Bahir Dar University
Bahir Dar Institute of Technology
Faculty of Mechanical and Industrial Engineering
Thermal Engineering Chair

Seminar Presentation on April 24, 2026

Title: "Energy Utilization and Efficiency Enhancement in Food Processing: A CFD-Based Performance Enhancement of Electric Injera Baking Technology"

SHORT BIOGRAPHY OF PRESENTER

Mr. Matebu Limeneh is a Lecturer at the Faculty of Mechanical and Industrial Engineering, Bahir Dar Institute of Technology, Bahir Dar University. He has been serving the institute as Ass. Lecturer and Lecturer rank since 2016, contributing to education, research, and technology transfer activities. He has earned his BSc degree in Mechanical Engineering from Bahir Dar Institute of Technology, Bahir Dar University, in 2016. He also obtained his MSc degree in Thermal Engineering from the same institution in 2021. In addition, he holds Higher Diploma Program (HDP) certification in teaching from Bahir Dar University.

Mr. Matebu has been actively involved in teaching undergraduate courses in Mechanical engineering, supervising student research projects, and academic advising. His research and professional activities focus on renewable energy, energy storage, HVAC systems, efficient cooking technologies, and Computational Fluid Dynamics. He has conducted research on efficient energy cooking, energy storage and energy auditing. Mr. Matebu has different publications, and is involved in different community service and technology transfer projects, providing practical engineering solutions to societal challenges. He has served in School of Aerospace Science and Engineering as department head and now serving as Academic Program Officer. He is also currently leading a mega research project funded by BDU.

Abstract: Food processing, the processing of raw materials to edible food products, are responsible for about 5% of the overall greenhouse gas emissions globally. Despite the significant role of these processes in the environment, cooking energy efficiency is an understudied and disjointed area of research. Although past studies have been conducted from different scales, methodological approaches, and definitions of efficiency, which makes it difficult to compare and advance culinary energy efficiency, the seminar aims to bring together these different views of culinary energy efficiency using a single framework. A methodological integration approach, including experimental validation of CFD simulations and exergy analysis is the key path to overcome the limitations of traditional energy balance methods. This seminar also presents, an applied case study on the electric injera baking stove technology in Ethiopia, referred to as Mitad, which is an important baking utensil in the culture and society of Ethiopia but has lower baseline thermal efficiency levels (≈53%) and longer baking times due to the lower conductivity of traditional clay plates. To optimize the thermal efficiency and reduce baking times, a validated three-dimensional computational fluid dynamics (CFD) approach has been developed to assess the performance of composite materials with enhanced conductivity levels using copper, iron, and aluminum additives. Through this approach, an improvement in conductivity levels of up to 179% has been observed, reducing baking times by up to 50.5% and improving surface temperature uniformity by up to 83%. Thermal efficiency levels have also increased to between 88.5% and 89.7%, and specific energy consumption has reduced by up to 29% to 0.272 kWh/kg. This study has shown the potential of computational fluid dynamics to optimize thermal cookware technology and reduce energy consumption and improve sustainability.