Strengthening the Nuclear Non-Proliferation Regime in the 21st Century: Multilateral Approaches to the Nuclear Fuel Cycle

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Abbreviations and Acronyms

AEC	(United Nations) Atomic Energy Commission
AECC	Angarsk Electrolytic Chemical Combine
CANDU	Canada Deuterium Uranium (reactor)
CAS	(IAEA) Committee on Assurances of Supply
COCOM	Coordinating Committee for Multilateral Export Controls
DOE	(US) Department of Energy
GIS	Group of Interested States
GNEP	Global Nuclear Energy Partnership
GNPI	Global Nuclear Power Infrastructure
HEU	Highly Enriched Uranium
IAEA	International Atomic Energy Agency
INFCE	International Fuel Cycle Evaluation
IPS	(IAEA Expert Group on) International Plutonium Storage
IUEC	International Uranium Enrichment Center
LEU	Low Enriched Uranium
MESP	Multilateral Enrichment Sanctuary Project
MOX	Mixed Oxide nuclear fuel
NAM	Non-Aligned Movement
NNWS	Non-Nuclear Weapons States
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NSG	Nuclear Suppliers Group
NWS	Nuclear Weapons States
Prep-Com	Preparatory Committee for the Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons
RANF	Reliable Access to Nuclear Fuel
RFCC	Regional Nuclear Fuel Cycle Centres
SIPRI	Stockholm International Peace Research Institute
TVA	Tennessee Valley Authority
UK	United Kingdom of Britain and Northern Ireland
UN	United Nations
US	United States of America
USSR	(former) Union of Soviet Socialist Republics

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Abstract

In recent years, the multilateral approach to the nuclear fuel cycle has been promoted as a potential mechanism for strengthening the nuclear non-proliferation regime. The multilateral approach has the potential to gain international favour over what has become traditional practice – the indigenous development and control of nuclear facilities. This thesis explores the way in which four states have responded to the revived attention on multilateral approaches to the nuclear fuel cycle, within the framework of the norm life cycle. The varying levels of support reflect broader international opinion on this issue, as many developing states remain concerned that they may be required to forgo not only the "inalienable right" to peaceful nuclear energy, but also the prospective economic and technological benefits of indigenous development in order to participate. However, as the risk of further proliferation and nuclear terrorism comes to the fore of international agendas, facilitating multilateral control of the most sensitive aspects of peaceful nuclear energy may be the key to strengthening the non-proliferation regime in the 21st century.

Introduction

After a period of unpopularity following the reactor meltdowns at Three Mile Island in 1979 and Chernobyl in 1986, international interest in nuclear energy has been revitalised over the last decade, a "nuclear renaissance" that is driven by a number of different factors.[1] For countries with increasing populations, the subsequent augmentation of energy demand is problematic, and nuclear power can seem like a good solution. Nuclear power is a relatively reliable source of energy, particularly when

[1] Sharon Squassoni, "Nuclear Energy: Rebirth of Resuscitation?" Carnegie Endowment for Peace, March 2009, http://www.carnegieendowment.org/files/nuclear_energy_rebirth_resuscitation.pdf. John Deutch (Co-Chair), Ernest J. Moniz (Co-Chair), Stephen Ansolabehere, Michael Driscoll, Paul E. Gray, John P. Holdren, Paul L. Joskow, Richard K. Lester, and Neil E. Todreas, "The Future of Nuclear Power: An Interdisciplinary MIT Study". (Cambridge, Mass.: Massachusetts Institute of Technolgy, 2003), http://web.mit.edu/nuclearpower/.

compared with hydro or solar sources that are weather-dependent and are not viable options in all geographic areas. Recent concerns regarding human-accelerated climate change increase the appeal of nuclear power, as reactors emit a low level of greenhouse gases. Additionally, developing countries may equate the adoption of nuclear power with emergence into the 'developed' world. Nuclear energy is a technologically advanced venture that is difficult to achieve without assistance; therefore, establishing a nuclear power programme may be a source of great national pride. However, concern about the potential for a global expansion of nuclear fuel cycle facilities parallels the revival in interest in nuclear power, for several reasons. The ability of states to adequately manage the safety and security of sensitive nuclear materials, technologies, and facilities; the potential for the development of latent nuclear capabilities that may escalate existing international security tensions; and the link between the development of civilian nuclear energy programmes and military nuclear activities contribute to international anxieties on this matter. These concerns have sparked renewed international interest in multilateral nuclear approaches. This thesis explores the extent to which multilateral approaches to the nuclear fuel cycle constitute an emerging norm – a move away from the traditionally accepted practice of allowing individual states to indigenously engage in the full range of fuel cycle activities to a new practices of international ownership and management, in the interests of global security.

The ongoing and seemingly intractable situations in Iran and North Korea illustrate the worst-case scenario for the non-proliferation regime: a state's engagement in peaceful nuclear activities verges on straying beyond its civilian boundaries, increasingly approaching to the development of a usable nuclear weapon. Unlike North Korea, it is

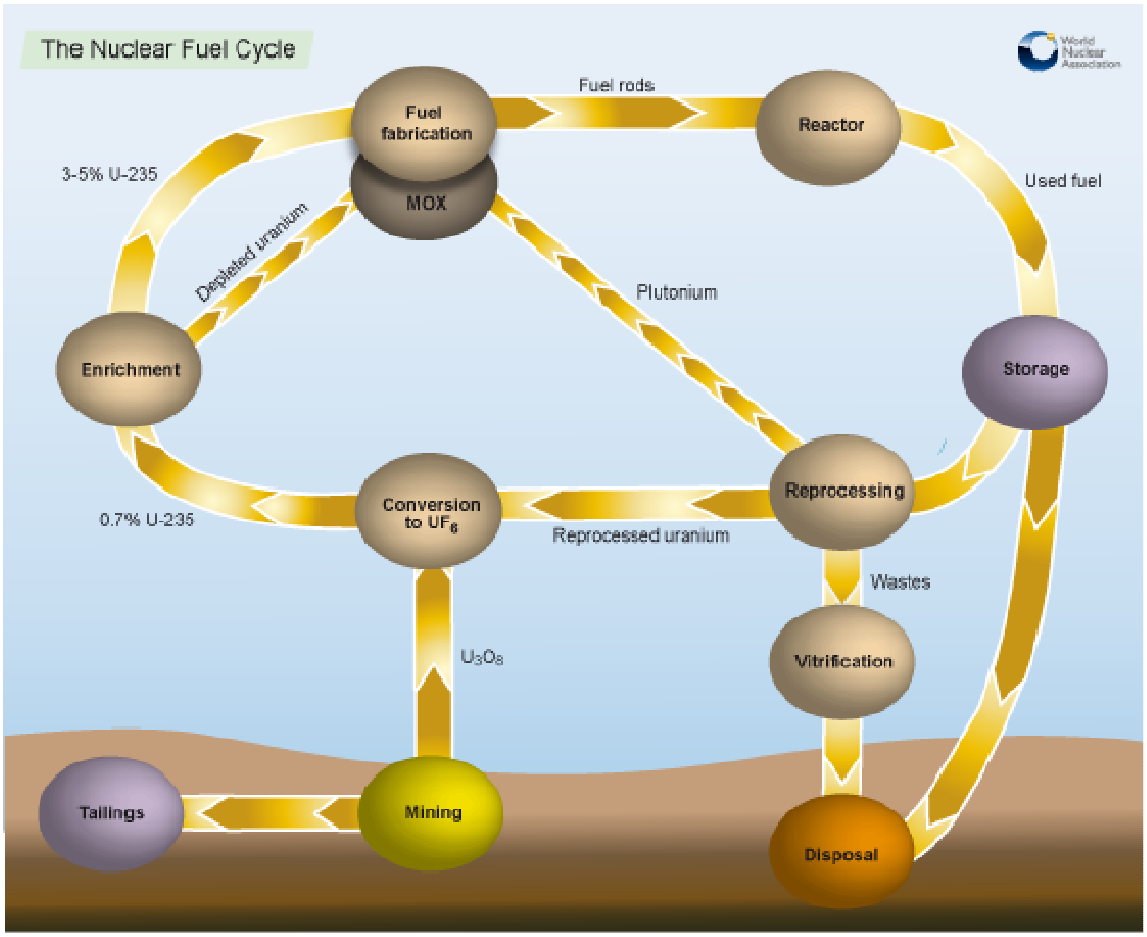
unclear from the open literature whether Iran's activities have yet to definitively cross the military line; but if it has not yet done so, the risk that it will is ever-increasing and demonstrates the root problem of the spread of peaceful nuclear technology: its dual-use nature.

In recent years, two major issues have surfaced for the global nuclear non-proliferation regime. The first has been an ongoing issue since the beginning of the nuclear age – the dual-use nature of nuclear technology. That some parts of the nuclear fuel cycle can be applied in both civilian and military realms presents a serious threat to global non-proliferation efforts. It is no secret that a state can cultivate a nuclear weapons programme from the knowledge and physical components of a civilian nuclear energy programme. Civilian nuclear programmes have been used to disguise weapons research and development in a long list of states, including Argentina, Brazil, France, India, Israel, North Korea, Pakistan, South Africa, South Korea, and Taiwan.[2] In fact, civilian applications of nuclear energy arose out of nuclear weapons research and development conducted by the Manhattan Project in the 1940s.[3] As is evident from past events, political will is often the only barrier between peaceful nuclear activities and the development of nuclear weapons. Proliferation decisions can be motivated by a desire to increase international power and prestige, or military, security or domestic political incentives.[4] Other considerations, such as the time, finances, and the level of deception

[2] Man-Sung Yim, "Nuclear Nonproliferation and the Future Expansion of Nuclear Power," *Progress in Nuclear Energy* 482006), 507.
[3] Ibid., 505.
[4] Ibid., 508. See also S. M. Meyer, *The Dynamics of Nuclear Proliferation* (Chicago, Illinois: The University of Chicago Press, 1984), 11-12. Wyn Q. Bowen and International Institute for Strategic Studies., *Libya and Nuclear Proliferation: Stepping Back from the Brink* (Abingdon, Oxon: Routledge for the International Institute for Strategic Studies, 2006).

required to go down a proliferation path, contribute to the political decision to pursue or refrain from nuclear weapons development.[5]

Figure 1. The Nuclear Fuel Cycle.[6]



[5] Yim, "Nuclear Nonproliferation and the Future Expansion of Nuclear Power," 508. J. D. L. Moore, *South Africa and Nuclear Proliferation: South Africa's Nuclear Capabilities and Intentions in the Context of International Non-Proliferation Policies* (Houndmills, Basingstoke, Hampshire: Macmillan Press, 1987), 128-29. Stockholm International Peace Research Institute, *The Near-Nuclear Countries and the NPT* (Stockholm and New York: Almqvist & Wiksell; Humanities Press, 1972), 22-3. Etel Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East* (Princeton: Princeton University Press, 2007).

[6] Reprinted with permission from the World Nuclear Association. http://www.world-nuclear.org/info/inf03.html Accessed 12 March 2008.

As shown in Figure 1, the nuclear fuel cycle is the process by which natural uranium is processed, used to produce electricity in a nuclear reactor, and eventually disposed of as nuclear waste. Uranium enrichment and the reprocessing of spent fuel are the two stages of the nuclear fuel cycle that present the greatest proliferation risk. The commonality between the two is fissile material; uranium or plutonium is used to create a chain reaction of energy that can power the reactors in nuclear power plants as well as nuclear weapons. Natural uranium contains about 0.7% of the fissile isotope Uranium-235 (U-235); the rest is non-fissile Uranium-238 (U-238). Fuel for a nuclear reactor requires between 3.5% and 5% U-235, also known as low-enriched uranium (LEU). Weapons-grade uranium, or highly enriched uranium (HEU), must be enriched to at least 90% to guarantee a high explosive yield. A bomb containing uranium enriched to any level above 50% would still have a large yield.[7] The technology used for enriching uranium, or increasing the proportion of U-235, is the same for both weapons and reactor fuel. Thus, centrifuges in nuclear facilities that enrich uranium for nuclear power can also be used to create weapons-grade material.

Plutonium is a reactor-made substance that results from reprocessing used uranium fuel in nuclear reactors. Plutonium can also be used in a nuclear weapon, and in much smaller amounts than uranium - 2-6 kilograms (kg) of high-grade plutonium compared with 6-20kg of HEU. The amounts of fissile material required in the pits of modern implosion nuclear weapons are smaller still.[8] The acquisition of plutonium is less

[7] Joseph Cirincione, *Bomb Scare: The History and Future of Nuclear Weapons* (New York: Columbia University Press, 2007), 4-11. Leonard S. Spector and Jacqueline R. Smith, *Nuclear Ambitions: the Spread of Nuclear Weapons, 1989-1990* (Boulder: Westview Press, 1990), 417-20. Mark Fitzpatrick and International Institute for Strategic Studies, *The Iranian Nuclear Crisis: Avoiding Worst-Case Outcomes* (Oxford: Routledge for the International Institute for Strategic Studies, 2008), 1, 19.

[8] Thomas B. Cochran and Christopher E. Paine, *The Amount of Plutonium and Highly-Enriched Uranium Needed for Pure Fission Nuclear Weapons* (Washington D.C.: National Resources Defence Council,

difficult than HEU, because it comes from the reprocessing of spent fuel, and making it a natural part of a closed fuel cycle.[9] Many states use reprocessing because some of the uranium contained in the waste can be reused in Mixed Oxide (MOX) reactor fuel, a process sometimes referred to as 'recycling'. China, France, Japan, Russia, the UK and the US all have stockpiles of reprocessed plutonium that have the potential to be used in weapons, radiological or "dirty" bombs, or as a terrorist target. According to a 1997 US Department of Energy (DOE) Report, almost any combination of plutonium isotopes can be used to make a nuclear weapon:

> "…reactor grade plutonium is weapons-usable, whether by unsophisticated proliferators or by advanced nuclear weapon states… At the lowest level of sophistication, a potential proliferating state or sub-national group using designs and technologies no more sophisticated than those used in first-generation nuclear weapons could build a nuclear weapon from reactor-grade plutonium that would have an assured, reliable yield of one or a few kilotons (and a probable yield significantly higher than that). At the other end of the spectrum, advanced nuclear weapon states such as the United States and Russia, using modern designs, could produce weapons from reactor-grade plutonium having reliable explosive yields, weight, and other characteristics generally comparable to those of weapons made from weapon-grade plutonium."[10]

Due to the ability to utilize parts of a civilian fuel cycle for military purposes, a state that is engaged in uranium enrichment or spent fuel reprocessing as part of its civilian

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1995), 5-6. For an overview of the types of nuclear weapons see Donald MacKenzie and Graham Spinardi, "Tacit Knowledge, Weapons Design, and the Uninvention of Nuclear Weapons," *The American Journal of Sociology* 101, no. 1 (1995), 50-52.; Cirincione, *Bomb Scare: The History and Future of Nuclear Weapons*, 9-12.

[9] In a closed fuel cycle, spent fuel is reprocessed, separating uranium and plutonium from the remaining waste. Plutonium from nuclear reactor waste cannot be used for an advanced nuclear weapon without the chemical separation of weapons-usable plutonium-239 isotopes from the less stable plutonium-240 isotopes. However, it could still be used in a radiological weapon. In an open, or 'once-through' fuel cycle, all spent fuel is disposed as waste. See Deutch *et al*, "The Future of Nuclear Power: An Interdisciplinary MIT Study". Stockholm International Peace Research Institute, *The Near-Nuclear Countries and the NPT*, 6. Leonard S. Spector, *Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990* (Boulder, Colorado: Westview Press, 1990), 420-22. Institute for Energy and Environmental Research, Institute for Energy and Environmental Research, Last updated July 2005, http://www.ieer.org/fctsheet/pu-props.html. Accessed 17 April 2008.

[10] International Panel on Fissile Materials, "Global Fissile Material Report 2007: Developing the technical basis for policy initiatives to secure and irreversibly reduce stocks of nuclear weapons and fissile materials," (2007), 117. http://www.fissilematerials.org/ipfm/site_down/gfmr07.pdf. Accessed 10 June 2008.

nuclear energy programme also has a 'latent capacity' for nuclear weapons development, which presents a serious challenge to non-proliferation efforts. A full fuel cycle civilian programme requires many common elements to a military weapons programme, such as uranium deposits, metallurgists, chemical engineers, nuclear engineers, physicists, chemists, electronic and explosive specialists, and electricity production capacity.[11] The availability of dual-use materials and knowledge provides an opportunity for states to "go nuclear" very quickly, if domestic leadership deemed it beneficial to do so, due to international security factors. Thus, the dual-use nature of the materials and technology involved in producing electricity from atomic energy is a major weakness for the non-proliferation regime.

In addition to the dual-use problem, a second major challenge to the nuclear non-proliferation regime has come to the fore as the extent of Iran's nuclear activities has become apparent. Although the primary function of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), as indicated in its title, is to prevent the further spread of nuclear weapons, it simultaneously introduces the right to access nuclear power for states that agree to use it exclusively for peaceful purposes. Article IV of the NPT states that all Parties have an "inalienable right" to research, produce, and use nuclear energy for peaceful purposes, and in addition, to participate in the full exchange of "equipment, materials and scientific and technological information for the peaceful uses of nuclear energy".[12] In addition to electricity generation, nuclear energy has many

[11] Jo Dong-Joon and Gartzke Erik, "Determinants of Nuclear Weapons Proliferation," *The Journal of Conflict Resolution* 51, no. 1 2007), 173.
[12] "Treaty on the Non-Proliferation of Nuclear Weapons," *Treaty Series: Treaties and International Agreements Registered or Filed or Recorded at the Secretariat of the United Nations.* Vienna: 1970. Article IV. Available at http://www.un.org/Depts/dda/WMD/treaty/

peaceful scientific applications, including in the fields of medicine, agriculture, and water resource management.[13]

The deliberate ambiguity in the text of the NPT, which was required to satisfy the negotiating parties at the time of negotiation, has become problematic for the present-day debate on the obligations and rights of States Parties. Given the significant changes in the international security environment since the 1970s, former IAEA Director General Mohamed ElBaradei has stated the need to regard the treaty "as part of a living, dynamic regime".[14] New security challenges, including the development of number of nuclear-armed states outside the NPT regime, need to be taken into account in addition to the rights afforded to States Parties regarding nuclear energy. Article IV states that peaceful nuclear energy must be used in conformity with Articles I and II.[15] Article I forbids the transfer of nuclear weapons to any recipient by a nuclear weapon state (NWS) and the assistance or encouragement of any non-nuclear weapon state (NNWS) to manufacture nuclear weapons or other nuclear explosive devices.[16] Article II prohibits NNWS from receiving nuclear weapons, and from asking for assistance to manufacture nuclear weapons or other nuclear explosive devices.[17]

Some states believe that the "inalienable right" to nuclear technology is an unconditional entitlement – that any state may choose to adopt nuclear energy as a source of electricity in their territory, and subsequently technical assistance will be

[13] International Atomic Energy Agency, "Department of Nuclear Sciences and Applications", http://www-naweb.iaea.org/na/index.html. Accessed 14 March 2008.
[14] Xinjun Zhang, "The Riddle of 'Inalienable Right' in Article IV of the Treaty on the Non-Proliferation of Nuclear Weapons: Intentional Ambiguity," *Chinese Journal of International Law* 5, no. 3 (November 1, 2006 2006), 650.
[15] "Treaty on the Non-Proliferation of Nuclear Weapons", 1970. Article IV
[16] Ibid. Article I
[17] Ibid. Article II

given to them.[18] In the 1980s, the representative of France on the first IAEA Board of Governors, Bertrand Goldschmidt, concluded that restrictions on certain nuclear activities would be incompatible with the Treaty itself.[19] Former director of the Stockholm International Peace Research Institute (SIPRI) Frank Barnaby agreed with this assessment, arguing that an NPT Party was only forbidden from creating a fully assembled nuclear weapon, including fissile material, and thus all other non-nuclear components could be constructed without being in noncompliance.[20] Conversely, Leonard S. Spector asserted that the commitment made by Parties in signing the NPT to refrain from manufacturing weapons includes "all related development, component fabrication, and testing".[21]

In light of the clandestine nuclear weapons development, the security breaches of nuclear facilities, and the nuclear safety events that the international community has since witnessed, the strictly legal interpretation of Article IV articulated by Goldschmidt and Barnaby is now held largely by developing states.[22] For the most part, experts and developed states accept that unrestricted access to all nuclear technologies

[18] "Statement by H.E. Reza Aghazadeh, Vice President of the Islamic Republic of Iran and President of the Atomic Energy Agency of Iran", (presented at the Forty-Eighth Regular Session of the General Conference of the International Atomic Energy Agency, Vienna, September 2004). http://www.iaea.org/About/Policy/GC/GC48/Statements/index.html . "Statement by Ambassador Antonio Guerreiro, Permanent Representative of Brazil", (presented at the Fifty-Second Session of the General Conference of the International Atomic Energy Agency, Vienna, September-October 2008). http://www.iaea.org/About/Policy/GC/GC52/Statements/index.html

[19] Goldschmidt Bertrand, "A Historical Survey of Nonproliferation Policies," *International Security* 2, no. 1 1977), 80.

[20] Frank Barnaby, "Can Nuclear-weapon Proliferation Be Prevented?" *Bulletin of Peace Proposals* 8, no. 1 (1977), Available from http://sdi.sagepub.com. Accessed 29 July 2009.

[21] Zhang, "The Riddle of 'Inalienable Right' in Article IV of the Treaty on the Non-Proliferation of Nuclear Weapons: Intentional Ambiguity," 653.

[22] Many developing states see the push by NWS for increasing restrictions on the Article IV rights of NNWS as hypocritical, given the lack of progress made on nuclear disarmament. In addition, some NNWS are concern that if 'good behaviour' becomes a prerequisite for technical cooperation, and the international community becomes suspicious that a state might have a hidden military agenda for its peaceful nuclear technology and materials, then the full exchange of science may be denied in the interests of international security.

would undermine effective non-proliferation, nuclear safety and nuclear security measures.[23] The increased spread of not only nuclear technology, but nuclear know-how, since the NPT entered into force has reduced the economic and technological barriers that previously separated peaceful and military nuclear programmes more distinctly.[24] The issue of nuclear terrorism is a compounding factor, adding to an already complex nuclear equation.

Since the 2002 public revelation of the extent of Iran's clandestine nuclear activities, Iranian officials have been persistent in their defence that Article IV allows them to carry out such activities, as they are "transparent, peaceful and under the watchful eyes of IAEA inspectors".[25] Despite being rich in natural resources, such as oil and gas, which could provide a source of electricity, Iran wishes to develop nuclear energy. This in itself is less of a concern to the international community than the fact that Iran also wants to develop the full nuclear fuel cycle. On one hand, it is understandable that they would not want to be reliant on foreign supplies of fresh reactor fuel, having previously experienced the cancellation of supplier contracts due to pressure from the US.[26] On the other hand, nuclear power is an expensive venture, even more so when all the components of the fuel cycle are added. Russia, which has supplied nuclear reactor

[23] See for example, "Statement by the Australian Representative", (presented at the Fifty-Second General Conference of the International Atomic Energy Agency, Vienna, September-October 2008). http://www.iaea.org/About/Policy/GC/GC52/Statements/index.html . "Statement delivered by Mr. Dominique Ristori, Deputy Director General for the Coordination of Nuclear Activities, Directorate-General for Energy and Transport, European Commission", (presented at the Fifty-Second Session of the General Conference of the International Atomic Energy Agency, Vienna, September-October 2008). http://www.iaea.org/About/Policy/GC/GC52/Statements/index.html

[24] Lawrence Scheinman, "The Nuclear Fuel Cycle: A Challenge for Nonproliferation," *Disarmament Diplomacy* 76(March/April 2004), 2-4.

[25] "Address by His Excellency Dr. Mahmoud Ahmadinejad before the 61st Session of the General Assemby," (2006), http://www.un.org/webcast/ga/61/pdfs/iran-e.pdf. Accessed 17 March 2008.

[26] Jean du Preez and Maya Nakumara, "Iran and the IAEA: A Troubling Past with a Hopeful Future?" (Nuclear Threat Initiative, 2003). Available at http://www.nti.org/e_research/e3_35a.html. Accessed 12 December 2008.

technology to Iran in the past, offered a fuel supply arrangement to Iran in an effort to stop the development of an uranium enrichment centre. Iran refused this offer of assistance, as well as others, and continued its activities despite repeated requests from the IAEA to provide answers to unresolved issues.[27] The history of secrecy, the lack of cooperation with the IAEA once its activities were revealed, and the illogic of developing a full nuclear energy programme while other less expensive options are available have lead many to believe that Iran is trying to manufacture nuclear weapons. The IAEA has been unable to fully conclude that all of Iran's nuclear activities are for peaceful purposes.[28] Herein lies the crux of the issue: is Iran using the provisions of the Treaty to disguise its true intentions, or is it simply making the most of its "inalienable right" to nuclear technology to provide a secure electricity supply for its population, while maintaining the option for export revenue that could be generated by oil and gas?

To address the weaknesses within the non-proliferation regime, ElBaradei proposed the idea of internationalised uranium enrichment and reprocessing centres to curb the potential for the diversion of weapons-grade material, and provide assurances of fuel supply.[29] A guaranteed fuel source reduces the incentive for states to enrich uranium indigenously, as obtaining ready-made fuel elsewhere is significantly less expensive than indigenous production. There is some evidence that states have already begun to accept this idea. Several working papers at the Preparatory Committees for the 2010

[27] Karl Vick, "Iran Rejects Russia's Proposal on Uranium: With Security Council Action Looming, Tehran Takes Stance of 'Wait and See'," *Washington Post*, 13 March 2006. Mohamed ElBaradei, "GOV/2010/10 - Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran," (Vienna 2010).
[28] ElBaradei, "GOV/2010/10 - Implementation of the NPT Safeguards Agreement and relevant provisions of Security Council resolutions 1737 (2006), 1747 (2007), 1803 (2008) and 1835 (2008) in the Islamic Republic of Iran," 9, Para. 47.
[29] Mohamed ElBaradei, "Towards a Safer World," *The Economist* 369, no. 8346 (16 October 2003).

Review Conference of the Parties to the NPT (Prep-Com) since 2003 propose initiatives and show support for multilateral arrangements. To date there have been 12 official proposals, all of which are slightly different but carry the common multilateral theme (these will be outlined in more detail in Chapter Three). Put simply, the idea is for states to collectively engage in the stages of the nuclear fuel cycle that pose the greatest risk for proliferation. Additional benefits that come from this approach include increased levels of safety and security for fuel cycle facilities, and preventing states from developing latent nuclear capacities. This may involve, for example, the creation of multilateral enrichment and reprocessing centres, or a fuel bank under the control of the IAEA.

A growing number of states and individuals support the move toward multilateral approaches to the nuclear fuel cycle, but it is by no means a foregone conclusion that these approaches will replace indigenous nuclear development as the dominant international norm. Some states argue that because the "grand bargain" that the NNWS signed up to in the 1970s has not been reciprocated by the NWS in terms of nuclear disarmament, proposals that restrict their Article IV rights are unjust. Potential problems with the multinational approaches include a further widening of the gap between the nuclear 'haves' and 'have-nots'; and unfair control and commercial benefits left to a few select states. Differing levels of technology, economic development and resources, as well as competing political considerations, mean states may reach differing conclusions as to how beneficial a multilateral fuel cycle will be.

This thesis explores both the fuel cycle proposals and state responses to them in an attempt to assess whether a new norm is emerging. It adopts a case study approach in order to achieve this, gauging responses to the fuel cycle proposals of four key states: – Australia, Indonesia, Norway and the Republic of Korea (South Korea). The support of these states is critical for the norm to gain wider support, for the reasons explained in the methodology section in Chapter Two. Chapter Two provides the theoretical framework for this analysis: it explains how global norms develop in the international system, by drawing together realist explanations of state action and constructivist understandings of the role of ideological motivations that frame the collective behavioural changes of states. Chapter Three outlines the historical international efforts to control the spread of nuclear energy and its associated materials and technologies, then summarises recent proposals for multilateral nuclear fuel cycle initiatives. Chapter Four presents the responses of the four cases to the multilateral concept using qualitative analysis (rather than quantitative which is better suited to larger case-study groups). Chapter Five discusses these responses further by considering them within the context of a 'norm life cycle': to what extent do the reactions of these states support or subvert the hypothesis that the multilateral approach is an emerging international norm? Conclusions are presented in Chapter Six, establishing the significance of this research within a broader context, and providing recommendations for policy and for further research.

Chapter Two: Theoretical Framework

In the absence of an overarching authority in the international system, norms construct the rules of behaviour for the international community by defining the boundaries of acceptable behaviour. Behavioural norms create and support a relatively stable international system, and prevent states from acting in whatever way they wish.[30] In their article "International Norm Dynamics and Political Change", Finnemore and Sikkink present a three-stage "norm life-cycle" that has become a key component of norm analysis. This framework identifies "norm emergence", "norm cascade" and "internalisation" as three distinct stages of norm development, bridged by the "tipping point" between the first and second stages, where critical states embrace and support the norm, prompting others to do the same. Chapter Two of this thesis will expand on the way in which global norms develop in the international system, by drawing together realist explanations of state action and constructivist understandings of the role of ideological motivations in framing the collective behavioural changes of states.

The constructivist approach to the study of international relations is reflective of its sociological origins, emphasizing the role of principles and ideas in shaping the behaviour of states within the international community, and recognizing the unique historical contexts that influence the way that states perceive themselves and others.[31] As such, the way in which states understand the actions and proposals for action made by others differs, depending on the level of priority given to any particular issue. The

[30] Martha Finnemore and Kathryn Sikkink, "International Norm Dynamics and Political Change," *International Organization* 52, no. 4 (Autumn 1998), 888.
[31] See for example Alexander Wendt, "Anarchy is What States Make of It," *International Organization* 46, no. 2 (Spring 1992). Martha Finnemore, *National Interests in International Society* (Ithaca, N.Y.: Cornell University Press, 1996). Peter J. Katzenstein, ed. *The Culture of National Security: Norms and Identity in World Politics* (New York: Colombia University Press,1996).

constructivist perspective gives weight to the concept of international norms: ideas and rules give behavioural parameters to states, ideologically limiting their behavioural options on a number of global issues. Within this context, it could be argued that multilateral approaches to the nuclear fuel cycle are an emerging international norm, competing with the existing norm that permits the indigenous development of fuel cycle facilities, including those that pose the most proliferation risk.

Three theoretical paradigms

Realism

Historically, international relations debates divided scholars into two main theoretical standpoints – realism and liberalism. Realist perspectives are embodied by Cold War logic and strategy. In the anarchical international system, conflict between states is a constant threat; therefore, acting in one's own self-interest by maximising security and power are the primary concerns. The balance of power in the international system is vital to maintaining stability.[32] However, in the post-Cold War world, realist logic looks increasingly out-of-date. States are no longer isolated entities, but are instead connected to each other in a myriad of ways. Further, the majority of states are no longer primarily faced with the threat of inter-state conflict; increasingly, threats are faced by multiple states or are even global in their nature – environmental degradation, the depletion of the earth's ozone layer, financial crises, poverty, the uncontrolled spread of conventional arms, and terrorism.

[32] See for example Hans J. Morgenthau, *Politics Among Nations: The Struggle for Power and Peace* (New York: Alfred J. Knopf, 1978). Thomas Hobbes, *Hobbes's Leviathan* (Oxford: Clarendon Press, 1967). Kenneth Neal Waltz, *Theory of international politics* (Reading, Mass.: Addison-Wesley, 1979). Kenneth Neal Waltz, *The Spread of Nuclear Weapons: More May be Better*, Adelphi Papers (London: International Institute for Strategic Studies, 1981).

Liberalism

Classic liberalist perspectives identified domestic actors, organisations and structures as an influence on the interests and identities of states on the international stage. From the 1980s, the focus shifted slightly, emphasising the interconnected nature of the international system and the role that international institutions and norms play in contemporary international relations.[33] Neoliberal theorists, such as Robert Keohane, argue that while international organisations have played a progressively pervasive role in the international system, this is primarily driven by the desire for states to reduce costs and increase transparency, rather than power maximisation or moral concerns.[34]

Constructivism

During the latter part of the 20th century, a "third way" began to emerge. Constructivism can be seen as a path between the two traditional paradigms, drawing on a little from each and in doing so, addressing some of the perceived weaknesses in both schools of thought. The constructivist school views the international system with a sociological slant. For example, not only are states influenced by international norms, but they also play a role in creating them.[35] While liberalist interpretations focus on the effect of norms and institutions on the behaviour of states, constructivists assert that during the process of successful norm creation, a negotiation occurs between states and

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[33] See Thomas Risse-Kappen, ed. *Bringing Transnational Relations Back In: Non-State Actors, Domestic Structures and International Institutions* (Cambridge, U.K.: Cambridge University Press,1995). Robert O. Keohane, *After Hegemony: Cooperation and Discord in the World Political Economy* (Princeton, N.J.: Princeton University Press, 1984). Robert O. Keohane, *International Institutions and State Power: Essays in International Relations Theory* (Boulder: Westview Press, 1989).

[34] Maria Rost Rublee, *Nonproliferation Norms: Why States Choose Nuclear Restraint* (Athens: University of Georgia Press, 2009), 25. Robert O. Keohane and Joseph S. Nye, *Power and Interdependence*, 3rd ed. (New York; London: Longman, 2001).

[35] Wendt, "Anarchy is What States Make of It," 137-38. Richard Price and Nina Tannenwald, "Norms and Deterrence: The Nuclear and Chemical Weapons Taboos," in *The Culture of National Security: Norms and Identities in World Politics*, ed. Peter J. Katzenstein (New York: Colombia University Press, 1996).

the norm, and between norms themselves.[36] Constructivism differs most significantly from realism by acknowledging that states have unique historical and cultural contexts, from which they view the international system. These contexts give states different national values, which in turn affects their domestic priorities, foreign policies and behaviour in the international system.[37] Thus, states do not always act in a manner that maximises their national security and power within the international system, although naturally, they do not act in a manner that decreases these either. This thesis assumes that international norms constrain state behaviour once they become internalised, but that during the process of emergence states have varying motivations for accepting and supporting the norm, both self-interested and ideological.

Norms theory

Norms theory is underpinned by the assumption that ideas and ideologies guide behaviour, in contrast with the realist approaches that have traditionally been dominant in international relations literature, and the liberalist approaches that have tried to account for realism's shortcomings. Traditionally, norms theory was used as an anthropological tool, where it was applied to explain the behaviour of individuals in a social group. However, it is increasingly used to examine the emergence and operation of epistemic communities, international organisations, and regimes, despite the long-standing preference for realist strategic logic and utility maximisation models.[38]

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[36] Alexander Wendt, *Social Theory of International Politics*, Cambridge studies in international relations (New York: Cambridge University Press, 1999). Katzenstein, ed. *The Culture of National Security: Norms and Identity in World Politics*.

[37] Finnemore, *National Interests in International Society*, 15.

[38] See for example, Thomas Risse, Stephen C. Ropp, and Kathryn Sikkink, eds., *The Power of Human Rights: International Norms and Domestic Change* (Cambridge and New York: Cambridge University Press, 1999). G. Goertz and P. F. Diehl, "Toward a Theory of International Norms: Some Conceptual and Measurement Issues," *Journal of Conflict Resolution* 36, no. 4 (December 1992), 634.

In the international system, states were once relatively free to behave as they pleased. However, since the turn of the 19th century, states have been subject to increasing behavioural restrictions, as the international community as a whole has redefined its boundaries. Norms guide state behaviour by providing expectations of behavioural standards, and are sometimes codified and implemented into rules or conventions, which actors then choose to "obey, break, or redefine".[39] Normative parameters help to facilitate social order, guiding actors toward pro-social behaviour by limiting behavioural options from what is *physically* possible to what is *conceivably* possible within the community.[40] As they compete with each other for dominance within the international community, norms shift the boundaries of acceptable behaviour as new norms prevail over old ideas, providing a basis for explaining change in the international system. Research on international norms has traced now-globally recognised principles and behavioural standards from their emergence as ideas in the international arena. Norms have played a vital role in restraining and altering the behaviour of states, particularly over the course of the 20th century. Behaviours that were once considered standard practice, such as the capture, enslavement and trade of free peoples, were challenged by new ideas about universal human rights, leading to the end of the slave trade, slavery, and apartheid.[41] Women's suffrage, environmental protection and free trade all began as ideas that grew to become widely accepted

[39] R. Charli Carpenter, *Innocent Women and Children: Gender, Norms and the Protection of Civilians* (Hampshire, England and Burlington, USA: Ashgate, 2006), 10.
[40] Amitai Etizioni, "Social Norms: Internalization, Persuasion, and History," *Law & Society Review* 34, no. 1 (2000), 159. Ann Florini, "The Evolution of International Norms," *International Studies Quarterly* 40, no. 3 (September 1996), 366.
[41] See for example Risse, Ropp, and Sikkink, eds., *The Power of Human Rights: International Norms and Domestic Change*. Audie Klotz, *Norms in International Relations: The Struggle Against Apartheid* (Ithaca: Cornell University Press, 1995). Ethan A. Nadelmann, "Global Prohibition Regimes: The Evolution of Norms in International Society," *International Organization* 44, no. 4 (Autumn 1990). Daniel C. Thomas, *The Helsinki Effect: International Norms, Human Rights, and the Demise of Communism* (Princeton, New Jersey: Princeton University Press, 2001).

principles. Ideas about conduct during war have developed into norms regarding the use of certain weapons of mass destruction, including nuclear non-proliferation and the non-use of nuclear weapons, and have led to global conventions banning certain conventional weapons, including land mines and cluster munitions.[42]

The slave trade was once common practice and highly profitable, until abolitionist groups emerged in Britain in the mid 1700s, whose members believed that decreasing the availability of new slaves would force owners to treat slaves in a more humane manner.[43] However, it was not until 1807 that the British government passed the Abolition of the Slave Trade Act, rendering participation in the African Slave Trade illegal, despite its profitability at the time. Following this, the Royal Navy devoted around 20 per cent of its warships to the task of intercepting slave ships, boarding those suspected of carrying slaves.[44] After 1817, Britain developed a network of bilateral treaties, allowing it the right to search vessels flying the flags of other states. Some of these bilateral treaties were "obtained at the barrel of a gun"; other countries that refused to sign were nonetheless subjected to the further boarding of ships suspected by the Royal Navy of involvement in the slave trade.[45]

Norms theory has also been used to explain state choices where the outcome does not appear to fit within a realist understanding. According to Maria Rost Rublee, the most plausible scenario that explains the lack of nuclear proliferation is that the norm of *non-*

[42] See for example: Price and Tannenwald, "Norms and Deterrence: The Nuclear and Chemical Weapons Taboos.". Rublee, *Nonproliferation Norms*. Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East*.
[43] Rene de Nevers, "Imposing International Norms: Great Powers and Norm Enforcement," *International Studies Quarterly* 92007), 65.
[44]Suzanne Miers, *Britain and the Ending of the Slave Trade* (London: Longman, 1975).; de Nevers, "Imposing International Norms," 66.
[45] de Nevers, "Imposing International Norms," 66.

proliferation has created a situation where it would be undesirable for states to 'go nuclear'.[46] The normative parameters change the cost-benefit calculation of this decision, adding "breaking with international standards of behaviour" to the costs. Within the increasingly interconnected international system, the price is too high for all but a few to pay.

Criticism of realist approaches

Norms theory and constructivism differ greatly from realism, which has been the traditional theoretical perspective for analysis of international relations. Realist theory centres around the belief that states are rational actors who will always act with their own self-interest as their primary concern. In the realist paradigm, "rationality of behaviour is presupposed; idealistic or altruistic motivations are excluded; and the pursuit of material self-interest is treated as the driving force of human behaviour".[47] This approach tends to emphasise the strategic aspect of state behaviour, and exclude the normative aspect, often reducing norms to basic arguments about material interests versus ethical ideals.[48] Realists characteristically reject norms as rationalisations for self-interest and deny that they have explanatory power.[49] Even when there is a lack of self-interested motivations, some realists argue that altruism can be regarded as a strategic move for gains that will be acquired later.[50] For example, the act of giving a gift may appear to solely benefit the recipient, but is possibly intended to establish a "relationship of reciprocity".[51] Where realist arguments most often fall short is in their lack of ability to explain change in the boundaries of acceptable behaviour in the

[46] Rublee, *Nonproliferation Norms*.
[47] Richard A. Falk, *A Study of Future Worlds* (New York: Free Press, 1975), 13.
[48] Goertz and Diehl, "Toward a Theory of International Norms: Some Conceptual and Measurement Issues.". Klotz, *Norms in International Relations: The Struggle Against Apartheid*, 13.
[49] Klotz, *Norms in International Relations: The Struggle Against Apartheid*, 13.
[50] Ibid.
[51] Ibid.

international system, and their failure to explain policy convergences among large numbers of states.[52] Additionally, realist predictions of widespread nuclear proliferation have not eventuated, indicating that other factors, including strong norms against nuclear weapons acquisitions, have influenced state behaviour.

Realist perspectives view the international system as one where each state primarily looks after its own interests, by maximizing its own power in relation to other states.[53] Given this assumption, state choices are based on a "rational calculation of national interest",[54] and thus international norms do not directly influence state behaviour.[55] This perspective may help to explain state behaviour in some contexts, but not all. Nadelmann asserts that while international regimes do tend to reflect the economic and political interests of the more powerful states, moral factors that are unrelated to these interests "play important roles in the creation and evolution of such regimes".[56] The support of global powers is crucial to the development of new norms, but without the support of smaller states, normative change will not occur. Thus, within the international system, there are examples of both morally motivated and economically convenient norms. The inadequacy of unilateral and bilateral measures to combat illegal transnational activities tends to induce multilateral cooperation in both instances; no government has adequate resources to be able to effectively monitor "all of the high seas or to investigate and punish the array of illicit activities that are committed abroad and harm its interests or citizens".[57] Piracy and the slave trade are both examples of

[52] Florini, "The Evolution of International Norms," 366.
[53] Goertz and Diehl, "Toward a Theory of International Norms: Some Conceptual and Measurement Issues," 636.
[54] Ibid.
[55] Ibid.
[56] Nadelmann, "Global Prohibition Regimes: The Evolution of Norms in International Society," 480.
[57] Ibid., 481.

prohibited behaviour that emerged as ideas, and became salient norms despite their advantages at the time, now enforced by their institutionalisation in global prohibition regimes.[58]

Realism's inability to broadly explain change in the international system does not necessarily mean that state behaviour is not influenced by realist motivations, nor does it render realist perspectives incompatible with constructivist approaches. To the contrary, as the constructivist perspective sees the cultural and political histories of each state as influences on its actions in the present. Thus, while an individual state may indeed be driven by realist-type power and utility maximisation, not all states are primarily focused on this endeavour.

The norm life cycle

Finnemore and Sikkink's "norm life cycle" has become a key feature in the norms literature. They assert that norms evolve in a three-stage process. The first stage is "norm emergence", where "norm entrepreneurs" attempt to persuade states to embrace a new norm. Those states that accept the new norm then become norm leaders, and help to win the support of others. Bridging the first and second stages is the "tipping point" where a "critical mass of relevant state actors adopt the norm", causing the second stage – a "norm cascade". The increased number of states accepting the new norm then leads to the third and final stage of the life cycle – "internalisation". At this point, the norm becomes prevalent in the community and acquires a "taken-for-granted" quality.[59] Hulme and Fukudu-Parr assert that in addition, there is a distinction, in the final stage between "institutionalisation" and "implementation", where a norm may have achieved

[58] Ibid., 479.
[59] Finnemore and Sikkink, "International Norm Dynamics and Political Change," 895.

widespread vocal support, but practical action has not yet been enacted.[60] This gap can be seen in their analysis of the Millennium Development Goals, and parallels with the perceived lack of progress on nuclear disarmament, despite its widespread vocal support.

It is important to note, as Finnemore and Sikkink point out, that the emergence of a new norm does not guarantee that norm will reach the second or third stages and become a pervasive or salient norm; many norms emerge "but fail to reach a tipping point and therefore do not become an internalised, widespread belief".[61] While there is no exact number that indicates a "tipping point", Finnemore and Sikkink assert that it often occurs when roughly one-third of states have accepted the norm. However, *which* states are involved is also significant.[62] On any given issue in international relations, there is often a single state, or a small handful of states, whose support is necessary for the issue to move forward – global powers, regional leaders, or (potential) long-term holdouts. For example, as of April 2010, a number of key states have signed but failed to ratify the Comprehensive Test Ban Treaty (CTBT). China and the US are the only NWS that have not yet ratified. Their status as global power and NWS makes them critical states for the norm against nuclear testing. Their refusal to ratify the CTBT has been subsequently followed by the refusal of Cuba, DPRK, India, Pakistan, Saudi Arabia, Somalia, Syria to sign.

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[60] David Hulme and Sakiko Fukudu-Parr, "International Norm Dynamics and 'the End of Poverty': Understanding the Millennium Development Goals (MDGs)," (2009), http://www.eadi.org/fileadmin/MDG_2015_Publications/fukuda-parr_and_hulme_2009_international_norm_dynamics.pdf. Accessed 3 March 2010.
[61] Finnemore and Sikkink, "International Norm Dynamics and Political Change," 895.
[62] Ibid.

Once a norm is established and internalised, most states will adhere to that norm, most of the time, though not necessarily for the same reasons. Motivational factors for norm adherence will have some variance between states. Likewise, states have varying reasons for supporting a new norm during its emergence, both self-interested and ideological. As illustrated by Maria Rost Rublee, norms theory and realist approaches are not mutually exclusive. Rublee asserts that behavioural change can occur in two ways: "(I) a cost-benefit calculation leading to change in behaviour, with no change in underlying preferences". This realist mechanism can be broken down further into two subcategories: "(I.A) material costs and benefits", and "(I.B) Social costs and benefits". The second means of behavioural change is "(II) a change in preferences that leads to change in behaviour".[63] Although much of the constructivist studies on international norms have focussed on ideological preferences change (II), this thesis takes the view that a state's cost-benefit calculation, including potential self-interest factors, is relevant for assessing norm development.[64] This is because a state may choose to comply with an existing norm, or support an emerging one, for many reasons including that of self-interest. Therefore, acknowledging the potential costs and benefits, both social and material, should be part of the equation. Cost-benefit calculations include a wide spectrum of factors, including economic stability, regional stability, human rights, environmental concerns and international awareness of state actions. For some, power maximisation is still a big factor; however, 'power' does not necessarily translate into the same traditional material terms for each state.

[63] Rublee, *Nonproliferation Norms*, 19.
[64] Ibid.

Looking at nuclear proliferation provides an example of this. Assuming that state security comes from military advantage, acquiring a nuclear weapon is a rational state response if its aim is to have more military power than its potential adversaries do.[65] However, only four states outside of the original NPT NWS have developed a nuclear weapon.[66] The way in which a state perceives the international environment, and its own place within that system, affects its course of action by altering its "preferences".[67] Small and middle power states may view the acquisition of nuclear weapons as a course of action that would diminish its legitimacy and make it a social outcast, instead of increasing its power within international society.[68] The social cost of breaking the norm of non-proliferation is higher than the security gains the state would acquire, particularly when there are other means of increasing security.

Identifying normative change

Normative change becomes more apparent when an emerging norm or idea evolves through the 'life cycle' and reaches a 'tipping point'. The majority of research evaluating normative change has been retrospective, examining successful transformation of behaviour in the international arena.[69] Naturally, it is much easier to trace backwards than to predict into the future, or isolate important factors as they occur. However, Finnemore and Sikkink's norm life cycle provides a useful tool for identifying potentially significant states, "norm leaders", and other key states whose

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[65] John J. Mearsheimer, "The False Promise of International Institutions," *International Security* 19, no. 3 1994), 8.
[66] Rublee, *Nonproliferation Norms*, 6.
[67] William J. Long and Suzette R. Grillot, "Ideas, Beliefs, and Nuclear Policies: The Cases of South Africa and Ukraine," *Nonproliferation Review* 7, no. 1 (Spring 2000), 27.
[68] T.V. Paul, *Power Versus Prudence: Why Nations Forgo Nuclear Weapons* (Quebec City: McGill-Queen's University Press, 2000), 152.
[69] In addition to this bias, Kowert and Legro identify another: the tendency of analysts to focus on "good" or desirable norms, such as the spread of democracy and human rights. See Paul Kowert and Jeffrey Legro, "Norms, Identity, and Their Limits: A Theoretical Response," in *The Culture of National Security: Norms and Identities in World Politics*, ed. Peter J. Katzenstein (New York: Colombia University Press, 1996).

support will be required for the emerging norm to become a successfully internalised one.

What does an emerging norm require in order to become successful? The first factors are norm entrepreneurs, who work from an organisational platform, bring attention to the issue, and offer a new idea as a resolution to an issue. The entrepreneur plays a vital role in framing the situation in such a way that the new norm makes sense to others. Rublee suggests that one of the ways this process occurs is when the new norm is "linked" to conventional values.[70] The second factors are norm leaders, states that embrace the norm early in its life cycle, and help convince others to support the idea. These states help to highlight the norm and the issue, "activating" the norm and emphasizing its importance. Activation does not always cause the successful cascade of acceptance, as emerging ideas constantly compete with one another for dominance[71]; not all of these can succeed. Rublee presents three conditions that affect the outcome of norm transmission – uncertainty, similarity and conflict. Uncertainty, particularly where the costs and/or benefits are in flux, creates a situation where group influence becomes more acceptable to individual actors. Individuals are more likely to internalise the influence of the group rather than simply conform. When environmental conditions are unstable or uncertain, similarity between a norm entrepreneur or norm leader and actors means the actors will accept their influence more readily. When an actor feels valued by, or values a group, conformity is more likely. Conflict negatively affects the influence of norm entrepreneurs and leaders; divisions within a group reduce their

[70] Rublee, *Nonproliferation Norms*, 80.
[71] Ibid., 48, 80.

ability to cooperate and dilute the effect of group influence. When conflict arises, actors within the group take sides, which can prevent others from effective persuasion.[72]

On the other hand, "crisis triggers" can create a situation that is more conducive to the acceptance of new ideas, particularly among resistant states. The nuclear meltdown at Chernobyl provided a demonstrable example of the consequences of lax nuclear safety, and was followed by a dramatic decrease in the construction of new nuclear power plants as well as safety upgrades on a number of existing nuclear power plants.[73] When India conducted its "peaceful nuclear explosion" in 1974, members of the international community responded through the creation of the Nuclear Suppliers Group (NSG). After the discovery of Iraq's clandestine nuclear weapons programme during the 1990 Gulf War, further controls on the export of nuclear technology were agreed upon through the Wassenaar Arrangement. By bringing imagined worst-case scenarios into reality, crisis triggers can inspire cooperative action.

A new norm of nuclear energy?

The Iranian and North Korean nuclear issues and renewed interest in nuclear power can be viewed as crisis triggers for the multilateral approach to the nuclear fuel cycle. It appears as though existing nuclear norms are being challenged by these environmental factors, and new ideas are emerging in order to thwart clandestine nuclear weapons development and proliferation from arising in the future. In an attempt to adapt the norm of non-proliferation to reflect current and potential future proliferation challenges, IAEA Director General ElBaradei began to promote multilateral nuclear approaches in

[72] Ibid., 50.
[73] Luis Lederman, "Nuclear Safety Aspects" (IAEA) http://www-ns.iaea.org/publications/nsaf-aspects.htm. Accessed 13 April 2010

an op-ed published in *The Economist* in 2003.[74] Since then a number of states have supported this idea and put forward proposals outlining how such a scheme might work.[75] While only two of those specific proposals have managed to move forward concretely, there has been a significant amount of interest in the concept more broadly.[76]

Despite the level of interest, there is concern about the wider implications of the introduction of a multilateral approach to the field of nuclear energy. In effect, a multilateral fuel cycle may mean further restrictions on access to peaceful nuclear technology for a number of states. Some developing states have expressed interest in utilising nuclear energy to supply electricity to their growing populations.[77] As NPT member states, they have the right to access "equipment, materials and scientific and technological information for the peaceful uses of nuclear energy" under Article IV of the Treaty. However, under a multilateral fuel cycle regime, that access may be limited to a few select states, as discussed in Chapter Three.

Within the nuclear non-proliferation regime, two ideas are currently competing against each other for supremacy. One idea posits that a multilateral approach to nuclear energy will increase international scrutiny and make it virtually impossible for a state to embark on a path to nuclear weapons through a civilian nuclear energy programme.

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[74] ElBaradei, "Towards a Safer World."
[75] More detailed discussion of these proposals will be presented in later chapters.
[76] The Russian Initiative and the NTI-IAEA Fuel Bank. The US GNEP initiative, which received some initial support but strong criticism, has been abandoned under the new Obama Administration.
[77] More than 50 states have recently expressed to the IAEA their interest in new nuclear power programmes, including: Algeria, Bahrain, Chile, Egypt, Ghana, Indonesia, Israel, Italy, Jordan, Kenya, Kuwait, Libya, Malaysia, Morocco, Namibia, Niger, Nigeria, Oman, Philippines, Qatar, Saudi Arabia, Senegal, Syria, Thailand, Tunisia, Uganda, United Arab Emirates, Uruguay, Venezuela, Vietnam, and Yemen.

The other suggests that restricting access to peaceful nuclear energy technologies goes against the spirit and text of the NPT, and impinges on the rights of NNWS. From the perspective of many NNWS, it is a concern that while most have held up their end of the NPT "grand bargain", progress on nuclear disarmament by NWS has not been as far-reaching as they would have hoped.

This thesis considers the concept of multilateral approaches to the nuclear fuel cycle as a potential or emerging international norm, through an examination of the responses of four case study states to the recent fuel cycle proposals. While process tracing is more typical for examining the development of international norms from their origins, this method is somewhat unsuitable for norms that have not yet become salient.[78] Yet, we can still look for evidence of a norm's progression through the life cycle as it arises. Other case-study methods include "controlled comparison", where the investigator analyses a number of individual cases, then compares their observations to deduce theories; and "congruence procedures" which, like process tracing, infers "theories from observations within cases".[79]

The case study method has been criticised for its inability to be generalised to other cases.[80] Although a single-case study provides a weak basis for applying results to others cases, the use of multiple cases can allow for the inference of broader

[78] Process tracing has been used in a number of studies of the development of international norms, where investigators backwards-trace the chain of events leading to an international norm achieving widespread internalisation or coherence. See, for example: Kowert and Legro, "Norms, Identity, and Their Limits: A Theoretical Response," 469-74. de Nevers, "Imposing International Norms," 62-74. Price and Tannenwald, "Norms and Deterrence: The Nuclear and Chemical Weapons Taboos.". Florini, "The Evolution of International Norms.". Solingen, *Nuclear Logics: Contrasting Paths in East Asia and the Middle East*.
[79] Stephen Van Evera, *Guide to Methods for Students of Political Science* (Ithaca: Cornell University Press, 1997), 68.
[80] Ibid., 53.

conclusions. Multiple-case studies with reasonably consistent background conditions provides a "semi-controlled environment" that allows results to give wider implications beyond the immediate cases presented.[81]

The responses of these states, which are explored in Chapter Four, have the potential to be crucial to the success or failure of the norm, broadly due to their nuclear histories, position within the international system, and potential role to play within a multilateral fuel cycle. As one of the world's few uranium exporters, Australia has a major role to play in this process. Embracing the multilateral approach could significantly affect the potential future economic benefits of the domestic uranium industry by limiting the available opportunities for expanded fuel cycle activities. Australian support for an internationalised fuel cycle would provide assurances to smaller, non-western states that may be wary of bigger global powers interfering in their sovereign territory. Indonesia has stated its intentions to move toward nuclear energy, and as a non-western NNWS and founding member of the Non-Aligned Movement (NAM), its reaction to the multilateral approach will likely reflect that of other states in a similar position. Norway has taken a leadership role in the effort to minimize the use of HEU in civilian reactors, and is one of only a handful of states to have pledged a donation toward the initiative to create a low-enriched uranium (LEU) fuel reserve. At the 2005 NPT Review Conference, South Korea made comments supporting multinational approaches to the fuel cycle. If it chooses to forgo potential or latent nuclear capabilities in light of the tense security environment on the Korean Peninsula, this would add significant weight to the argument that the multilateral approach is an emerging international norm.

[81] Ibid., 52.

Chapter Three: The Multilateral Nuclear Fuel Cycle

This chapter provides a historical background to the efforts to control nuclear technology, the previous failed attempts to introduce multilateral nuclear approaches to the international community, and the current proposals for multilateral initiatives that came in response to ElBaradei's revival of the idea. Controlling the spread of nuclear technology has been a primary concern since the dawn of the nuclear age. The nuclear weapons development by the US during WWII, the Manhattan Project, was conducted under an umbrella of secrecy in order to prevent its enemies from obtaining similar nuclear capabilities.[82] After the former USSR conducted its first nuclear test in 1949, restrictions on technical cooperation for states developing nuclear power decreased.[83] Control increased during the 1970s following India's nuclear weapons development, in the realisation that states could use peaceful nuclear activities to lead them to military weapons programmes. In the 1990s, control over nuclear technologies increased further, after the discovery of Iraq's nuclear weapons programme, and North Korea's withdrawal from the NPT. While efforts to control the spread of nuclear technologies have been gradually increasing over the past six decades, the influence of states that engage in nuclear trade has limited the degree of global control. Previous efforts to promote multilateral approaches during the 1950s and 1970s were thwarted as well, due to the desire of states to retain national control over their nuclear activities.

[82] See F. G. Gosling, *The Manhattan Project: Making the Atomic Bomb* (Diane Pub Co, 1999), 19. Edward T. Sullivan, *The Ultimate Weapon: the race to develop the atomic bomb* (New York: Holiday House, 2006).
[83] V.S. Emelyanov, "Nuclear Energy in the Soviet Union," *Bulletin of Atomic Scientists* 27, no. 9 (November 1971).

A historical trend of control

Post-WWII

In the post-WWII environment, the UN Atomic Energy Commission (AEC) was established by the first UN General Assembly Resolution in 1946, which aimed to bring nuclear energy and weapons technologies under international control to prevent their uncontrolled spread.[84] That same year, the US proposed the Baruch Plan, based on a governmental report by Undersecretary of State Dean Acheson and Chairman of federally owned electric cooperation Tennessee Valley Authority (TVA) David Lilienthal. The Acheson-Lilienthal report stated that inspection of nuclear facilities alone would provide insufficient protection against clandestine nuclear weapons development.[85] The primary recommendation of the Report was the creation of "an international agency conducting all intrinsically dangerous operations in the nuclear field, with individual nations and their citizens free to conduct, under license and a minimum of inspection, all non-dangerous, or safe, operations".[86] The Baruch Plan, presented by the US at the UN AEC in 1946, proposed that an international atomic development agency should manage all aspects of atomic energy, controlling "dangerous" activities, and licensing and inspecting peaceful ones. The Plan also recommended that following the implementation of an adequate safeguards system and renunciation of nuclear weapons, states should cease weapons manufacture, destroy existing arsenals, and surrender nuclear secrets to the international atomic development

[84] United Nations General Assembly, "Resolution 1 (1946) [Establishment of a Commission to Deal With the Problem Raised by the Discovery of Atomic Energy]," (United Nations, 1946).
[85] Board of Consultants, "A Report on the International Control of Atomic Energy (The Acheson-Lilienthal Report)," (Washington, D.C.: Secretary of State's Commission on Atomic Energy, 1946), 9.
[86] Ibid., 31.

agency.[87] The Plan was rejected by the former USSR, due to mistrust of the US.[88] In that same year, the US congress mandated total secrecy on the atomic weapons programmes and banned all exports of nuclear technology and materials under the Atomic Energy Act of 1 August 1946.[89] Despite this, the USSR became the second nuclear-armed state three years later. In 1949, the US and its European allies established The Coordinating Committee for Multilateral Export Controls (COCOM), to control dual-use exports to the Former USSR under an Industrial List.[90]

In December 1953, President Eisenhower proposed the "Atoms for Peace" initiative at the UN General Assembly.[91] This proposal called for cooperative efforts between the UK, the US, and the USSR to assist other states in developing peaceful nuclear energy, in exchange for a promise not to develop nuclear weapons. Atoms for Peace additionally advocated for the creation of an "international atomic energy agency to inspect and control all nuclear material".[92] Two years later, the US began to sign bilateral nuclear cooperation agreements with a number of states, to supply nuclear reactors. Argentina, Belgium, Brazil, Greece, Portugal and Turkey were among the first signatories, and were given declassified reactor information and up to six kilograms of

[87] "The Baruch Plan", National Science Digital Library, http://www.atomicarchive.com/Docs/Deterrence/BaruchPlan.shtml. Accessed 12 April 2009.
[88] Helen M. Cousineau, "The Nuclear Non-Proliferation Treaty and Global Non-Proliferation Regime: A U.S. Policy Agenda," *Boston University International Law Journal* 12, no. 2 (1994), 410.
[89] Ibid., 411.
[90] Karim K. Shehadeh, "The Wassenaar Arrangement and Encryption Exports: An Ineffective Export Control Regime that Compromises United States Economic Interests," *American University of International Law Review* 15, no. 1 (November/December 1999), 274.
[91] Dwight D. Eisenhower, "Address by Mr. Dwight D. Eisenhower, President of the United States of America, to the 470th Plenary Meeting of the United Nations General Assembly" (1953). http://www.iaea.org/About/history_speech.html Accessed 12 July 2009.
[92] Cousineau, "The Nuclear Non-Proliferation Treaty and Global Non-Proliferation Regime: A U.S. Policy Agenda," 411.

20% enriched uranium.[93] By 1961, a total of 39 bilateral agreements had been signed.[94] Eisenhower's vision of a uranium bank, created by a stockpile of fissile materials from US and USSR nuclear weapons, never eventuated. Instead, Atoms for Peace became nothing more than "a collection of agreements on bilateral technical cooperation and information exchange, backed up by a safeguards system that ultimately became the domain of the International Atomic Energy Agency (IAEA)."[95]

The IAEA was established in 1957, amid much support from UN Member States. However, disagreement on the whether IAEA safeguards should apply to natural uranium, and if the IAEA should set levels for plutonium stockpiles, led to a diluted version of the safeguards system – one with the qualities that the Acheson-Lilienthal Report had argued would fail to prevent nuclear proliferation.[96] Indeed, the sharing of nuclear information and knowledge during this period marks the beginning of a number of nuclear weapons development cases. Indian scientists participated in US nuclear energy projects between 1955-1974. India purchased heavy water from the US in the 1960s, which was used in an unsafeguarded Canada Deuterium Uranium (CANDU) reactor that produced the plutonium used in the first Indian peaceful nuclear explosion.[97] In 1959, the former USSR signed a nuclear cooperation agreement with North Korea, resulting in 30 years of training and technology exchange, including the construction of the Yongbyon Nuclear Research Centre.[98] The know-how and

[93] John Krige, "Atoms for Peace, Scientific Internationalism, and Scientific Intelligence," *Osiris* 21, no. 1 2006), 29.
[94] Ibid.
[95] Leonard Weiss, "Atoms for Peace," *Bulletin of Atomic Scientists* 59, no. 6 (Nov/Dec 2003), 41.
[96] Ibid.
[97] Ibid., 42. CANDU reactors are a type of Pressurized Heavy Water Reactor (PHWR), which uses natural uranium for fuel, instead of enriched uranium.
[98] International Institute for Strategic Studies, *North Korea's Weapons Programmes: A Net Assessment* (Basingstoke: Palgrave Macmillan, 2003), 27.

technology gained through cooperation with not only the USSR, but Canada, the former East Germany and Japan, ultimately gave North Korea the ability to develop its nuclear weapons programme.[99]

Post-NPT

Between 1965 and 1968, the NPT was negotiated, in recognition of the need to address the potential for peaceful nuclear energy programmes to lead to nuclear weapons development, and to ensure that proliferation of nuclear weapons was contained.[100] Shortly thereafter in 1971, the Zangger Committee collated a trigger-list of sensitive technologies; in order to import items on the list, states were required to accept IAEA safeguards and inspections.[101] However, as the list only contained "especially designed or prepared" items rather than dual-use technologies, its effectiveness was limited.[102] Concern at India's peaceful nuclear explosion was the catalyst that led to the creation of the NSG in 1975. The group developed a set of export standards for suppliers transferring nuclear technology and materials to NNWS, including "restraint" in the export of uranium enrichment and reprocessing plants.[103] NSG's guidelines were similar to those of the Zangger Committee, but went further in restraining uranium enrichment and plutonium extraction technology.[104] Initially, the US advocated for the most sensitive parts of the nuclear fuel cycle to be prohibited from export, and reprocessing to take place in multilateral facilities.[105] France and West Germany objected, the former having already agreed to sell reprocessing plants to Pakistan and

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[99] Ibid., 27, 32.
[100] Bertrand Goldschmidt, "The Negotiation of the Non-Proliferation Treaty (NPT)," *IAEA Bulletin* 22, no. 3/4.
[101] Yim, "Nuclear Nonproliferation and the Future Expansion of Nuclear Power," 510.
[102] Joseph Cirincione, Jon B. Wolfsthal, and Miriam Rajkumar, *Deadly Arsenals: Tracking Weapons of Mass Destruction* (Washington, D.C.: Carnegie Endowment for International Peace, 2002), 415.
[103] Yim, "Nuclear Nonproliferation and the Future Expansion of Nuclear Power," 510.
[104] Cirincione, Wolfsthal, and Rajkumar, *Deadly Arsenals: Tracking Weapons of Mass Destruction*, 413.
[105] Ibid., 416.

South Korea, and the latter, to provide full fuel cycle facilities to Brazil. These two states additionally objected to a requirement on full-scope safeguards as a condition of all sales. Although the US proposal did not go ahead, NSG did develop a trigger list of exports that would only be permitted if the items were covered by IAEA safeguards.[106] At the time, NSG had only seven members; as of April 2010, membership has expanded to 46 members and one observer (the European Commission).[107]

Also in 1975, the IAEA began an international dialogue on the technical aspects of nuclear proliferation, the "Regional Nuclear Fuel Cycle Centres Study Project".[108] Prompted by concern over the nuclear waste and reprocessing at back-end of the fuel cycle and an anticipated expansion of nuclear power, the study examined "the economic, safety, safeguards and security aspects of a multinational as opposed to a wholly national nuclear fuel cycle approach".[109] The 1977 report of the project highlighted non-proliferation and safeguards, radioactive waste management, and economic considerations of the centres, focussing on back-end multilateral arrangements. Economically, the benefits of economies of scale significantly reduce the costs of constructing and operating. Multiple states pooling their resources would be able to deal with waste more cost-effectively with larger facilities, and the national investment (capital plus operating costs) could be reduced by an estimated 40-60% for larger states, and at least 30% for smaller countries.[110] From a non-proliferation standpoint, RFCC arrangements would improve export controls on sensitive

[106] Ibid.
[107] Nuclear Suppliers Group, "Participants," (Nuclear Suppliers Group) http://www.nuclearsuppliersgroup.org/Leng/03-member.htm. Accessed 1 April 2010
[108] International Atomic Energy Agency, *Study Project on Regional Nuclear Fuel Centres* (Vienna: International Atomic Energy Agency, 1977).
[109] Ibid., Foreword.
[110] Ibid., 24, 27.

technologies and allow better physical protection of sensitive facilities.[111] Economic advantages would flow on from having a wider pool of potential location sites for facilities, which additionally would have operational advantages if co-location were possible.[112]

The International Nuclear Fuel Cycle Evaluation (INFCE) study of 1977-1980 was a technical and analytical study, as and such, the 25000 pages of reports from its working groups did not contain policy recommendations.[113] Rather, the study addressed the technical possibilities of regional fuel cycle facilities and multilateral approaches to the back-end of the fuel cycle, such as the storage of plutonium. Neither the RFCC nor INFCE studies developed into multilateral action, as concerns regarding the "plutonium economy" decreased, and a lack of willingness to forgo national reprocessing control prevented progress in this area.[114]

The IAEA Expert Group on International Plutonium Storage (IPS) and the IAEA Committee on Assurances of Supply (CAS) followed the two previous studies in the 1980s. Once again, the enthusiasm of the IAEA and a small number of states was not matched by the wider international community, with the majority of states unwilling to relinquish sovereign control over their nuclear activities.[115]

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[111] Ibid., 22.
[112] Ibid., 23.
[113] R. Skjoldebrand, "The International Nuclear Fuel Cycle Evaluation - INFCE," *IAEA Bulletin* 22, no. 2 (1980), http://www.iaea.org/Publications/Magazines/Bulletin/Bull222/22204883033.pdf. Accessed 2 April 2010.
[114] Ibid.
[115] Tariq Rauf and Fiona Simpson, "The Nuclear Fuel Cycle: Is It Time for a Multilateral Approach?," *Arms Control Today*, (2004), http://www.armscontrol.org/act/2004_12/Rauf. Accessed 5 May 2008. Yury Yudin, *Multilateralization of the Nuclear Fuel Cycle: Assessing the Existing Proposals* (Geneva: United Nations Institute for Disarmament Research, 2008), 6.

Post-Cold War

The 1990 Gulf War revealed Iraq's clandestine nuclear weapons programme, a exposure that demonstrated NPT membership was not a foolproof barrier preventing proliferation. In response, the NSG developed further restrictions on the export of dual-use nuclear technology and materials in 1992.[116] In July 1996, the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies was established as a non-binding multilateral export control regime, "to contribute to regional and international security and stability, by promoting transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies".[117] There are currently 40 participating states, which "seek, through their national policies, to ensure that transfers of these items do not contribute to the development or enhancement of military capabilities."[118] The Arrangement entails a set of guidelines on conventional arms and another on dual-use items and technologies, based on an agreed list of controlled goods. States have the discretion to accept or deny requests for export of dual-use items; members exchange information on all export license denials for items on the Sensitive List, a subset of the dual-use list, and license approvals by the state that were denied by others in the preceding 12 months.[119]

Efforts to control the spread of nuclear technology, particularly dual-use and sensitive items and materials, have been made by a majority of states since the 1940s. The

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[116] "The Nuclear Suppliers Group (NSG) at a Glance." Arms Control Association, http://www.armscontrol.org/factsheets/NSG. Accessed March 6 2010.
[117] Wassenaar Arrangement, "Introduction," Wassenaar Arrangement, 19 January 2010, http://www.wassenaar.org/introduction/index.html. Accessed 1 April 2010.
[118] Wassenaar Arrangement, "Introduction", Wassenaar Arrangement, 19 January 2010, http://www.wassenaar.org/introduction/index.html. Accessed 1 April 2010.
[119] Cirincione, Wolfsthal, and Rajkumar, *Deadly Arsenals: Tracking Weapons of Mass Destruction*, 422-23.

dangers of nuclear know-how and technology being obtained by states under the pretence of peaceful nuclear applications has always been a concern, dealt with through controlling access to technology by multilateral coordination of export controls and information sharing. When the NPT was negotiated in the latter half of the 1960s, the problematic nature of dual-use nuclear technology was not forgotten; however, the need for NNWS to secure access to peaceful applications was also paramount for them. More than four decades later, this issue remains unresolved and problematic, as exemplified by the ongoing Iranian nuclear situation.

Post-Iran - new multilateral proposals

The 2003 revelations of the twenty years of clandestine nuclear activities in Iran shocked the international community, and triggered a revival of the multilateral nuclear fuel cycle concept. In his 2003 article in *The Economist*, ElBaradei described the need for collective non-nuclear security in response to the battered state of the nuclear non-proliferation regime. Limitations on the processing of weapons-usable material, proliferation-resistant nuclear power systems, and multilateral nuclear approaches, he argued, should be regarded as a "peremptory norm" in the international system, binding on all states with no exceptions.[120] To further explore this idea, ElBaradei appointed an international group of experts in 2004 to consider possible multilateral approaches to the nuclear fuel cycle.[121] The Group released its report in February 2005, outlining five suggested multi-national approaches:

[120] ElBaradei, "Towards a Safer World."
[121] "Multilateral Approaches to the Nuclear Fuel Cycle: Expert Group Report to the Director General of the IAEA," (Vienna: International Atomic Energy Agency, 2005), 1.

- Reinforcing existing commercial market mechanisms through long term commercial contracts and government-backed suppliers' arrangements, including fuel leasing, take-back, storage and fuel banks;[122]
- Developing international supply guarantees involving the IAEA. The IAEA may act as a guarantor of service supplies, for example by administrating a fuel bank;[123]
- Promoting voluntary conversion of existing national facilities to multinational ones, with the participation of NPT NNWS and NWS, and non-NPT States;[124]
- Creating multinational arrangements for new facilities, utilising joint-ownership or co-management for front and back end nuclear facilities;[125]
- The development of a nuclear fuel cycle with stronger multilateral arrangements and broader cooperation involving international organisations such as the IAEA.[126]

The Expert Group intended for these recommendations to be introduced gradually, moving from fuel assurances with IAEA involvement, to the conversion of existing facilities to multilateral control, and eventually new multilateral facilities. Multilateral arrangements have been shown to be successful with the Anglo-Dutch-German uranium enrichment company URENCO, which conducts enrichment in one country only but supplies fuel to its co-financing partners.[127] After this report was released, other states began to put forward more refined proposals drawing on the five

[122] Ibid., 102.
[123] Ibid., 103.
[124] Ibid.
[125] Ibid.
[126] Ibid.
[127] Ibid., 9.

suggestions from the Expert Group. There are a number of additional proposals currently on the table that have followed the Report's release, outlined in the following section. These can be broadly categorised into three groups: global visions, shared facilities, and assurance of supply.

Global visions

The Global Nuclear Energy Partnership

The Global Nuclear Energy Partnership (GNEP) is an initiative lead by the US, proposed in early 2006.[128] GNEP aims to reduce the risk of nuclear proliferation by developing proliferation-resistant nuclear power technologies and providing multilateral nuclear fuel cycle services, including the provision of reliable fuel sources and spent fuel take-back. Through GNEP, the US wanted to cooperate with countries with "secure and advanced nuclear capabilities", to provide fresh fuel to, and recover used fuel from, States who agree to use nuclear energy solely for power generation.[129]

According to the US Department of Energy (DOE), this initiative will reduce carbon emissions (by increasing the number of states using nuclear energy for generating electricity); reduce the capability of "rogue states or terrorists" to use plutonium separated from spent fuel for nuclear weapons (through the development of more advanced reprocessing facilities); make nuclear energy available to a wider number of states (by creating a reliable fuel source that does not require states to develop their own nuclear fuel cycle facilities indigenously); and enhance the global non-

[128] "Department of Energy Announces New Nuclear Initiative", U.S. Department of Energy, http://www.ne.doe.gov/newsroom/2006PRs/nePR020606.html. Accessed March 3 2009.
[129] "Nuclear Waste Explained", U.S. Department of Energy, http://www.ocrwm.doe.gov/ym_repository/about_project/waste_explained/do.shtml. Accessed September 12 2008.; "Lisowski to lead DOE's Global Nuclear Energy Partnership", Los Alamos National Laboratory, http://www.lanl.gov/news/index.php/fuseaction/home.story/story_id/8903. 6 March 2009.

proliferation regime by reducing the spread of enrichment and reprocessing technologies (by limiting them to advanced nuclear states). [130] Today there are three permanent international nongovernment observers and 25 participating observer countries.[131]

The GNEP framework was widely criticised. Commentators have described GNEP as a "premature", "goofy idea" that is "expensive, misdirected and out of sync with the needs of the industry and the nation".[132] The Federation of American Scientists (FAS) published a scathing article highlighting many weaknesses and illogical arguments put forward by the scheme's proponents, including the DOE's focus on selling GNEP through public relations rather than on technical grounds.[133] A recently re-released "Strategic Plan" that used the word "recycling" 37 times in 10 pages exemplifies this. In the new version of the Plan, terms such as "Advanced Burner Reactor" were altered, becoming "Advanced Recycling Reactor". The "Consolidated Fuel Treatment Center", a reprocessing plant for spent fuel, became the "Nuclear Fuel Recycling Center". Rebranding nuclear facilities with 'green' terminology would presumably alleviate public concerns regarding the proximity of nuclear facilities to local communities, making the idea more publicly acceptable.

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[130] US Department of Energy, "Global Nuclear Energy Partnership Strategic Plan," (December 2006), http://www.westgov.org/wieb/meetings/hlwsprg2007/briefing/GNEPsplan.pdf. Accessed 6 March 2009.
[131] The partners are Australia, Bulgaria, Canada, China, France, Ghana, Hungary, Italy, Japan, Jordan, Kazakhstan, Republic of Korea, Lithuania, Poland, Romania, the Russian Federation, Senegal, Slovenia, Ukraine, United Kingdom and the United States. The three permanent international nongovernment observers are the International Atomic Energy Agency, the Generation IV International Forum and Euratom. "Global Nuclear Energy Partnership (GNEP) Steering Group Action Plan", Global Nuclear Energy Partnership, http://www.gneppartnership.org/docs/GNEP_actionplan.pdf. Accessed 4 March 2009.
[132] Mary O'Driscoll, "Nuclear Power: GNEP rush 'doesn't make sense,' industry official says," *Greenwire*, 10 January 2007.
[133] Federation of American Scientists, "Global Nuclear Energy Partnership (GNEP)", Federation of American Scientists (FAS), http://www.fas.org/programs/ssp/nukes/nuclear_power_and_fuel_cycle/gnep.html. Accessed 5 August 2008.

One of the most concerning elements of GNEP was the speed at which it was pushed through the system under the Bush Administration. In August 2006, DOE announced they were going to skip the demonstration process and go directly to commercial scale plants and a commercial sized fast neutron reactor, while continuing research on advanced reprocessing technologies and reactors.[134] In 2007, the US Congress Committee on Appropriations voiced its concerns over the President's rush to get GNEP up and running, stating in the Energy and Water budget for 2008 that it is "unnecessary to rush into a plan that continues to raise concerns among scientists and has only weak support from industry given that there are reasonable options available for short term storage of nuclear waste and that this project will cost tens of billions of dollars and last for decades".[135] One year later, the Committee cut all GNEP funding in the 2009 budget, stating that the initiative undermines US non-proliferation policy.[136]

Other criticisms highlighted the lack of research on the technologies upon which GNEP proposed to expand. The framework is reliant on unproven, under-developed technologies for the reprocessing of spent fuel. Additionally, states who "sign up" are not required to make a legally binding commitment or to commit any funding to the scheme; they merely agree to support the expansion of nuclear power and the closure of the nuclear fuel cycle.[137]

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[134] Ibid.
[135] US House of Representatives Committee on Appropriations, "Summary: 2008 Energy and Water Appropriations," (2008), http://appropriations.house.gov/pdf/EnergyandWater-FC.pdf. Accessed 20 March 2009.
[136] US House of Representatives Committee on Appropriations, "Summary: 2009 Energy and Water Appropriations," (2009), http://appropriations.house.gov/pdf/EWFY0902-23-09.pdf. Accessed 27 February 2010.
[137] "Global Nuclear Energy Partnership Statement of Principles," (Global Nuclear Energy Partnership, 2007).

Global Nuclear Power Infrastructure

In January 2006, the Russian government began to promote the "Global Nuclear Power Infrastructure" (GNPI), a global network of enrichment centres that would deal with the enrichment stage of the fuel cycle, operating under IAEA safeguards.[138] The "Statement on the Peaceful Use of Nuclear Energy" emphasized the need to create a global infrastructure allowing equal access to nuclear energy, and suggested international fuel cycle service centres under IAEA auspices as one potential element.[139] Under GNPI, those states that wish to participate in the scheme would enjoy equal access to enriched uranium.

International Uranium Enrichment Centre at Angarsk

While there has been little discussion about the back-end of the fuel cycle, Russia has moved forward with great momentum since the initial enrichment proposal in 2006. The Angarsk Electrolytic Chemical Combine (AECC), an existing Russian nuclear fuel cycle facility that has provided enrichment services since the 1980s, was chosen to house the pilot GNPI international uranium enrichment centre (IUEC).[140] The first IUEC agreement was concluded between Russia and Kazakhstan on 10 May 2007.[141] The IUEC will be operated on Russian soil and under Russian law as a "commercial company co-owned and co-managed by the shareholders", who are commercial

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[138] "INFCIRC/667: Communication received from the Resident Representative of the Russian Federation to the Agency transmitting the text of the Statement of the President of the Russian Federation on the Peaceful Use of Nuclear Energy," (2006), http://www.iaea.org/Publications/Documents/Infcircs/2006/infcirc667.pdf. Accessed 3 March 2009.
[139] Ibid.
[140] Anya Loukianova, "The International Uranium Enrichment Center at Angarsk: A Step Towards Assured Fuel Supply?" (Nuclear Threat Initiative, November 2008) http://www.nti.org/e_research/e3_93.html. Accessed 3 March 2009.
[141] Segey V. Ruchkin, "International Uranium Enrichment Center in Angarsk: A Way to Ensure the Security of Nuclear Fuel Supply and Non-Proliferation," in *Future of the Nuclear Secuirty Environment in 2015: Proceedings of a Russian - U.S. Workshop*, ed. Ashot A. Sarkisov and Rose Gottemoeller (Washington, D.C.: The National Academies Press, 2009), 120.

companies authorized by their own governments.[142] Technology within the AECC-IUEC will be "black boxed"; Russia will maintain exclusive control and shareholders will not have access to the sensitive technology or nuclear materials. This provides the assurance that Russia is meeting its non-proliferation obligations.[143] Kazakh state-owned nuclear company Kazatomprom (KAP) holds 10% share of the IUEC, as does Armenia's NPP - Medzamor, which officially joined in February 2008.[144] Armenia's uranium deposits will be enriched at Angarsk, and Russia will assist in the construction of a new nuclear power reactor in Armenia.[145] Ukraine seems set to join in 2010, and Russia recently agreed to build two reactors there.[146] Russia has reportedly had interest in IUEC partnerships with Mongolia, South Korea, and Uzbekistan. In May 2008, a Japanese delegation visited Angarsk with a view to develop Japanese-Russian cooperation and obtain first-hand knowledge about the IUEC. Belgium, Belarus, Bulgaria, Finland, Japan, Kyrgyzstan, Slovakia, and South Korea have been invited to participate in the IUEC.[147] In 2010, the chair of India's Atomic Energy Commission announced India's interest in participating.[148] In addition to the uranium enrichment initiative, the IAEA and ROSATOM signed an agreement on 29 March 2010 to create a

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[142] Ibid., 121.
[143]"INFCIRC/708: Communication received from the Resident Representative of the Russian Federation to the IAEA on the Establishment, Structure and Operation of the International Uranium Enrichment Centre", International Atomic Energy Agency, 8 June 2007, http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc708.pdf. Accessed 6 October 2008.
[144] Anya Loukianova, "The International Uranium Enrichment Center at Angarsk: A Step Towards Assured Fuel Supply?"
[145] Anya Loukianova, "The International Uranium Enrichment Center at Angarsk: A Step Towards Assured Fuel Supply?", Nuclear Threat Initiative, November 2008, http://www.nti.org/e_research/e3_93.html. Accessed 3 March 2009.
[146] Ibid. World Nuclear News, "Ukraine Set to Take Stake in IUEC," *World Nuclear News*, (2009), http://www.world-nuclear-news.org/ENF-Ukraine_set_to_take_stake_in_IUEC-1412095.html. Accessed 20 April 2010.
[147] Anya Loukianova, "The International Uranium Enrichment Center at Angarsk: A Step Towards Assured Fuel Supply?"
[148] RIA Novosti, "India may join Russia in establishing Angarsk Nuclear Fuel Bank ", http://www.globalsecurity.org/wmd/library/news/india/2010/india-100310-rianovosti03.htm. Accessed 22 April 2010.

reserve of LEU stored at the IUEC as UF_6 under IAEA safeguards.[149] The agreement marks a significant step forward for the IAEA Fuel Bank proposal, which will be detailed later in this chapter.

Shared facilities

Multilateral Enrichment Sanctuary Project

The German Government circulated its Multilateral Enrichment Sanctuary Project (MESP) proposal on 7 May 2007.[150] MESP aims to reduce incentives for states to develop indigenous uranium enrichment centres, by guaranteeing access to nuclear fuel, regardless of political considerations.[151] An International Enrichment Centre (IEC), operating under the control of the IAEA, would provide the supply of fresh fuel.[152] Much like the Russian proposal, the IEC would be commercially operated, but on "international property".[153] A Host Country would allow the IAEA to have control and some sovereign rights over a portion of their territory.[154] The enrichment plant would be owned, managed, and governed by an international commercial company set up by a Group of Interested States (GIS), and operate under normal market conditions.[155] By allowing participating states to share in the commercial operation of the plant, as well as access to a fresh fuel supply, MESP aims to prevent further development of national

[149] Sasha Henriques, "Agreement Signed to Set Up a Low Enriched Uranium Reserve", IAEA, http://www.iaea.org/NewsCenter/News/2010/uraniumfuelbank.html. Accessed 22 April 2010.
[150] "INFCIRC/704: Communication received from the Resident Representative of Germany to the IAEA with regard to the German proposal on the Multilateralization of the Nuclear Fuel Cycle", International Atomic Energy Agency, http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc704.pdf. Accessed 4 March 2009.
[151] "Germany Outlines Multiparty Approach to Nuclear Fuel Cycle Plan Calls for Fuel Supply Placed under International Supervision ", International Atomic Energy Agency, 18 February 2008, http://www.iaea.org/NewsCenter/News/2008/germany_nfc.html. Accessed 27 February 2008.
[152] Ibid.
[153] Ibid.
[154] "INFCIRC/727: Communication dated 30 May 2008 received from the Permanent Mission of the Federal Republic of Germany to the Agency with regard to the German proposal for a Multilateral Enrichment Sanctuary Project", International Atomic Energy Agency, http://www.iaea.org/Publications/Documents/Infcircs/2008/infcirc727.pdf. Accessed 6 October 2008.
[155] Ibid.

enrichment plants and provide a cost-effective way of expanding global enrichment capabilities.

Multilateralisation of the Nuclear Fuel Cycle

In 2007, the Austrian government put forward a proposal that suggested the creation of an International Nuclear Fuel Bank to increase the international transparency.[156] In subsequent statements, Austria has suggested that the IAEA act as an intermediary for all civilian nuclear transactions.[157] IAEA involvement could gradually be increased to include control over enrichment and reprocessing facilities.[158] Eventually, all national enrichment and reprocessing facilities would be under IAEA auspices.[159]

Assurance of supply

Nuclear Threat Initiative – IAEA Fuel Bank

In 2006, non-profit organisation the Nuclear Threat Initiative (NTI) announced its intention to donate $50 million towards the creation of an IAEA LEU stockpile.[160] The fuel bank will act as a guaranteed supply of nuclear reactor fuel for states that have chosen not to build indigenous fuel cycle facilities and have had their ordinary supply interrupted. The NTI donation was conditionally on IAEA Member States committing an additional $100 million in funding for the fuel reserve. In December 2008, the European Union pledged Euro 25 million (approximately US$32 million). In March

[156] "INFCIRC/706: Communication received from the Federal Minister for European and International Affairs of Austria with regard to the Austrian proposal on the Multilateralization of the Nuclear Fuel Cycle", International Atomic Energy Agency, http://www.iaea.org/Publications/Documents/Infcircs/2007/infcirc706.pdf. Accessed 10 March 2008.
[157] "General Exchange of Views: Austrian Statement", UN Disarmament Commission, http://www.reachingcriticalwill.org/political/dc/statements08/Austria.pdf. Accessed 28 February 2009.
[158] Ibid.
[159] Ibid.
[160] "Nuclear Threat Initiative Commits $50 Million to Create IAEA Nuclear Fuel Bank", IAEA; NTI, https://iaea.org/NewsCenter/PressReleases/2006/prn200616.html. Accessed March 13 2008.

2009, Kuwait announced a pledge of US$10 million. The pledge joins those of Norway ($5 million), The United Arab Emirates ($10 million) and the United States ($50 million), to total approximately US$107 million in contributions, and was able to be put into motion by the IAEA Board of Governors.[161] This process had become stalled until Russia offered to house the Fuel Bank at its Angarsk facility. In 2010, the agreement between the IAEA and Russia was formalised.[162]

Concept for a Multilateral Mechanism for Reliable Access to Nuclear Fuel

The Six Nation Proposal, "Concept for a Multilateral Mechanism for Reliable Access to Nuclear Fuel" (RANF), aims to provide a solution to problems arising from enrichment contracts being disrupted for political reasons.[163] Tabled in June 2006, RANF is an initiative from the six enrichment supplier states – France, Germany, the Netherlands, Russia, the U.K. and the US – and offers a guarantee of fresh fuel supply from international markets to states that opt out of national enrichment activities. As a backup mechanism operated through the IAEA, RANF ensures that states adhering to their IAEA non-proliferation obligations would be able to arrange a new supply if their existing supply arrangements were interrupted for non-commercial or technical reasons.[164] In the case that this mechanism is unsuccessful, a reserve of enriched uranium could be utilized, again via the IAEA.

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[161] "Multinational Fuel Bank Proposal Reaches Key Milestone: Kuwait Pledge of US $10 Million Secures International Funding for Next Steps ", International Atomic Energy Agency, http://www.iaea.org/NewsCenter/News/2009/fbankmilestone.html. Accessed March 9 2009.
[162] Sasha Henriques, "Agreement Signed to Set Up a Low Enriched Uranium Reserve."
[163] "GOV/INF/2006/10: Communication dated 31 May 2006 received from the Permanent Missions of France, Germany, the Netherlands, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland and the United States of America," (IAEA, 2006). "GOV/INF/2007/11: Possible New Framework for the Utilization of Nuclear Energy: Options for Assurance of Supply of Nuclear Fuel," ed. IAEA Board of Governors (Vienna: IAEA, 2007), Annex 9: 4.
[164] As outlined in the proposal, this includes: Comprehensive Safeguards Agreement and Additional Protocols entered into force; adherence to nuclear safety standards and the CPPNM; and abstention from

IAEA Standby Arrangements System for the Assurance of Nuclear Fuel Supply

The IAEA Standby Arrangements System proposal was put forward by Japan on September 1, 2006.[165] The proposal aims to establish a "Standby Arrangements System" under IAEA auspices, which will help to prevent market failure through increased sharing of information, in addition to the assurance of a supply system in the six-nation proposal.[166]

Enrichment Bonds

In 2006, the UK proposed a virtual fuel reserve, as a logistical suggestion to follow up the RANF proposal.[167] An Enrichment Bond would be realised through a three-way agreement between the IAEA, a supplier state and a recipient state. The supplier state would agree that its national enrichment providers would not be prohibited from supplying the recipient state with its enrichment services, should the guarantee in the agreement be invoked.[168] Naturally, this would also be subject to compliance with IAEA non-proliferation commitments and international law.[169] Using the IAEA as an

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the development of sensitive nuclear fuel cycle activities in favour of international market supply and services.

[165] "INFCIRC/683: Communication received on 12 September 2006 from the Permanent Mission of Japan to the Agency concerning arrangements for the assurance of nuclear fuel supply," (IAEA, 2006). "GOV/INF/2007/11: Possible New Framework for the Utilization of Nuclear Energy: Options for Assurance of Supply of Nuclear Fuel," Annex 10: 2.

[166] "INFCIRC/683: Communication received on 12 September 2006 from the Permanent Mission of Japan to the Agency concerning arrangements for the assurance of nuclear fuel supply", International Atomic Energy Agency, 1 September, http://www.iaea.org/Publications/Documents/Infcircs/2006/infcirc683.pdf. Accessed October 5 2008.

[167] "UK Non-Paper: Enrichment Bonds: A Voluntary Scheme for Reliable Access to Nuclear Fuel", United Nations Association of the UK, http://www.una-uk.org/peaceandsecurity/uk_non_paper001.pdf. Accessed March 4 2009. "INFCIRC/707: Communication dated 30 May 2007 from the Permanent Mission of the United Kingdom of Great Britain and Northern Ireland to the IAEA concerning Enrichment Bonds - A Voluntary Scheme for Reliable Access to Nuclear Fuel," (IAEA, 2007).

[168] Ibid.

[169] Ibid.

intermediary will create confidence in the scheme, particularly for smaller, non-Western or developing states.

Reserve of Nuclear Fuel

At the forty-ninth session of the IAEA General Conference in September 2005, the US announced its intention to commit up to 17 metric tons of HEU to be blended down into LEU and placed in a fuel reserve. This would support other efforts to provide reliable access to fuel for states that choose to avoid the development of indigenous enrichment and reprocessing.[170]

Ensuring Security of Supply in the International Nuclear Fuel Cycle

The World Nuclear Association published a report in May 2006 outlining the position of the collective uranium industry on reinforcing existing assurances for the supply of enrichment and reprocessing services.[171] The proposal envisages two levels of guarantees, in addition to the existing guarantee of supply provided by the strong performance record of the international market.[172] A second level would come from agreements between states performing enrichment services and the IAEA, to be invoked when normal commercial supplies are interrupted due to political causes.[173] The third level of assurances comes from governmental reserves of enriched uranium,

[170] "INFCIRC/659: Communication dated 28 September 2005 from the Permanent Mission of the United States of America to the Agency," International Atomic Energy Agency, http://www.iaea.org/Publications/Documents/Infcircs/2005/infcirc659.pdf. Accessed 5 October 2008.
[171] World Nuclear Association, "Ensuring Security of Supply in the International Nuclear Fuel Cycle," (World Nuclear Association, 2006).
[172] Ibid., 3.
[173] Ibid.

which could be accessed in the event that enrichment service providers could not meet their level two commitments.[174]

Nuclear Fuel Cycle

A non-paper submitted to the IAEA for discussion by the European Union (EU) proposed that proliferation resistant technology, long-term supply arrangements, equal rights and obligations on suppliers and consumers, and market neutrality should all form part of multilateral approaches to nuclear energy. Subsequently, the EU argued that no singular approach should be taken; rather all options should be considered, in order to take into account the varying concerns of states.[175]

The Expert Group envisioned that a global shift in nuclear fuel cycle practices might begin with supply guarantees. Interrupted supply of fuel is a primary concern for states considering nuclear energy, and one reason Iran put forward in defence of its construction of an enrichment facility.[176] Sourcing fuel from a provider on the international market has two primary benefits for the recipient state. The first is economic; enrichment facilities are expensive, and an international guarantee that fuel will be provided negates the need to construct such a facility. Secondly, an international market that is commercially competitive and free of monopolies and political constraints is beneficial to both consumers and producers because it would be more stable.

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[174] Ibid.
[175] "European Union non paper on the Nuclear Fuel Cycle," (IAEA, 2007), Annex 16. "GOV/INF/2007/11: Possible New Framework for the Utilization of Nuclear Energy: Options for Assurance of Supply of Nuclear Fuel."
[176] See for example "Statement by Ambassador A.A. Soltanieh Resident Representative of Islamic Republic of Iran to the IAEA," (2006), 4, 9. http://www.iaea.org/NewsCenter/Focus/IaeaIran/bog020206_statement-iran.pdf. Accessed March 6, 2009.

Proposals that aim more directly to deal with non-proliferation will add to that sense of stability. The proliferation risks usually associated with facilities containing sensitive materials or technology can be offset by multilaterally-controlled facilities. Diversion and theft of materials or technology, diffusion of sensitive technology to unauthorised entities, clandestine or parallel military programmes are unlikely to occur while so many eyes from a number of states are watching. In addition, the chance that a state could obtain technology and knowledge and then "breakout" from the NPT regime is minimal if facilities are multi-national.

Chapter Four: Case Studies

The multilateral proposals outlined in Chapter Three are the first sign that the multilateral approach to the nuclear fuel cycle has gained significant support from global powers, such as the US and Russia, and nuclear suppliers, such as France. While the support of these states is crucial for the development of the multilateral norm, developing states, potential nuclear customers, and non-nuclear developed states will also need to accept and support the initiatives in order for this potential norm to evolve through the norm life cycle.

In order to assess whether the response to the multilateral fuel cycle proposals is indicative of an emerging international norm, Chapter Four will examine the responses of four states: Australia, Indonesia, Norway, and South Korea. All four states have historical experience with peaceful nuclear energy, giving them a degree of similarity that is useful for contrasting their responses. Indonesia and South Korea have clear intentions to expand their domestic nuclear industries; Australia has explored this option in recent years, although public support for this is limited. Norway has neither the need for nuclear power, nor the inclination, and in this research provides an example of a 'positive test' for support of the norm, a useful point of comparison for the other three cases.

Case study one: Australia

Australia's history as a strong non-proliferation advocate, exporter of yellowcake, limited experience with peaceful nuclear energy and an apparent aversion to domestic nuclear power renders its response to the multilateral proposals worthy of consideration. Primarily, this premise rests on the assumption that Australia may be a

prime candidate to facilitate or host a multilateral nuclear fuel cycle venture, due to its position as a middle, rather than great, power within the international system, and geographic location near Asia, which is set for nuclear power expansion in the near future. While such an undertaking would have economic and social benefits for Australia, it also may be more palatable for prospective customer states to accept Australia as its supplier. As the holder of the world's largest Reasonably Assured Resources (RAR) of uranium recoverable at low cost, Australia will remain a key player in international nuclear fuel cycle activities.

Australia's nuclear history

Uranium was first discovered in Australia in 1894.[177] During the 1930s, two sites in South Australia, Radium Hill and Mount Painter, were mined for radium for medical uses.[178] After WWII, the Australian Government incentivised the discovery and mining of uranium in response to requests from the U.K. and the US for uranium sources, which would eventually fuel their nuclear weapons.[179] Hundreds of deposits were discovered in Queensland and the Northern Territory, and mining soon began at Mary Kathleen, Rum Jungle, Radium Hill and other areas.[180] Between 1944 and 1964, some 7300 tonnes of uranium ore were exported.[181] In 1984, the Australian Labor Party (ALP), in government at the time, introduced a "three mines" policy, restricting uranium mining to the Ranger and Nabarlek mines in the Northern Territory, and

[177] Uranium Mining Processing and Nuclear Energy Review Taskforce, "Uranium Mining, Processing and Nuclear Energy Review - Opportunities for Australia?" (Barton, ACT: Department of the Prime Minister, 2006), 17.
[178] World Nuclear Association, "Australia's Uranium and Nuclear Power Prospects," (2009), http://www.world-nuclear.org/info/inf48.html. Accessed 2 June 2009.
[179] Uranium Mining Processing and Nuclear Energy Review Taskforce, "Uranium Mining, Processing and Nuclear Energy Review - Opportunities for Australia?" 17.
[180] The Mary Kathleen site is located in far northwest Queensland; Radium Hill lies in New South Wales, northeast of Adelaide; Rum Jungle is in the Northern Territory near Darwin.
[181] Uranium Mining Processing and Nuclear Energy Review Taskforce, "Uranium Mining, Processing and Nuclear Energy Review - Opportunities for Australia?" 17.

Olympic Dam in South Australia. This policy was overturned in 2007 leading up to the general election; however, mining is currently still only permitted in New South Wales, Northern Territory and South Australia. Exploration is permitted in Queensland. Currently, the three operating mines are Ranger in the Northern Territory, and Beverley and Olympic Dam in South Australia. In addition, Honeymoon and Four Mile in South Australia are nearing production capability, and several other prospective sites are being investigated in Western Australia.[182]

In 1956, construction began on the High Flux Australian Reactor (HIFAR), which reached criticality in January 1958 and routine full-strength in 1960.[183] Originally built to test materials for future power reactors, HIFAR produced neutrons for nuclear medicine and scientific research for almost 50 years until it was shut down in 2007.[184] Its replacement, the Open Pool Australian Lightwater reactor (OPAL) reached criticality in 2006 and was opened in 2007, but has had significant water seepage problems requiring extended shutdown periods. OPAL returned to normal operation in 2010.

During the early 1970s, the Australia Atomic Energy Commission (AAEC) conducted research into laser isotope separation and the feasibility of an enrichment plant in Australia, and continued secret centrifuge research that had been carried out at the Lucas Heights facility since the mid-1960s.[185] AAEC Annual Reports during the 1970s

[182] "Australian Uranium Industry - Mines", Australian Uranium Association, http://www.aua.org.au/Content/AustralianUraniumMines.aspx. Accessed April 5 2010.
[183] Australian Nuclear Science and Technology Organisation (ANSTO), "Australia's First Reactor", ANSTO, http://www.ansto.gov.au/discovering_ansto/history_of_ansto/hifar. Accessed 5 February 2009.
[184] Ibid.
[185] Clarence Hardy, *Enriching Experiences: Uranium Enrichment in Australia 1963 - 2008*, Second ed. (Peakhurst, NSW: Glen Haven, 2008), 47, 49.

indicate an intention to develop a wider spectrum of fuel cycle facilities in Australia, including the conversion of yellowcake to uranium hexafluoride gas.[186] Throughout the 1970s, several studies were completed on potential nuclear fuel facilities, including a joint feasibility study with Japan on the construction of an enrichment plant for Australia;[187] a study on conversion and enrichment plants in South Australia, which was conducted by URENCO, British Nuclear Fuels Ltd., and the AAEC;[188] and a government study on the feasibility of an Australian commercial uranium enrichment industry, with maximum processing of raw materials prior to export.[189]

In 1983, the government terminated work on uranium enrichment and laser enrichment due to lack of funding and failure to keep up with competing overseas progress.[190] In the mid-1980s, the Uranium Enrichment Group of Australia (UEGA) abandoned its plans for a final-stage feasibility study on the establishment of a centrifuge enrichment facility.[191] The AAEC was replaced by the Australian Nuclear Science and Technology Organisation (ANSTO) in 1987, and although the new organisation still provides the government with advice, few experts remain in the specific area of uranium enrichment.[192]

Australia's experience in the field of peaceful nuclear energy has been gained through more than 50 years of operation of two research reactors, and its uranium mining

[186] Ibid., 49. Uranium hexafluoride gas is the form of uranium that is enriched in a centrifuge to increase the proportion of fissile material.
[187] Ibid., 52.
[188] Ibid., 53.
[189] Ibid., 82.
[190] Ibid., 110. A private Australian company, Silex Systems Limited (SILEX) pursued research on laser isotope separation processes during the early 1990s, focussing on uranium enrichment from 1994.
[191] Ibid., 113.
[192] Ibid.

industry. Although there is interest in developing the nuclear industry, a lack of technical knowledge and expertise, legal barriers, widespread domestic anti-nuclear sentiment and concern regarding the effect on the indigenous Aborigine population present major obstacles to expansion of any sort.[193]

Australia's response to international fuel cycle proposals

Australian support for a multilateral approach to the nuclear fuel cycle has been positive, although somewhat mild. Following ElBaradei's 2003 article in *The Economist*, an Australian statement at the 2004 NPT PrepCom gave support to the "development of an international dialogue on limiting the spread of sensitive technologies".[194] The statement also suggested that "states may wish to consider a moratorium on any new enrichment or reprocessing plants", until international dialogue on limiting the spread of such capabilities was established.[195] At the 2005 NPT Review Conference, a joint working paper submitted by Australia emphasised the need for balance between non-proliferation efforts and access to peaceful nuclear energy, stating that multilateral approaches should complement existing non-proliferation mechanisms such as IAEA safeguards and export controls.[196] In a statement to the Main Committee III, Australian representative Terry Bevan argued that rather than debate the legal

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[193] The physical and environmental affects of uranium mining and nuclear testing in Australia have been well documented. A nuclear waste repository poses similar risks, including environmental degradation in the surrounding areas, and potential contamination of water resources.

[194] ElBaradei, "Towards a Safer World."; "Cluster III Issues: Statement made by Mr. John Page, Executive Officer, Arms Control Section, Department of Foreign Affairs and Trade: Cluster III Issues," (2004), 1. http://www.reachingcriticalwill.org/legal/npt/prepcom04/australiaCL3.pdf. Accessed 19 January 2010.

[195] "Cluster III Issues: Statement made by Mr. John Page, Executive Officer, Arms Control Section, Department of Foreign Affairs and Trade: Cluster III Issues."

[196] Austria Australia, Canada, Denmark, Hungary, Ireland, the Netherlands, New Zealand, Norway and Sweden, "NPT/CONF.2005/WP.11: Articles III (3) and IV, preambular paragraphs 6 and 7, especially in their realtionship to article III (1), (2) and (4) and preambular paragraphs 4 and 5 [Approaches to the nuclear fuel cycle]" (presented at the 2005 NPT Review Conference, New York, 26 April 2005), Para. 3. http://www.reachingcriticalwill.org/legal/npt/RevCon05/wp/WP11.pdf?OpenElement Accessed 26 July 2009.

interpretation of Article IV, states should "consider the consequences of a world in which dozens of states possess the full nuclear fuel cycle and the capability to break out to nuclear weapons should they consider it in their immediate interests". The statement argued further that indeed such a "spread of sensitive technology would be inconsistent with the non-proliferation goals of the treaty".[197]

In June 2006, the Australian Government began a major review of the country's nuclear industry, the Uranium Mining, Processing and Nuclear Energy Review (UMPNER).[198] The release of the UMPNER report followed the publication of two related government reports – "Australia's Uranium – Greenhouse friendly fuel for an energy hungry world"[199] and the September report by the Uranium Industry Framework (UIF) Steering Group.[200] The UMPNER taskforce was appointed by the Prime Minister to review "uranium mining, value-added processing and the contribution of nuclear energy in Australia."[201] The report was released in 2007, and highlighted the opportunity for Australia to expand its nuclear industry in several areas, including: increasing production and export of uranium oxide to meet the expected increase in demand; adding value to such exports by including fuel fabrication, uranium conversion and enrichment; constructing a national repository of low-level waste, and investigating deep and underground repositories; investigating nuclear power as an option for

[197] Terry Bevan, Australian Embassy and Permanent Mission to the United Nations, Vienna "Seventh Review conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons: Main Committee Statement III," (2005).
[198] Hardy, *Enriching Experiences*, xi.
[199] "Australia's Uranium - Greenhouse friendly fuel for an energy hungry world," ed. House of Representatives Standing Committee on Industry and Resources (The Parliament of the Commonwealth of Australia, (2006).
[200] "Uranium Industry Framework: Report of the Steering Group," (Canberra: Commonwealth of Australia, 2006)
[201] Uranium Mining Processing and Nuclear Energy Review Taskforce, "Uranium Mining, Processing and Nuclear Energy Review - Opportunities for Australia?" 1.

meeting expected increases in domestic power demand; removing legal and technical barriers to the implementation of an expansion of the nuclear industry in Australia; increasing the nuclear knowledge and skills base; and encouraging "informed discussion of the issues."[202]

The "Australia's Uranium" report examined the strategic importance of the country's uranium resources, its potential to be used to reduce global greenhouse gas emissions, and the environmental impact of Australia's uranium, including nuclear waste management.[203] The report regarded Australia as being in a good position to expand its uranium industry, and suggested that the fact that Australia lags behind in production and export, despite having substantially larger uranium reserves than all other competitors, is "unsatisfactory for the nation."[204] Failure to allow industry development has significant costs, including "loss of the industry's current and potential contribution to the national and state economies, regional development, services and employment in Aboriginal communities and further promotion of Australia's role in the international nuclear community."[205] The Committee recommended that the Australian Government establish an uranium enrichment industry, develop a waste disposal industry and a geologic repository, develop the full fuel cycle, including the 'leasing' of fuel assemblies to customer countries, and the take-back of waste for final disposal.[206] Such an expansion of nuclear activities, including development of fuel cycle services, would also require a parallel progression of Australia's nuclear skills base.[207]

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[202] Uranium Mining Processing and Nuclear Energy Review Taskforce, "Uranium Mining, Processing and Nuclear Energy Review - Opportunities for Australia?" 2, 13
[203] "Australia's Uranium - Greenhouse friendly fuel for an energy hungry world," xxi.
[204] "Australia's Uranium - Greenhouse friendly fuel for an energy hungry world," 72.
[205] "Australia's Uranium - Greenhouse friendly fuel for an energy hungry world," 497-98.
[206] "Australia's uranium - Greenhouse friendly fuel for an energy hungry world," (Canberra2006), 641.
[207] Ibid., 676.

The "Uranium Industry Steering Group" was charged to identify "opportunities for, and impediments to, the sustainable development of the Australian uranium industry" in the short, medium and longer term. The recommended actions included in the report were aimed at increasing Australia's international competitiveness, and "fostering broader community understanding and acceptance of the economic and social benefits derived from having a safe, secure, efficient and highly productive Australian uranium mining industry."[208] While the majority of its recommendations were largely regulatory and of little consequence to this research, such government-directed research of the nuclear industry is significant, as it demonstrates a desire to stimulate thinking on this issue.

Following the release of these reports, and ahead of the 2007 NPT Prep-Com, then-Prime Minister John Howard unveiled a new nuclear policy that would see further development of the uranium mining industry in Australia.[209] The Government's strategy involved removing existing legal restrictions on uranium mining, with a view to increasing exports and an expansion of the domestic nuclear industry, including the possibility of nuclear power.[210] During the Prep-Com, an Australian Working Paper reiterated the dangers of uranium enrichment and spent fuel reprocessing as dual-use parts of the nuclear fuel cycle. The Paper stated Australia's openness to exploring the potential for fuel assurances to reduce the incentive to seek indigenous dual-use fuel cycle capabilities.[211] During the general debate, Australia reflected on the way in which

[208] "Uranium Industry Framework: Report of the Steering Group," (Canberra: Commonwealth of Australia, 2006), 11.
[209] AAP, "PM Unveils Nuclear Plan," *Sydney Morning Herald*, 28 April 2007.
[210] Ibid.; Staff Writers, "Howard's Nuclear Vision Unveiled," (2007), http://www.news.com.au/howards-nuclear-vision-unveiled/story-e6frfkp9-1111113429896. Accessed 12 March 2008.
[211] France Canada, and the Republic of Korea,, "NPT/CONF.2010/PC.I/WP.66 - Nuclear Power Development: Meeting The World's Energy Needs and Fulfilling Article IV" (presented at the

the Iranian situation had put the enrichment and reprocessing aspects of the fuel cycle under scrutiny, and re-stated its support for international dialogue on multilateral approaches, which "have the potential to advance energy security and non-proliferation objectives".[212]

In September 2007, Australia joined the Global Nuclear Energy Partnership. In a statement to the IAEA General Conference that same week, Australia announced that it had signed the Statement of Principles, becoming a partner in an initiative that "deserves broad support" in its goal to minimise the proliferation risks posed by an expansion of peaceful nuclear energy.[213] The statement also referred to the commitment Australia had made to participate in the Generation IV International Forum, and the government's decision to export uranium to India, subject to an exception to the guidelines of export by the NSG.[214]

Leading up to the general election in December 2007, the subject of nuclear power and the role it may play in Australia's future divided public opinion. Prime Minister Kevin Rudd was elected, ending 17 years of Liberal Party leadership under Howard, and bringing in a new government with very different views on nuclear issues. Unlike Howard, who was increasingly in favour of nuclear power in Australia, Rudd and the

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Preparatory Committee for the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Vienna, 13 June 2007), Para. 15. http://www.un.org/NPT2010/documents.html Accessed 4 September 2010.

[212] "Statement delivered by Ambassador Caroline Millar in the General Debate", (presented at the First Preparatory Committee Meeting for the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, New York, 30 April 2007), 2. http://www.reachingcriticalwill.org/legal/npt/prepcom07/statements/30aprilAustralia.pdf Accessed 17 May 2008.

[213] Australia, "Australian Statement to the IAEA General Conference" (presented at the IAEA General Conference, Vienna, September 2007). http://www.austria.embassy.gov.au/vien/IAEA_2007.html

[214] Ibid.

Australian Labor Party were vehemently opposed. However, this had little effect on Australia's outward view on multilateral fuel cycle approaches.

Many of the sentiments expressed at the 2007 Prep-Com were repeated in 2008 in the Vienna Group working paper, and Australian statements, once again indicated an interest in constructively exploring proposals which "support and strengthen the non-proliferation objectives of the NPT."[215] The working paper stressed that multilateral approaches should complement existing non-proliferation instruments and, where appropriate, should be under the auspices of the IAEA while ensuring commercial competitiveness.[216]

In 2008 Australia jointly established the International Commission on Nuclear Non-Proliferation and Disarmament with Japan. With the aim of contributing to the nuclear debate, and building momentum and consensus in the lead up to the 2010 NPT Review Conference, the creation of the commission was reflective of the priority both Australia and Japan place on nuclear issues.

Australia's response to the multilateral proposals was initially very positive. Then-Prime Minister Howard wanted to capitalise on this movement by value-adding uranium exports through enrichment and fuel production. In many ways, Australia's strong non-proliferation history and position as a middle power within the international system makes it a prime candidate for such a venture; it carries favour among some developing nations that other more advanced nuclear states may not enjoy to the same

[215] Vienna Group, "NPT/CONF.2010/PC.II/WP.16," (2008), http://www.un.org/NPT2010/SecondSession/documents.html. Accessed 16 May 2008.
[216] Ibid.

degree. Since the election of current Prime Minister Rudd in 2008, Australia has remained supportive of multilateral approaches as a non-proliferation measure, but the Government also seems wary about being perceived as "pro-nuclear" domestically. Within Australia, support for indigenous development of the nuclear industry is limited, and Rudd's Labor Party has traditionally opposed such expansion. Prior to the 2007 election, Rudd specifically addressed the nuclear issue on a number of occasions, stating that despite the Labor Party's reversal on its opposition to uranium mine expansion, nuclear power was an unnecessary option for Australia.[217] Submissions for the aforementioned reports suggest commercial interest in the growth of the nuclear industry, which is logical for a country with huge uranium resources. Furthermore, given the plans for nuclear power expansion in Southeast Asia, Australia may be a prime candidate to facilitate multilateral approaches in the region.

Case study two: Indonesia

Indonesia is the world's largest Islamic state, with the fourth largest population globally. In addition, as a founding member of NAM, Indonesia's response to this issue will be influential over smaller, developing states, as well as members of NAM. As one of the states that has shown serious interest in domestic nuclear power, Indonesia potentially has much to lost under a multilateral scheme. Indonesia has a strongest nuclear science experience of the ASEAN states. Its enthusiasm or apathy for the multilateral approach may influence a significant number of other states that are interested in adopting nuclear power.

[217] AAP, "Rudd defends uranium u-turn," *The Age*, 30 April 2007.

Indonesia's nuclear history

Although Indonesia is not yet a nuclear-powered state, it has made a strong investment in developing its nuclear science and technology skills and knowledge base, as well as a number of research and development facilities. After joining the IAEA in 1957, the Institute of Atomic Energy (Lembaga Tenaga Atom, or LTA) was established in 1959, with the aim of conducting nuclear research and promoting nuclear energy. Nuclear cooperation agreements were signed with the US, the USSR and Yugoslavia under the Atoms for Peace between 1956 and 1960.[218] In 1965, the Institute was renamed the National Atomic Energy Agency (Badan Tenaga Atom Nasional, or BATAN). Indonesia's first research reactor achieved criticality in 1964 at the Bandung Nuclear Complex - a Triga Mark II Reactor - that started with a power of 250 kW; the power of this reactor was increased to 1000 kW in 1971 and further to 2000 kW in the year 2000.[219] It was during this period that President Sukarno announced his intention for Indonesia to develop a nuclear weapon; however this was short-lived, and the project terminated in 1966. In 1966, the Pasar Jumat Nuclear Complex was constructed, and was followed by the adoption of IAEA comprehensive safeguards in 1967.[220] Nuclear Technology Research Center of GAMA, Yogyakarta, which has housed the Kartini research reactor since it became fully operational in 1979, was established in1974. The Siwabessy Multipurpose Research Reactor came online in 1987 at the Serprong Nuclear Complex, which also contains facilities for the production of radioisotopes and radiopharmaceuticals, fuel fabrication for both research and power reactors, and the

[218] James F. Keeley, "A List of Bilateral Civilian Nuclear Co-operation Agreements: Volumes 1 - 5," (2009), https://dspace.ucalgary.ca/handle/1880/47373. Accessed 8 April 2010. Between 1969 and 2006, Indonesia signed peaceful nuclear energy cooperation agreements with Argentina, Canada, China, France, Germany, India, Pakistan and South Korea.
[219] Mark Fitzpatrick, ed. *Preventing Nuclear Dangers in Southeast Asia and Australasia: an IISS Strategic Dossier* (London: The International Institute for Strategic Studies, 2009), 62.
[220] Ibid., 63.

management of radioactive waste.[221] Throughout this history, Indonesia achieved several fuel cycle capabilities, including uranium conversion and fuel fabrication for its research reactors.[222]

Interest in introducing nuclear power to Indonesia's energy mix has been ongoing and cyclical. In the mid-1970s, 14 potential nuclear power plant sites were proposed by the Location Sub-committee of the Nuclear Power Plant Construction Preparation Committee (KPP-PLTN).[223] In a two-year survey from 1978-1979, a joint feasibility study was conducted by BATAN and Nucleare Italiana Reattori Aavanzati (NIRA), which identified the Muria Peninsula as the most suitable.[224] However, opposition from the World Bank and the Ministry of Finance prevented further advancement of any plans.[225] Conducted in1991-1996 by Japanese consulting company NEWJEC, the Site and Environmental Study on Muria identified three appropriate areas on the Muria Peninsula in their feasibility study – Ujung Lemahabang and Ujung Grenggengan near the village of Balong; and Ujung Watu, a few kilometres east of Balong.[226] Once again, the study did not lead to action. The plan was thwarted by the 1997 Asian financial

[221] International Atomic Energy Agency, "Indonesia", IAEA, http://www-pub.iaea.org/MTCD/publications/PDF/cnpp2009/countryprofiles/Indonesia/Indonesia2003.htm. Accessed February 12 2010. National Nuclear Energy Agency (BATAN) Indonesia, "Presentation on BATAN," (2009), www.rcaro.org/page/regional/.../16_sri/sri_Presentasi%20RCARO.ppt. Accessed April 9, 2010. Robert M. Cornejo, "When Surkarno Sought the Bomb: Indonesian Nuclear Aspirations in the Mid-1960s," *The Nonproliferation Review* 7, no. 2 2000). Richard Tanter, "Indonesia Nuclear Chronology," (2008), http://www.globalcollab.org/Nautilus/australia/reframing/aust-ind-nuclear/ind-np/muria/chronology/view. Accessed 15 August 2009.
[222] Fitzpatrick, ed. *Preventing Nuclear Dangers in Southeast Asia and Australasia: an IISS Strategic Dossier*, 68.
[223] Tanter, "Indonesia Nuclear Chronology."
[224] Fitzpatrick, ed. *Preventing Nuclear Dangers in Southeast Asia and Australasia: an IISS Strategic Dossier*, 65.
[225] Richard Tanter, "Indonesian Nuclear Power Proposals", Nautilus Institute at RMIT, 21 January 2010, http://www.globalcollab.org/Nautilus/australia/reframing/aust-ind-nuclear/ind-np. Accessed 12 February 2010.
[226] Fitzpatrick, ed. *Preventing Nuclear Dangers in Southeast Asia and Australasia: an IISS Strategic Dossier*, 65.

crisis and the political and economic collapse that followed.[227] In 1997, Russia announced its intentions to develop floating nuclear power plants, and planned to supply them to states that have outlying islands or coastal communities where electricity is not available on current supply lines, such as Indonesia and China.[228] Although the reactors did not begin construction until 2007, Jakarta newspaper *Antara* reported in 2003 that the State Minister for Research and Technology stated, "Russia has offered us a floating nuclear power plant".[229]

More recently, plans to construct a nuclear power plant in Indonesia have been revived. Several cooperation agreements have been reached, including an agreement with Russia in 2006, and a Memorandum Of Understanding (MOU) with Medco Energy International and Korea Hydro and Nuclear Power (KHNP) to build Indonesia's first nuclear power plant.[230] In 2006, the Indonesian government announced plans to begin construction on a 4,000MW nuclear power plant by 2010 with an intended completion date of 2016.[231]

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[227] Ibid. Richard Tanter, "Nuclear fatwa: Islamic jurisprudence and the Muria nuclear power station proposal," *Austral Policy Forum*, (2007), http://gc.nautilus.org/Nautilus/australia/apsnet/policy-forum/2007/nuclear-fatwa-islamic-jurisprudence-and-the-muria-nuclear-power-station-proposal. Accessed 5 December 2008.

[228] "Norway Goes Critical Over Floating Reactors," Vol. 2102, (1997), http://www.newscientist.com/article/mg15621024.300-norway-goes-critical-over-floating-reactors.html. Accessed 6 April 2009

[229] "Russian floating reactor construction starts," *World Nuclear News*, 17 April 2007. "Russia Offers RI a Floating Nuclear Power-Plant," *Antara*, 20 April 2003.

[230] "Joint Statement by President of the Russian Federation Vladimir V.Putin and the President of the Republic of Indonesia Susilo Bambang Yudhoyono, Moscow, December 1, 2006," (2006), http://www.indonesia.mid.ru/relat_e_02.html. 8 April 2010. Ryu Jin, "KEPCO Eyes Nuclear Power Plant in Indonesia," *The Korea Times*, 24 July 2007.

[231] Mohamed ElBaradei, "Nuclear Power in a Changing World" (Jakarta, 8 December 2009), 6. http://www.iaea.org/NewsCenter/Statements/2006/ebsp2006n024.html Accessed 15 April 2010. Michael S. Malley, "Prospects for Nuclear Proliferation in Southeast Asia, 2006-2016," *The Nonproliferation Review* 13, no. 3 2006), 611.

The recent move towards nuclear energy in Indonesia has been driven by an increased need for energy supply, and has been supported by the IAEA.[232] However, there has been strong public opposition to the move toward nuclear power. Particular concerns have been raised regarding the geological instability of the proposed site, and the competence of authorities to handle safety and security aspects and manage nuclear waste. In 2007, a traditional Indonesian Islamic meeting, *bahtsul masa'il*, was held at the Nahdlatul Ulama headquarters in Jepara, a town in north Central Java to discuss the proposal for a nuclear power plant on the Muria Peninsula. The meeting was attended by more than 100 regional Islamic leaders, government ministers, senior officials, scientists, lawyers, sociologists, and activists, both for and against the government's plan for the Muria nuclear power plant. Outside, thousands of protestors waited; several thousand had marched overnight from the village of Balong, where the nuclear plant was planned, to make their voices heard.[233] At the conclusion of the meeting, the Islamic leaders announced a *fatwa* (Islamic ruling) on the Muria Peninsula project decrying it as *haram* (forbidden), much to the surprise of the Government and the nuclear industry.[234] For the world's largest Islamic population, such a decree holds great influence over public opinion. In the lead up to the election later that year, candidates backed away from the subject entirely. However, shortly before the election the plan to have the first nuclear reactor online in 2016 was still on track according to

[232] See for example, International Atomic Energy Agency, "Reviewing Nuclear Capability: IAEA-Led Missions Evaluate Nuclear Power Preparedness in Indonesia and Vietnam", IAEA, http://www.iaea.org/NewsCenter/News/2009/nuclcapability.html. Accessed February 12 2010.; ElBaradei, "Nuclear Power in a Changing World", 6.
[233] Amy Chew, "Indonesia straddles a nuke power tightrope," (2007), http://findarticles.com/p/articles/mi_8016/is_20070920/ai_n44370543/. Accessed 8 April 2010. Tanter, "Nuclear fatwa: Islamic jurisprudence and the Muria nuclear power station proposal."
[234] Tanter, "Nuclear fatwa: Islamic jurisprudence and the Muria nuclear power station proposal."

the retiring Minister for Research and Technology.[235] Just after the election, his successor confirmed his support for the nuclear project, stating: "the plan to build the nuclear power plant must go on"; the heads of BATAN and the Nuclear Regulatory Agency (BAPETEN) reiterated their long-standing appeals for "a nuclear answer to Indonesia's chronic electricity difficulties."[236]

Indonesia's response to the international fuel cycle proposals

On the issue of multilateral nuclear approaches, Indonesia has remained relatively cautious in its response. First and foremost, governmental statements at NPT Preparatory Committee meetings and the Review Conference since ElBaradei's 2003 article have simply reiterated the importance of maintaining the existing "inalienable right" to the peaceful uses of nuclear energy. At the 2004 NPT Prep-Com, Indonesian statements emphasised "the importance of ensuring the inalienable rights of all states Parties … to the Peaceful Uses of Nuclear Energy. These right[s] must be fully protected at all times and no States Party should be limited in the exercise of this right in accordance with the Treaty."[237] At the 2007 NPT Prep-Com, Indonesia made comments that were slightly more poignant, restating the right of each country to choose to utilise peaceful nuclear energy, and that this choice should be respected "without jeopardizing its policies or international cooperation agreements and arrangements for peaceful uses of nuclear energy and its fuel-cycle policies."[238]

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[235] Richard Tanter, Arabella Imhoff, and David Von Hippel, "Nuclear Power, Risk Management and Democratic Accountability in Indonesia: Volcanic, regulatory and financial risk in the Muria peninsula nuclear power proposal," *The Asia-Pacific Journal* 51, no. 1 (21 December 2009), 5.
[236] Ibid.
[237] Indonesia, "Intervention by the Delegation of Indonesia at the Third Session of the Preparatory Committee for the 2005 NPT Review Conference," (2004), http://www.reachingcriticalwill.org/legal/npt/prepcom04/indonesiaCL2.pdf. Accessed 12 February 2009.
[238] "Statement by Ambassador Triyono Wibowo at the First Session of the Preparatory Committee for the 2010 Review Conference of the States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons," (2007),

Further, Indonesia argued that for NNWS, the ability to make the choice to pursue peaceful nuclear activities may be "crucial to the achievement of energy security and energy independence", and although some believe that dual-use technologies need more restriction, *excessive* controls "may unfairly deprive developing countries of nuclear energy and technology," which they are entitled to under the NPT.[239]

It is clear that Indonesia believes the IAEA should be at the centre of any multilateral fuel cycle arrangement, strengthening the NPT by "closing the loopholes of the aspirant proliferators and non-state actors through a multilateral process. In this regard, enhancing the role of the IAEA, as nuclear energy promoter and nuclear proliferation preventer, has become imperative."[240]

In 2005, Indonesia held the international workshop, "Iran and Indonesia's Nuclear Issue", which examined the Iranian nuclear issue from an Indonesian perspective. Conference speakers included Ambassadors from Indonesia, Iran, and Russia, as well as representatives from BATAN and the Indonesian Ministry of Foreign Affairs.[241] Indonesian Ambassador Sudjadnan Parnohadiningrat emphasised the rights of all member states of the IAEA and parties to the NPT, including Iran, to develop peaceful nuclear energy, but stressed the importance of adhering to IAEA Safeguards including the Additional Protocol.[242] Ambassador Parnohadiningrat urged that the Iranian nuclear

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http://www.reachingcriticalwill.org/legal/npt/prepcom07/statements/30aprilIndonesia.pdf. Accessed 12 February 2009.
[239] Ibid.
[240] "Statement by HE. Rezlan Ishar Jenie at the Third Session of the Preparatory Committee for the 2005 NPT Review Conference," (2004), http://www.reachingcriticalwill.org/legal/npt/prepcom04/indonesia26.pdf. Accessed 17 February 2009.
[241] Indriana Kartini, ed. *Indonesia and Iran's Nuclear Issue* (Jakarta, Indonesia: LIPI Press, 2005).
[242] Sudjadnan Parnohadiningrat, "Indonesia and Iran's Nuclear Issue," in *Indonesia and Iran's Nuclear Issue*, ed. Indriana Kartini (Jakarta: LIPI Press, 2005), 6.

situation needed to be addressed multilaterally and peacefully, rather than by the coercive arm of any single state.[243] Indonesian Ministry of Foreign Affairs director Ratu Silvy Gayatri underlined the importance of all NPT States Parties to comply with their obligations; the failure to do so presents a potential serious blow to the NPT regime.[244]

At the 2009 IAEA General Conference, Indonesia's representative expressed the opinion that any multilateral arrangement, "which would also guarantee the assurance of nuclear fuel supply", should complement other efforts to strengthen the regime.[245] Once again, the statement highlighted the need to prevent multilateral arrangements from hindering the rights of states to access and develop peaceful nuclear science and technology.[246]

As a founding member of NAM, statements from this group, particularly those delivered by Indonesia, are also relevant in the context of this thesis. At the 2009 NPT Preparatory Committee, Indonesia, on behalf of NAM, stated on the issue of assurance of nuclear fuel supply, that "extensive, comprehensive and transparent consultations" are needed before this issue is considered by the international community.[247] NAM

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[243] Ibid., 7.
[244] Ratu Silvy Gayatri, "Iran's Nuclear Issue in Indonesia's Perspective," in *Indonesia and Iran's Nuclear Issue*, ed. Indriana Kartini (LIPI Press, 2005), 40.
[245] "Statement by H.E. Mr. Triyono Wibowo", (presented at the 53rd General Conference of the International Atomic Energy Agency, Vienna, 15 September 2009). http://www.iaea.or.at/About/Policy/GC/GC53/Statements/indonesia.pdf Accessed 6 August 2009.
[246] Ibid., 3.
[247] "Statement by the Delegation of Indonesia to the United Nations on behalf of the Group of Non-Aligned States Parties to the Treaty on the Non-Proliferation of Nuclear Weapons: Cluster Three Issues", (presented at the Third Session of the Preparatory Committee for the 2010 NPT Review Conference, New York, 8 May 2009), 2. http://www.reachingcriticalwill.org/legal/npt/prepcom09/statements/8MayC3_NAM.pdf Accessed June 17, 2008.

rejected the notion that certain peaceful nuclear activities should be discouraged due to their "alleged sensitivity".[248]

The strong belief that is held in Indonesia regarding the right to peaceful nuclear activities is emphasised by examples of the country's attitude and actions over the Iranian nuclear issue. In a statement to the Security Council in March 2007, Indonesia voted in favour of Resolution 1747, emphasizing that should Iran comply, the measures specified in Resolution 1737 (2006) would be terminated. Indonesia stressed that "the solution to the issue of Iran should in no way affect or change the inalienable rights of all parties to the NPT, including Iran, to develop and research the production and use of nuclear energy for peaceful purposes."[249] In 2008, Indonesia noted that although states are guaranteed the right to develop and use peaceful nuclear energy, there is no guarantee of the security of supply of technology or materials. In their endeavour to create such security indigenously, states are viewed with suspicion.[250] Indonesia suggested that multilateral arrangements for assuring nuclear fuel supply may provide a way to solve this problem.[251] The statement also emphasised Iran's progress in cooperating with the IAEA. Subsequently, Indonesia abstained on the vote on Resolution 1803 (2008), which imposed sanctions on Iran.[252]

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[248] Ibid., 3.
[249] "Record of the 5647th Meeting of the United Nations Security Council", United Nations, 24 March 2007, http://daccess-dds-ny.un.org/doc/UNDOC/PRO/N07/281/52/PDF/N0728152.pdf?OpenElement. Accessed 6 April 2009.
[250] "Statement by H.E. Dr. R.M. Marty M. Natalegawa at the Security Council before the vote on the resolution on non-proliferation (Iran)", (New York, 3 March 2008). http://www.indonesiamission-ny.org/NewStatements/ps030308.htm Accessed February 19, 2010.
[251] Ibid.
[252] "Security Council Tightens Restrictions on Iran's Proliferation-Sensitive Nuclear Activities, Increases Vigilance Over Iranian Banks, Has States Inspect Cargo," (New York: United Nations, 2008).

Indonesia has reacted with much caution, and remains suspicious that the multilateral approaches on offer may be a way for nuclear supplier states to exert further control over the international nuclear industry, by restricting who can have certain nuclear facilities. Indonesia has firmly defended the right of all states to develop nuclear energy, without conditions, and without discrimination of any kind.

Case study three: Norway

Norway has a history as an active promoter of international peace, arms control, nuclear disarmament and non-proliferation. Multilateral nuclear approaches fit with Norway's broader foreign policy objectives by increasing the security of fissile materials and the transparency of nuclear activities. With no need to develop nuclear power as an energy source, Norway has nothing to lose by supporting multilateral approaches, and thus its consideration of the issue is ideological, rather than practical. For this reason, Norway's response is representative of those states that will take a principled, rather than pragmatic, stance on this issue.

Norway's nuclear history

Norway was the sixth state to build a nuclear reactor, an experimental reactor that went critical in 1951. Although there are indications that Norway had some interest in developing both nuclear weapons and nuclear power early on in the nuclear age, this never turned into definite plans, largely due to a lack of uranium resources and trained scientists. However, Norway still had a number of nuclear-related activities. During the 1940s and 1950s, Norway produced heavy water as a by-product of the production of fertilizer,[253] and exported this to France in 1940 and Israel in 1959.[254] In 1948, the

[253] Astrid Forland, "Norway's Nuclear Odyssey: From Optimistic Proponent to Nonproliferator, " *The Nonproliferation Review* 4, no. 2 1997), 3

Institutt for Atomenergi (currently known as the Institute for Energy Technology, IFE) was established at Kjeller, and three years later the JEEP I reactor went critical.[255] Over the next 15 years, three more research reactors came online, however buy 1970 the JEEP I and NORA reactors had been shutdown and were being decommissioned.[256] As early as 1955, Norwegian scientists had developed a technique for separating Plutonium, which continued until the 1970s. Also during the 1950s, there was much interest in the concept of atomic naval propulsion. In fact, this was the principal task of the Institute of Atomic Energy.[257]

Norway's response to the international fuel cycle proposals

The Norwegian response to the multilateral fuel cycle proposals reflects the view that such approaches can help to reconcile peaceful uses with global non-proliferation concerns by ensuring that a nuclear renaissance does not undermine the non-proliferation regime or threaten human safety and the environment.[258] Norway supports several initiatives, such as that put forward by Germany, to develop international cooperation on fuel production and waste management, and the IAEA-NTI fuel bank.[259]

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[254] Astrid Forland, "Norway's Nuclear Odyssey: From Optimistic Proponent to Nonproliferator " *The Nonproliferation Review* 4, no. 2 1997), 6, 10.
[255] "Implementation of the Obligation of the Convention on Nuclear Safety in Norway: The second Norwegian report in accordance with Article 5 of the Convention on Nuclear Safety," (Østerås: Norwegian Radiation Protection Agency, 2001), 2.
[256] Ibid. the JEEP and NORA nuclear research reactors are heavy-water moderated reactors that are powered by natural uranium, instead of enriched uranium fuel.
[257] A.A., "Nuclear Research In Norway," *Atomnaya Energiya* 14, no. 3 (March 1963).
[258] Norway, "Statement on Non-Proliferation - Cluster Three" (presented at the 2009 Preparatory Committee for the 2010 Review Conference of Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, New York, 8 March 2009).
http://www.reachingcriticalwill.org/legal/npt/prepcom09/statements/11MayC3_Norway.pdf Accessed 10 March 2009.
[259] Ibid. . "Norway contributes $5 Million to IAEA Nuclear Fuel Reserve," (Ministry of Foreign Affairs, Norway, 2008).

In 2004, the UN Secretary General's High Level Panel on Threats, Challenges, and Change recommended in its report that states should "voluntarily institute a time-limited moratorium on the construction of any further enrichment or reprocessing facilities, with a commitment to the moratorium matched by a guarantee of the supply of fissile materials by the current suppliers at market rates."[260] At the time, Norway was one of the few state supporters of this recommendation, calling for a moratorium on the construction of "facilities for sensitive technologies" in October at the UN First Committee.[261]

Statements in international forums have vocalised Norway's support for multilateral fuel cycle approaches. A 2005 Seven Nation Initiative (7NI) Ministerial statement welcomed the IAEA Expert Group report, and recommended the establishment of mechanisms to guarantee the supply of nuclear fuel and fuel cycle services for non-proliferation compliant states.[262] At the 2007 NPT Prep-Com, Norway submitted a working paper, in which it advocated the renewal of international efforts for a multilateral approach to the nuclear fuel cycle, welcomed the work that has been done to "develop international fuel-supply guarantees and acknowledged the progress made

[260] United Nations, "A More Secure World: Our Shared Responsibility - Report of the Secretary General's High-level Panel on Threats, Challenges and Change," (2004), 44.
[261] Harald Mueller, "Multilateral Nuclear Fuel-Cycle Arrangements," 35, http://www.wmdcommission.org/files/No35.pdf. Accessed March 5, 2009.; Norway, "First Committee statement by Ambassador Johan L. Løvald in the thematic debate on nuclear weapons" (New York, 12 October 2005). http://www.norway-un.org/Statements/2006-/CommitteeMeetings/20051012_nuclear/ Accessed 16 August 2008.
[262] The 7NI is a collaborative initiative led by Norway, including Australia, Chile, Romania, South Africa and the United Kingdom, which aims to contribute to the debates on nuclear disarmament and non-proliferation. "Declaration by the Foreign Ministers of Australia, Chile, Norway, Romania, South Africa, and the United Kingdom on Strengthening Adherence to International Non-Proliferation and Disarmament Efforts," (2005), http://www.acronym.org.uk/docs/0507/doc05.htm Accessed 15 August 2008.

in establishing international centres of excellence at shared facilities".[263] In September 2007, Norway's statement to the IAEA General Conference further indicated support for multilateral approaches, arguing that they offered a "potential accommodation of our energy needs and our non-proliferation concerns."[264] Norway urged member states and the IAEA to move forward with discussions on the fuel cycle with greater urgency.[265]

Perhaps the most significant response has been Norway's financial contribution to the IAEA-NTI Fuel Bank. In February 2008, it was announced at the high-level international conference, "Achieving the Vision of a World Free of Nuclear Weapons" in Oslo, that Norway would contribute US$5 million to the plan.[266] Norwegian Foreign Minister Jonas Gahr Støre described the fuel bank as a "concrete and effective step" in support of global non-proliferation and disarmament goals.[267] Foreign Minister Støre has been very vocally supportive of multilateral approaches for a few years now, promoting them in his speech at ElBaradei's Nobel Prize ceremony in 2005.

Norway is a prominent multilateral actor in a number of areas, and has played a key role within the international community in this respect, chairing the Iraq sanctions committee, the Seven Nations Initiative, the UNHCR's executive board, and the

[263] Norway, "NPT/CONF.2010/PC.I/WP.65 - Cluster Three: Working Paper Submitted By Norway" (presented at the Preparatory Committee for the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Vienna, 10 May 2007). http://www.un.org/NPT2010/documents.html Accessed 17 August 2008.Para. 5-6
[264] Norway, "Statement to the IAEA 51st General Conference" (presented at the IAEA General Conference, Vienna, September 2007). http://www.iaea.org/About/Policy/GC/GC51/Statements/ Accessed 17 August 2008.
[265] Ibid.
[266] Ministry of Foreign Affairs, "Norway Contributes $5 Million to IAEA Nuclear Fuel Reserve", Ministry of Foreign Affairs, http://www.regjeringen.no/en/dep/ud/press/News/2008/fuelreserve.html?id=502101. Accessed 29 January 2009.
[267] "Norway contributes $5 Million to IAEA Nuclear Fuel Reserve."

Peacebuilding Commission's country-specific working group. Norway's reputation for neutrality and good intentions gives actions such as its contribution to the IAEA-NTI Fuel Bank weight.[268]

Case study four: South Korea

South Korea is a crucial state for any consideration of nuclear energy issues, primarily due to its role within the ongoing nuclear tension in Northeast Asia. South Korea has a long history of nuclear activities; however, its ability to engage in the full fuel cycle has been limited because of the proliferation risks posed by spent fuel reprocessing. By undertaking this stage of the fuel cycle, South Korea could escalate its already fraught relationship with North Korea. This leaves South Korea with a problem: what to do with its spent fuel. Thus, adopting a multilateral nuclear approach may alleviate a number of issues, and increase transparency and trust on the Korean Peninsula.

South Korea's nuclear history

In the mid-1950s, South Korea and the Unites States signed "the Agreement of Cooperation between the Governments of South Korea and the United States Concerning the Civil Uses of Atomic Energy", which was quickly followed by the establishment of the Nuclear Energy Division of the Ministry of Education.[269] South Korea became a member of the IAEA in 1957, and in 1962 its first nuclear reactor, a TRIGA research reactor from the US, achieved criticality.[270] One decade later, the

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[268] Bruce Jones, "Thought Piece on Norway's Role in the Multilateral System," http://www.regjeringen.no/nb/dep/ud/kampanjer/refleks/innspill/globalorden/jones.html?id=492983. Accessed 25 March 2010

[269] Chung-Taek Park, "The Experience of Nuclear Power Development in the Republic of Korea," *Energy Policy* 20, no. 8 (August 1992), 724. In 1958, the Office of Atomic Energy was established, which was reorganised into the Bureau of Atomic Energy in the Ministry of Science and Technology (MOST) in the 1970s. See Park, "The Experience of Nuclear Power Development in the Republic of Korea," 274-75.

[270] "Status of Multilateral Arms Regulation and Disarmament Agreements – NPT," United Nations Office for Disarmament Affairs, http://disarmament2.un.org/TreatyStatus.nsf. Accessed July 16 2009

construction of its first nuclear power plant began, reaching criticality in 1977 and achieving commercial operation in 1978.[271] This plant was a turnkey project with the US, where the contractors are responsible for the plant's construction and performance.[272] Two additional turnkey reactors were ordered in 1973 and 1974, from Canada and the US respectively.[273] During the 1980s, six more nuclear power plants were constructed. Instead of using the turnkey approach, the involvement of domestic industries increased by separately contracting the plant's components.[274]

In 1987, South Korea began a technical transfer programme to achieve nuclear technical self-reliance.[275] The evolution of South Korean nuclear power plant designs testifies to this programme. Its initial eight Pressurized Water Reactors (PWRs) drew from Westinghouse and Framatome (now AREVA) technologies, and its next two, from Combustion Engineering, which eventually became part of Westinghouse. Following this, the Korean Standard Nuclear Power Plant (KNSP) became a recognized design in its own right and evolved to the KNSP+ in the 1990s.[276] In 2005, these units were rebranded as Optimized Power Reactors (OPR-1000). Currently six of these units are operating and four are under construction.[277] These units and the Advanced Pressurized Reactors (APR-400) are being actively marketed in the Middle East and North Africa. In December 2009, the APR-400 was selected for the United Arab

[271] Park, "The Experience of Nuclear Power Development in the Republic of Korea," 725.
[272] Ibid.
[273] Ibid.
[274] Ibid., 726.
[275] Ibid.
[276] World Nuclear Association, "Nuclear Power in South Korea", 13 January, http://www.world-nuclear.org/info/inf81.html Accessed 11 January 2010.
[277] This shows the interest Korea has in becoming a serious nuclear state. Ambitious, technologically advanced, able to produce nuclear technologies for export.

Emirates nuclear power programme. Under a US$20.4 billion contract, 14 reactors will be constructed, the first of which is planned to be operational in 2020.

Domestically, South Korea has 20 operational power reactors, and another 12 either under construction, on order, or planned. The first reactor, KORI-1, will be closed in 2017. Fuel for these reactors is currently imported, largely from Australia and Canada, although the state has increasing involvement in uranium exploration in Canada, and uranium mines in Africa and South America.[278] In 2007, KHNP signed a long-term contract with AREVA, for the provision of enrichment services at France's Georges-Besse II plant. As of 2009, KHNP also has a 2.5% equity stake in the plant.[279]

The Korea-US Agreement constrains South Korea's ability to fully engage in nuclear fuel cycle activities. Specifically, reprocessing of spent reactor fuel is prohibited. However, the transportation costs of overseas reprocessing is too expensive to be a viable option. Thus, South Korea has embarked on a number of research and development projects looking at ways to reduce and reuse reactor waste. These include the DUPIC (Direct Use of spent PWR fuel In Candu reactors) programme, the Advanced Spent Fuel Conditioning Process (ACP), and pyroprocessing. [280]

The Ministry of Science and Technology (MOST) has formulated a Comprehensive Nuclear Energy Promotion Plan (CNEPP) every five years since 1997. The Third

[278] World Nuclear Association, "Nuclear Power in South Korea".
[279] Ibid.
[280] DUPIC is a joint project with the IAEA INPRO project, and involves stripping spent fuel of around 40% of its fission products by subjecting its crushed form to heat in oxygen. It can then be reformed into PHWR fuel. ACP was a cooperative effort between South Korea and the US. In 2008, the IAEA approved an electro-refining laboratory, as part of the Advanced Spent Fuel Conditioning Process facility (ACPF) at KAERI, to begin in 2016 and expand to a commercial demonstration plant in 2025.

CNEPP, for 2007-2011, envisions nuclear energy as the future primary driver of growth. To this end, the development of SMART,[281] increasing the industry for export of nuclear-related items, and developing nonproliferation fuel cycle technology are key points on the agenda.[282]

South Korea's response to the international fuel cycle proposals

In the lead-up to the 2007 NPT Prep-Com, South Korean Ambassador Choi Young-jin gave a presentation at a panel on the nuclear fuel cycle at the Middle Powers Initiative Article VI Forum in Vienna. During his presentation, the Ambassador described the multilateral approach to the nuclear fuel cycle as "an idea whose time has come."[283] He argued that in order for such a regime to become successful, states must consider an "enlightened national interest as opposed to classic narrow national self-interest".[284] That is, states should consider what is in the best interest of all states, rather than just direct national interest.

At the 2007 NPT Prep-Com, South Korea submitted a working paper with Canada and France, which called the multilateral nuclear fuel cycle approaches "another facet" for the non-proliferation regime.[285] Deputy Minister for Policy Planning and International Organisations of the Ministry of Foreign Affairs and Trade stated:

> "Given the nexus between proliferation dangers and sensitive fuel-cycle technologies and facilities, we recognize the need to control their transfer, particularly to countries of proliferation concern or those countries that have no legitimate need for such

[281] System Integrated Modular Advanced Reactor. The basic design of this new reactor is complete, however development has been stalled due to the absence of orders.
[282] Korea Nuclear International Cooperation Foundation (KONICOF), "Nuclear Policy." http://eng.konicof.or.kr/03_atom/03_policy.php Accessed 3 February 2010.
[283] Ambassador Choi Young-jin, "The Nuclear Fuel Cycle and Proliferation Challenges to the NPT Regime," (2007), http://www.gsinstitute.org/mpi/docs/A6F_Vienna_Choi.pdf. Accessed 24 July 2009.
[284] Ibid.
[285] Canada, "NPT/CONF.2010/PC.I/WP.66 - Nuclear Power Development: Meeting The World's Energy Needs and Fulfilling Article IV". Para. 23

> technologies and facilities in terms of their economic feasibility or energy security. We believe that ironclad guarantees of a secure fuel supply at a reasonable price should be provided to those countries that voluntarily forgo the possession of sensitive fuel-cycle facilities."[286]

This statement is telling of Korea's position on this issue; countries that pose a greater risk of proliferation, or have better energy options, should not have open access to all facets of nuclear technology.

During the 2008 NPT Prep-Com, Canada, France and South Korea submitted a very similar working paper to that of 2007, this time with Estonia, Poland, Romania, Ukraine and the United Kingdom. Although multilateral fuel cycle approaches were addressed with more brevity than in the proceeding year, they were described in the paper as "a framework for the safe, secure, and proliferation-resistance development of nuclear energy applications."[287]

At the 2009 NPT Prep-Com, the South Korean working paper of 6 May highlighted the country's dependence on nuclear energy in its domestic energy mix, and because of this South Korea "fully supports international efforts to realize the goals and spirit of initiatives on multilateral approaches to the nuclear fuel cycle, and is willing to constructively participate in discussions on this subject."[288] On 8 May at the same

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[286] Republic of Korea, "Statement by H.E. Mr. Park In-kook - General Debate" (presented at the Preparatory Committee for the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Vienna, 30 April 2007). http://www.un.org/en/conf/npt/2007/statements/Republic_of_Korea.pdf Accessed 5 September 2009.

[287] Estonia Canada, France, Poland, Republic of Korea, Romania, Ukraine and the United Kingdom of Great Britain and Northern Ireland, "NPT/CONF.2010/PC.II/WP.40 - Nuclear Power Development: Meeting the World's Energy Needs and Fulfilling Article IV " (presented at the Preparatory Committee for the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, Geneva, 9 May 2008). http://www.un.org/NPT2010/SecondSession/documents.html Accessed 5 September 2009.

[288] Republic of Korea, "NPT/CONF.2010/PC.III/WP.28 - Multilateral Approaches to the Nuclear Fuel Cycle," *Preparatory Committee for the 2010 Review Conference of the Parties to the Treaty on the Non-*

conference, South Korean Ambassador Kim Bong-hyun highlighted the country's participation in such multilateral activities as the GEN VI Forum, GNEP, and the IAEA's International Project on Innovative Reactors and Fuel Cycles (INPRO) and Regional Cooperation Agreement (RCA). The Ambassador commended the leading role the IAEA had taken in regard to the multilateral proposals, and noted South Korea's financial contribution to research on multilateral approaches to the nuclear fuel cycle currently being undertaken at the United Nations Institute for Disarmament Research (UNIDIR).[289]

In June, South Korea released a non-paper entitled "The Republic of Korea's Suggestion on Possible Criteria for Multilateral Approaches to the Nuclear Fuel Cycle", which stated the international community's need to seek "effective approaches to address the proliferation risk resulting from access to sensitive nuclear fuel technologies by an increasing number of countries."[290] The paper suggested an incentive-based approach, offering constant economically attractive prices, as well as full fuel cycle services including the back-end, "in exchange for voluntary commitment to refrain from seeking sensitive nuclear fuel cycle facilities for an extended period", reflecting the need to balance rights and obligations for all states.[291]

Proliferation of Nuclear Weapons, (2009), Para. 3. http://www.un.org/disarmament/WMD/Nuclear/NPT2010Prepcom/PrepCom2009/documents.html.

[289] Republic of Korea, "Statement by H.E. Ambassador Kim Bong-hyun - Cluster Three Issues" (presented at the Preparatory Committee for the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons, New York, 8 May 2009). http://www.reachingcriticalwill.org/legal/npt/prepcom09/statements.html Accessed 6 September 2009.

[290] "INFCIRC/760 - Communication of 8 June 2009 received from the Permanent Mission of the Republic of Korea concerning a non-paper 'The Republic of Korea's Suggestion on Possible Criteria for Multilateral Approaches to the Nuclear Fuel Cycle'", International Atomic Energy Agency, http://www.iaea.org/Publications/Documents/Infcircs/2009/infcirc760.pdf. Accessed 8 September 2009.

[291] Ibid.

These four case studies have similar nuclear backgrounds, yet differing nuclear aspirations; their responses to the proposals on multilateral nuclear fuel cycle approaches reflect this difference. However, other factors influence their perspectives on this issue, and the following chapter will discuss the effect of the way in which critical states process an emerging norm has on its eventual emergence or failure.

Chapter Five: Multilateral Nuclear Fuel Cycle Approaches as an International Norm

For the most part, analysis of norms theory in international relations has focussed its attention on historical cases; analysts have used examples of successful and salient norms, with relatively little attention given to emerging, changing or failed norms.[292] This gap in the understanding of how and why certain norms become salient and others do not means that international actors have limited available strategies to use in order to strengthen support for emerging norms. From an academic perspective, this gap leaves norms literature endlessly backward looking, unable to speculate about the future. As part of the broader aims of this thesis, this chapter attempts to bridge part of this gap, by analysing the state responses to the recent multilateral proposals as part of the emergence of a new norm. What do the reactions of the case study states indicate about the multilateral approach as an international norm? Do these reactions reveal stages of norm development within the norm life cycle? What is motivating or leading these states to react in the way each has? What has influenced the norm processing of each state? Why do the most critical states remain unconvinced? What are the consequences for them of accepting such a concept in regards to their own Article IV rights? Multilateral nuclear approaches have been put forward at various times during the nuclear age, and have never received the level of support that they are currently experiencing. This chapter will discuss the factors that have lead to this increased support for the case study states, suggesting the potential for this emerging norm to become salient.

[292] Kowert and Legro, "Norms, Identity, and Their Limits: A Theoretical Response." Goertz and Diehl, "Toward a Theory of International Norms: Some Conceptual and Measurement Issues."

An emerging norm?

There are three primary indications of the emergence of multilateral nuclear approaches as an international norm. Following Finnemore and Sikkink's norm life cycle, the first is the existence of a norm entrepreneur with an international organisational platform. The second is the positive responses of three of the four critical states identified in this thesis. The third indication is the progress that has been made on transforming the proposals into reality. However, negative indications are also present. The concerns raised by Indonesia that multilateral approaches may infringe on the NPT Article IV rights of States Parties reflect the reasons identified as inhibitors of previous attempts to introduce multilateral nuclear frameworks.

While the origins of the multilateral approach can be identified as early as the 1940s, interest generated through ElBaradei's reintroduction of the idea in 2003 has for the first time resulted in genuine interest from states. ElBaradei's successful efforts to gather further support since then is reflective of both his own credibility within the international community and the strength of the concern surrounding both the Iranian situation and the nuclear renaissance. In Finnemore and Sikkink's norm life cycle, ElBaradei can be identified as a norm entrepreneur, with an international organisation as a platform for communication and credibility. In 2003, his article in *The Economist* outlined his proposal for a new nuclear framework in three parts. First, he suggested a limit on the processing of weapons-usable material in civilian nuclear energy programmes, as well as on the production of new material, by restricting these operations exclusively to multinational facilities. Second, nuclear-energy systems should have built-in features that would prevent diversion of nuclear material to

weapons production. This would involve the development of, for example, new nuclear facilities that would not separate plutonium from spent fuel. Third, there should be serious consideration of multinational approaches to the management and disposal of spent fuel and radioactive waste. These initiatives would be advantageous on multiple levels, he argued, by reducing the cost of nuclear-energy systems and therefore making them available to "more people in more countries"; increasing the physical security of nuclear facilities; and increasing non-proliferation controls by limiting access to weapons-grade material. ElBaradei also added that the new framework should be inclusive of nuclear-weapon states, non-nuclear-weapon states, and those outside the current regime.

ElBaradei took a number of subsequent steps to propel the multilateral fuel cycle concept back into the international spotlight. This included presenting his ideas at the 15th Annual Conference of the Indian Nuclear Society in November 2004, emphasizing the potential for inclusion of non-NPT States in multilateral initiatives; convening an international Expert Group, chaired by former IAEA Deputy Director Bruno Pellard, to consider possible multilateral approaches to the nuclear fuel cycle; and organising an IAEA Special Event, "New Framework for the Utilization of Nuclear Energy in the 21st Century: Assurances of Supply and Non-Proliferation", in September 2006.[293]

In contrast with historical attempts to introduce multilateral approaches into the international community, ElBaradei has managed to draw significant interest from a

[293] Mohamed ElBaradei, "Introductory Statement to the Board of Governors", IAEA, http://www.iaea.org/NewsCenter/Statements/2004/ebsp2004n003.html. Accessed 4 September 2008. "50th IAEA General Conference Special Event", IAEA, http://www-pub.iaea.org/Mtcd/Meetings/Announcements.asp?ConfID=147. Accessed March 10 2008.

number of states. Following his initial steps to advocate for multilateral nuclear approaches, a number of states indicated their support by drafting proposals for multilateral nuclear fuel cycle initiatives, as outlined in chapter three. Chapter Four demonstrated the outright support for specific initiatives from Australia, Norway, and South Korea, contrasting with the caution of Indonesia's response. Within the norm life cycle, this mixed response indicates that the multilateral approach to the nuclear fuel cycle *is* an emerging norm, competing against the existing salient norm of indigenous control and development of the full nuclear fuel cycle. However, this alone does not necessarily mean that multilateral approaches will reach the tipping point, and become an internalised, widely held belief.

Norm processing

The way in which a state processes a norm and the motivations for accepting or supporting the norm varies according to the stage of the life cycle. During 'emergence', states are persuaded by the norm entrepreneur. This differs from latter stages, when the norm acquires the 'oughtness' quality that norms are most well-recognised for.[294] Contestation between existing normative and social structures is an intrinsic part of the norm life cycle process, where old practices and new ideas clash and compete for dominance. This occurs during the emergence stage of the life cycle, and helps to explain why only a small number of states embrace the norm in the beginning. Motivations for accepting new international norms during emergence are altruistic or self-interested. As the emerging norm is supported by an increasing number of states and reaches the tipping point, institutionalisation and demonstration of the norm's benefits help to motivate support of additional states. As this happens, the social costs

[294] Finnemore and Sikkink, "International Norm Dynamics and Political Change," 895.

of remaining outside the norm increase. Thus, those resistant to the idea in the beginning may eventually find themselves in an environment where rejecting the norm has more negative social consequences than when they first rejected the idea. In this case, the processes of demonstration and institutionalisation have already begun. The Russian IUEC initiative has gained initial shareholders and is attracting the attention of prospective members, including India. After reaching its financial milestone in 2009, the NTI proposal for an IAEA Fuel Bank has also become a step closer to reality after the IAEA Board of Directors approved a Russian proposal to locate the reserve on Russian Soil in November 2009.[295] Examples of successful, functioning multilateral nuclear fuel cycle initiatives will enhance their credibility and stimulate further support by previously wary states.

Case Studies

There are some supporting states for which embracing the norm is relatively easy. Norway is one such example, as a state without nuclear power aspirations that has a strong history of supporting non-proliferation and, more broadly, international peace initiatives. For states such as Norway, the cost-benefit calculation for this norm involves many benefits at a cost that is affordable. Norway's response can be assumed to reflect that of the states that can afford to take a purely ideological stance. With abundant hydropower supply, an already developed population, and security provided through NATO's nuclear arrangements, Norway's consideration of this issue can rest solely on non-proliferation grounds.

[295] "GOV/2009/81: Request by the Russian Federation regarding its Initiative to Establish a Reserve of Low Enriched Uranium (LEU) for the Supply of LEU to the IAEA for its Member States," (2009), http://www.iaea.org/Publications/Documents/Board/2009/gov2009-81.pdf. Accessed February 4, 2010.

For Australia, the calculation is also weighted towards the benefit side. Multilateral nuclear fuel cycle approaches provide it with an opportunity to expand its nuclear industry and increase exports of uranium yellowcake. There is additional potential for uranium to be enriched on Australian soil in a multilateral facility. Naturally, there is some financial costs involved, but the benefits are clear. Uranium oxide is a significant export for Australia. Uranium exports ranked 13th of Australia's top mineral and fuel exports in 2008, valued at $736 million.[296] If uranium enrichment or fuel fabrication could be added to the mix, the value of this export will increase. With so many states looking to adopt nuclear power, the market for fuel cycle services, including provision of enriched uranium for reactor fuel, is wide open for new players. There are currently only five companies that provide over 90% of worldwide enrichment services.[297] In 2005, 12360 tonnes of uranium yellowcake (U_3O_8) was exported from Australia, valued at A$573 million. However, if these exports had been enriched uranium instead of uranium yellowcake, their value would have been A$1140 million.[298] Naturally, there would be additional costs involved with creating the higher value product; however, with Australia's large uranium reserves, investing in fuel cycle facilities may pay itself off reasonably quickly. A briefing paper by Nuclear Fuel Australia Ltd, *The Case for Uranium Enrichment in Australia*, suggests that because Australia has the most stringent safeguards requirements for uranium supply, has already developed both centrifuge and laser enrichment technologies, and is a major exporter of uranium, the

[296] Australian Government Department of Foreign Affairs and Trade, "Trade at a Glance 2009," http://www.dfat.gov.au/publications/taag/index.html. Accessed 17 April 2010.
[297] Clarence Hardy, "The Case for Uranium Enrichment in Australia," (Sydney 2007), 5. The five companies are: Areva (France), Cameco (Canada), Coverdyn (U.S.), Springfields Fuels Ltd (U.K.), and Tenex (Russia).
[298] Ibid., 7.

construction of a conversion plant and uranium enrichment facility would be beneficial.[299]

When the topic of nuclear power in Australia was raised by Prime Minister Howard towards the end of his term in office, it was controversial and received a divided public response. On one hand, Australia's energy needs are currently being met through the use of coal, which Australia has in abundance as the world's largest coal exporter, and fourth largest coal producer.[300] For the year 2007-2008, around 75 per cent of Australia's electricity was generated through coal.[301] Although coal is not a clean energy, it is available at low cost, and the size of Australian coal reserves will allow this to be the case for many years to come. Thus, the *need* for an alternative, costly, and as seen by many, dangerous source of energy is not apparent. On the other hand, the Australia nuclear industry is keen to expand its horizons.

Australia wanted to be one of the "advanced states", nuclear fuel cycle suppliers, in Bush's GNEP framework. At the time, Howard was proactively engaging Australia on its nuclear future through the UMPNER Review. As a state with substantial uranium resources, it would make sense to develop more fuel cycle facilities domestically if nuclear power became part of the energy mix in the future. The proposals for a nuclear waste repository equally fall under this umbrella: useful if Australia intends on utilising nuclear power, but the lack of broad public support for this energy option makes nuclear fuel cycle expansion controversial. Acceptance of the idea that some states

[299] Ibid.
[300] US Department of Energy, "Australia Energy Data, Statistics and Analysis - Oil, Gas, Electricity and Coal", http://www.eia.doe.gov/emeu/cabs/Australia/Background.html. Accessed March 19 2010.
[301] Geoscience Australia, "Australian Energy Resource Assessment," (2010), 146. https://www.ga.gov.au/image_cache/GA16878.pdf. Accessed 25 March 2010.

should not have enrichment or reprocessing facilities also motivated its membership in GNEP. Howard had a positive relationship with former-President Bush, who had referred to Australia as a "regional sheriff". Since the election of Kevin Rudd and the Labor Party, the Government has publicly backed away from nuclear topics. The National Radioactive Waste Management Bill 2010 is currently under debate, as the Labor Party seeks to replace the Commonwealth Radioactive Waste Management Act 2005. The difference between the two is that the 2005 Act sought to create a national waste repository, while the 2010 Bill seeks to establish a single national facility for the management of low-level and short-lived radioactive medical and scientific waste.[302] The new government has nonetheless remains a member of GNEP.

Similarly for South Korea, the benefits of being involved in a multilateral fuel cycle arrangement are obvious, given the limitations it faces in regards to an expansion of the nuclear industry. This is currently limited through the US-Korea Arrangement, set to expire in 2014, and is a delicate matter due to the North Korea situation. Yet, as a state with advanced nuclear capabilities and a good record of nuclear safety, it may be a good candidate for facilitating a multilateral approach in the Asia-Pacific region. Like Australia, South Korea may have jumped on board with GNEP partly as a precautionary measure, wanting to negate classification as a "customer" instead of an "advanced nuclear supplier state" and in doing so, trying to ensure that its rights to access nuclear technology and materials for peaceful purposes remain status quo. South Korea has shown interest and made a large investment in developing its domestic

[302] See for example "House debates, Thursday, 18 March 2010: National Radioactive Waste Management Bill 2010, Second Reading", http://www.openaustralia.org/debates/?id=2010-03-18.45.2. Accessed 23 April 2010. Angus Martyn, "http://www.openaustralia.org/debates/?id=2010-03-18.45.2," (Australian Parliamentary Library, 2010).

nuclear power programme, which provides around 50% of the country's energy needs. The inability to employ reprocessing activities has led to innovative projects on reprocessing alternatives and nuclear waste solutions, as the nation's spent fuel builds up with nowhere to go, as offshore reprocessing is too expensive to be a viable option. These factors, plus its membership in the Generation IV International Forum, demonstrate its position as an advanced nuclear state. Yet the security situation on the Korean Peninsula and corresponding tensions in North Asia may lead some to believe South Korea is a risky state in which to have the enrichment and reprocessing stages of the nuclear fuel cycle. In addition, the latent nuclear capability that results from these technologies may increase existing regional tensions. For example, a nuclear-capable South Korea could lead to an escalation of the nuclear or military activities of China or North Korea, regardless of whether the threat they perceive is real or imagined. By the same margin, South Korea's desire to be at the forefront of nuclear technology may in part be fuelled by a desire to ward-off threats by North Korea, whose efforts in the nuclear realm have been hampered in part by a lack of technological ability.

The cost-benefit calculation for Indonesia includes some additional factors that render cost a heavier burden than the potential benefits. As a founding member of the NAM, Indonesia has traditionally been a staunch critic of Western efforts to exert control over the international community, and has been outspoken about its perception that the NWS have not done enough to live up to their Article VI NPT obligations. Indonesia is currently considering the nuclear power option, and as enrichment and reprocessing are expensive endeavours, one might think a multilateral arrangement may be economically attractive to a developing nation. The issue is that some of the proposals have a

condition on participation: the 'client' state must forgo the *right* to such activities before it can gain the benefits. Although this is not a requirement of all proposals, former President Bush framed the multilateral initiatives as condition in February 2004 during a speech at the National Defense Academy.[303] In states such as Indonesia, this condition is viewed with disdain. Why should states with long records of safe, proliferation-free peaceful nuclear activities give up rights afforded to them under the NPT, when the states that are dictating this course of action have worked so slowly on their own obligations under the same treaty? Indonesia holds the principles of sovereignty, independence, and self-determination in high regard, reflected in the 1973 Treaty of Amity and Cooperation signed between the founding members of ASEAN, as well as its membership in NAM. This viewpoint has motivated its vocal advocacy of Iran's right to engage in peaceful nuclear activities.[304] Because of this, it seems unlikely that Indonesia would be open to engaging with the current multilateral fuel cycle proposals on the table, due to the ongoing inaccurate perception that in order to participate in *any* such initiative, states are *required* to forgo enrichment and reprocessing rights.

However, this is not to say that such reluctance will continue indefinitely. Cooperation among Southeast Asian nations, under the principles of respect for sovereignty, continues to positively reinforce stability within the region. Certainly from an economic perspective, the realities of the high cost of an indigenous nuclear programme including enrichment and/or reprocessing have hindered attempts to begin such an effort in the

[303] Sean Lucas, "The Bush Proposals: A Global Strategy for Combating the Spread of Nuclear Weapons Technology or a Sanctioned Nuclear Cartel?" (NTI 2004) http://www.nti.org/e_research/e3_58a.html Accessed 29 July 2008.
[304] "Statement by H.E. Dr. R.M. Marty M. Natalegawa at the Security Council before the vote on the resolution on non-proliferation (Iran)".

past, although this has not prevented strong research and medical programmes. Despite its concerns about the right to access, it may be wise for Indonesian officials to consider scenarios where Southeast Asian multilateral nuclear cooperation may be workable, perhaps with assistance from Australia and South Korea for enrichment and reprocessing.

Indonesia has a real need for increased power generation capacity, as "its public utilities have never generated enough electricity to meet demand from households and industry, and in recent years the shortfall in production has become more serious."[305] However, its geographic position on the "Ring of Fire" and subsequently high amount of seismic activity presents a major safety concern for this densely population archipelago, as any nuclear accidents that may result from a seismic event may have grave domestic and international consequences. Given the dense population of Indonesia and close proximity of its neighbours, adequate preparation for dealing with a nuclear accident must take a high priority. This may come in the form of a regional nuclear emergency response team, or coordinated training for nuclear power plant staff.

International security considerations

One interesting point to note is the fact that three of the four case study states, those that have reacted positively toward the multilateral fuel cycle initiatives, are all protected by nuclear weapons. Australia is protected by the US under the ANZUS Treaty, Norway is protected by the US under the NATO alliance, and Korea is also protected under the US nuclear umbrella. Indonesia, on the other hand, is afforded no such protection. In fact, the South East Asian Nuclear-Weapon-Free Zone (SEANWFZ)

[305] Michael S. Malley and T. Ogilvie-White, "Nuclear Capabilities in Southeast Asia," *The Nonproliferation Review* 16, no. 1 2009), 28.

includes protocols that the NWS can sign, undertaking to respect the treaty and not to contribute to any act in violation of the treaty or its protocol by States Parties, or to use or threaten to use nuclear weapons against any State Party or within the SEANWFZ.[306] While it seems unlikely that Indonesia's intentions in defending the right to maintain existing rights to access peaceful nuclear technology are part of a long-term plan to develop its own nuclear protection, being non-aligned and unprotected by and from nuclear weapons impacts on Indonesia's processing of the multilateral fuel cycle norm.

NPT rights and obligations

The refusal by the NWS to sign the SEANWFZ protocols, coupled with the perceived lack of progress on nuclear disarmament, could be seen as actions that are contrary to the spirit of the NPT. From the perspective of many non-aligned states, NWS have not lived up to their end of the bargain. NNWS are highly likely to resist efforts to further restrict their access to technology, knowledge and equipment, without a concerted effort to put disarmament goals and principles into action. At the 2000 NPT Review Conference, "13 Practical Steps" were agreed upon as a path leading to general and complete nuclear disarmament. These steps included obtaining the remaining signatures and ratifications of the Comprehensive Test Ban Treaty (CTBT); the negotiation of a non-discriminatory, verifiable treaty banning the production of fissile material; entry into force and full implementation of START II and conclusion of START III negotiations; and direct steps by the nuclear weapons states leading to disarmament, including reductions in nuclear arsenals, increased transparency in regards to nuclear

[306] "Southeast Asia Nuclear-Weapon-Free Zone Treaty (Treaty of Bangkok) ", *James Martin Center for Nonproliferation Studies* http://www.nti.org/e_research/official_docs/inventory/pdfs/seanwfz.pdf. Accessed April 7 2010.

capabilities, and reductions in non-strategic weapons.[307] Almost ten years later, the 13 Steps have had only limited success. The CTBT still requires ratification by many of the Annex II States in order to come into force, including China and the US. The Conference on Disarmament has finally agreed to a programme of work including negotiations on a treaty banning the production of fissile material, but is yet to begin work.

The lack of progress on steps that were agreed to by consensus at the 2000 Review Conference presents a key challenge for states trying to push the multilateral fuel cycle concept – change cannot be accomplished via *diktat*; it will require bargaining.[308] Developing states such as Brazil, China, India, Iran, and South Africa have more power, in both economic and political terms, and change in the international system is unlikely to succeed without their support.[309] In addition to these States, smaller and less powerful countries are insistent on greater equality[310] and will not accept greater discrimination within the NPT regime. As George Perkovich writes:

> "These eminent Americans along with Russian and French officials and experts act as if they were merely requesting an upgrade of the nuclear order software from 1.0 to 2.0. They fail to appreciate that key developing countries feel that the original software did not work well for them and that they received comparatively poor, indeed unfair, service from the original vendors. Not having benefited as fully as they expected from the original bargain, these developing countries do not want to sign a new contract for the purported upgrade they are being offered. And with the diffusion of technology anticipated in coming years, resembling the diffusion of open-source codes in computer software, they believe they have alternatives. A vision of a nuclear-weapon-free world

[307] "The Promises of the 2000 NPT Review Conference", Reaching Critical Will, http://www.reachingcriticalwill.org/legal/npt/13point.html. Accessed February 2 2009.
[308] George Perkovich, "Principles for Reforming the Nuclear Order," (2008), 17. http://www.carnegieendowment.org/files/Perkovich_Reforming_Nuclear_Order.pdf. Accessed 5 March 2009.
[309] Ibid.
[310] Ibid.

> is not necessary to *justify* stronger controls on fuel-cycle technology, but it is absolutely necessary to *achieve* such controls."[311]

Indeed the case of Iran perhaps demonstrates the fears of other NNWS well. The IAEA has yet to find evidence that Iran has diverted nuclear material to a nuclear weapons programme. Despite many occurrences of non-compliance from failing to report its activities over their 18-year period, this, according to Michael Spies, "does not satisfy the criteria in the Safeguards Agreement allowing for the Agency to report the matter to the UN Security Council,"[312] which may happen only in the instance that the IAEA Board of Governors is unable to verify a lack of diversion of nuclear material.[313] It was this basis under which North Korea was referred in 2003.[314] In the case of Iran, the Board's referral was given under the broader language of Article III.B. of the IAEA Statute, which allows the IAEA to refer situations to the Security Council for "issues within the Security Council's competence",[315] reasoning that the "absence of confidence that Iran's nuclear programme is exclusively for peaceful purposes ha[s] given rise to questions that are within the competence of the Security Council."[316] The NAM has generally supported Iran's position, though with caution, perhaps with the premise of protecting their own rights under Article IV rather than the belief that Iran's nuclear programme is exclusively for peaceful purposes.[317] As Spies states,

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[311] Perkovich, "Principles for Reforming the Nuclear Order," 18.
[312] Michael Spies, "Iran and the Limits of the Nuclear Non-Proliferation Regime," *American University International Law Review* 22, no. 3 (Accessed 26 October 2009 2007), 425.
[313] IAEA, *Text of the Agreement Between Iran and the Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, art. 19, IAEA Doc. INFCIRC/214 (Dec. 13 1974)
[314] Spies, "Iran and the Limits of the Nuclear Non-Proliferation Regime," 426.
[315] Ibid., 427.
[316] IAEA Doc. GOV/2005/77, art. 2 ; *see also* IAEA Statute, Art. III.B.4 (allowing the IAEA to submit reports to the U.N. Security Council for issues within the Security Council's competence).
[317] See for example, Tanya Ogilvie-White, "International Responses to Iranian Nuclear Defiance: The Non-Aligned Movement and the Issue of Non-Compliance," *European Journal of International Law* 18, no. 3 2007).

although there are growing suspicions about the nature of Iran's nuclear programme and its intentions for the future, its violations "have not risen to the level where an argument can be made that Iran has forfeited its rights under Article IV."[318] Yet, the situation has gone before the Security Council, which has required Iran to stop its enrichment activities so that outstanding questions can be answered.

The trouble with increasingly restrictive non-proliferation initiatives, vital as they may be, is the perception that they are also eroding the rights to peaceful nuclear activities afforded to NNWS under Article IV. Additionally, the very slow and small amount of disarmament progress from NWS hinders the acceptance of significant non-proliferation measures, such as the multilateral nuclear fuel cycle approaches, as NNWS are wary that the NPT regime may end up even more discriminatory than it originally intended. While multilateral approaches have great potential to shore up existing gaps in the nuclear non-proliferation regime, some states are reluctant to jump on board, for many reasons. The existing gap between nuclear 'haves' and 'have nots', the potential for economic disadvantage, the perceived lack of progress on nuclear disarmament, a history of international control of peaceful nuclear technologies, and the need to protect existing Treaty rights all contribute to a feeling of distrust between advanced nuclear states and developing ones.

[318] Spies, "Iran and the Limits of the Nuclear Non-Proliferation Regime," 428.

Chapter Six: Conclusion

Peaceful or otherwise, the dual-use nature nuclear technology and materials has always rendered nuclear activities problematic. In recent years, the issue of promoting nuclear power while preventing nuclear weapons proliferation has been further complicated by the Iranian nuclear situation, and the impending "nuclear renaissance". For the IAEA, multilateral approaches to the nuclear fuel cycle offer a way to navigate forward, protecting the rights of those states that choose to utilise nuclear energy, while simultaneously strengthening the weaknesses in the regime that have become all too apparent. The notion that nuclear fuel cycle activities should be a multilateral endeavour has unfortunately not gained international favour over indigenous approaches since its initial introduction into international forums in the early stages of the nuclear age. Various factors and concerns have prevented states from whole-hearted and widespread acceptance, despite periodic efforts through the IAEA to encourage internationalised nuclear cooperation.

The concluding chapter of this thesis will address the degree to which norms theory explains increased support for multilateral approaches to the nuclear fuel cycle, suggest other measures that can be taken by norm leaders to transmit and activate this norm, highlight problems that will need to be addressed in order to increase support for multilateral approaches, and address the broader significance of this issue.

The normative explanation

The traditional application of norms theory has identified salient international norms, retrospectively tracing their evolution. This thesis has taken a different approach, attempting to identify an emerging norm with the potential to become a new international norm. In addition, this thesis has drawn constructivist and realist approaches together in the theoretical assumption that during the emergence stage of the life cycle states have both ideological and self-interested reasons for supporting a new norm. When examined through the norm life cycle framework, it can be best concluded that multilateral approaches are still in the 'emergence' stage - yet to gain widespread support, but not without significant backing.

The renewed interest that has been generated by ElBaradei, as a norm entrepreneur, clearly distinguishes it from past attempts to introduce multilateral nuclear controls. For the first time since the Baruch Plan and Atoms for Peace, states and international organisations have given serious consideration to the practical application of the multilateral approach. This resulted in the proposals outlined in Chapter Three, which identify the support of the global powers, including the US and Russia, whose support is crucial for norm development.

The state responses to the multilateral nuclear fuel cycle proposals indicate enthusiasm from advanced, developed states, and caution from developing states. At present, support seems to be limited to advanced nuclear suppliers, states that have the luxury to take a purely ideological stance, such as Norway, or states that already are engaged in the nuclear industry, and thus have the potential to receive economic or technological

benefits from participating, such as Australia and South Korea. However, for states such as Indonesia, that intended to develop indigenous nuclear fuel cycle facilities, the prospect of being denied that option is a serious concern. Gaining the support of such states is critical for the development of this norm; without their cooperation, the norm will fail to reach the "tipping point" and normative change will not occur.

Tangible progress in the nuclear paradigm that has been made recently reinforces the ideological push to change state practice in regard to the most sensitive aspects of the nuclear fuel cycle. These developments include President Obama's push toward nuclear disarmament, seen in the NPR and the Nuclear Summit held in April 2010; agreement on a Programme of Work in the Conference on Disarmament including a fissile material treaty in 2009; successful negotiations by Russia and the US on a START replacement, the Prague Treaty; Russia's creation of the International Uranium Enrichment Center at Angarsk; and progress on the IAEA LEU fuel bank. That multilateral nuclear approaches will support other aspects of the nuclear non-proliferation regime should provide some incentive for states to extend their support. The increased levels of nuclear safety and security achieved through multilateral approaches could encourage further progress on securing fissile materials. In turn may encourage more movement within the Conference on Disarmament, which until 2009 had failed to pass a programme of work since 1995. Increased nuclear security will permit the recent momentum on nuclear disarmament to continue.

Although the NPT guarantees states the right to access nuclear technology for peaceful purposes, it is perhaps the case that this right needs to be conditional on "good

behaviour" in order to contribute to wider international security. On the other hand, there is a large degree of resistance from NNWS to further restrict their NPT rights while the disarmament progress of NWS remains, in their view, minimal.

Multilateral nuclear approaches in the broader context

The risks posed by the uncontrolled development of nuclear technologies are exemplified as worst-case scenarios by the ongoing situations in Iran and North Korea. In the case of Iran, the actual development of a deliverable nuclear weapon remains a risk rather than a reality. However, the twenty years of concealment from the IAEA, linkages to the military, constantly changing explanations according to the inspectors' finding, refusal of access to the sites and to key information personnel when requested is uncharacteristic of peaceful civilian nuclear development.[319] The Iranian case prompted reconsideration over the extent of access to peaceful nuclear technology, and the use of multilateral approaches to mitigate the risks such access poses, particularly, but not exclusively, for states of proliferation concern. In the context of an expansion in the use of nuclear power and corresponding increase in facilities to accommodate the demand for nuclear fuel cycle services, multilateral approaches may provide the best mechanism to alleviate risks while still enabling states to make national decisions regarding their energy security.

The threat of nuclear terrorism not only arises from the potential for terrorists to acquire a nuclear weapons, or even radiological material for a "dirty bomb"; an attack on an insecure nuclear facility would likely be devastating enough to be a worthwhile target for terrorist groups or non-state actors. Multilateral facilities would bring more

[319] Therese Delpeche, *Iran and the Bomb: the Abdication of International Responsibility*, trans. Ros Schwartz (Paris: Editions Autrement, 2006), 105.

standardisation to the security levels of nuclear facilities worldwide, with particular benefits for developing states that may have economic barriers preventing more than a minimal level of security. The same logic can be applied to the area of nuclear safety. A multilateral approach would ensure that facilities have properly trained staff, well-maintained equipment, and ability to sufficiently respond to a nuclear incident or emergency.

The security of fissile materials is an area of particular concern, even in developed states. Documented accounts of the attempted black market sale of HEU in Russia in 2006, and the breech of a key national nuclear facility in South Africa in 2007 are just two examples.[320] In Russia, old and damaged nuclear portal monitors, underpaid security staff, and an unstable electricity supply are major factors contributing to the ability for black market agents to acquire fissile material. Multilateral approaches would increase the available funding for nuclear checkpoints at border security, at least at particularly vulnerable locations, such as on the Russo-Georgian border.

Implications for the real world

Policy recommendations

That the majority of the twelve proposals have come from 'supplier' states is indicative of a lack of consultation between these states and the developing non-nuclear states. The issues raised by developing states regarding the proposals, primarily concerning the requirement to forgo enrichment and reprocessing rights, need to be addressed, and new reworked proposals put forward. The requirement for states to give up these rights

[320] See Michael Bronner, "100 Grams (and Counting...): Notes from the Nuclear Underworld", Belfer Center for Science and International Affairs, Harvard Kennedy School, 4 October 2008.; Micah Zenko, ""A Nuclear Site Is Breached." South African Attack Should Sound Alarms," *The Washington Post*, 20 December 2007.

is a somewhat unrealistic expectation, and unless there are significant incentives to do so, this will be a hindrance to the development of the multilateral approaches. This could be done through *ad hoc* international groups, or an IAEA working group.

Placing the IAEA at the centre of any arrangement is key to gaining the trust of developing states that may be wary of multilateral arrangements impinging on their rights by overzealous 'advanced' nuclear states. This has been identified as an important factor by Indonesia, a state that has been careful to avoid any definitively positive statements on the issue. This would require additional funding for the IAEA; however, the involvement of the IAEA may prove to be a critical feature in any successful multilateral endeavour.

The IAEA-NTI fuel bank has achieved its donation threshold, with US$100 million from member states activating the US$50 million from NTI. The proposal was stalled in the IAEA Board of Governors, with states lacking certainty about the whole idea; however, in 2009 the IAEA accepted an offer from Russia to host the fuel bank at its IUEC at Angarsk. Thus, this initiative needs further support from states, both in terms of supplying the actual fuel, and buy-in to the scheme. The US and Russia can take a leading step here, through the donation of LEU.

The end of ElBaradei's leadership at the IAEA signals an important role for norm leaders. ElBaradei's role as a norm entrepreneur led to a greater level of international interest in multilateral nuclear approaches than ever before. Now that he no longer has the platform of the IAEA, "norm leaders" and other states that are in support of

multilateral approaches will need to establish international dialogue on this issue to ensure that it does not fall by the wayside. Linking multilateral nuclear approaches with non-proliferation and nuclear security is a vital task for norm leaders; the failure to do so may result in unintended negative linkages to the international control of nuclear power. Instead, framing the issue as a positive reinforcement of the non-proliferation regime will help to encourage dialogue from states that may be concerned about the potential loss of Article IV rights.

Further research

As evidenced by the variety of multilateral proposals, there is no single direction for the multilateral approach. Further research should investigate which style of approach would be most amenable to the states of most proliferation concern. Shared facilities may work better in regions with existing integrated cooperation; black-boxed technology, as used in the Russian IUEC, may be better where a single state already has the technology, and its neighbours are developing nuclear power. Alternatively, a holistic multilateral approach on new facilities may be more appropriate in Southeast Asia or South America, where states have some nuclear experience but lack the financial means to develop nuclear power programmes on their own.

The major problem this norm will face in the struggle to become a salient norm has been shown in this thesis: developing states are concerned about what multilateral approaches will mean in terms of their ability to make decisions about their energy needs, without restriction or discrimination on their existing NPT rights. Thus, part of the immense task ahead in shoring up the nuclear non-proliferation regime is simply convincing developing states that adopting multilateral approaches is not an accusation

or an admittance of their potential guilt; it is merely an acknowledgement that, on more than one occasion, clandestine nuclear activities have gone under the radar of the existing non-proliferation system. Within the context of the history of the non-proliferation regime, increasing levels of restriction on sensitive technologies is not out of character. Rather, it parallels an increasing recognition of the risks of proliferation posed by dual-use nuclear technologies, and the decreasing economic and technological barriers that lie between nuclear power and nuclear weapons. As such, multilateral approaches should be viewed as a method of encouraging non-proliferation and an incentive for NPT compliance rather than a mechanism for the denial of technology. The responses of new nuclear states and their decisions about the way that they engage in the nuclear field may ultimately determine whether multilateral approaches become the pervasive practice. Additionally, should this approach become the preferred method for existing nuclear states, those that do not accept it initially may find themselves subject to international normative pressures to do so. Further research on the attitudes of new (or soon-to-be) nuclear powered states will be particularly useful for reworking the proposals for multilateral fuel cycle initiatives. From a normative perspective, revisiting the response of a broad spectrum of states to the multilateral approach should be considered in the medium term. At this point, the indicators of a "tipping point" or "cascade" may be more discernable than at present.

Conclusion

The nuclear non-proliferation regime is under an ever-increasing amount of strain. The longer the Iranian and North Korean nuclear situations remain unresolved, the more entrenched positions on both sides will become. The inability to resolve these issues will damage the credibility of the non-proliferation regime further. Thus, the outcome

of these crises has serious implications not only for the future of the regime, but also for wider international security dynamics, particularly in the Middle East and North Asia. As an increasing number of developing countries consider nuclear energy as a means to provide power to their growing populations, the concept of the multilateralisation of the nuclear fuel cycle could provide assurances to both sides of the nuclear divide: fuel supply guarantees and low proliferation risks.

The foundations for multilateral approaches to the nuclear fuel cycle already exist within the international system. European companies have collaborated on uranium enrichment for decades, and bilateral technical cooperation through the IAEA has provided many states with assistance in developing peaceful nuclear activities in a variety of fields. The critical point that those in support of this approach need to recognise is that states cannot be forced to buy-in; they must be encouraged. Technology denial will not prevent determined states from acquiring nuclear technology; yet it will simultaneously contribute to the resentment and sense of inequity that already plagues the regime.

Controlling the spread of nuclear technology has been an ongoing measure taken against the proliferation of nuclear weapons since the 1940s. Multilateral approaches to the nuclear cycle fuel can be seen as a part of that pattern. However, it is not just another small step in a long line of activities; it would be a major reconfiguration of the global nuclear energy framework. As such, the concerns raised by some developing states regarding their right to determine their own energy futures without discrimination are valid and need to be acknowledged and addressed by proponents. Multilateral

nuclear approaches could be the key component of broader efforts to prevent the collapse of the nuclear non-proliferation regime in the 21st century, creating greater security of fissile material, increasing the safety standards of nuclear facilities, and fostering trust and cooperation in the international system.

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