The Determinants of Chinese Civilian Nuclear Cooperation: A Comparative Analysis of China's Nuclear Export Strategy in Eastern Africa

July 2019

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Presented in partial fulfilment of the requirements for the Degree of

International Master in Security, Intelligence and Strategic Studies

Word Count: 20 200

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Date of Submission: July 26, 2019

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Abstract

The global nuclear governance system is designed to prevent accidents and malicious actions involving nuclear materials, and to disallow the spread of nuclear weapons. In recent years, China has invested heavily in its nuclear industry and is set to overtake the United States as global nuclear leader, providing it substantial influence in nuclear governance and responses. This will have consequences for international security as it is unknown if China will prioritize security concerns over economic and political consideration, which could reduce the effectiveness of the nuclear governance system. A significant share of China's exports is targeted for countries in Africa and Asia, many located in volatile regions and without stable government structures. It is necessary for the West to respond to this challenge through cooperative measures and effective policies, but in order to do so it is imperative to first understand the drivers behind China's nuclear export strategy.

This paper made the first in-depth examination of China's civilian nuclear cooperation and examined a series of defined hypotheses to understand its behaviour. It looked at Chinese nuclear exports to state in Eastern Africa and used comparative analyses to identify differences between those who receive nuclear aid and those who do not. The units of analysis were selected based on a list that contains every nuclear cooperation agreement signed by China up until 2018. Initial findings reject established theories and indicates that there is a correlation between China's Belt and Road ambitions and nuclear assistance. More precisely, countries that are more skeptical and where public resistance and sentiment is expressed, are more likely to receive nuclear assistance. This suggests that nuclear aid could be provided as a tool of statecraft to cement China's position and increase its regional standing to achieve its stated political and economic objectives under the Silk Road. However, more research is needed to make any final conclusions.

Acknowledgements

This dissertation has been a long, educational, interesting and, at times, frustrating journey. It has been a process that has allowed me to meet and engage with some of the foremost experts in the nuclear field, and expand my knowledge and expertise on the subject, but also one that has at several occasions made me question my sanity. The experience has been unique in many ways and I would not be without it. To get to this point, I first want to thank Dr James Keeley at the University of Calgary for his hard work and unconditional support by providing me the dataset on China's nuclear cooperation agreements. This has been invaluable for the results of my research and it could not have been done without this. Next, I want to thank Daniel Kim at the Partnership for Global Security for his guidance and interesting discussions, from which I have broadened my understanding and interest in the nuclear domain. I also want to direct my gratitude to my advisor, Dr. Jan Ludvik at Charles University Prague, for his thoughtful contributions and feedback. Last, but not least I want to thank my family for their motivation and support throughout this process, and especially my father for believing in me and getting me through all the moments of despair.

Table of Content

List of Abbreviations

BRI	Belt and Road Initiative
CCP	China Communist Party
COW	Correlates of War Project
CGNPG	China General Nuclear Power Group
CNC	Civilian Nuclear Cooperation
CNNC	China National Nuclear Corporation
CSA	Comprehensive Safeguards Agreement
CTBT	Comprehensive Nuclear-Test-Ban-Treaty
DCA	Defence Cooperation Agreements
EU	European Union
GDELT	Global Database of Events, Language, and Tone
GDP	Gross Domestic Product
GNI	Gross National Income
IAEA	International Atomic Energy Agency
IMF	International Monetary Foundation
LAPSSET	Lamu Port-South Sudan-Ethiopia
MERICS	Mercator Institute for China Studies
NCA	Nuclear Cooperation Agreement
NPT	Non-proliferation Treaty
NSG	Nuclear Suppliers Group
PRC	People's Republic of China
PLA	People's Liberation Army
SASAC	Assets Supervisions and Administration Commission
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNSC	United Nations Security Council
U.S.	United States
USSR	Union of Soviet Socialist Republic
WMD	Weapons of Mass Destructions
WTO	World Trade Organisation

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Introduction

Nuclear power has experienced a renaissance in recent years due to challenges related to climate change, rising electricity demands and high import dependency for fossil fuels. It offers a safe, reliable and clean source of energy, particularly valued by developing nations in the process of industrializing. However, concerns have grown in line with the interest over the potential consequences of exporting nuclear reactors to politically tense regions, that lack the necessary prerequisites and institutional framework to operate them securely. All nuclear technology and materials are dual-use in nature, and the diffusion of nuclear programs for peaceful purposes could result in the proliferation of nuclear weapons. This paradox raises an interesting puzzle; if nuclear energy can lead to the proliferation of the most destructive weapon available, why do states provide nuclear assistance to other nations?

The People's Republic of China (PRC) has made significant investments in its nuclear power sector in recent years and accounts for over half of the global new nuclear reactor investments. It is predicted to surpass the U.S. in terms of nuclear power production by 2030, assuming the mantle of global nuclear leadership and increasing its influence in critical areas like nuclear governance and trade. However, China does not hold an in-depth record of initiating improvements to the nuclear governance system. This could have significant strategic implications for nuclear safety, security, non-proliferation, international relations, climate change and trade. Beijing seeks to utilize its growing domestic nuclear sector by exporting excess capacity abroad and intends to build 30 nuclear reactors in foreign countries by 2030.[1] A significant share of these are going to developing countries in Africa and Asia, many located in unstable regions and without strong democratic institutions. This constitutes a challenge for international security, as even limited reversals on its commitments can cause disruptions in international non-proliferation affairs.

[1] David Stanway, "China Could Build 30 'Belt and Road' Nuclear Reactors by 2030: Official," *Reuters* (June 20, 2019), https://www.reuters.com/article/us-china-nuclearpower/china-could-build-30-belt-and-road-nuclear-reactors-by-2030-official-idUSKCN1TL0HZ [accessed 10 July 2019]

The West needs to engage China and work to strengthen the nuclear governance system. It is particularly important in a time where nuclear innovations, newbuilds and developments are catching momentum. A failure to do so will have consequences for international security and could lead to the unregulated, widespread dissemination of nuclear materials, equipment and technology. However, it is imperative to first understand the underlying motivations, drivers and effects of China's nuclear export strategy. Understanding why and how China provides nuclear assistance allows for a more tailored, direct and effective policy response. This paper offers the first comprehensive comparative analysis of China's nuclear export regime, with a focus on Eastern Africa, and seeks to understand the determinants of its civilian nuclear cooperation. It builds on existing supply-side literature and examines several independent variables in the framework of Chinese nuclear cooperation agreements to test both established and new hypotheses.

Background

The Global Nuclear Governance System

In the 1950s, the U.S. and the USSR found themselves in a competition to counter each other's international influence through exports of nuclear materials, equipment and technology. Controlled nuclear fission was perceived as cutting-edge physics that offered a cheap and infinite source of electricity, in addition, to serve as a symbol of economic and technological superiority. Both powers emphasized the psychological and strategic benefits that derived from nuclear assistance over the potential economic and security concerns, and nuclear aid was conditioned on political rather than technical assurances. This development led to the global dissemination of sensitive dual-use technologies, without regard to the proliferation potential.[2] However, the fears and expectations generated by discoveries of the diverse applications of nuclear technologies soon called for better control of fissile materials.

The first step towards a global nuclear governance system came in 1954 after President Eisenhower, in his Atoms for Peace speech, proposed to the U.N. General Assembly the creation of an international body to both regulate and promote nuclear power.[3] This vision was followed up with an international scientific conference on the peaceful uses of nuclear energy and eventually led to the Conference on the International Atomic Energy Agency (IAEA) Statute which approved the founding documents of the Agency. The primary purpose of the IAEA is to promote the peaceful uses of nuclear energy and to effectively prevent nuclear accidents and the proliferation of nuclear materials and technology.[4] However, the Cuban missile crises displayed the limitations of the IAEA and its capability to implement valid measurements on an international scale. It further proved the need for a comprehensive legally binding framework, particularly regarding non-proliferation. These experiences became a pivotal moment in nuclear governance, where mounting concerns over Nth country proliferation caused the U.S. and the USSR to engage in talks to explore mechanisms to prevent the spread of nuclear weapons.

[2] Sarah Bidgood, "The Establishment of the London Club and Nuclear-Export Controls," in *Once and Future Partners: The United States, Russia and Nuclear Non-Proliferation,* edited by William C. Potter and Sarah Bidgood, Adelphi Series (2016), p. 136.
[3] Dwight D. Eisenhower, *Atom for Peace* (Abilene, Kansas: Eisenhower Presidential Library), https://www.eisenhower.archives.gov/research/online_documents/atoms_for_peace.html [accessed 3 May 2019]
[4] IAEA, *History,* https://www.iaea.org/about/overview/history [accessed 3 May 2019]

These negotiations resulted in the Non-Proliferation Treaty (NPT), which opened for signatures in 1968.[5]

The NPT constitutes the cornerstone in global nuclear governance and builds on a three-pillar system, with an implicit balance between them, designed to reduce further spread of nuclear weapons. The first pillar focuses on non-proliferation and pledges nuclear weapon states not to transfer, assist or encourage the acquisition of nuclear weapons to non-nuclear-weapon states or for the latter to acquire such devices. The second pillar promotes disarmament to ease international tension and commits nuclear weapon-states to pursue negotiations on effective measures to cease nuclear arms races and reduce their nuclear stockpiles, with the intention of complete denuclearization. Finally, the third pillar entitles all parties the right to develop civilian nuclear energy programs for peaceful purposes and to benefit from international cooperation in the field, in conformity with their non-proliferation obligations.[6] Furthermore, it defines the IAEA as the main governing body, responsible for the implementation and supervision of safeguards to prevent proliferation, expanding its authority and capacity to take necessary measures if signatory states violate their legal obligations. Summarized, the NPT is a central bargain where commitments to non-proliferation are exchanged for the access to peaceful nuclear technology, concluded under safeguards agreements with the International Atomic Energy Agency (IAEA).[7]

Nuclear Safeguards

Nuclear safeguards are a set of technical measures that applies to all nuclear-related activities that fall under the NPT. Non-nuclear signatories, in addition to state parties to the regional nuclear-weapon-free-zone treaties, are required to conclude comprehensive safeguard agreements (INFCIRC/153) with the IAEA. The comprehensive safeguards agreement (CSA), legally binding, is the most common safeguards agreement, currently concluded by the IAEA with 175 states, and provides credible assurances that member states adhere to their responsibilities concerning non-proliferation.[8] It allows the Agency to independently verify that nuclear materials are not being used contrary to

[5] *IBID.*
[6] United Nations Office for Disarmament Affairs, *Treaty on the Non-Proliferation of Nuclear Weapons,* https://www.un.org/disarmament/wmd/nuclear/npt/text [accessed 21 April 2019]
[7] Thomas Graham Jr., *Avoiding the Tipping Point* (Arms Control Association), https://www.armscontrol.org/act/2004_11/BookReview [accessed 21 April 2019]
[8] IAEA, *Safeguards Agreements*, https://www.iaea.org/topics/safeguards-agreements [accessed 3 May 2019]

their intended peaceful application, that the state does not engage in illicit nuclear activities, and ensures that safeguards are applied to all nuclear material in the jurisdiction, control or territory of the state.[9] This includes observation, review of records and reports, nuclear material accounting destructive and nondestructive measurements, containment and surveillance, and unattended monitoring.[10] In addition to the CSA, the IAEA operates with two additional safeguards agreements. The first, the voluntary offer agreement, permits the IAEA to apply safeguards to select eligible facilities and materials connected to a states' peaceful nuclear activities under a voluntary offer. All nuclear-weapon states to the NPT, not required to sign the CSA, has concluded this agreement. It allows the IAEA to verify that nuclear technology and materials are not withdrawn from safeguards unless provided for in the agreement.[11] The second, the item-specific safeguards agreement, covers only nuclear items or facilities specified in the safeguard agreement. It commits the state parties not to utilize these for the manufacture of nuclear explosive devices or weapons, or to further any military purpose. All non-NPT nuclear-weapon states, except North Korea, has signed this agreement.[12]

The nuclear safeguards have been useful in verifying activities involving the declaration of nuclear equipment. However, experiences from Iraq and North Korea in the early 1990s demonstrated the need for a more flexible system that could also detect undeclared nuclear activities. This resulted in the implementation of the Additional Protocol, which expanded the rights of access to information and locations, complemented the information gap under the CSA, and strengthened the IAEA's ability to assure the absence of undeclared nuclear activities, equipment and materials.[13] Along with safeguards, the regulatory control for nuclear non-proliferation also includes other measures, such as transport control, border control, international cooperation, monitoring compliance with the Comprehensive Nuclear-Test-Ban-Treaty (CTBT) and export controls.

[9] *IBID.*
[10] United States Nuclear Regulatory Commission, *International Safeguards* (NRC, 2019), https://www.nrc.gov/materials/fuel-cycle-fac/international-safeguards.html [accessed 3 May 2019]
[11] IAEA, *Safeguards Legal Framework*, https://www.iaea.org/topics/safeguards-legal-framework/more-on-safeguards-agreements [accessed 3 May 2019]
[12] *IBID.*
[13] IAEA, *Additional Protocol*, https://www.iaea.org/topics/additional-protocol [accessed 21 April 2019]

Nuclear Exports Controls

Nuclear export controls hold a prominent role in the nuclear safeguards system. An effective export regime is required to prevent the proliferation of dual-use goods that can be misused for military purposes. Few countries possess a full nuclear fuel cycle, and, at present, all states depend on foreign assistance of components critical to the development and operation of a civilian nuclear energy program. International transactions are common for nuclear materials, technologies and equipment, and are being closely monitored under a comprehensive nuclear export control system to make sure all components are used for their intended purpose.

Nuclear export control dates back to the early adaptation of the NPT. In Article III.2 of the treaty, signatories are to provide a "…source of special fissionable material, or equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any non-nuclear weapon state for peaceful purposes, unless […] subjected to the safeguards required by this Article."[14] However, the NPT does not specify what this encompasses, which prompted the first informal efforts to coordinate export policies between the major nuclear supplier nations. In 1971, a group of NPT and non-NPT states, led by Professor Claude Zangger, engage in multilateral negotiations to establish a list that encompassed all nuclear-related equipment that fell in under article III.2 and, hence, triggered the application of IAEA safeguards.[15] The efforts of this workgroup, known as the Zangger Committee, had significance for the implementation of the NPT but failed to sufficiently address other dual-use exports that fell outside of those identified in the NPT.

The limitations of the Zangger Committee's "trigger-list" became evident in 1974 after India conducted its first successful test of a nuclear explosive device. This device was created using plutonium from a research reactor provided by Canada and supplied by the United States. The diversion of dual-use technologies underlined the need to expand multilateral control, safeguards and guidelines across all nuclear suppliers to effectively limit the spread of nuclear weapons to states outside the non-proliferation regime.[16]

[14] United Nations Office for Disarmament Affairs, *Treaty on the Non-Proliferation of Nuclear Weapons,* https://www.un.org/disarmament/wmd/nuclear/npt/text [accessed 21 April 2019]
[15] Zangger Committee, "History," https://zanggercommittee.org/history.html [accessed 21 April 2019]
[16] Sarah Bidgood, "The Establishment of the London Club and Nuclear-Export Controls," in *Once and Future Partners: The United States, Russia and Nuclear Non-Proliferation,* edited by William C. Potter and Sarah Bidgood, Adelphi Series (2016), p. 137.

These challenges resulted in the establishment of the Nuclear Suppliers Group (NSG), at the time consisting of the United States, USSR, France, West Germany, Japan, Canada and the United Kingdom. The NSG was created to issue guidelines and terms under which nuclear exports could take place and monitor international nuclear trades to strengthen export controls.[17] While the IAEA is responsible for supervising the overarching regulatory framework for export controls, the authority for controlling international nuclear trade rests with national governments.[18] Uneven applied licensing of nuclear exports by national authorities can hinder compliant international nuclear trade. This practice is troublesome because depending on the objectives behind a state's nuclear export strategy, it can lead to a race where governments lower the threshold for nuclear assistance to acquire new markets and deprioritizes the security implications this entails.

China and the International Order

Traditionally, China has expressed little interest in engaging with international institutions and has maintained a mostly antagonistic attitude towards the international system. This posture changed in the late 1970s after the government introduced a series of market-orientated economic reforms and the U.S. shifted its diplomatic recognition from Taipei to Beijing, resulting in a more supportive Chinese view of the postwar international order.[19] Following this, China has slowly integrated into and become increasingly dependent on the international order. It has committed to hundreds of international institutions, increased its support for multilateral activities and norms, expressed interest in global developments, and engaged in strengthening global governance.[20]

Nevertheless, Beijing has been significantly more successful in its economic adaptation and recognizes the further need for political and ideological integration to achieve its

[17] World Nuclear Association, *An Effective Export Control Regime for a Global Industry* (England: WNA, 2018), https://www.world-nuclear.org/getmedia/cc6d54da-ee87-4642-aee3-99e0231016d9/Export-Controls-Report.pdf.aspx [accessed 17 May 2019]

[18] World Nuclear Association, *An Effective Export Control Regime for a Global Industry* (April 2018), p. 3, https://www.world-nuclear.org/getmedia/cc6d54da-ee87-4642-aee3-99e0231016d9/Export-Controls-Report.pdf.aspx [accessed 20 June 2019]

[19] Ministry of Foreign Affairs of the People's Republic of China, *The Establishment of Sino-U.S. Diplomatic Relations and Vice Premier Deng Xiaoping's Visit to the United States,* https://www.fmprc.gov.cn/mfa_eng/ziliao_665539/3602_665543/3604_665547/t18007.shtml [accessed 12 May 2019]

[20] Michael J. Mazarr, Timothy R. Heath and Astrid Stuth Cevallos, *China and the International Order* (Santa Monica, California: RAND Corporation, 2018), pp. 25 – 28.

strategic objectives. China perceives the current global order to be a particular challenge for its great power ambitions, being an unfair balance of power and a system that privileges the U.S. and its allies. It does, however, see the advantage of a legitimate global system regarding equitable institutions and decision-making processes and is therefore set to reform rather than replace it. It acknowledges that the current system is closely identified with the norms, values and ideals of Western countries, particularly the United States, and attempts to push for an alternative model could be seen as revisionist and aggressive behaviour. Therefore, China seeks to counter U.S. unilateral position by establishing a multipolar order which promotes a more substantial degree of equality among the member States and provides non-Western countries increased influence in the forming of international norms, rules and standards.[21]

According to a research report from RAND Corporation (2018), China has become increasingly dependent on the international order through institutions like the United Nations, the World Trade Organization (WTO) and the International Atomic Energy Agency (IAEA), but remains poorly positioned in respect to its medium and long-term goals.[22] In contrast to the U.S., China is constrained by its lack of allies, partners and international support to exercise global leadership, and its corrupt and inexperienced military has demonstrated only incipient capability to project power.[23] Additionally, the global community has been reluctant in embracing its values and ideals, and its soft power approaches continue to lag.[24] To tackle this, Beijing seeks to adjust its approach to global governance in a manner that continues to serve its strategic objectives but simultaneously recognizes its limitations. In other words, it is looking to increase its international influence in a way that supports its revitalization as a great power.[25] By advocating its political values, norms and ideals, Beijing consolidates its claim to leadership and position institutions favourably. This allows it to strengthen coalitions further to support its policy preferences, protect its interests, and balance against the power of its international rivals.[26]

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[21] IBID, *p. 35.*
[22] IBID, *p. 76.*
[23] Kirsten Gunness and Oriana Skylar Mastro, "A Global People's Liberation Army: Possibilities, Challenges, and Opportunities," *Asia Policy* 11, no. 22 (2016), pp. 131-155.
[24] Joseph Nye, *The Limits of Chinese Soft Power* (Massachusetts: Belfer Center for Science and International Affairs, 2015), https://www.belfercenter.org/publication/limits-chinese-soft-power [accessed 13 May 2019]
[25] Michael J. Mazarr, Timothy R. Heath and Astrid Stuth Cevallos, *China and the International Order* (Santa Monica, California: RAND Corporation, 2018), pp. 78.
[26] IBID, *p. 89.*

Global Nuclear Leadership

The nuclear governance system is essential in maintaining global safety, security and safeguards obligations, but has proven unable to meet some of the modern-day challenges adequately. In every suspected case of proliferation post-1990s, none of the states that sought to acquire nuclear weapons was deterred by the multilateral institutions established for this exact purpose. The non-proliferation success stories, including Libya and the former Soviet states, have, to a large extent, been a direct result of government-to-government negotiations rather than pressure by international bodies. Moreover, these bodies often cooperate with other ad hoc forums of interested parties, like the P5+1 group on Iran or the Six-Party Talks on North Korea. These efforts still have proven inadequate to prevent the spread of nuclear materials and technologies and states, such as North Korea and Iran, continue to pursue nuclear capabilities.[27]

Nuclear governance has for the past six decades continued to evolve and adapted to new requirements and events in the international system, even though this evolution has been more reactive and episodic than strategic. The major nuclear states of the West, most notably the U.S. and France, have been at the forefront of pushing international conventions and norms to respond to nuclear challenges effectively. This engagement has been imperative for the developments of the existing governance regimes.[28] However, this is likely to change due to the evolution of nuclear suppliers. China is projected to overtake the U.S. in terms of nuclear power generation by 2026, effectively becoming the most significant global nuclear operator and market.[29] This shift will allow it considerably more influence in international institutions like the IAEA and, hence, provide it with the means to impact developments of nuclear safety, security and safeguards regimes in its favour.

The nuclear marketplace is competitive, and the lack of industrial economies and reactor standardization makes it hard to profit from single development projects. Beijing is, therefore, looking to expand its export portfolio, mainly focusing on developing

[27] Council on Foreign Relations, "The Global Nuclear Nonproliferation Regime," *Global Governance Monitor* (May 2012), https://www.cfr.org/report/global-nuclear-nonproliferation-regime#chapter-title-0-2 [accessed 20 June 2019]
[28] Partnership for Global Security, "Evolving Nuclear Governance for a New Era" *Global Nexus Initiative* (Policy Memo and Recommendations, April 2017), http://globalnexusinitiative.org/wp-content/uploads/2017/04/GNI-Policy-Memo-3.pdf [accessed 20 June 2019]
[29] Nuclear Energy Institute and Partnership for Global Security, "Nuclear Power for the Next Generation: Addressing Energy, Climate, and Security Challenges," *Global Nexus Initiative* (2018), p. 10.

nations along its Belt and Road (BRI) corridors in the Middle-East, Asia and Africa.[30] In the past, China has shown troubling behaviour as a nuclear supplier. This raise concerns that the China Communist Party (CCP) is prepared to undermine the nuclear governance standards over commercial interests by providing nuclear assistance to countries that lack both experience and strong credentials with nuclear power. Widespread dissemination of nuclear materials and equipment increases the risks of nuclear incidents and can, eventually, lead to proliferation.

[30] World Nuclear Association, *Nuclear Power in China* (June 2019), http://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx [accessed 20 June 2019]

Literature Review

Introduction

Traditionally, nuclear weapons proliferation literature has been focused disproportionately on the demand-side of proliferation, which examines why states seek to develop nuclear weapons. Scholars have devoted much less attention to the supply-side and how countries proliferate. Until recently, it did not exist a theory that examines civilian nuclear cooperation, and it was believed that such assistance was provided for economic profits or because the supplier failed to understand the consequences.[31]

In recent years, there have been two major attempts to address this puzzle. Matthew Kroenig (2009) introduced the first scholarly research that sought to explain cross-national variation in nuclear assistance over time. His main argument is that states provide sensitive nuclear assistance, the transfer of nuclear materials and technologies directly relevant to a nuclear weapons program, for strategic reasons.[32] He found that under certain circumstances, it can be in the 'suppliers' interest to promote the proliferation of nuclear weapons, even if this violates international norms and threatens strategic calculations. Moreover, he showed the connection between nuclear assistance and proliferation by proving that counties which engage in sensitive nuclear cooperation are more likely to acquire nuclear weapons.[33] Though Kroenig's research made significant contributions to the debate on nuclear assistance, he maintains a narrow focus which is directed exclusively to only a small subset of nuclear cooperation. Matthew Fuhrmann (2009) expanded the scholarly understanding of nuclear cooperation in his work on civilian nuclear assistance. In his study, he examined more than 2000 nuclear cooperation agreements (NCAs) and found that states export nuclear components and materials for politico-strategic reasons.[34] His research was the first to analyse this phenomenon in a broader context and included seemingly innocuous nuclear aid that also has the potential to lead to the proliferation of nuclear weapons. His findings have been crucial in order to establish a generalizable academic theory that explains why states provide nuclear assistance.

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[31] Scott Sagan, "Why do States Build Nuclear Weapons? Three Models in Search of a Bomb" *International Security* 21, no. 3 (1997), pp. 54-86.
[32] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010), p. 2.
[33] *IBID,* pp. 189 – 205.
[34] See Fuhrmann (2009); Fuhrmann (2010)

Kroenig and Fuhrmann both offer hypotheses that attempt to identify and deconstruct the underlying reasons that motivate a state to provide nuclear assistance. Their research, though it differs in scope and method, have been pioneering and have opened up an essential field of research that overlooked for a long time. This literature review examines their research, together with established theories in international relations, to present a theoretical framework that includes the most commonly accepted hypotheses for why 'states' engage in nuclear cooperation.

Power Projection

According to Kroenig (2012), nuclear proliferation does not uniformly impact states, but rather, is closely linked to their position in the international system. Power-projecting states, states that can engage in a full-scale, conventional, ground war on the territory of a potential target, are most threatened by proliferation due to the strategic constraints it entails.[35] Though other high-impact, low probability scenarios, like nuclear terrorism, is considered a threat, a review of internal strategic assessments shows that leaders in power-projecting states are most concerned about the constrains proliferation puts on its conventional military power.[36]

The notion that nuclear weapons deter military intervention by conventional means is consistent with nuclear deterrence literature. Sagan (1996) argues that the perceived benefits of nuclear deterrence are the primary reason why states seek to acquire nuclear weapons.[37] For power-projecting states, the use of force can be deployed to overthrow governments, change a 'states' political orientation or reduce its military capabilities. However, faced against a nuclear state, direct military interventions become less attractive due to the high strategic costs involved. In addition to deterring power-projecting states from the actual use of force, proliferation also undermines the credibility of the threat itself and, therefore, reduces the effectiveness of coercive diplomacy.[38] Diplomatic approaches, particularly coercive measures, depends on the credibility of the state to follow through in order to be effective but nuclear weapons

[35] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010), p. 14.
[36] *IBID.*
[37] Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," *International Security* 21, no. 3 (1996), pp. 54 – 56.
[38] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010), p. 14.

reduce the adversaries estimates of the probability that the threat of force will be carried out. The high strategic costs involved limits how far power-projection states can push in a crisis and, accordingly, limit their means in conflicts with other nuclear-armed states.

This notion correlates with previous quantitative analyses, where Gartzke and Kroenig (2009) found that states are less likely to prevail in international disputes against countries that possess nuclear weapons.[39] Furthermore, proliferation negatively impacts alliances structures because nuclear weapons reduce the value of the extended security guarantees power-projecting states provide for their allies. Kroenig (2012) explains that power-projection states offer protection to cement their alliances and to cultivate their bilateral relationships. However, proliferation has the potential to undermine the credibility of such security commitments against nuclear-armed states, and the client state could instead obtain security independence by acquiring nuclear weapons themselves.[40] Nuclear proliferation is a greater threat to power-projecting states as they need to reapportion its strategic attention to new and potential emerging nuclear threats. Kroenig (2012) hypothesises that states not able to project conventional military power over another state is less threatened by proliferation, as the strategic costs are lower compared to power-projecting states. Therefore, these are more likely to provide nuclear assistance.[41]

He uses the case of 'Israel's nuclear program to exemplify this. He argues that the U.S., who enjoyed a force projection capability over Israel, denied providing the latter with anything more than a research reactor through the "Atoms for 'Peace' program. It feared that a more comprehensive nuclear program and technology transfer could lead to a proliferation in the Middle East, which had the potential to undermine U.S. strategic position in the region.[42] France, on the other side, did not possess this kind of strategic leverage over Israel and was less threatened by the risk of proliferation. Instead, a nuclear-armed Israel presented a chance to constrain Egypt, its regional power and its

[39] Erik Gartzke and Matthew Kroenig, "A Strategic Approach to Nuclear Proliferation," *Journal of Conflict Resolution* 53, no. 2 (2009), pp. 151 – 160.
[40] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010), p. 22.
[41] *IBID, pp. 34 – 35.*
[42] *IBID*, p. 67.

support to the forces that were fighting France in the Algerian civil war.[43] This balance suggests that states, which are unable to project power over others, are more likely to engage in nuclear cooperation.

Economic incentives

It commonly believed that economic incentives drive states, particularly those in economic hardship, to engage in civilian nuclear cooperation. In his research on non-traditional supplier nations, William C. Potter (1990) concludes that these, similar to traditional suppliers, seek to pursue nuclear exports for economic profits.[44] He argues that nuclear exports, particularly for states that have recently industrialised, offers means to acquire foreign exchange, reduce debt, pursue barter transactions for desired commodities and to renegotiate unfavourable terms of trade.[45] The case of the Brazil-Iraq nuclear cooperation provides empirical evidence for this claim, where Brazil in the late '70s sought to integrate itself with oil producers in the Middle East to guarantee supply, negotiate discounts and expand its export regime to alleviate balance of payment pressures.[46] Iraq, on the other side, was looking to bypass its commitments to the NPT in order to establish its nuclear program and offered Brazil lucrative trade deals in exchange for nuclear assistance.[47]

This notion is further strengthened by Chestnut (2007) who emphasises the risk of proliferation by Pyongyang due to the economic underdevelopment and the low levels of economic growth in North Korea.[48] The DPRK has successfully established extensive nonnuclear covert smuggling capabilities, and estimates suggest that the 'regime's state-sponsored criminal network profited between $500 million to $1 billion from criminal activities in 2005.[49] Though the regime justifies its illicit activities on ideological terms, recent reports have shown that financial necessities primarily

[43] *IBID.*
[44] William C. Potter, *International Nuclear Trade and Nonproliferation: The Challenge of Emerging Suppliers* (Maryland, United States: Rowman & Littlefield, 1990), p. 412.
[45] William C. Potter, "The New Nuclear Producers: The Main Threat to Supply-Side Restraints?" in *Limiting the Proliferation of Weapons: The Role of Supply-Side Strategies,* ed. Jean-Francois Rioux (Ottawa: Carleton University Press, 1992), pp. 26 – 28.
[46] Dani K. Nedal, *Brazil-Iraq Nuclear Cooperation* (Washington D.C.: The Wilson Centre, 2013), https://www.wilsoncenter.org/publication/brazil-iraq-nuclear-cooperation [accessed 8 March 2019]
[47] *IBID.*
[48] Sheena Chestnut, *"Illicit Activity and Proliferation: North Korean Smuggling Networks" International Security* 32, no. 1 (2007), p. 80.
[49] U.S. Congress, Senate, Committee on Homeland Security and Governmental Affairs, *North Korea: Illicit Activity Funding the Regime*, 109th Cong., 2nd sess., 2006, p. 1.

motivate this behaviour.[50] Pyongyang has the economic incentives to sell nuclear materials or components if forced into a corner by, for example, embargoes and sanctions. Additionally, Macfarlane (2013) found that countries with a nationalised nuclear industry are more likely to focus on selling assistance and services, as the economic benefits for the state are significantly higher.[51]

However, other scholars (Kroenig, 2010; Fuhrmann, 2009) have been sceptical to the significance of economic incentives in explaining why states engage in nuclear transfers. Kroenig (2010) addresses the abovementioned arguments and outlines that this logic bases itself on the assumptions that less-developed nations and countries with low economic growth are more likely to provide nuclear assistance, even if it poses a risk to themselves.[52] This correlates with the perception that supplier nations can secure a highly beneficial economic source of income through nuclear assistance, but examining contemporary cases (China to Pakistan, 1981 – 1986; USSR to China, 1958 – 1960; Pakistan to Iran, Libya and North Korea, 1977 – 2002; France to Israel 1959 – 1965), Kroenig finds no evidence that supports this claim. He notes that the suppliers in these cases were advanced industrial economies, that did not receive any significant financial benefits. In some cases (USSR to China, 1958 – 1960), the assistance proved to be an economic burden rather than the perceived advantage.[53] Kroenig argues that for a state with developed nuclear fuel-cycle capabilities, it is economically more beneficial to provide fuel-cycle services for other states rather than exporting the facilities themselves.[54] The export of capabilities would reduce the customer base and potentially create competitors in the market. Kroenig receives support from Solingen (2007) and T.V. Paul (2000), who adds that in 'today's globalised markets, states are likely to be reluctant to risk international trade and investment on controversial foreign policies over the low economic gains that nuclear trade yields.[55]

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[50] Sheena Chestnut, *"Illicit Activity and Proliferation: North Korean Smuggling Networks" International Security* 32, no. 1 (2007), p. 80.
[51] Allison Macfarlane, "Where, How and Why Will Nuclear Happen? Nuclear "Renaissance" Discourses from Buyers and Suppliers," in *The Nuclear Renaissance and International Security*, edited by Adam N. Stulberg and Matthew Fuhrmann (Stanford: Stanford University Press, 2013), p. 64.
[52] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010), p. 41.
[53] *IBID, pp. 107-108, 117-118, 126-127, 145-146.*
[54] William C. Potter, *Nuclear Power and Nonproliferation: An Interdisciplinary Perspective* (Boston: Oelgeschlager, Gunn & Hain, 1981), p. 106.
[55] Etel Solingen, *Nuclear Logics* (Princeton: Princeton University Press, 2007) and T.V. Paul, *Power Versus Prudence: Why Nations Forgo Nuclear Weapons* (Montreal: McGill-Queen's University Press, 2000)

Strategic bilateral relationships

Recent research on nuclear exports suggests that states engage in this type of cooperation for strategic reasons. Matthew Fuhrmann (2009) explains that countries accept the risk of proliferation because nuclear assistance is an effective instrument of statecraft.[56] He refers to Singer, Bremer and Stuckey (1972) who underpinned the critical role energy plays in facilitating economic growth and its importance for national power.[57] Nuclear power, therefore, improves the energy production of the state, which directly influences its material capacity and the enhanced energy-production capacity allows for resources to be reallocated for military purposes.[58] Moreover, civilian nuclear assistance promotes stronger bilateral relationships. Hans Morgenthau (1962) argued that foreign aid cultivates closer political ties by evoking a sense of gratitude from the recipient state, which motivates it to engage in cooperation with the supplier in a range of different domains.[59] This effect strengthened further if the assistance is either perceived valuable or if the recipient relies on the supplier to obtain the given asset.[60]

According to Fuhrmann (2009), nuclear energy meets the abovementioned criteria and states values it because "…it stimulates economic growth, symbolises technological modernity and scientific competence, fosters energy independence, and provides a foundation that a weapons program could draw on in the future."[61] The political and strategic benefits of nuclear energy and the fact that most countries are dependent on assistance to adopt nuclear energy constitute that civilian nuclear assistance is effective in strengthening bilateral relationships. Fuhrmann (2009) theorised that states provide nuclear exports and assistance mainly for politico-strategic reasons, the most important being to strengthen allies and alliances.[62] In the global, anarchic system, alliances are particularly essential to establish a balance of power and constrain threatening states and can, therefore, provide a useful instrument to deter third party aggression and promote peace.[63] Moreover, Sprecher and Krause (2006) add that great powers can

[56] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 186.
[57] David J. Singer, Stuart Bremer and John Stuckey, "Capability Distribution, Uncertainty, and Major Power War, 1820 – 1965" in *Peace, War and Number,* edited by Bruce Russett (California: Sage Publications, 1972), p
[58] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 186.
[59] Hans Morgenthau, "A Political Theory of Foreign Aid," *The American Political Science Review* 56, no. 2 (1962), pp. 301-309.
[60] Stephen M. Walt, *The Origins of Alliance* (Itacha: Cornell University Press, 1987), p. 43.
[61] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 186.
[62] *Ibid, p. 187.*
[63] Kenneth Waltz, *Theory of International Politics* (New York: McGraw-Hill, 1979)

pursue alliances for other reasons, for example, if they are seeking the rights to establish foreign military bases, acquire overflight rights or to manage weaker states.[64] The controversial U.S. nuclear deal with India in 2005 is an example of how nuclear assistance was used to strengthen bilateral ties. Burns (2005) noted that the deal was not only imperative for the normalisation of the Indo-American relations but also crucial for the strategic partnership to further develop.[65]

For the supplier states, the anticipated benefits from its alliance are imperative for its strategic interests but do not always materialise. The dynamic nature of international politics suggests that the absence of enforcement mechanisms, changes in the strategic environment and 'recipients' incentives to free-ride can impact the 'latter's commitments to its alliance obligations.[66] Published research on alliances and dependability in war shows that allies often prove to be unreliable. By examining wars between 1916 and 1965, Sabrosky (1980) found that allies only fought together in 27 per cent of the cases and opposed each other twelve per cent of the time.[67] Fuhrmann (2009) concludes that states cannot assume the support of its allies when it comes to important topics like votes in the United Nations Security Council, collaboration on issues like terrorism or proliferation, limit trade with a third party, or ratify treaties that serve strategic interests.[68] This suggests that alliances do not guarantee support for strategic assistance. Intra-alliances should, therefore, be continuously maintained after they are forged to ensure that it yields the benefits anticipated that led to the creation of it in the first place. Civilian nuclear cooperation has been described to be particularly useful to achieve the abovementioned goals but does also carry the risk of proliferation, mainly if the alliance is established on weak grounds.

[64] Christopher Sprecher and Volker Krause, "Alliances, Armed Conflict, and Cooperation: Theoretical Approaches and Empirical Evidence," Journal of Peace Research 43, no. 4 (2006), pp. 363-365.
[65] Nicholas Burns, "The U.S. and India: An Emerging Entente?" *Testimony before the House International Relations Committee*, Washington D.C. (2005), https://2001-2009.state.gov/p/us/rm/2005/52753.htm [accessed 11 March 2019]
[66] Lars Skålnes, *Politics, Markets and Grand Strategy* (Ann Arbor, Michigan: University of Michigan Press, 2000), pp. 16-17.
[67] Alan Sabrosky, "Interstate Alliances: Their Reliability and the Expansion of War," in *The Correlates of War II: Testing Some Realpolitik Models*, edited by David Singer (New York: Free Press, 1980), pp. 161-198.
[68] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 187.

Common enemies

Related to the strategic incentives of alliances, scholars have pointed out that states provide nuclear assistance to strengthen enemies of enemies. According to Waltz (1979), states that are threatened by an adversary can effectively constrain its power by cooperating with its enemies.[69] This logic suggests that if a common enemy threatens two states, they are likely to form an alliance. However, Fuhrmann (2009), states that a common enemy does not necessarily lead to formal alliances. This can be exemplified by the case of the United States and India, whom both perceive China as a threat. Still, no formal defence or military cooperation has been established even though the two continue to cooperate in a variety of ways to counter 'China's increasing influence in Asia.[70] Paul, Wirtz and Fortmann (2004) refer to this form of "informal" cooperation as soft balancing.[71] Matthew Kroenig (2010) argues that the notion of common enemies is particularly relevant for nuclear cooperation due to the high strategic cost proliferation entails and that soft balancing is a viable strategy used by supplier nations to counter the potential threat from other states.[72]

It is useful to achieve this objective for two reasons. First, it allows for closer bilateral relations between the supplier and the recipient state and improves the 'former's ability to counter the threat from its common adversary. For example, China provided Pakistan with nuclear assistance in the '90s intending to limit 'India's power capabilities in South Asia and constrain its aspirations of becoming a dominant regional power.[73] This aid also gave China another strategic advantage, as India directed its attention to the newly formed threat of a nuclear Pakistan instead of Beijing. Second, the assistance also constrains the power of the threatening state by making it increasingly difficult for it to exert aggression or influence over the recipient. In the '70s, the United States provided Iran with nuclear aid to strengthen it politically and economically, making it

[69] Kenneth Waltz, *Theory of International Politics* (New York: McGraw-Hill, 1979)

[70] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 189.

[71] T.V. Paul, James Wirtz and Michel Fortmann, *Balance of Power: Theory and Practice in the 21st Century* (California: Stanford University Press, 2004), pp. 14-15.

[72] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Itacha: Cornell University Press, 2010), p. 36.

[73] Thazha, Varkey Paul, "Chinese-Pakistani Nuclaer Missile Ties and the Balance of Power," *The Nonproliferation Review* 10, no. 2 (2003), pp. 1-9.

increasingly difficult for the Soviet Union, a common enemy, to pressure or attack Teheran.[74]

In his research on nuclear exports, Kroenig (2010) identified multiple potential benefits for states that provide nuclear assistance to another state in which they share a common enemy. These included deterring powerful rivals from intervening in regions of strategic importance for the supplier state; decreasing adversaries' ability to use coercion as a diplomatic tool; absorbing the enemy into a regional nuclear crisis; reorient its strategic attention; or trigger further proliferation within the adversary's sphere of influence.[75] Even if the nuclear assistance is given is intended for civilian nuclear programs, the dual-use nature of nuclear technologies, equipment and materials crates uncertainty and sends a powerful message to the common enemy. However, while nuclear cooperation can be used as a powerful tool in international relations, supplier states run the risk of proliferating nuclear weapons to states in which they do not have bilateral ties or formal alliances established.

[74] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 189.
[75] Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Itacha: Cornell University Press, 2010), p. 38.

Theory

Introduction

The rise of China and the threat of nuclear proliferation continues to pose some of the most significant challenges to the international system. These issues are going to have a direct impact on the future of the international order, the balance of power within this system, and the probability of armed conflict between dominant and lesser powers alike. Beijing has since the late 1970s, grown to become a significant factor in the global non-proliferation regime. It has continued to make efforts to increase its influence in managing proliferation challenges, which will be further amplified by its recent investments in its domestic nuclear industrial sector. China's position as a permanent member of the UNSC and the Board of Governors of the IAEA grants it the power to impact how these bodies respond to global non-proliferation threats.[76] However, its growing support for non-proliferation does not seem to be in line with its planned nuclear expansion. Under the Belt and Road Initiative, Beijing has expressed the intention to export up to 30 nuclear reactors by 2030.[77] Many of these destined for developing nations in Africa and Asia who lack the necessary institutional framework, knowledge and stability to operate them securely.

Furthermore, China does not hold an in-depth record of initiating improvements to the nuclear governance system and has expressed troublesome behaviour in the past as a nuclear supplier. This conduct has caused for concern as Beijing is strengthening its influence in every aspect of global nuclear governance simultaneously as it is expanding its nuclear exports regime. This constitutes a problem seeing it is uncertain if China will prioritise security concerns over economic and political considerations. Its predicted dominant position in the nuclear sphere suggests that even limited reversals on its international commitments can result in significant disruptions in global non-proliferation affairs. The West needs to engage with China to deepen its support and involvement in non-proliferation efforts, but in order to do this, it is first essential to understand the motivation and drivers behind China's nuclear export strategy.

[76] Evan S. Medeiros, *Reluctant Restraint: The Evolution of China's Non-proliferation Policies and Practices, 1980-2004* (California: Stanford University Press, 2007), pp. 4-5.
[77] David Stanway, "China Could Build 30 'Belt and Road' Nuclear Reactors by 2030: Official," *Reuters* (June 20, 2019), https://www.reuters.com/article/us-china-nuclearpower/china-could-build-30-belt-and-road-nuclear-reactors-by-2030-official-idUSKCN1TL0HZ [accessed 20 July 2019]

The hypotheses explored in the previous chapter adds a significant contribution to the supply-side literature and offers valuable insight into why states provide nuclear assistance. However, China presents a new scenario. Its comprehensive nuclear industrial sector, troubled past as a supplier, and prominent role in international bodies suggests that there are few, if none, comparable cases. These factors make it difficult to draw any conclusions to why China provides nuclear assistance to other states based on previously established generalizable theories. New research is therefore needed to understand the causes and effects of China's nuclear rise in Africa and Asia. This chapter will examine and discuss three of the most recognised hypotheses before presenting three new ones to understand China's nuclear export strategy**.**

Research question

What are the determinants behind China's nuclear export strategy and why does it only provide nuclear assistance to certain countries in Eastern Africa?

Assessing Established Theories

Previous research on civilian nuclear cooperation suggests that countries provide nuclear assistance for politico-strategic reasons, mainly to improve bilateral relationships, strengthen relations with enemies of enemies, or to boost democracies.[78] Additionally, there is a common perception that states provides nuclear assistance for economic gains. This paper agrees that China's nuclear export regime is motivated by Beijing's strategic interests but argue that existing accounts fail to explain these adequately. Most of the available research seeks to establish a more generalizable theory that examines this phenomenon in a broader international context, without consideration to national or regional differences. These differences are important, and a qualitative examination focused exclusively on China provides a more in-depth insight into the key drivers behind its nuclear export strategy.

The most commonly accepted hypotheses on nuclear assistance fails to explain the developments seen in China's nuclear export market after it revitalised its export strategy in 2005. First, the assumption that China utilises nuclear assistance as a tool

[78] See Fuhrmann (2009); Kroenig (2010)

for improving bilateral relations is inherently flawed, as Beijing holds a long-touted conviction that alliances are out-dated and irrelevant. Zhou Bo, Honorary Fellow with the Centre of China-American Defense Relations, articulates that China maintains a range of strategic partnerships but that it sees alliances to be counter-productive in respect to its independent foreign policy.[79] Beijing is focused on establishing global influence and regional pre-eminence and therefore pushes a non-confrontational strategy to advance its interests without offending anyone in geopolitics. Furthermore, military alliances are perceived as a mean for states to protect themselves from external threats, something Beijing does not need for its survival. Its closest potential allies, like Pakistan, Laos and North Korea, are not particularly powerful in relative terms and could inflict more damage than good. Alliances with more powerful states, such as Russia, would only antagonise the U.S. and result in more volatile relations, which would entail extensive political and economic costs for China.[80] Beijing also holds positive experiences from the Cold War, where its non-alliance and non-interference policy helped it obtain support, particularly from developing countries.

Second, the fundamental objectives of China's foreign policy are to preserve its independence, sovereignty and territorial integrity, in addition to establishing a favourable international environment for its reform and promote international stability.[81] To achieve this, it recognises the need to maintain peaceful relations with its geopolitical competitors and maintain regional stability in its vicinity. China has long adhered to and promoted a foreign policy based on mutual respect, non-aggression and non-interference in internal affairs of other states.[82] The idea that China uses nuclear assistance to strengthen enemies of enemies contradicts its political aspirations and directly jeopardises Beijing's chances to position itself as a global power. The current governance system makes it hard for China to provide nuclear assistance covertly and any openly attempts to assist rogue regimes would be in direct violations of its international obligations under the NPT. Violations of this would at minimum result in international condemnation, negatively impact the image Beijing is working to establish

[79] Zhou Bo, "The US is Right That China Has No Allies – Because it Doesn't Need Them" *South China Morning Post,* 13 June 2016, https://www.scmp.com/comment/insight-opinion/article/1974414/us-right-china-has-no-allies-because-it-doesnt-need-them [accessed 28 May 2019]
[80] Graham Allison and Robert D. Blackwill, *Lee Kuan Yew: The Grand Masters' Insights on China, the United States and the World* (Belfer Center Studies in International Security, MIT Press: Cambridge, 2013), pp. 31 – 34.
[81] Evan S. Medeiros, *China's International Behavior: Activism, Opportunism and Diversification* (Santa Monica: RAND Corporation, 2009), pp. 45 – 60.
[82] Andrew J. Nathan, "Principles of China's Foreign Policy," *Asia for Educators* (2009), http://afe.easia.columbia.edu/special/china_1950_forpol_principles.htm [accessed 21 June 2019]

of China as a responsible global actor. Furthermore, the complex and volatile state of affairs in many developing states suggests that unconditioned assistance of dual-use commodities could have severe consequences also for the supplier. If Beijing fosters nuclear weapon developments in the Indo-Pacific, it would be more of a threat to itself than to the mainland U.S. The political climate in many of these states suggests that it could risk destabilising the region and trigger unwanted conflicts.

Finally, recent studies on nuclear assistance have not found any empirical evidence that favours the contention that states seek to export to promote growth in their nuclear industries and for economic profits. This hypothesis does, however, resonate more in the case of China. According to an analysis from the Massachusetts Institute of Technology, nuclear power plants are up to three times less expensive in Asia due to differences in reactor designs, construction management, and cheaper and more effective supply lines and workforce.[83] China is also looking to streamline its logistics operations and export reactors on a large-scale, all which will help drive costs down. Still, nuclear power requires significant investments and China is looking to capture new markets by offering operational and financial support. This business model constitutes that China is not likely to see a return of investment in the nearby future, and there is nothing that indicates that Beijing will reap significant financial gains from its nuclear export industry. Moreover, China is looking to close its nuclear fuel cycle to get full control over all sectors of its nuclear industry and reduce its dependence on foreign aid or imports. Research on nuclear fuel cycle capacities suggests that this will further decrease the likelihood of profits because the costs of nuclear power would be higher with a closed fuel cycle.[84]

The above hypotheses are the most frequently used to explain the causes of civilian nuclear cooperation but mostly fails to explain China's nuclear assistance to foreign countries. For the reasons mentioned in previous chapters, it is necessary with a new framework that analyses this phenomenon in an isolated way. The next three hypotheses are not intended to establish a generalizable theory but rather define the key drivers of China's nuclear export strategy exclusively.

[83] MIT Energy Initiative, *The Future of Nuclear Energy in a Carbon-Constrained World* (Boston: MIT Press, 2018), pp. 38-42, https://energy.mit.edu/research/future-nuclear-energy-carbon-constrained-world/ [accessed 21 June 2019]
[84] Mark Hibbs, *The Future of Nuclear Power in China* (Washington, D.C.: Carnegie Endowment for International Peace, 2018), pp. 88.

Hypothesis 1: China provides nuclear assistance to states with equal political systems.

In his research, Fuhrmann (2009) argues that democratic nuclear suppliers are more likely to offer peaceful nuclear assistance to other democracies than to nondemocracies.[85] The notion that the political system of a state affects international security is recognised in international relations. Kant (1795), a German philosopher, recognised that equal state systems, mainly republics, tended to be more pacifist towards each other than to other forms of governments.[86] States that share similar political ideologies are, therefore, incentivised to strengthen each other through political or economic cooperation. This allows them a better position to achieve their political objectives and can reduce the geopolitical influence of adversarial states. Under the Cold War, the U.S. leveraged this strategy to counter the influence of communism in weak democracies, allowing it to strengthen other democracies and potential allies.[87] It also reduced the influence and relative strength of nondemocracies, in which it could experience later conflicts.

For the PRC, a one-party state operating in the framework of a socialist republic, international recognition of its political system is crucial to achieving its great power ambitions. Beijing has repeatedly emphasised that it does not seek to adopt other political systems but rather seeks to promote its own to increase its international standing and global support.[88] Beijing might, therefore, use its nuclear exports to either strengthen nondemocracies and push for its political model or seek to weaken democratic states and, hence, U.S. presence and influence in the region.

[85] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 192.
[86] Immanuel Kant, *Perpetual Peace: A Philosophical Sketch* (Königsberg: Friedrich Nicolovius, 1795), pp. 6-8.
[87] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 191.
[88] Zheping Huang, "Xi Jinping says China's Authoritarian System Can Be a Model for the World," *Quartz* (March 9, 2018), https://qz.com/1225347/xi-jinping-says-chinas-one-party-authoritarian-system-can-be-a-model-for-the-world/ [accessed 6 July 2019]

Hypothesis 2: China provides nuclear assistance to improve support and progress developments in countries involved in the Belt and Road Initiative.

The Belt and Road Initiative (BRI) is a development strategy and investment project adopted by the Chinese government to strengthen regional cooperation and trans-continental connectivity. Through the construction and development of a vast number of railways, highways, energy pipelines, ports and streamlined border crossings, Beijing seeks to deepen and expand infrastructure, trade and investment links across Eurasia and the Indo-Pacific periphery to promote economic integration.[89] However, it is interesting that while countries around the world are starting to feel the impact of these billion-dollar investments, which continues to grow at a rapid rate, there exists no publicly-available source or data that tracks the projects, countries involved or the investments. The overall response to the Initiative has been ambivalent and reflects the uncertainty in respect to its intentions, short-term successes and long-term implications.

The Initiative has, in many ways, become Beijing's most valued geopolitical tool to manifest its plans and build soft power globally. It has, however, seen an increasing number of challenges rise in recent years, some which threaten the project's overall success. A failure to deliver would be a crushing blow to China's grand strategy and result in a significant setback for its regional and global aspirations. This suggests that Beijing could seek to utilise civilian nuclear cooperation along the Silk Road corridors to strengthen its influence. Nuclear assistance could be offered to states of high strategic importance for the successes of the BRI or in countries that are becoming increasingly negative to the impacts of China's massive investments.

[89] Caroline Freund and Michele Ruta, *Belt and Road Initiative* (Washington, D.C.: The World Bank, 2018), https://www.worldbank.org/en/topic/regional-integration/brief/belt-and-road-initiative [accessed 4 June 2019]

Hypothesis 3: China provides nuclear assistance to strengthen energy systems in emerging markets

Energy is an essential component for countries to industrialise and grow their economies. This allows them to achieve mid-level income status, accommodate population growth and increase the standard of living for its citizens. Many developing countries have managed to cultivate economic growth in recent decades, and a significant portion of the worlds emerging markets are now located in Asia and Africa. This definition is used to describe nations that are in the progress of becoming more advanced economies, often through opening their markets and liberalising trade policies. However, energy poverty remains a significant barrier for further economic growth, which could result in a regional stagnation. Nuclear power offers a safe, reliable and affordable source of energy and is often seen as a valuable investment and a solution for developing countries to solve their energy problems.

Beijing could provide nuclear power to emerging markets to strengthen their energy sectors. This move would allow them to increase their economic growth and purchasing power parity, which would allow China to increase its exports of commodities and excess industrial capacity. Many of these markets are also connected to the Silk Belt corridors and involved in several prominent development projects. The lack of access to energy in the same regions creates a predicament for Chinese developments under the BRI, as the majority of the projects are related to transport, telecommunications, or energy, all requiring a reliable source of power to operate. The third hypothesis examines if Beijing offers nuclear assistance based on the energy profile of its recipients, to advance its own economic and strategic objectives.

Methodology

Introduction

In his work on civilian nuclear cooperation, Matthew Fuhrmann created a dataset based on a list compiled by Dr James Keeley (2003) that contained every bilateral nuclear cooperation agreement (NCA) that concluded between 1945 and 2003.[90] These agreements, signed by both the suppling and the importing state, authorise nuclear transactions of technology, equipment and materials, and are generally concluded at high levels of government. Typically, an NCA include a set of general provisions, including the authorisations of transfers related to nuclear facilities, technology, materials, or knowledge; guarantees that technology transferred will not be used for any nuclear explosive device or for any research and development of explosive devices; assurances that safeguards will be applied to all technology, materials, and know-how that is transferred; prohibitions against transferring facilities or materials to unauthorised third parties; and guarantees that adequate physical security is maintained for all nuclear materials and facilities transferred as part of the agreement.[91] Because supplier states rarely permit nuclear transfers without an NCA signed with the recipient state, the agreements also function as the mean by which countries regulate the nuclear marketplace.

Fuhrmann's work remains the only research that examines the dynamics and causes of civilian nuclear cooperation in greater detail and this, therefore, offers a solid baseline for further, supplier-specific analyses of nuclear assistance. Critics have argued that NCAs presents a profoundly inaccurate measure of nuclear cooperation, [92] but Fuhrmann has provided evidence that these treaties serve as a decent proxy for nuclear transfers and that the majority of signed NCAs leads to actual assistance.[93] Moreover, cooperation agreements are useful in capturing governments' incentives to provide aid, even if it does not yield a return of investment, because they can help explain the behaviour of nuclear suppliers. The long implementation time of nuclear power

[90] Matthew Fuhrmann, *The Nuclear Cooperation Agreement Dataset: Codebook* (Texas: Texas A&M University, 2012), http://www.matthewfuhrmann.com/uploads/2/5/8/2/25820564/nca_codebook.pdf [accessed 19 May 2019]
[91] Matthew Fuhrmann, *Atomic Assistance: How Atoms for Peace Cause Nuclear Insecurity* (Ithaca: Cornell University Press, 2012), p. 19.
[92] Christoph Bluth, Matthew Kroenig, Rensselaer Lee, William Sailor and Matthew Fuhrmann, "Correspondence: Civilian Nuclear Cooperation and the Proliferation of Nuclear Weapons," *International Security* 35, no. 1 (2010), p. 189, https://www.jstor.org/stable/40784651?seq=1#page_scan_tab_contents [accessed 19 May 2019]
[93] IBID, pp. 195 – 196.

constitutes that a significant number of the NCAs analysed have yet to materialise, and many of these documents are the only source of information that confirms a collaboration on nuclear assistance. This paper combines parts of Fuhrmann's research design with a comprehensive dataset created based on a list exclusively supplied by Dr James Keeley. The list contains all NCAs available for China up until 2018.

Research Design

The chosen research design focuses on the use of case studies, which relies on qualitative methods for analysing the determinants behind China's nuclear export strategy. Case studies offer an up-close, in-depth and detailed examination of a given social phenomenon and its related contextual conditions. These studies are typically qualitative and use processes of naturalistic inquiry to understand the underlying reasons, opinions and motivations of the phenomenon. It focuses on "why" instead of "what" to uncover trends and provides more in-depth insight into the problem, resulting in a narrative description of behaviour or experience.

The emphasise is therefore not to analyse cause and effect, discover generalizable truths or make predictions but rather the exploration and description of said phenomenon.[94] The main characteristics of this method are that it provides a high level of detail, is narrowly focused, and capable of combining both subjective and objective data to achieve its goals. Research in the field of political science presents a challenge due to the lack of transparency and official information and data available, particularly when examining the behaviour of governments. In terms of nuclear cooperation agreements and countries involved in the BRI, there exists no publicly-accessible database and the information used in this research has been extracted using different sources. Most of these are qualitative because the projects and cooperation initiatives by Beijing have yet to materialise and currently only exists on paper. The chosen design allowed for an in-depth examination of the discourse, documents and information available for the selected cases through open-sources.

[94] Roger Gomm, Martyn Hammersley and Peter Foster, *Case Study Method* (California: Sage Publications, 2009), pp. 1 – 7.

Civilian Nuclear Cooperation

Civilian nuclear cooperation has occurred frequently since the U.S. first started exporting nuclear materials and technology under its Atoms for Peace program. Nevertheless, it has received little scholarly attention compared to the demand-side of proliferation and remains poorly understood. The term civilian nuclear cooperation encompasses a broad spectre of various forms of atomic assistance related to nuclear energy programs, from training and education to fuel services and reactor designs. In order to analyse China's nuclear exports regime, a definition of what civilian nuclear cooperation is and what it is not is needed.

Most of the available scholarly literature on nuclear transfers is largely policy-orientated and focused on the proliferation of weapons-grade material, without consideration to other forms of assistance. Kroenig (2010) is commonly credited for his ground-breaking work on nuclear assistance and introduced in his research a comprehensive explanation to why States choose to transfer nuclear materials and technology.[95] However, his focus and definition centres around the concept of sensitive nuclear assistance, comprising of bomb designs, enrichment and reprocessing facilities and weapons-grade fissile material. Sensitive nuclear transfers occur infrequently and only account for a fraction of all nuclear assistance between states.[96] Fuhrmann (2012) expands the academic understanding of nuclear transfers in a broader context in his work on nuclear assistance, and offer the most precise definition available.

He defines civilian nuclear cooperation to be "the state-authorised transfer of nuclear facilities, technology, materials or know-how from one country to another for civilian purposes […] It excludes nuclear transactions that are not approved by the supplier country."[97] Fuhrmann underlines that nuclear assistance under this definition is either intended to support research on or the production of nuclear energy in the recipient state. This excludes all assistance given with the explicit intention of military application, including transfers of warheads, bomb designs or dual-use technologies or materials.

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[95] See Matthew Kroenig, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca: Cornell University Press, 2010)

[96] *IBID,* p. 2.

[97] Matthew Fuhrmann, *Atomic Assistance: How Atoms for Peace Programs Cause Nuclear Insecurity* (Ithaca, Cornell University Press, 2012), p. 13.

Under this definition, Fuhrmann (2012) classifies civilian nuclear cooperation into five operational categories to distinguish between the various forms of nuclear assistance. The first is safety agreements, encompassing all measures taken to prevent human or technical accidents involving nuclear or radiological materials and to effectively minimise the consequences of such an incident if it should occur. The systems in a nuclear power plant are highly complex and tightly coupled, making them susceptible to accidents and with substantial damage potential. It is common for states to cooperate on topics related to nuclear safety to mitigate the risk of accidents. Second is intangibles agreements, limited to technical exchange, research and development, or the education and training of nuclear scientists and operators. States with well-developed nuclear facilities often take the initiative to invite personnel from other countries to visit and receive training in reactor operations or nuclear physics, and close cooperation on technology research is seen as mutually beneficial.

Next are nuclear materials agreements, involving all agreements related to materials that are critical for reactor operations and, therefore, hold a central position in the nuclear marketplace. This mainly involves nuclear fuels, such as natural or enriched uranium and plutonium, but also other materials, including heavy water, graphite, or thorium. Nuclear progressive states often import uranium and enrich it domestically for then to export the finished product readied for usage in reactors, instead of exporting the capacities themselves. This is done due to the complexity and specialised facilities and technical expertise needed in the enrichment and extraction process of nuclear fuels. These three categories are generally limited to a single area, whereas the latter two cover a broader area of nuclear cooperation. The fourth operational category is comprehensive research agreements. Commonly, this is used to provide research capabilities, such as research reactors, to countries that are in the early phase of their nuclear program, but it can also authorise the sale of nuclear fuels, promote training and technical exchanges. Finally, are comprehensive power agreements which constitutes a significant share of all civilian nuclear cooperation. These help states expand or develop its nuclear power program either for electricity generation or desalinisation and approve the transfer of nuclear power reactors. These agreements are often multifaceted and encourage the

transfer of nuclear fuel cycle facilities, materials, and intangibles, and may also authorise cooperation in nuclear safety or research.[98]

Dual-Use Technologies

The concept of dual-use is central to understanding the motivations for countries to engage in civilian nuclear cooperation and the implications this presents for the non-proliferation regime. The term dual-use means that the product in question can be utilised for more than one purpose at any given time, often used to describe civilian technologies or materials that also have potent military applications. Dual-use is particularly relevant in the nuclear domain, considering that all nuclear technologies are dual-use in nature, and therefore pose perplexing challenges for the implementation of effective nuclear safeguards and a rigid non-proliferation regime.[99] In his research, Fuhrmann (2009) presented findings that indicate a correlation between nuclear aid and nuclear weapons programs. He found that 13 per cent of all countries that received assistance through nuclear cooperation agreements later embarked upon nuclear weapon programs, compared to only 4 per cent of the countries that did not receive such support.[100] These findings suggest a probabilistic relationship where recipient countries are more likely to seek nuclear weapons and nuclear trade does, therefore, either indirectly or directly increase the risk of proliferation.[101]

The dual-use dilemma is interesting in the context of civilian nuclear cooperation for two reasons. First, countries that offer assistance designed to support the recipient country's nuclear energy program also provides the means necessary to develop nuclear weapons. The steps for the two processes are directly related and often interchangeable; from uranium mining and enrichment to fuel fabrication and reprocessing.[102] This is evident in for example the cases of India and Pakistan, whom both diverted the assistance provided through the Atoms for Peace for military purposes,[103] or North

[98] Matthew Fuhrmann, *Atomic Assistance: How Atoms for Peace Programs Cause Nuclear Insecurity* (Ithaca, Cornell University Press, 2012), p. 21.
[99] William M. Evan and Bret B. Hays, "Dual-use Technology in the Context of the Non-Proliferation Regime," *History and Technology* 22, no. 1 (2006), pp. 105 – 107.
[100] The United States, the Soviet Union and the United Kingdom are the only countries that began weapons programs without assistance through NCAs, because they all did so before 1952.
[101] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 185.
[102] Campaign for Nuclear Disarmament, *The Links Between Nuclear Power and Nuclear Weapons*, https://cnduk.org/resources/links-nuclear-power-nuclear-weapons/ [accessed 11 May 2019]
[103] Peter R. Lavoy, *The Enduring Effects of Atoms for Peace* (Washington, D.C.: Arms Control Association, 2003), https://www.armscontrol.org/act/2003_12/Lavoy [accessed 11 May 2019]

Korea that started its nuclear weapons program after having received support from the Soviet Union.[104] However, dual-use is not limited to the export of physical items like reactors or fuel services but also encompass "soft assistance" like education and training. Through education initiatives, the recipient state is allowed to develop the necessary expertise to safely and securely operate its nuclear power industry. However, it also provides it with the technical knowledge on how to use the same facilities for the production of weapons-grade nuclear fuel. In 1957, the U.S. agreed to share a nuclear research reactor with South Africa, who eventually used the knowledge it had obtained to advance its nuclear weapons program.

Second, while dual-use transfers increase the likelihood of proliferation, it does not guarantee it. This is important as it distinguishes civilian nuclear assistance from other forms of arms or military cooperation. Many countries are reluctant to engage in conventional arms trades because the applications and intentions of such transfers are clear. However, dual-use exports allow for the recipient State to convince the supplier that the transfers will not be used for military purposes, and the supplier itself can rationalise the assistance by thinking that it will not facilitate proliferation.[105] This issue is exacerbated by exporters who calculate that the single transfers they provide are harmless but fail to see it in a broader context. Due to the complexity of nuclear weapons, a state is often required to receive assistance from multiple sources in more than one aspect of the fuel cycle. In the case of India, New Delhi signed a total of nineteen nuclear cooperation agreements before it was able to produce its first explosive device – none of them single-handedly able to provide a functional bomb.[106]

Data

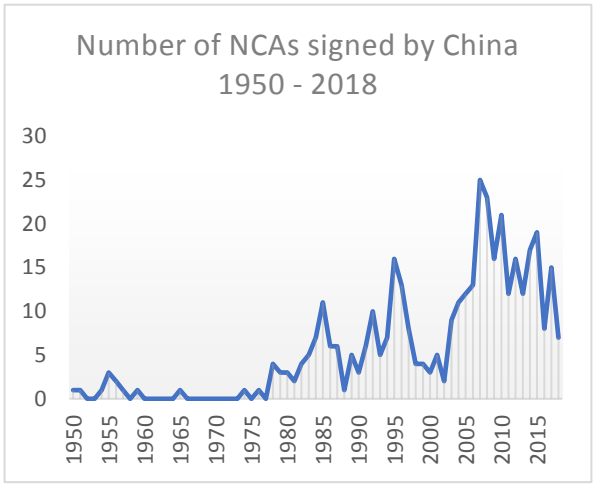
The data used to test the hypotheses derives from a dataset created based on the updated list provided by Dr Keeley that tracks all available bilateral nuclear cooperation agreements (NCA) signed by China between 1950 and 2018. This list includes all agreements that fall under either of the five operational categories and each entry contains the title of the agreement, the state parties, the date of signature and the

[104] Arms Control Association, *Arms Control and Proliferation Prolife: North Korea* (2018), https://www.armscontrol.org/factsheets/northkoreaprofile [accessed 11 May 2019]
[105] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), p. 185.
[106] *IBID.*

source(s). It excludes all agreements related to the uses of nuclear technology for agriculture, medical or industrial processes, or that were financial or legal in terms of liability. Moreover, the treatment of state and quasi-state agencies presents a persistent problem throughout the list.

In China, both the China National Nuclear Corporation (CNNC) and the China General Nuclear Power Group (CGNPG) are prominent in the nuclear scene. However, both companies operate with a set of subsidiary organisations, as they attempt to offer a full range of nuclear services. Information from secondary sources does not differentiate between China, as a state actor, the CNNC and CGNPG, or its subsidiaries as signatories of the agreement. This confusion creates some uncertainty about the status of the agreement. However, in general terms, agreements that involved the CNNG and the CGNPC was included while NCAs signed with private or commercial entities excluded. For some agreements, the date listed did not specify if it was the date the agreement was announced, reported or signed. If date was not listed, an approximate period was included based on information indicating activity that suggested when the agreement was signed.[107]

Based on this list, a total of 392 NCAs was identified, signed with 58 different countries since 1950, with a significant portion concluded after 2005. Agreements that exclusively dealt with non-proliferation assurances, administrative agreements that did not authorize nuclear cooperation or agreements designed for the sole purpose of the decommission power plants are not included in this number. Neither is agreements that offered no convincing evidence that it had been signed. The increase in signed cooperation agreements from 2005 can be explained by the Long-Term Development Plan of Nuclear Power (2005 – 2020) that was adopted by the State-owned Assets Supervisions and Administration Commission (SASAC) the same year.[108] This plan



[107] See Appendix 1: Explanatory Note, Horne-PRC List.
[108] 国家核电中长期发展规划(2005-2020年)

outlined the Chinese government's ambitions to increase its nuclear-generating power from 7 gigawatts (GWe) to 70 GWe by 2020 and, more importantly, the framework for how Beijing sought to change the unregulated status of the nuclear energy industry.[109]

Adopting this plan represented a paradigm shift in Chinese nuclear thinking for two reasons. First, Beijing recognized the need to increase investments in nuclear power to diversify its energy supply and to effectively meet the rising demands from a growing population, industrialization and urbanization. Second, the intertwined nature of the domestic nuclear developments and nuclear market indicated that expansion at home would transform China's nuclear export regime. These changes transformed its nuclear industry into a politically-orientated tool that could be used to advance its economic and political goals in certain regions.

The strategic reorientation constitutes a crossroad in Chinese nuclear exports. The year 2005 is, therefore, used as a baseline in the dataset and all entries before 2005 have been excluded. Next, the entries were classified accordingly to their operational category to assure they met the predetermined criteria set to maintain relevance to the further case studies. Cooperation agreements where China was not the exporter has been removed but cases where either both states received support or where it was difficult to determine the supplier is included. For the latter case, secondary sources were used to locate indicators suggesting China being the supplier and, if no evidence was obtainable, the particular case was removed from the dataset. Out of 392 NCAs originally on the list, 50.8% of the agreements (199) between China and recipient countries have been included in the dataset. To summarize, all countries identified have signed at least one NCA with China after 2005 and have received nuclear assistance that falls under one or more of the operational categories.

The second dataset used is an up-to-date list of countries directly involved in infrastructure and development projects with China under the Belt and Road Initiative. However, there exists no official government resource and the publicly available information is limited, and the data had to be compiled from several sources using other databases that map development progress. Two parameters were used to limit the extent

[109] Yi-Chong Xu, *The Politics of Nuclear Energy in China* (Basingstoke, UK: Palgrave Macmillan, 2010), pp. 60 – 64.

of the data. The first identified what 'involvement' constituted, as most states in the world maintain some bilateral agreements with China. To be considered a BRI project, it had to be within the scope of the "Vision and Actions on Jointly Building the Silk Road Economic Belt and 21st Century Maritime Silk Road," or the "Vision for Maritime Cooperation Under the Belt and Road Initiative." These two documents outline the Chinese government's vision for the BRI and define goals related to infrastructure investments, trade facilitation, human relations, economic integration and policy coordination.[110] In the documents, developments in the transport and energy sector in certain parts of Europe, Asia and Africa are prominent and have received most of the attention. These findings correlate with the report by ICBC Standard Bank and Oxford Economics that found that out of 1,100 projects announced or started, more than three quarters fell under these two sectors.[111] This allowed the dataset to be narrowed in only to include projects that fell under either of these two categories.

Next, the MERICS database on Belt and Road developments is a comprehensive interactive source that only tracks projects above a fixed $25 million value threshold. Using this significantly reduced the amount of data and removed all minor project entries. It is reasonable to assume that Beijing has invested far more in projects in states' that hold strategic significance for the BRI, particularly considering that the total investment has surpassed $750 billion.[112] Combining the two datasets resulted in a list of 73 countries across Europe, Africa, Middle East, Asia and Oceania. However, few of the databases consulted presented any data for Central- or Latin America. Further qualitative analysis revealed that at least Brazil, Venezuela, Ecuador and Bolivia are involved in on-going projects funded by China.[113] The total number of countries involved in the BRI, under the predetermined criteria, then increase to a total of 77.[114]

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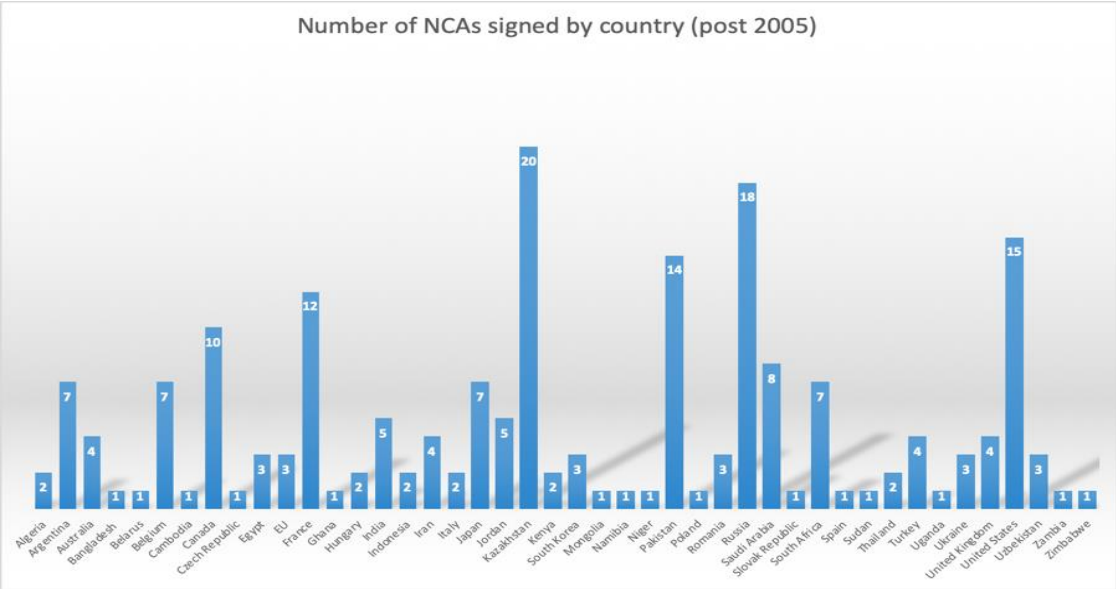
[110] See National Development and Reform Commission (NDRC), *Vision and Actions on Jointly Building the Silk Road Economic Belt and 21st Centuary Maritime Silk Road*, http://en.ndrc.gov.cn/newsrelease/201503/t20150330_669367.html and Yidaiyilu.gov, *Vision for Maritime Cooperation Under the Belt and Road Initiative*, https://eng.yidaiyilu.gov.cn/zchj/qwfb/16639.htm
[accessed 4 June 2019]

[111] ICBC Standard Bank, *Belt and Road Interim Report: Tracking Evolving Scope, Discovering Expanding Opportunities* (April 2018), pp. 14 -15, https://www.oxfordeconomics.com/my-oxford/projects/430082 [accessed 4 June 2019]

[112] ICBC Standard Bank, *Belt and Road Interim Report: Tracking Evolving Scope, Discovering Expanding Opportunities* (April 2018), p. 14, https://www.oxfordeconomics.com/my-oxford/projects/430082 [accessed 4 June 2019]

[113] June Teufel Dreyer, "The Belt, the Road and Latin American," *Foreign Policy Research Institute* (January 2019), https://www.fpri.org/article/2019/01/the-belt-the-road-and-latin-america/ [accessed 5 June 2019]

[114] For full list see Appendix 4



Using the methods above resulted in two comprehensive and detailed datasets that contain all nuclear cooperation agreements China has signed and all states directly involved in infrastructure developments under the Initiative. These will be cross-referenced and used to identify case studies for the empirical analyses.

Case Selection

For the case studies, the samples were selected through a method of purposeful sampling. This technique is a form of non-probability method that allows for the identification and selection of information-rich cases that holds a high degree of relevance to the phenomenon investigated. It assures that all the cases meet the predetermined criterion of importance and remain credible regarding the scope of the research.[115] By cross-referencing the two datasets, 33 countries were identified that were both involved in the BRI and received nuclear assistance from China under NCAs. Due to the political orientation and the established political institutions in most European countries, in addition to the balance of power and non-dependent bilateral relationships, these cases have been excluded. Oceania was excluded for the same reason and because it only contains one case, Australia. For Latin America, the information available in English was limited and though the region is within China's sphere of interest, it is geographically disconnected, and the geopolitical competition is fiercer from both the U.S. and Russia.

[115] Michael Quinn Patton, *Qualitative Research & Evaluation Methods*, 4th ed (California: SAGE Publications, 2015), Exhibit 5.8 Purposeful Sampling Strategies

The units of analysis have been limited to five nations in Eastern Africa, namely Kenya, Uganda, Zambia, Tanzania, and Ethiopia. All are considered developing countries, with similar economic, energy and demographic profiles. All are involved in projects under the BRI, but only the former three receives nuclear assistance from China. This provides a good basis for a comparative analysis that will examine a set of independent variables in an attempt to identify the reason why China provides civilian nuclear cooperation to some and not others in the same region.

Limitations

The foremost challenge throughout this process has been the access to reliable and verifiable information. Any research within the nuclear domain is going to face this problem, which has been particularly challenging regarding China, who holds a long history of censorship and is in the process of establishing itself as a dominant actor in the nuclear marketplace. There is little to no official information obtainable, and many government sources are only found in Mandarin, making the language barrier a persistent problem. Furthermore, there has been done little research on the supply-side of proliferation in general, and no other study has examined the nuclear energy export strategy of China in modern times. The scope of the research dictated that prioritisations had to be made to maintain a certain degree of reliability and validity in the empirical findings. However, this also means that there is much work left to be done and other hypotheses remain untested.

Empirical analysis

Alliances and Common Enemies

Introduction

In the literature on civilian nuclear cooperation, politico-strategic reasons are often considered the most probable explanations to why states provide nuclear assistance. The most commonly accepted theory being that countries do so to either strengthen their allies or alliances or to impose high strategic costs on common enemies.[116] In order for Beijing to pursue its aspirations of establishing itself as a preeminent regional power, it could leverage its nuclear export capabilities to restructure the balance of power or to constrain its geopolitical competitors, mainly the U.S.

To determine the relationship between China's nuclear export strategy and the politico-strategic hypotheses, two datasets by the Correlates of War Project was used. The first contains all bilateral defence cooperation agreements (DCAs) up until 2010. These establish the institutional framework for long-term military and defence cooperation between states and include all agreements related to defence policy, joint exercises and training, intelligence sharing, military industries and weapon procurement, and defence-related research and development.[117] The second is the Formal Alliance dataset. This track formal alliances concluded between at least two states and further classifies them according to type. Type I is defence pacts, the highest level of military commitment, and requires members of the alliance to assist in the event of an attack against another member. Type II, non-aggression pacts, pledges members to either remain neutral or not to support the use of force against other signatories if it is being attacked. Type III is ententes, which only commits members to consult each other in times of conflict or crises.[118]

The African government have in general been relatively inactive in DCAs, except for South Africa. Out of the 1851 entries in the dataset, the countries in Eastern Africa only accounted for 18 agreements, of which one was signed with the U.S. The rest had been

[116] Matthew Fuhrmann, "Taking a Walk on the Supply Side: The Determinants of Civilian Nuclear Cooperation," *Journal of Conflict Resolution* 53, no. 2 (2009), pp. 187 – 189.
[117] Brandon J. Kinne, "The Defense Cooperation Agreement Dataset (DCAD)," *Journal of Conflict Resolution* 1, no. 27 (2019), https://journals-sagepub-com.ezproxy.lib.gla.ac.uk/doi/pdf/10.1177/0022002719857796 [accessed 9 July 2019]
[118] The Correlates of War Project, "Formal Alliances Data Set," *The University of Alabama* (2015), http://www.correlatesofwar.org/data-sets/formal-alliances [accessed 13 July 2019]

signed mainly with regional neighbours, but many were also outdated. The lack of DCAs reveals that there are little or no formal military or security cooperation between the units of analysis and major global powers. In the Formal Alliances dataset, none of the countries had signed pacts with other states outside of the continent. The only exception being Ethiopia who signed a non-aggression pact with the Soviet Union in 1978. Nevertheless, the region has received increased attention in recent years from the U.S., Russia and China for its geostrategic significance. It is, therefore, necessary to conduct a qualitative analysis using open-source information to identify the different states political and military engagement with other countries.

Kenya

Since it gained independence, Kenya has continued to establish and maintain bilateral relationships globally, mainly concentrated on strengthening economic cooperation. Its closest allies are its neighbours in the African Great Lakes region, namely Uganda and Tanzania, whom it works with through the East African Community to promote social and economic integration.[119] Kenya holds cordial relations with Russia, who views it as a strategic partner in Africa, but this relationship is economically-focused and the trade between them limited. The most significant area of cooperation is in the arms trade and security-related training programs, but Russia is just one of many procurement sources. It is expected that the bilateral ties will continue to develop in strategic areas like natural resources and nuclear energy, but Kenya's strong ties to the U.S. leaves little room for this to evolve beyond the economic dimension.[120]

The same goes for China, who is another major trading partner for Kenya. There have been periods with increased military exchanges, but the cooperation focuses mainly on progression in the diplomatic and economic realm. However, Beijing has recently pushed to strengthen its influence in Kenya, partly because of its abundant access to natural resources and strategic significance for its BRI.[121] In the West, Nairobi holds long-lasting, uninterrupted ties with the United States, a major economic, political and

[119] Paulo Drummond, K Wajid and Oral Williams, *The Quest for Regional Integration in the East Africa Community* (Washington D.C.: International Monetary Fund, 2015), pp. 1-4.
[120] Mehmet Cem Ogultürk, "Russia's Renewed Interests in the Horn of Africa as a Traditional and Rising Power," *Rising Powers Quarterly* 2, no. 1 (2017), pp. 121-143, http://risingpowersproject.com/quarterly/russias-renewed-interests-in-the-horn-of-africa-as-a-traditional-and-rising-power/ [accessed 7 July 2019]
[121] Isaac Ongiri, "Kenya Signs 17 Multi-Billion Deals with China," *Business Daily Africa* (May 10, 2014), http://www.businessdailyafrica.com/Kenya-signs-17-multi-billion-deals-with-China/-/539546/2310366/-/1514laoz/-/index.html [accessed 7 July 2019]

military partner and its most reliable ally. This relationship was cemented by the latter's democratic transition in 2002 and its central role in the U.S.-led War on Terror on the horn of Africa. The two have grown mutually dependent, as Washington recognises the geostrategic importance of Kenya for it to increase its presence in the region.[122] This strong relationship is further confirmed by a research report, released by Pew Research Center, that tracks global attitudes and trends, which found that Kenya is the most pro-American state in Africa and among top 6 globally. More than 70% of Kenyans held a positive view of the U.S. and its leadership in 2018.[123] In terms of adversaries, Kenya has directed most of its military attention to Somalia over gas- and oil field disputes in its territorial waters and the threat from transnational terrorist groups like Al-Shabaab.

Uganda

Uganda's primary foreign policy objectives are to maintain friendly relations with countries in its immediate vicinity due to its landlocked state and import dependence. It is particularly reliant on the transportation infrastructure in Kenya and Tanzania for access to trade routes to the Indian ocean. Nevertheless, it has been involved in a series of regional escalations in recent years on its northern, western and southern border, with South Sudan, Congo and Rwanda respectively, over ethnic tensions.[124] In general, Uganda maintains good relations with the U.S. and has been a strong supporter and regional partner in the global War on Terror. In return, Uganda has received significant development, military and financial assistance. However, the relationship has also been defined by Washington's openly criticism of Uganda's human rights violations, particularly the 2014 Uganda Anti-Homosexuality Act, and its slow progression toward political pluralism.[125] To the East, China has grown to become its principal trading partner and the trade between the two has quadrupled to US$1 billion in less than ten years.[126]

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[122] Global Security, *Kenya – U.S. Relations, https://www.globalsecurity.org/military/world/kenya/forrel-us.htm* [accessed 7 July 2019]

[123] Pew Research Center, "Opinion of the United States: Do you have a favourable or unfavourable view of the U.S.?" *Global Attitudes Survey: Global Indicators Database* (2018), https://www.pewresearch.org/global/database/indicator/1 [accessed 7 July 2019]

[124] Peace Insight, *Uganda: Conflict Timeline*, https://www.peaceinsight.org/conflicts/uganda/conflict-profile/conflict-timeline/ [accessed 7 July 2019]

[125] Drazen Jorgic and Philippa Croome, "New Law Drives Uganda's Embattled Gays Deeper into Shadows," *Reuters* (March 9, 2014), https://www.reuters.com/article/us-uganda-gays/new-law-drives-ugandas-embattled-gays-deeper-into-shadows-idUSBREA2806420140309 [accessed 9 July 2019]

[126] The Observatory for Economic Complexity, *Uganda*, https://atlas.media.mit.edu/en/profile/country/uga/ [accessed 9 July 2019]

Moreover, Beijing has leveraged its non-interference policy to strengthen its influence in Uganda further. It has continued to increase its investments and support to Kampala, as more Western countries have halted their financial aid because of its discriminatory laws. Data from Afro Barometer also shows that public opinion on China is on the rise, particularly due to its direct foreign investments and export of cheap Chinese goods.[127]

Zambia

Zambia has been focused on supporting the liberation movement in Eastern Africa after it gained its independence in 1964 and has established friendly ties with most of its regional neighbours. It has made successful efforts in integrating with the global community and is currently a member of a large number of international organisations, including the UN, WTO, the African Union and the IAEA. Zambia has a good relationship with the U.S., but most of their interaction is related to the U.S. providing support in forms of foreign aid, anti-corruption efforts and medical relief. Zambia has not been actively involved in U.S. counter-terrorism operations in the region, but there has been some military cooperation related to the United Nations Mission in the Central African Republic, though this is considered to be minuscule.[128]

The relationship with China continues to grow and is overall more intertwined compared to the U.S., even though there have been tensions here as well over the poor working conditions and minimum wage Zambian citizens face under Chinese management. This resulted in violent riots in 2012 with fatal outcomes, causing major political tension between the two states.[129] Relations have since slowly stabilised, and China's investments in Zambia has increased its standing, and it currently enjoys high public confidence. There has been a rise in Chinese private security companies operating in Zambia, but military cooperation is less prominent, and most of the engagement is over trade, private direct investments and infrastructure developments under the Belt and Road.[130] Zambia also holds economic and cultural bilateral ties with Russia, but the latter has found itself in a competition with China for influence.

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[127] AfroBarometer, *Chinese Influence in Uganda: Positive or Negative,* http://afrobarometer.org/online-data-analysis/analyse-online [accessed 9 July 2019]
[128] U.S. Department of State, "U.S. Relations with Zambia: Bilateral Relations Fact Sheet," *Embassy of the United States to Lusaka, Zambia* (November 7, 2018), https://www.state.gov/u-s-relations-with-zambia/ [accessed 21 July 2019]
[129] Alexis Okeowo, "China, Zambia, and a Clash in a Coal Mine," *The New Yorker* (October 9, 2013), https://www.newyorker.com/business/currency/china-zambia-and-a-clash-in-a-coal-mine [accessed 21 July 2019]
[130] Global Security, *Zambia – China Relations,* https://www.globalsecurity.org/military/world/africa/zm-forrel-prc.htm [accessed 21 July 2019]

Tanzania

Equal to Zambia, Tanzania has been in the forefront of promoting peace, political unity and independence in the African Great Lakes region, giving it a solid reputation with its neighbouring states. Its integration in the international system has allowed it to strengthen its international recognition by actively contributing to peacekeeping missions and refugee aid. Tanzania's diplomatic relations with the U.S. was established during the Cold War and later framed by the latter's development policies to Africa. Following the bombing of the U.S. embassies in Dar es Salaam in 1998, Tanzania got involved in U.S. counter-terrorism operations in Eastern Africa and this collaboration has further cemented their relations.[131] However, its diplomatic ties with other Western countries have deteriorated in modern times over alleged human rights violations. Last year, President Magufuli proclaimed that the West was an unreliable partner and that he would instead turn to China, who set fewer conditions for various assistance.[132] Tanzania has a long-standing relationship with China that is characterised by infrastructure investments, trade and diplomatic interactions. Their relationship has been further strengthened by cooperation under the BRI and Beijing continues to expand its influence in Tanzania. Dodoma also enjoys close defence ties with China, most of all the countries in the region. It is actively engaged in military exchanges, naval exercises and military equipment procurements.[133]

Ethiopia

Ethiopia is situated in a relatively tense environment and has been frequently involved in escalations on its borders with Somalia and Eritrea, though the latter has improved significantly over the recent year. Its religious orientation has led it to seek closer ties with the West, whom it has managed to form strong bilateral relations with and depended on for its modernisation and trade. Ethiopia first became a focal point after the Suez Canal was opened and has continued to play an active role in regional and global politics, particularly in the Horn of Africa. This has increased its standing with the international community, and Addis Adaba hosts a range of international

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[131] William Claiborne, "Bombs Explode at 2 U.S. Embassies in Africa; Scores Dead," *The Washington Post* (August 8, 1998), https://www.washingtonpost.com/wp-srv/inatl/longterm/eafricabombing/stories/main080898.htm?noredirect=on [accessed 21 July 2019]

[132] Omar Mohammed, "Under Pressure from Western Donors, Tanzanian Leaders Prefers Chinese Aid," *Reuters* (November 27, 2018), https://www.reuters.com/article/us-tanzania-china-aid/under-pressure-from-western-donors-tanzanian-leader-prefers-chinese-aid-idUSKCN1NW1SB [accessed 22 July 2019]

[133] Global Security, *Tanzania – China Relations, https://www.globalsecurity.org/military/world/tanzania/forrel-prc.htm* [accessed 22 July 2019]

institutions, including the headquarters of the UNs Economic Commission for Africa (UNECA) and the African Union.[134] Ethiopia is a strategic partner for the United States, and the states cooperate in most sectors, including economic, military and politics. It has also been a significant contributor and allied in the Global War on Terror and holds geostrategic significance for U.S. national interests in the Middle-East.[135] However, also here have the relationship been strained in recent years over allegations of human rights violations and the U.S. has accused Addis Adaba of funnelling aid financing into anti-democratisation initiatives. Ethiopia's relationship with China has steadily increased over the years but is mostly restricted to the economic domain, mainly by foreign direct investments and trade agreements. Beijing is seen as an essential business partner, and Chinese finances have helped Addis Adeba increase its economic growth and export capacities. Cooperation in other areas is less prevalent, mainly due to the U.S. presence in the country.

Key Findings

The qualitative analysis confirms the findings from the COW Alliances and DCA datasets that there is an absence of formal military cooperation with the major powers in the region. Most assistance in this sector has taken place under the U.S. War on Terror and has then been based on Washington's terms. Moreover, there is a persistent trend that the countries in Eastern Africa prioritise strengthening regional cooperation over international relations. Countries maintain diplomatic relations with both the U.S. and China, even though the extent of the interactions varies between the individual states. The geopolitical developments in the region have led to an increased focus from the global powers, who have expanded their efforts to obtain strategic advantages. The increased attention has caused fluctuations in different areas of strategic cooperation, but there are no tendencies of hostile relations. No evidence supports a correlation between China's nuclear assistance and the alliance or common enemies' hypothesis.

[134] Global Security, *Ethiopian Foreign Relations,* https://www.globalsecurity.org/military/world/ethiopia/foreign-relations.htm [accessed 22 July 2019]
[135] James Jeffrey, "US-Ethiopia Relationship Changing Amid Horn of Africa Power Struggle," *Public Radio International* (November 9, 2018), https://www.pri.org/stories/2018-11-08/us-ethiopia-relationship-changing-amid-horn-africa-power-struggle [accessed 22 July 2019]

Economic Profits

Introduction

The theory that states that export nuclear technologies and materials for economic gains are commonly accepted, though, it is debated among experts how profitable nuclear assistance can be in terms of economic growth. Recent research on civilian nuclear cooperation has not found empirical evidence that supports this claim but notes that it cannot be excluded entirely.[136] China presents a unique case in the context of previous research on the topic, which has primarily examined the export markets of Western countries. First, it has ambitious plans for its domestic nuclear reactor fleet and is invested in expanding from 45 to 60 units by 2030, effectively increasing its nuclear power generating capacity to 90 – 160GWe.[137] China accounts for more than half of all new nuclear power investments and is expected to surpass the U.S. in nuclear power production sometime before 2030.[138] Second, the domestic nuclear market of a state is tightly coupled with its export market. China's expansion at home will provide it with the knowledge, streamlined capacity and qualified workforce to increase its nuclear exports abroad at significantly reduced costs. According to an analysis from the Massachusetts Institute of Technology, nuclear power plant new builds are up to three times less expensive in Asia due to differences in reactor designs and construction management, and cheaper and more effective supply lines and workforce.[139] Lastly, China seeks to export its indigenously designed pressurised water reactor, the Hualong 1. Recipient states will then be more dependent on China to assist in all phases of the nuclear cycle, effectively creating a monopoly and reducing the competition from other supplier nations.

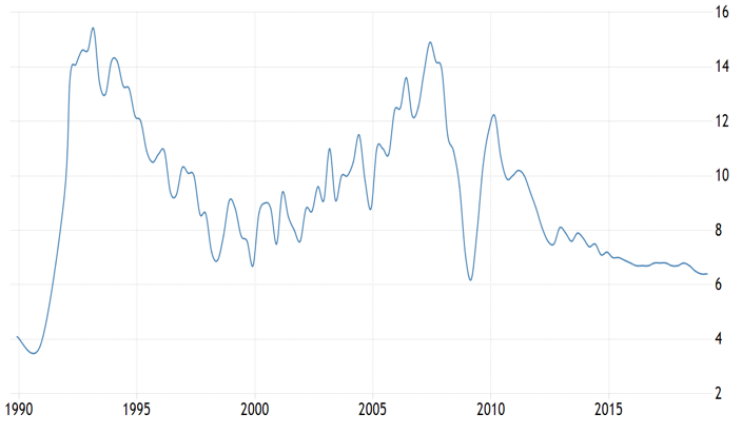


Table 1: China GDP Annual Growth Rate
Source: https://tradingeconomics.com/china/gdp-growth-annual

[136] See Kroenig, *Exporting the Bomb* (2010), p. 4; Fuhrmann, *Atomic Assistance: How Atoms for Peace Programs Cause Nuclear Insecurity* (2012), p. 45.
[137] World Nuclear Association, "Nuclear Power in China" *WNA Country Profiles (July 2019),* https://www.world-nuclear.org/information-library/country-profiles/countries-a-f/china-nuclear-power.aspx [accessed 10 July 2019]
[138] Mark Hibbs, *The Future of Nuclear Power in China* (Washington, D.C.: Carnegie Endowment for International Peace, 2018), p. 4.
[139] MIT Energy Initiative, *The Future of Nuclear Energy in a Carbon-Constrained World* (Boston: MIT Press, 2018), pp. 38-42, https://energy.mit.edu/research/future-nuclear-energy-carbon-constrained-world/ [accessed 21 June 2019]

China's grand strategy is centred around three interrelated objectives; to preserve domestic order, protect against external threats to its sovereignty and territory, and attain geopolitical influence in the international order.[140] It has been able to pursue these goals at a rapid pace due to its unprecedented economic growth over the past two decades, which has allowed it to modernise the People's Liberation Army (PLA), progress industrialisation, and invest in key development areas. However, its annual GDP growth rate has stagnated in recent years over a shrinking working-age population, higher average wages and a more balanced economy.[141] To tackle these challenges, China could seek to leverage its nuclear momentum and export its domestic nuclear reactor design on a large-scale to re-establish its economic power. According to Wang Shoujun, a standing committee member of China's People's Political Consultative Conference, nuclear exports have already been adopted as a state strategy and will help optimise export trade and consequently free up domestic high-end manufacturing capacities. He further predicted that China could build up to 30 reactors under the Belt and Road over the next decade, which could create up to five million new jobs in the sector and earn Chinese companies up to US$145 billion. [142]

Independent Economic Variables

Measuring China's estimated economic profits from nuclear assistance to foreign countries presents a challenge. There exists no hard data or agreements available that shows how much its nuclear industry could yield or how this would affect its GDP, and the historical evidence is scant. Most of the tangible evidence that outlines China's nuclear aspirations only exists in the form of signed NCAs and public announcements. This indicates, due to the long implementation time for nuclear new builds and the return of investment, that there will not be any quantitative data available any time soon. By using data from the World Bank, it was possible to create a dataset containing a series of independent economic variables for each unit of analysis. This dataset made it possible to identify if there is a relationship between nuclear assistance and economic profits by examining economic trends and correlations in Eastern Africa. The

[140] Michael D. Swaine and Ashley J. Tellis, *Interpreting China's Grand Strategy: Past, Present and Future* (California: RAND Corporation, 2000), p. x.
[141] Christopher Balding, "What's Causing China's Economic Slowdown?" *Foreign Affairs* (March 11, 2019), https://www.foreignaffairs.com/articles/china/2019-03-11/whats-causing-chinas-economic-slowdown [accessed 10 July 2019]
[142] David Stanway, "China Could Build 30 'Belt and Road' Nuclear Reactors by 2030: Official," *Reuters* (June 20, 2019), https://www.reuters.com/article/us-china-nuclearpower/china-could-build-30-belt-and-road-nuclear-reactors-by-2030-official-idUSKCN1TL0HZ [accessed 10 July 2019]

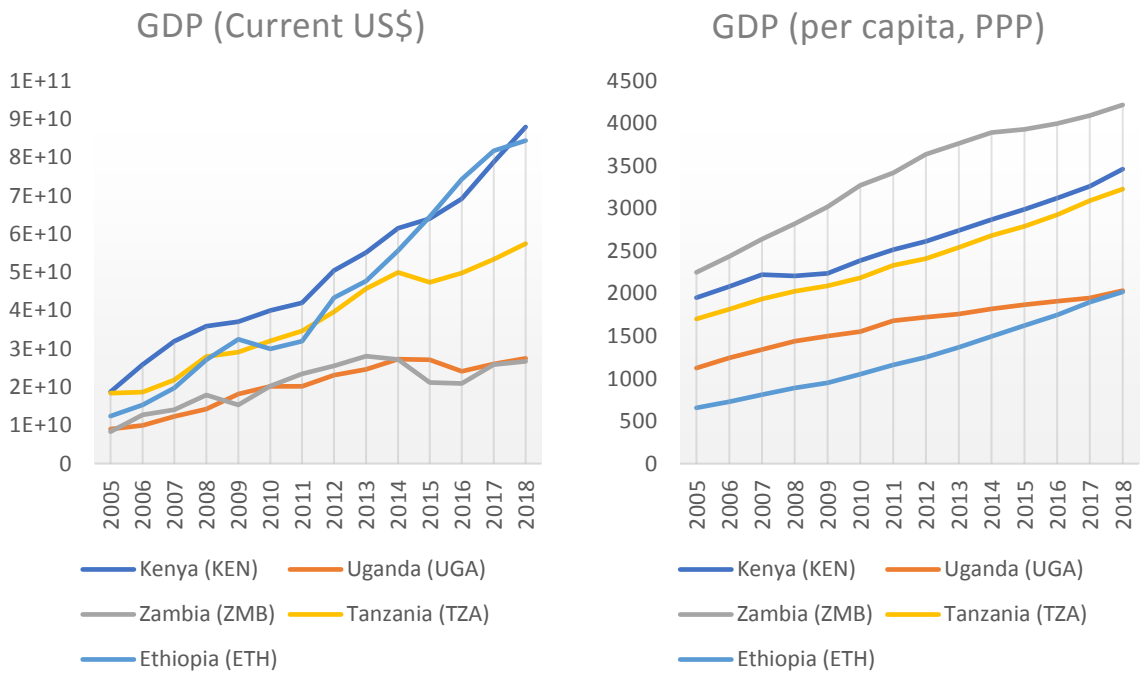
independent variables examined were exports (current US$; percentage of GDP), imports (current US$; percentage of GDP), Gross Domestic Product (annual percentage growth; per capita current US$; per capita annual percentage growth; purchasing power parity current international $), and Gross National Income (annual percentage growth; per capita current US$; per capita annual percentage growth; purchasing power parity current international $).

The first independent variable is the gross domestic product (GDP). GDP is the most common indicator used to measure the health of a states' economy and includes a series of factors such as investments, consumption, consumer and government spending, imports and exports. Increased GDP often entails lower unemployment rates, higher wages, more profit for businesses and increased purchasing power.[143] The dataset focuses on GDP in current US$ and GDP per capita purchasing power parity (PPP). GDP per capita PPP is the domestic product of a state converted to international dollars and then divided by the total number of citizens. The second variable is the gross national income (GNI). While GDP measures production exclusively within a states' borders, GNI is a measurement of its income and includes all sources earned by residents and businesses, including those abroad. GNI is included as both current US$ and per capita PPP. The final variable shows the total import and export per unit of analysis measured in percentage of GDP.

[143] Kimberly Adams, "What GDP Tells us About the Economy," *Marketplace* (July 26, 2018), https://www.marketplace.org/2018/07/26/what-gdp-tells-us-about-economy/ [accessed 12 July 2019]

Kenya

The economic growth in Eastern Africa overall has been significantly higher in recent decades compared to other regions on the continent, at almost 7 per cent in 2018. This growth has been supported by the implementation of economic, social and political reforms and increased export revenues. However, the development has occurred disparate between the countries in the region. Kenya maintains a liberalised external trade system and is often described as the economic powerhouse of Africa. It has adopted a series of investment-friendly reforms to attract foreign and local investors and currently ranks as 61st on the World Banks Ease of Doing Business Index.[144] Kenya has traditionally relied on industries such as agriculture, tourism and manufacturing for its growth but the government has pushed to diversify its economy and started exporting its first crude oil in 2018.[145] Nairobi has continued to invest in its telecommunications, transport and construction sectors, which are all supported by a large pool of qualified workers, and is expected to maintain its economic growth in the coming years.



[144] The World Bank, "Rankings and Ease of Doing Business Score: Kenya," *Ease of Doing Business Index* (2019), https://www.doingbusiness.org/en/rankings [accessed 12 July 2019]

[145] Tsvetana Paraskova, "Kenya Starts Its First-Ever Crude Oil Exports," *OilPrice.com* (June 4, 2018), https://oilprice.com/Latest-Energy-News/World-News/Kenya-Starts-Its-First-Ever-Crude-Oil-Exports.html# [accessed 12 July 2019]

Uganda

Uganda has experienced slower annual growth compared to other countries in the region. Poor economic management, institutionalised corruption and chronic political instability have left it among the poorest and least-developed nations in the world.[146] However, its economic prospects are considered to be healthy. Uganda holds significant natural resources and ample fertile land and has seen an increase in foreign direct investments as it is preparing to start its oil production. Traditionally dependent on industries such cement and steel, in addition to rain-fed agriculture like sugar, tobacco and cotton, Kampala has also made progress in diversifying its economy, mainly in the information and communications technology sector.[147]

Zambia

Zambia is the second-largest copper producer on the continent and has significantly benefitted from the steady increase in copper prices since 2001. It gained middle-income status in 2011 and continues to be one of the fastest-growing economies in Africa, with average GDP growth of 6.7% per annum. However, it lacks economic diversification, which makes it vulnerable to market fluctuations. Moreover, Zambia has some of the highest levels of inequality globally, and only a small fraction of it urban population has benefitted from its economic growth. It struggles with high unemployment rates, extreme poverty, and market-distorting energy and agriculture policies, in addition to growing government debts.[148] The government outlined in its 7th National Development Plan, 2017 – 2021, that its main focus is to pursue economic diversification and resiliency for sustained growth and socio-economic development.[149]

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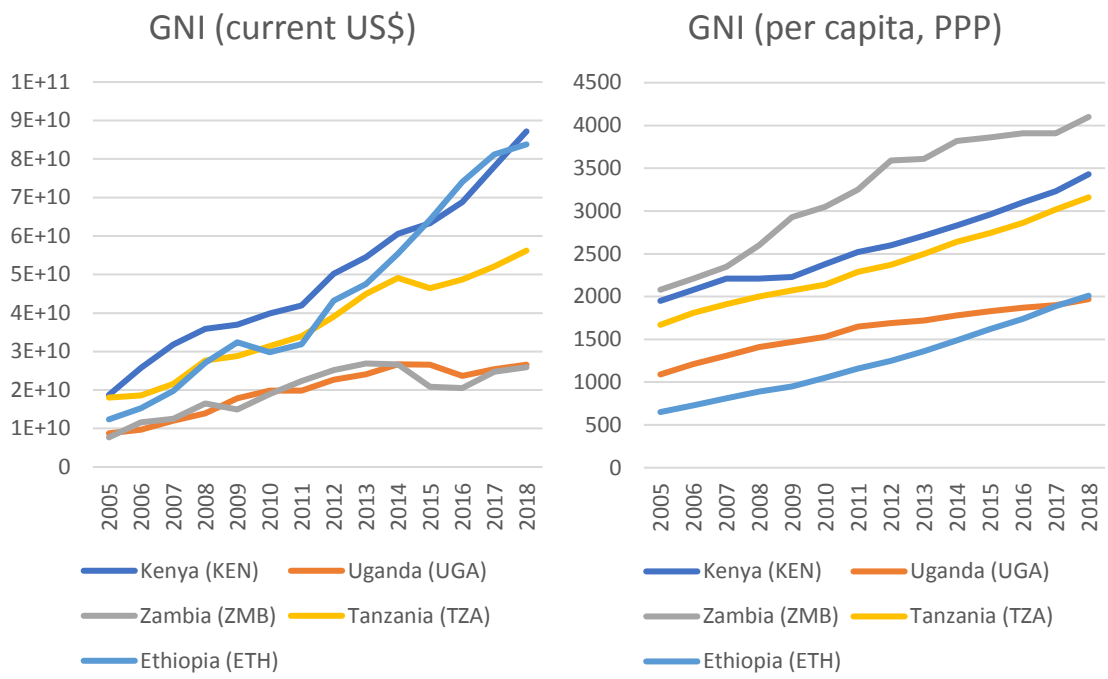
[146] The World Bank, "The World Bank in Uganda," *Country Profiles* (2019), https://www.worldbank.org/en/country/uganda/overview#1 [accessed 12 July 2019)

[147] *IBID.*

[148] Central Intelligence Agency, "Zambia," *The World Factbook* (2019), https://www.cia.gov/library/publications/the-world-factbook/geos/za.html [accessed 12 July 2019]

[149] Embassy of Zambia, *Seventh National Development Plan 2017 – 2021* (2017), http://www.zambiaembassy.org/document/seventh-national-development-plan-2017-2021 [accessed 12 July 2019]



Tanzania

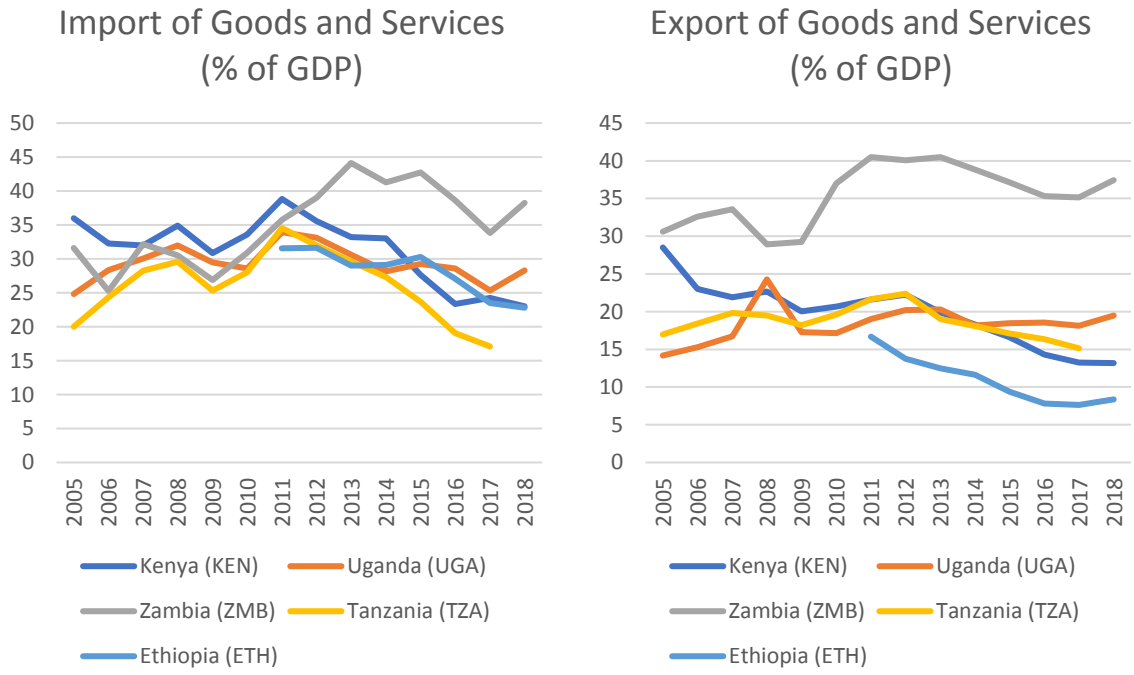
Tanzania has sustained a high economic growth rate over the last ten years, averaging 6-7% per annum, and is the tenth-largest economy in Africa. It is highly dependent on agriculture, accounting for a quarter of its GDP and employs over 60% of its workforce, but has diversified through tourism and mineral exports, particularly gold and diamonds. It has continued to rehabilitate its ageing infrastructure to maintain reliable trade links for inland countries and managed to increase private-sector growth and investments through banking reforms. Compared to other countries in the region, Tanzania has strong trade ties with countries outside the continent, where India, China and the U.S. remains its main import and export partners.[150]

Ethiopia

Ethiopia is the second-most populous state in Africa and has one of the fastest-growing economies in the world. It is categorised a transition economy and is working to privatise state-owned assets and implement structural transformations to develop market-based institutions. Until 2017, Ethiopia had seen a decade with broad-based economic growth with an average annual increase of 10.3 per cent. Construction and services account for most of its growth, and the government has expressed intent to

[150] Central Intelligence Agency, "Tanzania," *The World Factbook* (2019), https://www.cia.gov/library/publications/the-world-factbook/geos/tz.html [accessed 12 July 2019]

achieve lower-middle-income status by 2025.[151] Concerning trade partners, Ethiopia maintains strong ties with the Western countries and its main export partners include Switzerland, the Netherlands, Germany and the Netherland. However, Ethiopia remains one of the poorest countries in the world with a per capita income of US$750. Its main challenges are to sustain economic growth and reduce poverty, both of which depend on job creation and improved governance. About 50% of the Ethiopian population is under the age of 18 and estimates suggest that hundreds of thousands of jobs need to be created yearly to keep up with the population growth.[152] It also struggles with limited competitiveness, an underdeveloped private sector, and political disruption.



Key findings

The economic data shows that the region has seen significant economic development and continues to grow. It does not offer any conclusive evidence that explains why China provides nuclear assistance to only some of the countries in Eastern Africa but does present two new dimensions. First, all units of analysis are either seeking or have managed to diversify their economies, and the regional economic prospects are positive. This indicates that the purchasing power of the state and the population is set to increase, in some cases even rapidly, creating new emerging markets. New markets can be

[151] The World Bank, "The World Bank in Ethiopia," *Country Profile* (2019), https://www.worldbank.org/en/country/ethiopia/overview [accessed 12 July 2019]
[152] The Economist, "A Brittle Western Ally in the Horn of Africa," *Briefing* (November 1, 2017), http://www.economist.com/node/10062658 [accessed 12 July 2019]

leveraged for high economic profits as the import demands will rise, particularly for commodities, and China could use nuclear assistance to cement its position as the regions primary trading partner. Second, qualitative examinations of each states' economy also show that many of these hold significant natural resources. Access to resources like metals, arable land and hydrocarbons are becoming increasingly competitive and are essential for states to develop. China could provide states with nuclear power to secure exclusive rights to extract these resources for its rise.

Equal Political Systems

Introduction

The Economist Intelligence Unit's 2018 Democracy Index was used to examine the political systems of the units of analysis. The index tracks the development of democratic processes in 165 independent states and offers a snapshot of the state of each nations' political system. Each state is then ranked on a scale from 0 to 10, based on the rating for 60 indicators, grouped into five categories: electoral process and pluralism; civil liberties; the functioning of government; political participation; and political culture.[153] The total score is then used to determine the regime type of the state. Countries with a score of eight or higher are considered full democracies. These states have functioning governments and maintain high-levels of political freedoms and civil liberties. Besides, the media is independent and diverse, there are effective systems of checks and balances, and the judiciary is independent. Countries with scores equal to or less than eight but greater than six are considered flawed democracies. Here, elections are held free and fair, though issues like media freedom infringements can occur, and fundamental civil liberties are respected. These democracies are, however, less stable regarding political cultures and governance, and political participation is generally lower.

Next, states that score equal to or less than six but greater than four are categorised as hybrid regimes. These states are often prevented from holding free and fair elections due to substantial irregularities and government pressure against opposition parties are common. Political cultures, governance and political participation, is weaker than in flawed democracies, corruption widespread, and the rule of law is weak. Countries in this category often struggle with media censorship, and the judiciary is not independent. Lastly, states with a score equal to or lower than four are deemed authoritarian regimes. Many of these countries are considered dictatorships, where political pluralism is absent and democratic institutions have little to no impact. Infringements on civil liberties are common, there is no independent judiciary, and the media is typically state-owned or controlled by government-affiliated groups.[154]

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[153] The Economist Intelligence Unit, "Democracy Index 2018: Me too? Political participation, protest and democracy," *Report* (2018), p. 48, http://www.eiu.com/Handlers/WhitepaperHandler.ashx?fi=Democracy_Index_2018.pdf&mode=wp&campaignid=Democracy2018 [accessed 6 July 2019]

[154] The Economist Intelligence Unit, "Democracy Index 2018: Me too? Political participation, protest and democracy," *Report* (2018), p. 49,

Kenya

According to Freedom House, East Africa has continued to see a downward spiraling trend regarding democratic processes and institutions in recent years.[155] Kenya has often been considered one of the most stable countries in Africa and has traditionally maintained strong bilateral ties with Western democratic governments. It began its transition into a democracy in 1963, after it adopted a republican form of government and introduced a presidential system. It remained a single-party state until the early 1990s when it held its first multi-party election. In 2010, the government reversed the democratic process by passing a new constitution that consolidated the President's power in the executive branch, adopting a presidential representative democratic system of governance. It allowed the President to control the state, government and executive branch, sharply limiting the powers and influence of the opposition. Kenya is effectively a unitary state, governed by a single power, but it does hold democratic elections every five years. However, the high stakes, where the winner takes everything, often leads to periods of political unrest and violent outbursts.[156]

Uganda and Zambia

Uganda maintains a similar unitary republic system to that of Kenya, where the President is both the head of state and government and controls the executive branch. It too holds democratic elections every five years and allows multi-party participation, but the opposition is allowed little to no power outside of this.[157] Zambia has a near-identical government structure, but is often ranked higher than Kenya and Uganda on democratic indexes, and is often found among the top 10 democracies in Africa. It maintains a more inclusive political environment and the transfer of power between the executive, legislative and juridical branch is more fluent than the others.[158]

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http://www.eiu.com/Handlers/WhitepaperHandler.ashx?fi=Democracy_Index_2018.pdf&mode=wp&campaignid=Democracy2018 [accessed 6 July 2019]

[155] Freedom House, "Freedom in the World 2019: Democracy in Retreat," *Report* (2019), p. 7, https://freedomhouse.org/sites/default/files/Feb2019_FH_FITW_2019_Report_ForWeb-compressed.pdf [accessed 6 July 2019]

[156] Stephanie Hanson, "Understanding Kenya's Politics," *Council on Foreign Relations* (January 2008), https://www.cfr.org/backgrounder/understanding-kenyas-politics [accessed 6 July 2019]

[157] BBC, *Uganda Country Profile* (10 May 2018), https://www.bbc.com/news/world-africa-14107906 [accessed 6 July 2019]

[158] Freedom House, "Zambia Prolife," *Freedom in the World 2018 Report* (2018), https://freedomhouse.org/report/freedom-world/2018/zambia [accessed 6 July 2019]

Tanzania and Ethiopia

The political system of Tanzania also takes place in the framework of a unitary presidential democratic republic, similar to Kenya, Uganda and Zambia. It commonly scores somewhat higher on the electoral process and pluralism index, meaning it holds more free and fair elections, and its judicial branch is considered to be independent of the legislative and executive.[159] Last, Ethiopia is the only unit of analysis that maintains a different political system. It is structured as a federal parliamentary republic but is de facto an authoritarian regime controlled by the Ethiopian People's Revolutionary Democratic Front. The government currently holds all seats in parliament and tightly manage parliamentary elections. It has also demonstrated its willingness to repress both the opposition and media on numerous occasions.[160]

Key findings

Analysing the data of the different political systems in Eastern Africa shows that all the units of analysis, except Ethiopia, are categorised as hybrid regimes. This indicates that none of the countries has established strong democratic institutions or processes, though all have adopted certain democratic features. These range from electoral processes and pluralism, to political participation and culture. Nevertheless, the overall score remains relatively low and in the same bracket, which can be explained by similar political systems. Ethiopia presents the only outlier case in the dataset, with an authoritarian government closer related to the CCP model. These findings could suggest that Beijing seeks to strengthen its influence in hybrid and non-democratic regimes to undermine democratic institutions and reduce the Western influence in the region. The lack of nuclear assistance in Ethiopia would support this and could be explained based on similar political systems. However, the data does not provide any conclusive evidence for this theory. Tanzania is also a hybrid regime but has not signed any NCAs with China; neither does it plan to install nuclear power plants at this time.

Democracy Index 2018	Kenya	Uganda	Zambia	Tanzania	Ethiopia
Overall score	5,11	5,2	5,61	5,41	3,35
Global rank	98=	96	86	91=	128=
Regional rank	17	16	10	12=	29=
Electoral process and pluralism	3,5	5,25	6,17	7	0
Functioning of government	5,36	3,57	4,64	5	3,57
Political participation	6,67	4,44	3,89	5	5,56
Political culture	5,63	6,88	6,88	5,63	5
Civil liberties	4,41	5,88	6,47	4,41	2,65
Regime type	Hybrid regime	Hybrid regime	Hybrid regime	Hybrid regime	Authoritarian

[159] World Atlas, *What Types of Government Does Tanzania Have?* https://www.worldatlas.com/articles/what-type-of-government-does-tanzania-have.html *[accessed 6 July 2019]*

[160] Freedom House, "Ethiopia Prolife," *Freedom in the World 2018 Report* (2018), https://freedomhouse.org/report/freedom-world/2018/ethiopia [accessed 6 July 2019]

Energy

Introduction

Energy is central to all human endeavours and closely related to a nation's growth and prosperity. Every industrialised state depends on reliable and affordable access to energy to maintain its industrial output, a minimum living standard and to protect against adversaries. In developing countries, the need for energy is more fundamental and imperative to alleviate poverty, improve trade and expand its industrial sectors and infrastructure. In Eastern Africa, the energy sector, despite its potential, remains underdeveloped and the region is characterised by low per capita energy consumption, reliance on biomass and low connection rates to the national grid.[161]

Nuclear power offers a safe, reliable and affordable source of energy and is often perceived to be a valuable investment and a solution for developing countries to achieve mid-income status. In Africa and Asia, this has opened up a new market for nuclear exports, one that China could seek to utilise to increase its market share. However, the prioritisation of Beijing's nuclear exports is not likely to be arbitrary but based on a coherent strategy that promotes its interests in the region. First, the lack of access to energy in Eastern Africa creates a predicament for Chinese developments under the BRI, as the majority of the projects are related to transport, telecommunications or energy, all requiring a reliable source of power to operate. Further constraints on already out-dated and underdeveloped electricity grids could entail sub-optimal operations of additional infrastructure or, worst case, lead to a complete system breakdown. Beijing depends on this project to be successful for its global objectives and could provide nuclear assistance to increase a states' installed electricity capacity and energy resilience, allowing it to accommodate for large-scale projects under the Initiative.

Next, the region holds a significant portion of the worlds emerging market economies. The definition is used to describe nations that are in the progress of becoming a more advanced economy, through rapid industrialisation and growth. For developing nations, this entails stronger purchasing power, rising need for investments and increased exports of goods, and this can provide a high return of investments for potential

[161] United Nations Economic Commission for Africa, "Energy Access and Security in Eastern Africa: Status and Enhancement Pathways," *Development Report* (Ethiopia: ECA Documents Publishing and Distribution, 2014), https://www.uneca.org/sites/default/files/PublicationFiles/energy_access_and_security_in_ea_eng_fin_lowres_27dec2013.pdf [accessed 20 July 2019]

investors. For many economies, access to electricity remains a constraint. China could seek to strengthen a nations' energy sector to incentivise further economic growth and the transition into an emerging economy. In reality, this would create new markets for Beijing to export its excess industrial capacity, goods and services, and strengthen its economic growth. It would also allow it to be in front of the line and assert itself as a major trading partner, creating stronger relationships with the targeted countries. This hypothesis draws from the economic and strategic assessments outlined and can be explored by examining energy data for all units of analysis.

To assess if there is a correlation between the energy profile of countries and nuclear assistance, data gathered from the World Bank is used to analyse both the current state and developments in the energy sector for each unit of analysis. The dataset includes generating capacity, the primary source of fuel, import dependency, access to electricity and predicted growth.

Kenya

Kenya has seen steady economic growth in recent years and has continued to implement political, structural and economic reforms to increase its attractiveness to global investors. It is in the process of achieving mid-income and emerging market status but could be restricted by its underdeveloped energy sector. In a regional context, Kenya has one of the most developed energy grids and is mostly self-sufficient with current effective production capacity at 2,651 MW and peak demands at just over 1,800 MW.[162] It has made progress to transition to renewable sources to reduce its carbon emissions but also its import dependence. More than 80% of its fuel sources comes from geothermal, hydro- and wind power, followed by hydrocarbons, predominantly gas and oil, accounting for about 18%. It has traditionally depended on Saudi Arabia for its oil imports, but recent discoveries of oil reserves have reduced this and also provided Kenya with a role as a regional oil exporter.

[162] Neville Otuki, "Electricity Demands Crosses 1,800 MW Mark," *Africa Business Daily* (July 3, 2018), https://www.businessdailyafrica.com/economy/Electricity-demand--crosses-1-800MW-mark/3946234-4645308-ur8eup/index.html [accessed 22 July 2019]

In a regional perceptive, Kenya has a high connectivity rate with more than 63,8% of the population connected to the national grid, with an expected rise to 80% by 2020.[163] Though a positive development, it also constitutes problems. In addition to a growing population, Nairobi is experiencing the effects of rapid urbanisation and industrialisation, and a rising middle class with stronger purchasing power. In a country that already struggles with frequent blackouts, the expectations of reliable energy supply will rise in line with the energy demand. Kenya also struggles with aging infrastructure and its power grid is not optimised to handle a doubling of its current generating capacity. These problems are interesting seen in the light of Kenya's expressed intent to source out all hydrocarbons by 2020.[164]

Its investments in renewable sources is a move to cure for power deficit by implementing off-grid solutions, providing the population energy utilising wind and solar. Looking at the current infrastructure developments in Kenya, particularly in the energy and transportation sector, this presents a problem. These projects are going to put additional strain on the existing grid, but with the government focused on off-grid solutions, it could mean that the grid will not be expanded fast enough to accommodate this. Considering Kenya's geostrategic importance in China's development projects suggests that the lack of energy could become a major bottleneck that could both slow regional developments under the New Silk Road but also Kenya's domestic economic growth.

Uganda

Uganda has also been upgraded to an emerging market by the International Monetary Foundation (IMF). It has seen a significantly weaker economic growth compared to Kenya but holds a greater potential due to its abundant natural resources, and it is expected that foreign investments in the country are only going to rise.[165] However, Uganda is one of the least developed nations in the world, and it requires significant investments, particularly in its energy sector, to accommodate for its expected growth.

[163] Power Africa, "Development of Kenya's Power Sector 2015 – 2020," *US Aid* (2015), https://www.usaid.gov/sites/default/files/documents/1860/Kenya_Power_Sector_report.pdf [accessed 22 July 2019]
[164] Johnny Wood, "Kenya is Aiming to be Powered Entirely by Green Energy by 2020," *World Economic Forum* (December 5, 2018), https://www.weforum.org/agenda/2018/12/kenya-wants-to-run-entirely-on-green-energy-by-2020/ [accessed 22 July 2019]
[165] Africa Business Pages, "The Emerging Markets of Africa," https://www.africa-business.com/features/africa-emerging-business.html [accessed 22 July 2019]

The biggest challenge is that 90% of its total primary energy consumption is generated by biomass, mainly firewood and charcoal. Its installed generating capacity is 1,167 MW, and electricity only accounts for 1.4% of the national energy balance.[166] Energy is tightly coupled with financial and social developments, and Uganda does not have the generating capacity, neither the infrastructure, to accommodate the on-going developments. It has made efforts to become energy self-sufficient and has been successful in its investments in hydropower but remains highly dependent on oil imports from the United Arab Emirates and Saudi Arabia, making it vulnerable to price fluctuations.[167] Furthermore, Uganda has below-average electricity connectivity with only 15% being connected to the national grid, and it also has one of the lowest per capita electricity consumptions in the world with 215 kWh per capita.[168]

For Kampala, energy developments are seen as a priority and recognised a major barrier to achieve mid-income status and increase its foreign trade exports. Its economic potential lies in its natural resources, but the mining industry is highly energy-intensive. This constitutes that it will require significant grid upgrades into rural regions that are not yet connected to maintain operations. Uganda has recently discovered significant oil reserves and the planned improvements in its oil sector, including the construction of an oil refinery, comes on top of this.[169] Furthermore, it is expected that Uganda will see a rapidly increasing energy demand in the coming years due to investments, population growth and industrialisation. Uganda has completed much of the necessary transportation corridors needed to scale up its export market and is connected to sea lanes by railroad through Tanzania. Nevertheless, even with an improved grid, Uganda struggles to meet its rising energy demands and is working on expanding its hydropower sector. It has also, similar to Kenya, expressed intent to explore renewable off-grid solutions, also for its mining and hydrocarbon industries. This would have implications

[166] Ministry of Energy and Development, "Uganda's Sustainable Energy for All Initiative – Action Agenda," *Government of Uganda Development Report* (June 2015), https://www.seforall.org/sites/default/files/Uganda_AA_EN_Released.pdf [accessed 22 July 2019]
[167] The Observatory for Economic Complexity, "Where Does Uganda Import Refined Petroleum From?" *OEC Country Profile* (2017), https://oec.world/en/visualize/tree_map/hs92/import/uga/show/2710/2017/ [accessed 22 July 2019]
[168] *IBID*.
[169] Export.gov, "Uganda – Oil and Gas," *Uganda Country Commercial Guide* (July 2019), https://www.export.gov/article?id=Uganda-Oil-and-Gas [accessed 23 July 2019]

for larger, more energy-intensive projects as it does not provide a reliable baseload or stable access required.[170]

Zambia

Zambia has substantial economic potential, holding 6% of global copper reserves in addition to other attractive resources like zinc, lead, cobalt and uranium. However, it struggles with some of the same challenges as Uganda to utilise its potential. Zambia depends on biomass for more than 80% of its total primary energy consumption and public access to the electricity grid is only around 30%. Its total installed electricity capacity is around 2800 MW, of which 85% is generated from hydropower, and the remaining 15% comes from fossil fuels.[171] Though Zambia relies on imports for part of its fossil fuel consumption, mainly petroleum products, it has been successful in ramping up its domestic power industry. The African Development Bank has reported that Zambia has managed to become self-sufficient in terms of energy generating capacity by aggressively investing and developing its hydro- and solar power industries. Its progressive developments allowed it to stop all electricity imports from its neighbour states in 2018, and the government is now planning for an energy surplus that will make it more resilient regarding expected increases in energy demands.[172]

Tanzania

Tanzania has been defined as an emerging market for almost two decades and has continued to experience high economic growth in recent years, with an average annual rate of 6-7%. Its energy sector is, however, underdeveloped and continues to be a bottleneck for further economic growth, attracting foreign direct investments, and expanding its trade ties regionally and globally. Similar to other countries in the region, Tanzania relies on biomass for 90% of its primary energy consumption and only 10-15% of the population is connected to the national grid. Its installed generating capacity is at 1,1513 MW, most of which comes from domestic hydroelectric sources, followed

[170] Ministry of Energy and Development, "Uganda's Sustainable Energy for All Initiative – Action Agenda," *Government of Uganda Development Report* (June 2015), https://www.seforall.org/sites/default/files/Uganda_AA_EN_Released.pdf [accessed 22 July 2019]
[171] USAID, "Zambia: Power Africa Fact Sheet," *Power Africa Initiative* (November 20, 2018), https://www.usaid.gov/powerafrica/zambia [accessed 23 July 2019]
[172] African Development Bank Group, "Zambia On Track to Energy Surplus Following Major Boost in Electricity Production," (February 5, 2019), https://www.afdb.org/en/news-and-events/zambia-on-track-to-energy-surplus-following-major-boost-in-electricity-production-18969 [accessed 22 July 2019]

by thermal and liquid fuels.[173] It depends on India, the United Arab Emirates and Saudi Arabia for the imports of the two latter ones.[174] The biggest challenge for Tanzania is that it has not been able to develop its energy industries in line with rapid population growth. Its total production capacity and the ageing grid is not optimised to accommodate for the continuing investments made in the country.

Many of these are large-scale, energy-intensive projects pushed by international organisations or foreign states, including ports, railways, telecommunications infrastructure and energy pipeline, and will require massive upgrades in the years to come. Currently, it is estimated that the power demand growth in Tanzania will be between 10-15% annually, and the government has started adopting a series of reforms to encourage investments further. It has expressed a vision to increase both connectivity to 50% by 2025 and power generation capacity to at least 5000 MW by next year.[175] Looking at this in the context of current affairs and the role Tanzania has for regional developments and its strategic significance for Beijing, it is evident that there is an urgent need for improvements in all chains of its energy industry. Tanzania is not dimensioned to accommodate for these developments, and this could have broader consequences in the grand scheme of things putting an effective halt to the process of continental integration.

Ethiopia

The World Bank group labelled Ethiopia, an emerging market in 2017, and it is the second-fastest-growing economy globally calculated by the annual percentage change in GDP. Its international integration and regional significance suggest that it will continue its socio-economic progress. Much of this is due to both domestic and foreign investments in strategic sectors like transportation, agriculture and mining.[176] Ethiopia follows the broader regional trend with a heavy dependence on biomass for its primary energy consumption and low grid access, with only 27% of the population connected.

[173] Export.gov, "Tanzania Energy," *Tanzania Country Commercial Guide* (January 29, 2019), https://www.export.gov/article?id=Tanzania-Energy [accessed 23 July 2019]
[174] OEC, "Where Does Tanzania Import Refined Petroleum from?" *Global Country Profile,* *https://oec.world/en/visualize/tree_map/hs92/import/tza/show/2710/2017/* [accessed 23 July 2019]
[175] Export.gov, "Tanzania Energy," *Tanzania Country Commercial Guide* (January 29, 2019), https://www.export.gov/article?id=Tanzania-Energy [accessed 23 July 2019]
[176] Commonwealth, "Ethiopia's Emerging Market," https://commonwealthfunds.com/news-insights/ethiopias-emerging-market/ [accessed 23 July 2019]

However, it has abundant renewable resources readily available, including hydropower, wind, solar and geothermal sources, though little of this has been exploited yet.

Nevertheless, it is close to being entirely self-sufficient for its energy consumption. Ethiopia faces a series of challenges related to its large population of over 100 million people, rapid population growth and industrialisation. Most prominent is that the energy demands are forecasted to grow by approximately 30% annually, in a nation that is already struggling with severe energy poverty.[177] The government launched its Growth and Transformation Plan in 2010 to transform Ethiopia into a middle-income by 2025. The plan consists of three 5-year phases and intends to increase its total generation capacity to 10,000 MW up from 4,500. Its installed capacity derives mainly from hydropower, which accounts for 90% of the total, followed by 8% and 2% from wind and thermal respectively.[178]

Key Findings

Looking at the energy situation for all the units of analysis, there are some common traits present. Most of the countries are experiencing high levels of energy poverty, low grid connectivity rates, and increasing demands for energy. On the other side, there is a generally low import dependence, a high share of renewable energy sources and a strong focus on improving the electricity production capacity. All states are also perceived to be emerging markets but under different criteria and are expected to see increased economic growth in the coming years. Off-grid solutions have attracted attention as a viable solution to solve less energy-intensive needs, but there is a concern about grid capacity and large-scale projects coming online. The correlation between emerging markets and energy poverty is exciting, but there are no apparent correlations that explain why only Kenya, Uganda and Zambia has signed NCAs with China.

[177] Export.gov, "Ethiopia – Energy," *Ethiopia Country Commercial Guide* (May 11, 2018), https://www.export.gov/article?id=Ethiopia-Energy [accessed 23 July 2019]
[178] *IBID.*

Belt and Road Initiative

Introduction

The African continent was initially not included in the BRI but has grown to become a priority for Beijing. It contains a vast number of sovereign nations, is abundant in natural resources and holds geostrategic significance for China to achieve its global aspirations. Besides, many of the nations do not have deep-rooted democratic systems or stable political institutions, making them susceptible to foreign pressure and influence. Eastern Africa, in particular, plays a prominent role in China's grand strategy, as it connects Asia with the continent by the Maritime Silk Road and offers a transit hub for maritime traffic to and from Europe. The region has seen billions of dollars in infrastructure investments and offers the most tangible evidence of the transformative powers of the new Silk Road.

The Initiative has, in many ways, become Beijing's most important geopolitical tool to manifest its plans and build soft power. However, in recent year, it has experienced an increasing number of challenges related to its infrastructure developments, some which threaten the project's overall success. Firstly, China depends on political and public support both at home and abroad to complete its transregional trade corridors. If countries become resistant to its efforts, they might opt-out, which could trigger a domino-effect, consequently disallowing Beijing to pursue its grand strategy. Since nuclear power is a useful tool of statecraft, it could be leveraged by China along the Silk Belt corridors to cement its influence and establish the framework needed to maintain positive sentiments among the recipients. Secondly, the scale of the BRI dictates that the strategic significance differs substantially between the states involved. Those countries serving as hubs or where the security environment is fragile is likely to see more substantial investments than those of lesser strategic value. China could offer nuclear assistance to countries that are of high strategic importance to strengthen its influence and the bilateral relationship between the two countries.

To assess if Beijing utilises nuclear assistance for these purposes, the degree of involvement was first analysed for each unit of analysis using the MERICS database. This also allowed an understanding of how significant each project, and also state, was in more holistic terms. Next, the public perceptions of Chinese developments were mapped for each nation using a big data analysis of media articles conducted by

Bruegel, a Brussels-based economic think tank. The analysis is based on the Global Database of Events, Language, and Tone (GDELT), an open-access platform that covers TV, print and online media in over 100 languages across 132 countries. This analysis was used to produce a quantitative dataset that measured the media sentiment in all countries, where it was possible, involved in the New Silk Road.

Kenya

Kenya is recognised for its stable political, economic and security environment, and laid-back foreign investment regulations. These characteristics are highly valued by Beijing, who sees the country as an entrance port to the continent. It has become a significant strategic partner for China and Kenya is actively involved in a series of prominent development projects under the BRI. Most notably is the Lamu Port-South Sudan-Ethiopia (LAPSSET) corridor, the largest on-going development project in the region valued at $25 billion. The LAPSSET will integrate Kenya with Ethiopia, Uganda and South Sudan and, once completed, be further connected to the Douala-Lagos-Cotonou-Abidjan railway, establishing a transportation corridor across the continent. The project also adds a second seaport in the coastal town of Lamu, boosting Kenya's status as a transport and logistics hub and mitigating the overused capacity from Mombasa port.[179]

However, in the region, Kenya has been the hardest hit by the offloading of Chinese excess capacity, which has generated public contempt. Key domestic industries have suffered from increased imports of cheap materials and labour, and its economic competitiveness has decreased in line with the influx of goods and services to its main export destinations, namely Tanzania and Uganda.[180] According to the media sentiment analysis from Bruegel, the Sub-Saharan African region displays the most positive attitude towards the BRI, next to Central Asia. The positive views of China are likely due to the regions share of underdeveloped countries, which receives sorely needed infrastructure investments and development that will increase their economic growth

[179] Wanjohi Kabukuru, "A Megaproject Rises in East Africa," *Africa Renewal*, https://www.un.org/africarenewal/magazine/august-2016/megaproject-rises-east-africa [accesssed 19 June 2019]
[180] Paul Nantulya, "Implications for Africa from China's One Belt One Road Strategy," *Africa Center for Strategic Studies* (March 22, 2019), https://africacenter.org/spotlight/implications-for-africa-china-one-belt-one-road-strategy/ [accessed 17 July 2019]

and standard of living. In Eastern Africa, Kenya maintains a cautious positive attitude to the BRI but scores significantly lower than the other countries in the region.[181]

Uganda

Uganda has a more volatile political and security environment but remains strategically significant for China for its abundant natural resources and role as a transit country. Its most prominent involvement in the BRI is the Uganda – Tanzania Crude Oil Pipeline, known as the Hoima Tanga Pipeline, intended to transport crude oil from Uganda's oil fields to the coastal town of Tanga in Tanzania. China has also provided large-scale funding for two Hydropower Plants, the Isimba and the Karuma, and the Kampala-Entebbe Expressway. The latter is a four-lane toll highway that links the capital of Kampala with the Entebbe International Airport.[182] In the media sentiment analysis, Uganda is the only Eastern Africa state that scores lower than Kenya and only maintains a minor positive attitude towards the BRI. It holds many of the same experiences as Kenya, but the main concern is that it is being lured into a debt trap which will allow China to take over its main assets eventually. The government has rejected this at multiple occasions and continues to express a mostly optimistic view of the effects to the BRI, while the country's public debt has grown from $9.1 to $11.1 billion just in the last year.[183]

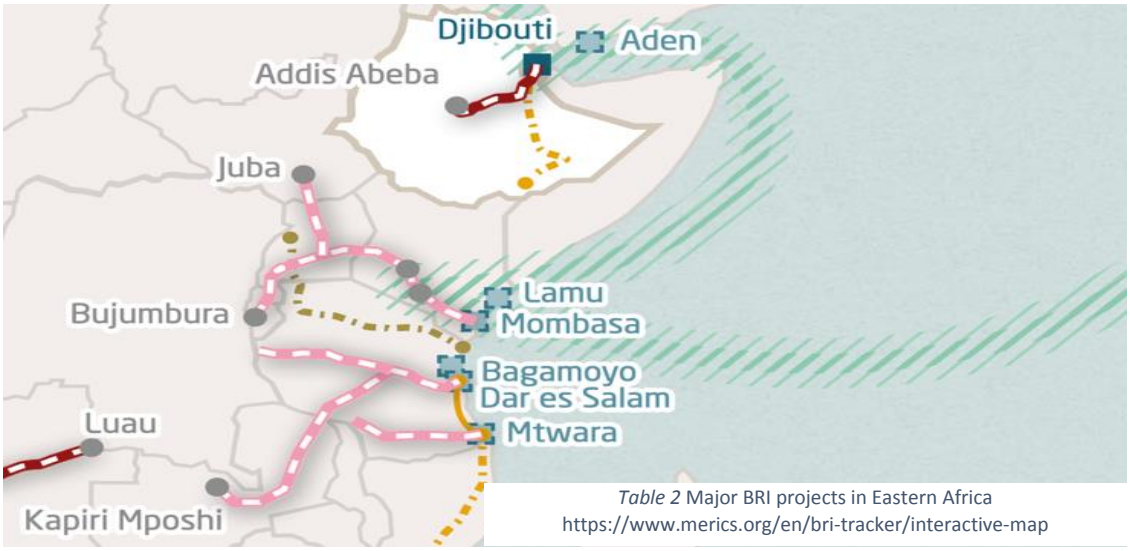

Table 2 Major BRI projects in Eastern Africa
https://www.merics.org/en/bri-tracker/interactive-map

[181] Alicia Garcia and Jianwei Xu, "Countries' Perceptions of China's Belt and Road Initiative: A Big Data Analysis," *Bruegel* no. 1 (2019), https://bruegel.org/wp-content/uploads/2019/02/WP-2019-01final.pdf [accessed 16 July 2019]
[182] Mercator Institute for China Studies, *MERICS Belt and Road Tracker* (2019), https://www.merics.org/en/bri-tracker/interactive-map [accessed 17 July 2019]
[183] Business Times Africa, "China To Take Over Uganda's Main Assets Over Unpaid Rising Huge Debt," *Opinion and Analysis* (March 04, 2019), http://businesstimesafrica.net/index.php/world/item/4110-china-to-take-over-uganda-s-main-assets-over-unpaid-rising-huge-debt [accessed 16 July 2019]

Zambia

Zambia has seen the least investments from China in terms of major development projects. It is less critical in terms of regional integration and holds no geostrategic significance for Beijing to achieve its economic and political aspirations for the continent. The most prominent project under the BRI is the Dar es Salam – Kapiri Mphosi railway, connecting the country to the more extensive regional infrastructure network through Tanzania and granting Lusaka access to sea lanes.[184] There is still a strong Chinese presence in Zambia, and it is reasonable to assume that Beijing is targeting the nations abundant access to natural resources. Minerals and metals like copper, cobalt and zinc are all needed for the production for everything from jet engines to electrical equipment and pharmaceuticals. Zambia remains one of the poorest nations in Africa and has one of the world's fastest-growing populations. This suggests that the government is lenient to accept any form of foreign aid that can increase its economic growth, even if it is only short-term. There is a strong positive sentiment towards the BRI, likely related to the developments Zambia is currently seeing, but there have also here been raised concerns about potential debt issues. These are, however, far outweighed by the perceived gains from Chinese investments.[185]

Tanzania

Tanzania draws parallels to Kenya and has become another focal point for China for its stable economic growth and geostrategic significance. Dar es Salam is involved in numerous Chinese-funded BRI projects, including the Rovuma-Gauteng gas pipeline; Mtwara-Dar es Salam natural gas pipeline; Dar es Salam-Kapiri Mposhi railway to Zambia; and Hoima Tanga oil pipeline. Besides, Beijing is heavily investing in deep-water ports in Mtwara, Dar es Salam and Bagamoyo, all which will sharply increase the trade capacity between the two continents.[186] Bagamoyo is the single largest infrastructure project in Tanzania, and China seeks to establish an exclusive economic zone and transform the city into an industrial gateway for other landlocked African

[184] Mercator Institute for China Studies, *MERICS Belt and Road Tracker* (2019), https://www.merics.org/en/bri-tracker/interactive-map [accessed 17 July 2019]
[185] Alicia Garcia and Jianwei Xu, "Countries' Perceptions of China's Belt and Road Initiative: A Big Data Analysis," *Bruegel* no. 1 (2019), https://bruegel.org/wp-content/uploads/2019/02/WP-2019-01final.pdf [accessed 16 July 2019]
[186] Mercator Institute for China Studies, *MERICS Belt and Road Tracker* (2019), https://www.merics.org/en/bri-tracker/interactive-map [accessed 17 July 2019]

countries.[187] Compared to other countries in the region, the debt trap dilemma appears to be less of an issue for Tanzania. It recognises the financial burden that the infrastructure developments entail but perceives the strategic advantages of a modern transport network to be far higher.[188] Though concerns get raised on an infrequent basis over the long-term implications and terms of the deal, Tanzania exhibits the most positive attitude of all African countries towards the effects of the BRI, only beaten by Botswana.[189]

Ethiopia

Ethiopia has seen fewer infrastructure investments than its regional neighbours and is only involved in a limited number of development projects. However, it holds promise for China who seeks to increase its presence in the Horn of Africa to protect its strategic interests in the Bab el-Mandeb Strait, a critical chokehold for operational continuity of the Maritime Silk Road. To do so, Beijing opened its first overseas military base in Djibouti in 2017, amplifying its regional influence and the global reach of its armed forces.[190] The base is located in a high-risk conflict zone, locked in by Eritrea, Somalia, Yemen – and Ethiopia. In a regional context, the latter is relatively stable and presents the best option for China to establish a land-based logistics chain to Djibouti, strengthening its military resiliency and presence. Beijing is currently invested in three large-scale projects in Ethiopia; the Addis Adeba-Djibouti highway, te Ogadan-Djibouti oil pipeline and the LAPSSET railway.[191]

Sub-Saharan African Country	Tone	Tone ranking
Botswana	4.98	1
Liberia	3.05	2
Tanzania	3.05	3
Chad	2.42	4
Zambia	2.32	5
Ethiopia	1.90	6
Rwanda	1.79	7
Malawi	1.66	8
Ghana	1.54	9
Nigeria	1.52	10
Zimbabwe	1.26	11
Somalia	1.06	12
Cameroon	1.02	13
Mauritius	0.74	14
Madagascar	0.65	15
Kenya	0.42	16
Senegal	0.30	17
Uganda	0.13	18
South Africa	-0.16	19

Table 3 Tone Ranking for Sub-Saharan Africa (19 countries)
https://bruegel.org/wp-content/uploads/2019/02/WP-2019-01final.pdf

[187] International Financial Program, "Bagamoyo: The Largest Construction Project in Tanzania," *Risk Magazine* (December 28, 2018), https://riskmagazine.nl/article/2018-12-28-bagamoyo-the-largest-construction-project-in-tanzania [accessed 16 July 2019]
[188] Xihua, "Why Belt and Road Initative is Anything but Debt Trap," *China Daily* (April 14, 2019), http://global.chinadaily.com.cn/a/201904/14/WS5cb26c77a3104842260b60d7.html [accessed 16 July 2019]
[189] Alicia Garcia and Jianwei Xu, "Countries' Perceptions of China's Belt and Road Initiative: A Big Data Analysis," *Bruegel* no. 1 (2019), https://bruegel.org/wp-content/uploads/2019/02/WP-2019-01final.pdf [accessed 16 July 2019]
[190] Tyler Headley, "China's Djibouti Base: A One Year Update," *The Diplomat* (December 4, 2018), https://thediplomat.com/2018/12/chinas-djibouti-base-a-one-year-update/ [accessed 16 July]
[191] Mercator Institute for China Studies, *MERICS Belt and Road Tracker* (2019), https://www.merics.org/en/bri-tracker/interactive-map [accessed 17 July 2019]

This will increase the trade flow between Addis Adeba and Djibouti and grant Ethiopia easier access to vital sea lanes in the Gulf of Aden, but also allow China to strengthen its position and thereby control over the Strait. Ethiopia is one of the poorest countries in the world, with a staggering unemployment rate and unbalanced demographic structures. Foreign investments are perceived necessary for the country to produce jobs for a rising population, increase economic growth and meet electricity demands. Ethiopia, therefore, views Chinese investments as a welcomed contribution and its measured media sentiment for the BRI generally scores high.

Key findings

Eastern Africa has seen a significant rise in foreign direct investments, though this has not materialised uniformly. Data from the MERICS database indicate a correlation between strategic significance and extent of which states are involved in projects under the BRI. It is, however, difficult to quantify the level of strategic significance the individual states hold, but the empirical findings can be assessed in the context of Beijing's grand strategy. Kenya and Tanzania are likely to be ranked high as they are imperative for China's plans of economic integration and growth. This is followed by Ethiopia which, due to the oversea base in Djibouti, is vital for China to achieve its great power ambitions, and it has become an important partner for the People's Liberation Army. This cooperation allows Beijing to maintain a continuous regional presence, protect its maritime interests and extend the global reach of its Armed Forces. Finally, Uganda and Zambia have received less attention because China does not depend on them to assert itself on the continent. Both are on the economic spectre, and their natural resources allow China to strengthen various domestic sectors.

Conclusion

This paper has attempted to identify the determinants of China's civilian nuclear cooperation by examining different variables in countries in Eastern Africa. Understanding the key drivers behind this is important, as it allows for more direct policy-responses and efforts to strengthen the global nuclear governance system. The research builds on existing literature, established theories and new hypothesis to test this in the framework of China's nuclear cooperation agreements. The hypotheses tested predicted that Beijing provided nuclear assistance either to strengthen alliances or weaken common enemies, for economic profits, to states with equal political systems, based on the units of analysis energy profiles, or countries involvement in the Belt and Road Initiative.

The empirical analysis does not show any correlation between the diplomatic, economic or political profiles of the countries assessed and Chinese nuclear assistance. This proves that the previous established generalizable theories are not adequate in explaining the nuclear behaviour of China, and that new research is needed. The remaining two hypothesis examined the strategic importance and public sentiments in countries under the Silk Road and the energy profile of each country. It is evident that Beijing weights the strategic importance of each state for its development project and invest thereafter, though there are no correlation in terms of nuclear aid. States that function as hubs or is vital for it to achieve its geopolitical objectives are involved in more costly projects than those of lesser significance. More interestingly, it appears to be a pattern between the level of public sentiment and resistance to Beijing's increasing influence in countries involved in the Belt and Road. The media sentiment analysis from Bruegel shows that the countries that have received nuclear assistance are less supportive of China.

In these countries it is also a gap between the public discontent and statements released by the government that are in general more positive. This could suggest that China is looking to use nuclear reactors to strengthen its influence and reduce national resistance in countries that are less accommodating to its expansion. Nuclear power plants provide enough energy to allow countries to grow economically and increase their income-status and average living situation and is therefore an effective mean to increase public

support. This could also explain why governments are more positive than the public, as the population has not been impacted by the plans that only exists on paper. The second hypothesis on energy profiles is also interesting as Beijing could provide nuclear assistance to strengthen emerging markets and progress its own objectives in the region. There is no evident correlation that supports this claim but there are still many areas that remains unexplored. The most interesting being the correlation between nuclear aid and the natural resources available in each state, which should be further investigated.

It is interesting that projects related to nuclear power plants, despite their prominent role in China's development strategy, are not mentioned in many of the official government documents. In progress reports released by the Ministry of Foreign Affairs of the People's Republic of China and the government service website China Daily, just the term 'nuclear' in a broader context is not mentioned once. This lack of transparency could be explained by the dual-use nature of nuclear technologies, where Beijing leaves nuclear projects out to downplay the threat from nuclear proliferation along the BRI corridors. Moreover, it could be a strategic move to shift the attention away from its violations of the nonproliferation regime. China is, under the NSG, prohibited to provide nuclear assistance to states that have not signed the NPT but yet, it remains deeply involved in nuclear reactor projects in Pakistan. There are also concerns that China is too focused on its domestic growth to realize the security risks tied to nuclear exports in a scant regulatory environment. Sudan, for example, holds a geopolitical significance for the BRI and have signed a framework agreement with China for its first nuclear power plant, but has not signed the IAEA additional protocol which makes it hard to verify all its nuclear activities.

The nuclear developments of China are particularly interesting at this time as it is expanding its nuclear industry and simultaneously increasing its influence in international governance bodies. This research has been partly successful in identifying the determinants behind China's nuclear assistance but there are still much that remains before a final conclusion can be made. It has, however, opened up a field that should be further explored to understand the causes and consequences of Beijing's nuclear behaviour. This is particularly important to ensure the continued effectiveness of the global nuclear governance system.

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国家核电中长期发展规划(2005-2020年)

Appendix 1: PRC Nuclear Cooperation List

HORNE PRC LIST

ALGERIA

1825: ALGERIA and CHINA (PRC). Co-operation in Peaceful Uses of Nuclear Energy. Signed February 1983. **Last Date in Force:** unknown. **Source:** NTI: PRC; NTI: Algeria.

Note: This concerns a 15 MW research reactor. NTI: PRC reports on April 18, 1991 that PRC blocked sale of a reactor to Algeria under the Feb. 1983 agreement. Wilson Archive Record ID # 116907: NIE 5-91 C of July 1991: indicates this is still being built, under IAEA safeguards.

Links: See Sequence # 1826.

1826: ALGERIA and CHINA (PRC). Agreement for a Heavy Water Reactor. Signed December 1986. **Last Date in Force:** unknown. **Source:** WNC 19980124.

Note: NTI: PRC reports on April 18, 1991 that China blocked the sale of a reactor to Algeria under the February 1983 agreement. Wilson Archive Record ID # 116907: NIE 5-91 C of July 1991: indicates this is still being built, under IAEA safeguards.

Links: See Sequence # 1825.

1460: ALGERIA and CHINA (PRC). Nuclear Co-operation Agreement. Signed June 1, 1996. **Last Date in Force:** unknown. **Source:** PPNNP 34: 4-5; FBIS-CHI-96-107, 19960603; NTI PRC.

Note: FBIS-CHI-96-107, 19960603 reports the signing of a document concerning the second phase of a project for a nuclear research facility, and a summary of talks on the peaceful use of nuclear energy concerning the acceleration of a project for a radioactive isotopes and radioactive pharmaceuticals facility. NPR 5:1:142, WNC 19970521, and NTI PRC report an agreement signed May 21, 1997 between the Algerian Minister of Higher Education and Scientific Research and the China Nuclear Energy Engineering Corporation for the supply of blueprints and designs for the third stage of construction of the Algerian Center for Nuclear Energy Research.

Links: See Sequence # 1827.

1827: ALGERIA (Minister of Higher Education and Scientific Research) and CHINA (PRC) (China Atomic Energy Authority). Letter of Intent on Peaceful Utilization of Nuclear Technology. Signed October 17, 1996. **Last Date in Force:** unknown. **Source:** WNC 19961018.

Note: This may concern production and research facilities for radioisotopes. It could be linked to the agreement of June 1, 1996, sequence number 1460.

Links: See Sequence # 1460, 1461.

1461: Merged into Sequence # 1460: see Note. Number to be reassigned.

1828: ALGERIA (Ministry of Energy and Mines) and CHINA (PRC) (China Atomic Energy Authority). Development of Peaceful Nuclear Energy. Signed March 24, 2008. **Last Date in Force:** unknown. **Source:** NN 20080326; WMDI #24, 20080600; AMAE 20080325.

Note: WMDI #24, 20080600 gives the signature dates for Sequences #s 1828 and 1829 as March 24, 2008. Sequence # 1828 appears to be for assistance in the construction and operation of a power reactor. *Intelligence on Iran* notes this in its November 2015 factsheet, but it is not clear if this is merely a reference to the original agreement or an actual Last Known Date.

1829: ALGERIA (Energy and Mines Ministry) and CHINA (PRC) (Atomic Energy Authority). Agreement on Training, Research and Human Resources. Signed March 24, 2008. **Last Date in Force:** unknown. **Source:** NN 20080326; WMDI # 24, 20080600; NLB 82: 200.

WMDI #24, 20080600 gives the signature dates for Sequences #s 1828 and 1829 as March 24, 2008. *Intelligence on Iran* notes this in its November 2015 factsheet, but it is not clear if this is merely a reference to the original agreement or an actual Last Known Date.

ARGENTINA

0001: ARGENTINA and CHINA (PRC). Purchase of Heavy Water. Signed December 1982. **Source:** Mallea. **Last Date in Force:** unknown.

0002: ARGENTINA and CHINA (PRC). Sale of Enriched Uranium to Argentina. Reported January 20, 1983. **Last Date in Force:** unknown. **Source:** Wilson Archive Record ID #116893.

Note: The source says this was an indirect sale, through Western European intermediaries. Mallea reports (1982 or 1983) a purchase of uranium as well.

0166: ARGENTINA and CHINA (PRC). Co-operation in the Peaceful Uses of Nuclear Energy. Signed April 15, 1985; in force October 30, 1985. **Last Date in Force:** indefinite duration. **Source:** ILM 25:352; NLB 38: 51-52; NTI PRC; Ornstein p. 52; MRECIC-BDT 3461; CNEA Annual Report 1986-87.

Note: CNEA Annual Report 1986-87 lists this as signed April 19, 1985.

0003: ARGENTINA (Comisión Nacional de Energía Atómica and Nucleoeléctrica Argentina S.A.) and CHINA (China National Nuclear Corporation and China Zhongyuan Engineering Corporation). Agreement on Intention to Cooperate in the Nuclear Area. Signed August 26, 2010. **Last Date in Force:** unknown. **Source:** CNEA Annual Report 2010; CNEA Noti 20100902.

Note: CNEA Noti 20120522 notes a meeting under the agreement. This is a possible Last Known Date.

0004: ARGENTINA (Ministry of Federal Planning, Public Investment and Services) and CHINA (PRC) China National Energy Administration). Agreement on Nuclear Energy Cooperation. Signed June 25, 2012; in force September 2014? **Last Date in Force:** unknown. **Source:** SNF 20120702, 20140910; WNN 20140725; WNC 20120626, 20120705; references in MRECIC-BDT 10685 and MRECIC-BDT 10703.

Note: This seems to involve a feasibility study for a 4th nuclear power plant. MRECIC-BDT 10685 is a Joint Declaration of June 25, 2012, and MRECIC-BDT 10703 of July 18, 2014 is an agreement on cooperation in construction of a reactor.

0005: ARGENTINA and CHINA (PRC). Joint Declaration. Signed June 25, 2012. **Last Date in Force:** unknown. **Source:** MRECIC-BDT 10685.

0006: ARGENTINA and CHINA (PRC). Agreement on Cooperation in the Construction of a Pressurized Heavy Water Reactor in Argentina. Signed July 18, 2014, in force July 18, 2014. **Last Date in Force:** when the project is completed. **Source:** SNF 20140910, 20150209; MRECIC-BDT 10703; IAEA CNPP 2016. (Argentine update is 2015); NTI Argentina.

Note: SNF 20150209 may suggest this comes into force February 3, 2015.

0007: ARGENTINA and CHINA (PRC). Joint Plan of Action. Signed July 18, 2014, in force July 18, 2014. **Last Date in Force:** December 31, 2008. **Source:** MRECIC-BDT 10698.

Note: Article 6 is on nuclear cooperation; Article 13 includes a reference to nuclear energy.

0008: ARGENTINA (Federal Planning Minister) and CHINA (PRC) (China National Nuclear Corporation). Nuclear Cooperation Agreement. Signed February 3, 2015. **Last Date in Force:** unknown. **Source:** WNN 20150203.

Note: Signed during the 2nd Argentine-Chinese Meeting of Strategic Dialogue.

0009: ARGENTINA (Minister of Energy and Mines) and CHINA (PRC) (China National Energy Administration). Declaration of Intent re Two Nuclear Power Plants and Chinese Financing. Reported or announced June 30, 2016. **Last Date in Force:** unknown. **Source:** SNF 20160711; WNN 20160701.

Note: This follows from and reaffirms the agreement of November 2015 between Nucleoeléctrica Argentina S.A. and the China National Nuclear Corporation**.** See also SNF 2016092. SNF 20170526 reports a contract between China National Nuclear Corporation and Nucleoeléctrica, signed May 17, 2017, regarding these.

GENERAL NOTE: The Argentine firm Nucleoeléctrica Argentina S.A. signs a number of agreements with Chinese entities: I note the following:

- With the China National Nuclear Corporation on September 28, 2012. Referenced in MRECIC-BDT 10703; CNEA Noti 20130208 indicates discussion of this and of other projects.
- With the China National Nuclear Corporation on January 22, 2013. Referenced in MRECIC-BDT 10703; CNEA Noti 20130208 indicates discussion of this and of other projects.
- With the China National Nuclear Corporation on January 29, 2013. SNF 20130208; NN 20130204; WNN 20130204. This is one of two agreements apparently signed on this date. The first is in regard to collaboration in PWRs (engineering, construction, operation and maintenance) and production and stockpiling of fuel, licensing, prolonging life and advanced technologies. NN 20130204 reports that the first agreement covers reactor pressure tubes, including engineering, fabrication, operation and maintenance.
- A second agreement with China National Nuclear Corporation was signed January 29, 2013. SNF 20130208; NN 20130204; WNN 20130204. The second covers the transfer of Chinese technology to Argentina and raises the possibility of cooperation in supplying third states.
- An agreement was signed with the China National Nuclear Corporation and Industrial and the Commercial Bank of China on July 18, 2014. SNF 20140910. This seems to cover the supply of services and equipment for Atucha 3, and follows from the agreement of June 25, 2012 (Sequence # 0004). NTI: Argentina notes an agreement regarding Atucha 3 signed in 2014 (possibly Sequence # 0006?). WNN 20140904 notes a Nucleoeléctrica Argentina and China National Nuclear Corporation contract re Atucha 3. WNN 20151105 notes ratification of this in February 2015 and agreement on the text for a framework agreement for a 5th plant, as well as technical and commercial contracts for a 4th plant. See also WNN 20151116. SNF 20150529 notes an agreement regarding Atucha 4 ratified in February 2015.
- With the China National Nuclear Corporation, a Contract for Two Nuclear Power Plants (technical and economic agreements), on November 15, 2015. SNF 20151123. This agreement touches on a heavy water reactor (Atucha 3 for a CANDU-6 type) and a PWR (Hualong-1 type) on a new site.
- A contract with the China National Nuclear Corporation on May 17, 2017. SNF20170526. See the Note for the agreement reported/announced June 30, 2016 See Sequence # 0009). This agreement also seems to follow from the agreement of November 15, 2015.

AUSTRALIA

1466: AUSTRALIA (Australian Nuclear Science and Technology Organisation) and CHINA (PRC) (China National Nuclear Corporation). Research Agreement. Signed March 1992. **Last Date in Force:** unknown. **Source:** EOS 7:33.

Note: This concerns the Australian Synroc radioactive waste management technique.

0627: AUSTRALIA and CHINA (PRC). Agreement on the Transfer of Nuclear Material. Signed April 3, 2006; in force February 3, 2007. **Last Date in Force:** February 2, 2037. **Source:** ATS 2007/3.

Note: This may also terminate at the same time as the nuclear co-operation agreement of April 3, 2006, Sequence # 0657.

Links: See Sequence # 0657 and Sequence # 0017.

0010: AUSTRALIA (Australian Safeguards and Nonproliferation Office) and CHINA (China Atomic Energy Authority). Administrative Arrangement pursuant to the Agreement of April 3, 2006 on the Transfer of Nuclear Material. Signed Nov. 24, 2006. **Last Date in Force:** likely February 2, 2037. **Source:** ASNO Annual Report 2006-2007.

Note: This follows from Sequence # 0627.

Links: See Sequence # 0627

0657: AUSTRALIA and CHINA (PRC). Agreement on Co-operation in the Peaceful Uses of Nuclear Material. Signed April 3, 2006; in force February 3, 2007. **Last Date in Force:** February 2, 2037. Source: ATS 2007/4; UNTS 44569, 44570.

Note: This may also terminate at the same time as the nuclear transfer agreement of April 3, 2006, sequence number 0627.

Links: See Sequence # 0627. See Sequence # 0010.

0011: AUSTRALIA and CHINA (PRC). Nuclear Cooperation Agreement. Signed January 4, 2007, supposedly coming into force February 2007? **Last Date in Force:** unknown. **Source:** SNF 20070104.

Note: this is separate from the other agreement signed on this date.

0012: AUSTRALIA and CHINA (PRC). Nuclear Cooperation Agreement [uranium safeguards]. Signed January 4, 2007. Supposedly coming into force February 2007? **Last Date in Force:** unknown. **Source:** SNF 201070104.

Note: this is separate from the other agreement signed on this date.

BANGLADESH

0013: BANGLADESH and CHINA (PRC) Agreement for Cooperation in the Peaceful Uses of Nuclear Energy. Signed April 7, 2005**. Last Date in Force:** 15 years duration. **Source:** Bang MFA; CAEA 20060516; WNC 20100902.

Note: WNC 20090512 reports an existing agreement with China but gives no dates or details. WNC 20100902 reports an agreement in 2005 for a 300 MWe nuclear power plant. IAEA CNPP 2016 (Bangladesh) reports an agreement.

BELARUS

0014: BELARUS and CHINA (PRC). Agreement on Cooperation in Peaceful Uses of Nuclear Energy. Signed December 17, 2008. **Last Date in Force:** unknown. **Source:** WNC 20080520; Nuclear.ru 20081217, 20090505; IAEA CNPP 2016 (Belarus update 2010).

Note: IAEA CNPP 2016 (Belarus update 2010) says it was approved by Belarus April 23, 2009. See also WNA Country Profile (Belarus) June 26, 2013. Nuclear.ru 20090505 notes approval of agreement by Belarus government. WNC 20080520 *foresees* negotiations on an NPP in Belarus. WNC 20081218 *announces signing* of an agreement on peaceful uses of nuclear energy on Dec. 16, 2008. This is termed a "conceptual" document, a foundation for cooperation. Includes cooperation in fundamental and applied studies, research in peaceful uses, joint development of innovative reactor technologies, safety, radiation safety, and environmental protection. WNC 20090504 reports an agreement signed December 2008 is "approved". WNC 20090505 reports the same, saying the agreement was signed December 16, 2008.

BELGIUM

0481: BELGIUM and CHINA (PRC). Co-operation in the Peaceful Uses of Atomic Energy. Signed April 18, 1985; in force April 18, 1985. **Last Date in Force:** indefinite duration. **Source:** UNTS 23372. NLB 37: 41.

1874: BELGIUM and CHINA (PRC). Nuclear Co-operation Agreement. Signed September 21, 2006. **Last Date in Force**: unknown (2011? see note). **Source:** WNC 20061024.
Note: SCK-CEN 20060921 reports a collaboration agreement between the Studiecentrum voor Kernenergie – Centre d'Etude de l'Energie Nucléaire and China National Nuclear Corporation, signed September 21, 2006. This concerns radioprotection and monitoring, safety, safeguards, innovative concepts, nuclear metrology, reference materials, nuclear medicine, dismantling of nuclear installations, management of radioactive waste, fusion. It is supposed to terminate in 2011. This may be that agreement.

0015: Belgium (Studiecentrum voor Kernenergie – Centre d-Etude de l'Energie Nucléaire) and CHINA (PRC) (Ministry of Science and Technology). Cooperation Agreement [emergency planning]. Signed June 18, 2007. **Last Date in Force:** unknown. **Source:** SCK-CEN 20070618.
Note: This is one of six agreements signed this day. They are linked to the CNNC-SCK-CEN agreement of Sept 21, 2006 (Sequence # 1874). They cover emergency planning, artificial intelligence, study of materials for future reactors, dismantling of nuclear installations, research on underground storage, and storage of radioactive waste.
Links: See Sequence # 1874.

0016: Belgium (Studiecentrum voor Kernenergie – Centre d-Etude de l'Energie Nucléaire) and CHINA (PRC) (Ministry of Science and Technology). Cooperation Agreement [study of materials for future reactors]. Signed June 18, 2007. **Last Date in Force:** unknown. **Source:** SCK-CEN 20070618.
Note: This is one of six agreements signed this day. They are linked to the CNNC-SCK-CEN agreement of Sept 21, 2006 (Sequence # 1874). They cover emergency planning, artificial intelligence, study of materials for future reactors, dismantling of nuclear installations, research on underground storage, and storage of radioactive waste.
Links: See Sequence # 1874.

0017: Belgium (Studiecentrum voor Kernenergie – Centre d-Etude de l'Energie Nucléaire) and CHINA (PRC) (Ministry of Science and Technology). Cooperation Agreement [dismantling of nuclear installation]). Signed June 18, 2007. **Last Date in Force:** unknown. **Source:** SCK-CEN 20070618.
Note: This is one of six agreements signed this day. They are linked to the CNNC-SCK-CEN agreement of Sept 21, 2006 (Sequence # 1874). They cover emergency planning, artificial intelligence, study of materials for future reactors, dismantling of nuclear installations, research on underground storage, and storage of radioactive waste.
Links: See Sequence # 1874.

0018: **Belgium (Studiecentrum voor Kernenergie – Centre d-Etude de l'Energie Nucléaire) and CHINA (PRC) (Ministry of Science and Technology).** Cooperation Agreement [research on underground storage]. Signed June 18, 2007. **Last Date in Force:** unknown. **Source:** SCK-CEN 20070618.

Note: This is one of six agreements signed this day. They are linked to the CNNC-SCK-CEN agreement of Sept 21, 2006 (Sequence # 1874). They cover emergency planning, artificial intelligence, study of materials for future reactors, dismantling of nuclear installations, research on underground storage, and storage of radioactive waste.

Links: See Sequence # 1874.

0019: **Belgium (Studiecentrum voor Kernenergie – Centre d-Etude de l'Energie Nucléaire) and CHINA (PRC) (Ministry of Science and Technology).** Cooperation Agreement [storage of radioactive waste]. Signed June 18, 2007. **Last Date in Force:** unknown. **Source:** SCK-CEN 20070618.

Note: This is one of six agreements signed this day. They are linked to the CNNC-SCK-CEN agreement of Sept 21, 2006 (Sequence# 1874). They cover emergency planning, artificial intelligence, study of materials for future reactors, dismantling of nuclear installations, research on underground storage, and storage of radioactive waste.

Links: See Sequence # 1874.

0020: **Belgium (Studiecentrum voor Kernenergie-Centre d'Etude de l'Energie Nucléaire, Tractobel Engineering and Belgonucléaire) and CHINA (PRC) (China National Nuclear Corporation).** Framework Agreement on Construction of a MOX Fuel Plant in China. Signed October 6, 2010. **Last Date in Force:** unknown. **Source:** SNF 20101012; SCK-CEN 20101006.

Note: This concerns construction of a MOX pilot fuel fabrication plant and the use of MOX fuel in China. The SCK-CEN press release on this expresses the hope that it will lead to a commercial agreement that includes technology transfer and technical assistance by the Belgian partners. Hibbs 20170217 reports that the project was intended to provide MOX fuel for the China Experimental Fast Reactor, but the collapsed after Belgium and China could not agree on terms.

Links: See Sequence # 1677 and the Note for Sequence # 1957.

0021: **BELGIUM (Studiecentrum voor Kernenergie-Centre d'Etude de l'Energie Nucléaire) and CHINA (PRC) (Chinese Academy of Sciences).** Memorandum of Understanding on Collaboration. Signed October 6, 2010. **Last Date in Force:** unknown. **Source:** SNF 20101013; SCK-CEN 20101006; NLB 86: 94; WNA Fast Neutron Reactors; WNN 20101007; NucNet No. 176, 20101006 and No. 189, 20101025.

Note: This is involved with Belgium's MYRRHA project (Multipurpose Hybrid Reactor for High-Technology Applications), and involves an exchange of expertise in nuclear research. WNN 20101007 notes that MRRHA research on transmutation could be useful re waste management. MYRRHA also includes research in energy, medical, industrial and renewable energy areas. NucNet No. 176, 20101006 and NucNet No. 189, 20101025 report an agreement dated October 6, 2010, concerning MYRRHA, waste treatment. An SCK-CEN Press

Release 20150914 refers to “good contacts we already had with the Chinese research institutes over the last 35 years.”

0022: BELGIUM and CHINA (PRC). Framework Agreement on Nuclear Cooperation. Signed October 17, 2018. **Last Date in Force:** unknown. **Source:** WNN 20181018.

BELGO-LUXEMBOURG ECONOMIC UNION

0135: BELGO-LUXEMBOURG ECONOMIC UNION and CHINA (PRC). Protocol on Scientific and Technological Co-operation. Signed November 23, 1979; in force November 23, 1979. **Last Date in Force:** indefinite duration. **Source:** UNTS 18296.

Note: This includes nuclear co-operation.

BRAZIL

0023: BRAZIL and CHINA (PRC) (Chinese Nuclear Industry Corporation). Purchase of Enrichment Services. Signed December 1982. **Source:** Mallea.

Note: Wilson Archive Record ID # 116872, a document dated April 4, 1984, reports a purchase by Brazil of enriched uranium. It refers to visits in December 1982 "to agree on the purchase by Brazil of enriched uranium from the Chinese Nuclear Industry Corporation," and refers to having obtained such a supply without being subject to full-scope safeguards. The document also comments on the possibility of a further nuclear cooperation agreement. See Sequence # 0287.

Links: A possible link to Sequence # 0287.

1273: BRAZIL and CHINA (PRC). Agreement Supplementary to the Agreement on Scientific and Technological Co-operation. Signed May 29, 1984; in force May 29, 1984. **Last Date in Force:** indefinite duration. **Source:** UNTS 23240. DAI.

Note: This supplements the Agreement on Scientific and Technological Co-operation of March 25, 1982 (in force March 30, 1984), UNTS 23239. The Supplementary Agreement includes co-operation in nuclear power.

Links: See the reported purchase of enriched uranium in December 1982, Sequence # 0023.

0287: BRAZIL and CHINA (PRC). Memorandum of Understanding on Co-operation in the Peaceful Uses of Nuclear Energy. Signed May 29, 1984; in force May 29, 1984. **Last Date in Force**: no specific provision. **Source:** ILM 24:1392. UNTS 23035. DAI.

Note: This is an agreement to pursue the negotiation of a nuclear co-operation agreement. DAI 2014 has this still in force. The ILM item carries the footnote "As of August 30, 1985, no such agreement as described in paragraph 5 [re the conclusion of a nuclear cooperation agreement] had been concluded, nor is one likely to be concluded in the near future." See, however, Sequence # 1345.

Links: See Sequence # 1345.

1345: BRAZIL and CHINA (PRC). Agreement on Co-operation in Peaceful Uses of Nuclear Energy. Signed October 11, 1984; in force December 21, 1987. **Last Date in Force:** indefinite duration. Source: UWTRC 125897; UNTS 25897; DAI.

Links: See Sequence # 0287.

1881: BRAZIL and CHINA (PRC). Nuclear Co-operation Agreement. Signed May 2004, reported May 30, 2005. **Last Date in Force:** unknown. **Source:** WNC 20050530.

DAI reports various agreements occurring under this, but there is no specific mention of nuclear cooperation.

GENERAL NOTE: The Brazilian firm Eletrobras and/or its subsidiary, Eletronuclear, signed a number of agreements as well. I note the following:

- A Memorandum of Understanding for Further Cooperation in Nuclear Energy with the China National Nuclear Corporation on September 1, 2007. WNN 20170904. This concerns Angra 3 and possible follow-up projects.
- A Memorandum of Understanding with the China National Nuclear Corporation on May 19, 2015. SNF 20150529; WNN 20170904.
- A Memorandum of Understanding with the China National Nuclear Corporation in December 2016. WNN 20170904.

CAMBODIA

0024: Cambodia (Office of Council of Ministers and Cambodian Commission on Sustainable Development) and CHINA (PRC) (China National Nuclear CorporE. Signed September 12, 2017. **Last Date in Force:** unknown. **Source:** WNN 20170913; SNF 20100921.

Note: This calls for cooperation in human resources development.

CANADA

1286: CANADA and CHINA (PRC). Co-operation in the Peaceful Uses of Nuclear Energy. Signed November 7, 1994; in force November 7, 1994. **Last Date in Force:** indefinite duration. **Source:** CTS 1994/27. UNTS 34969.
Links: See also the agreement of February 24, 1997, Sequence # 1360. See the Protocol of July 19, 2012 and the Administrative Arrangement of July 26, 2012.

1542: CANADA and CHINA (PRC). Agreement. Signed September 12, 1995. **Last Date in Force:** unknown. **Source:** NPR 3:2:132.

Note: This concerns the supply of a 300 MWe reactor.

1470: CANADA and CHINA (PRC). Agreement on Nuclear Technology Sales. Signed October 10, 1995. **Last Date in Force:** unknown. **Source:** DFAIT 19951018.
Links: See also Sequence # 0025.

0025: CANADA and CHINA (PRC). Agreement on Purchase of two 700 MWe CANDU Reactors. Signed October 13, 1995. **Last Date in Force:** unknown. **Source:** NPR 3:2:132-3.
Note: This could be for the Qinshan project. It may be an agreement in principle to negotiate. See also "Memorandum of Understanding on Consultations on the Qinshan CANDU Nuclear Power Plant," FBIS-CHI-95-199, 19951016, and FBIS-CHI-95-225, 19951024.
Links: See Sequence # 0026. See Sequences #s 00034 and 0035 for other agreements involving the Third Qinshan Nuclear Power Company.

1359: CANADA (Atomic Energy Control Board) and CHINA (PRC) (National Nuclear Safety Administration). Protocol on Technical Co-operation and Exchange of Information in Nuclear Regulatory Matters. Signed June 6, 1996. **Last Date in Force:** unknown. Source: FBIS-CHI-96-111, 19960607.

Note: This includes training, assistance and exchanges of personnel.

0026: Canada (Atomic Energy of Canada Ltd.) and CHINA (China National Nuclear Corporation). Reactor Construction Agreement. Signed November 26, 1996. **Last Date in Force:** unknown. **Source:** WNC 19961126.
Note: This is for 2 CANDU-type reactors in Qinshan (Zhejiang province) (Qinshan 3rd Phase). Atomic Energy of Canada Ltd. Is treated here as a Crown Corporation, on the same level as the China National Nuclear Corporation for the purposes of this list, until part of it is sold to the engineering firm SNC-Lavalin and reconstituted as the subsidiary CANDU Energy.
Links: See the agreement of October 13, 1995, Sequence # 0025. See Sequences #s 0034, and 0035 for other agreements involving the Third Qinshan Nuclear Power Company.

1360: CANADA (Atomic Energy Control Board) and CHINA (PRC). Administrative Agreement Pursuant to the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy. Signed February

24, 1997. **Last Date in Force:** unknown, but presumably for the duration of the Agreement of November 7, 1994. See also the Note for the agreement of September 5, 2016. **Source:** AECB-R Summer 1997; CNSC List 2017.

Note: This is assumed here to be a safeguards agreement tied to Sequence # 1286.

Links: this was signed pursuant to Sequence # 1286.

0027: CANADA (Natural Resources Canada?) and China (PRC) (China National Energy Administration?). Memorandum of Understanding on Energy Cooperation. Signed 2001, renewed 2006, renewed February 8, 2012; renewed June 2017(?). **Last Date in Force:** unknown. **Source:** NRCan.

Note: This includes nuclear energy. It involves a Canada-China Joint Working Group on Energy Cooperation, co-chaired by Natural Resources Canada and the China National Energy Administration. The Joint Statement on Climate Change and Clean Growth of December 4, 2017 notes the renewal of a Memorandum of Understanding in the Field of Energy in June 2017 (thus a possible Last Known Date). That statement identifies the parties as Natural Resources Canada and the China National Energy Administration.

Links: See Sequence # 0040.

0028: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (China National Nuclear Corporation). Memorandum Extending and Deepening Nuclear Cooperation. Reported or announced October 22, 2003. **Last Date in Force:** unknown. **Source:** SNF 20031022.

Note: SNF 20031022 notes an intention to investigate the possible use of CANDU reactors for LWR fuel recycling and thorium use.

Links: Possibly connected to Sequences # 0029 and 0030. SNF 20050119 and NucNet 20050120 note the agreement between Atomic Energy of Canada Ltd. and the China National Development and Reform Commission on January 20, 2005 (Sequence # 0031) that complements a 2003 Memorandum and paves the way for further cooperation.

0029: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (China National Nuclear Safety Administration). Framework Agreement on Cooperation in Nuclear Safety. Reported/announced September 20, 2004. **Last Date in Force:** unknown. **Source:** SNF 20040920.

Note: This is in regard to the Advanced CANDU Reactor (ACR).

Links: Possibly linked to Sequence # 0028, and to Sequence # 1892.

0030: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (Nuclear Safety Centre of the Chinese national environmental Authority, SEPA). Agreement. Reported/announced September 20, 2004. **Last Date in Force:** unknown. **Source:** SNF 20040920.

Links: Possibly linked to Sequence # 0028.

0031: Canada (Natural Resources Canada, and Atomic Energy of Canada Ltd.) and CHINA PRC (National Development and Reform Commission of China, and China National Nuclear Corporation). Memorandum of Understanding on Nuclear Energy Cooperation. Signed January 20, 2005, renewed January 20,

2010. **Last Date in Force:** November 7, 2014. **Source:** NRCan; Referenced in Memorandum of Understanding of November 8, 2014.
NOTE: superseded by Sequence # 0038.
Links: Does Sequence # 1892 follow from this? SNF 20050119 and NucNet 20050120 note the agreement between Atomic Energy of Canada Ltd. and the China National Development and Reform Commission on January 20, 2005 that complements a 2003 Memorandum (Sequence # 0028) and paves the way for further cooperation.

1892: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (China National Nuclear Corporation). Agreement for Nuclear Energy Co-operation. Signed September 5, 2005. **Last Date in Force:** unknown.
Source: CNNC News, 20050913; WNN 20160923.
Note: SNF 20050905 puts the signature date at September 9, 2005. The agreement includes design of the Advanced CANDU and related CANDU system work.
Links: This could follow from the agreement of January 20, 2005. See Sequence # 0011, and Sequence # 0028.

0032: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (Nuclear Power Institute of China). Memorandum of Understanding on the Development of Low Uranium Consumption and CANDU Technologies in China. Reported/announced January 15, 2008. **Last Date in Force:** unknown. **Source:** WNN 20080115.
Note: The R&D will include advanced nuclear fuel cycle technologies (e.g. recycling uranium).
Links: See Sequences # 0033 and 0034. For other agreements regarding advanced fuels, see Sequences #s 0028, 0033, 0034, 0035, 0038, 0039 and the General Note.

0033: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (Chinese Nuclear Power Institute). Declaration of Intention on Joint Development of CANDU Fuel. Reported/announced February 6, 2008. **Last Date in Force:** unknown. **Source:** SNF 20080206 and 20081118.
Note: The goal is to reduce the consumption of uranium in CANDU reactors. It covers projects in engineering, technical conception, R&D, development and demonstration projects, advanced fuel cycles (including recycling in reactors of LWR fuels) and 4th generation nuclear production systems.
Links: See Sequences # 0032 and 0034. For other agreements regarding advanced fuels, see Sequences #s 0028, 0032, 0034, 0035, 0038, and the General Note. .

0034: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (Third Qinshan Nuclear Power Co., China North Nuclear Fuel Corporation, and Nuclear Power Institute of China). Agreement on Development of Advanced Reactor Fuel. Signed November 3, 2008. **Last Date in Force:** unknown. **Source:** SNF 20081108.
Note: The agreement covers using spent fuel from Chinese LWRs in CANDUs.
Links: This follows from Sequence # 0033. See also Sequence # 0035 involving the Third Qinshan Nuclear Power Company. For other agreements regarding

advanced fuels, see Sequences #s 0028, 0032, 0033, 0035, 0038, and the General Note.

0035: CANADA (Atomic Energy of Canada Ltd.) and CHINA (PRC) (Third Qinshan Nuclear Power Co., China North Nuclear Fuel Corporation, and Nuclear Power Institute of China). Agreement to Study Use of Thorium in CANDU Reactors. Signed July 14, 2009. **Last Date in Force:** end of October 2009? **Source: SNF 20090811.**

Note: This follows from Sequence # 0034. .

Links: See Sequence # 0034. See also other agreements involving the Third Qinshan Nuclear Power Company, Sequence # 0034. For other agreements regarding advanced fuels, see Sequences # 0028, 0032, 0033, 0034, 0038, and the General Note. .

0036: CANADA and CHINA (PRC). Protocol to the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy [Agreement of November 7, 1994, Sequence # 1286]. Signed July 19, 2012, in force January 1, 2013. **Last Date in Force:** indefinite duration. **Sources:** CTS 2013/4; TGM 20120210 (p. 4); NEI 20120214; SNF 20120715; NRCan; IEAD # 8216; APFC May 2016; WNC 20120828; NTIGSN 20120210;

Note: TGM 20120210 (p. 4) and NEI 20120214 reported/announced the completion of negotiations on this. It concerns nuclear material transferred for processing or conversion to a Chinese facility not listed in China's safeguards agreement with the IAEA. It lasts until the facilities are included in that safeguards agreement. The Protocol and the Arrangement allow the export of Canadian uranium ore concentrates to China, and additional verification measures. It lasts until the facilities are included under that safeguards agreement.

Links: See Sequence # 1286, and the Administrative Arrangement of July 26, 2012, Sequence # 1360.

0037: CANADA (Canadian Nuclear Safety Commission) and CHINA (PRC) (China Atomic Energy Authority) Administrative Arrangement pursuant to the Protocol to the Agreement for Cooperation in the Peaceful Uses of Nuclear Energy. Signed July 26, 2012. **Last Date in Force:** unknown (presumably for the duration of the agreement of November 7, 1994, Sequence # 1286). **Source:** CNSC Press Release 20120727; NN20120730; WNN 20120723.

Note: The Protocol and the Arrangement allow the export of Canadian uranium ore concentrates to China, and additional verification measures.

Links: See Sequence # 0036 and Sequence # 1286.

0038: CANADA (Natural Resources Canada) and CHINA (PRC) (China National Energy Administration). Memorandum of Understanding on Nuclear Energy Collaboration. Signed November 8, 2014, in force November 8, 2014. **Last Date in Force:** indefinite duration. **Source:** NRCan.

Note: This supersedes the agreement of January 20, 2005, which was renewed on January 20, 2010 and was intended to expire January 20, 2015. WNN Nov 10, 2014 reports this is an "expanded" Memorandum of Understanding.

Links: See Sequence # 0031 and the CANDU Energy agreement reported/announced November 10, 2014 (See the General Note).

0039: CANADA (Canadian Nuclear Safety Commission) and CHINA (PRC) (China National Nuclear Safety Administration). Memorandum of Understanding on Safety Cooperation. Signed August 28, 2016, in force August 28, 2016. **Last Date in Force:** unknown. **Source:** WNN 20160905; CNSC List; CNSC Press Release 20160902.

NOTE: The source also notes Sequence # 1360, which it says is to facilitate the 1994 agreement (Sequence # 1286).

0040: CANADA and CHINA (PRC). Joint Statement on Climate Change and Clean Growth. Signed December 4, 2017. **Last Date in Force:** unknown. **Source:** PRCFM 20171204.

Note: This announces a Ministerial Dialogue on Clean Energy, between PRC National Energy Administration and Natural Resources Canada, which includes nuclear. It will seek ways to expand energy trade, including uranium, and get progress in nuclear energy through Advanced Fuel CANDU reactor in China. It notes the renewal of a Memorandum of Understanding in the Field of Energy (National Energy Administration and Natural Resources Canada) in June 2017.

Links: See Sequence # 0027.

GENERAL NOTE: CANDU Energy, a division of SNC-Lavalin acquired from Atomic Energy of Canada Ltd., has the following agreements:

- An Agreement on Development of Thorium and Recycled Uranium as Alternative Fuels for New CANDU Reactors with the China National Nuclear Corporation, on August 3, 2012, for two years. NN 20120806. The source reports an agreement between CANDU Energy and three subsidiaries of China National Nuclear Corporation. The source also notes agreements among these actors in November 2008 and July 2009 (Sequences #s 0034 and 0035). It also reports this as an agreement re the development of thorium and recycled uranium as alternative fuels for new CANDU reactors. See Sequences #s 0028, 0032, 0033, 0034, 0035 for other agreements linked to advanced fuels.
- An agreement with China Nuclear Poweer Engineering Company (a China General Nuclear subsidiary), signed in July 2014, for two reactors at Cernavoda in Romania. WNN 20190509.
- An agreement with Shanghai Electric, reported/announced November 10, 2014. WNN 20141110. This apparently follows from the agreement of November 8, 2014, (Sequence # 0038).

CHILE

0041: **CHILE and CHINA (PRC).** Basic Agreement on Scientific and technical Cooperation. Signed 1980, in force October 14, 1980. **Last Date in Force:** unknown. **Source:** CCHEN Noti 2011.

Note: This is somewhat speculative: the CCHEN is the Chilean nuclear agency, Comisión Chilena de Energia Nuclear, but I have no information of nuclear content in this agreement. It may be that nuclear cooperation develops under the terms of this. INFCIRC/350 signed Sept 18, 1987, between IAEA, Chile and China (PRC) applies safeguards to a shipment of enriched UF6 supplied by China to Chile for fabrication into fuel elements.

1119: CHILE and CHINA (PRC). Agreement on Co-operation in the Peaceful Use of Nuclear Energy. Signed March 17, 1989. **Last Date in Force:** unknown. **Source:** PPNNP 6:4; EOS 3:21; 4:78; NTI PRC.

Note: This could include uranium mining, processing and metallurgy. CCHEN Noti 2011 notes a Protocol with the China National Nuclear Corporation this year, in force March 17, 1989. Could this be it, or does it follow from this?

CHINA (REPUBLIC OF – ROC) (TAIWAN)

0042: CHINA (PRC) (Association for Relations Across the Taiwan Straits) and CHINA (ROC) (Straits Exchange Foundation). Agreement on Cross-Strait Nuclear Power Safety Cooperation. Signed October 20, 2011, in force June 29, 2012. **Last Date in Force:** no specific termination provision. **Source:** NN 20111014; ROCAEC; SNF 20111025; WNN 20111021, 201111024; WNC 20111020.

Note: A Taiwan Embassy US news report (www.taiwanembassy.org/us_en/post/2567.html) indicates this came into effect on June 29, 2012. The Seventh Meeting of the Cross-Straits Economic and Cultural Forum, on May 8, 2011, called for a "tightening up" of exchanges and cooperation in nuclear safety, supporting the Association for Relations Across the Taiwan Straits and the Straits Exchange Foundation to incorporate the issue of nuclear safety in their agenda. It urged the creation of a notification mechanism about safe nuclear power generation, tighter cooperation between organizations specializing in nuclear safety, in-depth exchanges re emergency management of nuclear power incidents and improvement of safety techniques. WNC 20110511 notes that Cross-Straits meetings have been held since 2008, and notes proposals for a nuclear safety cooperation agreement.

CZECH REPUBLIC

0043: CHINA PRC and Czech Republic. Agreement on Cooperation in the Peaceful Uses of Nuclear Energy. Signed 2014. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20171128.

0044: Blank.

GENERAL NOTE: The China General Nuclear Power Corporation and CEZ signed a Declaration of Intention in Nuclear Energy and Renewable Energy on March 30, 2016. SNF 20160413. The source also reports a China General Nuclear Corporation agreement with the Czech Energy Alliance on March 29, 2016. The Czech Energy Alliance is a group of 14 Czech businesses, including CEZ (a Czech energy conglomerate), created September2015.

EGYPT

0045: CHINA (PRC) and EGYPT. Agreement Concerning a 27 Kw Subcritical Neutron Source Reactor. Signed 1985. **Last Date in Force:** unknown. **Source:** NTI China's nuclear exports, 2009.

0046: CHINA (PRC) and Egypt. Agreement Concerning a Zero-power Reactor. Signed 1991. **Last Date in Force:** unknown. **Source:** NTI China's Nuclear Exports 2009.

1911: CHINA (PRC) and EGYPT. Agreement on Peaceful Nuclear Co-operation. Signed 2001. **Last Date in Force:** unknown. **Source:** NTI: Egypt. WNC 20020124.

1912: CHINA (PRC) and EGYPT. Agreement on Co-operation in the Peaceful Use of Atomic Energy. Signed January 23, 2002. **Last Date in Force:** unknown. **Source:** WNC 20020418, 20020421; NTI Egypt.

1913: CHINA (PRC) and EGYPT. Co-operation Agreement. Signed January 23, 2003. **Last Date in Force:** unknown. **Source:** NTI Egypt. NTI Issue Brief 20061222.

Note: The Issue Brief says this apparently concerns assistance in uranium mining and possible enrichment by China.

1914: CHINA (PRC) and EGYPT. Agreement on Co-operation in Peaceful Uses of Nuclear Energy. Reported November 8, 2006. **Last Date in Force:** unknown. **Source:** NN 20061109, 20061114.

0047: CHINA (PRC) (China National Nuclear Corporation) and EGYPT (Egyptian Nuclear Safety Authority -- NPPA). Declaration of Intention to Strengthen Collaboration in the Nuclear Field. Signed end of May 2015. **Last Date in Force:** unknown. **Source:** SNF 20150603.

0048: CHINA (PRC) (China National Nuclear Corporation)) and Egypt (Nuclear Power Plant Authority). Memorandum of Understanding to Cooperate in Construction of Power Reactors. Signed between May 21 and 23, 2015. **Last Date in Force:** unknown. **Source:** WNN 20150528.

EUROPEAN UNION (including predecessors and some components, such as the European Commission and EURATOM)

0049: CHINA (PRC) and EUROPEAN UNION. Agreement for Scientific and Technical Cooperation. Signed December 22, 1998, in force December 14, 1999. **Last Date in Force:** Indefinite duration (5 years then tacit renewal). **Source:** UNTS 47953.

Note: There is no specific nuclear reference in this, so its inclusion here is speculative. It could be connected to the EU's Framework Programme, which has some possible nuclear content?

1915: CHINA (PRC) and EUROPEAN UNION (EURATOM). Agreement on Research and Development Co-operation in Peaceful Uses of Nuclear Energy. Announced December 8, 2004. **Last Date in Force:** unknown. **Source:** WNC 20041208; Gong.

Note: Gong, however, says this never came into force, and was replaced by an agreement of April 24, 2008 (Sequence # 0050). EC Energy and Euratom News report in force August 2008, but this could be the agreement of April 24, 2008. Meetings of the co-ordination committee are held on March 21, 2011 and there are various others into 2012.

Links: See Sequence # 0050.

0050: CHINA (PRC) and EUROPEAN UNION (EURATOM). Agreement for Research and Development Cooperation in the Peaceful Uses of Nuclear Energy. Signed April 24, 2008. **Last Date in Force:** unknown. **Source:** Gong.

Note: This reportedly replaces Sequence # 1915, which Gong says never came into force. EC Energy and Euratom News report an agreement in force August 2008, but this could be the agreement of April 24, 2008. Meetings of the co-ordination committee are held on March 21, 2011 and there are various others into 2012: possible Last Known Date?

Links: See Sequence # 1915.

0051: CHINA (PRC) and EUROPEAN UNION. Joint Declaration on Energy Security. Signed May 3, 2012. **Last Date in Force:** unknown. **Source:** EC Energy.

Note: This notes an intention to strengthen cooperation on nuclear safety.

0052: CHINA (PRC) and EUROPEAN UNION. China-EU 2020 Strategic Agenda for Cooperation. Signed Nov 2013. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20131123.

Note: This comes at the 16th China-EU summit. This includes reference to strengthening cooperation within ITER, a strategic bilateral partnership on fusion energy research, exchanges and cooperation in nuclear safety, the nuclear fuel cycle, nuclear emergency response, nuclear waste management and nuclear security. It also deals with pursuing a general EURATOM agreement and closer scientific cooperation in nuclear energy development.

FINLAND

1121: CHINA (PRC) and FINLAND. Nuclear Co-operation Agreement. Signed 1987. **Last Date in Force:** unknown. **Source:** Potter p.255; NTI PRC.

FRANCE

0570: CHINA (PRC) and FRANCE. Scientific and Technical Co-operation Agreement. Signed January 21, 1978; in force May 2, 1978. **Last Date in Force:** indefinite duration. **Source:** RTAF 1979/32; FrBTA 19780084; NEA Vol. II, p. 93.

Note: Agreements involving the Commissariat à l'Energie Atomique on January 15, 1979 (Sequence # 0537) and November 22, 1982 (Sequence number 0538) follow from this.

Links: See Sequences #s 0537 and 0538. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

1015: CHINA (PRC) (Minister of Foreign Trade) and FRANCE (Minister of Foreign Commerce). Long-term Agreement on the Development of Economic Relations and of Co-operation. Signed December 4, 1978; in force July 9, 1979. **Last Date in Force:** July 8, 1986. **Source:** Referenced in Sequence # 0540; UNTS 27177; FrBTA 19870175.
Note: This includes French sales in the area of nuclear electric power generation.

0537: CHINA (PRC) (Chinese Science Academy) and FRANCE (Commissariat à l'Energie Atomique). Co-operation Agreement. Signed January 15, 1979. **Last Date in Force:** unknown. **Source:** NEA Vol. II, p. 93; NTI PRC.

Note: This follows from Sequence # 0570.

Links: See Sequence # 0570. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

0538: CHINA (PRC) (Ministry of Industry) and FRANCE (Commissariat à l'Energie Atomique). Agreement on the Peaceful Use of Nuclear Energy. Signed November 22, 1982. Amended October 16, 1984. **Last Date in Force:** unknown. **Source:** NEA Vol. II, p. 93; CEA Annual Report 1984; referenced in Sequence # 0540; WNC 20030901.
Note: This follows from Sequence # 0570. The text of Sequence # 0540 gives a signature date of December 22, 1982. CAEA 20090422 and others indicate ongoing series of meetings under this, resulting in periodic protocols outlining specific projects (possible Last Known Date?). NTI PRC reports December 27 1982 as concluding a preliminary agreement. CEA News #3 Jan 2008 notes an agreement signed July 2, 2007 (Sequence # 0058) which follows from this.
Links: See Sequence # 0570, Sequence # 0058.

0941: CHINA (PRC) and FRANCE. Memorandum of Understanding. Signed May 5, 1983. **Last Date in Force:** December 10, 1989. **Source:** NEA Vol. II, p. 94. NTI PRC.

Note: This concerned the supply of nuclear power plants. It was fol-

lowed on March 12, 1986, by a letter of intent concerning two reactors.

Links: See Sequence # 0053 and Sequence # 1916.

0540: CHINA (PRC) (National Bureau of Nuclear Safety and Minister of Nuclear Industry) and FRANCE (Commissariat à l'Energie Atomique). Cooperation in Nuclear Safety. Signed December 11, 1984; in force December 11, 1984. **Last Date in Force:** December 10, 1989. **Source:** IAEA p. 73.

1916: CHINA (PRC) and FRANCE. Agreement in Principle. Signed December 13, 1985. **Last Date in Force:** unknown. **Source:** NTI PRC.

Note: China agrees in principle to buy two French power reactors.

Links: See also Sequence # 0941 and Sequence # 0053.

0053: CHINA (PRC) and FRANCE. Letter of Intent concerning two reactors. Signed March 12, 1986. **Last Date in Force:** unknown. **Source:** NTI PRC.
Links: See also Sequence # 0941, and Sequence # 1916.

1122: CHINA (PRC) (National Nuclear Safety Administration) and FRANCE (Commissariat à l'Energie Atomique, Institut de Protection et de Sûreté Nucléaire). Agreement Concerning Safety Evaluation of the Guangdong Nuclear Power Station. Signed December 1986; in force April 4, 1987. **Last Date in Force:** unknown. **Source:** CEA Annual Report 1987. NTI PRC.

Note: NTI PRC gives the date as November 1986, in force April 4, 1987.

1123: CHINA (PRC) (Ministry of Nuclear Industry) and FRANCE (Commissariat à l'Energie Atomique). Co-operation Agreement in Civil Uses of Nuclear Energy. Signed April 1987. **Last Date in Force:** unknown. **Source:** CEA Annual Report 1987; NTI PRC.

Note: Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

1917: CHINA (PRC) and FRANCE. Protocol. Reported November 25, 1994. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: This is said to promise a strengthening of co-operation in the development of nuclear technology for peaceful purposes and a sharing of research findings regarding Pressurized Water Reactors fast neutron reactors and waste disposal.

Links: Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

0054: CHINA (PRC) (National Nuclear Safety Administration) and FRANCE (Autorité de Sûreté Nucléaire) Agreement on Cooperation in Nuclear Safety and Radioprotection. Signed 1995, renewed February 18, 2008. **Last Date in Force:**

unknown. **Source:** ASN Lettre #34, October 2013; ASN Press Release 20080226; ASN Annual Report 2008; PRCNNSA Calendar.

Note: A meeting under this takes place September 24-25, 2013, thus a possible Last Known Date.

1671: CHINA (PRC) (National Natural Science Foundation) and FRANCE (Commissariat à l'Energie Atomique). Agreement. Signed April 1997. **Last Date in Force:** unknown. **Source:** CEA Annual Report 1997.

Links: Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

1672: CHINA (PRC) (China National Nuclear Corporation) and FRANCE (Commissariat à l'Energie Atomique). Sixth Co-operation Protocol. Signed April 1997. **Last Date in Force:** unknown. **Source:** CEA Annual Report 1997.

Note: See also the agreement of July 2000, sequence number 1673. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

Links: See Sequence # 1673.

1471: CHINA (PRC) and FRANCE. Co-operation Agreement on the Development of the Peaceful Uses of Nuclear Energy. Signed May 15, 1997; in force January 20, 1998. **Last Date in Force:** indefinite duration. **Source:** NLB 62:81-82; RTAF 1998/32; Base Pacte; UNTS 36270; FrBTA 19970102.
Links: See Sequence # 0059.

1673: CHINA (PRC) (China Atomic Energy Agency) and FRANCE (Commissariat à l'Energie Atomique). Co-operation Protocol. Signed July 2000. **Last Date in Force:** 2003. **Source:** CEA Annual Report 2000.

Note: This is apparently the seventh such protocol. See also the agreement of April 1997(?), sequence number 1672. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

Links: See Sequence # 1672.

0055: CHINA (PRC) (Ministry of Science and Technology) and FRANCE (Commisariat à l'Energie Atomique). Agreement. Signed January 2004. **Last Date in Force:** unknown. **Source:** CEA Bilat.

Note: This includes magnetic confinement fusion. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

0056: CHINA (PRC) (Nuclear and Radiation Safety Center) and FRANCE (Institute de Radioprotection et de Sûreté Nucléaire). Agreement on Cooperation in Nuclear Safety and Radioprotection. Signed April 2007. **Last Date in Force:** unknown. **Source:** PRCNSC; PRCNNSA.
Note: PRCNNSA reports an agreement of China National Nuclear Safety Administration and France IRSN signed April 2007 on cooperation in nuclear safety and radioprotection – same thing?

0057: China PRC (Commission for Science, Technology and Industry for National Defence, and China Atomic Energy Authority) and France (Commissariat à l'Energie Atomique). Ninth Protocol on Cooperation in the Field of Civil Application of Nuclear Power. Reported/announced June 2007. **Last Date in Force:** unknown. **Source:** CEA News # 1, June 2007:

Note: Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies.

0058: CHINA (PRC) (China Atomic Energy Authority) and FRANCE (Commissariat à l'Energie Atomique). Agreement on Education, Training and Teaching. Signed July 2, 2007. **Last Date in Force:** three years duration. **Source:** CEA News #3, January. 2008.

Links: This comes under Sequence # 0538. Note that the Commissariat à l'Energie Atomique signs a number of Protocols with various Chinese agencies.

0059: CHINA (PRC) and FRANCE. Implementing Arrangement for the Agreement of May 15, 1997 Regarding the Development of the Peaceful Uses of Nuclear Energy. Signed November 26, 2007. **Last Date in Force:** indefinite duration – or for duration of Sequence # 1471. **Source:** NTI France; NTI PRC; IEAD # 7970. FrBTA 20070178**.**
Note: This implements Sequence # 1471.
Links: See Sequence # 1471. NN 20080818 suggests that this agreement might lead to the agreement announced on August 10, 2008 between the China Guangdong Nuclear Power Corporation and Electricité de France. See the General Note.

0060: CHINA (PRC) (National Nuclear Safety Administration) and FRANCE (Autorité de Sûreté Nucléaire) Agreement on Cooperation regarding the European Pressurized Water Reactor. Signed February 18, 2008. **Last Date in Force:** unknown. **Source:** ASN Annual Reports 2008, 2011, 2012; ASN Press Release 20080226; PRCNNSA Calendar.

Note: ASN Annual Report 2011 and 2012 report on meetings regarding this in 2011 and 2012. Possible Last Known Date.

0061: CHINA PRC (China Atomic Energy Authority) and France (Commissariat à l'Energie Atomique). Cooperation agreement. Signed April 21, 2009. **Last Date in Force:** 3 years duration. **Source:** WNC 20090421.
Note: It includes waste, fusion, and training. The source says this is the tenth such agreement, the first being signed in November 1982 (Sequence # 0538).

Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies

0062: **CHINA (PRC) (China National Nuclear Corporation?) and FRANCE (Commissariat à l'Energie Atomique).** Agreement. Signed December 2009. **Last Date in Force:** unknown. **Source:** CEA News #12, Spring 2010.

Note: This creates the Franco-Chinese Nuclear Energy Institute, which is to strengthen existing cooperation with the China National Nuclear Corporation. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies

0063: **CHINA (PRC) (China National Nuclear Corporation) and FRANCE (Agence nationale pour la gestion des déschets radioactifs – ANDRA)** Cooperation Agreement on Management of Radioactive Waste. Signed September 2012. **Last Date in Force:** unknown. **Source:** ANDRA Annual Report 2012.
Note: This covers research and studies on geological storage.

0064: **CHINA (PRC) and France.** Joint Statement. Reported/announced March 27, 2014. **Last Date in Force:** unknown. **Source:** WNN20140327.
Note: This encourages stakeholders to advance cooperation efforts in nuclear areas.

0065: **CHINA (PRC) and France.** Joint Statement. Signed July 1, 2015. **Last Date in Force:** unknown. **Source:** NN 20150702.
Note: This concerns deepening nuclear cooperation.

0066: **CHINA (PRC) and FRANCE.** Joint Statement. Signed February 21, 2017. **Last Date in Force:** unknown. **Source:** NN 20170223.
Note: This concerns deepening nuclear cooperation.

0067: **CHINA (PRC) (China General Nuclear) and France (Commissariat à l'Energie Atomique).** Agreement. Signed Jan 9, 2018. **Last Date in Force:** unknown. **Source:** WNN 20180110.

Note: This concerns cooperation in nuclear technology, advanced fuels and materials, fuel cycle supply chain, reactor life management, and design of Gen IV reactor. Note that the Commissariat à l'Energie Atomique signs a number of protocols with various Chinese agencies

GENERAL NOTE: The French firm AREVA had the following agreements:

- An Agreement concerning Technical Assistance for Phase 2 of the Ling Ao Nuclear Power Plant, with the China Guangdong Nuclear Power Corporation, on June 11, 2004. SNF 20040610.
- An Agreement regarding Two Reactors at Qinshan, with the China National Nuclear Corporation, on June 11, 2004. SNF 20040610.
- A Contract regarding the Construction of Two EPR Reactors, with the China Guangdong Nuclear Power Corporation at the end of November 2007. SNF 20081019.
- An Agreement with the China National Nuclear Corporation, in November 2007. WNN 20180110. The source reports this is an agreement to assess the feasibility of construction of a Reprocessing Plant in China. See also the

AREVA - China National Nuclear Corporation agreement reported/announced January 10, 2018.

- An Agreement in regard to the China Guangdong Nuclear Power Corporation Increasing its Share in UraMin, a Mining Firm owned by AREVA, at the start of October 2008. SNF 20081019.
- An Agreement regarding the Creation of a Joint Enterprise for Engineering etc. for Reactors, with the China Guangdong Nuclear Power Corporation, at the start of October 2008. SNF 20081019.
- An Agreement on Collaboration in Nuclear Safety and Operational Excellence, with the China National Nuclear Corporation, reported/announced November 7, 2011. WNN 20111107.
- A Letter of Intent on Reprocessing Spent Chinese Fuel, with the China National Nuclear Corporation, on April 25, 2013. WNN 20130426. See the agreement reported/announced March 27, 2014 between AREVA and China National Nuclear Corporation (not the safety agreement, apparently?).
- A Letter of Intent on Front-End Fuel Cycle Services (Zirconium Facility), with the China National Nuclear Corporation, reported/announced December 9, 2013. WNN 20131209.
- An Agreement with the China National Nuclear Corporation, reported/announced March 27, 2014. WNN20140327. This follows from the AREVA-China National Nuclear Corporation agreement of April 25, 2013.
- An Agreement on Safety Instrumentation and Control Systems, with the China National Nuclear Corporation, reported/announced March 27, 2014. WNN 20140327. This appears to be separate from the other AREVA-China National Nuclear Corporation agreement reported/announced on March 27, 2014.
- A Memorandum of Understanding on Spent Fuel Reprocessing and Recycling Facility with the China National Nuclear Corporation on June 30, 2015. WNN 20150721.
- An Agreement on Fuel Cycle Cooperation with the China National Nuclear Corporation on June 30, 2015. WNN 20150721**.** This covers extraction and conversion of uranium, fabrication of zirconium fuel assemblies, decommissioning, transportation, recycling.
- A Memorandum of Understanding on Nuclear Transport and Logistics Services with the China National Nuclear Corporation reported/announced January 30, 2015. WNN 20150130.
- A Memorandum of Commercial Agreement on Construction of a Reprocessing Plant in China, with the China National Nuclear Corporation, reported/announced January 10, 2018. WNN 20180110. See the AREVA - China National Nuclear Corporation agreement reported signed in November 2007 to assess the feasibility of this.

The French firm FRAMATOM signed a Protocol with the China National Nuclear Corporation, reported/announced January 11, 2018. WNN 20180111. This covers the development of global strategic cooperation and renews for 10 years an agreement (unknown date) for the supply of fuel components.

The French firms AREVA and Electricité de France signed the following agreements:

- An Agreement on Power Reactor Cooperation with the China National Nuclear Corporation on June 30, 2015. WNN 20150721**.**
- A Letter of Intent on a Long-Term Partnership in Medium and High Power Reactors with the China National Nuclear Corporation on June 30, 2015. WNN 20150721.

The French Firm Electricité de France signed an Agreement with the China Guangdong Nuclear Power Corporation, reported/announced August 10, 2008. NN 20080818**.** The source suggests that the implementing arrangement of November 26, 2007, Sequence # 0059. It concerns investment in and operation of two reactors.

GERMAN DEMOCRATIC REUBLIC (GDR)

0068: CHINA (PRC) (State Office for Nuclear Safety) and GERMAN DEMOCRATIC REUBLIC (State Office for Atomic Safety and Radiation Protection). Protocol on Cooperation in the Field of Nuclear Safety. Signed October 28, 1988. **Last Date in Force:** Terminated by exchange of notes Nov 27, 1991.**Source:** FRGB 1992: 64.

Note: The German Democratic Republic ceased to exist as of October 3, 1990.

0069: BLANK.

GENERAL NOTE: The German Democratic Republic and China (PRC) also had a number of technical and scientific cooperation agreements. I do not know what their content was.

GERMANY (FEDERAL REPUBLIC)

0070: CHINA (PRC) and GERMANY (FEDERAL REPUBLIC). Agreement on Scientific-Technical Cooperation. Signed Ocobert 9, 1978, in force November 10, 1978. **Last Date in Force:** November 9, 1988. **Source:** Bfs List 2014; FRGB 1978: 1526.

Note: This shows up in the Bundesamt für Strahlenschtuz (Federal Office for Radiation Protection) list of bilateral agreements in the field of nuclear safety and radiation protection (Bfs list 2014).

0291: CHINA (PRC) and GERMANY (FEDERAL REPUBLIC). Co-operation Concerning Peaceful Uses of Nuclear Energy. Signed May 9, 1984; in force May 9, 1984. **Last Date in Force:** May 8, 2004. **Source:** UNTS 23388; FRGB 1984: 554; ILM 25:369; Bfs list 2014; NTI PRC.
Note: NTI PRC gives date as May 1, 1984.
Links: See Sequence # 1126.

1124: CHINA (PRC) and GERMANY (FEDERAL REPUBLIC). Scientific and Technical Co-operation and Nuclear Co-operation Agreement. Signed April 11, 1986. **Last Date in Force:** unknown. **Source:** FoF 1986: 365; NTI PRC.

1918: CHINA (PRC) and GERMANY (FEDERAL REPUBLIC). Agreement. Signed 1987. **Last Known Date:** unknown. **Source:** NTI PRC.

1125: CHINA (PRC) and GERMANY (FEDERAL REPUBLIC). Nuclear Co-operation Agreement. Signed January 1989. **Last Date in Force:** unknown. **Source:** EOS 1:40; NTI PRC.

Note: This is reported to include the construction of a 10 MW high temperature gas-cooled reactor and an intent to build a 300 MW high temperature reactor. The report states that this marks 10 years of research and technical co-operation.

1126: CHINA (PRC) (National Nuclear Safety Administration) and GERMANY (FEDERAL REPUBLIC) (Federal Environment Minister). Co-operation Agreement on Radiation Protection and Nuclear Safety. Signed April 12, 1992; in force June 14, 1993? **Last Date in Force:** indefinite duration. **Source:** FBIS-WEU 19920413; NLB 51:85 and 52:77; FRGB 1993: 1266; Bfs list 2014.
Note: This arises within the co-operation agreement of May 8, 1984, sequence number 0291.
Links: See Sequence # 0291.

0072: CHINA (PRC) (National Nuclear Safety Administration) and GERMANY (FEDRAL REPUBLIC) (Gesellschaft für Anlagen- und Reaktorsicherheit – GRS). Agreement on Cooperation and Information Exchange in the Field of Nuclear Safety. Signed July 15, 1998. **Last Date in Force:** unknown. **Source:** GRS Annual Report 2008.

Note: The Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) is a state-owned company, specializing in safety and waste management. Based on the GRS 2008 Annual Report, the Last Known Date for this is 2008

0073: BLANK

GHANA

0074: **CHINA (PRC) and GHANA.** Supply Agreement for the Purchase of a 30 Kw Neutron Source Research Reactor and Supply of HEU. Signed October 14, 1994. **Last Date in Force:** unknown. **Source:** IAEA CNPP 2016 (Ghana update 2012).

Note: This agreement was "facilitated" by the IAEA. Based on the IAEA CNPP 2016 Ghana entry, the Last Known Date for this is 2012.

HUNGARY

0075: CHINA (PRC) (China National Energy Administration) and HUNGARY (Minister of National Development). Declaration of Intention to Collaborate on R&D and Training in the Nuclear Field. Signed May 16, 2015. **Last Date in Force:** unknown. **Source:** SNF 20150608.

Note: This looks forward to cooperation in construction, operations of nuclear power plants, and waste treatment.

0076: CHINA (PRC) (China National Energy Administration) and Hungary (National Development Ministry). Memorandum of Understanding on Cooperation in Education and Research in the Nuclear Power Sector. Signed May 26, 2015. **Last Date in Force:** unknown. **Source:** WNN 20150528; Hu Min Nat Dev 20150527; PRCFM Comm 20171128.

Note: This covers training, dissemination of information, and research and development in nuclear science and industry.

INDIA

1472: CHINA (PRC) (China Nuclear Energy Industry Corporation) and INDIA (Department of Atomic Energy). Contract for Fuel for Tarapur. First shipment reported January 5, 1995. **Last Date in Force:** unknown. **Source:** CR 32:2:194. FBIS-NES-95-003, 19950105, FBIS-NES-95-004, 19950106, FBIS-NES-95-006, 19950110, FBIS-NES-95-009, 19950113, FBIS-NES-013, 19950120, FBIS-NES-95-038, 19950227; YK 6:3; IMEA, *Foreign Affairs Record*, January 1995. NTI PRC.

Note: This apparently replaces the supply of French fuel to the Tarapur reactor under the France-India agreement, sequence # 0640. See Sequence # 0071 (currently – this should get a new #?) for the original supply by the US.

0077: CHINA (PRC) and INDIA. Report of the India-China Joint Study Group on Comprehensive Trade and Economic Cooperation. Signed April 11, 2005. **Last Date in Force:** unknown. **Source:** IMEA Bilateral Documents 20050411.

Note: This notes possibilities for nuclear cooperation. The Study Group was itself set up by the Declaration on Principles for Relations and Comprehensive Cooperation, June 23, 2003. IMEA Bilateral Documents 20030623.

0078: CHINA (PRC) and INDIA. Statement: A Shared Vision for the 21st Century. Signed January 14, 2008. **Last Date in Force:** unknown. **Source:** ITDB.

Note: This includes a reference to the promotion of bilateral civil nuclear cooperation.

0079: CHINA (PRC) and INDIA. Joint Statement. Signed May 20, 2013. **Last Date in Force:** unknown. **Source:** *New India Express* 20130521.

Note: This includes a reference to nuclear power cooperation.

0080: CHINA (PRC) and INDIA. Joint Statement on Building a Closer Developmental Partnership. Signed September 19, 2014. **Last Date in Force:** unknown. **Source:** IMEA Bilateral Documents 20140919.

Note: This includes a reference to nuclear cooperation.

0081: CHINA (PRC) and India. Joint Statement. Signed May 15, 2015. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20150520; IMEA Bilateral Documents 20150515.

Note: Includes cooperation in civil nuclear energy as one area for initiation and expansion of cooperation, under the China-India Closer Developmental Partnership.

INDONESIA

0082: CHINA (PRC) and INDONESIA. Report dated September 18, 1965 regarding a meeting with the Atomic Energy Group of the Indonesian Economic Delegation. **Last Date in Force:** not relevant. **Source.** Wilson Archive Record # 119295.

Note: Subsequent meetings are reported in Wilson Archive Record #s 121565 (September 20, 1965), 121566 (September 21, 1965), 121567 (September 23, 1965), 121568 (September 25, 1965), 121569 (September 25, 1965) and in Record # 118047 (September 30, 1965, this last being a meeting between Mao Tse-tung and the Indonesian delegation. The Indonesians requested and got some visits to nuclear-related sites and facilities, and proposed long-term nuclear cooperation. It is not clear whether this visit was in association with an existing cooperation agreement of any kind.

1127: CHINA (PRC) and INDONESIA. Nuclear Co-operation Agreement. Signed 1985**. Last Date in Force:** unknown. **Source:** Potter p. 255; NTI PRC.

Note: This appears to be a training agreement.

0083: CHINA (PRC) and INDONESIA. Joint Declaration on Strategic Partnership. Signed April 25, 2005; in force April 25, 2005. **Last Date in Force:** March 3, 2007. **Source:** IndoTD.

Note: This includes expanding the March 24, 2002 (in force March 24, 2002) Memorandum of Understanding on the Establishment of the Energy Forum to include nuclear energy. The March 24, 2002 Memorandum terminates March 23, 2007.

0084: CHINA (PRC) and Indonesia. Joint Statement on Strengthening Comprehensive Strategic Partnership. Signed March 26, 2015. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20150327.

Note: This states the intent to work for an early signing of a nuclear cooperation agreement. It includes also advancing cooperation under the Joint Committee on Science and Technology, including on nuclear power technologies.

0085: BLANK

GENERAL NOTE: The China Nuclear Engineering Corporation and Indonesia's National Atomic Energy Agency (BATAN) sign an Agreement on the Development of High-Temperature Gas-cooled Reactors on August 1, 2016. SNF 20160811; WNN 20160804 and 20170317.

IRAN

1919: CHINA (PRC) and IRAN. Nuclear Co-operation Agreement. Signed 1985. **Last Date in Force:** unknown. **Source:** Potter p. 255; WNC 19951217; NTI PRC. Note:

Note: NTI: PRC notes a 1985 agreement on a reactor and reactor sites, but notes that it was "not officially recognized by the Chinese government." Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

1920: CHINA (PRC) and IRAN. Agreement. Signed mid-1987. **Last Date in Force:** unknown. **Source:** CIA ME-SA p. 28.

Note: This is reported to include "scientific exchanges and the eventual purchase from China of miniature neutron source reactors and a heavy-water research reactor." WNC 19951217 suggests an agreement for the construction of 3 different facilities. CIA Acquisitions 1997 reports 2 Chinese projects (a research reactor and a zirconium production facility) would be completed but any new cooperation was suspended in 1997. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Link: See Sequence # 1921.

1921: CHINA (PRC) and IRAN. Agreement. Signed 1989. **Last Date in Force:** unknown. **Source:** NTI PRC; AYIL 1992.

Note: This supposedly concerns the transfer of nuclear technology to Iran. This may be a commercial contract related to supply of a cauldron and a miniature reactor. It may be used for medical as well as research purposes? NTI PRC reports cancellation on October 1, 1992 of an agreement for a 20 MWe reactor. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: See Sequence # 1920 and Sequence # 0090.

1128: CHINA (PRC) (Nuclear Industry Organization) and IRAN (Atomic Energy Commission). Supply of Small Research Reactor. Reported/announced June 1990. **Last Date in Force: unknown. Source:** EOS 3:9; AYIL 1992; NTI Iran

Note: NTI PRC reports cancellation on October 1, 1992 of an agreement for a 20 MWe reactor. Supposedly all future PRC-Iran nuclear

cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: Sequences #s 1920 and 1921?

0086: CHINA (PRC) and IRAN. Agreement on Scientific Cooperation and Transfer of Military Technology. Signed 1990. **Last Date in Force:** unknown, but reportedly for ten years. **Source:** NTI China's nuclear exports 2009.

Note: This includes nuclear scientific cooperation. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

1922: CHINA (PRC) and IRAN. Agreement. Signed 1991. **Last Date in Force:** unknown. **Source:** NTI PRC; IAEA-CNNP Iran 2002. AYIL 1992, 1995;

Note: This is about the supply of nuclear technology to Iran. IAEA-CNNP Iran 2002 notes an agreement in 1991 with China for the supply of two 300 MW PWRs, confirmed in 1993, but "never realized." This may be a commercial contract related to supply of a cauldron and a miniature reactor. NTI PRC reports cancellation on October 1, 1992 of an agreement for a 20 MWe reactor. AYIL 1995 says there were difficulties in implementing the agreement, stated by a Chinese official May 1995. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: See also Sequences #s 1920, 1921, 1924, 1926 and Sequences #s 0088, 0089 and 0090.

1923: CHINA (PRC) and IRAN. Agreement. Signed 1992. **Last Date in Force:** unknown. **Source:** NTI PRC; WNC 19951217.

Note: This is supposedly about the supply of various equipment to Iran, including electromagnetic uranium enrichment technology. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: See Sequences #s 1921, 1922 (Note), and Sequence # 0090.

1924: CHINA (PRC) and IRAN. Nuclear Co-operation Agreement. Signed September 1992. **Last Date in Force:** unknown. **Source:** NTI Iran; AYIL 1993; NTI PRC.

Note: This includes joint work on nuclear power plants, uranium exploration and extraction, and radiation safeguards. It is reported to have been ratified by Iran on April 13, 1993. NTI PRC gives a signature date of September 10, 1992, and says it includes two 300 MW reactors

and co-operation in exploring for and mining uranium. Netiran 19930413 reports ratification by the Iranian Parliament. NTI PRC reports "finalization" of a 1992 agreement regarding 2 300-MWe reactors, May 16, 1995 (Sequence # 0088), but supposedly this was suspended by September 1995 and cancelled by a US-PRC letter (PRC For Minister to US Sec of State Oct 29, 1997). Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: See also Sequences #s 1922, 1926.

0087: CHINA (PRC) and Iran. Agreement on Fusion Cooperation. Signed February 1993. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: The source reports (February 17, 1995) the transfer of a Tokamak fusion reactor from the Chinese Academy of Sciences to Azad University. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

1926: CHINA (PRC) and IRAN. Reactor Agreement. Possibly signed February 16 or 21, 1993. Announced July 4, 1994. **Last Date in Force:** unknown. **Source:** NTI Iran. Wisc. China; AYIL 1995, 1996. Wisc. Iran;
Note: This is for a 300 MW reactor near Tehran? Wisc. Iran reports a 1994 China National Nuclear Corporation contract for 2 x 300 MWe reactors, and a January 1997 Chinese cancellation (See Sequence # 0088). AYIL 1996 notes a report in September 1995 that the agreement would be canceled. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: See Sequences #s 1922, 1924 and Sequences #s 0088 and 0089. Is this an overlap with these or a follow-on?

1925: CHINA (PRC) and IRAN. Agreement. Signed July 6, 1993. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: This may be a protocol covering co-operation in many areas, including the construction of a nuclear power station in China. NTI PRC reports an agreement re 2 300-MWe reactors on July 4, 1993. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.
Links: See Sequences #s 1922, 1924 (Note), 1926 (Note), Sequences #s 0088 and 0089.

0088: CHINA (PRC) (China National Nuclear Corporation) and IRAN. Contract for 2 x 300 MWe Reactors. 1994. **Last Date in Force:** January 1997. **Source:** Wisc. Iran.

Note: The source reports a January 1997 cancellation. See the Note for Sequence # 1926.

Links: See Sequences #s 1922, 1924 (Note), 1926 (Note), Sequence 0089.

0089: CHINA (PRC) and Iran: Agreement on two 300 MWe Nuclear Reactors. Signed May 16, 1995. **Last Date in Force:** unknown. **Source:** NTI China Nuclear Exports 2009.

Note: NTI PRC reports "finalization" of a 1992 agreement regarding 2 300-MWe reactors, May 16, 1995 but supposedly this was suspended by September 1995 and cancelled by a US-PRC letter (PRC For Minister to US Sec of State Oct 29, 1997).

Links: See Sequences #s 1922, 1924 (Note), 1926 (Note), Sequence 0088.

0090: CHINA (PRC) and Iran. Calutron System for Enriching Uranium. Signed September 1995. **Last Date in Force:** unknown. **Source:** NTI December 7, 2010.

Note: I cannot confirm this source. I am looking for others. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

Links: See Sequences #s 1921, 1922, 1923.

0091: CHINA (PRC) and Iran. Agreement to sell Iran a Uranium Hexafluoride Conversion Plant. Signed October 15, 1995. **Last Date in Force:** unknown. **Source:** NTI China Nuclear Exports 2009.

Note: NTI PRC: reports that the UF_6 facility was reportedly canceled by September 18, 1997. Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

1927: CHINA (PRC) and IRAN. Uranium Exploration Agreement. Signed April 18, 1996. **Last Date in Force:** unknown. **Source:** NTI Iran.

Note: Supposedly all future PRC-Iran nuclear cooperation was cancelled at a US-PRC summit in 1997. Irantracker reports a Chinese commitment to end official nuclear cooperation with Iran in 1997, but says some contacts continue with Chinese entities.

0092: CHINA (PRC) and IRAN. Agreement on Nuclear Energy Cooperation. Signed June 14, 2011. **Last Date in Force:** unknown. **Source:** WNC 20110617.

Note: The source for this report is from North Korea. It gives no details.

0093: CHINA (PRC) and Iran. Agreement. Reported/announced July 23, 2015. **Last Date in Force:** unknown. **Source:** NN 20150723.

Note: This is regarding building two nuclear power plants.

0094: CHINA (PRC) (China National Nuclear Corporation) and IRAN (Atomic Energy Organization of Iran). Agreement on Re-equipping the Arak IR-40 Reactor and Construction of AC1000 (?) Reactors. Reported/announced September 8, 2015. **Last Date in Force:** unknown. **Source:** SNF 20150908.

Note: Proliferation News 20150827 reports that a memorandum of understanding regarding the Arak reactor is to be signed.

Links: See Sequence # 0095.

0095: CHINA (PRC) (China National Nuclear Corporation) and IRAN (Atomic Energy Organization of Iran). Contract for Re-equipping the Arak IR-40 reactor. Signed April 23, 2017. **Last Date in Force:** unknown. **Source:** SNF 20170502; WNN 20170424; Fin Trib 20170424; CNNC Press Release 20170426.

Note: The CNNC Press Release reports an agreement with two of its subsidiaries on the retrofit of the Arak IR-40 reactor. Fin Trib 20170424 also reports a US-China-Iran joint statement of intent, released October 8, 2015, re this project and the signing soon after of a relevant document.

Links: See Sequence # 0094.

ITALY

0541: CHINA (PRC) (Second Ministry of Machine Building – SMMB) and ITALY (Comitato Nazionale per l'Energia – CNEN). Agreement on Scientific and Technical Co-operation for Peaceful Uses of Nuclear Energy. Signed May 19, 1980. Program for 1980-81, May 19, 1980. **Last Date in Force:** unknown. **Source:** FBIS-PRC 19800520; NTI PRC; referenced in the agreement of 1987, Sequence #1033.

Note: The reference in Sequence # 1033 could be taken as a Last Known Date.

Links: See Sequence # 1033.

1129: CHINA (PRC) and ITALY. Nuclear Co-operation Agreement. Signed 1984. **Last Date in Force:** unknown. **Source:** Potter p. 255; NTI PRC.

1033: CHINA (PRC) (National Nuclear Safety Administration) and ITALY (Comitato Nazionale per la Ricerca e per lo Sviluppo dell'Energia Nucleare e delle Energie Alternative). Agreement on the Exchange of Nuclear Safety Information. Signed 1987; in force 1987. **Last Date in Force:** 1992. **Source:** IAEA p. 80. NTI PRC.

0096: CHINA (PRC) and ITALY. Declaration of Intent on Scientific and Technological Cooperation. Signed November 7, 2008. **Last Date in Force:** unknown. **Source:** WNC 20081107.

Note: This is pure speculation on my part. It is not clear if there is any nuclear content.

0097: CHINA PRC (China General Nuclear) and Italy (SOGIN – Societa Gestione Impianti Nucleari). Agreement on Cooperation in Managing Radioactive Waste and Decommissioning of Nuclear Facilities. Signed June 11, 2014. **Last Date in Force:** unknown. **Source:** WNN 20140612; NucNet No. 184, 20140612**.**

Note: This will see SOGIN cooperate with a China General Nuclear subsidiary (China Nuclear Power Engineering Company). NucNet No. 184, 20140612 also reports this, as a Memorandum of Understanding on decommissioning, spent fuel and radioactive waste management. SOGIN is a state-owned company specializing in nuclear site decommissioning and radioactive waste management. It appears to sell services widely. CGN operates 4 nuclear power stations with 10 reactors. I believe China General Nuclear was formerly China Guangdong Nuclear Power Corporation.

GENERAL NOTE: The Italian firm Ente Nazionale per l'Energia Elettrica (ENEL), established as a public agency in 1962, became a limited company in 1992 and privatized in 1999, has an Agreement for the Exchange of Information in the Nuclear Field, with the China National Nuclear Corporation, reported/announced June 30, 2014. SNF 20140630. This is for the design, construction, operation and maintenance of nuclear power plants.

JAPAN

0098: CHINA (PRC) and JAPAN. Agreement on Natural Uranium. Reported/announced January 20, 1983. **Last Date in Force:** unknown. **Source:** Wilson Archive Record # 116893.

Note: Reportedly for 30 tons of natural uranium.

1928: CHINA (PRC) and JAPAN. "Partial" Nuclear Co-operation Agreement. Announced March 2, 1984. **Last Date in Force:** unknown**. Source:** NTI PRC.

Note: This permits the export of pressure vessel components from Japan to China.

0542: CHINA (PRC) and JAPAN. Agreement for Cooperation in the Peaceful Uses of Nuclear Energy. Signed July 31, 1985; in force July 10, 1986. **Last Date in Force:** indefinite duration. **Source:** NLB 36: 41; NEA Vol. II, p. 171; JAIL 30: 225; UNTS 24577; NTI PRC.

Links: See also Sequence #1373.

1929: CHINA (PRC) and JAPAN. Nuclear Cooperation Agreement. Signed September 1989. **Last Date in Force:** unknown. **Source:** NTI PRC.

Note: This covers power reactor design, nuclear medicine, environmental protection and radioactive waste management.

1373: CHINA (PRC) (National Nuclear Safety Administration) and JAPAN (Nuclear Safety Bureau of the Science and Technology Agency). Nuclear Safety Cooperation Agreement. Signed May 3, 1994. **Last Date in Force:** unknown. **Source:** NPR 2:1:130. FBIS-CHI-94-085 19940503; CR 31:2:293; NTI PRC.

Note: This is in conjunction with the agreement of July 31, 1985, Sequence number 0542.

Links: See Sequence # 0542.

1674: CHINA (PRC) (China National Nuclear Corporation) and JAPAN (Japan Atomic Energy Research Institute). Peaceful Uses of Nuclear Energy. Renewed 1998-99. Termination: 1999. Source: JAERI Annual Report 1998-99.

0099: CHINA (PRC) (Chinese Academy of Science Institute of Energy Physics) and JAPAN (Japan Atomic Energy Research Institute). Memorandum of Understanding on Ultrashort Pulse High Intensity Lasers. Signed FY 2004. **Last Date in Force:** unknown. **Source:** JAERI Annual Report 2004-2005.

Note: This is speculative.

0100: CHINA (PRC) (Nuclear and Radiation Safety Center) and JAPAN (Japan Nuclear Energy Safety Organization). Agreement on Nuclear Safety Technical Cooperation. Signed 2005. **Last Date in Force:** unknown. **Source:** PRCNNSA; PRCNSC.

Note: The JNESO is an independent administrative agency providing technical support to the Japanese nuclear regulatory authority.

1930: CHINA (PRC) (Institute of Plasma Physics) and JAPAN (Japan Atomic Energy Agency). Agreement on Co-operation in Fusion Energy Research

and Development. Signed January 2007. **Last Date in Force:** unknown. **Source:** JAEA News 20070417.

0101: CHINA (PRC) and Japan. Joint Press Communique. Signed April 2007. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20070411.
Note: This includes a reference to nuclear energy cooperation.

0102: CHINA (PRC) and Japan. CHINA (PRC)-Japan Communique. Signed May 8, 2008. **Last Date in Force:** unknown. **Source:** WNC 20080508, 20080510.
Note: This reports an agreement to "strengthen" cooperation in nuclear energy. The text of the communique is in WNC 20080510.

0103: CHINA (PRC) (Chinese Academy of Science Institute of High Energy Physics) and JAPAN (Japan-Proton Accelerator Research Complex – J-PARC). Implementation of Cooperative Program in the Field of Spallation Neutron Source Development. Signed May 29, 2008. **Last Date in Force:** unknown. **Source:** JAEA News 20080530.

0104: CHINA (PRC) (China Nuclear Energy Association) and JAPAN (Japan Atomic Energy Forum). Agreement on Cooperation in the Peaceful Use of Nuclear Energy. Signed November 26, 2009. **Last Date in Force:** unknown. **Source:** SNF 20091213.

0105: CHINA (PRC) (Ministry of Environmental Protection) and Japan (Ministry of Environment). Agreement to Create a Dialogue Mechanism on Nuclear Safety. Reported/announced May 4, 2012. **Last Date in Force:** unknown. **Source:** NN 20120507, 20160609.

JORDAN

0106: CHINA (PRC) and JORDAN (Jordan Atomic Energy Commission). Framework Agreement on Nuclear Cooperation. Signed August 19, 2008. **Last Date in Force:** unknown. **Source:** SNF 20080826, 20081124. 20081207; *Jerusalem Post*, 20081125; WNN 20080820; NLB 82: 199; WISE; NucNet No. 66, 20080820; YNN 20080822; IAEA CNPP 2016 (Jordan); WNC 20080819; NTI China chronology 2008-9; NN 20081126; NTI PRC.

Note: This creates a legal framework for nuclear cooperation. It is variously reported in these sources to include desalination; basic and applied research; nuclear plant design, construction and operation; mineral exploration and processing; uranium enrichment; training; construction of research reactors. SNF 20080826 reports what seems to be a preliminary agreement signed Aug 19, 2008, on the design, construction and operation of nuclear power plants, uranium mining etc. It is not clear whether these are two separate agreements, the same one or what.

Links: See the agreement with the Jordan University of Science and Engineering reported/announced December 17, 2008 (see the General Note). This is said to follow from an August 19, 2008 agreement. See also Sequences #s 0108 and 0109..

0107: CHINA (PRC) (China National Nuclear Corporation) and JORDAN (Jordan Atomic Energy Commission). Cooperation Protocol on Peaceful Use of Nuclear Energy. Signed September 17, 2008. **Last Date in Force:** unknown. **Source:** CNNC News Sept.26, 2008.

0108: CHINA (PRC) (China National Nuclear Corporation) and JORDAN (Jordan Atomic Energy Commission). Executive Agreement on Cooperation in Nuclear Energy. Signed November 24, 2008. **Last Date in Force:** unknown. **Source:** CNNC News 20081212; NN 20081126; WNC 20081125; WISE; NTISGN 20081126; YYN 20081128.

Note: This is a protocol to the August 19, 2008 agreement, focusing on mining, enrichment, training and research.

Links: See Sequence # 0106.

0109: CHINA (PRC) and Jordan. Agreement on a Sub-critical Assembly. Signed November 24, 2008. **Last Date in Force:** unknown. **Source:** WNC 20081125; NLB 82: 200; NN 20081126. NTISGN 20081126.

Note: This is supposed to follow from the agreement of August 19, 2008. It is for the supply of a sub-critical assembly to Jordan University of Science and Technology. SNF 20081217 reports that it includes training for engineers and scientists.

Links: See Sequence # 0106.

0110: CHINA (PRC) and JORDAN. Agreement. Signed January 2009. **Last Date in Force:** unknown. **Source:** NN 20090226.

Note: This is reportedly to develop uranium mines and possibly build a reactor.

GENERAL NOTE: The Jordan University of Science and Engineering signed an Agreement cooperation in the design, construction and operation of nuclear power plants, desalination, training and research, and uranium mining with China (PRC), reported/announced December 17, 2008. SNF 20081217. This is supposed to follow from Sequence # 0106.

KAZAKHSTAN

1931: CHINA (PRC) and KAZAKHSTAN. Strategic Partnership in the Uranium Industry. Signed November 6, 2004. **Last Date in Force:** unknown. **Source:** WNC 20040707; NN 20041115.
Note: This may be between the China National Nuclear Corporation and Kazatomprom?

0111: CHINA (PRC) (China National Nuclear Corporation) and KAZAKHSTAN (Kazatomprom). Strategic Agreement for a Mutually Beneficial Partnership. Signed December 2006. **Last Date in Force:** unknown. **Source:** Zhang and Bai.
Note: Is this the same as or related to Sequence # 1931?

0112: CHINA (PRC) (China Guangdong Nuclear Power Group) and Kazakhstan (Kazatomprom). Nuclear Cooperation Agreement. Reported/announced 2006. **Last Date in Force:** unknown. **Source:** NN 20090430.
Note: The China Guangdong Nuclear Power Corporation becomes the China General Nuclear Power Corporation.

1932: **CHINA (PRC) (China Guangdong Nuclear Power Group) and KAZAKHSTAN (Kazatomprom).** Agreement for Fuel Production. Signed May 2007. **Last Date in Force:** unknown. **Source:** Kassenova. WNN 20151215; Nuclear.ru 20070525.
Note: See the note for Sequence #s 0114 and 0115.

0113: CHINA (PRC) (China General Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom). Agreement on Chinese Participation in Kazakh Uranium Mining Joint Ventures. Signed September 2007. **Last Date in Force:** unknown. **Source:** Zhang and Bai; NTI Kazakhstan.
Note: NTI Kazakhstan reports an agreement on October 22, 2007 to permit delivery of fuel products to China (Sequence # 1932?), and establishment of a joint venture to develop uranium resource
Links: See the note for Sequences #s 0114 and 0115. **See also Sequence # 1933?**

0114: CHINA (PRC) (China General Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom). Agreement on Kazatomprom Investment in the Chinese Nuclear Power Industry. Signed September 2007. **Last Date in Force:** unknown. **Source:** Zhang and Bai; NTI Kazakhstan.
Note: This could be a financial agreement. NTI Kazakhstan reports an agreement on October 22, 2007 to permit delivery of fuel products to China (Sequence # 1932?), establishment of a joint venture to develop uranium resources (Sequence # 0113?), and possible investment by Kazatomprom in the Chinese nuclear power industry. Is this last the same as Sequence # 1933? NTI Kazakhstan 20081104 announces the signature of two agreements, one between Kazatomprom and China Guangdong Nuclear Power Group/ China General Nuclear Power to cover joint uranium mining, trade in U, fuel production and NPP construction, and the other between Kazatomprom and the China National Nuclear Corporation on the implementation of long-term nuclear cooperation projects (Sequence # 0115).

0115: CHINA (PRC) (China National Nuclear Corporation) and KAZAKHSTAN (Kazatomprom) Strategic Framework Agreement for Cooperation Signed

September 28, 2007. **Last Date in Force:** unknown. **Source:** CAEA 20071002. SNF 20071031; Zhang and Bai.

Note: NTI Kazakhstan 20081104 announces the signature of two agreements, one between Kazatomprom and China Guangdong Nuclear Power Group/China General Nuclear to cover joint uranium mining, trade in U, fuel production and nuclear power plant construction (Sequences #0113 and 0114?), and the other between Kazatomprom and the China National Nuclear Corporation on the implementation of long-term nuclear cooperation projects.

1933: CHINA (PRC) and KAZAKHSTAN. Agreement on Use of Uranium Resources. Signed November 2007. **Last Date in Force:** unknown. **Source:** WNC 20071108. WNC 20071122. Kassenova.

Note: This could be between Kazatomprom and the China Guangdong Nuclear Power Corporation. Is this the same as the agreements of September 2007 (Sequences #s 0113 and 0114)? YNN 20081105 reports a possible Memorandum signed September 2007. SNF 20071031 puts the signature in mid-October, a Declaration of Intent concerning joint exploration of Uranium deposits in Kazakhstan, and the parties as Kazatomprom and the China General Nuclear Power Corporation (See Sequence # 0114). See also Nuclear.ru 20071015.

Links: See Sequence # 0113 and 0114.

0116: CHINA (PRC) (China National Nuclear Corporation) and KAZAKHSTAN (Kazatomprom). Long-term Nuclear Cooperation Projects Agreement. Signed 2008. **Last Date in Force:** unknown. **Source:** Zhang and Bai.
Note: The China National Nuclear Corporation will invest in a uranium mine.
Links: See Sequences # 1931, and Sequence # 0114.

0117: CHINA (PRC) (China General Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom). Cooperation Agreement. Signed October 31, 2008. **Last Date in Force:** unknown. **Source:** Zhang and Bai; NucNet No. 89, 20081108.
Note: This includes cooperation in uranium mining, fuel fabrication for power reactors, long-term trade in natural uranium, the generation of nuclear electricity, and construction of nuclear power facilities. NucNet No. 89, 20081108 indicates an agreement signed October 31, 2008, setting up a joint venture. Nuclear.ru 20081031 reports that the China General Nuclear Power Corporation agreement covers joint mining of uranium, fuel fabrication, long-term trade in natural uranium, generation of electricity and construction of nuclear power facilities. WNC 20090203 announces the creation of the joint mining venture. WNC 20090429 reports an agreement on the Irkol mine signed October 2008, which will remain in effect for 25 years. See also WNC 20090430; NN 20081103; NTI Nuclear CHINA (PRC) Nuclear Chronology 2000-2009.
Links: See Sequences #s 0113, 0114, 0118, 0124 and Sequence # 1933.

0118: CHINA (PRC) (China General Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom). Establishment of a Joint Uranium Mining Venture.

Reported/announced February 3, 2009. **Last Date in Force:** unknown. **Source:** NTI Kazakhstan 20090203; NLB 83: 141.

Links: See Sequences #s 0113, 0114, 0117.

0119: CHINA (PRC) (China Guangdong Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom). Strategic Partnership Agreement. Signed April 29, 2009. **Last Date in Force:** unknown. **Source:** SNF 20090506; NTI Kazakhstan 20090429; WNN 20100205.

Note: This will create a joint enterprise for nuclear power plant construction in China. NTI Kazakhstan 20090429 reports this agreement, and one for the supply of 24,200 tons of uranium to China by 2020. (But see the General Note). WNC 20090429 reports that the two parties have been working together since 2006 (Sequences #s 1932, 1933?).

0120: CHINA (PRC) (China National Nuclear Corporation) and KAZAKHSTAN (Kazatomprom). Memorandum. Signed April 2010. **Last Date in Force:** unknown. **Source:** WNC 20101111.

Note: This sets up a joint venture for the construction of nuclear power plants in China.

0121: CHINA (PRC) and KAZAKHSTAN. Agreement on Cooperation in the Field of the Peaceful Use of Nuclear Energy. Signed June 12, 2010. **Last Date in Force:** unknown. **Source:** WNC 20100612, 20101111.

Note: This appears to be an intergovernmental agreement, separate from the China Guangdong Nuclear Power Corporation and Kazatomprom agreement signed the same day Sequence # 0122).

0122: CHINA (PRC) (China Guangdong Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom). Uranium Supply Agreement. June 12, 2010. **Last Date in Force:** unknown. **Source:** WNC 20100612. NN 20100615; Nuclear.ru 20100616.

Note: This is to supply natural U concentrates to Kazatomprom. It appears to be separate from the intergovernmental agreement signed the same day Sequence # 0121).

0123: CHINA (PRC) (China National Nuclear Corporation) and KAZAKHSTAN (Kazatomprom). Long-term Uranium Concentrate Delivery Contract. Signed November 11, 2010. **Last Date in Force:** unknown. **Source:** WNC 20101111.

0124: CHINA (PRC) (China Guangdong Nuclear Power Group) and Kazakhstan (Kazatomprom). Agreement on Strategic Cooperation in the Nuclear Industry. Signed 2011. **Last Date in Force:** unknown. **Source:** WNC 20120203.

Note: This seems to focus primarily on uranium supply. Nuclear.ru 20110310 also notes a Memorandum of Understanding between Kazatomprom and China Guangdong Nuclear Power Group on investment. IAEA-DPR 20110223 reports for February 22, 2011 an agreement between Kazatomprom and China Guangdong Nuclear Power Group to expand cooperation (see the General Note).

0125: **CHINA (PRC) and KAZAKHSTAN.** Declaration of Strategic Partnership. Reported/announced June 13, 2011. **Last Date in Force:** unknown**. Source: ITAR-TASS 20110613.**

Note: It is not clear that this declaration has a nuclear component, however the news item also noted a Kazatomprom-China National Nuclear Corporation agreement on "strategic nuclear interaction". That could link to the supply of fuel pellets to China.

0126: **CHINA (PRC) and KAZAKHSTAN.** Agreement on Nuclear and Alternate Energy Cooperation. Reported/announced June 14, 2011. **Last Date in Force:** unknown**. Source:** IAEA-DPR 20110614.

0127: **CHINA (PRC) and KAZAKHSTAN.** Joint Declaration on New Stage of Comprehensive Strategic Partnership. Signed August 31, 2015. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20150831.

Note: This references deepening nuclear cooperation, including uranium processing and nuclear fuel production and supply.

0128: **CHINA (PRC) (China General Nuclear Power Corporation) and KAZAKHSTAN (Kazatomprom).** Agreement on Extensive and More Intensive Cooperation. Reported/announced December 15, 2015. **Last Date in Force:** unknown. **Source:** WNN 20151215.

GENERAL NOTE: Kazatomprom has an agreement on implementing long-term cooperation in nuclear projects, signed on October 31, 2008, with the China Nuclear Energy Industry Corporation, a China National Nuclear Corporation subsidiary. NucNet No. 89, 20081108; YNN 20081105; WNC 20081031. NN 20081103. NucNet No. 89, 20081108 indicates an agreement setting up a joint venture. Kazatomprom also has a Long-Term Uranium Supply Agreement with China Nuclear Energy Industry Corporation **s**igned February 21, 2011. Zhang and Bai. This is for 30,000 tonnes between 2011 and 2020. Nuclear.ru 20110310 reports it was for 25,000 tons.

Kazatomprom has a long-term uranium supply contract with CGNPC Uranium Resources Co Ltd (a branch of China Guangdong Nuclear Power Corporation) signed November 2010, for 24,200 tonnes. Zhang and Bai. Nuclear.ru 20101111 reports an agreement signed November 11, 2010. NN 20090430 gives the duration of the uranium supply agreement as 2008-2020.

KENYA

0129: CHINA (PRC) (China General Nuclear Power Corporation) and KENYA (Kenya Nuclear Electricity Board). Memorandum of Understanding on Nuclear Cooperation. Signed Sepembert 7, 2015. **Last Date in Force:** unknown. **Source:** WNN 20150909; SNF 20150917.

Note: This concerns construction, operation, supply of fuel, safety, waste management and decommissioning, training. *The East African*, 20150911 http://www.theeastafrican.co.ke, reports a memorandum of understanding.

0130: CHINA (PRC) (China General Nuclear Power Corporation) and KENYA (Kenya Nuclear Electricity Board). Information-sharing (confidentiality) Agreement. Reported/announced March 21, 2017. **Last Date in Force:** unknown. **Source:** WNN 20170323.

NOTE: I have included these in the main list, but might later decide to put them into a GENERAL NOTE.

KOREA (DEMOCRATIC PEOPLE'S REPUBLIC—NORTH KOREA)

1934: CHINA (PRC) and KOREA (DPRK). Nuclear Co-operation Agreement. Signed September 1959. **Last Date in Force:** unknown. **Source:** NTI North Korea; NTI PRC.

1935: CHINA (PRC) and KOREA (DPRK). Training Agreement. Signed April 1974. **Last Date in Force:** unknown. **Source:** NTI PRC.

KOREA (REPUBLIC OF – SOUTH KOREA, ROK)

1130: CHINA (PRC) (Research Institute of Nuclear Power Operation) and KOREA (ROK) (Korea Atomic Energy Research Institute). Contract to Provide Information. Reported February 1991. **Last Date in Force:** unknown. **Source:** EOS 5: 55.

Note: NTI PRC gives the date of signature as February 1991.

1473: CHINA (PRC) and KOREA (ROK). Scientific and Technological Co-operation Agreement. Signed September 30, 1992; in force October 30, 1992. **Last Date in Force:** indefinite duration. **Source:** FBIS-CHI-94-199, 19941014; NPR 3:2:134. UNTS 30365.

Note: The third meeting of the Joint Committee sees the announcement of an agreement to form the ROK- China (PRC) Nuclear Energy Joint Committee. WNC 20090109 reports the 15th ROK-PRC Joint Committee on Cooperation in Economy, Trade and Technology. The meeting was held December 29-30, 2008, and the 1st meeting was held December 14-16, 1992.

Links: See Sequence # 1938.

0131: BLANK

1374: CHINA (PRC) and KOREA (ROK). Co-operation concerning Peaceful Uses of Nuclear Energy. Signed October 31, 1994; in force February 11, 1995. **Last Date in Force:** indefinite duration. **Source:** NLB 57: 88. UNTS 31911; AYIL 1995; NTI PRC.

Note: NTI PRC notes this for November 1994, and says it allows South Korean firms to participate in the construction of nuclear power plants in China

Links: See also Sequences # 1937 and 1938, and perhaps 1940.

1936: FOLDED INTO SEQUENCE # 1374. NUMBER TO BE REASSIGNED.

1474: CHINA (PRC) and KOREA (ROK). Protocol on Nuclear Safety Co-operation. Signed December 13, 1994. **Last Date in Force:** unknown**. Source**: NPR 2:3: 134.

Note: This concerns monitoring radioactivity, nuclear accident co-operation, and information exchanges in nuclear safety and regulation. See also FBIS-CHI-94-199, 19941014, FBIS-CHI-94-212, 19941102, and FBIS-CHI-94-239, 19941213; NTI PRC, NTI South Korea

1937: CHINA (PRC) and KOREA (ROK). Agreement. Signed February 1995**. Last Date in Force:** unknown. **Source:** NTI PRC.

Note: This concerns co-operation in establishing manufacturing facilities in China for nuclear components and equipment, and fabrication of major components.

Links: See Sequence # 1374.

1938: CHINA (PRC) and KOREA (ROK). Agreement to Establish the South-Korea-China Nuclear Energy Joint Committee. Signed May 11, 1995. **Last Date in Force:** unknown. **Source:** NTI South Korea.
Note: This follows from Sequence # 1374. CAEA Press Releases up to December 4, 2006 note meetings of a China –ROK joint committee on nuclear energy. Is that this committee or that formed in Sequence # 1941?
Links: See Sequences # 1374, 1473, 1941.

1675: CHINA (PRC) (China Institute for Radiation Protection) and KOREA (ROK) (Korea Institute of Nuclear Safety -- KINS). Arrangement for Co-operation in the Field of Nuclear Safety and Radiation Protection. Signed June 19, 1995**. Last Date in Force:** unknown. **Source:** KINS.

1939: CHINA (PRC) and KOREA (ROK). Agreement to Provide a Pressure Vessel. Reported/announced September 18, 1995. **Last Date in Force:** unknown. **Source:** NTI South Korea.

Note: This is reportedly for a 300 MW reactor in Pakistan. NTI South Korea notes an agreement announced September 18, 1995, but then reports on September 22, 1995 that ROK will NOT provide the pressure vessel.

1940: CHINA (PRC) and KOREA (ROK). Co-operation Agreement. Signed November 14, 1995. **Last Date in Force:** unknown. **Source:** NTI South Korea.

Note: This concerns the construction of nuclear power plants, the development of passenger planes, and the exploitation of natural gas.

Links: possibly Sequence # 1374?

1676: CHINA (PRC) (National Nuclear Safety Administration) and KOREA (ROK) (Korea Institute of Nuclear Safety). Arrangement for Technical Co-operation in the Field of Nuclear Safety. Signed April 17, 1996; amended December 4, 2000. **Last Date in Force:** unknown. **Source:** KINS.

1941: CHINA (PRC) and KOREA (ROK). Establishment of a Nuclear Consultative Council. Signed November 12, 1996. **Last Date in Force:** unknown. **Source:** NTI South Korea.
Note: CAEA Press Releases up to December 4, 2006 note meetings of a China –ROK joint committee on nuclear energy (Last Known Date?). Is that this committee or the committee formed by Sequence # 1938?
Links: Sequence # 1938?

1942: CHINA (PRC) and KOREA (ROK). Nuclear Co-operation Agreement. Signed 1999. **Last Date in Force:** unknown. **Source:** WNC 20000907.

1943: CHINA (PRC) and KOREA (ROK). Establishment of a Joint Nuclear Hybrid Research Center at Chinghua University. Signed November 18, 2003. **Last Date in Force:** unknown. **Source:** NTI South Korea.

0132: CHINA (PRC) and SOUTH KOREA (ROK). Agreement on Safety Cooperation. Reported/announced April 14, 2011. **Last Date in Force:** unknown. **Source:** NN 20110411.

Note: This concerns cooperation and information sharing in a nuclear emergency. It is not clear if this is a formal agreement or simply an expression of interest.

0133: CHINA (PRC) (China National Emergency Response Technical Assistance Centre -- NNERTAC) and SOUTH KOREA (ROK) (Korea Institute of Nuclear Safety -- KINS). Cooperation Agreement. Signed November 27, 2015. **Last Date in Force:** unknown. **Source:** SNF 20151216.

0134: CHINA (PRC) (China National Nuclear Safety Administration) and SOUTH KOREA (Korea Nuclear Safety and Security Commission -- NSSC). Agreement on Radiation Monitoring. Signed November 27, 2015. **Last Date in Force:** unknown; may be for 3 years? **Source:** SNF 20151216.

GENERAL NOTE: The China National Nuclear Corporation and the Korea Electric Power Corporation sign a Memorandum of Understanding on Technical Cooperation in June 1994. NTI PRC.

SEQUENCE NOTE: Sequence # 0135 was already assigned in the 2009 list.

LIBYA

0136: CHINA (PRC) and LIBYA. Agreement on Cooperation in the Fields of Nuclear Power Engineering and Chemistry. Signed February 1992. **Last Date in Force:** unknown. **Source:** JPRS-TND-93-007, 19930305.

MALAYSIA

1375: CHINA (PRC) and MALAYSIA. Memorandum of Understanding on Science and Technology Co-operation. Signed 1992. **Last Date in Force:** unknown. **Source:** FBIS-CHI-94-007, 19940111.
Note: Nuclear energy was included as one possible area of co-operation in the first meeting of the joint committee created under this.

MONGOLIA

0137: CHINA (PRC) (China National Nuclear Corporation) and MONGOLIA (Mongolian Nuclear Energy Agency). Memorandum of Cooperation in the Area of Uranium Resources and Nuclear Energy. Signed 2010. **Last Date in Force:** unknown. **Source:** Zhang and Bai; MNEA; CNNC News 20100719; WISE.

Note: See also the General Note.

GENERAL NOTE: The China National Nuclear Corporation Mongolia Project Company reached an agreement with the Mongolian Nuclear Energy Agency for the Gurvanbulag Uranium Mine Early-Stage Mining Work on June 26, 2012. Zhang and Bai.

MOROCCO

1496: CHINA (PRC) (State Science and Technology Commission) and MOROCCO (Ministry of Energy and Mines). Agreement. Signed September 20, 1996. **Last Date in Force:** unknown. **Source:** PPNNP 44: 6-7. WNC 19960921.

Note: This seems to be on first phase research for cooperation and development of a nuclear heat reactor sea water desalination demonstration plant, within an IAEA project. This agreement concerns a feasibility study prior to this. It concerns a 10 MW reactor at Tan-Tan, Morocco, for desalination. WNC 19960921 reports this as under the IAEA, and as an agreement on studies and co-operation regarding a desalination reactor. SNF 19981214 reports a joint feasibility study for a 10 MWe reactor.

NAMIBIA

0138: CHINA (PRC) (China National Nuclear Corporation) and NAMIBIA. Permission to Prospect and Explore the Rossing Uranium Deposits. Signed August 1, 2006. **Last Date in Force:** unknown. **Source:** Zhang and Bai.

NIGER

1944: CHINA (PRC) (China National Nuclear Corporation) and NIGER. Agreement. Signed 2006. **Last Date in Force:** unknown. **Source:** WMDI 20; Zhang and Bai.

Note: This allows the China National Nuclear Corporation to develop a uranium deposit. Zhang and Bai may suggest that this is an agreement to develop the Azelik-Abokurum deposit. A company (Société des Mines a'Azelik) was created in 2007 to do this.

PAKISTAN

1131: CHINA (PRC) and PAKISTAN. Nuclear Co-operation Agreement? Signed May 26, 1976. **Last Date in Force:** unknown. **Source:** Potter p. 224; NTI PRC; PTS VII: 33.

Note: This may be a continuation of a technical co-operation agreement signed on July 30, 1966. It is not clear if nuclear co-operation was involved. See also Potter p. 230. PTS VII: 33 is the Protocol of the 9th session on scientific and technical cooperation, signed April 20, 1989. It notes an agreement of May 30, 1976 on Scientific and Technical Cooperation. The 9th session notes projects for 1989-90, but that list does not specifically include nuclear power projects. See also Wilson Archive Record ID # 116893, which reports a visit by Chinese officials in which nuclear cooperation was discussed, and 1976 and 1977 visits by Chinese nuclear experts. This may be military rather than/as well as civilian?

1132: CHINA (PRC) and PAKISTAN. Co-operation in the Peaceful Uses of Nuclear Energy. Signed September 15, 1986; in force November 10, 1986. **Last Date in Force:** indefinite duration. **Source:** UNTS 26165; PPNNP 8: 5; K 1986: 34674; NTI WMD Chronology; NTI Pakistan; reference in PTS XII: 93.

Note: All equipment supplied by China is to be put under IAEA safeguards: see e.g. INFCIRC/393, signed Sept 10, 1991 regarding a miniature neutron source reactor supplied by China. WNC 20101019 notes that this covers construction of 4 reactors by 2011. China (PRC) argues within the Nuclear Suppliers Group that the Chashma reactors are therefore grandfathered under the agreement, which was signed before China joined the NSG.

Links: The various other Chashma agreements are Sequences #s 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0150, 0153 and 0155.

1133: CHINA (PRC) (China National Nuclear Corporation) and PAKISTAN (Pakistan Atomic Energy Commission). Contract for Chashma 1. Signed December 31, 1991 and February 2, 1992. **Last Date in Force:** unknown. **Source:** Proliferation News 20100427. NTI PRC.
Note: This concerns a 300 MW plant at Chashma. See also EOS 1:39; 2:16; 6:30-31. PPNNP 16:4. FBIS-CHI-93-150 1993 0806; reference in PTS XII: 93; NTI Pakistan. A draft contract was apparently produced in November 1989, but the contracts were signed December 31, 1991 and February 2, 1992.

Links: There are several other Chashma contracts, for the expansion of the power plant and for various services, etc. See Sequences #s 1132, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149,

0150, 0153 and 0155.

0139: CHINA (PRC) (Nuclear and Radiation Safety Center) and PAKISTAN (Nuclear Safety and Radiation Protection Authority). Agreement on Technical Consulting Services for the Safety Appraisal and Supervision of the Chashma Nuclear Power Plant. Signed June 1992.. **Last Date in Force**: unknown ("Successfully executed" Dec. 1994). **Source**: PRCNSC; PRCNNSA.

Note: See also the agreement of September 2004 Sequence # 0144, which might differ from this or be an extension of it. The "successful execution" could be the last date.

Links: See Sequences #s 0142 and 0151.

1945: CHINA (PRC) and PAKISTAN. Agreement for Supply of Fuel for the Chashma Nuclear Power Plant. Reported/announced March 17, 2001. **Last Date in Force:** unknown (15-year agreement). **Source:** WNC 20010317.

Links: See also Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0150, 0153 and 0155.

1946: CHINA (PRC) and PAKISTAN. Memorandum of Understanding. Reported/announced March 17, 2001. **Last Date in Force:** unknown. **Source:** WNC 20010317.

Note: This concerns construction of a second 300 MW reactor at Chashma. This agreement is separate from Sequence # 1947.

Links: See also Sequences #s 1132, 1133, 1945, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0150, 0153 and 0155.

0140: CHINA (PRC) (China Atomic Energy Authority?) and PAKISTAN. Memorandum of Understanding for Cooperation on Chashma Phase 2. Signed March 24 2003. **Last Date in Force:** unknown. **Source:** Proliferation News 20100921; CAEA Annual Report 2003.

Note: China cites this agreement as cover for providing Pakistan with reactors after it joins the NSG in 2004 (see also the note for Sequence # 1132). NTI PRC notes a Memorandum of Understanding on the construction of Chashma Phase 2, signed March 2003, but says the agreement was still not finalized as of November 2003. SNF 20030401 reports an agreement about Chashma.

Links: See also Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0146, 0147, 0149, 0150, 0153 and 0155.

0141: CHINA (PRC) and PAKISTAN. Joint Declaration. Signed November 3, 2003. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20031104.

Note: This notes the intention to expand cooperation in various areas, including nuclear power.

1947: CHINA (PRC) (China National Nuclear Corporation) and PAKISTAN (Pakistan Atomic Energy Commission). Nuclear Reactor Agreement. Signed May 4, 2004. **Last Date in Force:** unknown. **Source:** WNC 20040524, 20080414. AECO No. 2; reference in PTSXII: 93; NTI Pakistan.

Note: This concerns the second reactor at Chashma, but is separate

from Sequence # 1946.

Links: See also Sequences #s 1132, 1133, 1945, 1946, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0150, 0153 and 0155.

0142: CHINA (PRC) (National Nuclear Safety Administration) and PAKISTAN (Nuclear Regulatory Authority Nuclear Safety Centre). Agreement on Technical Support in Nuclear Safety Appraisal and Supervision. Signed September 2004. Renewed April 2011. **Last Date in Force:** unknown. **Source:** PRCNNSA; PRCNSC.

Note: This is apparently in regard to Chashma. PRCNNSA reports this was renewed April 2011. This could therefore be the 2004 renewal of the 1992/94 agreement? PRCNSC Annual Report 2009 also notes an agreement on nuclear safety and radiation protection renewed in June 2009, and PRCNSC reports renewal of a cooperation agreement re this in April 2011. PNRA Annual Report 2011 reports an Agreement for Exchange and Cooperation in the Field of Nuclear Safety and Radiation Protection, signed in 2011.

Links: See Sequences #s 0139 and 0151.

0143: CHINA (PRC) and PAKISTAN. Treaty of Friendship, Cooperation and Good-Neighbourly Relations. Signed April 5, 2005. **Last Date in Force:** indefinite duration. **Source:** PTS XI: 70.

Note: This refers to the peaceful uses of nuclear technology.

1948: CHINA (PRC) and PAKISTAN. Agreement on Two Additional Reactors at Chashma. Reported/announced April 10, 2005. **Last Date in Force:** unknown. **Source:** AECO No. 7.

Note: This is apparently in addition to the reactor agreed upon on May 4, 2004 (Sequence # 1947).

Links: See also Sequences #s 1132, 1133, 1945, 1946, 1947, and Sequences #s 0140, 0146, 0147, 0149, 0150, 0153 and 0155.

1949: CHINA (PRC) and PAKISTAN. Framework Agreement on Co-operation in the Field of Energy. Signed February 20, 2006. **Last Date in Force:** no specific termination provisions. **Source:** PMFA 20061125, "Text of the Joint Statement between the Islamic Republic of Pakistan and the People's Republic of China; PTS XII: 8.

Note: This may include nuclear energy. NTI PRC reports Sequence # 1949 as signed February 28, 2006.

0144: CHINA (PRC) and PAKISTAN. Five-year Development Program for Trade and Economic Cooperation. Signed November 24, 2006. **Last Date in Force:** unknown. **Source:** PTS XII: 40.

Note: This includes nuclear power cooperation.

1950: CHINA (PRC) and PAKISTAN. Agreement on Nuclear and Conventional Energy Co-operation. Reported/announced April 23, 2007. **Last Date in Force:** unknown. **Source:** NN 20070424.

Note: It is not clear if this is a formal agreement, but it seems to include both nuclear and conventional energy. Does it give rise to the Pakistan-China Joint Energy Group? WNC 20120506 reports the first meeting of this in July 2011, and says the second will be hold May 7, 2012.

0145: CHINA (PRC) (China National Nuclear Corporation) and PAKISTAN. Framework Agreement Reported/announced around June 2008. **Last Date in Force:** unknown**. Source:** WNC 20101230.

0146: CHINA (PRC) (China National Nuclear Corporation) and Pakistan (Pakistan Atomic Energy Commission). Agreement for Chashma Nuclear Power Plant units III and Unit IV (C-4). Signed Oct 15, 2008; in force Oct 15, 2008. **Last Date in Force:** no specific provision. **Source:** PTS XII: 93.

Note: CNNC News 20081018 gives a signature date of Oct 18, 2008. WNC 20081018, 20081021 report an agreement on two new reactors October 18, 2008, as does NTISGN Oct 20, 2008.

Links: See Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0147, 0149, 0150, 0153 and 0155.

0147: CHINA (PRC) (China National Nuclear Corporation) and PAKISTAN. Contract for Chashma 3 and 4. Signed February 2009. **Last Date in Force:** unknown. **Source:** WNC 20100429, 20111115.

Links: See Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0149, 0150, 0153 and 0155.

0148: CHINA (PRC) and PAKISTAN. Fuel Supply Agreement. Signed September 30, 2009. **Last Date in Force**: unknown. **Source:** WNC 20101230.

0149: CHINA (PRC) and PAKISTAN. Agreement to Build 2 more Units at Chashma. Signed February 2010. **Last Date in Force**: unknown. **Source:** NTI PRC.

Note: This is in addition to Chashma 3 and 4. IAEA-DPR 20100429 indicates there could be a financing agreement signed February 2010 involving China National Nuclear Corporation. IAEA-DPR 20101214 reports a March announcement by China National Nuclear Corporation about starting work on 2 new plants, and September 2010 talks beginning for a 1 GW plant. Proliferation News 20100401 reports a financing agreement reported/announced March 30, 2010. See also WNC 20101230.

Links: See Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0150, 0153 and 0155.

0150: CHINA (PRC) and PAKISTAN. Agreement for 2 more Reactors. Signed June 8, 2010. **Last Date in Force:** unknown. **Source:** WNC 20110716**.**

Note: The source also reports a Chinese loan. WNC 20100925 indicates an agreement signed June 8, 2010 between China Nuclear Industry Fifth Construction Company and the China Zhangyuan Engineering Corporation regarding Chashma construction. This may be subsidiary to this agreement, or this may be the actual agreement reported? NN 20130322 reported/announced a China (PRC)–Pakistan Memorandum of Understanding on Chashma reported/announced July 2010.

Links: See Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0153 and 0155.

0151: CHINA (PRC) and PAKISTAN (Pakistan Nuclear Regulatory Administration). Agreement for Exchange and Cooperation in the Field of Nuclear Safety and Radiation Protection. Renewed June 2009. Renewed April 2011**. Last Date in Force:** unknown. **Source:** PNRA Annual Report 2011; PRCNSC Annual Report 2009; PRCNSC.

Note: PRCNSC Annual Report 2009 also notes an agreement on nuclear safety and radiation protection renewed in June 2009, and PRCNSC reports renewal of a cooperation agreement re this in April 2011. It is not clear if this is related to Sequences #s 0140 and 0143 or not.
Links: **See Sequences #s 0139 and 0142.**

0153: **CHINA (PRC) and PAKISTAN.** Contract for a 5th Unit at Chashma. Reported/announced February 2013. **Last Date in Force:** unknown. **Source:** WNA Country Profile July 8, 2013; NN 20130322.
Links: See Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0150 and 0155.

0154: **CHINA (PRC) (China National Nuclear Corporation) and Pakistan (Pakistan Atomic Energy Commission).** Framework Agreement for Technical Cooperation in Exploration and Development of Uranium Resources. Signed June 30, 2017. **Last Date in Force:** unknown. **Source:** WNN 20170731.

0155: **CHINA (PRC) (China National Nuclear Corporation) and Pakistan (Pakistan Atomic Energy Commission)** Agreement concerning the Chashma 5 Reactor. Reported/announced November 23, 2017. **Last Date in Force:** unknown**. Source:** WNN 20171123; NN 20171130; SNF 20171123.
Note: This is an HPR 1000 (1000 MWe "Hualong One" model).
Links: **See** See Sequences #s 1132, 1133, 1945, 1946, 1947, 1948 and Sequences #s 0140, 0146, 0147, 0149, 0150, and 0153.

GENERAL NOTE: The China Nuclear Power Operation Technology Corporation, a subsidiary of the China National Nuclear Corporation, signed a training agreement with the Pakistan Nuclear Regulatory Authority, reported/announced 2007. PNRA Annual Report 2007, 2008, 2009. This covers training in nuclear power plant operation, in-service inspections, accident analysis, and experience feedback. PNRA Annual Report 2009 notes a January 2009 extension of an agreement with the China Nuclear Power Operation Technology Corporation. PNRA Annual Report 2010 reports renewal of cooperation, and an agreement on training of personnel and joint research, at the 5th meeting of the Steering Committee between the PRCNNSA and the PNRA.
The China Nuclear Power Operation Technology Corporation, a subsidiary of the China National Nuclear Corporation, signed a training agreement with the Pakistan Nuclear Regulatory Authority in 2008. PNRA Annual Report 2008. This concerns the development of physical models for training of PNRA personnel. PNRA Annual Report 2009 notes a January 2009 extension of an agreement with the China Nuclear Power Operation Technology Corporation. PNRA Annual Report 2010 reports the renewal of cooperation, and an agreement on training of personnel and joint research, at the 5th meeting of the Steering Committee between the PRCNNSA and the PNRA.

PERU

1475: CHINA (PRC) and PERU. Nuclear Co-operation Agreement. Reported/announced October 10, 1995. **Last Date in Force:** unknown. **Source:** NPR 3:2:133.

POLAND

0156: CHINA (PRC) China National Energy Administration) and POLAND (Vice-Minister of Energy). Agreement on Cooperation in Peaceful Use of Nuclear Energy. Signed July 14, 2017. **Last Date in Force:** unknown. **Source: SNF 20170725.**

Note: PRCFM Comm 10171128 reports a Memorandum of Understanding on nuclear energy cooperation signed in July 2017.

ROMANIA

1134: CHINA (PRC) and ROMANIA. Nuclear Co-operation Agreement. Signed 1984. **Last Date in Force:** unknown. **Source:** Potter p. 255; NTI PRC.

0157: CHINA (PRC) and ROMANIA. Memorandum of Understanding on Peaceful Uses of Nuclear Energy. Reported/announced November 26, 2013. **Last Date in Force:** unknown. **Source:** NN 20131126; NucNet No 47, 20131129.
Note: This is separate from the Letter of Intent also noted by NN 20131126 on the same day (see General Note).

0158: CHINA (PRC) and ROMANIA. Agreement on Cooperation in the Peaceful Use of Nuclear Energy. Signed 2014. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20171128.
Note: NN 20140903 reports that this will be signed in September 2014, but PRCFM Comm 20171128 merely reports a 2014 signature.

0159: CHINA (PRC) (China General Nuclear Power Corporation) and ROMANIA. Contract for Cernavoda. Signed October 19, 2014. **Last Date in Force:** unknown. **Source:** McGoldrick.
Note:

GENERAL NOTE: China Guangdong Nuclear Power Corporation and the Romanian entity Nuclearelectrica signed a Confidentiality Agreement on October 19, 2011 concerning possible involvement in the completion of reactors at Cernavoda. WNN 20111021.

WNN 20131126 and NN 20131126 reported/announced on November 26, 2013 a Letter of Intent for 2 Units at Cernavoda between China Guangdong Nuclear Power Corporation and Nuclearelectrica**.** The Letter of Intent is separate from the Memorandum of Understanding reported/announced on the same day (Sequence # 0157).

WNN 20151115 reports a China General Nuclear Power Corporation–Nuclearelectrica Memorandum of Understanding for the development, construction, operation and decommissioning ofCernavoda 3 and 4.

WNN 20190508 reports a “preliminary invstors’ agreement” between China General Nuclear Power Corporation and Nuclearelectrica on May 9, 2019, regarding the completion of Cernavoda units 3 and 4. This creates a joint venture for the project.

RUSSIA/USSR

1962: CHINA (PRC) and RUSSIA (USSR). Agreement on Creation of a Joint Non-Ferrous and Rare Metals Corporation. Signed March 27, 1950. Joint Communique noting the Transfer of Shares to China, October 12, 1954. Protocol to this effect, signed December 30, 1954. Last Date in Force: December 30, 1954. Source: Mir, p. 255; ST pp. 152, 318, 321; Ginsburgs – IO.

Note: See the Protocol of a Russian government meeting, Wilson Archive Record ID # 110594. This is a protocol of a meeting April 25, 1947. It approves a draft resolution to organize geological prospecting work for "rare elements" in North Korea and in Xinjiang province (China). The party is to include specialists for simultaneous extraction of uranium and thorium. However, it was decided to remove proposals for Xinjiang (to be considered separately), while keeping those for North Korea. The draft resolution was to be sent to Stalin.

While there is no explicit mention of uranium, the term "non-ferrous metals" could possibly include it. The initial agreement was for 30 years. Acts of ratification were exchanged on September 30, 1950. The company created was "Sovkitmetall." It may have operated near Urumchi. This arrangement was likely superseded by the agreement of January 30, 1955, Sequence # 1963.

Links: See Sequence # 1963 and Sequence # 0162.

0160: CHINA (PRC) RUSSIA (USSR). Agreement concerning Technical Training of CPR Specialists in the USSR**.** Signed December 6, 1951. **Last Date in Force:** unknown (see Note). **Source:** ST 283.
Note: The source says this is cited in the atomic agreement of April 27, 1955 as basis for training of Chinese atomic specialists in USSR. GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.
Links: See Sequence # 0292.

0161: CHINA (PRC) and RUSSIA (USSR). Agreement concerning Scientific and Technical Collaboration. Signed October 12, 1954. **Last Date in Force:** Duration 5 years + additional 5 if not denounced (See Note). **Source:** ST pp. 318, 321; Lewis and Litai; Yanqiong and Jifeng?
Note: ST p. 321 notes that the Protocol of 1st meeting of Commission for Scientific and Technical Collaboration was signed December. 28, 1954. Lewis and Litai report this agreement; it may correspond to Yanqiong and Jifeng's 54.01 agreement. GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.

0292: CHINA (PRC) and RUSSIA (USSR). Aid in Developing Research in Physics of the Atomic Nucleus and in Utilization of Atomic Energy for Needs of the National Economy. Signed April 27, 1955; in force April 27, 1955.

Last Date in Force: no specific provision (see Note). **Source:** USSR 1958; Rohn 411510; NTI PRC; YK 8:3; Yanqiong and Jifeng; Shen and Xia; Lewis and Litai. ST pp. 326-7; CIA 1956.

Note: GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961. This agreement cited the Technical Training agreement of December 6, 1951 (Sequence # 0160) as a basis for training Chinese atomic specialists. CIA 1956 notes a 1955 agreement providing for a research reactor, cyclotron, technical assistance and training.

Links: See Sequence # 0160.

1963: CHINA (PRC) and RUSSIA (USSR). Agreement on Exploration, Identification, and Geological Survey for Radioactive Elements in the PRC. Signed January 30, 1955. **Last Date in Force:** unknown (see Note). **Source:** NTI PRC; YK 8; Yanqiong and Jifeng (55.01); Shen and Xia; Lewis and Litai.

Note: Lewis and Litai say his provides for joint uranium surveys in China and the sale of surplus uranium to the USSR. Soviet-Chinese nuclear co-operation, both civil and military, apparently ended in the late 1950s. Shen and Xia also report a uranium exploration and mining agreement for 1954, but this could be the agreement to transfer shares? See Sequence # 1962. Lewis and Litai note arrangements (possibly in 1954?) for Russian advisors to accompany a Chinese team, but report that the January 1955 agreement was the first formal agreement. Yanqiong and Jifeng; Shen and Xia give the signature date as January 20, 1955. Yanqiong and Jifeng say this is superseded by the agreement of December 19, 1955 Sequence # 0162). GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.

Links: See Sequence # 0162 and Sequence # 1962.

0162: CHINA (PRC) and RUSSIA (USSR). Uranium Exploration Agreement. Signed December 19, 1955. **Last Date in Force:** unknown (see Note). **Source:** Shen and Xia; Yangqiong and Jifeng; Lewis and Litai.

Note: Yangqiong and Jifeng say this supersedes the agreement of January 20 (or 30) 1955 (Sequence # 1963). Lewis and Litai say the agreement of Dec. 19, 1955 changes the Sino-Soviet uranium survey from a joint operation to Chinese management. GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.

Links: See Sequence # 1962 and 1963.

0543: CHINA (PRC) and RUSSIA (USSR). Aid by USSR in Construction of Industrial Enterprises. Signed April 7, 1956. **Last Date in Force:** unknown (see Note). Source: ST p. 353.

Note: ST p. 353 says this agreement covers the construction of 55 industrial enterprises, including a 6+ MWe reactor and aid in geological exploration. GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.

0163: CHINA (PRC) and RUSSIA (USSR). Agreement on Assisting China to Develop Atomic Energy Industry. Signed August 27, 1956. Supplementary Agreement on Technical Assistance of Atomic Energy Industry signed September 29, 1958. **Last Date in Force:** unknown (see Note). **Source:** Shen and Xia; Yangqiong and Jifeng; Lewis and Litai; NTI PRC.

Note: Shen and Xia say August 17, 1956, as does NTI PRC. Kazuko reports an agreement on technological aid in the nuclear industry signed September 17, 1956. Lewis and Litai suggest an August 1956 agreement. Yangqiong and Jifeng report a Supplementary Agreement on Technical Assistance of Atomic Energy Industry signed September 29, 1958. They also suggest another supplement, but give no further information. Lewis and Litai report a September 29, 1958 supplement to their August 17, 1956 agreement, dealing with the scale and scheduling of Soviet aid. GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.

0164: CHINA (PRC) and RUSSIA (USSR). Agreement on Production of New Weapons and Military Technology Equipment and Establishment of a Comprehensive Atomic Energy Industry in China. Signed October 15, 1957. **Last Date in Force:** unknown (see Note). **Source:** Litai and Lewis; Shen and Xia; Yangqiong and Jifeng.

Note: This includes nuclear weapons, but may go beyond that. GS p. 149 notes an Exchange of Notes on Loss of Force of Agreement on Scientific-Technical Cooperation of Oct. 12, 1954, (and others) signed June 19, 1961.

1135: CHINA (PRC) and RUSSIA (USSR). Economic and Scientific Co-operation Agreement. Signed April 24, 1990. **Last Date in Force:** unknown (ten years duration). **Source:** FoF 1990: 309; FBIS-SOV 19901127; NTI PRC

Note: This appears to include the supply of two nuclear power stations. It may lead to the Tianwan project (see Sequence # 1951 and subsequent Sequences). The Tianwan nuclear power plant is in Lianyungang city in Jiangsu province.

Links: See Sequence # 1951 and subsequent Sequences listed there for Tiawan Phase 1 agreements.

1951: CHINA (PRC) and RUSSIA. Agreement on the Tianwan Nuclear Power Plant. Signed December 18, 1992. **Last Date in Force:** unknown. **Source:** WNC 19961227; PRCMFA Comm 20001122. WNC 20100505; NPR 6:1:148.

Note: Subsequent sequences on the Tianwan project give a possible Last Known Date. The Tianwan nuclear power plant is in Lianyungang city in Jiangsu province. This project appears to originate in Sequence # 1135.

On December 29, 1997, China Jiangsu Nuclear Power Corporation and Atomstroyexport signed the general contract for Tianwan Phase 1 (units 1 and 2). WNC 20100505. Rosatom News 20111103 notes a TVEL fuel supply contract for Tianwan Phase 1, signed in 1997. NTI PRC reports on January 8, 1998 on a deal to supply equipment for 2 VVER-1000 reactors (Contract for Nuclear Fuel Supply and Technology Transfer, signed 1998**)**.

The Joint Communique of the 5th Regular Meeting between Heads of Government, signed Nov 3, 2000 (PRCMFA Comm 20101122) notes an agreement between Jiangsu Nuclear Power Company and the Russian Finance Minister on construction of Tianwan pursuant to the intergovernmental agreement of December 18, 1992 on joint construction of NPPs in China and on the provision of government loans by Russia to China. A further protocol, signed March 2, 2010, revises the terms of payment (WNC 201001202, 20101211).

Minatom 20090923 notes the signature of an Atomstroyexport-Jiangsu protocol of final acceptance of Tianwan Unit 2. A protocol of acceptance of Unit 1 was signed on June 2009.

WNN 20100302 reports that TVEL will ship a final batch of fuel for Tianwan units 1 and 2 this month; it saysthat TVEL and Jiangsu signed a contract for the initial core and three reloads in December 1997, with subsequent fuel to be manufactured in China. WNN 20101102, Minatom 20101102, and Rosatom News 20101103 report on a TVEL-Jiangsu and China Nuclear Engineering Industry Company package of contracts re supply of fuel, fuel production technology and zirconium fuel components. The first part concerns the supply of 6 reloads of fuel for Tianwan Unit 1. The second contract documents the supply of production technology for fuel fabrication plant for the 7th reload. The third contracts for the supply of zirconium components for the 6th reload of Tianwan units 1 and 2, and the 7th reload at Tianwan Unit 2. Final fuel delivery for Tianwan units 1 and 2 under this contract will begin in 2014. It also notes final delivery by TVEL under the 1997 supply contract was in March 2010. In April 2010 TVEL signed a contract for delivery of 6 pilot fuel assemblies to be used in licensing for a new design.

WNN 20170428 notes an October 2013 TVEL-Jiangsu/China Nuclear Engineering Industry Company contract for deliveries of fuel. It also notes TVEL-Jiangsu/ China Nuclear Engineering Industry Company contracts for supply of fuel and engineering services for Tianwan units 1 and 2, signed April 26, 2017. SNF 20170515 notes TVEL-Jiangsu/China Nuclear Engineering Industry Company contracts re supply of fuel, zirconium components for fuel assemblies, and engineering services for Tianwan.

Links: See Sequences #s 1135, and Sequences #s 0185 and 0191.

1952: CHINA (PRC) and RUSSIA. Agreement on Co-operation in the Construction on the Territory of the PRC of a Gaseous Centrifuge Plant

for the Enrichment of Uranium for Nuclear Power. Signed December 18, 1992. Contract signed March 1993. Protocol signed December 27, 1996. Supplementary Protocol announced November 6, 2007. **Last Date in Force:** unknown. **Source:** Bukharin, p. 207. NTI: WMD Chronology. WNC 19961227; 20071106 and 20071107; NN 20071107.
Note: The 1996 protocol concerns an expansion of the plant's capacity. NTI PRC also reports a January 1996 establishment of a joint venture to build an enrichment facility, and a further agreement on Phase 4 on May 23, 2008 between Techsnabexport and China Nuclear Energy Industry Corp. There may also be a November 1994 agreement with the Russian Minister of Atomic Energy to create a Rosatom-China National Nuclear Corporation joint venture?

Zhang, notes agreements in 1993, 1996 and 2008. The 1966 agreement may be a contract for a gas centrifuge plant, signed Dec. 27, 1996 (WNC 19961227).
A November 6, 2007 Supplementary Protocol was announced at the 12th meeting of the Chinese and Russian Prime Ministers.

Links: See Sequences #s 0171, 0176 and 0178.

0165: CHINA (PRC) and RUSSIA. Nuclear cooperation agreement. Signed December 1993. **Last Date in Force:** unknown. **Source:** NTI PRC. **Does this show up elsewhere in here?**

SEQUENCE NOTE: Sequence 0166 was already assigned in the 2009 list.

0167: CHINA (PRC) (Chinese State Corporation for Nuclear Industry) and RUSSIA (Atomic Energy Ministry). Agreement for the Development of an Experimental Fast Neutron Reactor. Signed 1995. **Last Date in Force:** unknown. **Source:** NN 19990816.

Note: I assume this is the Chinese Experimental Fast Reactor (CEFR).

Links: See Sequences #s 1677 and 1957, and Sequences #s 0020 and 0169.

0168: CHINA (PRC) and RUSSIA. Agreement to help China develop Civilian Nuclear Power Plants. Reported/announced January 6, 1996. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: The source reports this concerns conversion of bomb-making facilities to civilian nuclear power facilities. The source also reports on June 27, 1997 with regard to an agreement by the Russian Atomic Energy Ministry regarding this.

1953: CHINA (PRC) and RUSSIA. Agreement on Peaceful Uses of Atomic Energy. Signed April 25, 1996. **Last Date in Force:** unknown. **Source:** WNC 19960425. NTI PRC.
Note: This includes broader development in the energy sector. NTI PRC gives date as April 24, 1996. It may extend to April 1999?

1954: CHINA (PRC) (National Nuclear Safety Administration) and RUSSIA (Federal Nuclear and Radiation Safety Authority – Rostechnadzor). Agreement on Cooperation in the Field of Nuclear Safety. Signed April

25, 1996, in force April 25, 1996**. Last Date in Force:** indefinite duration. **Source:** WNC 19960425; Rostech 2015.

0169: CHINA (PRC) and RUSSIA. Document regarding the Development of Nuclear Power Engineering in China and the Building of a Fast Neutron Reactor. Signed May 21, 1997. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: I assume this is the CEFR.
Links: See Sequences # 1677 and 1957, and Sequences #s 0020 and 0167.

0170: CHINA (PRC) and RUSSIA. Agreement for Supply of Two VVER-1000 Power Reactors. Signed May 21, 1997. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: The May 21, 1997 agreement was signed at the first meeting of the Russia-China Subcommittee on Nuclear Issues, of the Sino-Russian Committee for Regular Prime Ministerial Meetings. NTI PRC notes a May 21, 1997 agreement to add 2 VVER-1000 reactors. I am assuming this is in regard to Tianwan Phase 2 (units 3 and 4), but is distinct from the other agreement reported for May 21, 1997. (See Sequence # 0169.)
WNN 20101102 says Atomstroyexport signed a contract for Tianwan Phase 2 in October 2006. Rosatom Nuclear Industry in the Media 20111018 notes a Jiangsu and China Nuclear Power Engineering-Atomstroyexport contract for engineering procurement and construction regarding Phase 2, with preliminary contracts signed October 2006, and a general contract signed November 2010. Minatom 20070510 notes an Atomstroyexport-Jiangsu contract for power engineering technical consultations (it is not clear if this is Phase 1 or Phase 2?) Minatom 20071106 notes the signature on November 6, 2007 by Atomstroyexport and Jiangsu of a framework agreement for construction of Tianwan 3&4. SNF 20071112 also notes the October 2006 contract.
WNN20071108 also notes Techsnabexport-China Nuclear Energy Industry Company (CNEIC) agreements on fuel supply. Minatom 20090917 reports a March 23, 2009 Atomstroyexport-Jiangsu contract on the construction of Tianwan Phase 2, and a September 27, 2009 Atmostroyexport-Jiangsu contract for technical design of Tianwan Phase 2. WNC 20100324 and SNF 20100406 indicate a contract concerning Units 3 and 4, between Atomstroyexport and Jiangsu signed on March 23, 2010. Nuclear.ru 20100323 notes an Atomstroyexport-Jiangsu umbrella contract regarding Tianwan Phase 2 signed March 23, 2010.
Rosatom Annual Report 2010 notes a Jiangsu-Atomstroyexport contract for the detailed design phase of Tianwan Phase 2, signed Sept 27, 2010. Other sources agree with this item and date: Rosatom News 20100928; Nuclear.ru 20100927; Minatom 20100927; WNN 2010092. NTI PRC 20101125 reports on a general contract for Tianwan Phase 2. WNN 20100927 notes a Jiangsu-Atomstroyexport contract to develop technical design for the second stage of Tianwan (units 3 and 4) and seems to indicate that this is separate from the China National Nuclear Corporation-Rosatom agreement reported for September 27, 2010 (Sequence # _____). See also SNF 20101004, and WNN 20101102 (this latter reports an Atomstroyexport contract for Tianwan Phase 2 signed October 2010).

SNF 20111025 notes a Jiangsu-Atomstroyexport contract for Tianwan Phase 2, signed at the end of November 2010. Rosatom Nuclear Industry in the Media 20111018 and Rosatom Highlights 20110916 note a Atomstroyexport-Jiangsu general contract signed Nov 23, 2010 comes into force in September 2011 (See Sequence # 0184, but this reports a November 3 contract). A separate WNC 20120605 report says that a Tianwan 3 and 4 construction contact took effect in August 2011.

Rosatom Annual Report 2011 notes a General contract for Tianwan Phase 2, signed September 2011. Rosatom News 20101123 notes an Atomstroyexort-Jiangsu contract signed November 23, 2011 as does Nuclear.ru 20101123.

WNN 20131022 reports a TVEL-Jiangsu and China Nuclear Engineering Industry Company contract to supply fuel for Tianwan Phase 2, for deliveries to 2015. SNF 20131025 reports two Jiangsu-TVEL long-term uranium supply agreements for Tianwan Phase 2.

Rosatom News 20140129 reports a Jiangsu-Atomenergomash agreement to start production of steam generators for Tianwan Phase 2. WNN 20170428 reports further TVEL contracts for fuel and engineering services for Tianwan 1 and 2, signed April 26, 2017. SNF 20170515 reports on China Nuclear Engineering Industry Company/Jiangsu- TVEL contracts for supply of fuel, zirconium components for fuel assemblies, and engineering services for Tianwan (not clear which phase).

Note on the Russia-China Subcommittee on Nuclear Issues, of the Sino-Russian Committee for Regular Prime Ministerial Meetings: NTI PRC notes a meeting on January 18, 1999, with signature of a protocol on the meeting signed January 21 (see Seq # 1952). WNC 20060929 and Rostech AR 2006 note the tenth session of Subcommittee, Sept 27-29, 2006, with a statement dated September 29. Rostech Annual Report 2007 notes the eleventh session, July 25, 2007. Rostech Annual Report 2008 notes the twelfth session, October 22-23, 2008, with the protocol signed October 17, 2008. Rostech Annual Report 2009 notes the thirteenth session September 17, 2009. WNC 20100914 reports/announces the fourteenth session. Rostech Annual Report 2013 notes the seventeenth session September 13, 2013. Rosatom News Release 20170915 notes the Protocol on work done and areas of future cooperation, signed on September 14, 2017 at the twenty-first meeting.

Links: For Tianwan Phase 2, related 0171, 0178, 0179 (?), 0180, 0181, 0184, 0185, 0186 and 0191. For Russia-China Sub-commission meetings, see also Sequences #s 0171, 0173, 0177, 0184 and 0190.

0171: CHINA (PRC) (Chinese State Commission on National Defense Science, Technology and Industry) and RUSSIA (Ministry of Atomic Energy). Agreement for Construction of a Nuclear Power Station near Lianyugang and a Gas-Centrifuge Enrichment Plant in Shaanxi Province. Signed January 21, 1999. **Last Date in Force:** unknown. **Source:** PNNL-13197, p. 12; NTI PRC; SNF 19990127.

Note: NTI PRC notes a meeting of the Russia-China Subcommission for Nuclear Issues on Jan 18, 1999, with signature of a protocol on the meeting signed January 21, 1999. Topics include Tianwan and the gas enrichment centrifuge project. SNF 19990127 notes a protocol, signed by the Chinese president of the

State Committee on Science, Technology and Industry and Russian Ministry of Atomic Energy, "completing" the agreement of 1997 on the delivery of two VVER-1000s for Tianwan (See Sequence # 0170). This could refer to Tianwan Phase 2 (units 3 and 4).
Links: Assuming this is for Tianwan Phase 2, the links are: Sequences #s 0170, 0178, 0179 (?), 0180, 0181, 0184, 0185, 0186 and 0191. For the gas centrifuge plant, the links are Sequences 1952 and Sequences 0176 and 0178.

1677: CHINA (PRC) and RUSSIA. Agreement on Co-operation on the Construction and Operation of a Fast Neutron Experimental Reactor in China. Signed July 18, 2000; in force July 18, 2000. **Last Date in Force:** unknown (ten years' duration, with automatic extension for 1 or more 5-year periods). **Source:** NLB 66: 63; WNC 20000718; NTI PRC; FBIS-CHI-20000718; NN 20050908; LEX-FAOC078508.
Note: This concerns the Chinese Experimental Fast Reactor (CEFR). WNC 20000718 gives the signature date as July 18, 2000, as do NN 20050908 and FBIS-CHI-20000718. NLB 66: 63 says it comes into force on signature and lasts 10 years. NTI PRC reports an agreement signed July 10, 2000. SNF 20000719 confirms a general agreement but no clarification re the exact date. LEX-FAOC078508 gives a date of the text as July 18, 2000, but this does not always correspond in this source to the date of signature.
Links: See Sequence # 1957; Sequences #s 0020 and 0167.

0172: CHINA (PRC) and Russia. Treaty on Good-Neighbourliness and Cooperation. Signed July 16, 2001. **Last Date in Force:** unknown: (indefinite duration once it comes into force). **Source:** PRCFM Comm July 24, 2001.
Note: This includes a reference to nuclear energy cooperation.

1956: CHINA (PRC) (State Committee for Science, Technology and Defence Industry) and RUSSIA (Atomic Energy Ministry). Nuclear Co-operation Agreement. Signed July 20, 2001. Protocol announced November 6, 2007. **Last Date in Force:** unknown. **Source:** NN 20010726, 20071107. NTI PRC. WNC 20071107.

Note: This includes designing a nuclear energy plant for spacecraft and the manufacture of MOX fuel. The 2007 Protocol was announced at the12th meeting of the Chinese and Russian Prime Ministers – possible Last Known Date.

Links: See also Sequence # 0196.

1957: CHINA (PRC) and RUSSIA. Fast Reactor Agreement. Signed July 2002.
Last Date in Force: unknown. **Source:** NN 20051031.
Note: WNN 20170104 notes a TVEL contract with the Chinese Institute of Atomic Energy to provide fuel for the Chinese Experimental Fast Reactor signed in Dec 2016 and in force Jan 10, 2017. NEI 20180104 also notes the contract and says TVEL and China Institute of Atomic Energy have been working on the fuel supply for the CEFR since 1999.

Hibbs says the CEFR was supposed to use MOX, but seems likely to continue to use HEU. He reports that in 2000s China hoped o set up a MOX fabrication plant based on Belgian tech, but Belgium would not agree to terms set by China and the project was "scuttled." See Sequence # 0020.

Links: Assuming this refers to the CEFR project, see Sequence # 1677; Sequence # 0020 and 0169.

0173: CHINA (PRC) and RUSSIA. Protocol of the Meeting of the Russian-Chinese Subcommission on Nuclear Issues. Signed September 6, 2005. **Last Date in Force:** unknown. **Source:** Nuclear.ru 20050908.

Note: See the Note for Sequence 0170 for other sub-commission meetings.

0174: CHINA (PRC) and RUSSIA. Agreement to Promote Cooperation in Nuclear Power. Signed November 9, 2006. **Last Date in Force:** unknown. **Source:** WNC 20121206.

Note: Nuclear.ru 20061111 notes the November 9, 2006 signature of a memorandum between the China National Defense Science, Technology and Industry Commission and Rosatom on the mid-term program of Russian-Chinese cooperation in peaceful uses of atomic energy. I am treating this as the same item.

0175: China (PRC) and RUSSIA (Rosatom). Protocol for Mid-Term cooperation in Peaceful Uses of Nuclear Energy. Signed November 6, 2007. **Last Date in Force:** unknown. **Source:** CAEA Nov 9, 2007.

Note: Pomper reports an agreement in November 2007 for two more Tianwan units (Tianwan Phase 3?). WNN 20071108 also notes a framework agreement for two more units at Tianwan.

Links: For other Tianwan Phase 3 agreements, see Sequence #0191?

0176: CHINA (PRC) (China Commission for Science, Technology and Industry for National Defence) and RUSSIA (Rosatom). Intergovernmental Protocol for Cooperation in Construction of a Uranium Enrichment Centrifuge Plant. Reported/announced November 9, 2007. **Last Date in Force:** unknown. **Source:** CAEA 20071109; Pomper; Nuclear.ru 20071107

Note: Would this be the same as the agreement signed November 6, 2007 (Sequence # 0175)? Nuclear.ru 20071107 notes the signature of documents regarding gas centrifuge cooperation, between Rosatom and the China Commission for Science, Technology and Industry for National Defence., as a protocol to the December 18, 1992 agreement (Sequence # 1952). Pomper reports this is for a fourth facility. NTI PRC reports a further agreement on Phase 4 on May 23, 2008 between Techsnabexport and China Nuclear Energy Industry Corp. The supplementary protocol of Nov 2007 may be a Techsnabexport framework agreement with China Nuclear Energy Industry Corp to supply uranium for 11 years, starting in 2010. WNN 20071108 reports the agreement and its connection to the 1992 agreement (Sequence # 1952). It was agreed that a 500,000 SWU cascade at the Hanzhun site would be the final part of that aspect of the agreement. Techsnabexport is supposed to aid

in the construction and in supply of LEU for 11 years from 2011 (draft contracts between Techsnabexport and the China Nuclear Engineering Industry Company are to be submitted to the China Nuclear Engineering Industry Company by the end of "this month.") It says that 500,000 SWU of Russian-supplied capacity was already operating at Hunzhun, installed in late 1990s. "This and other framework agreements were signed by … Rosatom and … (China) Defense Science, Technology and Industry Committee." NN 20080528 agreement to supply a fuel enrichment plant and to supply uranium, signed May 23, 2008, by Russ and PRC government officials. NLB 82: 199 and NTI PRC also note a China-Russia agreement on technical assistance for the construction of Phase 4 of the gaseous uranium enrichment plant, signed May 23, 2008. WNC 20080523 and 20080526 note a China Nuclear Energy Industry Company-Teksnabexport Agreement on the Basic Provisions of the Contract on Providing Technological Assistance for Building Phase 4 of a Centrifuge Plant and Providing China with Uranium Enrichment Services or Uranium Enrichment Products, signed May 23, 2008. Novosti 20080527 suggests this apparently concerns BOTH provision of enrichment services and helping China complete the 4th phase of its centrifuge enrichment plant. Minatom 20090919 notes delivery of gas centrifuges to China, under a Techsnabexport- China Nuclear Energy Industry Company contract signed August 2008.

Zhang and Bai note an agreement by Techsnabexport in 2008 for the supply of enriched uranium supply for Westinghouse AP 1000 reactors. This may concern Tianwan Phase 3 (units 5 and 6), which was to have two AP-1000 reactors. See also the US-China (PRC) agreements regarding the AP-1000 (Sequence # 1969).

Links: For other gas centrifuge agreements see Sequence # 1952 and Sequences #s 0171 and 0178.

0177: CHINA (PRC) and RUSSIA. Protocol of the 12th Meeting of Russian-Chinese Subcommission on Nuclear Issues. Signed October 17, 2008. **Last Date in Force:** unknown. **Source:** Nuclear.ru 20081017; WNN 20081021 and 20091015; WNC 20081023; Rostech Annual Report 2008.

Note: WNN 20081021 notes that the meeting agreed on an 800 MWe demonstration fast breeder reactor (BN-800?). WNN 20091015 terms this a "call for" construction of this. The 13th meeting will be held in 2009. See also the Rosatom-China National Nuclear Corporation agreement signed/reported/announced Oct 28, 2008.

I am treating this as the point of origin of the BN-800 reactor project. WNN 20100927 notes an October 2009 agreement for pre-project work and design work for 2 x 800 fast neutron power plants at Sanming in Fujian province. WNA Fast Reactors notes a 2009 agreement on sale of 2 BN-800 fast reactors to China. This source also notes an October 2009 agreement with Atomstroyexport for pre-project and design work on 2 BN-800 fast reactors. However, this source also says the project has been suspended. WNN 20091015 reports a high-level agreement for pre-project and design work was signed Oct 14, 2009. NTI PRC says the parties are parties include Atomstroyexport, China Institute of Atomic Energy and the China Nuclear Energy Industry Corporation. Rosatom News 20091016 also reports an agreement,

WNC 20100914 reports/announces the 14th meeting of Russian-Chinese Subcommittee on Nuclear Questions; it reports agreement on building 2 BN-800 type fast reactors. WNC 20100927 says signing of a deal on these will come later.

WNN 20100927 reported an agreement on pre-project and design work for 2 BN-800 fast reactors. It is not clear if this is the same as or follows from the October 14, 2009 agreement. Rosatom News 20100928 and Nuclear.ru 20101028 report a Rosatom –China National Nuclear Corporation Memorandum of Cooperation on fast demonstration reactors. ITAR-TASS 20111010 notes possible fast reactor agreement at October 11-12 talks. Hibbs reports a China-Russia agreement that include joint work on design of advanced fast reactors, signed Nov. 7, 2016.

Links: For other BN-800 agreements see Sequences #s 0178, 0179 (?), 0180 (?), 0182 and 0183(?). For the CFR-600, see also Sequences #s 0178, 0180 and 0185.In some cases I cannot distinguish between the CFR-600 fast reactor and the BN-800 fast reactors.

0178: CHINA (PRC) PRC and RUSSIA. Joint Communique of the 13th Regular Meeting between Heads of Government. Signed October 28, 2008. **Last Date in Force:** unknown. **Source:** PRCFM Comm October 29, 2008.

Note: This notes the intent to continue cooperation in nuclear energy, including Phase II of Tianwan, fast reactor technology, construction of enrichment plants, exploration for uranium mines, nuclear power plants, reprocessing of fast reactor fuel and spent fuel, and recycling of nuclear waste. It also references the October 28, 2008 Rosatom-China National Nuclear Corporation Memorandum of Understanding on building 2 reactors and a commercial demonstration fast reactor for the Tianwan project. I assume this is the BN-800 fast reactor

Links: For Tianwan Phase 2 see also Sequences #s 0170, 0171, 0179, 0180, 0181, 0184, 0185, 0186 and 0191. For the BN-800 fast reactor, see Sequences #s 0177, 0179 (?) 0180 (?), 0`182 and 0183 (?). For the CFR-600, see also Sequences #s 0177, 0180 and 0185. In some cases I cannot distinguish between the CFR-600 fast reactor and the BN-800 fast reactors. For uranium exploration, see Sequence # 0182.

0179: CHINA PRC (China National Nuclear Corporation) and RUSSIA (Rosatom). Memorandum of Agreement on Jointly Building Two Additional Power Generating Sets and Fast Reactor for Commercial Demonstration for the Expansion Project of the Tianwan Nuclear Power Station. Signed October 28, 2008. **Last Date in Force:** unknown. **Source:** WNC 20081028 and 20081030; PRCMFA Comm 20081029. Nuclear.ru 20081028.

Notes: Rosatom Annual Report 2009 notes a Rosatom-China National Nuclear Corporation agreement on a 2009 timeline for Tianwan Phase 2. The fast reactor may be CFR-600 or BN-800??

Links: For Tianwan Phase 2 see also Sequences #s 0170, 0171, 0178, 0180, 0181, 0184, 0185, 0186 and 0191**.** For the BN-800 fast reactor see Sequences #s 0177, 0178, 0180 (?), 0182 and 0183 (?). For the CFR-600, see also Sequences #s 0177, 0179, 0180 and 0185. In some cases I cannot distinguish between the CFR-600 fast reactor and the BN-800 fast reactors.

0180: CHINA (PRC) and RUSSIA. Joint Statement of the Moscow Meeting. Signed June 2009. **Last Date in Force:** unknown. **Source:** PRCFM Comm 20090618; WNC 20090618

Note: This notes nuclear energy cooperation and satisfaction with progress on Tianwan Phase 2 and the commercial demonstration fast reactor. WNC 20090618 reports (for June 17, 2009) an agreement to start building a second Tianwan reactor and a commercial fast neutron reactor. This fast reactor may be the BN-800.

Links: For Tianwan Phase 2 see Sequences #s 0170, 0171, 0178, 0179, 0181, 0184, 0185, 0186 and 0191. For the BN-800 see Sequences #s 0177, 0178, 0180 (?), 0182 and 0183 (?). For the CFR-600, see also Sequences #s 0177, 01780179, and 0185. In some cases I cannot distinguish between the CFR-600 fast reactor and the BN-800 fast reactors.

0181: CHINA (PRC) (China National Nuclear Corporation) and RUSSIA (Rosatom). Memorandum of Understanding on Issues Related to the Construction of the Tianwan Nuclear Power Plant. Signed Oct 13, 2009. **Last Date in Force**: unknown. **Source:** WNC 20091013, 20091016.

Note: This may be financial or may go beyond that? Nuclear.ru 20091014 notes the signature of a protocol concerning Tianwan Phase 2.

Links: For Tianwan Phase 2 see Sequences #s 0170, 0171, 0178, 0179, 0180, 0184, 0185, 0186 and 0191

0182: CHINA (PRC) and RUSSIA. Agreement on Civilian Nuclear Energy Cooperation. Reported/announced September 2 (?), 2010. **Last Date in Force:** unknown. **Source**: WNN 20100902.

Note: This comes at the 13th meeting of the two states' nuclear companies. (This is chaired by head of Rosatom and head of China Atomic Energy Authority. This does not appear to be the same as the Russian-Chinese Subcommission on Nuclear Issues, the thirteenth meeting of which is reported by Rostech Annual Report 2009 to be on September 17, 2009. See the Note to Sequence # 0170, the agreement of May 21, 1997.) This agrees to expand nuclear cooperation to include floating nuclear power plants and other things. NEI 20100830-20100906 reports an agreement to expand nuclear power cooperation in 7 areas, including floating nuclear power plants, uranium exploration, eliminating old plant, and developing markets abroad, and on nuclear safety. WNN 20110916 reports an agreement concerning floating nuclear power plants. WNN 20111208 reports a first meeting (at the end of November 2011) re cooperation in developing marine nuclear energy for floating nuclear power plants and possibly for marine propulsion. WNC 20100914 reports/announces the 14th meeting of Russian-Chinese Subcommittee on Nuclear Questions; it reports agreement on building 2 BN-800 type fast reactors. WNC 20100927 says signing of a deal on these will come later.

WNC 20100927 and SNF 20101004 note a September 27, 1010 Joint Statement on Deepening the Strategic Partnership, which includes reference to deepening nuclear cooperation, signed at a meeting of Russian President Medvedev in China (Sequence # 0183). Is this the same thing? SNF 20101004 reports an agreement at the end of September 2010, permitting cooperation

between Atomstroyexport and Jiangsu Nuclear Power Corporation on Tianwan Phase 2, a contract between these two having been signed as well on September 27, 2010.

Links: On floating nuclear power plants, see also Sequences #s 0187, 0188 and 0191**.** On uranium exploration, see Sequence # 0178.

0183: CHINA (PRC) (China National Nuclear Corporation) and RUSSIA (Rosatom). Agreement on Strategic Interaction for the Peaceful Use of Nuclear Energy. Signed September 27, 2010. **Last Date in Force:** unknown. **Source:** WNC 20100927.

Note: Is this the same as the agreement reported for September 2 (?), 2010? (Sequence # 0182). Itar-tass.com 20100927 reports on China (PRC)-Russian cooperation agreements in the energy sector, including a Rosatom-China Nuclear Energy Industry Corporation agreement on strategic cooperation in the field of the use of nuclear energy for peaceful purposes. China Nuclear Energy Industry Corporation (China Nuclear Engineering Industry Corporation?) may be a subsidiary of China National Nuclear Corporation.
Links: See Sequence # 0182.

0184: CHINA (China Atomic Energy Agency) and RUSSIA (Rosatom). Agreement on Tianwan Phase 2. Signed September 15, 2011. **Last Date in Force:** unknown. **Source:** WNC 20110915; Rosatom Nuclear Industry in the Media 20110916.
Note: This "activates" the construction contract signed on November 3, 2010 (?) between Jiangsu Nuclear Power Corp and Atomstroyexport. The activation agreement was signed during a meeting of the intergovernmental commission's sub-commission on nuclear power. Rosatom Nuclear Industry in the Media 20110916 reports this also, as a Protocol on Cooperation, and implies that this brings the agreement on Tianwan Phase 2 into force.
Links: For other Tianwan Phase 2 agreements see Sequences #s 0170, 0171, 0178, 0179, 0180, 0181, 0185, 0186 and 0191.

0185: CHINA (PRC) (China National Nuclear Corporation and/or China Atomic Energy Authority?) and RUSSIA (Rosatom). Roadmap Plans for Nuclear Cooperation. Reported/announced June 5, 2012. **Last Date in Force:** unknown. **Source:** WNC 20120605; Rosatom Annual Report 2012; Russ Pres Press Release 20120605.
Note: The document initialed June 5, 2012 is reported to be a protocol to the intergovernmental agreement of 1992 (Seq # 1951). According to WNC 20120605 the document initialed June 5, 2012 is reported to be a protocol to the intergovernmental agreement of 1992 (Seq # 1951). It extends the agreement on Tianwan Phase 1 (units 1 and 2) to Tianwan Phase 2 (units 3 and 4)**.** Russ Pres Press Release 20120605 also refers to a "roadmap" signed on "individual areas of Russian-Chinese cooperation in nuclear energy."
Links: See Sequence # 1951. For Tianwan Phase 1 see also Sequence # 0191. For Tianwan Phase 2 see also Sequences **#s** 0170, 0171, 0178, 0179, 0180, 0181, 0184, 0186 and 0191.

0186: CHINA (PRC) and RUSSIA. Protocol on Cooperation in Construction of Units 3 and 4 of the Tianwan Nuclear Power Plant (Tianwan Phase 2). Signed December

6, 2012, in force May 11, 2013. **Last Date in Force:** unknown. **Source:** RDFA Treaties; WNC 20121206; NN Dec 10, 2012.

Links: For Tianwan Phase 1 see also Sequence # 0191. For Ti9anwan Phase 2 see also Sequences **#s** 0170, 0171, 0178, 0179, 0180, 0181, 0184, 0185 and 0191.

0187: CHINA (PRC) (China National Nuclear Corporation) and RUSSIA (Rosatom). Memorandum of Intent regarding a Floating Nuclear Power Plant. Reported/announced July 29, 2013. **Last Date in Force:** unknown. **Source:** NPD 20130729; NN 20130731.

Links: See also Sequences #s 0182, 0188 and 0191.

0188: CHINA (PRC) China Atomic Energy Authority and RUSSIA (Rosatom). Declaration of Intention on Cooperation concerning Floating Nuclear Power Plants. Reported or announced June 3, 2014. **Last Date in Force:** unknown. **Source:** SNF 20140603.

Note: SNF 20140804 notes this agreement, and a supplementary agreement between Rusatom Overseas and China National Nuclear Corporation New Energy Company on possible collaboration on floating nuclear power plants. TASS reports the China National Nuclear Corporation-Rusatom Overseas memorandum was signed July 2014.

Links: See also Sequences #s 0182, 0187 and 0191.

0189: CHINA (PRC) (China National Nuclear Corporation) and RUSSIA (Rosatom). Protocol regarding Discussions on Nuclear Cooperation in Third Countries. Signed April 2015. **Last Date in Force:** unknown. **Source:** TASS 20150601.

0190: CHINA (PRC) and RUSSIA. Joint Statement on Development of Strategic Cooperation in Peaceful Uses of Atomic Energy. Signed November 7, 2016. **Last Date in Force:** unknown. **Source:** Rosatom News Release 20170915; WNN 20161108

Note: This is reported to have provided guidance for the 21st meeting of the Russian-Chinese Sub-Commission for Nuclear Issues) noted on September 14, 2017 (Sequence # 0192). WNN 20161108 gives the date of the joint statement as November 8, 2016. See also the Strategic Cooperation Agreement reported/announced November 11, 2016.

Links:

0191: CHINA (PRC) and RUSSIA. Strategic Cooperation Agreement in the Peaceful Use of Nuclear Energy. Reported or Announced November 11, 2016. **Last Date in Force:** unknown. **Source:** SNF 20161111.

Note: The source notes agreements on Tianwan, floating nuclear power plants, and on 4th generation reactors.

Links: For Tianwan Phase 1 see Sequence 1135 and 1951, and Sequence 0185. For Tianwan Phase 2 see also Sequences #s 0170, 0171, 0178, 0179, 0180, 0181, 0184, 0185 and 0186. For Tianwan Phase 3, see also Sequence #s 0175 (?). For Tianwan Phase 4, see Sequences #s 0179 (?) and 0193.

0192: CHINA (PRC) (China Atomic Energy Authority) and RUSSIA (Rosatom). Protocol on Work Done and Areas of Future Cooperation. Signed September 14, 2017. **Last Date in Force:** unknown. **Source:** Rosatom News Release 20170915.

Note: This was signed at the 21st meeting of the Russian-Chinese Sub-Commission for Nuclear Issues.

0193: CHINA (PRC) and RUSSIA. Agreement for Two VVER-1200 Reactors at Tianwan. Signed June 8, 2018. **Last Date in Force:** unknown. **Source:** SNF 20180627; WNN 20180608.

Note: This is Tianwan Phase 4 (units 7 and 8). WNN 20181107 says Atomstroyexport signed a contract with China National Nuclear Corporation on November 6, 2018,. See also SNF 20181121. WNN 20190312 reports the general contract signed for Tianwan Phase 4 (units 7 and 8), signed March 7, 2019 (the source may say 2018 – I presume an error) by Atomstroyexport and China National Nuclear Corporation.

Links: See also Sequence # 0179 (?) and 0191.

0194: CHINA (PRC) and RUSSIA. Agreement for Two VVER-1200 Reactors at Xudabao. Signed June 8, 2018. **Last Date in Force:** unknown. **Source:** SNF 20180627; WNN 20180608.

Note: WNN 20180608 notes a technical design contract for a 2nd pair of reactors at Xudabao, signed March 7, 2012019 (the source may say 2018 – I presume an error) by Atomstroyexport and China National Nuclear Corporation.

Links: See also Sequence # 1969.

0195: CHINA (PRC) and RUSSIA. Agreement on Cooperation in Construction of the CFR-600 Reactor. Signed June 8, 2018. **Last Date in Force:** unknown. **Source:** SNF 20180627; WNN 20180608.

Note: This concerns supply of equipment, fuel and services for the China Fast Reactor pilot project. WNN 20181107 reports the November 6, 2018 signature of contracts by the Rosatom subsidiary Afrikantov OKBM and China National Nuclear Corporation, concerning the supply of equipment and services, license for right to use software, and services for the examination of documentation.

Links: For other CFR-600 agreements see Sequences 0179(?) and 0180.

0196: CHINA (PRC) and RUSSIA. Agreement concerning Thermonuclear Generators for Lunar Exploration. Signed June 8, 2018. **Last Date in Force:** unknown. **Source:** SNF 20180627; WNN 20180608.

Note: This concerns Radioisotope Thermoelectric Generator (RITEG) parts for China's lunar exploration program. SNF 20181121 may suggest additional contracts signed under this on November 6, 2018.

Links: For other lunar reactor agreements see Sequence # 1956.

SAUDI ARABIA

1958: CHINA (PRC) and SAUDI ARABIA. Atomic Energy Co-operation Agreement. Reported October 31, 1999. **Last Date in Force:** unknown. **Source:** WNC 19991031.

Note: This is reported in the context of co-operation over the last few years.

0197: CHINA (PRC) and SAUDI ARABIA. Agreement on Cooperation in the Development and Use of Nuclear Power for Peaceful Purposes. Signed January 15, 2012. **Last Date in Force:** unknown. **Source**: SNF 20120118; McGoldrick. WNC 20120116; IAEA-DPR 20120117; Intelligence on Iran; ISIS-Online; NTISGN 20120117.

Note: ISIS-Online reports the signature date, and approval by the Saudi cabinet March 4, 2013. The agreement seems to include building nuclear power plants, research reactors, supply of fabricated fuel.

0198: CHINA (PRC) (China National Nuclear Corporation) and SAUDI ARABIA (King Abdullah City for Atomic and Renewable Energy). Agreement. Signed August 2012. **Last Date in Force:** unknown. **Source:** McGoldrick.

0199: CHINA (PRC) (China National Nuclear Corporation) and SAUDI ARABIA. Memorandum of Understanding to Promote Cooperation in Nuclear Science and Technology. Signed November 27, 2013. **Last Date in Force:** unknown. **Source:** NucNet No 47, 20131129; NucNet No 33, 20140815.

Note: The sources report the establishment of a working group to explore possibilities for cooperation. This leads to the Memorandum of Understanding of August 7, 2014.

Link: See Sequences #s 0200 and 0201.

0200: CHINA (PRC) (China National Nuclear Corporation) and SAUDI ARABIA (King Abdulazziz City for Science and Technology). Declaration of Intention on the Promotion of Cooperation in Nuclear Science and Technology. Reported or announced December 6, 2013. **Source:** SNF 20131206.

Note: The source reports the creation of a working group.

Links: See Sequences #s 0199 and 0201.

0201: CHINA (PRC) (China National Nuclear Corporation) and SAUDI ARABIA (King Abdullah City for Atomic and Renewable Energy). Memorandum of Understanding on a Cooperation Mechanism in the Peaceful Applications of Nuclear Energy. Signed August 7, 2014. **Last Date in Force:** unknown. **Source:** KACARE Press Release 20140808; NucNet No 33, 20140815.

Note: This foresees establishment of working groups on design and technology, small modular reactors, human resources development, nuclear fuel recycling, and nuclear engineering. It follows from the Memorandum of Understanding of November 27, 2013.

Link: See Sequence # 0199 and 0200.

0202: CHINA (PRC) and SAUDI ARABIA. Memorandum of Understanding on Construction of High-Temperature Gas-Cooled Reactors. Signed January 2017. **Last Date in Force:** unknown. **Source:** WNN 20171006.

Note: The China Nuclear Engineering Corporation and the King Abdullah City for Atomic and Renewable Energy signed a Memorandum of Understanding on

the Construction of a High-Temperature Gas-Cooled Reactor on January 19, 2016. WNN 20160120; SNF 20160126. They also signed an Agreement for a Joint Study of the Feasibility of Constructing a High-Temperature Gas-Cooled Reactor in Saudi Arabia in March 2017. WNN 20170329.

0203: CHINA (PRC) (China National Nuclear Corporation) and SAUDI ARABIA (Saudi Geological Survey). Memorandum of Understanding regarding Bilateral Cooperation in Uranium and Thorium Resources. Signed March 16, 2017. **Last Date in Force:** unknown. **Source:** WNN 20170731; CNNC Press Release 20170317; SNF 20170328.

Note: SNF 20170905 notes an agreement to deepen this cooperation. A CNNC Press Release 20170720 reports a symposium on Saudi uranium and thorium resources evaluation held July 17, 2017. It also says survey work was to occur within the next 2 years, and it reports the completion of the fieldwork phase in May.

Links: See also Sequence # 0204.

0204: CHINA (PRC) (China National Nuclear Corporation) and SAUDI ARABIA (Saudi Geological Survey). Memorandum of Understanding on Uranium and Thorium Mining and Exploration. Signed April 24, 2017. **Last Date in Force:** unknown. **Source:** WISE.

Links: See also Sequence # 0203.

GENERAL NOTE: The China Nuclear Energy Corporation and the King Abdullah City for Atomic and Renewable Energy sign a Declaration of Intention on the Peaceful Use of Nuclear Energy, reported/announced September 2, 2016. SNF 20160902. This concerns training and technology transfer.

The Beijing Research Institute of Chemical Engineering and Metallurgy – a China National Nuclear Corporation affiliate – and the King Abdullah City for Atomic and Renewable Energy sign a Collaborative Agreement on Research on Extraction of Uranium from Seawater on July 15, 2017. CNNC Press Release 20170720.

The Beijing Research Institute of Chemical Engineering and Metallurgy – a China National Nuclear Corporation affiliate – and the King Abdulazziz City for Science and Technology sign an Agreement to Collaborate on Research on Extracting Uranium from Seawater on July 15, 2017. This is apparently a 2-year agreement. WNN 20170731; WISE.

The China Nuclear Engineering Group and the Saudi Technology Development and Investment Company (TAQNIA) sign a Declaration of Intention concerning Development of Desalination Installations using High-Temperature Reactors in August 2017. SNF 20170904.

SLOVAK REPUBLIC

0205: CHINA (PRC) (China National Nuclear Corporation, China Atomic Energy Authority) and SLOVAK REPUBLIC (Economy Ministry, Nuclear Power Plant Research Institute – VUJE). Memorandum of Understanding on Cooperation in Development of the Nuclear Fuel Cycle Supply Chain. Signed November 24, 2015. **Last Date in Force:** unknown. **Source:** WNN 20151125.

Note: This apparently follows similar agreements with UK and France to develop a "comprehensive European nuclear industry supply chain."

SOUTH AFRICA

0206: CHINA (PRC) and SOUTH AFRICA. Sale of Enriched Uranium to South Africa. Signed 1981. **Last Date in Force:** unknown. **Source:** Wilson Archive Record # 116893.

Note: The source says this was an indirect sale through Western European intermediaries.

0207: CHINA (PRC) and SOUTH AFRICA. Sale of Dismantled Nuclear Equipment from Pelindaba Nuclear Centre. Reported/announced December 15, 1997. **Last Date in Force**: unknown. **Source:** NTI PRC.

0208: CHINA (PRC) and SOUTH AFRICA. Exchange of Notes constituting an Agreement concerning the Sale of the Beva Nuclear Fuel Fabrication Plant. Signed October 7, 1999, in force October 7, 1999. **Last Date in Force:** unknown. **Source:** SA Bilat.

1959: CHINA (PRC) and SOUTH AFRICA. Technical and Scientific Co-operation Agreement. Signed March 2003. **Last Date in Force:** unknown. **Source:** NTI South Africa.

Note: This includes the peaceful use of nuclear energy. SA Bilat does not list this, but it does list a March 3, 1999 science and technology agreement.

1960: CHINA (PRC) and SOUH AFRICA. Technical and Scientific Co-operation Agreement. Signed March 2005. **Last Date in Force:** unknown. **Source:** NTI South Africa.

Note: This includes the peaceful use of nuclear energy. SA Bilat does not list this, but it does list a March 3, 1999 science and technology agreement.

0209: CHINA (PRC) and SOUTH AFRICA. Agreement on Cooperation in the Peaceful Uses of Atomic Energy. Signed June 21, 2006. **Last Date in Force:** unknown. **Source:** SAYIL 2006; SA Bilat; NN 20140306; CEIP-S.

Note: CEIP-S reports this concerns mining of uranium, joint development of nuclear reactors and exchange of personnel, but the original source it cites (dated June 21, 2006) notes only that the deal is proposed, not that it has yet been signed. South Africa Info March 20140305reports a nuclear cooperation agreement signed in 2006, covering the design, construction and operation of nuclear reactors.

Links: Sequences #s 0210 (?), 0211 (?).

0210: CHINA (PRC) and SOUTH AFRICA. Agreement on Cooperation in the Minerals and Energy Sector. Signed September 24, 2007; in force September 24, 2007. **Last Date in Force:** indefinite duration. **Source:** UNTS 45054; SAYIL 2010.

Note: This is speculative on my part.

Links: Sequences #s 0209 (?), 0211 (?).

0211: CHINA (PRC) and SOUTH AFRICA. Memorandum of Understanding regarding the Establishment of the China-South Africa Energy Cooperation Sectoral Committee. Signed August 24, 2010; in force August 24, 2010. **Last Date in Force:** indefinite duration. **Source:** UNTS 48080; SAYIL.

Note: This references implementation of a September 24, 2007 Memorandum of Understanding. There is no specific reference to nuclear sector, so this is speculative.

Links: Sequences #s 0209 (?), 0210 (?). These are speculative on my part.

0212: CHINA (PRC) and SOUTH AFRICA. Comprehensive Strategic Partnership Declaration (Beijing Declaration?). Signed August 24, 2010. **Last Date in Force:** unknown. **Source:** WNC 20100824, 20100901.

Note: This includes an announcement of 38 agreements. It also includes an agreement on mineral exploration and "creating conditions to facilitate practical cooperation," and considering third party involvement in energy, nuclear energy and other projects.

0213: BLANK.

0214: CHINA (PRC) PRC and SOUTH AFRICA. Framework Agreement on Nuclear Cooperation. Signed November 7, 2014. **Last Date in Force**: unknown. **Source:** WNN 20141110; McGoldrick; SNF 20141117.

0215: BLANK

0216: CHINA (PRC) and SOUTH AFRICA. Memorandum of Understanding on a Nuclear Fuel Cycle Partnership. Signed December 2014. **Last Date in Force:** unknown. **Source:** WNN 20150424.

Note: The source also notes a financing agreement on the construction of a nuclear power plant. McGoldrick notes "several" nuclear agreements in December 2014, including a memorandum of understanding on nuclear fuel cycle partnership, a financing agreement re the construction of a nuclear power plant, and training, between China National Nuclear Corporation and the Nuclear Energy Corporation of South Africa.

0217: BLANK

0218: CHINA (PRC) (Nuclear energy regulator) and SOUTH AFRICA (South African nuclear energy regulator). Technical Cooperation Agreement. Reported/announced November 16, 2015. **Last Date in Force:** unknown. **Source:** AFP 20151116.

Note: This includes licensing procedures, vendor inspections, inspector training, joint inspections and technical support.

GENERAL NOTE: SNF 20050309 reports/announces for March 10, 2009 a Chinenergy and Pebble Bed Modular Reactor Ltd. cooperation agreement on the commercialization of the pebble-bed modular reactor. SNF 20090406 reports/announces a declaration of intention on cooperation in development projects for a high temperature reactor based on pebble bed technology, between the Institute of Nuclear and New Energy Technology (INET) of Tsinghua University, and Chinergy Ltd., and Pebble Bed Modular Reactor Ltd.

The China General Nuclear Power Corporation and the State Nuclear Power Technology Corporation, and the Nuclear Energy Corporation of South Africa sign a Skills Development and Training Agreement in February 2014. McGoldrick; South Africa Info 20150315; NN 20140306

The China National Nuclear Corporation and the Nuclear Energy Corporation of South Africa sign an Agreement on Training in Project Management for Nuclear Power Projects Signed December 2014. WNN 20150424. McGoldrick notes "several" nuclear agreements in December 2014, including a memorandum of understanding on nuclear

fuel cycle partnership, a financing agreement re the construction of a nuclear power plant, and training, between China National Nuclear Corporation and the Nuclear Energy Corporation of South Africa. A further Memorandum of Understanding on Training in Nuclear Power Plant Construction is signed April 21, 2015. WNN 20150424.

SPAIN

0942: CHINA (PRC) and SPAIN. Agreement on the Peaceful Uses of Nuclear Energy. Signed October 25, 1985; in force 1985. **Last Date in Force:** unknown. **Source:** NEA Vol. II, p. 215. AFDI 1989: 663-683.

0219: CHINA (PRC) (National Nuclear Safety Administration) and SPAIN (Consejo de Seguridad Nuclear) Cooperation Agreement. Signed 1991, extended May 1996 or Oct. 1997, further extensions in 2008 and February 28, 2012. **Last Date in Force:** unknown. Source: CSN Memoria 2008; CSN Informe 1999, 2001, 2008, 2012. CSN Noticias 2012, 2014; CSN SN #1 1996 and #6, 1997; CSN News 20120228.

0220: CHINA (PRC) and Spain. Agreement on Cooperation in the Peaceful Uses of Nuclear Energy. Signed November 14, 2005, in force March 20, 2009. **Last Date in Force:** indefinite duration. **Source:** Spain LCB.

GENERAL NOTE: WNN 20160203 notes a Suzhou Nuclear Power Research Institute and ENUSA and Tecnatom agreement to cooperate on nuclear fuel inspection systems, signed January 28, 2016. The source notes that cooperation among these three began in 2014. ENUSA is a Spanish public enterprise, supplying services to the Spanish nuclear industry, among other activities.

SUDAN

0221: CHINA (PRC) (China National Nuclear Corporation) and SUDAN (Minister of Energy and Water). Framework Agreement on Nuclear Energy. Signed May 23, 2016. **Last Date in Force:** unknown. **Source:** SNF 20160530; WNN 20160524; NPD 20160524.

Note: The SNF source notes "several" CNNC-Sudan agreements regarding nuclear energy between 2010 and 2013. This source also suggests two framework agreements. Another source, ISIS-Online, 20160523, reports only a nuclear energy agreement. This agreement might follow from a Strategic Partnership agreement signed in 2015.

SWEDEN

0943: CHINA (PRC) and SWEDEN. Industrial and Scientific Co-operation in the Nuclear Field. Signed December 5, 1978; in force December 5, 1978. **Last Date in Force:** indefinite duration. **Source:** NEA Vol. II, p.226.

GENERAL NOTE: SNF 20111121 reports/announces a CHINA (PRC) (China Institute of Atomic Energy – a China National Nuclear Corporation subsidiary) and SWEDEN (Studsvik) Contract for supply of software. Studsvik Energiteknik AB supplies nuclear analysis software. Originally majority government-owned, and established to operate nuclear reactors, it is now private.

SWITZERLAND

0944: CHINA (PRC) and SWITZERLAND. Co-operation in the Peaceful Uses of Nuclear Energy. Signed November 12, 1986; in force August 15, 1988. **Last Date in Force:** indefinite duration. **Source:** NLB 39: 37; NEA Vol. II, p. 239; NTIS DE91-602655; SBDTI.

SYRIA

0222: CHINA (PRC) and SYRIA. Agreement to Supply a Research Reactor. Signed 1991.
Last Date in Force: unknown. **Source:** NTI Syria.
Note: A trilateral PRC-IAEA-Syria safeguards agreement on this was signed February. 28, 1992, in force May 18, 1992. The text of this is in NTI Syria.

THAILAND

0223: CHINA (PRC) (China Guangdong Nuclear Power Corporation, and China Light and Power) and THAILAND (Electrical Generation Authority of Thailand, under the Minister of Energy). Memorandum of Understanding on Nuclear Power Cooperation. Signed November 16, 2009. **Last Date in Force:** duration is three years. **Source:** CGNPC Press Release 20091116; WNC 20091117.
Note: This is an agreement to exchange knowledge and information over the next three years; it may pave the way to a nuclear power plant.

0224: CHINA (PRC) (National Energy Administration) and Thailand (Energy Minister). Agreement to Cooperate in the Peaceful Use of Atomic Energy. Signed March 29, 2017. **Last Date in Force:** unknown. **Source:** WNN 20170405.

TURKEY

0225: CHINA (PRC) and TURKEY (Ministry of Energy and Natural Resources.) Agreement on Cooperation for the Use of Nuclear Energy for Peaceful Purposes. Signed April 9, 2012. **Last Date in Force:** unknown. **Source:** WNC 20120409, 20120921, 20130309; Proliferation News, 20120410; WNC 20120921.

Note: NN 20160225 reports a delay in Turkish ratification of this, but NPD 20160905 announces Turkish ratification. This is one of two agreement signed this day.

0226: CHINA (PRC) (National Energy Administration) and TURKEY (Minister of Energy and Natural Resources). Letter of Intent on Bilateral Cooperation in the Field of Nuclear Energy. Signed April 9, 2012. **Last Date in Force:** unknown. **Source:** Proliferation News, 20120410; WNC 20120409.
Note: This is one of two agreements signed this day.

0227: CHINA (PRC) and TURKEY. Memorandum of Understanding for the Mutual Development of Nuclear Power Technologies. Signed June 2016. **Last Date in Force:** unknown. **Source:** NPD 20160905; SNF 20160707.
Note: SNF 20160707 gives the signature date as June 29, 2016.

0228: CHINA (PRC) (China National Nuclear Safety Administration) and Turkey (Turkish Atomic Energy Authority). Agreement on Cooperation in Nuclear Safety. Signed September 3, 2016. **Last Date in Force:** unknown. **Source:** NN 20160908.

GENERAL NOTE: The State Nuclear Power Technology Corporation and TURKEY sign an Exclusivity Agreement for a third nuclear power plant in 2014. NPD 20160905; NN May 12, 2016. This concerns an AP-1000 and 2 CAP-1400s, from China State Power Investment Corporation.

UGANDA

0229: CHINA (PRC) (China National Nuclear Corporation) and UGANDA (Ministry of Energy and Mineral Development). Memorandum of Understanding on the peaceful uses of nuclear energy. Signed May 11, 2018. **Last Date in Force:** unknown. **Source:** WNN 20180514.

Note: NN 20170511 reported agreement on a draft memorandum. WNN 20180514 notes the report of a draft text in May 2017, and reports that this agreement has medicine, agriculture and industrial uses as its priority areas.

UKRAINE

1961: CHINA (PRC) and UKRAINE. Peaceful Use of Nuclear Energy. Signed March 27, 1996. **Last Date in Force:** unknown. **Source:** NTI PRC.

Note: This includes co-operation in uranium prospecting and mining, research and development of water-cooled rectors, construction and safety measures of nuclear power stations.

0230: CHINA (PRC) (State nuclear regulator) and UKRAINE (State Nuclear Regulatory Committee of Ukraine). Regulatory Cooperation Agreement. Signed June 2004? **Last Date in Force:** unknown. **Source:** SNRCU Annual Report 2005.

0231: CHINA (PRC) and UKRAINE. Joint Statement on Comprehensively Upgrading China-Ukraine Friendly and Cooperative Relations. Signed Sept 2, 2010. **Last Date in Force:** unknown. **Source:** WNC 20100902, 20100903.

Note: This includes a brief reference to cooperation in the nuclear sector.

0232: CHINA (PRC) and UKRAINE. Agreement on Strategic Partnership. Reported/announced June 20, 2011. **Last Date in Force:** unknown. **Source**: ITAR-TASS 20110620.

0233: CHINA (PRC) (China National Energy Administration) and UKRAINE (Energy Minister). Memorandum of Mutual Understanding. Reported/announced June 20, 2011. **Last Date in Force:** unknown. **Source:** ITAR-TASS 20110620.

Note: This covers energy cooperation, including in the use of nuclear energy for peaceful purposes.

GENERAL NOTE: The China Guangdong Nuclear Power Corporation and Energoatom sign a Memorandum of Understanding for Cooperation in the Field of Nuclear Energy on February 2, 2010. WNN 20100205; SNF 20100215. Feb. 15, 2010. Energoatom is Ukraine's national nuclear energy generating corporation. This agreement includes cooperation in design, construction, operation and maintenance of nuclear power plants and R&D and training. A further Memorandum of Understanding is signed on May 26, 2011. SNF 20110615. This is to reinforce their cooperation.

The China National Nuclear Corporation and Energoatom sign a Memorandum of Understanding on Nuclear Energy Cooperation on May 30, 2011. WNN 20110607. This includes cooperation in design, construction, operation and maintenance of NPPs, and continuation of cooperation in safety, training, radiation protection, etc.

The Qingdao Xianchu Group) and the Ukraine State Scientific and Technical Center for Nuclear and Radiation Safety, and Institute for Safety Problems of the National Academy of Sciences sign an Agreement on cooperation in civil nuclear energy on September 25, 2015. NN 20151001. This includes areas such as scientific nuclear research, disposal of spent fuel and radioactive waste, establishment of a joint research and technology institute for new technologies for nuclear power decommissioning. It also continues cooperation in plant reconstruction and modernization, personnel training, nuclear safety and radiation protection.

UNITED KINGDOM

0234: CHINA (PRC) and UNITED KINGDOM. Agreement. Signed December 8, 1983. **Last Date in Force:** unknown. **Source:** NTI PRC.
Note: The source says this clears the way for a joint venture to build and operate a nuclear power plant in Guangdong province.

0293: CHINA (PRC) and UNITED KINGDOM. Co-operation in the Peaceful Uses of Nuclear Energy. Signed June 3, 1985; in force June 3, 1985. **Last Date in Force:** indefinite duration. **Source:** UKTS 1985/60; UNTS 24586.

0235: CHINA (PRC) and UNITED KINGDOM. Memorandum of Understanding on Enhancing Cooperation in the Field of Nuclear Energy. Signed October 15, 2013; in force October 15, 2013. **Last Date in Force:** Indefinite Duration. **Source:** UK DECC for text; WNN 20140618; NucNet No 257, 20131015.

Note: This establishes a Working Group on Cooperation on Nuclear Energy. SNF 20140623 suggests a Letter of Intent was signed October 18, 2013.

0236: CHINA (PRC) (China National Nuclear Corporation, China Atomic Energy Authority) and UNITED KINGDOM (National Decommissioning Authority (International Nuclear Services), Department of Energy and Climate Change). Memorandum of Understanding concerning Enhancing Cooperation in the Field of Civil Nuclear Industry Fuel Cycle Supply Chain. Signed June 17, 2014; in force June 17, 2014. **Last Date in Force:** indefinite duration. **Source:** UK NDA Press Release 20140618; UK DECC text; WNN 20140618; NucNet No 190, 20140618.

Note: Areas include civil nuclear fuel cycle, transportation, decommissioning, radioactive waste management and disposal. NDA's International Nuclear Services, its commercial arm, is the signatory. The NDA subsidiary, "International Nuclear Services," is the NDA signatory. The intention of the Memorandum is to "provide a framework to enhance cooperation in the civil nuclear areas of fuel cycle and transportation, decommissioning, and radioactive waste management and disposal." This Memorandum of Understanding is separate from the other PRC-UK agreement signed this day (Sequence # 0237).

0237: CHINA (PRC) and UNITED KINGDOM. Nuclear agreement. Signed June 17, 2014. **Last Date in Force:** unknown. **Source:** NucNet No. 190, 20140618.
Note: This is a separate agreement from the CNNC/CAEA –NDA(INS)/DECC agreement signed this day (Sequence # 0236).

0238: CHINA (PRC) and UNITED KINGDOM. Heads of Terms Agreement. Signed Nov 9, 2016. **Last Date in Force:** unknown. **Source:** WNN 20161110. **Note:** This is in regard to a Joint Research and Innovation Centre.

UNITED STATES

0239: CHINA (PRC) and UNITED STATES. Agreement on Cooperation in Science and Technology. Signed January 31, 1979; in force January 31, 1979. Extended January 12, 1984; extended January 25 and 27, 1989, in force January 27, 1989, effective February 1, 1989.Extended October 24 and 30, 1989; in force October 30, 1989. Extended April 30 and May 1, 1990; in force May 1, 1990. Amended and extended May 22, 1991; in force May 22, 1991, effective April 30, 1991. Extended August 6 and 28, 1996; in force August 28, 1996, effective April 30, 1996. Extended April 24 and 25, 2001; in force April 25, 2001. **Last Date in Force:** unknown. **Source:** TIAS 9179; KAV 308, 388, 2514, 2959, 4778; 5911

Note: There is a reference to energy cooperation in this agreement, though no specific nuclear reference. However, WNC 20120501 reports that the 14th meeting of the Sino-US Commission on Science and Technology Cooperation, created under this, and which opened on May 1, 2012 and meets every two years, included nuclear safety as a topic. As well, various other agreements (see Links) are subject in their termination terms to the ongoing existence of this agreement. For example, the agreement of January 18, 2011 is still listed as active by DOE/IA as of May 2016, which indicates a possible Last Known Date.

Links: See Sequences #s 0294. 0295 and 0544, and Sequences #s 0251 and 0253 (?)

0295: CHINA (PRC) (State Scientific and Technological Commission) and UNITED STATES (Nuclear Regulatory Commission). Protocol on Cooperation in Nuclear Safety Matters. Signed October 17, 1981; in force October 17, 1981. Amended and extended September 26, 1986; in force September 26, 1986, effective October 17, 1986. Amended and extended January 11, 1993; in force January 11, 1993. Signed September 24, 1998; in force September 24, 1998. Amended April 23, 2004; in force April 23, 2004. Amended January 7, 2008; in force January 7, 2008. Amended July 11, 2013. **Last Date in Force:** July 10, 2018. **Source:** TIAS 10287, 04-341, 08-107, 13-711; NRC text. IAEA p. 90. KAV 0294, 3479, 5536, 6690, 8344. UNTS 26953; PRCNNSA Calendar; US Case Act 08-23.

Note: The specific parties on the Chinese side vary over time, becoming ultimately the China National Nuclear Safety Administration. Although some NRC texts refer to the agreements of September 24 1998 and after as "successors," NRC Doc ML 103400265 and ML 033630429 seem to treat them as extensions of Sequence # 0295, so they are here merged into one sequence. This sequence seems to be linked as well to the Agreement on Scientific and Technological Cooperation of January 31, 1979, with, e.g. the extension of September 24, 1998 initially terminating in five years or with the January 31, 1979 agreement. This continues with the extensions of January 7, 2008 and July 11, 2013.

Links: See Sequence # 0239.

0544: CHINA (PRC) (State Science and Technology Commission) and UNITED STATES (Department of Energy). Co-operation in the Fields of Nuclear Physics and Magnetic Fusion Research. Signed May 11, 1983; in force May 11, 1983. Renewed April 2006 **Last Date in Force:** unknown.

Source: NLB 33:36. US DOE; DOE Bodman; DOE Press Release, 20070522.
Note: This was signed pursuant to the Agreement on Co-operation in Science and Technology of January 31, 1979. Annex 1 (Formal Fusion Arrangement) signed March 13, 1986, end date May 22, 1991, is replaced by an Annex 2 signed May 22, 1992. DOE Press Release, 20070522 may indicate a possible Last Known Date. Suttmeier p. 17 also seems to indicate ongoing cooperation under this.
Links: See Sequences # 0239 and 0253.

0294: CHINA (PRC) and UNITED STATES. Co-operation Concerning Peaceful Uses of Nuclear Energy. Signed July 23, 1985; in force December 30, 1985. **Last Date in Force:** October 28, 2015. **Source:** TIAS 12027; ILM 25:410; UNTS 40066; NTI PRC; NLB 36: 48, 61: 98.

Note: The US Congress approved the implementation of this agreement on March 19, 1998. NTI PRC reports this agreement was initialed April 30, 1984, but signed July 23, 1985. NTI PRC reports it came into force March 19, 1998. Superseded by the agreement of April 13, 2015.

Links: See Sequences # 1497and 1966, and Sequences #s 0244, 0255 and 0258.

1964: Folded into Sequence # 0544. Number to be reassigned.

0240: CHINA (PRC) and UNITED STATES. Exchange of Notes regarding Understanding concerning Assurances for Transfers of Nuclear Technology. Signed September 12, 1993. **Last Date in Force:** unknown. **Source:** Referenced in the agreement of April 13, 2015.

1560: CHINA (PRC) (China Atomic Energy Authority) and UNITED STATES (Department of Energy). Statement of Intent on Research Reactor Fuel. Signed February 23, 1995. **Last Date in Force:** no specific provision. **Source:** US DOE/IA; DOE Bodman.

Note: The focus is on conversion of research reactors from HEU to LEU. For Last Known Date: DOE/IA still lists this as active as of May 2016. DOE Bodman has start date February 23, 1995, but no end date, Focus is on conversion of research reactors to LEU.

1376: CHINA (PRC) (State Planning Commission) and UNITED STATES (Department of Energy). Agreement of Intent concerning Peaceful Uses of Nuclear Technology. Signed October 29, 1997. **Last Date in Force:** unknown **(**DOE/IA and DOE Bodman list an end date as June 29, 1998 (use June 28, 1998). **Source:** NLB 61:98-99. WNC 19971106. Referenced in the agreement of June 29, 1998.
Note: This includes joint projects in the development and implementation of nuclear material export controls. It seems to have been superseded by the agreement of June 29, 1998, sequence # 1497.
Links: Sequence # 1497.

1497: CHINA (PRC) (State Development Planning Commission) and UNITED STATES (Department of Energy). Co-operation concerning Peaceful Uses of Nuclear Technologies. Signed June 29, 1998; in force June 29, 1998. **Last Date in Force:** indefinite duration. **Source:** NLB 62: 82-83, 64: 68-69; TIAS 12968; UNTS 50722; KAV 5282; NTI PRC; NTI US.

Note: This creates a Joint Coordinating Committee on Co-operation in Peaceful Uses of Nuclear Technologies, and "completes" the agreement of July 23, 1985, Sequence # 0294, being subject to that agreement. See also the agreement of October 29, 1997 (Sequence # 1376) and the agreement of September 15, 2003 (Sequence # 1966). The initial termination provisions of this agreement were for five years plus automatic renewal. Although DOE/IA lists this agreement as expired June 29, 2003, USNNSA Press Release 20110424 notes continuing cooperation under this, as do USNNSA Press Releases 20130417, 20150514 and 20160513. Working groups under the agreement cover nuclear energy technologies, safeguards and security, environment and waste management, nuclear emergency management, and radiological security. YNN 20110331 reports an agreement to expand cooperation under this at meeting of the Joint Coordinating Committee. YNN 20130419 reports 8^{the} eighth meeting of the JCC.

Links: See Sequences #s 0294, 1376 and 1966, and Sequence # 0244.

1965: Folded into Sequence # 0295. Number reassigned.

1966: CHINA (PRC) (China Atomic Energy Authority) and UNITED STATES (Department of Energy). Exchange of Notes on Government Nonproliferation Assurances in Nuclear Technology Transfers. Signed September 15 or 16, 2003. **Last Date in Force:** indefinite duration. **Source:** NTI PRC; WNC 20030917; referenced in the agreement of November 22, 2013.

Note: This appears to supplement Sequences # 0294 and 1497. NTI PRC dates the Exchange of Notes as September 15, 2003. The text of the implementing arrangement of November 22, 2013 notes an exchange of notes September 12, 2003 and a Statement of Intent between the US Department of Energy and the China Atomic Energy Authority on September 16, 2003, on the exchange of assurances for transfers of nuclear technology.

Links: See Sequences # 0294 and 1497, and Sequence # 0241.

0241: CHINA (PRC) (China Atomic Energy Authority) and UNITED STATES (Department of Energy). Statement of intent on the Implementation of Government Assurance of Nuclear Technology Transfer. Signed September 16, 2003. **Last Date in Force:** unknown. **Source:** DOE Abraham Tab 21.

Note: DOE/IA as of May 2016 lists this as expired. This concerns the implementation of the exchange noted in the agreement of September 15, 2003 and follows under Sequence # 1966. It affirms understandings regarding non-proliferation (safeguards) assurances re exchanges and transfers of nuclear technology.

Links: See Sequence # 1966.

1967: CHINA (PRC) (China Atomic Energy Authority) and UNITED STATES (Department of Energy). Statement of Intent concerning Co-operation in the Fields of Peaceful Use of Nuclear Energy and Nuclear Nonproliferation and Counterterrorism. Signed January 12, 2004. **Last Date in Force:** indefinite duration (DOE/IA lists as terminating January 12, 2009). **Source:** NTI PRC; NTI US; CAEA Annual Report 2004; USNNSA Press Release 20040112; DOE Abraham Tab 26; DOE Bodman.

1968: Folded into Sequence # 0295. Number reassigned.

0242: CHINA (PRC) (National Development and Reform Commission) and UNITED STATES (Department of Energy). Memorandum of Understanding concerning Cooperation on Bilateral Energy Policy Dialogue. Signed May 23, 2004, in force May 23, 2004. **Last Date in Force:** no specific termination date; DOE/IA lists this as expired May 23, 2009. **Source:** DOE/IA: Reference in the agreement of October 25, 2013**;** DOE Abraham Tab A; DOE Bodman.

Note: This creates an Energy Policy Working Group with nuclear energy as one of its areas. Despite the DOE/IA notation regarding expiry, it is superseded by the Memorandum of Understanding of October 25, 2013?

Links: See Sequence # 0254.

0243: CHINA (PRC) (China Atomic Energy Authority) and UNITED STATES (Department of Energy). Memorandum of Understanding. Signed January 2005. **Last Date in Force:** unknown. **Source:** CAEA Jan. 7, 2005**.**

1969: CHINA (PRC) and UNITED STATES (Department of Energy). Memorandum of Understanding in the Area of Advanced Pressurized Water Reactor Nuclear Power Projects in China and Related Technology. Signed December 16, 2006; effective December 16, 2006. **Last Date in Force:** No specific termination provisions, DOE/IA says this terminates December 16, 2011. **Source:** NN 20070301; DOE/IA; NRC Doc ML 103400265; referenced in the agreement of April 13, 2015; DOE Press Release 20061216; DOE Bodman Tab 2

Note: This apparently paves the way for Westinghouse to bid to construct 4 reactors (APR 1000) in China. This seems to fall under Sequence # 0294. Zhang and Bai note an agreement by Techsbanexport in 2008 for the supply of enriched uranium supply for Westinghouse AP 1000 reactors. This may concern Tianwan Phase 3 (units 5 and 6), which was to have two AP-1000 reactors. The Xubadao site was also supposed to have AP-1000 reactors (See Sequence # 0194) but later agreements introduced VVER-1200s.

Links: See Sequence # 0294. For other Westinghouse-related agreements, see Sequence # 1970, and Sequence # 0248.

1970: CHINA (PRC) (China National Nuclear Safety Administration) and UNITED STATES Nuclear Regulatory Commission). Memorandum of

Co-operation on Nuclear Safety for the Westinghouse AP1000 Nuclear Reactor. Signed May 23, 2007; in force May 23, 2007. **Last Date in Force:** unknown. **Source:** USDS 2007; SNF 20070611; NRC Press Release 20070523; NucNet 20070524.
Links: See Sequence # 1969 and Sequence # 0248.

0244: China (PRC) (National Development and Reform Commission) and UNITED STATES (Department of Energy). US-China Bilateral Civil Nuclear Energy Cooperative Action Plan. Signed September 18, 2007. **Last Date in Force:** unknown. **Source:** NTI US; NTI PRC; referenced in DOE/IA agreement of September 4, 2014; Referenced in the agreement of September 18, 2007 (Sequence # 0257), and in the agreement of April 13, 2015 (Sequence # 0258).
Note: This is a general plan for cooperation to January 2012 and beyond, to be guided by a Nuclear Energy Steering Committee. It links to Sequences #s 0294 and 1497. Areas include advanced fuel cycle technology, fast reactor technology, grid-appropriate reactors, simulation and modeling, safeguards and physical protection technology, and analysis and studies on global assured nuclear fuel supplies and services. Last Known Date April 13, 2015?
Links: See Sequences #s 0294 and 1497.

0245: CHINA (PRC) (China National Nuclear Safety Administration) and UNITED STATES (Nuclear Regulatory Commission). Agreement on Code Applications and Maintenance Program (CAMP). Signed December 2009. **Last Date in Force:** unknown. **Source:** PRCNNSA. PRCNNSA Annual Report 2009.
Note: PRCNNSA Annual Report 2009 notes the signature between December 14 and 18, 2009. NRC Doc Nureg/IA-0427 dated March 2013 notes a CAMP agreement between these parties in 2011: possible Last Known Date?

0246: CHINA (PRC) (Nuclear and Radiation Safety Center) and UNITED STATES (Nuclear Regulatory Commission). Agreement on Cooperative Severe Accident Research Program (CSARP). Signed December 2009. **Last Date in Force:** unknown. **Source:** PRCNSC; PRCNNSA.

0247: CHINA (PRC) (China National Nuclear Safety Administration) and US (Nuclear Regulatory Commission). Agreement on Nuclear Reactor Safety Research. Reported/announced February 5, 2010. **Last Date in Force:** unknown. **Source:** referenced in NRC Doc ML 100430020.
Note: The source provides no further information for this.

0248: CHINA (PRC) and UNITED STATES Further Memorandum of Understanding regarding Nuclear Safety for the Westinghouse APR 1000 Nuclear Reactor. Signed May 25, 2010. **Last Date in Force**: unknown. **Source:** TIAS 13-711; Noted in NRC Docs ML 110260168; WNC 20100525.

Note: This follows on Sequence # 1970. The NRC document notes the Further Memo re the APR 1000 (signed May25, 2010).

Links: See Sequence # 1970.

0249: CHINA (PRC) and UNITED STATES. US-China Joint Statement on Energy Security Cooperation. Reported/announced May 25, 2010. **Last Date in Force:** unknown. **Source:** NRC Docs ML 110260168.

Note: The document notes that, after intellectual property rights issues are addressed, the NRC and NNSA "are willing to make concerted efforts to promote technical cooperation on the safety of High Temperature Gas Cooled nuclear reactors."

0250: CHINA (PRC) (China Atomic Energy Authority) and US (Department of Energy). Memorandum of Understanding for Cooperation in Establishing a Center of Excellence on Nuclear Security in China. Signed January 17 and 19, 2011; in force January 19, 2011. **Last Date in Force:** terminates at any time. **Source:** DOE/IA; NTI PRC; YNN 20110120; NN 20110120.

Note: This concerns nuclear security and safeguards. It follows from the Nuclear Security Summit of April 2010. Subjects include security, safeguards, protection, materials control and accounting, detection, measurement, and emergency preparedness and response. For Last Known Date: DOE/IA as of May 2016 lists as active.

0251: CHINA (PRC) (Chinese Academy of Sciences) and UNITED STATES (Department of Energy) Protocol for Cooperation in Energy Sciences. Signed January 18, 2011; in force January 18, 2011. **Last Date in Force:** for duration of Scientific and Technical Cooperation Agreement of January 31, 1979. **Source:** US Case Act 2011-0016; TIAS 11-118.

Note: The Protocol's subject matter includes "nuclear energy sciences." It is signed under the terms of the January 31, 1979 Agreement Relating to Scientific and Technical Cooperation and continues as long as that agreement continues. DOE/IA lists the Protocol as still active as of May 2016.

Links: See Sequence # 0239.

0252: CHINA (PRC) (Chinese Academy of Sciences) and US (Department of Energy). Memorandum of Understanding for Cooperation in Nuclear Energy Sciences and Technology. Signed December 21 and 29, 2011; may start December 29, 2011. **Last Date in Force:** terminates at any time. **Source:** DOE/IA.

Note: This includes non-electrical applications, extraction of uranium from seawater. For Last Known Date: DOE/IA as of May 2016 lists as active.

0253: CHINA (PRC) and UNITED STATES. Agreement to Establish a Collaborative Innovation Center for Advanced Fusion Energy and Plasma Science. Signed 2012. **Last Date in Force:** unknown. **Source:** Suttmeier, p. 17.

Note: This is a follow-up to Sequence # 0544.

Links: See Sequence # 0544.

0254: CHINA (PRC) (National Energy Administration) and UNITED STATES (Department of Energy). Memorandum of Understanding on Bilateral Energy

Policy Dialogue. Signed October 25, 2013; may start October 25, 2013. **Last Date in Force**: unknown. **Source:** DOE/IA.

Note: This sets up the "Energy Policy Dialogue," with nuclear energy as one area. This supersedes and replaces the Memorandum of Understanding on Bilateral Energy Policy Dialogue signed May 23, 2004. For Last Known Date: DOE/IA las of May 2016 lists as active.

Links: See Sequence # 0242.

0255: CHINA (PRC) (National Energy Administration, China Atomic Energy Authority) and UNITED STATES (Department of Energy, National Nuclear Security Administration). Implementing Arrangement under the Agreement for Cooperation concerning Peaceful Uses of Nuclear Energy [July 23, 1985]. Signed November 22 and December 9, 2013. **Last Date in Force:** This has indefinite duration, linked to the duration of Sequence # 0294, – and presumably its successor agreement? **Source:** Referenced in TIAS 15-1029, the agreement of April 13, 2015 (Sequence # 0258); text in Federal Register, December 18, 2013.

Note: I presume that it will continue under the agreement of April 13, 2015 (TIAS 15-1029 – see below) as the text of that agreement seems to indicate that it came into force. The text of TIAS 15-1029 would seem to indicate that the implementing arrangement did come into force. The Arrangement follows under Sequence # 0294, but presumably continues under its successor? The Arrangement "will permit the exchange and joint development of Traveling Wave Reactor (TWR) design information and related Technology." WNA Fast Reactors notes that China National Nuclear Corporation and the US firm TerraPower signed an agreement regarding a prototype 600MWe TWR-600 in September 2015.

Links: See Sequence # 0294, and Sequence # 0258.

0256: CHINA (PRC) (National Natural Science Foundation) and US (Department of Energy). Memorandum of Understanding for Cooperation in Energy-Related Sciences. Signed February 19 and April 16, 2014; may start April 16, 2014. **Last Date in Force:** unknown, terminates at any time. **Source:** DOE/IA.

Note: This is largely basic research, but includes "fusion energy sciences." For Last Known Date: DOE/IA as of May 2016 lists this as active.

0257: CHINA (PRC) (China National Energy Administration) and US (Department of Energy). Statement of Intent concerning Joint Irradiation Testing Program at the China Experimental Fast Reactor. Signed September 4, 2014. **Last Date in Force:** no specific provision. **Source:** DOE/IA.

Note: This concerns a testing program for advanced fuels and cladding. For Last Known Date: DOE/IA as of May 2016 lists as active.

0258: CHINA (PRC) and UNITED STATES. Agreement for Cooperation concerning Peaceful Uses of Nuclear Energy. Signed April 13, 2015; in force October 29, 2015. **Last Date in Force:** October 28, 2045. **Source:** TIAS 15-1029.

Note: This supersedes Sequence # 0294.

Links: See Sequence # 0294.

UZBEKISTAN

0259: CHINA (PRC) (National Development and Reform Commission) and UZBEKISTAN (State Committee for Geology and Mineral Resources – Goskomgeologiya). Agreement on creating a joint venture for uranium exploration. Reported/announced August 31, 2009. **Last Date in Force**: unknown. **Source:** Nuclear.ru 20090831; WNC 20090902.

Note: This will lead to creation of a joint venture between Uranium Resources Co. (a subsidiary of China Guangdong Nuclear Power Corporation) and Goskomgeologiya for the Boztau area. See the agreement signed September 2009.

0260: CHINA (PRC) and UZBEKISTAN. Uranium exploration and development agreement. Reported/announced June 10, 2010. **Last Date in Force:** unknown. **Source:** WNN 20100610; YNN 20100610.

Note: It is not clear if this is different from the agreement signed on June 9, 2010 (see General Note).

GENERAL NOTE: Uranium Resources Ltd., a subsidiary of China General Nuclear Power Corporation and the Uzbek State Committee for Geology and Mineral Resources (Goskomgeo) signed a Joint Venture Agreement in September 2009. Zhang and Bai. This concerns the Sino-Uz Uranium Resources Co. Ltd., particularly the Boztau uranium exploration project.

Uranium Resources Ltd., a subsidiary of China General Nuclear Power Corporation and the Uzbek Navoi Mining and Metallurgy Combine signed a Natural Uranium Trade Agreement on June 9, 2010. Zhang and Bai. Navoi is a state-owned enterprise. They signed a Contract for Uranium Supply in May 2014. Zhang and Bai. Zhang and Bai report this is worth $800 million.

VIETNAM

0261: CHINA (PRC) and VIETNAM. Agreement for Cooperation in the Peaceful Uses of Nuclear Energy. Signed December 2000. **Last Date in Force:** unknown. **Source:** SNF 20090504; IAEA CNPP 2016 (Vietnam update 2016); WNN 20171113.
Note: The Last Known Date is 2017.

0262: CHINA (PRC) (China Guangdong Nuclear Power Corporation) and VIETNAM (Vietnam Atomic Energy Institute). Memorandum of Understanding to Cooperate in Nuclear Power. Signed July 21, 2010. **Last Date in Force:** unknown. **Source:** NTI PRC; NN 20100729.
Note: This is apparently an agreement to train experts and provide technology to VAEI.

0263: CHINA (PRC) (China Guangdong Nuclear Power Corporation) and VIETNAM (Vietnam Atomic Energy Commission). Memorandum of Cooperation in the Nuclear Power Sector. Reported/announced August 19, 2010. **Last Date in Force:** unknown. **Source:** See Note.
Note: The url is not accessible. This seems to be different from **Sequence # 0262.**

0264: CHINA (PRC) (National Nuclear Safety Administration and VIETNAM (Vietnam Agency for Radiation and Nuclear Safety -- VARANS). Agreement on Cooperation in Nuclear safety. **Last Date in Force:** unknown. Signed November 12, 2017. **Source:** SNF 20171124; WNN 20171113.
Note: This covers regulation, training, inspections, emergency planning, and radiation monitoring technology.

GENERAL NOTE: The China Guangdong Nuclear Power Corporation) and Electricity of Vietnam (EVN) sign a Letter of Intent on Nuclear Cooperation, reported/announced Feb. 24, 2009. WNN 20090229; SNF 20090504. This is in regard to construction of a nuclear power plant.

YUGOSLAVIA

0545: CHINA (PRC) and YUGOSLAVIA. Cooperation for Peaceful Use of Atomic Energy. Signed April 30, 1980. **Last Date in Force:** unknown. (Yugoslavia dissolved in 1991.) **Source:** Chiu p. 197; NTI PRC.

1136: CHINA (PRC) and YUGOSLAVIA. Nuclear Co-operation Agreement. Signed 1985. **Last Date in Force:** unknown. (Yugoslavia dissolved in 1991.) **Source:** Potter p. 255. NTI PRC.

ZAMBIA

0265: CHINA (PRC) and ZAMBIA. Memorandum of Understanding. Reported/announced May 22, 2017. **Last Date in Force**: unknown. **Source:** NN 20170525.

ZIMBABWE

0266: CHINA (PRC) and ZIMBABWE. Agreement on Uranium Mining. Reported/announced April 3, 2013. **Last Date in Force:** unknown. **Source:** NN 20130413.