



**2024 ENGINEERING INSTITUTION OF ZAMBIA  
SYMPOSIUM**

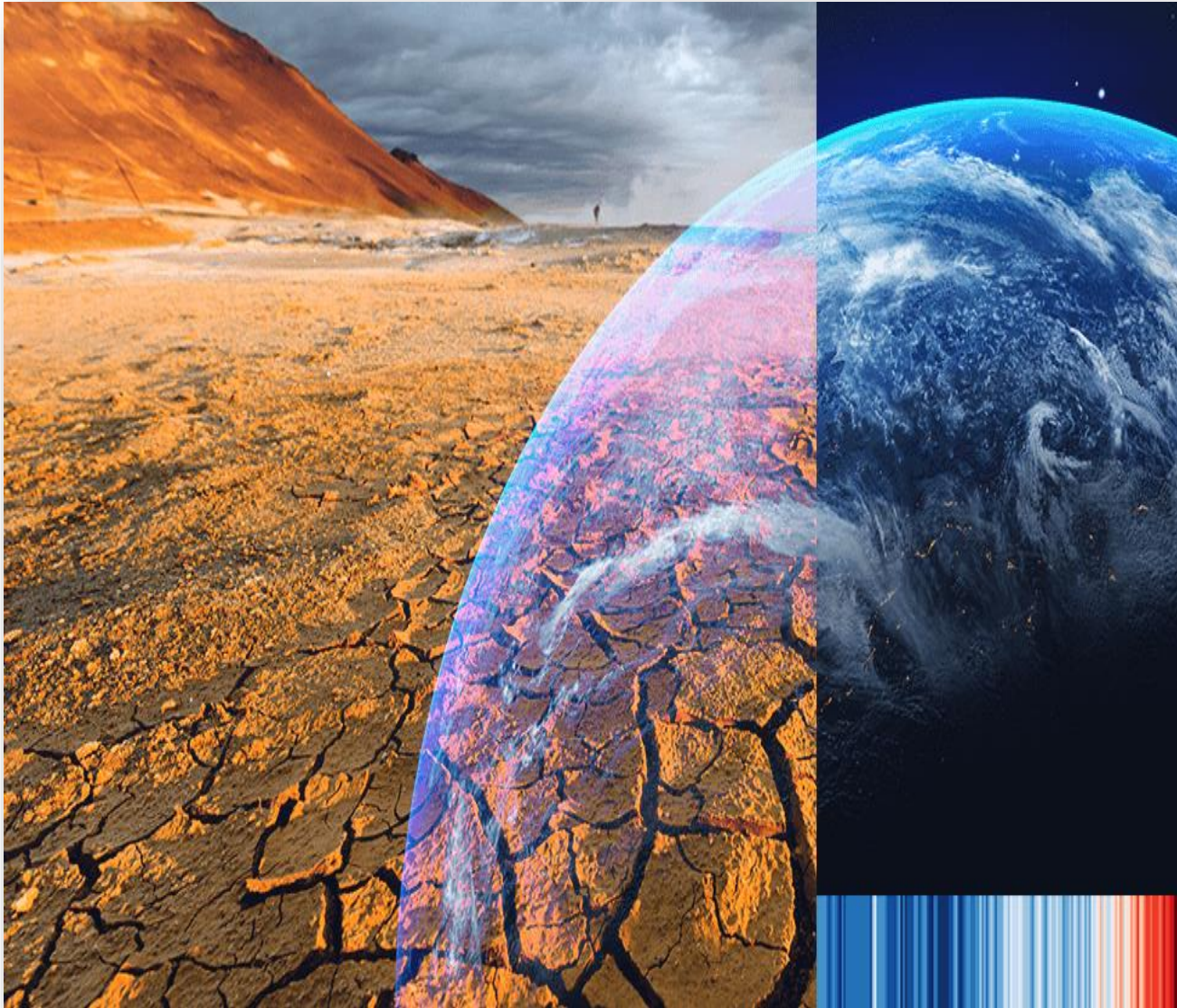
**WATER AND CLIMATE CHANGE: UNDERSTANDING THE  
IMPACT AND FINDING SOLUTIONS**

**Avani Victoria Falls Resort, Livingstone, Zambia**

Presenter: Eng.Dr. Patrick Mwamba Mubanga

Date:Friday ,19<sup>th</sup> April 2024

# PRESENTATION OUTLINE



1. Introduction
2. Effects of climate change on water resources
3. Strategies to address water resources challenges in the context of climate change
4. Case study: Adverse effect of climate change on water availability in Zambia: Implications for Irrigation Development
5. Conclusion

## 1.0 INTRODUCTION

- a) As part of her opening remarks for the 2023 United Nations' Annual Climate Change Conference (COP28) held in Dubai H.E. Mariam Bint Mohammed Almheiri, UAE Minister of Climate Change and Environment and COP28 said *“Countries must put water challenges and climate change at the heart of their climate ambitions to help fast-track the transition to a clean-energy future”*.
- b) Consequently, the interactions between water challenges and climate change could have an impact on the availability, quality and quantity of water for basic human needs, threatening the effective enjoyment of the human rights to water and sanitation for potentially billions of people (UN-Water, 2020).
- c) Climate change adaptation and mitigation through water management is critical to sustainable development and is essential to achieving the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change



## Objective

The objective of the presentation is to **highlight the water resources challenges associated with climate change and explore potential strategies** to mitigate against them.

## Approach to the study

In terms of the approach to the study, **a desk study review** was done on various documents.

## 2.0 EFFECTS OF CLIMATE CHANGE ON WATER RESOURCES

- a) Climate change exacerbates water scarcity by **altering precipitation patterns and increasing evaporation rates** (Turral, et al., 2008). These changes directly affect the availability of freshwater which reduces agricultural productivity, compromised food security and increased competition for water among various sectors.
- b) The quality of water is impacted by climate change, mainly due to **variations in temperature and patterns of rainfall**
- c) Climate change is also associated with an **increase in the frequency and intensity of extreme weather events, such as droughts** (Seneviratne & Nichol, 2012) which leads to water scarcity, crop failure and ecosystem disruption.

## 2. EFFECTS OF CLIMATE CHANGE ON WATER RESOURCES cont'd

- d) Climate change alters the timing and intensity of rainfall leading to changes in hydrological patterns which can affect rainfall pattern.
- e) Climate change impacts water-dependent sectors, such as agriculture, energy production, and industry. In the energy sector, reduced water availability can limit hydropower generation, increase load shedding and reliance on alternative energy sources (Teotónio, Rodríguez, Roebeling and Fortes, 2020).

### **3.0 STRATEGIES TO ADDRESS THE WATER RESOURCES CHALLENGES IN THE CONTEXT OF CLIMATE CHANGE**

- a) Reducing water wastage, promoting water-saving technologies and implementing efficient irrigation techniques in agriculture. On the other hand, conservation efforts such as rainwater harvesting, watershed management and reforestation can help recharge groundwater, increase water retention, and improve overall water availability (Srivastav, A.L., Dhyani, R., Ranjan, M.et al.,2021)
- b) Encouraging the growing of drought-resistant crops and promoting water-efficient practices in industries and households are vital for adaptation.
- c) Implementation of policies that encourage sustainable water use and management is crucial. This involves setting regulations, incentives, and pricing mechanisms to promote responsible water consumption and discourage wastage

### 3.0 STRATEGIES TO ADDRESS WATER RESOURCES CHALLENGES IN THE CONTEXT OF CLIMATE CHANGE CONT'D

- d) Continued **research and innovation** are crucial to develop advanced water-saving technologies, such as efficient irrigation systems, water purification techniques, and smart water management systems (Yaseen, Feijoo, Pandey, & Gupta, 2020).
- e) **Educating communities about the importance of water** conservation, sustainable practices, and the impact of climate change on water resources is essential (Rao, Laura, & Dhaniala, 2024).
- f) Addressing water challenges worsened by climate change often requires **cross-border cooperation**, especially in shared river basins and other water bodies like lakes.





## 4.0 CASE STUDY:ADVERSE EFFECT OF CLIMATE CHANGE ON WATER AVAILABILITY IN ZAMBIA: IMPLICATIONS FOR IRRIGATION DEVELOPMENT

The study simulated the impacts of climate change on water availability in Zambia's main river basins from current periods until the end of the century in 2100. The following were **the key findings from the research study**:



a) By 2050 and 2100, temperature is projected to increase by 1.9 & 2.3deg. Rainfall is projected to decrease by about 3% by mid-century and only marginally by about 0.6% towards the end of the century across the country. The Southern, Western and Eastern parts will be much more affected compared to the Northern region.

b) At basin level, the Northern basins are likely to stay the same or experience slight increases in water resources. However, river basins in the Eastern, Southern and Western parts such as Zambezi, Kafue and Luangwa are all projected to have less water resources available due to reduced rainfall and higher temperatures.

## 4.1 IMPLICATIONS ON AFFECTING SMALLHOLDER IRRIGATION DEVELOPMENT IN ZAMBIA

- a) Reduced water availability will increase irrigation costs, which in turn may reduce **its profitability among smallholder farmers, as they tend to have limited capital and capacity to adapt to higher cost structures.**
- b) Competition for the **reduced available water resources** will disadvantage the smallholder farmers.
- c) There is need for **continuous monitoring of the water resources** to track both the quantities and quality and assess suitability for irrigation.
- d) There is need for **feasibility studies on whether it is viable to transfer** water resources from low-demand surplus areas in the north to high-demand deficit areas in the southern parts of the country.



## 5.0 CONCLUSION



- a) Climate **change poses significant challenges to water resources**, including water scarcity and quality degradation, as well as increased frequency of extreme weather conditions.
- b) Addressing the water resources challenges in the context of climate change **requires a comprehensive, integrated, and multi-stakeholder approach**.
- c) Therefore, this could **involve a combination of technological innovation, policy reforms, community engagement**, and global cooperation to ensure sustainable water management



THANK YOU

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