Jaderná energetika mimo EU – Turecko a Ruská federace

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Ústav energetiky

FS ČVUT v Praze

Based mostly on WNA and IAEA publically available materials.

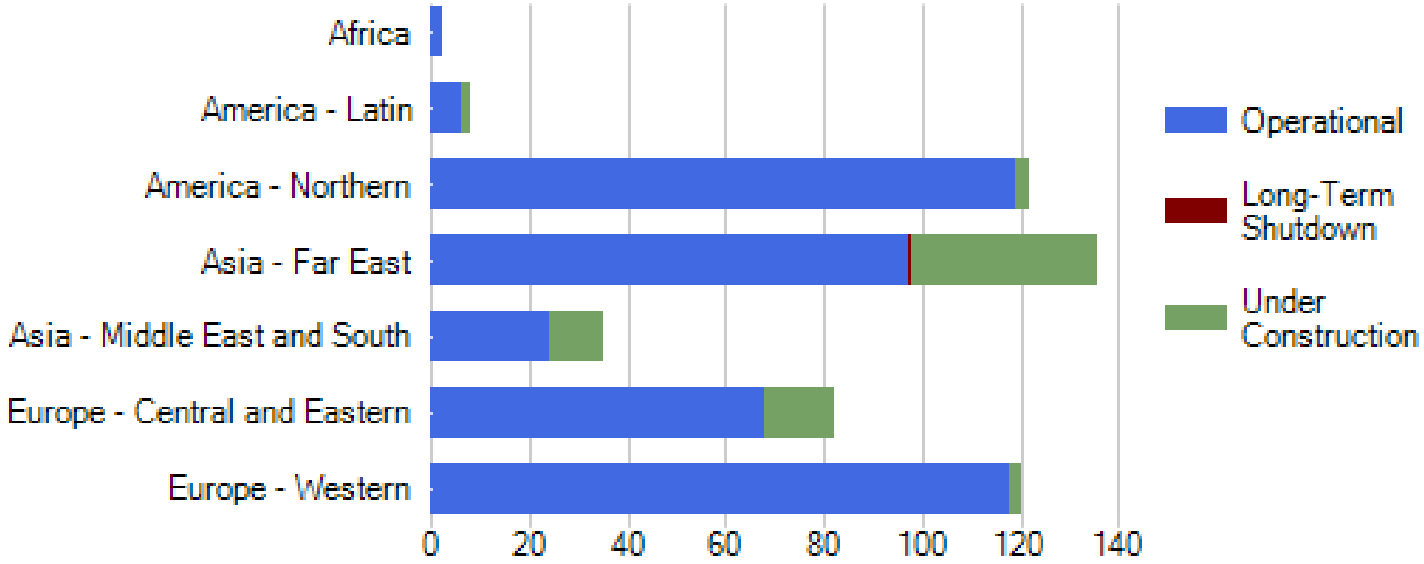
Current Status of Nuclear Energy

434 NUCLEAR POWER REACTORS IN OPERATION

370 409 MW_e TOTAL NET INSTALLED CAPACITY

1 NUCLEAR POWER REACTORS IN LONG-TERM SHUTDOWN

70 NUCLEAR POWER REACTORS UNDER CONSTRUCTION



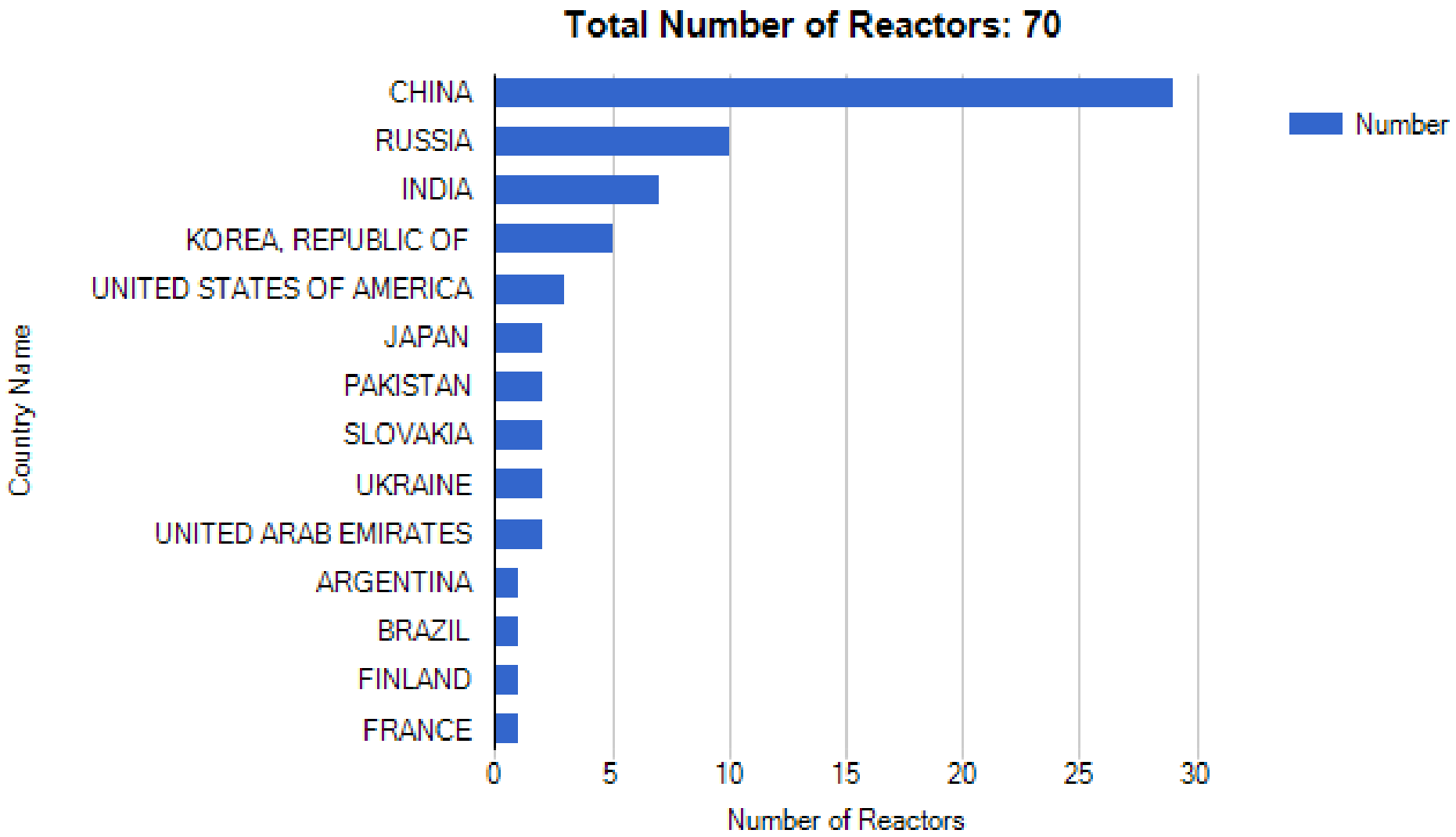
Types of Currently Operated Reactors

Reactor Type	Reactor Type Descriptive Name	Number of Reactors	Total Net Electrical Capacity [MW]	
PWR	Pressurized Light-Water-Moderated and Cooled Reactor	270	249563	
BWR	Boiling Light-Water-Cooled and Moderated Reactor	84	78046	
PHWR	Pressurized Heavy-Water-Moderated and Cooled Reactor	48	23961	
GCR	Gas-Cooled, Graphite-Moderated Reactor	15	8040	
LWGR	Light-Water-Cooled, Graphite-Moderated Reactor	15	10219	
FBR	Fast Breeder Reactor	2	580	
Total		**434**	**370409**	

Types of Reactors Under Constructions

Reactor Type	Reactor Type Descriptive Name	Number of Reactors	Total Net Electrical Capacity [MW]	
PWR	Pressurized Light-Water-Moderated and Cooled Reactor	58	58265	
PHWR	Pressurized Heavy-Water-Moderated and Cooled Reactor	5	3212	
BWR	Boiling Light-Water-Cooled and Moderated Reactor	4	5250	
FBR	Fast Breeder Reactor	2	1259	
HTGR	High-Temperature Gas-Cooled Reactor	1	200	
Total		**70**	**68186**	

Where Are Reactors Being Built



Models of Reactors Under Construction

Country	Reactor		Type	Model	Capacity (MW)			Operator	NSSS supplier
	Code	Name			Thermal	Gross	Net		
ARGENTINA	AR -3	ATUCHA-2	PHWR	PHWR KWU	2160	745	692	NASA	SIEMENS
BRAZIL	BR -3	ANGRA-3	PWR	PRE KONVOI	3765	1350	1245	ELETRONU	KWU
CHINA	CN -36	CHANGJIANG 1	PWR	CNP-600	1930	650	610	HNPC	DEC
	CN -37	CHANGJIANG 2	PWR	CNP-600	1930	650	610	HNPC	DEC
	CN -38	FANGCHENGGANG 1	PWR	CPR-1000	2905	1080	1000	GFNPC	DEC
	CN -39	FANGCHENGGANG 2	PWR	CPR-1000	2905	1080	1000	GFNPC	DEC
	CN -24	FANGJIASHAN 1	PWR	CNP-1000	2905	1080	1000	QNPC	NPIC
	CN -25	FANGJIASHAN 2	PWR	CNP-1000	2905	1080	1000	QNPC	NPIC
	CN -20	FUQING 1	PWR	CNP-1000	2905	1080	1000	FQNP	NPIC
	CN -21	FUQING 2	PWR	CNP-1000	2905	1080	1000	FQNP	NPIC
	CN -42	FUQING 3	PWR	CNP-1000	2905	1080	1000	FQNP	NPIC
	CN -43	FUQING 4	PWR	CNP-1000	2905	1080	1000	FQNP	NPIC
	CN -30	HAIYANG 1	PWR	AP-1000	3451	1253	1000	SDNPC	WH
	CN -31	HAIYANG 2	PWR	AP-1000	3415	1253	1000	SDNPC	WH
	CN -16	HONGYANHE 1	PWR	CPR-1000	2905	1080	1000	LHNPC	DEC
	CN -17	HONGYANHE 2	PWR	CPR-1000	2905	1080	1000	LHNPC	DEC
	CN -26	HONGYANHE 3	PWR	CPR-1000	2905	1080	1000	LHNPC	DEC
	CN -27	HONGYANHE 4	PWR	CPR-1000	2905	1080	1000	LHNPC	DEC
	CN -19	NINGDE 2	PWR	CPR-1000	2905	1089	1018	NDNP	SHE
	CN -34	NINGDE 3	PWR	CPR-1000	2905	1089	1018	NDNP	CFHI
	CN -35	NINGDE 4	PWR	CPR-1000	2905	1089	1018	NDNP	CFHI
	CN -28	SANMEN 1	PWR	AP-1000	3400	1250	1000	SMNPC	WH/MHI
	CN -29	SANMEN 2	PWR	AP-1000	3400	1250	1000	SMNPC	WH/MHI
	CN -44	SHIDAO BAY 1	HTGR	HTR-PM	500	211	200	HSNPC	Tsinghua
	CN -32	TAISHAN 1	PWR	EPR-1750	4590	1750	1660	TNPC	AREVA

Models of Reactors Under Construction

Country	Reactor		Type	Model	Capacity (MW)			Operator	NSSS supplier
	Code	Name			Thermal	Gross	Net		
	CN -33	TAISHAN 2	PWR	EPR-1750	4590	1750	1660	TNPC	AREVA
	CN -45	TIANWAN 3	PWR	VVER V-428	3000	1126	1050	JNPC	IZ
	CN -22	YANGJIANG 1	PWR	CPR-1000	2905	1080	1000	YJNPC	CFHI
	CN -23	YANGJIANG 2	PWR	CPR-1000	2905	1080	1000	YJNPC	CFHI
	CN -40	YANGJIANG 3	PWR	CPR-1000	2905	1080	1000	YJNPC	CFHI
	CN -41	YANGJIANG 4	PWR	CPR-1000	2905	1080	1000	YJNPC	CFHI
FINLAND	FI -5	OLKILUOTO-3	PWR	EPR	4300	1720	1600	TVO	AREVA
FRANCE	FR -74	FLAMANVILLE-3	PWR	EPR	4300	1650	1600	EDF	AREVA
INDIA	IN -30	KAKRAPAR-3	PHWR	PHWR-700	2166	700	630	NPCIL	NPCIL
	IN -31	KAKRAPAR-4	PHWR	PHWR-700	2166	700	630	NPCIL	NPCIL
	IN -25	KUDANKULAM-1	PWR	VVER V-412	3000	1000	917	NPCIL	MAEP
	IN -26	KUDANKULAM-2	PWR	VVER V-412	3000	1000	917	NPCIL	MAEP
	IN -29	PFBR	FBR		1253	500	470	BHAVINI	
	IN -21	RAJASTHAN-7	PHWR	Horizontal Pre	2177	700	630	NPCIL	NPCIL
	IN -22	RAJASTHAN-8	PHWR	Horizontal Pre	2177	700	630	NPCIL	NPCIL
JAPAN	JP -66	OHMA	BWR	ABWR	3926	1383	1325	EPDC	H/G
	JP -65	SHIMANE-3	BWR	ABWR	3926	1373	1325	CHUGOKU	HITACHI
KOREA, REP. O	KR -27	SHIN-HANUL-1	PWR	APR-1400	3938	1400	1340	KHNP	DHICKOPC
	KR -25	SHIN-KORI-3	PWR	APR-1400	3983	1400	1340	KHNP	DHICKOPC
	KR -26	SHIN-KORI-4	PWR	APR-1400	3938	1400	1340	KHNP	DHICKOPC
	KR -24	SHIN-WOLSONG-2	PWR	OPR-1000	2825	1000	960	KHNP	DHICKOPC
PAKISTAN	PK -4	CHASNUPP 3	PWR	CNP-300	999	340	315	PAEC	CZEC
	PK -5	CHASNUPP 4	PWR	CNP-300	999	340	315	PAEC	CZEC
RUSSIA	RU -151	AKADEMIK LOMONOSOV 1	PWR	KLT-40S 'Float	150	35	32	REA	ROSATOM

Models of Reactors Under Construction

Country	Reactor		Type	Model	Capacity (MW)			Operator	NSSS supplier
	Code	Name			Thermal	Gross	Net		
	RU -152	AKADEMIK LOMONOSOV 2	PWR	KLT-40S 'Float	150	35	32	REA	ROSATOM
	RU -170	BALTIC-1	PWR	VVER V-491	3200	1194	1109	REA	ROSATOM
	RU -116	BELOYARSK-4	FBR	BN-800	2100	864	789	REA	ROSATOM
	RU -120	KURSK-5	LWGR	RBMK-1000	3200	1000	915	REA	ROSATOM
	RU -163	LENINGRAD 2-1	PWR	VVER V-491	3200	1170	1085	REA	ROSATOM
	RU -164	LENINGRAD 2-2	PWR	VVER V-491	3200	1170	1085	REA	ROSATOM
	RU -161	NOVOVORONEZH 2-1	PWR	VVER V-392M	3200	1199	1114	REA	ROSATOM
	RU -162	NOVOVORONEZH 2-2	PWR	VVER V-392M	3200	1199	1114	REA	ROSATOM
	RU -63	ROSTOV-3	PWR	VVER V-320	3000	1100	1011	REA	ROSATOM
	RU -64	ROSTOV-4	PWR	VVER V-320	3000	1100	1011	REA	ROSATOM
SLOVAKIA	SK -10	MOCHOVCE-3	PWR	VVER V-213	1375	471	440	SE,plc	SKODA
	SK -11	MOCHOVCE-4	PWR	VVER V-213	1375	471	440	SE,plc	SKODA
UAE	AE-01	BARAKAH 1	PWR	APR-1400	3983	1400	1345	ENEC	KEPCO
UKRAINE	UA -51	KHMELNITSKI-3	PWR	VVER V-392B	3200	1000	950	NNEGC	ASE
	UA -52	KHMELNITSKI-4	PWR	VVER V-392B	3200	1000	950	NNEGC	ASE
USA	US -391	WATTS BAR-2	PWR	W (4-loop) (IC	3425	1218	1165	TVA	WH

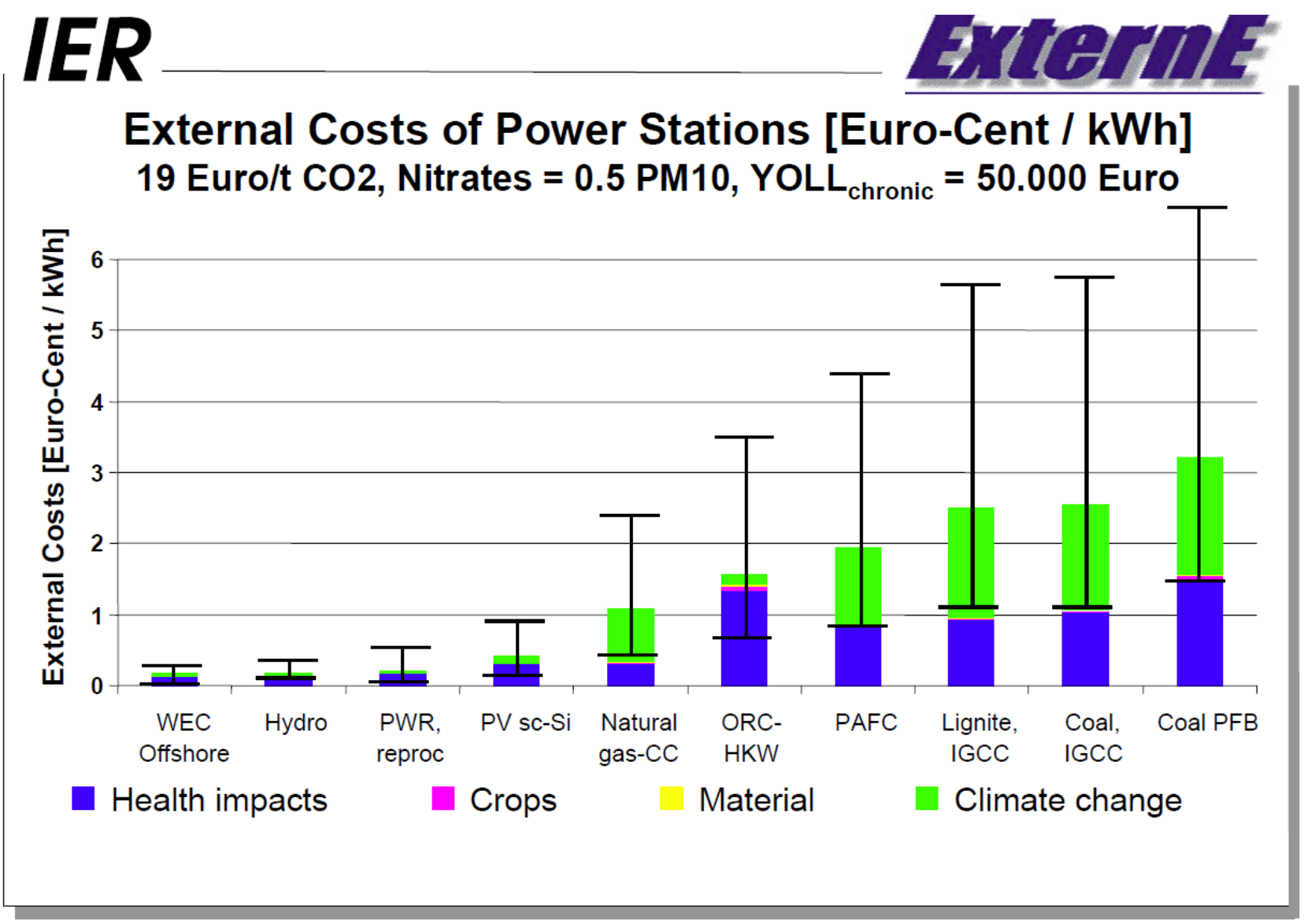
Situation in the EU

- Very few reactors under construction.
- Energy market rules are set by bureaucrats and salesmen, not by the needs of countries.
- Energy supply is not treated as state strategic industry.
- Denying facts and data reduces the competitiveness of EU.
- Destabilized market does not allow for high capital intensive projects.
- Imposing unrealistic safety standards on nuclear.

Major Advantages of Nuclear Power

- No emissions.
- Low operating costs guarantee long term stability of electricity prices
- Low external costs, environmental and health impact.
- High positive impact on technology development and country competitiveness in general.
- Very small amount of waste under control.

External Costs



Deaths per TWh

ENERGY SOURCE	DEATHS	FATAL/TWH	TWH	NOTES
Coal – world	67,000,000	129	520,000	(26% world energy, 50% of elec.)
Coal – USA/Europe				About ten times safer
Oil	101,000,000	133	720,000	(36% of world energy)
Natural Gas	6,000,000	13	460,000	(21% of world energy)
Biofuel/Biomass		12.00		
Peat		12.00		
Solar (rooftop)	480	0.44	960	(less than 0.1% of world energy)
Wind	1,760	0.15	12,000	(less than 1% of world energy)
Hydro + Banqiao)	195,000	0.84	232,000	(~2500 TWh/yr + 171,000 Banqiao dead)
Nuclear	15,000	0.07	208,000	(5.9% of world energy)
World	180.2 million	60	2,000,000	Terawatt-hours
Unaccounted	10.8 million	60	120,000	TWh = 6.00% … fatalities prorated

Czech Republic consumes around 70 TWh

- With our energy mix it leads to approx. 550 deaths per year – remember them when you turn on the lights tonight…
  - (546/coal+biomass, 1,7/nuclear, 2,4/hydro)

Turkey

- Turkey has had plans for establishing nuclear power generation since 1970.
- Today, plans for nuclear power are a key aspect of the country's aim for economic growth.
- Recent developments have seen Russia take a leading role in offering to finance and build 4800 MWe of nuclear capacity.
- Application has been made for construction and operating licenses for the first plant, at Akkuyu, and these are expected in mid 2014.
- A Franco-Japanese consortium is to build the second nuclear plant, at Sinop.

Energy Situation in Turkey

- Turkey imports much of its energy
  - nearly all of its oil and gas
  - in 2012 this amounted to more than $60 billion.
- Improving energy efficiency and energy security are high priorities.
- In 2012 Turkey's electricity production was 240 billion kWh gross from 53 GWe of plant.
  - 105 TWh (44%) came from gas (two thirds of this from Russia, most of the rest from Iran),
  - 68 TWh (28%) from coal,
  - 58 TWh (24%) from hydro.
  - Net import was 3 TWh.
  - Demand growth is about 8% pa,

Plány Turecka

- Plans for nuclear power are a key aspect of the country's aim for economic growth.
- It aims to cut back its vulnerable reliance on Russian and Iranian gas for electricity.
- The Ministry of Energy and Natural Resources (ETKB) projects 2020 electricity production
  - 499 TWh in a high scenario of 8% growth
  - or 406 TWh with a low one with 6.1% growth.
- Plans are to have 30 GWe of coal-fired capacity by 2023.
- However, much of the country’s coal resources are lignite with low calorific value – less than 12.5 MJ/kg, and a substantial amount (Afsin Ebistan) at less than 5 MJ/kg.

History of nuclear projects in Turkey

- Several nuclear power projects have been proposed:
  - In 1970 a feasibility study concerned a 300 MWe plant,
  - in 1973 the electricity authority decided to build a 80 MWe demonstration plant but didn't,
  - in 1976 the Akkuyu site on the eastern Mediterranean coast near the port of Mersin was licensed for a nuclear plant.
  - In 1980 an attempt to build several plants failed for lack of government financial guarantee.

Nineties Tender

- In 1993 a nuclear plant was included in the country's investment program following a request for preliminary proposals in 1992.
- Revised tender specifications were not released until December 1996.
- Bids for a 2000 MWe plant at Akkuyu were received from
    - Westinghouse + Mitsubishi,
    - AECL
    - Framatome + Siemens.
- Following the final bid deadline in October 1997, the government delayed its decision eight times between June 1998 and April 2000, when plans were abandoned due to economic circumstances.

Year 2006

- Early in 2006 the province of the port city of Sinop on the Black Sea was chosen to host a commercial nuclear power plant.
- This has the advantage of cooling water temperatures about 5 degrees C below those at Akkuyu, allowing about 1% greater power output from any thermal unit.
- A 100 MWe demonstration plant was to be built there first, then 5000 MWe of further plants to come into service from 2012.
- Some kind of public-private partnership was envisaged for construction and operation.

Year 2006 (2)

- In August 2006 the government said it planned to have three nuclear power plants total 4500 MWe operating by 2012-15.
- Discussions had been under way with Atomic Energy of Canada Ltd regarding two 750 MWe CANDU units as an initial investment.
- These and the PWR type were apparently preferred.
- The first units of some 5000 MWe total were to be built at Akkuyu, since the site was already licensed, but licensing was also proceeding for Sinop.

Turning Point?

- In November 2007 a new law concerning Construction and Operation of Nuclear Power Plants and Energy Sale (of their electricity) was passed
  - Turkish Atomic Energy Authority (TAEK) was to set the criteria for building and operating the plants.
  - The Turkish Electricity Trade & Contract Corporation (TETAS) would then buy all the power under 15-year contracts.
  - Public institutions are to build the plants if other offers are not satisfactory.
  - National Radioactive Waste Account (URAH) set up
  - Decommissioning Account (ICH) set up
  - Operators would pay into into URAH and ICH 0.15 c/kWh.
  - The OECD Paris and Brussels Conventions on third party accident liability would apply.

Follow Up

- Immediately subsequent to this law, Criteria for Investors who will Construct and Operate Nuclear Power Plants, and regulations were published.
- IAEA safety standards apply.
- In May 2008 a civil nuclear cooperation agreement with the USA entered into force
- In June 2010 a nuclear cooperation agreement with South Korea was signed
- In April 2012 two such agreements with China were signed.

Planned and Proposed Nuclear Power Reactors for Turkey

	Type	MWe gross	Start construction	Start operation
Akkuyu 1	VVER-1200	1200	January 2016	2021
Akkuyu 2	VVER-1200	1200	2017	2021
Akkuyu 3	VVER-1200	1200	2018	2022
Akkuyu 4	VVER-1200	1200	2019	2023
Sinop 1	Atmea1	1150	2017	2023
Sinop 2	Atmea1	1150		2024
Sinop 3	Atmea1	1150		?
Sinop 4	Atmea1	1150		?

Akkuyu

- TETAS called for tenders in March 2008, inviting bids for the first nuclear power plant at Akkuyu, near the port of Mersin.
- TAEK issued specifications, allowing for PWR, BWR or PHWR types of at least 600 MWe and with 40-year service life.
- Design certification in country of origin was acceptable, allowing TAEK to concentrate on site-specific aspects of the 4800 MWe project.
- Only bid received - from Atomstroyexport in conjunction with Inter RAO (both from Russia) and Park Teknik (Turkey), for an AES-2006 power plant with four 1200 MWe reactors.
- After some deliberation, TAEK found that it met technical criteria.
- It was later reported that TAEK required foreign vendors to take back used fuel, and none except ASE were prepared to do so.

Akkuyu

- Following commercial advice from TETAS, a government decision was expected in April 2009, however the cost of power over the first 15 years was found to be too high.
- August 2009 - two agreements between TAEK and Rosatom were signed
  - a nuclear cooperation agreement,
  - the early notification on a nuclear accident and the exchange of information on nuclear facilities.
- These progressed the possibility of a Russian nuclear project at Akkuyu, probably with 25% government equity to dampen the likely electricity price rise.
- The first reactor was expected to come on line in 2016, and others in 2017, 2018 and 2019.
- However, following a ruling by the country's top legal body, TETAS canceled the Atomstroyexport proposal and said that a new tender would be launched soon.
- In fact, the parties proceeded to a direct high-level agreement instead.

Akkuyu

- In May 2010 Russian and Turkish heads of state signed an intergovernmental agreement for Rosatom to build, own and operate (BOO) the Akkuyu nuclear power plant of four 1200 MWe AES-2006 units as a US$ 20 billion project.
- This will be its first foreign plant on that BOO basis.
- Rosatom, through Atomstroyexport and Inter RAO UES, will finance the project and start off with 100% equity in the Turkish Akkuyu project company (APC) set up to build, own, operate and decommission the plant.
- The project company became Akkuyu NPP JSC (Akkuyu Nukleer Santral/ NGS Elektrik Uretim AS) in 2011.
- Longer-term, Rosatom entities intend to retain at least 51% of the company.
- The Turkish firm Park Teknik and state generation company Elektrik Uretim AS (EUAS) are expected to take up significant shares.
- In May 2013 Rosatom invited EdF to become an equity partner in the project.
- Meanwhile, EUAS transferred the to the project company.

Akkuyu

- In July 2010 parliament ratified the May agreement for 4800 MWe at Akkuyu.
- In November the Russian parliament ratified it.
- The project company was registered in December 2011, and by mid 2012 the equity position was Rosenergoatom concern 92.85%, InterRAO UES 3.47%, Atomstroyexport 3.47%, and 0.1% each for Atomenergoremont and Atomtekhenergo.
- A 49% non-Russian strategic investor was being sought.
- Late in 2012 JSC Akkuyu NPP quoted the cost as $18.7 billion, and in December Russia's President announced that Russia would fully finance the project to more than $20 billion.
- Turkey's prime minister said that the equity capital of the JSC Akkuyu NPP would be increased to $2.4 billion, and the overall investment in the project would total $22 billion.

Akkuyu

- TETAS will buy a fixed proportion of the power at a fixed price of US$ 12.35 cents/kWh for 15 years, or to 2030.
- The proportion will be 70% of the output of the first two units and 30% of that from units 3 & 4 over 15 years from commercial operation of each.
- The remainder of the power will be sold by the project company on the open market.
- After 15 years, when the plant is expected to be paid off, the project company will pay 20% of the profits to the Turkish government.
- (These sovereign guarantees are not on offer for the Sinop plant.)

Akkuyu

- The project company was to apply for all licenses within twelve months, and the first reactor is to be on line within seven years of receiving these, with the others to follow at one-year intervals.
- By mid 2012 Rosatom said that the cost could be $25 billion.
- By the deadline - in December 2011 the project company had filed applications for
  - construction permits
  - power generation license
  - environmental impact assessment
- Atomstroyexport as general contractor starting construction in 2013.

Akkuyu

- In mid 2012 the company had received the site license.
- It let the first major contract for site works in February 2013, with work to start in September.
- The power generation license and environmental approval are expected by the end of 2013.
- The construction license is expected in mid 2014, enabling full construction to start in 2015 or January 2016.
- The company expected to commission the first unit in 2021.
- Some $1.3 billion expenditure on the project was budgeted by Rosatom for 2013.

Sinop

- Since February 2008 preparatory work has been under way at Sinop on the Black Sea to build a second nuclear plant there, along with a EUR 1.7 billion nuclear technology centre.
- A 5000-5600 MWe nuclear plant there is expected to cost about $22-25 billion.
- In March 2010 an agreement was signed between Korea Electric Power Corporation (Kepco) and EUAS for Kepco to prepare a bid to build the plant at Sinop, with four APR-1400 reactors starting operation from 2019.
- The bid, in conjunction with local construction group Enka Insaat ve Sanayi, was due in August.
- Kepco was to take 40% equity in the plant, and would help with financing.
- However, this proposal foundered due to the Kepco insistence on receiving electricity sales guarantees from the government, rather than from TETAS as at Akkuyu.

Sinop

- Japan then indicated its interest in negotiating to build the 5600 MWe plant.
- In December 2010 signed an agreement to prepare a bid for it, with a more definitive agreement expected in March 2011.
- Toshiba and Tepco were involved with the proposal, using four 1350 MWe ABWR units.
- However talks were suspended at Japan's request following the Fukushima accident, and Tepco has since opted out.
- Subsequent reports suggested a possible bid by Mitsubishi Heavy Industries with Kansai, which operates 11 PWRs, and using APWR units.
- In March 2012 Japan’s Ministry of Foreign Affairs announced that progress continued towards a nuclear cooperation agreement with Japan.

Sinop

- In November 2011 the prime minister requested the South Korean president to renew the Kepco bid.
- In April 2013 the energy minister said that Kepco was no longer in contention, and one report said it pulled out because of lack of treasury guarantees.
- In April 2012 Canada's Candu Energy signed an agreement with the EUAS to undertake a 6-month study on building a 3000 MWe plant at Sinop.
- In March 2013 the energy minister said that they had withdrawn from the process.
- The Energy minister said in April 2013 that talks were continuing with Mitsubishi-Areva-led and Chinese consortia, the latter led by China Guangdong Nuclear Power (CGNPC) and proposing ACPR1000 reactors, with Fangchenggang 3&4, due to be built from 2014, as reference units.

Sinop

- The consortium led by Mitsubishi Heavy Industries (MHI) and Areva, with Itochu, proposed four Atmea1 reactors with total capacity of about 4600 MWe at a cost of some $22 billion.
- This was accepted in May 2013, and an intergovernmental agreement was signed with Japan for “exclusive negotiating rights to build a nuclear power plant”.
- EUAS intends to take a 25% stake in the project company.
- Subject to a GdF Suez decision to proceed in 2016, construction start is planned for 2017 and operation from 2023.
- These are likely to be the first Atmea1 units built.
- They are designed for load-following and use the same steam generators as Areva’s large EPR (but 3 instead of 4).
- GdF Suez, which operates seven nuclear reactors in Belgium, is to be the operator.
- However, the same sovereign guarantees as at Akkuyu regarding power offtake are not on offer.

Third site

- There are proposals to build further nuclear capacity at another site, as part of 100 GWe required by 2030.
- TAEK has identified Igneada on the Black Sea, 12 km from the Bulgarian border, and Akcakoca between it and Sinop as possible third nuclear power plant sites.
- Ankara - with low seismic risk - and Tekirdag on the northwest coast of the Sea of Marmara have also been mentioned as possible sites.
- When agreement for the development of the Sinop plant has been finalized, the energy ministry plans to announce the site for the third plant with an invitation for expressions of interest to be issued by the end of 2013.

Uranium and fuel cycle

- Turkey has modest uranium resources, including 7400 tU listed in the 2007 Red Book which are amenable to mining by in situ leaching.
- The Temrezli deposit in the central Anatolian region 220 km east of Ankara was discovered by the Department of Energy, Raw Material and Exploration (MTA) in the early 1980s.
- MTA continued to explore the region for the next 10 years.
- Australian-based Anatolia Energy Ltd has a 100% interest in 18 exploration licenses which include the Temrezli project.
- Project activities are undertaken by A Dur Madencilik Ltd (Adur), a wholly-owned subsidiary.
- Anatolia Uranium Pty Ltd (AUL) has 65% ownership of the Temrezli project, with parent company Anatolia Energy directly holding 35%.
- AUL was an incorporated JV but ownership was rationalized in 2012-13.

Uranium and Fuel Cycle

- A preliminary economic assessment of the Temrezli ISL uranium project was published in June 2013, based on NI 43-101 figures.
- It found that costs would compare favorably with other (US) ISL projects at envisaged production of 3500 tU over ten years, up to 385 tU/yr.
- Indicated resources at Temrezli are 4200 tU and inferred resources 2500 tU, at 0.12%U and 0.077%U respectively.
- Cash production costs are estimated at $22.30/lb U3O8 (excluding tax and royalty).

Uranium and Fuel Cycle

- The Ministry of Energy & Natural Resources has awarded a Production License for the project, and a pre-feasibility study is now being carried out.
- A decision to proceed with mining is then possible, with prospective start in 2016
- Anatolia Energy also has a significant tenement holding in the Sefaatli (35 km away) and West Sorgun areas.
- The Rosatom agreement for Akkuyu also provides for setting up a fuel fabrication plant in Turkey.

Organization

- The Ministry of Energy and Natural Resources (ETKB) is responsible for meeting energy needs.
- The Atomic Energy Commission (AEC) oversees all nuclear activities, submits budgets to the prime minister, and sets TAEK's programs. An Advisory Council assists the AEC on matters referred to it. An Advisory Committee on Nuclear Safety is involved with licensing and gives advice to TAEK, which decides on them.
- The Turkish Atomic Energy Agency (TAEK) was set up under the 2007 law to set the criteria for building and operating nuclear plants. It incorporates the regulator.
- The Turkish Electricity Trade & Contract Corporation (TETAS) buys the power for distribution.
- TEIAS is the power grid operator.

Other issues

- R&D
  - A small Triga research reactor has operated at the Istanbul Technical University since 1979. It is regulated by the Turkish Atomic Energy Authority.
- Non-Proliferation
  - Turkey has had a safeguards agreement in force with the IAEA since 1981 and the Additional Protocol to its safeguards agreement has been in force since 2001.

Other Russian Projects

- Russia exports any part of nuclear power technology.
- Russian reactors are not pure Russian technology, offer wide variability of designs and suppliers
  - I&C from RollsRoyce
  - Turbine island from Alstom (Arabella)
  - Many minor suppliers from the Czech Republic
  - Etc.
- Finland
- Temelín
- Great Britain
- India
- China