

Global Outlook for Decommissioning

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International Atomic Energy Agency

Agenda

- Background
- Future decommissioning – overview of global situation
- Focus on Germany and Russian Federation
- Constraints on decommissioning programmes
- Conclusions

Background: Statute of the IAEA

Article II

Objectives – The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.

Article III

Para A.6. The Agency is authorized to **establish or adopt ... standards of safety** for protection of health and minimization of danger to life and property, and to **provide for the application of these standards ...**”

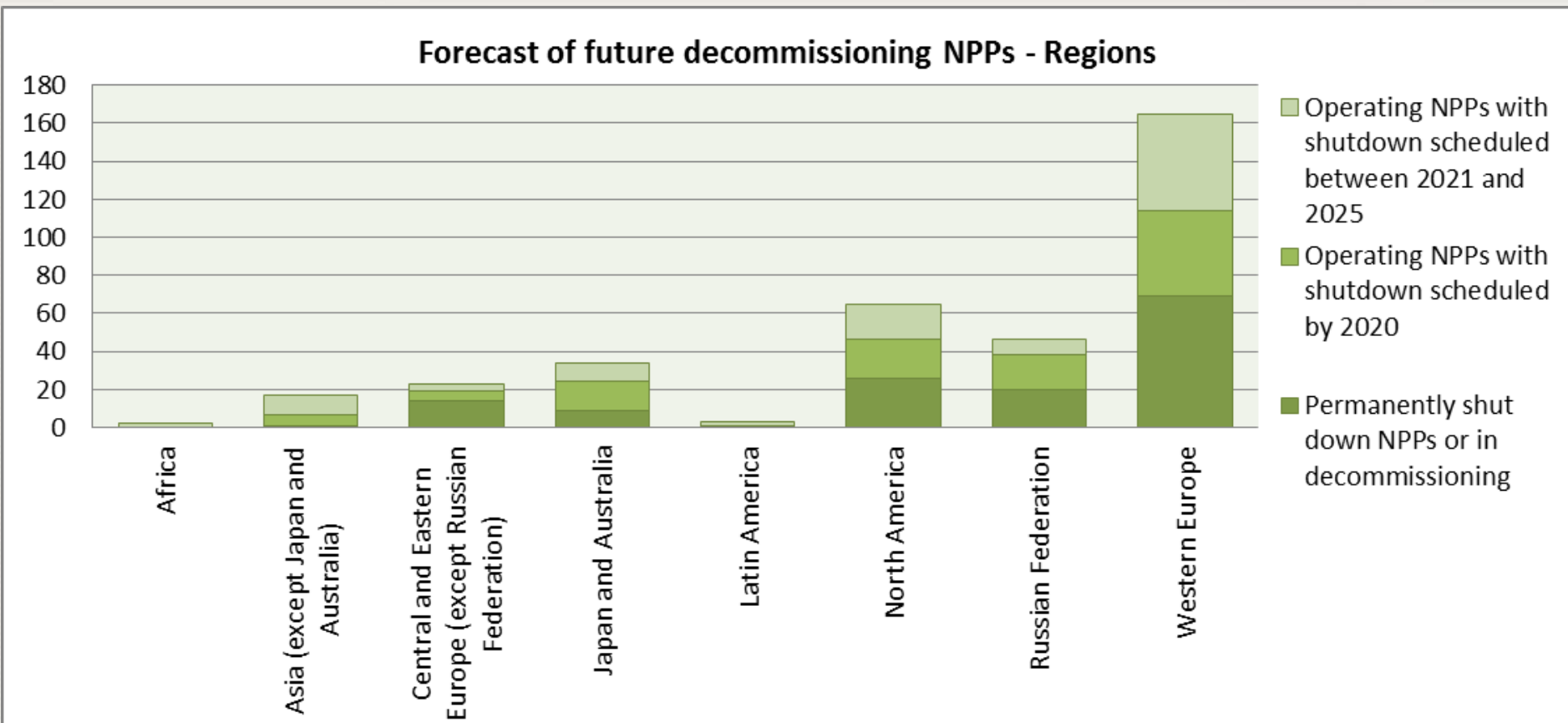
Article VIII

The agency shall take positive steps to encourage the **exchange among its members of information** relating to the nature and peaceful uses of atomic energy and shall serve as an intermediary among its members for this purpose.

Nuclear Power Plants – Global Status

In operation	Shutdown/under decommissioning	Fully decommissioned
440	139	11

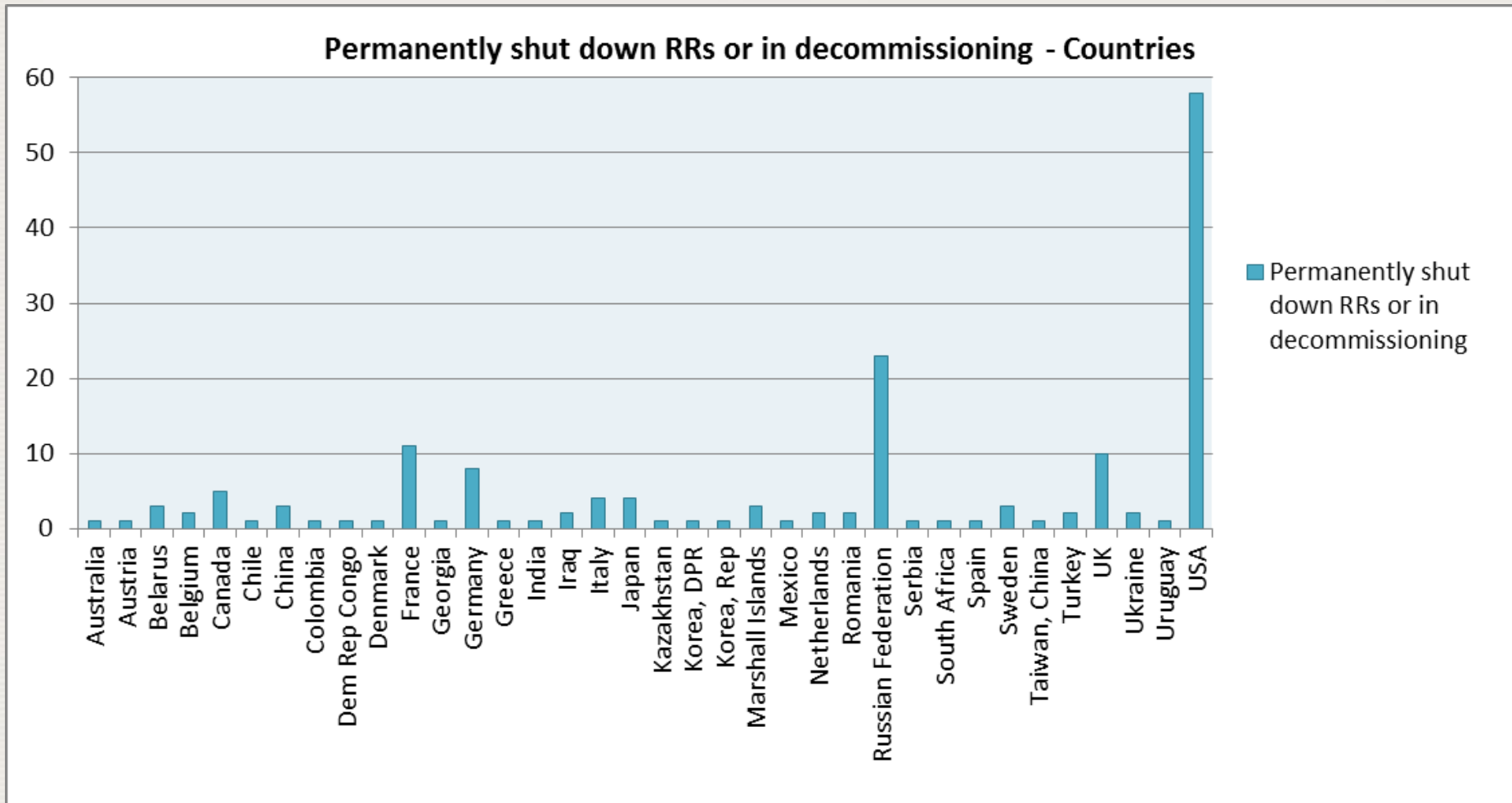
Future NPP Decommissioning – by Region



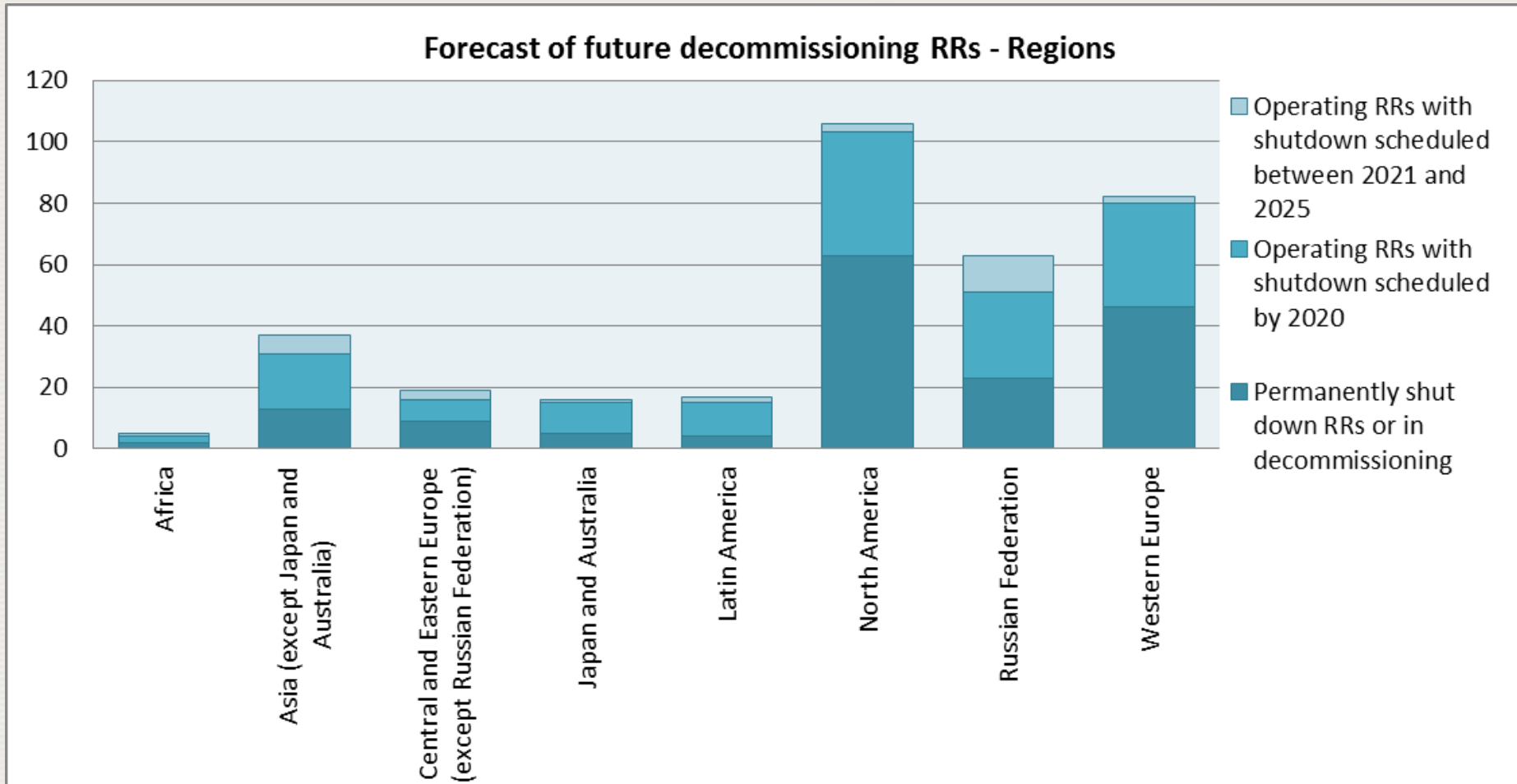
Research Reactors – Global Status

In operation	Shutdown/under decommissioning	Fully decommissioned
241	165	431

Future Research Reactor Decommissioning – by Country



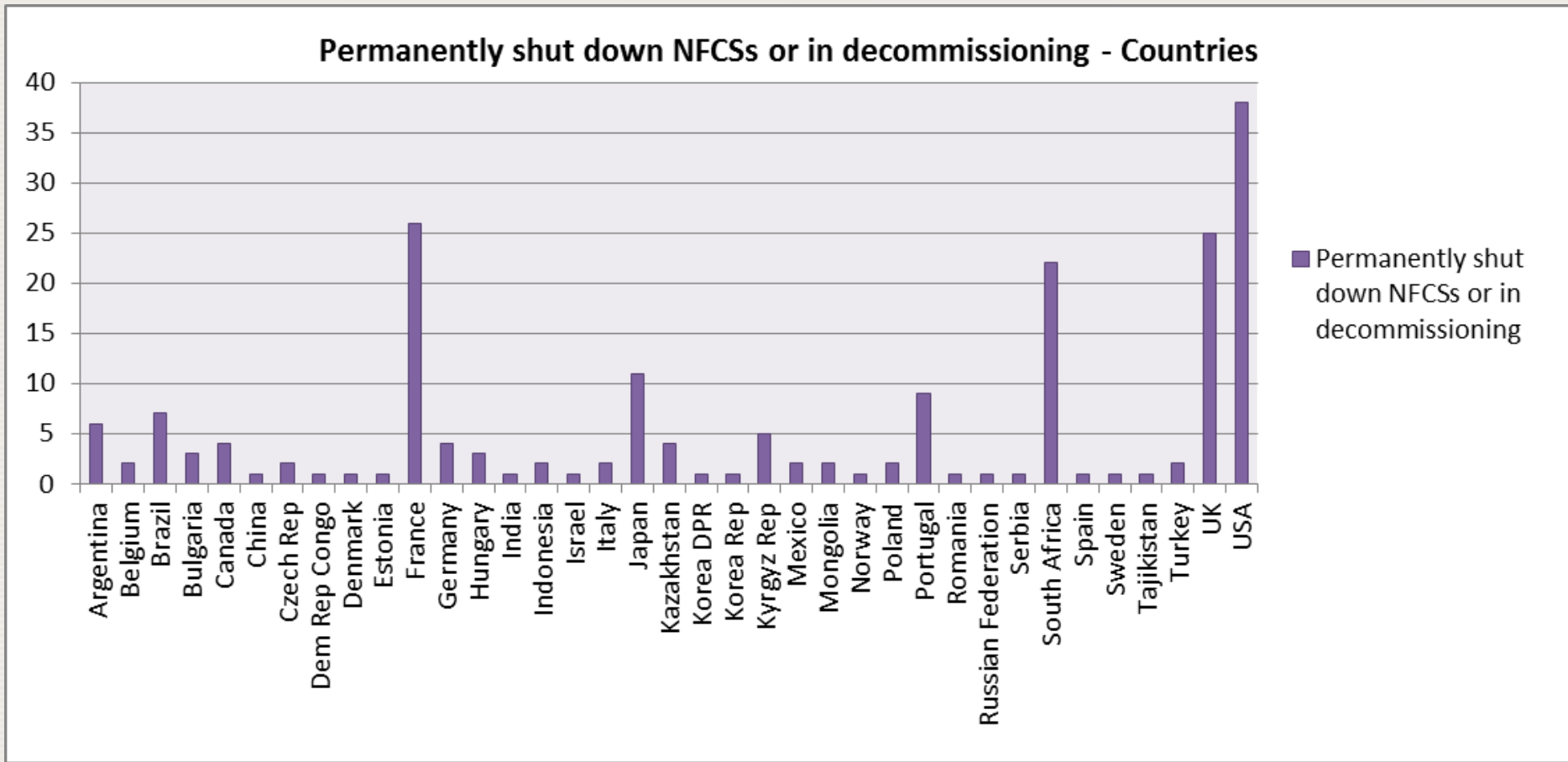
Future Research Reactor Decommissioning – by Region



Future Fuel Cycle Facilities – Global Status

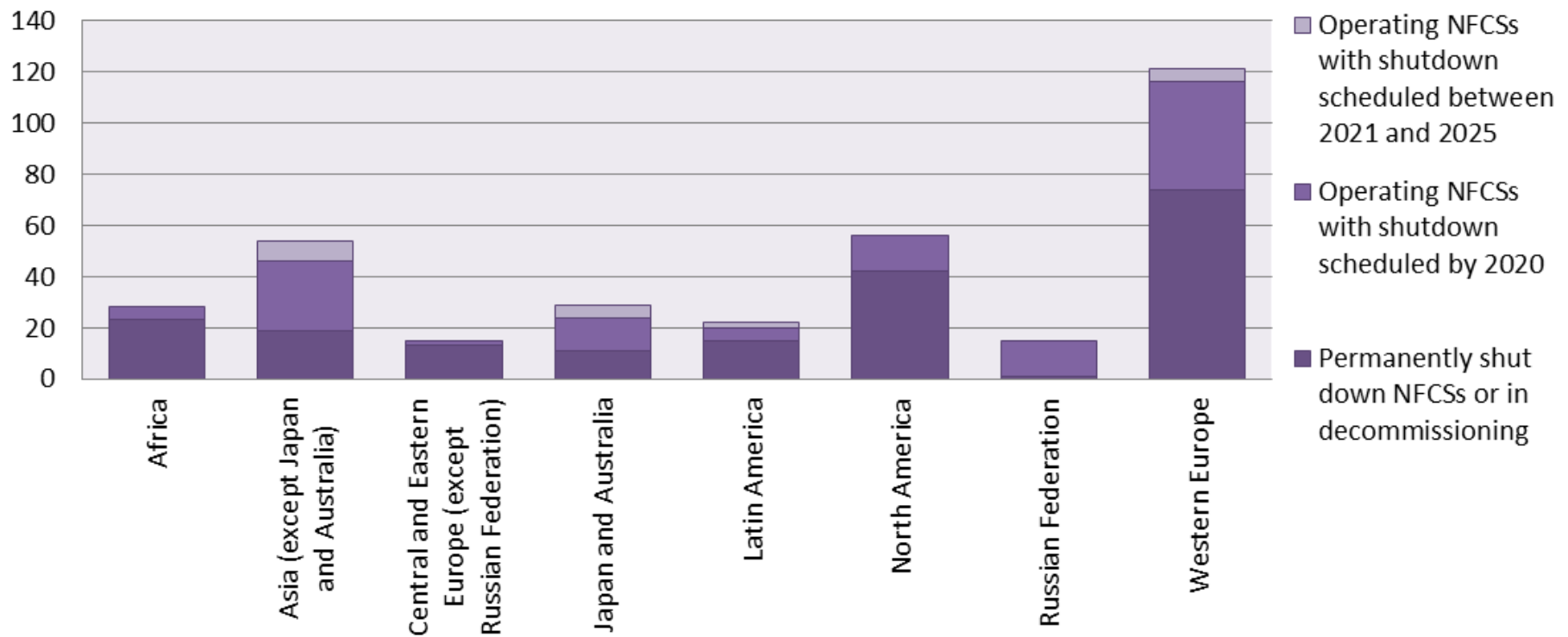
In operation	Shutdown/under decommissioning	Fully decommissioned
	198	172

Future Fuel Cycle Facility Decommissioning – by Country



Future Fuel Cycle Facility Decommissioning – by Region

Forecast of future decommissioning NFCs - Regions



Overview of finished and actual decommissioning projects

[from Ackermann, IDN Forum 2011]

Decommissioning of nuclear facilities in Germany – ongoing and completed decommissioning projects



Prototype / Commercial Reactor shut down / under decommissioning



Prototype / Commercial reactor decommissioning completed



Research Reactor shut down / under decommissioning



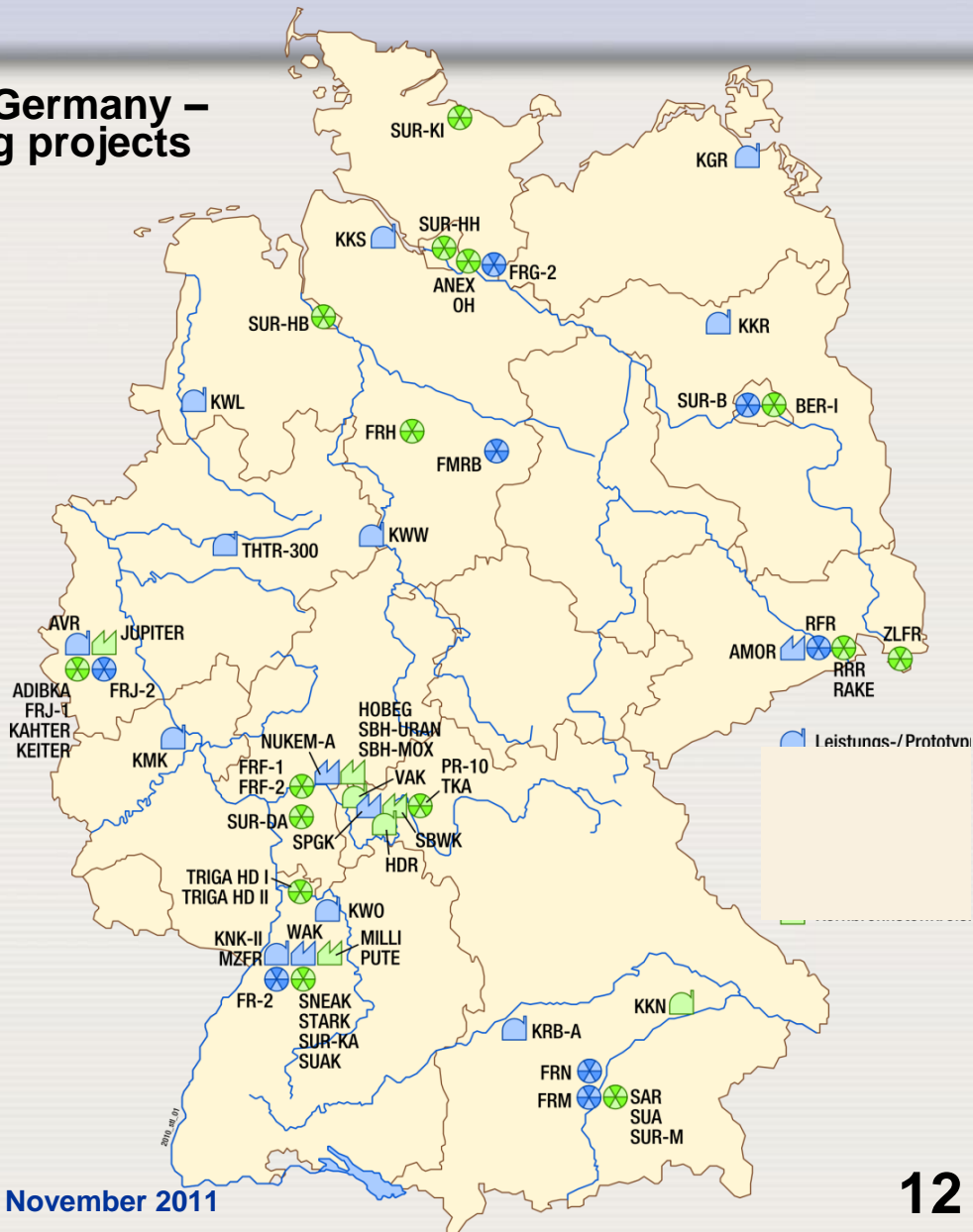
Research Reactor decommissioning completed



Nuclear Fuel Cycle Facility shut down / under decommissioning



Nuclear Fuel Cycle Facility decommissioning completed



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Overview of finished and actual decommissioning projects - prototype reactors [*from Ackermann, IDN Forum 2011*]

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Past and current decommissioning projects of prototype reactors

- a) Total: 19
 - Removed: 3
 - Under dismantling: 14
 - Safe enclosure: 2
- b) Reactor types: PWR, BWR, Fast Breeder, High Temperature Gas Cooled, Heavy Water Gas Cooled

Outlook for prototype reactors

- a) Dismantling of Lingen NPP, currently in Safe Enclosure
- b) 8 NPPs finally shut down due to changed atomic law as a consequence of Fukushima accident

Germany: Overview of finished and actual decommissioning projects - Prototype reactors *[from Ackermann IDN Forum 2011]*

Plant	Type	Power (MWe)	Period of Operation	Status
VAK Kahl	BWR	16	1960-85	Removed
MZFR Karlsruhe	PWR	58	1965-84	Dismantling
AVR Jülich	GCHTR	15	1966-88	Safe Enclosure
HDR Karlstein	BWR	25	1969-71	Removed
KKN Niederaichbach	GCR	106	1972-74	Removed
KNK-II Karlsruhe	FSCR	20	1977-91	Dismantling
THTR Hamm-Uentrop	GCHTR	308	1984-88	Safe Enclosure
SNR 300 Kalkar	FSCR	No nuclear operation		Leisure Park

BWR: Boiling Water Reactor

GCHTR: Gas Cooled High Temperature Reactor

FSCR: Fast Sodium Cooled Reactor

PWR: Pressure Water Reactor

GCR: Gas Cooled Reactor

Overview of finished and actual decommissioning projects - prototype reactors *[from Ackermann IDN Forum 2011]*



Leisure Park Kalkar



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Overview of finished and actual decommissioning projects - Power reactors *[from Ackermann IDN Forum 2011]*

Plant	Type	Power (MWe)	Period of Operation	Status
KKR Rheinsberg	PWR	70	1966-90	Under dismantling
KRB-A Gundremmingen	BWR	250	1966-77	Under dismantling
KWL Lingen	BWR	254	1968-77	Safe enclosure
KWO Obrigheim	PWR	357	1968-05	Under dismantling
KWW Würgassen	BWR	670	1971-95	Under dismantling
KKS Stade	PWR	672	1972-03	Under dismantling
KGR-1 Greifswald	PWR	440	1973-90	Under dismantling
KGR-2 Greifswald	PWR	440	1974-90	Under dismantling
KGR-3 Greifswald	PWR	440	1977-90	Under dismantling
KGR-4 Greifswald	PWR	440	1979-90	Under dismantling
KGR-5 Greifswald	PWR	440	1989-90	Under dismantling
KMK Mühlheim-Kärlich	PWR	1302	1986-88	Under dismantling

Overview of finished and actual decommissioning projects - Research reactors *[from Ackermann IDN Forum 2011]*

Past and ongoing decommissioning projects of research reactors

a) Total: 37

- Removed: 28
- Under dismantling: 3
- Safe enclosure: 2
- Final shut down / application for licence: 4

b) Variety of types of research reactors

- Argonaut type
- Critical assembly
- Educational reactors
- Liquid homogenous reactor
- Propulsion reactor
- Pool reactor (incl. TRIGA type)
- Heavy water reactor (incl. DIDO type)

Overview of finished and actual decommissioning projects - nuclear fuel cycle facilities *[from Ackermann IDN Forum 2011]*

Past and ongoing decommissioning projects of nuclear fuel cycle facilities

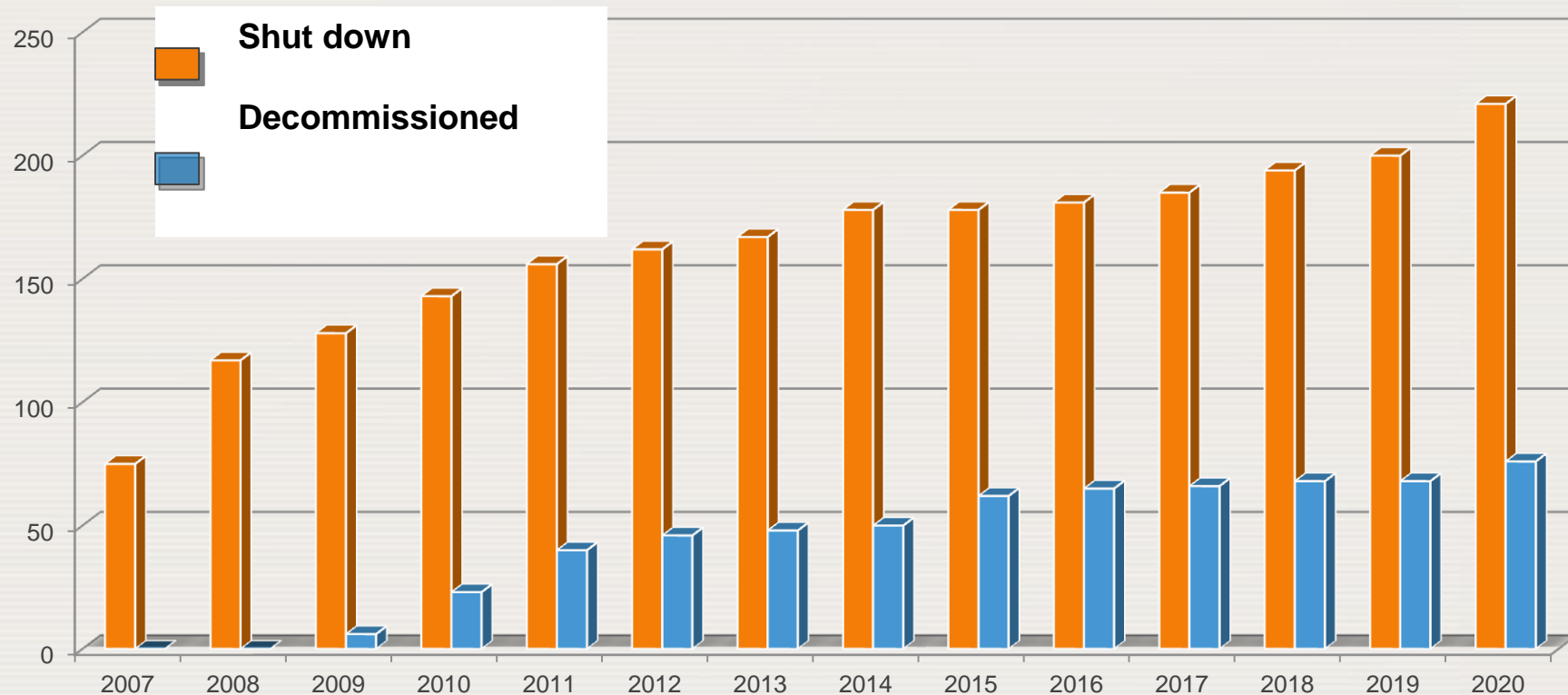
a) Total: 11

- Removed: 7
- Safe enclosure: 0
- Under dismantling: 4

b) Final shut down / application for licence: 0

Decommissioning Strategy for Russian Nuclear Legacy Facilities

[from Kudryavtsev, IAEA General Conference Side Event 2011]



Decommissioning Plans

[from Kudryavtsev, IAEA General Conference Side Event 2011]

2010 : preparatory work for the decommissioning started for 151 facilities

2015 : + 48 facilities

2020: + 20 facilities

2025: + 17 facilities

Tasks to be solved for Decommissioning Planning:

- Prioritization of decommissioning phases
- Secure availability of decommissioning funds
- Provide availability of the decommissioning technology and infrastructure

Constraints for Full-scale Decommissioning (Rosatom)

[from Kudryavtsev, IAEA General Conference Side Event 2011]

- Most nuclear sites under consideration include both operated and shut-downed facilities with a common infrastructure
- No large funds accumulated for decommissioning projects - work funded from Federal budget & reserves
- High cost for transportation and storage of radioactive waste
- No facilities available for the final disposal of long-lived waste
- Most shutdown nuclear facilities store/contain nuclear materials and/or spent fuels to be removed for centralized storage or reprocessing
- No clear legislation and financial basis exists for large-scale decommissioning projects

General Conference Side Event “Constraints to implementing D&D and ER” – (1)

- Aim: to understand why progress with D&D and ER in many countries is slow or negligible
- Main participants: UKTI (co-host); US; Russia; Japan; Kazakhstan; EBRD and European Commission
- Fundamental requirements for D&D and ER projects:
 - Legal and regulatory framework
 - Funding
 - Access to specialist resources (human and technological)

General Conference Side Event “Constraints to implementing D&D and ER” – (2)

- Important Considerations:
 - Institutional arrangements for liability and project management – need to ensure efficient use of scarce national resources
 - Waste disposal routes – need for integrated approaches to waste management
 - Technical expertise is concentrated in a small number of countries – need to create an environment that more easily allows technology and expertise to be transferred between countries

IAEA General Conference Side Event “Constraints to implementing D&D and ER” – (3)

- Next steps:
 - General support for the establishment of mechanisms to study current international best practices in a systemic way, e.g. through the formation of a working group to study and report on the issues
 - Such a group may consider whether new institutional arrangements at international level (encompassing a multi-donor framework) may be needed

Conclusions

- ❑ Public confidence in the nuclear industry cannot be taken for granted; need to work continuously to improve its structures and working arrangements
- ❑ Key requirement: an appropriate legal and institutional framework including funding systems
- ❑ Arrangements for capturing and sharing experience from ongoing decommissioning projects are of crucial importance
- ❑ Need to create an environment where technology and expertise developed in advanced programmes may more easily be applied in others

