

## **Academic Credentials**

**BSc (University of Cape Coast), PhD (University of Cape Town)**

**Physics, Policy and Politics of Climate Change: The Foundation of Human Survival**

### **Abstract**

Climate Change remains one of the most pressing challenges of our time, affecting every aspect of human life and the planet's ecosystems. Understanding Climate Change requires a strong foundation in Physics, as it governs key processes such as atmospheric dynamics, energy transfer and radiative forcing. However, understanding the science of Climate Change is not enough, scientific knowledge alone is insufficient to address climate crisis; effective solutions depend on the intersection of physics, policy and politics. These three pillars must work in unison to achieve meaningful Climate Change adaptation and mitigation. Translating climate science into action requires well-informed policies and political commitment at both national and international levels. This lecture explores how politics influences both the science and policy of Climate Change, shaping global responses and national commitments to climate action.

Change is an inevitable part of life, influencing human survival in various ways. Whether it is Climate Change, technological advancements, social transformations or biological evolution, humans have always had to adapt to survive. Throughout history, human survival has depended on our capacity to innovate and adjust to new circumstances. Humans have evolved to adapt to different environments, from genetic mutations that help in disease resistance to dietary shifts based on food availability. Shifts in political systems, economic models and social norms influence human survival by determining access to resources, rights and opportunities. The ability to recognise, respond and adapt to change is crucial for human survival. Climate Change stands out as a particularly urgent challenge at our time. The changes we are experiencing now are largely human induced compared to the past changes which had mostly been natural. The human induced changes are having adverse impact on us and predictions show that if we don't act now, it will be worse.

Climate Change is driven by physical processes governed by the laws of Physics, from the greenhouse effect to oceanic and atmospheric circulation patterns that regulate the Earth's climate. The scientific evidence is unequivocal—rising global temperatures, increasing frequency of extreme weather events, sea-level rise and shifting precipitation patterns are all

consequences of human-induced climate change. Understanding the physics behind these changes is essential for predicting future climate scenarios and developing effective mitigation and adaptation strategies. In the lecture, the complexity of the climate system is explained, with an emphasis on global warming, the human activities driving it and the impact of Climate Change. My research has focused on understanding the climate complexities with both Global Climate Models and Regional Climate Models.

The Physics of Climate Change explains the scientific basis of global warming, extreme weather events and long-term climate shifts. The lecture explains how greenhouse gases trap heat and contribute to rising global temperatures. It also establishes how our over dependence of fossil fuel contributes to global warming. The melting of Arctic ice, rising sea levels and increasing coastal erosion serve as tangible consequences of this warming, demonstrating the urgency of climate action. These impacts are not distant threats but immediate challenges that require decisive intervention. Addressing Climate Change is not merely about reducing emissions or adapting to its impacts—it is about safeguarding the very foundation of human existence. I will explain a number of research results and publications I have made that relates to climate science and modelling for future climate projections.

Climate policies are essential for mitigating and adapting to the adverse effects of Climate Change. Given its accelerating effects, it is imperative that policy decisions be informed by scientific evidence. Reports from the Intergovernmental Panel on Climate Change (IPCC) have played a crucial role in shaping global climate policies. Many global policies and decisions have been based on the IPCC reports from the first assessment report forming the United Nations Framework Convention on Climate Change (UNFCCC) to the last report, the 6th assessment report supporting the first global stocktake. I have contributed to the IPCC process in many ways as a climate expert, lead author, member of task group and as a Vice-Chair of working group I. Policies such as carbon pricing, renewable energy incentives, climate adaptation plans and international agreements like the Paris Accord play a pivotal role in shaping climate action.

Climate Change is inherently a political issue and is influenced by geopolitical considerations. The politics of Climate Change determines the level of commitment from governments, industries and societies, influencing how climate policies are framed, funded and enforced. International climate agreements, such as the Paris Agreement, highlight the importance of

global cooperation in addressing Climate Change. The politics of Climate Change thus play a crucial role in determining the ambition and implementation of climate policies worldwide. The lecture confirms the importance of aligning science-based recommendations with political action, emphasising that global climate policies must be strictly adhered to in order to prevent irreversible tipping points.

Recognising the interplay between climate science and governance, I share my own journey into partisan politics, highlighting the necessity of Scientists to engage directly with policy-making processes. Addressing Climate Change requires more than scientific knowledge—it demands advocacy, leadership and active participation in decision-making at all levels.

I will conclude the lecture with proposed solutions for climate action. I will emphasise the role of interdisciplinary collaboration in driving progress for addressing the climate crisis. I will acknowledge the contributions of colleagues, mentors and institutional support, reinforcing the importance of partnerships in advancing climate research and policy implementation. In the face of a rapidly changing climate, bold interventions are needed, and this lecture serves as both a call to action and a testament to the power of integrating science, policy and politics in securing a sustainable future.

## **Profile**

### **Introduction**

Prof. Nana Ama Browne Klutse is a distinguished Physicist and Climate Scientist, currently serving as the Chief Executive Officer of the Environmental Protection Authority of Ghana, a position she has held since January 2025, following her appointment by the President of Ghana. Before this role, she was the Head of the Department of Physics at the University of Ghana from August 2023 to January 2025, making her the first female to become a Head of the Department. She also holds an international leadership position as Vice-Chair of Working Group I of the Intergovernmental Panel on Climate Change (IPCC).

Previously, Prof. Klutse was a Senior Research Scientist at the Ghana Space Science and Technology Institute of the Ghana Atomic Energy Commission, where she managed the Remote Sensing and Climate Centre. Her expertise lies in climate modelling, climate change impacts and the development of adaptation and mitigation strategies, with a particular focus on Africa. She has played a crucial role in major climate research initiatives and has contributed significantly to global climate assessments.

A strong advocate for integrating indigenous knowledge with scientific research, Prof. Klutse works to develop locally relevant climate adaptation and mitigation solutions. She is also a passionate champion for women in STEM, actively encouraging young Ghanaian girls to pursue careers in Science while striving to make Science education more attractive.

Prof. Klutse joined the University of Ghana as a Senior Lecturer in August 2018 and was promoted to Associate Professor in 2021. In 2023, she achieved a historic milestone by becoming the first female full professor of Physics in Ghana and the first female Physics professor by the University of Ghana in its 75-year history.

### **Education**

Professor Nana Ama Browne Klutse began her education at Nyanfeku Ekroful Community Nursery School before progressing to Anomabu Methodist Primary and Junior High School. She later attended Mfantseman Girls' Secondary School, where she studied Science and completed her education in 1997. Her academic journey continued at the University of Cape Coast, where she pursued a degree in Physics. She later advanced her studies in Climatology at the University of Cape Town in South Africa and the International Centre for Theoretical Physics in Italy. These experiences laid the foundation for her dedicated research into climate dynamics in Africa, highlighting her commitment to understanding and addressing climate change challenges on the continent.

### **Research Interest and Publications**

Prof. Nana Ama Browne Klutse specialises in Atmospheric Physics, with a focus on understanding atmospheric dynamics and their impacts on human life, ecosystems and the environment. Her research explores how climate change influences critical sectors such as

agriculture, water resources and public health in Africa. She is particularly interested in climate variability, climate change modelling and Solar Radiation Management.

Her work involves transforming historical and projected climate data into actionable information for risk reduction and decision-making across various sectors. Advancing climate observations and projections, she develops tools to improve understanding of Africa's climate system and provides guiding principles for sector-specific climate services.

One of her recent research contributions, "Solar Radiation Management With Stratospheric Aerosol Interactions With Harmattan and Associated Impacts on Some Climate Variables Over Southern West Africa," examines how solar radiation management (SRM) during the harmattan season influences climate variability due to the inflow of dry desert air.

As of February 27, 2025, her research portfolio includes 70 scholarly articles with 6688 citations, reflecting her significant contributions to climate science and policy.

### **Teaching Experience**

Prof. Nana Ama Browne Klutse is a dedicated educator and researcher, teaching a range of Physics and Climate Science courses. At the University of Ghana, she lectures in Electricity and Magnetism, Mechanics and Thermal Physics, Meteorology, Climate Change and Society, Climate Change Modelling and Research Methods. She is affiliated with both the Department of Physics and the Centre for Climate Change and Sustainability Studies. Before joining the University of Ghana, she taught Satellite and Radar Meteorology, Cloud Physics and Atmospheric Physics at the University of Cape Coast. In addition to her university roles, she serves as a guest lecturer at the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), where she teaches Regional Climate System Modeling and Computational Tools for Climate Studies. During her tenure as a Researcher at the African Institute for Mathematical Sciences (AIMS), she also taught courses in Regional Climate System Modelling and Climate Modelling, contributing to the development of climate science expertise across Africa.

### **National Service and Affiliations**

Prof. Nana Ama Browne Klutse is the Acting Chief Executive Officer of the Environmental Protection Authority. She has played a key role in shaping Ghana's climate policies,

contributing to the country's Second, Third and Fourth National Communications to the United Nations Framework Convention on Climate Change (UNFCCC). She was also instrumental in developing the National Framework for Climate Services for Ghana. From 2012 to 2013, she collaborated with a team under the African Adaptation Programme of the UNDP to develop early warning systems for floods and droughts in northern Ghana, enhancing the country's resilience to climate-related disasters.

### **International service and Affiliations**

Prof. Nana Ama Browne Klutse serves as a Vice-Chair of Working Group I of the Intergovernmental Panel on Climate Change (IPCC). Since 2024, she has been a member of the Oversight Committee for the Exploring Options for Actively Cooling the Earth programme under the UK's Advanced Research and Innovation Agency (ARIA). She has been actively involved in the Coordinated Regional Climate Downscaling Experiment (CORDEX) since 2011 and has served as the Point of Contact for Africa since 2021.

Prof. Klutse played a key role as a Lead Author in the IPCC's Sixth Assessment Report (AR6) from 2017 to 2024. She has represented the Government of Ghana at multiple IPCC sessions, including the 48th Session in Incheon, South Korea (October 2018), the 49th Session in Kyoto, Japan (May 2019) and subsequent sessions in Monaco, Paris, Nairobi, Istanbul and Hangzhou, among others.

Her contributions to the IPCC extend beyond authorship. She was a member of the expert team for the IPCC's Scoping of the Special Report on the Impacts of Global Warming of 1.5°C in 2016 and participated in the 6th Assessment Report in 2017. She also served on the IPCC Task Group on Data (2019–2024), ensuring the accuracy and accessibility of climate data for global assessments.

Beyond the IPCC, Prof. Klutse has contributed to African Union initiatives, including serving on the African Space Policy and Strategy working groups. She was a member of the Research Advisory Panel of the South African Weather Service (2022–2024) and served as a Board Member of UNESCO's International Basic Science Programme (2021–2024).

### **Community engagements**

Prof. Nana Ama Browne Klutse has played a vital role in science education and community development. From 2010 to 2012, she coordinated the International Physics Olympiad, Ghana Team, encouraging young talent in Physics. Between 2012 and 2014, she worked under the PEER Science Project, educating maize farmers in Ghana's transition zone on optimal planting and harvesting times based on rainfall onset and cessation patterns.

As a mentor and patron, she supports various student organisations, including the Abura Asebu Kwamankese Tertiary Students and Associates (AAKTSA). Additionally, she is actively involved with Centre for Climate and Sustainability Empowerment (CCSE), Agbedus Consult, the Molex Foundation, Pro-Environment Africa and The Browne Foundation (TBF), which she established in honor of her father to support education and community development.

### **Political life**

Prof. Nana Ama Browne Klutse is an active member of the National Democratic Congress (NDC). She served on the NDC's Natural Resources, Mining and Science Manifesto Committee towards the 2024 elections, contributing her expertise in environmental and scientific policies. In the 2020 general elections, she was appointed as a member of the National Campaign Team, playing a key role in shaping the party's strategy. Prof. Klutse has also been actively involved in grassroots politics at the Abura Asebu Kwamankese Constituency. She is committed to political engagement and national development.

### **Awards and membership**

Professor Klutse has received numerous accolades for her contributions to science and climate action including: Recognition for a Woman in Science for her Contribution to Science, Schlumberger Faculty for the Future award, DAAD In-Country/In-Region Award and UNESCO award on Basics Physics for young Scientists.

### **Family**

Prof. Nana Ama Browne Klutse is the third child of Mr. Joseph Ramold Browne and Mrs. Sarah Browne of Nyanfeku Ekorful. She has three sisters: Maame Aba Bo, Araba Bo and Araba Edesima Browne. She is married to Dr. Charles Kofi Klutse, who is the Manager of the Nuclear Programme Management Centre at the Ghana Atomic Energy Commission. Together, they have three children: Nana Amoono, Illesi Ardime and Kafei Aforme Klutse.