the entropy law and the economic process

The Entropy Law and the Economic Process: Understanding the Connection

the entropy law and the economic process are two concepts that, at first glance, seem to belong to entirely different fields—thermodynamics and economics. However, a deeper exploration reveals a fascinating intersection where principles from physics help us better understand economic dynamics. The entropy law, rooted in the second law of thermodynamics, describes how systems naturally progress toward disorder or energy dispersion. Meanwhile, the economic process revolves around the production, distribution, and consumption of resources and goods. Bringing these ideas together provides a unique lens through which to analyze sustainability, resource management, and long-term economic growth.

What Is the Entropy Law?

The entropy law, also known as the second law of thermodynamics, states that in any closed system, the total entropy—a measure of disorder or randomness—always increases over time. Entropy can be thought of as the degree of energy dispersal or the amount of unusable energy within a system. Simply put, energy tends to move from concentrated, useful forms to more spread-out, less useful forms.

Why Entropy Matters Beyond Physics

While entropy is traditionally a concept in physics, its implications extend far beyond. In environmental science, for example, entropy explains why natural systems degrade without external inputs of energy. Similarly, the idea of irreversible processes and energy degradation has profound implications for economics, particularly when considering resource depletion and sustainability.

The Economic Process Through the Lens of Entropy

Economics traditionally focuses on the allocation of scarce resources to satisfy human wants and needs. However, when the entropy law is applied to economic activities, it emphasizes the physical realities underpinning these abstract transactions. The economic process involves transforming low-entropy natural resources—like minerals, fossil fuels, and timber—into goods and services. This transformation inevitably increases entropy because energy is consumed and dispersed, and waste is generated.

Economic Growth, Resource Use, and Entropy

One of the core insights of relating entropy to economics is understanding that economic growth typically involves increased energy consumption and resource depletion. As economies expand, they draw down stocks of low-entropy resources, converting them into high-entropy waste and pollution. This process is fundamentally irreversible, which challenges the notion of perpetual growth without considering ecological constraints.

The Role of Energy in Economic Systems

Energy is the lifeblood of economic activity. From manufacturing to transportation and services, energy consumption drives productivity. The entropy law reminds us that energy quality deteriorates as it is used; high-quality energy sources like fossil fuels degrade into less useful forms such as heat. This degradation limits the efficiency of economic processes and underlines the importance of energy conservation and renewable sources.

Implications for Sustainable Development

Understanding the entropy law in the context of the economic process has far-reaching implications for sustainability. It highlights the physical limits of resource use and the environmental costs of economic activities.

Why Circular Economies Matter

Traditional linear economies follow a take-make-dispose model, which accelerates entropy increase through waste generation. In contrast, circular economies aim to minimize entropy production by recycling materials, reusing products, and designing systems that retain energy quality as much as possible. This approach helps reduce environmental impact and conserves resources for future generations.

Technological Innovation and Entropy Management

While entropy sets fundamental limits, human ingenuity can help mitigate its effects. Advances in technology can improve energy efficiency, develop cleaner production methods, and enable recovery of materials from waste streams. Innovations such as smart grids, energy-efficient appliances, and renewable energy systems are key tools in managing entropy within economic processes.

Challenges in Integrating Entropy Concepts into Economic Policy

Despite its relevance, incorporating the entropy law into mainstream economic policymaking faces several hurdles.

Complexity of Measuring Economic Entropy

Unlike thermodynamic systems, economies are open and dynamic, making it difficult to quantify entropy precisely. Economists must grapple with translating physical entropy concepts into economic indicators that capture resource depletion, energy quality loss, and waste production effectively.

Balancing Growth and Ecological Limits

Policymakers often prioritize economic growth to improve living standards. However, the entropy perspective forces a reevaluation of growth models by emphasizing resource limits and environmental degradation. This tension calls for developing economic frameworks that integrate ecological realities without sacrificing social progress.

Practical Insights for Businesses and Consumers

The intersection of the entropy law and the economic process offers valuable guidance for both businesses and consumers striving to operate more sustainably.

- **Optimize Energy Use:** Companies can invest in energy-efficient technologies and processes to reduce entropy generation and operational costs.
- **Embrace Sustainable Materials:** Using renewable, recyclable, or biodegradable materials helps lower the entropy footprint of products.
- **Promote Circular Practices:** Designing products for reuse, repair, and recycling supports a circular economy model that counters entropy increase.

- **Consumer Awareness:** Individuals can contribute by choosing eco-friendly products, reducing waste, and conserving energy in daily life.

The Entropy Law and Economic Thought: Historical Perspectives

The connection between thermodynamics and economics is not entirely new. Early thinkers like Nicholas Georgescu-Roegen pioneered the idea of bioeconomics, emphasizing the role of entropy in economic processes. Georgescu-Roegen argued that economic activity is a process of irreversible energy transformation, which ultimately imposes physical limits on growth.

Modern Economic Theories and Entropy

More recently, ecological economics has emerged as a field recognizing the constraints posed by entropy and finite resources. This discipline challenges traditional neoclassical economics by integrating environmental and thermodynamic principles, advocating for policies that align economic activity with ecological sustainability.

Looking Ahead: The Future of Economics in an Entropic World

As the global community confronts climate change, resource scarcity, and environmental degradation, the relevance of the entropy law to economics grows stronger. Future economic models will likely need to embed entropy considerations more explicitly, promoting systems that balance human needs with planetary limits.

Understanding the entropy law and the economic process together encourages a shift in how we view progress—not just as endless growth but as the wise stewardship of energy and resources. By appreciating the physical realities underlying economic activity, societies can work toward resilient and sustainable economies that honor both human aspirations and the laws of nature.

Frequently Asked Questions

What is the entropy law and how does it relate to economics?

The entropy law, derived from the second law of thermodynamics, states that in a closed system, entropy (disorder) tends to increase over time. In economics, it implies that natural resources used in production degrade and energy quality diminishes, affecting sustainability and economic processes.

How does the entropy law impact sustainable economic development?

The entropy law highlights that economic activities consume low-entropy resources and generate high-entropy waste, leading to resource depletion and environmental degradation. Sustainable development requires accounting for this and promoting efficient resource use and waste recycling to slow entropy increase.

Why is the entropy law important in modeling economic processes?

Incorporating the entropy law into economic models helps understand the physical limits of production and resource use. It emphasizes that economic growth cannot be infinite because energy quality and material resources are finite and degrade over time.

How does the entropy law explain the relationship between the economy and the environment?

The entropy law shows that economic processes transform organized natural resources into less organized waste, increasing entropy. This transformation links economic activity directly to environmental impact, underscoring the need for environmental management in economic planning.

Can technological innovation overcome the constraints imposed by the entropy law?

Technological innovation can improve energy efficiency and resource use, slowing entropy increase, but it cannot eliminate the fundamental physical limits imposed by the entropy law. Energy degradation and resource depletion remain inevitable in the long term.

What role does the entropy law play in ecological economics?

Ecological economics integrates the entropy law to analyze the economy as a subsystem of the environment, emphasizing that economic processes must operate within ecological limits dictated by energy and resource constraints to maintain system stability.

How does the entropy law challenge traditional economic growth models?

Traditional economic growth models often assume endless substitution and growth potential. The entropy law challenges this by showing that natural resources are finite and subject to degradation, limiting long-term growth and necessitating a shift towards steady-state or sustainable economies.

What is the significance of energy quality in the context of the entropy law and the economic process?

Energy quality refers to the usability and organization of energy. The entropy law implies that economic activities degrade high-quality energy into lower-quality forms, reducing the energy available for productive use, which is critical for assessing economic efficiency and sustainability.

How can policymakers apply the entropy law to improve economic and

environmental outcomes?

Policymakers can use the entropy law to design regulations that promote energy efficiency, renewable resources, waste reduction, and circular economy practices, thereby minimizing entropy increase, conserving resources, and supporting sustainable economic development.

Additional Resources

The Entropy Law and the Economic Process: An Analytical Review

the entropy law and the economic process represent two fundamental concepts originating from distinct disciplines—thermodynamics and economics—yet their intersection offers profound insights into the sustainability and dynamics of economic systems. The entropy law, a principle rooted in physics, addresses the inevitable increase of disorder or energy dispersion in closed systems. Meanwhile, the economic process revolves around the production, distribution, and consumption of goods and services. Aligning these concepts reveals crucial implications for how economies function, grow, and ultimately face natural limits.

Understanding the relationship between the entropy law and the economic process is essential for economists, environmental scientists, and policymakers striving to reconcile economic development with resource constraints and environmental preservation. This article delves into the theoretical underpinnings, practical applications, and emerging research that elucidate this complex interplay, shedding light on the sustainability challenges embedded within modern economic frameworks.

The Foundations of the Entropy Law in Relation to Economics

The entropy law, formally known as the Second Law of Thermodynamics, states that in any closed system, entropy—often interpreted as disorder or unusable energy—tends to increase over time. This principle implies that energy transformations are never 100% efficient; some energy invariably dissipates as heat or becomes less available for work. While originally formulated to describe physical phenomena, this law has far-reaching implications when applied to economic systems, which can be viewed as open systems exchanging energy and matter with their environment.

Economist Nicholas Georgescu-Roegen was one of the first to systematically incorporate the entropy law into economic theory. He argued that economic processes are not isolated from physical realities but are instead bound by the same thermodynamic constraints governing natural systems. Resources extracted, transformed, and consumed in the economy inevitably generate entropy, leading to the degradation of natural capital. This perspective challenges traditional economic models that often treat resources as infinitely substitutable or overlook the physical limits imposed by entropy.

Economic Processes as Entropy-Generating Systems

In practical terms, the economic process involves converting low-entropy resources—such as fossil fuels, minerals, and clean water—into high-entropy waste products, including pollution, greenhouse gases, and degraded ecosystems. This conversion is intrinsic to production and consumption cycles, where energy is used to create goods and services but cannot be reused in its original form without external input.

The implications are twofold:

- **Resource Depletion:** As low-entropy resources diminish, the economy faces increasing scarcity, driving up costs and potentially stalling growth.
- **Environmental Impact:** The accumulation of high-entropy waste strains ecosystems, contributing to climate change, biodiversity loss, and health hazards.

These outcomes underscore why economic growth cannot be indefinitely decoupled from environmental degradation, a notion increasingly validated by empirical research linking resource consumption with ecological footprints.

Integrating the Entropy Law into Economic Theory

Traditional economic models, particularly neoclassical frameworks, often emphasize human ingenuity and technological progress as means to overcome natural limits. However, the entropy law introduces a fundamental constraint: no matter how efficient technologies become, the total entropy of the system plus its environment must increase. This challenges assumptions about perpetual growth and calls for a re-evaluation of economic sustainability.

The Concept of Entropy in Ecological Economics

Ecological economics explicitly incorporates thermodynamic principles to analyze economic systems within ecological boundaries. It highlights:

- **Material and Energy Flows:** The economy is seen as a subsystem of the biosphere, dependent on energy inputs and material throughput.
- **Irreversibility:** Economic activities are irreversible in nature due to entropy increase, meaning resources once used cannot be fully restored.
- **Scale vs. Allocation:** While allocation addresses resource distribution, scale considers the overall size and throughput of the economy relative to ecological limits.

By embedding the entropy concept into economic analysis, ecological economists argue for systems that prioritize efficiency, conservation, and regenerative practices over mere growth.

Contrasting with Conventional Growth Models

Conventional growth models typically rely on assumptions such as substitutability between natural and human-made capital and technological optimism. However, the entropy law reveals inherent physical constraints that technology alone cannot overcome.

For example, while renewable energy technologies reduce dependency on fossil fuels, they still require material inputs and generate waste, contributing to entropy. Similarly, recycling processes, although beneficial, cannot achieve perfect material recovery due to thermodynamic inefficiencies.

This recognition has led to increased interest in concepts such as:

- **Steady-State Economics:** Advocates for maintaining an economy within ecological limits, balancing inputs and outputs to minimize entropy generation.
- **Degrowth Movements:** Propose deliberate downscaling of production and consumption to reduce ecological impacts and entropy buildup.

Practical Implications for Policy and Economic Planning

Acknowledging the entropy law's role in the economic process has significant consequences for sustainability policies and resource management strategies.

Resource Efficiency and Circular Economy

Efforts to improve resource efficiency aim to reduce entropy generation by minimizing waste and maximizing the utility of inputs. The circular economy model embodies this approach by designing systems that keep materials in use for as long as possible, recovering and regenerating products at the end of their lifecycle.

However, the entropy law clarifies that circularity cannot be perfect; some degradation and loss are inevitable, necessitating continuous input of new low-entropy resources and energy. This reality emphasizes the importance of reducing overall throughput and not relying solely on recycling to achieve sustainability.

Energy Considerations and Renewable Transitions

Energy consumption is a critical factor in entropy generation within economic systems. Transitioning from fossil fuels to renewable energy sources reduces carbon emissions and environmental harm but does not eliminate entropy production.

For instance, solar panels and wind turbines require energy-intensive manufacturing and eventually face material degradation. Therefore, comprehensive energy strategies must consider lifecycle impacts and the thermodynamic realities of energy transformations.

Measuring Economic Success Beyond GDP

Traditional metrics like Gross Domestic Product (GDP) fail to account for entropy-related costs such as resource depletion and environmental degradation. Alternative indicators, including the Genuine Progress Indicator (GPI) and the Ecological Footprint, incorporate these factors to provide a more holistic view of economic performance.

Incorporating entropy law insights into such metrics encourages policies that reflect true economic sustainability rather than mere output growth.

Challenges and Critiques in Applying the Entropy Law to Economics

Despite its conceptual appeal, integrating the entropy law into economic analysis faces several challenges:

- **Complexity of Economic Systems:** Unlike closed physical systems, economies are open and influenced by social, cultural, and technological variables, complicating direct thermodynamic application.
- **Quantification Difficulties:** Measuring entropy changes within economic activities is technically challenging and requires interdisciplinary methods.
- **Policy Resistance:** Proposals based on entropy constraints often conflict with political and economic interests favoring growth-centric paradigms.

Nevertheless, ongoing research continues to refine methodologies and frameworks that bridge physical laws and economic realities, enhancing the robustness of sustainability science.

Future Directions in Research and Practice

Emerging fields such as industrial ecology, sustainability science, and systems economics increasingly incorporate entropy concepts to inform more resilient economic models. Innovations in data analytics, environmental accounting, and life cycle assessment contribute to better quantification and management of entropy in economic processes.

Moreover, integrating entropy considerations into education and policy design could foster a paradigm shift towards economies that respect ecological limits and prioritize long-term wellbeing over short-term gains.

The dialogue between thermodynamics and economics, encapsulated by the entropy law and the economic process, continues to evolve, offering a critical lens through which to assess humanity's relationship with the natural world. Recognizing the inescapable realities of entropy invites deeper reflection on how societies organize production, consumption, and growth within the finite capacities of our planet.

The Entropy Law And The Economic Process

the entropy law and the economic process: The Entropy Law and the Economic Process Nicholas Georgescu-Roegen, 1971 In the ultimate analysis man struggles for low entropy, and economic scarcity is the reflection of the Entropy Law, which is the most economic in nature of all natural laws. Thermodynamics itself is presented by the author as the physics of economic value and mans economic activity as analogous (though not identical) to that of the purposive sorting of the famous Maxwellian demon. Economic activity is in fact an extension and a complement of mans biological evolution. In it, man can use exosomatic organs, i.e., organs with which he is not endowed biologically but which have evolved through a process of mutation, selection, and diffusion similar to that of biological evolution. For wherever there is evolution, the author argues, there is the work of the Entropy Law with its irrevocable qualitative Change. This point leads the author to an extensive examination of the limitations of arithmomorphic models in all sciences. He argues that no complete description of reality, no philosophical argument (not even that of the ultrapositivists), no creative thought can dispense with dialectical concepts and reasoning, which he views somewhat differently from Hegel. The tight-knit excursus ends with an analysis of some general economic issues, from that of the analytical representation of a process to that of social conflict. The author argues that, because of the very nature of exosomatic evolution, the social conflict will last under any regime as long as there is a human society. -- Publisher's description.

the entropy law and the economic process: *The entropy law and the economic process* Nicholas Georgescu - Roegen,

the entropy law and the economic process: The entropy law and the economic process Nicholas Georgescu-Roegen, 1976

the entropy law and the economic process: *THE ENTROPY LAW AND THE ECONOMIC PROCESS. BY NICHOLAS GEORGESCU-ROEGEN.* Nicholas Georgescu-Roegen, 1974

the entropy law and the economic process: The Entropy Law and the Economic Process /Nicholas Georgescu-Roegen Nicholas Georgescu-Roegen, 1971

the entropy law and the economic process: Ideology, Social Theory, and the Environment William D. Sunderlin, 2003 Does human population growth threaten the environment, or does it guarantee we will safeguard it? Is economic growth the key ecological problem, or is it in fact the solution? What will be the leading force to save the planet: civil society, government, or private enterprise? This book shows that these polemical debates are governed not so much by access to 'facts' as they are by the political ideology of the expert advancing a particular argument. Moreover, the thoughts of these experts tend to be based largely in just one of three competing streams of political thought: the left, the center, or the right. Drawing on social theory, the author explains the philosophical origins of this tendency to rely on just one of three traditions, and why this poses a serious obstacle to conceptualizing the cause, nature, and resolution of environmental problems. Sunderlin argues that laying the foundation for a livable world involves giving conscious and dedicated attention to the core tenets of all three political traditions: action against class inequality and advocacy of social justice within and among countries; reformation of laws and policies emanating from the halls of power and technological innovation in centers of research; and wholesale cultural change and promotion of individual initiative, responsibility, and creativity.

the entropy law and the economic process: Valuing the Earth, second edition Herman E. Daly, Kenneth N. Townsend, 1992-11-24 Valuing the Earth collects more than twenty classic and recent essays that broaden economic thinking by setting the economy in its proper ecological and ethical context. They vividly demonstrate that, contrary to current macroeconomic preoccupations, continued growth on a planet of finite resources cannot be physically or economically sustained and is morally undesirable. Among the issues addressed are population growth, resource use, pollution, theology (east and west), energy, and economic growth. Their common theme is the notion, popular with classical economists from Malthus to Mill, that an economic stationary state is more healthful to life on earth than unlimited growth. A number of essays in the first edition have become classics and have been retained for this edition, which adds six new essays. Contributors Kenneth E. Boulding, John Cobb, Herman E. Daly, Anne H. Ehrlich, Paul R. Ehrlich, Nicholas Georgescu-Roegen, Garrett Hardin, John P. Holdren, M. King Hubbert, C. S. Lewis, E. F. Schumacher, Gerald Alonzo Smith, T. H. Tietenberg, Kenneth N. Townsend

the entropy law and the economic process: The Economic Process Carmine Gorga, 2010 This book transports the reader from the world of mainstream economics, in which the object of observation is The Market (exchange), to a world in which the object of observation is the economic process. Both producer and consumer must, respectively, be legitimate owners of real wealth and monetary wealth.

the entropy law and the economic process: The Origin of Wealth Eric D. Beinhocker, 2006 Beinhocker has written this work in order to introduce a broad audience to what he believes is a revolutionary new paradigm in economics and its implications for our understanding of the creation of wealth. He describes how the growing field of complexity theory allows for evolutionary understanding of wealth creation, in which business designs co-evolve with the evolution of technologies and organizational innovations. In addition to giving his audience a tour of this field of complexity economics, he discusses its implications for real-world issues of business.

the entropy law and the economic process: Physis, Biopower, and Biothermodynamics Enrique Leff, 2024-04-16 Building upon the idea that our current environmental question arises from the history of metaphysics—which privileged thought about Being (or ontology) over the conditions of life—this book reinterprets Heraclitus’s notion of physis as the fundamental, emergent potency of life, as the category to-be-thought by thinkers. In so doing, it deconstructs the interpretation offered by Heidegger and so stresses the struggle between the creative force of life and its subjection to the human Logos or meaning. Physis, understood as the pre-ontological potentiality of life itself, thus becomes the cornerstone of a materialist philosophy of life. Following engagements with the work of Nietzsche, Foucault, and Janicaud to explore the significance of human intervention into the realm of life via the will to power, biopower and the power of rationality respectively, the author explores twentieth-century rearticulations of the concept of physis through a range of developments in biothermodynamics, thus grounding a new philosophy of life and a new bioeconomics in a revisited biothermodynamics centered on the concept of negentropy. An extensive engagement with the history and development of thought about the generative force of life on Earth, Physis, Biopower, Biothermodynamics, and Bioeconomics: The Fire of Life will appeal to scholars of philosophy, social theory, and political theory with interests in environmental thought, political ecology, and questions of sustainability.

the entropy law and the economic process: Ranking Economic Performance and Efficiency in the Global Market: Emerging Research and Opportunities Gussen, Benjamen Franklen, 2017-08-10 There are numerous determinants that drive and influence economic efficiency in contemporary nations. Critical insights can be gained from developing analytical models to understand the economies of the world. Ranking Economic Performance and Efficiency in the Global Market: Emerging Research and Opportunities is an innovative source of scholarly information that discusses world rankings of modern national economies. Including a range of topics such as geopolitics, sovereignty, and jurisdictional considerations, this book is ideally designed for academics, researchers, professionals, and students interested in the relevant knowledge that can be extracted from the determinants of economic efficiency.

the entropy law and the economic process: Hearings, Reports and Prints of the Joint Economic Committee United States. Congress. Joint Economic Committee, 1975

the entropy law and the economic process: *The Barcelona School of Ecological Economics and Political Ecology* Sergio Villamayor-Tomas, Roldan Muradian, 2023-02-28 In this open access book, ecological economics and political ecology traditions converge into a single academic school. The book constitutes a common ground where multiple and critical voices are expressed, covering a broad scope of urgent matters at the crossroad between society, economy and the natural environment. The manuscripts composing this compendium offer appealing material for both experienced and younger researchers interested in interdisciplinary exchanges in the field of the social environmental sciences. It combines historical accounts with recent theoretical and empirical developments revolving around the interaction between three foundational notions of the Barcelona School: social metabolism, environmental justice and self-reflective science.

the entropy law and the economic process: *U.S. Economic Growth from 1976 to 1986: The limits to growth* , 1976

the entropy law and the economic process: *U.S. Economic Growth from 1976 to 1986* , 1976

the entropy law and the economic process: Environment and Ecology in the History of Economic Thought Vitor Eduardo Schincariol, 2024-07-05 This volume proposes a reconsideration of ecological and environmental aspects of the work and ideas of various heterodox authors and traditions in the history of economic thought, including the field of economic development. Many of the contributors to this book focus on thinkers and works which are not typically considered as part of the ecological sphere, while others consider such economists in a new light or domain. Thus, the book elucidates a new and useful research field of reconsidering ecological dimensions in the traditional history of economic thought as well as helping to delineate alternative views for ongoing debates on ecological themes. Did Veblen, Keynes, Sraffa, C. Furtado and other key economists and schools of thought of our age have relevant and useful insights with respect to environmental issues? Which aspects of their intellectual legacies should eventually be discarded in the face of our new environmental challenges? On the contrary, what aspects of their economic theories can be updated and adapted to a better interpretation of our present ecological concerns? How do they differ, and why? The essays contained in this book will help to answer these questions, by means of recovering, analysing and updating the work of some of the most relevant heterodox economists and schools of thought of our time. This book will be of great interest for readers in the history of economic thought, ecological economics, environmental economics and economic development.

the entropy law and the economic process: More Heat than Life: The Tangled Roots of

Ecology, Energy, and Economics Jeremy Walker, 2020-07-14 This book traces the interacting histories of the disciplines of ecology and economics, from their common origin in the ancient Greek concept of oikonomia, through their distinct encounters with energy physics, to the current obstruction of neoliberal economics to responses to the ecological and climate crisis of the so-called Anthropocene. Reconstructing their constitution as separate sciences in the era of fossil-fuelled industrial capitalism, the book offers an explanation of how the ecological sciences have moved from a position of critical collision with mainstream economics in the 1970s, to one of collusion with the project of permanent growth, in and through the thermal crisis of the biosphere.

the entropy law and the economic process: Enlarging economic doctrine United States. Congress. House. Committee on Interstate and Foreign Commerce. Subcommittee on Energy and Power, 1976

the entropy law and the economic process: Marx and the Earth John Bellamy Foster, Paul Burkett, 2016-01-12 A decade and a half ago John Bellamy Foster and Paul Burkett introduced a new, revolutionary understanding of the ecological foundations of Marx's thought, demonstrating that Marx's concepts of the universal metabolism of nature, social metabolism, and metabolic rift prefigured much of modern systems ecology. Ecological relations were shown to be central to Marx's critique of capitalism, including his value analysis. Now in Marx and the Earth Foster and Burkett expand on this analysis in the process of responding to recent ecosocialist criticisms of Marx. The result is a full-fledged anti-critique—pointing to the crucial roles that dialectics, open-system thermodynamics, intrinsic value, and aesthetic understandings played in the original Marxian critique, holding out the possibility of a new red-green synthesis.

the entropy law and the economic process: Energy and Economic Myths Nicholas Georgescu-Roegen, 2014-05-18 Energy and Economic Myths: Institutional and Analytical Economic Essays is a collection of materials that deal with various issues and concerns in economics. The title aims to clarify the misconception in economics. The first part of the text deals with the issues in natural resources and the economics of production. Next, the selection tackles the problems in institutional economics. Part III covers the epistemological and methodological concerns in economics. The title also talks about economic theories. The book will be of great interest to economists and readers who want to enhance their understanding of economic concepts.

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