



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

Name of the Student : RACHNA YADAV

Roll Number : 10614109

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Thesis Title: ENTROPY AND THE DEVELOPMENT PROCESS – An Entropic Perspective to Sustainable Development

Name of Thesis Supervisor(s) : Dr. Anamika Barua, Prof. Mrinal Kanti Dutta

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SHORT ABSTRACT

The aim of the thesis is to study and understand the relationship between the laws of thermodynamics and the development process. This has been implemented using the theoretical framework proposed by Nicholas Georgescu-Roegen (NGR) on the Entropy law and the Economic process and applying it to the case of development and urbanization in Guwahati city. According to NGR, all economic processes use low entropy energy and matter as inputs and transform these inputs into high entropy outputs as useful products and wastes. Depletion of low entropy natural resources would pose a limit to economic growth and filling of the natural sinks would also become a limiting factor for the economic processes. Recycling of wastes is also subject to developing appropriate and efficient technologies for waste conversion. Most of the present level of technologies on recycling processes are not very efficient and are also uneconomic. As per the entropy law, 100% recycling and transformation of energy and matter cannot be achieved in real world. The present study makes an attempt to understand and examine the debate surrounding NGR's theories on thermodynamics and economics. While doing so the study also follows and reviews the research studies on NGR in last 45 years. The study has attempted to move beyond the economic process and link entropy with development process and sustainability. In doing so, urbanization, as a unit of development which consumes large quantities of energy and matter that are subjected to processes dissipative in nature and adversely impact the assimilation capacity of the global sinks, has been taken up as a case for study of Guwahati city. Improved Quality of Life (QoL) and high living standards leading to development are what attract the people towards urbanization. Development that leads to better QoL is intrinsically linked with high per capita energy consumption and corresponding waste generation in form of waste heat and CO₂ emission. The Guwahati city case study has looked at entropy generation and CO₂ emissions, both direct and indirect, in energy, buildings and Agriculture Forestry and Other Land Use (AFOLU) sectors. The study also combines the two factors of waste heat and CO₂ emission into one factor of entropy generation. The study reveals that Guwahati city annually uses 50.42 Peta Joules (PJ) of energy of which 42.84 PJ are lost as waste heat directly and indirectly, in the process generating an entropy of 143.76 Tera Joules per Kelvin (TJK⁻¹) annually. The city also emits 6.31 Million Tonnes CO₂ (MtCO₂) annually. The study would help policy makers in taking appropriate policy measures for making Guwahati a sustainable city in the long run. The results of the study would also be useful for further research and decision making for achieving the Sustainable Development Goal No. 11 (SDG 11).