Introduction

The Politics of Nuclear Energy – A Debate Renewed

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Few words evoke more passionate debate and reveal such widely divergent views as the word "nuclear". Whether in reference to "nuclear weapons", "nuclear energy", or "nuclear terrorism", nuclear-related questions and issues continue to garner the attention or suffer the opprobrium of scholars, decision-makers, and international and regional organisations. Ever since the nuclear genie was let out of the bottle, fears of impending nuclear disaster—whether in the form of all-out nuclear war or nuclear terrorism—have gripped the attention of policy makers and scholars (for a recent restatement of these fears, cf. Niemeyer 2023; Jacobsen 2024; Karam 2021; Narang & Sagan 2022). As Robert Gates, the former United States (US) Secretary of Defence, noted, every high-ranking government official is kept awake at night by the spectre of a nuclear-armed terrorist group inflicting unimaginable destruction on society (quoted in Coetzee 2020:371). Also, in the wake of the Russian invasion of Ukraine in February 2022, frequent Russian nuclear sabre-rattling has reignited fears about an all-out nuclear blowout, while the safety of nuclear power plants during this war has remained a very real concern (Williams 2024). The prospect of a nuclear-armed Iran and how that development could (but not necessarily would) lead to a nuclear cascade in the Middle East also looms large (Coetzee 2021). At the same time, Chinese

modernisation of its nuclear forces continues apace, while nuclear-armed North Korea's rambunctious behaviour persists (Kristensen *et al.* 2024). Uncertainty about its external security situation is constraining South Korea, a country historically at odds with nuclear weapons possession, to begin contemplating or, at the very least, publicly discussing the merits and demerits of a South Korean nuclear weapons programme (Kelly & Kim 2024; Cha 2024:1). In the context of the unfolding bipolar or, as some contend, multipolar world, fears about the stability of nuclear deterrence have proliferated. Disruptive technologies, ranging from artificial intelligence (AI), cyber warfare, hypersonic weapons, to quantum computing, ostensibly pose insurmountable risks to deterrence stability, especially in relation to the survivability of second-strike nuclear forces and nuclear command and control systems (Lieber & Press 2017; Lieber & Press 2018; Coetzee 2021).

We also recognise and appreciate that consideration of nuclear issues cannot be wholly reduced to the dangers of nuclear Armageddon or nuclear terrorism. For more than seven decades, nuclear fission has been harnessed in service of improving the lot of the ordinary person, whether in the form of electricity generation (and the benefits accruing from it) or in pursuit of a range of industrial purposes. Accordingly, civilian nuclear energy has proven to be a reliable, (relatively) safe, mature technology, capable of providing abundant baseload and clean energy. This, of course, is only one half of the story. The other half can best be described as an unveiling of the dark side of civilian nuclear energy. In this unveiling, attention is focused on probing the intentional or unintentional effects accruing from the construction and operation of nuclear power plants, the management of radioactive nuclear waste, preventing nuclear accidents and responding to them when they do occur, and exposing the prevalence of nuclear sacrifice zones in which entire communities remain locked in the harmful effects accruing from their exposure or proximity to civilian or military applications of nuclear technology. Belatedly, there is also a growing recognition that today, as during the Cold War, civilian nuclear energy projects are weapons in the foreign policy toolboxes of nuclear exporters through which such

states export their ideological preferences and advance their geopolitical interests.

As evident from the above, the contestation over civilian nuclear energy—what this book calls the 'politics of nuclear energy'—remains unusually salient, and more so given several assessments that the future of civilian nuclear energy looks much rosier than what would have been predicted a few decades ago (cf. Tirone 2024; Azman 2024; Donovan 2022). Increased interest in civilian nuclear energy across the developing world and, by extension, in African countries have soared, as these countries attempt to fight and overcome the scourge of energy poverty, betting that nuclear energy can provide a long-term solution. Some countries that have turned their backs on civilian nuclear energy have restarted debates about returning to nuclear power, with Germany and Taiwan constituting but two cases (McGillis 2024; DW 2024; McGillis & Oung 2022). Whatever the outcome of these debates, the crucial point is that appetite for civilian nuclear energy remains strong and, in fact, growing and that the arrival of a new generation of advanced nuclear reactors (inclusive of small modular reactors (SMRs) and micro-reactors) could further entrench the upward trajectory of civilian nuclear energy. With the future of civilian nuclear energy looking bright, debate on and the politics of civilian nuclear energy is likely to remain central to national and international politics.

The idea and rationale for this book stem from humble beginnings. In November 2022, a small group of scholars (mostly from South Africa) presented papers at an online webinar titled "The Politics of Nuclear Energy in Africa". This engagement emerged against the backdrop of two discernible realities: one, an increased reliance on or, at the very least, expression of interest in nuclear energy by African countries to address their energy needs; two, the need to create a community of scholars (located in Africa and concerned with the continent's future) with specialist knowledge about (African) nuclear affairs and, concomitantly, critical engagement by such an expanding community with Africa's increasing nuclear footprint. Research by African scholars on *African* nuclear affairs, though not altogether absent, remains scant and, unfortunately, piecemeal.

Formerly, with Africa standing largely (though, of course, not completely) aloof of nuclear-related issues, no real need or scholarly appetite for nuclear-related research focusing on the continent existed. Where engagement did occur, it almost invariably focused on the South African case—i.e., South Africa's nuclear weapons programme or the continent's only nuclear power station located at Koeberg, South Africa. While such engagement, especially with reference to the safety and longevity of Koeberg, remains pertinent, Africa's increasing nuclear footprint is necessitating wide-ranging, persistent and critical engagement about how best to understand and manage the continent's nuclear future (and the sprawling range of issues accompanying civilian nuclear energy projects), the pitfalls to avoid, the constraints to be faced and, importantly, the opportunities to embrace. This edited volume attempts to fill this gap, emphasising that there are significant benefits *and* risks, opportunities *and* constraints, associated with Africa's nuclear future.

The plan of the book

With several African states turning to civilian nuclear energy or, at the very least, expressing their intentions to do so, mapping the benefits and pitfalls of civilian nuclear energy (projects) are crucial, as is finding the best pathways through the complexities constitutive of the nuclear energy landscape. It stands to reason that increased reliance on nuclear energy in Africa (and, for that matter, across developing economies) brings with it a host of issues, challenges, fears, constraints and, importantly, opportunities and benefits. Wherever the prospect of civilian nuclear energy emerges, we must be leery of exaggerating the drawbacks while neglecting the benefits, a proposition that cuts both ways. At best, civilian nuclear energy presents a trade-off, not a solution. Some of these fears, challenges and constraints—e.g., the spectre of nuclear terror and nuclear proliferation—are perhaps exaggerated, with the concomitant consequence of possibly dampening the enthusiasm for nuclear energy among some African states, especially those as yet uncommitted or undecided about civilian nuclear energy; other issues and fears,

such as those relating to nuclear waste management, nuclear sacrifice zones and the safety of existing nuclear power plants on the continent (notably, the Koeberg Nuclear Power Station in South Africa), are under-explored, and in dire need of critical engagement. Beyond these issues and fears, there is also the stark realisation that nuclear energy, and increased reliance on it by African countries, is unlikely to be a politically neutral activity. In fact, Africa's future nuclear footprint plays itself out against the backdrop of an intense geopolitical competition, one very much reminiscent of the Cold War powers' utilisation of civilian nuclear energy projects to spread and entrench their ideological preferences and further their geopolitical interests. That there are also real benefits to accrue from Africa's turn to civilian nuclear energy is undeniable. Moreover, some of these benefits could multiply (and some of the enduring concerns might be placated) by the arrival of SMRs and micro-reactors.

In short, Africa's increased nuclear footprint holds both promise and pitfalls, with long-term consequences—good and bad—for African agency, development, and security. Against this backdrop, the primary aim of this book is to analyse, explore, and evaluate the unfolding nuclear landscape of African states—in short, the 'politics of nuclear energy in Africa'. More specifically, the book has the following objectives, namely to:

- Describe the unfolding African nuclear landscape, with due emphasis on the increased reliance on nuclear energy to meet the soaring energy demands of African states and societies;
- Consider the costs and benefits to African states and societies accruing from an increased reliance on nuclear energy;
- Emphasise the significance and indispensability of international law and non-proliferation regimes and organisations to Africa's nuclear future;
- Describe, foreground, and address possible challenges related to managing nuclear power plants; and
- Describe and explain the larger geopolitical context in which African's nuclear future will unfold and the attendant consequences for African agency, development, and security.

Structure of the book

The authors of this volume attempt to probe the most pertinent issues related to Africa's increasing nuclear footprint, while noting that the issues covered here are not exhaustive of the complex issues part and parcel of the nuclear energy landscape. The contributors of this volume included scholars from the University of Johannesburg, South Africa—Prof. Anna-Mart van Wyk and Wandile Shezi; from the University of South Africa—Prof. Jo-Ansie van Wyk; from the South African Institute of International Affairs—Isabel Bosman; from the University of Leeds, the United Kingdom—Dr Tom Vaughan; from the University of the Western Cape, South Africa—Prof. Joelien Pretorius; and the University of the Free State, South Africa—Prof. Eben Coetzee.

Although the chapters of this volume speak to different aspects of the politics of nuclear energy, there is wide agreement that, for better or worse, nuclear energy stands central to the past, present and future of international politics—and, importantly, the future of Africa. Extensive and deep differences concerning the benefits (if any) and drawbacks (if any) of nuclear energy are, accordingly, discernible among the authors of this volume. These differences and open debate about them are something to be welcomed, celebrated and, with a view to the future, encouraged. In much the same vein, the book's chapters reflect different research goals (description and explanation or some combination of the two), different types of theories (problem-solving and critical and/or postcolonial theory), and different methods (empirical-analytical, interpretive and critical). Again, this tremendous diversity is a boon, itself reflective of the diversity of ways of understanding Africa's nuclear future and the need for open debate across scholars holding different ontologies, epistemologies, theories, and methods. Some chapters in this volume (see, especially, Chapters 1–3) are far more optimistic than others about the potential benefits of nuclear energy for the continent. Others (see, especially, Chapter 6) cast doubt on the presumed indispensability of nuclear energy to power national grids. Although no pretension is made in this book

about a proverbial golden thread running nicely through it, the chapters are structured with a view towards illuminating, on one end of a continuum, those who emphasize the overriding benefits of civilian nuclear energy (cf. Chapter 1), those who cast doubt on the indispensability of nuclear energy for powering national grids on its other end (Chapter 6), those emphasizing that nuclear energy constitute a trade-off with the benefits outweighing the drawbacks (Chapters 2 and 3), and, finally, those showcasing the dark side of nuclear energy and how the drawbacks of nuclear energy overshadows its real or potential benefits (Chapters 4 and 5). Ultimately, the structure of the book allows for the reader to approach each chapter as a standalone chapter, while sufficient continuity exists for the reader wishing to peruse and consume every page of the volume.

In Chapter 1, "The Potential Role of Nuclear Energy in Promoting Regional Economic Development in SADC", Wandile Shezi and Prof. Anna-Mart van Wyk make a case for energy as the indispensable foundation of modern-day society and industry. As the world moves towards cleaner energy initiatives, they argue, governments should embrace new technology to mitigate the effects of global warming. The over-reliance on coal as a source of energy continues to negatively affect the climate, and member states of the Southern African Development Community (SADC) continue to experience challenges in accessing sustainable energy in the region. As a result, the region has experienced lower economic growth prospects and challenges with industrial strategy. South Africa, the region's dominant energy generator, plays a significant role in ramping up energy supply to the region via the Southern African Power Pool (SAPP). In the chapter, a case for nuclear energy programmes (in the form of small modular reactors (SMRs)) is presented as a possible mitigation strategy for the region's energy crisis, with South Africa being poised to play a leading role in this strategy owing to its decades-long success in operating civilian nuclear energy programmes. Civilian nuclear energy is one of the most low-carbon-emitting energy sources in the world and is presented in this chapter as a key solution to addressing the twin challenges of global warming and energy poverty.

In Chapter 2, "Advancing Nuclear Energy: Why Peaceful Uses Need the Non-Proliferation and Disarmament Regimes," Isabel Bosman notes that the benefits accruing from the peaceful application of nuclear science and technology (of which electricity production is only one) cannot and should not be separated from the development and entrenchment of a robust legal framework. Such a framework is not only indispensable for the safety and security of nuclear power plants but is also critical for creating a security environment in which nuclear installations are protected in times of conflict and, more importantly, where the authority of these legal instruments is respected. An increasing number of African states have expressed interest in including nuclear power in their energy mix to extend electricity access to their populations and to combat the effects of climate change. Africa has relied on the law to establish its territory as a nuclear weapons-free zone through the Treaty of Pelindaba, which *inter alia* provides the legal basis for the peaceful uses of nuclear energy on the continent and contains articles relating to the physical protection of nuclear installations and preventing armed attacks against them. The Treaty on the Non-Proliferation of Nuclear Weapons (NPT), the cornerstone of the nuclear non-proliferation regime, was born out of the need to prevent an increasing number of states from acquiring nuclear weapons. In addition, the peaceful use of nuclear energy is one of the treaty's three core principles. Drawing on the links apparent from the Treaty of Pelindaba and the NPT, among others, between peaceful uses, non-proliferation, and disarmament, the chapter explores the notion that discussions about the peaceful application of nuclear energy and non-proliferation should not occur in isolation. Instead, such discussions should be seen as complementary and linked by a crucial element: the law.

In Chapter 3, "The Geopolitics of Nuclear Energy in Africa: What, Who, and Why?", Prof. Eben Coetzee examines the weaponisation of nuclear energy projects in service of the geopolitical interests of this century's leading great powers. The chapter first sets out to provide a case for civilian nuclear energy—especially in the form of advanced nuclear reactors (inclusive of SMRs and micro-reactors)—as an important

means by which African states can and should address their soaring energy needs. However, civilian nuclear energy, whether in the form of conventional or advanced nuclear technology, presents at best a trade-off. During the Cold War, the leading powers of the era quickly recognised the strategic utility of civilian nuclear energy projects, with each great power harnessing—or, at the very least, attempting to harness—these projects in service of creating an international order reflective of *their* interests and values. Today, much like during the Cold War, China and Russia are using civilian nuclear energy projects to create decades-long alliances in strategically vitally areas of the world, a strategic endeavour amounting to nothing less than an attempt to refashion the international order in accordance with *their* values and interests. The behaviour is typical of how great powers usually behave. In considering these projects, the chapter probes the debilitating consequences for African agency, especially given the fact that collaboration in civilian nuclear energy projects is likely to lock African states in decades-long strategic alliances with authoritarian states. Once again, African states are unwittingly caught in the crosshairs of great-power competition.

"Unfulfilled Desire, Impossible Futures: The Contradictions of African Regional Nuclear Ordering", written by Dr Tom Vaughan and Prof. Joelien Pretorius, is the focus of Chapter 4. There is a drive, the authors contend, to expand the nuclear regime complex in Africa at the meso level through regional cooperative arrangements, such as the African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA), the African Commission for Nuclear Energy (AFCONE), and the Forum of Nuclear Regulatory Bodies in Africa (FNRBA). At face value, a regional layer of the nuclear regime complex is seen as a common-sense good to take ownership of ordering nuclear matters in Africa, and to map a path to development in Africa amidst climate change through nuclear energy. There is also no doubt that these well-intentioned organisations pursue regime expansion to give Africa a louder voice in the global nuclear order, however there is reason to look more critically at the performative agency of these nuclear organisations.

Governance through regime complexes may serve interests and power relations that are not always evident in the goals set out in founding documents and work plans. The critical framework that the chapter brings to the table draws on the work of Gabrielle Hecht, Shampa Biswas, Itty Abraham and Sidra Hamidi and allows the authors to reveal some of the trade-offs and power relations at work.

In Chapter 5, Prof. Jo-Ansie van Wyk explores "The Necropolitics of Africa's Nuclear Sacrifice Zones". Nuclear sacrifice zones have been described as radioactive landscapes of risk that have typically resulted from uranium mining or nuclear waste disposal. The communities in these socio-political landscapes often display unique pathologies associated with anger, danger, risk and death. By utilising the work of Foucault and Mbembe on biopolitics and necropolitics, the contribution explores and compares the necropolitical nature of selected nuclear sacrifice zones in Africa and the implications thereof. The chapter's object is to identify challenges to and opportunities for the continent's peaceful use of nuclear energy.

Chapter 6, Prof. Anna-Mart van Wyk's "Koeberg Controversies", sheds light on Africa's lone nuclear power station, Koeberg, situated 30 kilometres north of Cape Town, South Africa. The plant has two French-supplied reactor units, which combined contribute 1,849 MW of power to South Africa's national grid—roughly 5% of the country's electricity. Over the years, but particularly during the last decade, the plant has been embroiled in controversy, ranging from extensive issues and delays related to the renewal of its operational licence for another 20 years to the identification of several issues by the International Atomic Energy Agency (IAEA) related to management, safety, revalidation, environmental qualifications, electromagnetic compatibility, and an appropriate monitoring system for the containment structure. In addition, senior managers have resigned or have been suspended. The primary aim of this chapter is to track Koeberg's operations and controversies since the plant's activation in 1984 and assess whether the life extension project is feasible or at risk of collapsing completely, which would be detrimental to

South Africa's energy generation given the continuous load-shedding that has plagued South Africa and to which Eskom (the state-owned electricity utility) has been unable to provide workable solutions.

Taken together, this book's six chapters provide a timely engagement with the unfolding nuclear landscape in Africa, emphasising that substantial issues, risks, constraints, challenges, opportunities, and benefits will likely mark the continent's turn to nuclear energy.

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