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# *Nuclear Power & Global Power Competition*

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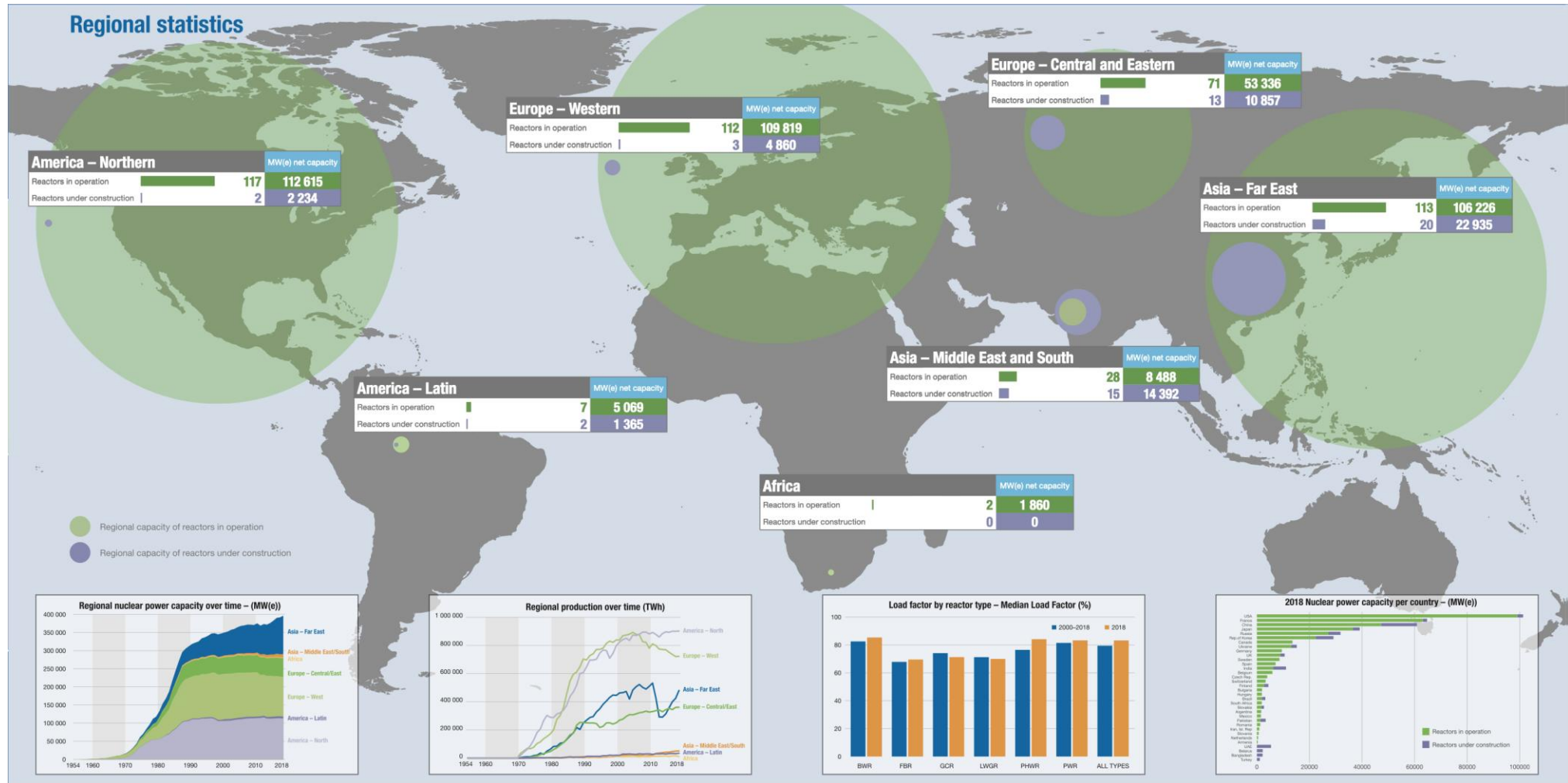
Energy Security & Climate Change Program

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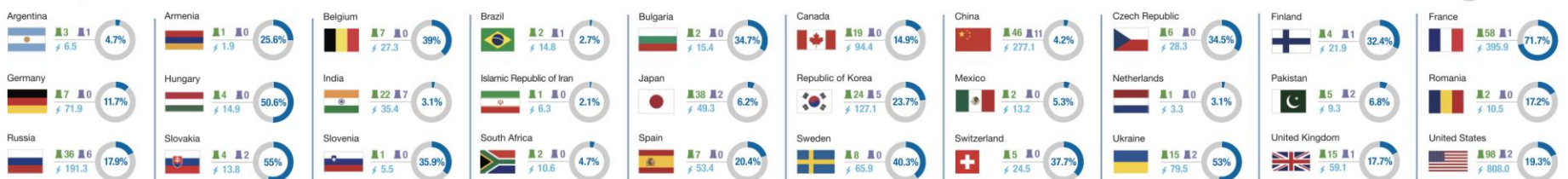
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## Regional statistics



## Country statistics



Taiwan, China: 5 reactors, 4 448 MW(e) in operation; 2 reactors, 2 600 MW(e) under construction; 26.7 TWh electricity supplied, 11.4% nuclear share.

## Global Nuclear Power Plant Status Changes (2018 ~)

	2018		2019		2020	2021 (H2)	Total
<b>Construction starts</b>	Akkuyu 1 (TR) Hinkley Pt C-1 (GB) Kursk 2-1 (RU) Rooppur 2 (BD) Shin-Kori 6 (KR)		Bushehr 2 (IR) Hinkley Pt C 2 (GB) Kursk 2-2 (RU) Taipingling 1 (CN) Zhangzhou 1 (CN)		Akkuyu 2 (TR) Sanaocun 1 (CN) Taipingling 2 (CN) Zhangzhou 2 (CN)	Akkuyu 3 (TR) Changjiang 3 (CN)	<b>16</b>
<b>New grid connection</b>	Haiyan 1 (CN) Haiyan 2 (CN) Leningrad 2-1 (RU) Rostov 4 (RU) Sanmen 1 (CN)	Sanmen 2 (CN) Taishan 1 (CN) Tianwan 4 (CN) Yangjian 5 (CN)	Akademik Lomonosov 1 (RU) Akademik Lomonosov 2 (RU) Novovoronezh 2 (RU)	Shin-Kori 4 (KR) Taishan 2 (CN) Yangjian 6 (CN)	Barakah 1 (AE) Belarusian 1 (BY) Fuqing 5 (CN) Leningrad 2-2 (RU) Tianwan 5 (CN)	Kakrapar 3 (IN) Kanupp 2 (PK) Tianwan 6 (CN)	<b>23</b>
<b>Permanent shutdowns</b>	Chinshan 1 (TW) Ikata 2 (JP) Leningrad 1 (RU) OHI 1 (JP) OHI 2 (JP) Onagawa 1 (JP) Oyster Creek (US)		Bilibino 1 (RU) Chinshan 2 (TW) Fukushima Daini 1 (JP) Fukushima Daini 2 (JP) Fukushima Daini 3 (JP) Fukushima Daini 4 (JP) Genkai 2 (JP)	Muehleberg (CH) Philippsburg 2 (DE) Pilgrim 1 (US) Ringhals 2 (SE)	Duane Arnold 1 (US) Fessenheim 1 (FR) Fessenheim 2 (FR) Indian Point 2 (US) Leningrad 2 (RU) Ringhals 1 (SE)	Indian Point 3 (US) Kuosheng 1 (TW)	<b>26</b>

(IAEA database, accessed on 8/26/2021)

## Global Nuclear Power Plant Status Changes (2018 ~) per **Russian** & **Chinese** Technologies

	2018		2019		2020	2021 (H2)
<b>Construction starts</b>	Akkuyu 1 (TR) Hinkley Pt C-1 (GB) Kursk 2-1 (RU) Rooppur 2 (BD) Shin-Kori 6 (KR)		Bushehr 2 (IR) Hinkley Pt C 2 (GB) Kursk 2-2 (RU) Taipingling 1 (CN) Zhangzhou 1 (CN)		Akkuyu 2 (TR) Sanaocun 1 (CN) Taipingling 2 (CN) Zhangzhou 2 (CN)	Akkuyu 3 (TR) Changjiang 3 (CN)
<b>New grid connection</b>	Haiyan 1 (CN) Haiyan 2 (CN) Leningrad 2-1 (RU) Rostov 4 (RU) Sanmen 1 (CN)	Sanmen 2 (CN) Taishan 1 (CN) Tianwan 4 (CN) Yangjian 5 (CN)	Akademik Lomonosov 1 (RU) Akademik Lomonosov 2 (RU) Novovoronezh 2 (RU)	Shin-Kori 4 (KR) Taishan 2 (CN) Yangjian 6 (CN)	Barakah 1 (AE) Belarusian 1 (BY) Fuqing 5 (CN) Leningrad 2-2 (RU) Tianwan 5 (CN)	Kakrapar 3 (IN) Kanupp 2 (PK) Tianwan 6 (CN)
<b>Permanent shutdowns</b>	Chinshan 1 (TW) Ikata 2 (JP) Leningrad 1 (RU) OHI 1 (JP) OHI 2 (JP) Onagawa 1 (JP) Oyster Creek (US)		Bilibino 1 (RU) Chinshan 2 (TW) Fukushima Daini 1 (JP) Fukushima Daini 2 (JP) Fukushima Daini 3 (JP) Fukushima Daini 4 (JP) Genkai 2 (JP)		Muehleberg (CH) Philippsburg 2 (DE) Pilgrim 1 (US) Ringhals 2 (SE)	Duane Arnold 1 (US) Fessenheim 1 (FR) Fessenheim 2 (FR) Indian Point 2 (US) Leningrad 2 (RU) Ringhals 1 (SE)

(IAEA database, accessed on 8/26/2021)

# Civilian Nuclear Power Sector Comparison: U.S., Russia, and China (2020)

Country	Reactor Units			Installed Capacity	Share in National Power Supply	Future Net Installed Capacity	Sector Structure
	Online	Under Construction	Permanent Shutdown				
USA	94	2	40	95.5 GWe	19.7%	92 GWe (2025 projection)	Multiple private companies
Russia	38	3	9	28.6 GWe	20.6%	44 GWe (2030 target)	Vertically & horizontally integrated under one state corp.
China	51	13	0	48.5 GWe	4.9%	70 GWe (2025 target); 120-200 GWe (2035 estimates)	Vertically integrated under 3 state corps.

(Sources: IAEA Power Reactor Information System, U.S. EIA, World Nuclear News, other news articles)

**TABLE 2: The Terms of Financing for Russian and Chinese Nuclear Export Deals\***

EXPORTER	IMPORTER	PROJECT	UNITS	DEBT			EQUITY	COUNTRY CREDIT RATING		
				AMOUNT BILLION USD	INTEREST RATE	REPAYMENT YEARS		MOODY'S	S&P	FITCH
RUSSIA	Bangladesh	Rooppu	2	\$12.65	1.75% <sup>1</sup>	28 <sup>2</sup>	-	Ba3	BB-	BB-
	Belarus	(Untitled)	2	\$10.00	-	25	-	B3	B	B
	Egypt	El Dabaa	4	\$25.00	3.00%	22 <sup>3</sup>	-	B2	B	B+
	Finland	Hanhikivi	1	\$2.20	-	-	34%	Aa1	AA+	AA+
	Hungary	Paks 2	2	\$13.30	Var. <sup>4</sup>	21 <sup>5</sup>	-	Baa3	BBB	BBB
	Jordan (Canceled)	(Untitled)	2	-	-	-	49.90%	B1	B+	BB-
	Turkey	Akkuyu	4	-	-	-	100% <sup>6</sup>	B1	B+	BB-
	Vietnam (Canceled)	Ninh Thuan 1	2	\$9.00	-	-	-	-	-	BB
CHINA	Argentina <sup>7</sup>	Atucha 3 & Unit V	2	See notes <sup>8</sup>	-	-	-	Ca2	CCC-	CC
	Pakistan	Karachi	2	\$6.50	See notes <sup>9</sup>	20	-	B3	B-	B-
	United Kingdom	Hinkley Point C	2	-	-	-	33.5% <sup>10</sup>	Aa2	AA	AA

Source: Adapted from Murphy, "The Bear and the Dragon," 16-17.

\* Dash (-) indicates information not publicly available. For Finland and Hungarian debt amounts, U.S. dollar value was added by the author using the average rate of exchange by *statista* in the year the financing arrangements were made: 2015 (€1 = US\$1.11) for Finland, and 2014 (€1 = US\$1.33) for Hungary (<https://www.statista.com/statistics/412794/euro-to-u-s-dollar-annual-average-exchange-rate/>).

<sup>1</sup> 4% cap

<sup>2</sup> 10-year grace period

<sup>3</sup> Starting 2029

<sup>4</sup> Below 4% for 11 years, then 4.5%, then 4.95%

<sup>5</sup> Starting at COD for second unit

<sup>6</sup> Goal to sell down to 51%; Russia-owned project; company must source all financing

<sup>7</sup> Initial deal canceled; revised project structure under negotiation (only a Hualong One project)

<sup>8</sup> 85% of project costs across two projects (Atucha 3, plus a Hualong One project; linked financing)

<sup>9</sup> "to be repaid at concessional rate"

<sup>10</sup> Plus 20% equity in Sizewell C (2 units), plus rights to Bradwell site for a Hualong One project (2 units)

## **Implications of Growing Nuclear Exports by Russia and China**

- **Security of nuclear power plants as critical infrastructure**
- **Geopolitical influence**
- **Nuclear governance**