 (Russian Federation)	-2.2	-3.1	-2.9 (+0.32 core drained)
BREST-OD-300 (Russian Federation)	-1.9	-0.3	-1.6

* for free fuel instead of bound fuel

** MK-III; (-3.8 in MK-I at 75 MWth, - 2.7 in MK-II)

*** MK-III; (-6.2 in MK-I at 75 MWth, - 6.3 in MK-II)

3. CORE CHARACTERISTICS (cont.)

3.13. Reactivity coefficients

Commercial Size Reactors

Plant	Reactivity coefficients		
	Isothermal temperature coefficient at full power (pcm/°C)	Total power coefficient of reactivity (pcm/MWth) at full power, constant inlet temperature	Maximum coolant void effect (dollars), including only regions with a positive coolant reactivity worth
Super-Phénix 1 (France)	-2.75	-0.1	+5.9
Super-Phénix 2 (France)	-	-	-
SNR 2 (Germany)	-	-	-
DFBR (Japan)	-	-	+4.0
CDFR (UK)	-0.20	-0.16	+5.7
BN-1600 (Russian Federation)	-1.6	-0.1	~ 0****
BN-800 (Russian Federation)	-1.7	-0.36	~ 0****
EFR	-1.1	-0.12	+6.4
ALMR (USA)	-	-	+6.5
SVBR-75/100 (Russian Federation)	-2.2	-3.1	-2.9 (+0.32 core drained)
BN-1800 (Russian Federation)	-	-	~ 0
BREST-1200 (Russian Federation)	-1.9	-0.3	-1.6
JSFR-1500 (Japan)	-	-	-
Breeding core	-0.6	-0.15	+5.3
Break even core	-0.6	-0.15	+5.3

**** core and upper part of subassemblies

3. CORE CHARACTERISTICS (cont.)

3.13. Reactivity coefficients

Experimental Fast Reactors

Plant	Reactivity coefficients	
	Doppler coefficient (Tdk/dt)	
	For voided core	For unvoided core
Rapsodie (France)	0	0
KNK-II (Germany)	-	-0.0030
FBTR (India)	0.0	0.0
PEC (Italy)	-0.002	-0.003
JOYO (Japan)	-0.00095	-0.0017
DFR (UK)	-	0.0002
BOR-60 (Russian Federation)	-	0.0015
EBR-II (USA)	value is very small, approximately -0.0003	sodium-in; therefore no sodium-out calculations have been made
Fermi (USA)	-	-0.00026
FFTF (USA)	-0.003	-0.005
BR-10 (Russian Federation)	0	0
CEFR (China)	-0.0021	-0.0025

Demonstration or Prototype Fast Reactors

Phénix (France)	-0.004	-0.006
SNR-300 (Germany)	-0.003	-0.004
PFBR (India)	-0.0045	-0.0066
MONJU (Japan)	-0.0040	-0.0057 to -0.0076
PFR (UK)	-	-0.0068
CRBRP (USA)	-0.0166	-0.00258
BN-350 (Kazakhstan)	-0.0049	-0.007
BN-600 (Russian Federation)	-0.0044	-0.007
ALMR (USA)	-0.0017	-0.0028
KALIMER-150 (Republic of Korea)	-	-0.0042
SVBR-75/100 (Russian Federation)	to be determined	
BREST-OD-300 (Russian Federation)	-	-0.0066

3. CORE CHARACTERISTICS (cont.)

3.13. Reactivity coefficients

Commercial Size Reactors

Plant	Reactivity coefficients	
	Doppler coefficient (Tdk/dt)	
	For voided core	For unvoided core
Super-Phénix 1 (France)	-0.007	-0.009
Super-Phénix 2 (France)	-	-
SNR 2 (Germany)	-	-
DFBR (Japan)	-	-0.008
CDFR (UK)	-0.0056	-0.0080
BN-1600 (Russian Federation)		-0.007
BN-800 (Russian Federation)	-0.004	-0.007
EFR	-0.005	-0.0065
ALMR (USA)	-0.0026	-0.0044
SVBR-75/100 (Russian Federation)	to be determined	
BN-1800 (Russian Federation)	to be determined	
BREST-1200 (Russian Federation)	-	-0.0066
DFBR (Japan)	-	-
Breeding core	-0.005	-0.006
Break even core	to be determined	-0.006