

## 1. GENERAL INFORMATION

### 1.1. Reactors

#### Experimental Fast Reactors

##### Plant

Rapsodie (France)	
KNK-II (Germany)	
FBTR (India)	Fast Breeder Test Reactor
PEC (Italy)	Prova Elementi di Combustibile
JOYO (Japan)	
DFR (UK)	Dounreay Fast Reactor
BOR-60 (Russia)	
EBR-II (USA)	Experimental Breeder Reactor II
Fermi (USA)	
FFTF (USA)	Fast Flux Test Facility
BR-10 (Russia)	
CEFR (China)	China Experimental Fast Reactor

#### Demonstration or Prototype Fast Reactors

Phénix (France)	
SNR-300 (Germany)	
PFBR (India)	Prototype Fast Breeder Reactor
MONJU (Japan)	
PFR (UK)	Prototype Fast Reactor
CRBRP (USA)	Clinch River Breeder Reactor Plant
BN-350 (Kazakhstan)	
BN-600 (Russia)	
ALMR (USA)*	Advanced Liquid Metal Reactor

#### Commercial Size Reactors

Super-Phénix 1 (France)	
Super-Phenix 2 (France)	
SNR 2 (Germany)	
DFBR (Japan)	Demonstration Fast Breeder Reactor
CDFR (UK)	Commercial Demonstration Fast Reactor
BN-1600 (Russia)	
BN-800 (Russia)	
EFR	European Fast Reactor
ALMR (USA)**	Advanced Liquid Metal Reactor

\* The demonstration of ALMR will be an actinide burner

\*\* The commercial plant will have 6 units, and will have a breeding mission using a heterogenous core with internal blanket

## GENERAL INFORMATION

### 1.2. Location, postal address of station

#### **Experimental Fast Reactors**

Plant	1.2.
Rapsodie (France)	CEN Cadarache 13115 St. Paul les Durance
KNK-II (Germany)	KfK, Post Box 3640, D-76021 Karlsruhe
FBTR (India)	Indira Gandhi Center for Atomic Research, Kalpakkam, 603 102, India
PEC (Italy)	Brasimone
JOYO (Japan)	Oarai Engineering Center, PNC; 4002, Narita, Oarai, Higashi-Ibaraki; Ibaraki-Prefecture, Japan
DFR (UK)	Dounreay, Caithness, Scotland KW 14 7TZ
BOR-60 (Russia)	Dimitrovgrad, U1'yanovsk region
EBR-II (USA)	Idaho, Argonne National Laboratory; P.O. Box 2528; Idaho Falls, ID 83401
Fermi (USA)	Lagoon Beach, Michigan
FFTF (USA)	Westinghouse Hanford, P.O. Box 1970 Richland, WA 99352
BR-10 (Russia)	Obninsk, Kaluga Region
CEFR (China)	FBR Research Center, CIAE, Fangshan Beijing

#### **Demonstration or Prototype Fast Reactors**

Phénix (France)	CEA Centre de Marcoule BP 171 30200 Bagnols sur Ceze
SNR-300 (Germany)	KKW Kalkar, Postfach 1220, D-4192 Kalkar
PFBR (India)	to be determined
MONJU (Japan)	1,2-chome, Shiraki, Tsuruga-city, Fukui-Prefecture, Japan
PFR (UK)	Dounreay, Caithness, Scotland KW14 7TZ
CRBRP (USA)	P.O. U, Oak Ridge Turnpike, Oak Ridge, TN 37830
BN-350 (Kazakhstan)	Mangyshlak Power Plant, Aktav, Kazakhstan
BN-600 (Russia)	Beloyarsk Power Plant, Zarechny; Sverdlovsk region
ALMR (USA)	To be determined

#### **Commercial Size Reactors**

Super-Phénix 1 (France)	CNPE de Creys Malville BP63, 38510 Morestel
Super-Phénix 2 (France)	cancelled
SNR 2 (Germany)	cancelled
DFBR (Japan)	to be determined
CDFR (UK)	cancelled
BN-1600 (Russia)	to be determined
BN-800 (Russia)	South Urals Power Plant, Chelyabinsk Region and Beloyarsk Power Plant, Sverdlovsk Region
EFR	to be determined
ALMR (USA)	to be determined

## GENERAL INFORMATION

- 1.3. Administrative and responsible authority  
1.3.1. Owner

### Experimental Fast Reactors

Plant	1.3.1.
Rapsodie (France)	Commissariat à l'Energie Atomique (CEA)
KNK-II (Germany)	Kernforschungszentrum Karlsruhe
FBTR (India)	Department of Atomic Energy, India
PEC (Italy)	ENEA
JOYO (Japan)	Power Reactor and Nuclear Fuel Development Corporation (PNC)
DFR (UK)	UK Atomic Energy Authority
BOR-60 (Russia)	Ministry for Atomic Energy
EBR-II (USA)	U.S. Department of Energy (USDOE)
Fermi (USA)	Power Reactor Development Co., Detroit Edison Co.
FFTF (USA)	U.S. Department of Energy
BR-10 (Russia)	Ministry for Atomic Energy
CEFR (China)	China Institute of Atomic Energy

### Demonstration or Prototype Fast Reactors

Phénix (France)	Commissariat à l'Energie Atomique (CEA) and Electricité de France (EdF)
SNR-300 (Germany)	Schnellbrüter - Kernkraftwerkgesellschaft (SBK)
PFBR (India)	Department of Atomic Energy, India
MONJU (Japan)	Power Reactor and Nuclear Fuel Development Corporation (PNC)
PFR (UK)	UK Atomic Energy Authority
CRBRP (USA)	U.S. Department of Energy (USDOE)
BN-350 (Kazakhstan)	Atomic Energy Agency
BN-600 (Russia)	Ministry for Atomic Energy
ALMR (USA)	to be determined

### Commercial Size Reactors

Super-Phénix 1 (France)	NERSA
Super-Phénix 2 (France)	
SNR 2 (Germany)	
DFBR (Japan)	to be determined
CDFR (UK)	
BN-1600 (Russia)	Ministry for Atomic Energy
BN-800 (Russia)	Ministry for Atomic Energy
EFR	to be determined
ALMR (USA)	to be determined

## GENERAL INFORMATION

### 1.3.2. Operator

#### Experimental Fast Reactors

Plant	1.3.2.
Rapsodie (France)	CEA
KNK-II (Germany)	Kernkraftwerk Betriebsgesellschaft
FBTR (India)	Department of Atomic Energy, India
PEC (Italy)	ENEA
JOYO (Japan)	PNC
DFR (UK)	UK Atomic Energy Authority
BOR-60 (Russia)	Ministry for Atomic Energy
EBR-II (USA)	Argonne National Laboratory
Fermi (USA)	Power Reactor Development Co., Detroit Edison Co.
FFTF (USA)	Westinghouse Hanford
BR-10 (Russia)	Ministry for Atomic Energy
CEFR (China)	China Institute of Atomic Energy

#### Demonstration or Prototype Fast Reactors

Phénix (France)	CEA + EdF
SNR-300 (Germany)	SBK
PFBR (India)	Department of Atomic Energy, India
MONJU (Japan)	PNC
PFR (UK)	UK Atomic Energy Authority
CRBRP (USA)	Tennessee Valley Authority
BN-350 (Kazakhstan)	Atomic Energy Agency
BN-600 (Russia)	Ministry for Atomic Energy
ALMR (USA)	to be determined

#### Commercial Size Reactors

Super-Phénix 1 (France)	NERSA
Super-Phénix 2 (France)	
SNR 2 (Germany)	
DFBR (Japan)	to be determined
CDFR (UK)	
BN-1600 (Russia)	Ministry for Atomic Energy
BN-800 (Russia)	Ministry for Atomic Energy
EFR	to be determined
ALMR (USA)	to be determined

## GENERAL INFORMATION

### 1.3.3. Designer

#### Experimental Fast Reactors

Plant	1.3.3.
Rapsodie (France)	Groupement Atomique Alsacienne Atlantique (GAAA)
KNK-II (Germany)	Interatom
FBTR (India)	Department of Atomic Energy, India
PEC (Italy)	ANSALDO/NIRA and ENEA
JOYO (Japan)	PNC/Toshiba/Hitachi/Mitsubishi/Fuji
DFR (UK)	UK Atomic Energy Authority
BOR-60 (Russia)	Hydropress Design Bureau, Podolsk
EBR-II (USA)	Argonne National Laboratory
Fermi (USA)	Atomic Power Development Associates
FFTF (USA)	Westinghouse Advanced Reactors Division
BR-10 (Russia)	Ministry for Atomic Energy
CEFR (China)	Beijing Institute of Nuclear Engineering and China Institute of Atomic Energy

#### Demonstration or Prototype Fast Reactors

Phénix (France)	CEA + EdF + GAAA
SNR-300 (Germany)	Internationale Natrium - Brutreaktor - Bau GmbH (INB)
PFBR (India)	Department of Atomic Energy, India
MONJU (Japan)	PNC/Mitsubishi/Hitachi/Toshiba/Fuji
PFR (UK)	TNPG*/NNC (National Nuclear Corporation)
CRBRP (USA)	Westinghouse Electric Corporation (lead)
BN-350 (Kazakhstan)	Machine Building Design Bureau, Nizhny Novgorod**
BN-600 (Russia)	Machine Building Design Bureau, Nizhny Novgorod**
PRISM (USA)	General Electric Company (lead)

#### Commercial Size Reactors

Super-Phénix 1 (France)	Novatome + EdF
Super-Phénix 2 (France)	Novatome + EdF
SNR 2 (Germany)	Interatom, Novatome, Ansaldo
DFBR (Japan)	The Japan Atomic Power Company
CDFR (UK)	National Nuclear Corporation
BN-1600 (Russia)	Machine Building Design Bureau, Nizhny-Novgorod**
BN-800 (Russia)	Machine Building Design Bureau, Nizhny-Novgorod**
EFR	Novatome, Siemens KWU***, NNC working as EFR Associates
ALMR (USA)	to be determined

\* TNPG - The Nuclear Power Group, now superseded by NNC.

\*\* Steam generator design by Hydropress Design Bureau, Podolsk.

\*\*\* Kraftwerk Union

## GENERAL INFORMATION

### 1.3.4. Manufacturer or chief contractor

#### Experimental Fast Reactors

Plant	1.3.4.
Rapsodie (France)	GAAA
KNK-II (Germany)	Interatom
FBTR (India)	Department of Atomic Energy, India
PEC (Italy)	ANSALDO/NIRA
JOYO (Japan)	Toshiba/Hitachi/Mitsubishi/Fuji
DFR (UK)	UK Atomic Energy Authority
BOR-60 (Russia)	Podol'sk Manufacturing Plant
EBR-II (USA)	Architect/engineer - H.K. Ferguson Co.; constructor - Diversified Builders, Inc.
Fermi (USA)	United Engineers and Constructors
FFTF (USA)	Bechtel Power Corporation
BR-10 (Russia)	Ministry for Atomic Energy
CEFR (China)	to be determined

#### Demonstration or Prototype Fast Reactors

Phénix (France)	CEA + EdF + GAAA
SNR-300 (Germany)	Interatom
PFBR (India)	Department of Atomic Energy, India
MONJU (Japan)	Mitsubishi/Hitachi/Toshiba/Fuji
PFR (UK)	TNPG/NNC (National Nuclear Corporation)
CRBRP (USA)	Stone and Webster Engineering Corporation
BN-350 (Kazakhstan)	Podol'sk Manufacturing Plant
BN-600 (Russia)	Ministry of Energetics (USSR) and State Committee on the Utilization of Atomic Energy (USSR)
ALMR (USA)	to be determined

#### Commercial Size Reactors

Super-Phénix 1 (France)	Novatome + NIRA
Super-Phénix 2 (France)	
SNR 2 (Germany)	
DFBR (Japan)	to be determined
CDFR (UK)	National Nuclear Corporation
BN-1600 (Russia)	to be determined
BN-800 (Russia)	Ministry for Atomic Energy
EFR	to be determined
ALMR (USA)	to be determined

## GENERAL INFORMATION

### 1.3.5. Licensing authority

#### Experimental Fast Reactors

Plant

1.3.5.

Rapsodie (France)	CEA
KNK-II (Germany)	Wirtschaftsministerium Baden - Württemberg
FBTR (India)	Atomic Energy Regulatory Board
PEC (Italy)	ENEA Nuclear Safety Direction
JOYO (Japan)	Science and Technology Agency
DFR (UK)	UK Atomic Energy Authority
BOR-60 (Russia)	Gosatomnadzor
EBR-II (USA)	
Fermi (USA)	US Atomic Energy Commission (now USDOE)
FFTF (USA)	U.S. Department of Energy
BR-10 (Russia)	Gosatomnadzor
CEFR (China)	China National Nuclear Safety Administration and China National Environment Protection Administration

#### Demonstration or Prototype Fast Reactors

Phenix (France)	French Administration
SNR-300 (Germany)	Wirtschaftsministerium Nordrhein - Westfalen
PFBR (India)	Atomic Energy Regulatory Board
MONJU (Japan)	Science and Technology Agency, and Ministry of International Trade and Industry
PFR (UK)	UK Nuclear Installation Inspectorate
CRBRP (USA)	U.S. Nuclear Regulatory Commission
BN-350 (Kazakhstan)	Atomic Energy Agency
BN-600 (Russia)	Gosatomnadzor
ALMR (USA)	U.S. Nuclear Regulatory Commission

#### Commercial Size Reactors

Super-Phénix 1 (France)	French Administration
Super-Phénix 2 (France)	
SNR 2 (Germany)	
DFBR (Japan)	to be determined
CDFR (UK)	Nuclear Installations Inspectorate
BN-1600 (Russia)	Gosatomnadzor
BN-800 (Russia)	Gosatomnadzor
EFR	to be determined
ALMR (USA)	U.S. Nuclear Regulatory Commission

## GENERAL INFORMATION

- 1.4. Dates of major events
- 1.4.1. Start of construction
- 1.4.2. First criticality
- 1.4.3. First electricity generation
- 1.4.4. First full power operation
- 1.4.5. Final shutdown

### Experimental Fast Reactors

Plant	1.4.1.	1.4.2.	1.4.3.	1.4.4.	1.4.5.
Rapsodie (France)	1962	Jan. 1967		Mar. 1967	Apr. 1983
KNK-II (Germany)		Oct. 1972	Apr. 1978	1978	Oct. 1991
FBTR (India)	1972	Oct. 1985	1994	1996	
PEC (Italy)	Jan. 1974	project cancelled			
JOYO (Japan)	Feb. 1970	Nov. 1982*		Mar. 1983*	
DFR (UK)	1954	1959	1962	1963	1977
BOR-60 (Russia)	1964	1968	1969	1970	
EBR-II (USA)	June 1958	**	Aug. 1964	1965	
Fermi (USA)	Aug. 1956	Aug. 1963	Aug. 1966	Oct. 1970	
FFTF (USA)	June 1970	Feb. 1980		Dec. 1980	
BR-10 (Russia)	1956	1958		1959***	
CEFR (China)	to be determined				

### Demonstration or Prototype Fast Reactors

Phénix (France)	1968	1973	1973	Mar. 1974	
SNR-300 (Germany)		project cancelled			
PFBR (India)	1997	2007	2008	2009	
MONJU (Japan)	1985	Apr. 1995	1995	1996	
PFR (UK)	June 1966	Mar. 1974	Jan. 1975	Feb. 1977	Mar. 1994
CRBRP (USA)	project cancelled				
BN-350 (Kazakhstan)	1964	Nov. 1972	1973	mid 73 not full	
BN-600 (Russia)	1967	Feb. 1980	Apr. 1980	Dec. 1981	
ALMR (USA)	2000	2005			

### Commercial Size Reactors

Super-Phénix 1 (France)	1976	1985	1986	1986	
Super-Phénix 2 (France)	project subsumed into EFR				
SNR 2 (Germany)	project subsumed into EFR				
DFBR (Japan)	to be determined				
CDFR (UK)	project subsumed into EFR				
BN-1600 (Russia)	to be determined				
BN-800 (Russia)	to be determined				
EFR	to be determined				
ALMR (USA)	to be determined				

\* MK-II; (Apr. 1977, July 1978, respectively, in MK-I)

\*\* dry criticality: Sept. 30, 1961

wet criticality: Nov. 11, 1963

\*\*\* At 5MWt as BR-5

## GENERAL INFORMATION

<u>1.5.</u>	Nominal full power	<u>1.6.</u>	Coolant
1.5.1.	Thermal (MWth)	1.6.1.	Primary circuit
1.5.2.	Electric (MWe) Gross	1.6.2.	Secondary circuit

### Experimental Fast Reactors

Plant	1.5.1.	1.5.2.	1.6.1.	1.6.2.
Rapsodie (France)	40	0	sodium	sodium
KNK-II (Germany)	58	20	sodium	sodium
FBTR (India)	40	13	sodium	sodium
PEC (Italy)	120	0	sodium	sodium
JOYO (Japan)	100*	0	sodium	sodium
DFR (UK)	60	15	NaK	NaK
BOR-60 (Russia)	55	12	sodium	sodium
EBR-II (USA)	62.5	20	sodium	sodium
Fermi (USA)	200	61	sodium	sodium
FFTF (USA)	400	0	sodium	sodium
BR-10 (Russia)	8	0	sodium	sodium
CEFR (China)	65	23.4	sodium	sodium

### Demonstration or Prototype Fast Reactors

Phénix (France)	563	250	sodium	sodium
SNR-300 (Germany)	762	327	sodium	sodium
PFBR (India)	1210	500	sodium	sodium
MONJU (Japan)	714	280	sodium	sodium
PFR (UK)	650	250	sodium	sodium
CRBRP (USA)	975	380	sodium	sodium
BN-350 (Kazakhstan)	750**	130	sodium	sodium
BN-600 (Russia)	1470	600	sodium	sodium
ALMR (USA)	840	303	sodium	sodium

### Commercial Size Reactors

Super-Phénix 1 (France)	2990	1242	sodium	sodium
Super-Phenix 2 (France)	3600	1440	sodium	sodium
SNR 2 (Germany)	3420	1497	sodium	sodium
DFBR (Japan)	1600	660	sodium	sodium
CDFR (UK)	3800	1500	sodium	sodium
BN-1600 (Russia)	4200	1600	sodium	sodium
BN-800 (Russia)	2100	800	sodium	sodium
EFR	3600	1580	sodium	sodium
ALMR (USA)	840	303	sodium	sodium

\* MK II; 50 and 75 MWth for MK-I.

\*\* 150 MWt used for desalination

**GENERAL INFORMATION**

- 1.7. Coolant temperature (°C)
- 1.7.1. Mixed coolant temperature in primary circuit at inlet to Intermediate Heat Exchanger (IHX)
- 1.7.2. Mixed coolant temperature in secondary circuit at inlet to Steam Generator (SG)
- 1.8. Steam conditions (at turbine inlet, full power)
- 1.8.1. Temperature (°C)
- 1.8.2. Pressure (MPa)

**Experimental Fast Reactors**

Plant	1.7.1.	1.7.2.	1.8.1.	1.8.2.
Rapsodie (France)	510	498		
KNK-II (Germany)	525	504	485	7.85
FBTR (India)	516	510	480	12.25
PEC (Italy)	550	495		
JOYO (Japan)	500*	470*		
DFR (UK)	350	330	270	1
BOR-60 (Russia)	545	480	430	8
EBR-II (USA)	473	467	433	8.79
Fermi (USA)	427	408	407	4.1
FFTF (USA)	565	538		
BR-10 (Russia)	470	380		
CEFR (China)	514	495	480	10.0

**Demonstration or Prototype Fast Reactors**

Phénix (France)	560	550	510	16.8
SNR-300 (Germany)	546	520	495	16.7
PFBR (India)	530	505	480	16.6
MONJU (Japan)	529	505	483	12.5
PFR (UK)	550	540	513	12.8
CRBRP (USA)	535	494	482	9.81
BN-350 (Kazakhstan)	430	415	410	4.5
BN-600 (Russia)	550	520	500	13.2
ALMR (USA)	499	477	429	15.2

**Commercial Size Reactors**

Super-Phénix 1 (France)	542	525	487	17.7
Super-Phénix 2 (France)	544	525	495	17.7
SNR 2 (Germany)	540	510	495	17.2
DFBR (Japan)	550	520	495	16.6
CDFR (UK)	540	510	490	17.4
BN-1600 (Russia)	550	515	495	13.7
BN-800 (Russia)	544	505	490	13.7
EFR	545	525	490	18.5
ALMR (USA)	499	477	429	15.2

\* MK-II; (470, 450, respectively, in MK-I, 75 MWth)

## GENERAL INFORMATION

- 1.9. Primary circuit configuration  
 1.10. Drive fuel charge

### Experimental Fast Reactors

Plant	1.9.	1.10.
Rapsodie (France)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
KNK-II (Germany)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
FBTR (India)	loop	PuC-UC
PEC (Italy)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
JOYO (Japan)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
DFR (UK)	loop	U-7% Mo metal alloy
BOR-60 (Russia)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
EBR-II (USA)	pool	U-Zr metal alloys*
Fermi (USA)	loop	U metal with 10 wt % Mo
FFTF (USA)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
BR-10 (Russia)	loop	UN (early PuO <sub>2</sub> , UC)
CEFR (China)	pool	PuO <sub>2</sub> -UO <sub>2</sub> **

### Demonstration or Prototype Fast Reactors

Phénix (France)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
SNR-300 (Germany)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
PFBR (India)	pool	PuO <sub>2</sub> -UO <sub>2</sub> *
MONJU (Japan)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
PFR (UK)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
CRBRP (USA)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
BN-350 (Kazakhstan)	loop	UO <sub>2</sub>
BN-600 (Russia)	pool	UO <sub>2</sub> first, partly PuO <sub>2</sub> -UO <sub>2</sub> later
ALMR (USA)	pool	U-Pu-Zr Metal (PuO <sub>2</sub> -UO <sub>2</sub> Backup)

### Commercial Size Reactors

Super-Phénix 1 (France)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
Super-Phénix 2 (France)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
SNR 2 (Germany)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
DFBR (Japan)	loop	PuO <sub>2</sub> -UO <sub>2</sub>
CDFR (UK)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
BN-1600 (Russia)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
BN-800 (Russia)	pool	PuO <sub>2</sub> -UO <sub>2</sub>
EFR	pool	PuO <sub>2</sub> -UO <sub>2</sub>
ALMR (USA)	pool	U-Pu-Zr metal (PuO <sub>2</sub> -UO <sub>2</sub> Backup)

\* Including some recycled fission products from the pyrometallurgical fuel cycle

\*\* UO<sub>2</sub> (60.5 U-235% enrichment) for first loading