

Energy Efficiency In Fertilizer Production And Use Eolss

The U.S. chemical industry is the largest in the world, and responsible for about 11% of the U.S. industrial production measured as value added. It consumes approximately 20% of total industrial energy consumption in the U.S. (1994), and contributes in similar proportions to U.S. greenhouse gas emissions. Surprisingly, there is not much information on energy use and energy intensity in the chemical industry available in the public domain. This report provides detailed information on energy use and energy intensity for the major groups of energy-intensive chemical products. Ethylene production is the major product in terms of production volume of the petrochemical industry. The petrochemical industry (SIC 2869) produces a wide variety of products. However, most energy is used for a small number of intermediate compounds, of which ethylene is the most important one. Based on a detailed assessment we estimate fuel use for ethylene manufacture at 520 PJ (LHV), excluding feedstock use. Energy intensity is estimated at 26 GJ/tonne ethylene (LHV), excluding feedstocks. The nitrogenous fertilizer production is a very energy intensive industry, producing a variety of fertilizers and other nitrogen-compounds. Ammonia is the most important intermediate chemical compound, used as basis for almost all products. Fuel use is estimated at 268 PJ (excluding feedstocks) while 368 PJ natural gas is used as feedstock. Electricity consumption is estimated at 14 PJ. We estimate the energy intensity of ammonia manufacture at 39.3 GJ/tonne (including feedstocks, HHV) and 140 kWh/tonne, resulting in a specific primary energy consumption of 40.9 GJ/tonne (HHV), equivalent to 37.1 GJ/tonne (LHV). Excluding natural gas use for feedstocks the primary energy consumption is estimated at 16.7 GJ/tonne (LHV). The third most important product from an energy perspective is the production of chlorine and caustic soda. Chlorine is produced through electrolysis of a salt-solution. Chlorine production is the main electricity consuming process in the chemical industry, next to oxygen and nitrogen production. We estimate final electricity use at 173 PJ (48 TWh) and fuel use of 38 PJ. Total primary energy consumption is estimated at 526 PJ (including credits for hydrogen export). The energy intensity is estimated at an electricity consumption of 4380 kWh/tonne chlorine and fuel consumption of 3.45 GJ/tonne chlorine, where all energy use is allocated to chlorine production. Assuming an average power generation efficiency of 33% the primary energy consumption is estimated at 47.8 GJ/tonne chlorine (allocating all energy use to chlorine).

Against the backdrop of ever increasing energy intensity, this book provides coverage of energy conservation and efficient utilization. It provides insights into various tools and techniques for energy conservation and suggests methodologies for developing energy efficient appliances and industrial processes.

For a variety of reasons, energy use in the agro-food sector continues to rise, and in many countries, is highly dependent on fossil fuels, contributing significantly to greenhouse gas emissions. It is therefore becoming urgent to consider how the food supply chain can improve its energy efficiency.

Productivity and Energy Efficiency

Energy Conservation for American Agriculture

Deeds and Wills of Christopher Irvin of Rowan County, North Caroline and His Son Christopher Irvin of North Caroline and Tennessee
Energy Use and Energy Intensity of the U.S. Chemical Industry
Agriculture, Fertilizers, and the Environment
Energy Conservation

Papers presented at a National Seminar on "Energy in Production Agriculture and Food Processing" held at Ludhiana, Oct. 30-31, 1987.

***The Potential for Energy Efficiency in the Fertilizer Industry
The forest products industry consumes large amounts of energy. Understanding how genetic variation in trees actually controls the characteristics of wood, the major raw material utilized by the industry, is an opportunity for energy savings. For companies that are vertically integrated (i.e., have both tree production and processing operations), energy savings can accrue for both production and processing. Tree production demands nitrogen fertilizers, the manufacture of which is highly energy intensive. Wood processing for paper product manufacturing requires digestion and bleaching, both of which are more efficient when the lignin content of wood is reduced. This project identified genes involved in utilization of nitrogen from fertilizer, and the coupling of nitrogen demand to lignin content, establishing a framework for reducing tree nitrogen demand per unit carbon gained. This creates opportunities for genetic manipulation of trees for greater energy efficiency.***

Seizing the Moment

Cutting Energy Costs

***The Potential for Energy Efficiency in the Fertilizer Industry
Department of Agriculture Could Do More to Help Farmers Conserve Energy***

***Executive Briefing Report, Technology Transfer
Situation 78***

Controlled Release Fertilizers for Sustainable Agriculture provides a comprehensive examination of precision fertilizer applications using the 4-R approach—the right amount of fertilizer at the right time to the right plant at the correct stage of plant growth. This volume consolidates detailed information on each aspect of controlled release fertilizers, including up-to-date literature citations, the current market for controlled release fertilizers and patents. Presenting the tremendous advances in experimental and theoretical studies on sustainable agriculture and related areas, this book provides in-depth insight into state-of-the-art controlled release mechanisms of fertilizers, techniques, and their use in sustainable agriculture. Conventional release mechanisms have historically meant waste of fertilizers and the adverse effects of that waste on the environment. Controlled release delivery makes significant strides in enhancing fertilizer benefit to the target plant, while protecting the surrounding environment and increasing sustainability. Presents cutting-edge interdisciplinary insights specifically focused on the controlled release of fertilizers Explores the benefits and challenges of 4-R fertilizer use

Includes expertise from leading researchers in the fields of agriculture, polymer science, and nanotechnology working in industry, academics, government, and private research institutions across the globe Presents the tremendous advances in experimental and theoretical studies on sustainable agriculture and related areas Global energy markets and climate change in the twenty first century depend, to an extraordinary extent, on China. China is now, or will soon be, the world's largest energy consumer. Since 2007, China has been the world's largest emitter of greenhouse gases (GHGs). Despite its large and rapidly expanding influence on global energy markets and the global atmosphere, on a per capita basis energy consumption and GHG emissions in China are low relative to developed countries. The Chinese economy, and with it energy use and GHG emissions, are expected to grow vigorously for at least the next two decades, raising a question of critical historical significance: How can China's economic growth imperative be meaningfully reconciled with its goals of greater energy security and a lower carbon economy? Most scholars, governments, and practitioners have looked to technology -- energy efficiency, nuclear power, carbon capture and storage -- for answers to this question. Alternatively, this study seeks to root China's future energy and emissions trajectory in the political economy of its multiple transitions, from a centrally planned to a market economy and from an agrarian to a post-industrial society. The study draws on five case studies, each a dedicated chapter, which are organized around three perspectives on energy and GHG emissions: the macroeconomy; electricity supply and demand; and nitrogen fertilizer production and use. Chapters 2 and 3 examine how growth and structural change in China's macroeconomy have shaped energy demand, finding that most of the dramatic growth in the country's energy use over the 2000s was driven by an acceleration of its investment-dominated, energy-intensive growth model, rather than from structural change. Chapters 4 and 5 examine efforts to improve energy efficiency and increase the share of renewable generation in the electric power sector, concluding that China's power system lacks the flexibility in generation, pricing, and demand to support further improvements in efficiency and scale up renewable generation at an acceptable level of cost and reliability. Chapter 6 examines energy use and GHG emissions from nitrogen fertilizer use, arguing that energy use and GHG emissions from nitrogen fertilizer use in China are high relative to other countries because of China's historical support for small and medium-sized enterprises using domestic technology; its continued provision of energy subsidies to fertilizer producers; and its lack of a well-functioning agricultural extension system. The case studies illustrate the limits of energy and climate policy in China without institutional reform. China's leaders have historically relied on economic growth to defer the difficult changes in political economy that accompany economic and social transition. However, many of the challenges of energy and climate policy require political decisions that reallocate resources among stakeholders. For instance, restructuring the Chinese economy away from heavy industrial investment and toward a higher GDP share of consumption will require financial sector reforms, such as interest rate liberalization or higher dividend payments for state-owned enterprises, that reallocate income from the industrial sector to households. Increasing power system flexibility will require price reforms that reallocate revenues and costs among generators, between generators and the grid companies, between producers and ratepayers, among ratepayer classes, and between and among provinces. Strong

public interest institutions are needed to make these changes, which suggests that China's energy and GHG emissions trajectories will be determined, to a large extent, by the politics of institutional reform.

This report reviews the potential for energy conservation in the fertilizer industry, describes the organizational aspects of implementing successful energy conservation programs, and gives details of particular conservation measures that may be considered. Since the production of ammonia is the most energy-intensive process for all fertilizer, a major emphasis of the report is on the potential savings in ammonia production, which can amount to as much as 30%, or up to US\$ 45/mt of ammonia. About half of the savings can be achieved by good housekeeping measures, with little or no investment cost; the other half involves a mix of short- and medium-term payback investments.

Comprehensive Energy Systems

Natural Resources and Sustainability

Policy Implications and Options for Developing Countries

India's Fertilizer Industry

Input Use Efficiency for Food and Environmental Security

Mini-fertilizer Plant Projects

Efficient Use and Conservation of Energy is a component of Encyclopedia of Energy Sciences, Engineering and Technology Resources in the global Encyclopedia of Life Support Systems (EOLSS), which is an integrated compendium of twenty Encyclopedias. The Theme on Efficient Use and Conservation Of Energy discusses matters of great relevance to our world such as: Efficient Use and Conservation of Energy in the Industrial Sector; Efficient Use and Conservation of Energy in Buildings; Efficient Use and Conservation of Energy in the Transportation Sector; Efficient Use and Conservation of Energy in the Agricultural Sector; Using Demand-Side Management to Select Energy Efficient Technologies and Programs . These two volumes are aimed at the following five major target audiences: University and College students Educators, Professional practitioners, Research personnel and Policy analysts, managers, and decision makers and NGOs.

Abstract: The conservation of energy can be approached in dozens of ways, by individuals, families, communities, farmers and industry. The 1980 Yearbook explores the uses of energy, describes ongoing energy research projects, explains the practical applications of available options, and discusses alternate sources of energy. In agriculture, some of the topics covered are the use and manufacture of fertilizers, greenhouse utilization and tips for producing cheaper plant and animal foods. Family living focuses on changing habits, home-insulation, better home and landscape design, and home management. Community activities include transportation pools, waste audits, recycling projects, education, etc. The various energy sources discussed include hydroelectric power, geothermal energy, wind, sun, wood, and farm wastes. Historical estimates of productivity growth in India's fertilizer sector vary from indicating an improvement to a decline in the sector's productivity. The variance

may be traced to the time period of study, source of data for analysis, and type of indices and econometric specifications used for reporting productivity growth. Our analysis shows that in the twenty year period, 1973 to 1993, productivity in the fertilizer sector increased by 2.3% per annum. An econometric analysis reveals that technical progress in India's fertilizer sector has been biased towards the use of energy, while it has been capital and labor saving. The increase in productivity took place during the era of total control when a retention price system and distribution control was in effect. With liberalization of the fertilizer sector and reduction of subsidies productivity declined substantially since the early 1990s. Industrial policies and fiscal incentives still play a major role in the Indian fertilizer sector. As substantial energy savings and carbon reduction potential exists, energy policies can help overcome barriers to the adoption of these measures in giving proper incentives and correcting distorted prices.

Structure and Prospects

Department of Energy Programs and Objectives

The Key to World Food Supplies

Sustainable Energy Solutions in Agriculture

OECD Green Growth Studies Improving Energy Efficiency in the Agro-food Chain

We need to know what opportunities there are and what limits exist to the improvement of energy efficiency, since this is the most cost-effective way to abate greenhouse gas emissions. This book presents a method whereby promising technologies can be identified and characterised that can contribute to an improvement of energy efficiency in the long term. An objective measurement of maximum improvement is provided by an analysis of the theoretical minimum specific energy demand. A descriptive inventory is then given of new and conceivable technologies that can improve efficiency, extending beyond the standard lists found in the literature. The method is applied to three main energy consuming branches of industry: paper and board, iron and steel, and nitrogen fertilizer. Each of the studies provides an in-depth analysis of the industry and an extensive survey of options for its improvement.

Natural Resources and Sustainability explores how human needs and desires, from sustenance and shelter to recreation and travel, have spurred the consumption of Earth's material resources. Scientists, ecologists, and other expert authors present the historical impact of commercial activities (in industries as varied as fisheries, agriculture, energy, and mineral extraction), discuss the global distribution and use of renewable and nonrenewable resources, and focus on

innovative approaches for the future. Readers will learn why renewal doesn't necessarily put a resource beyond harm and why the no-free-lunch adage applies to all natural resources.

Energy and agriculture; Options for change; Reducing direct uses of energy on farms; Reducing indirect uses of energy on farms; Meat, poultry, and dairy production; Urban agriculture.

Energy in Plant Nutrition and Pest Control

Hearings Before the Subcommittee on Family Farms, Rural Development, and Special Studies of the Committee on Agriculture, House of Representatives, Ninety-fifth Congress, First Session

The Fertilizer Industry

Energy Efficiency Guide for Industry in Asia

Energy Management and Conservation in Agricultural Production and Food Processing

Opportunities for Energy Savings in Crop Production

Part I Fertilizers: Fertilizer and energy use; Energy requirements, technology, and resources in the fertilizer sector; Legume nitrogen: symbiotic fixation and recovery by subsequent crops; Organic materials as alternative nutrient sources; Conservation of nutrients; Energy Efficiency, economics, and policy in the fertilizer sector; Part II. Pesticides: Energy in pesticide manufacture, distribution and use; Pesticide use in world agriculture; Alternative pest management practices; Maximizing pesticide use efficiency; Effects of application methods on energy use; The policy and economic issues of pest control and energy use.

Discusses The Concept Of Energy Use In Agriculture, Examines The Measurements Of Energy Efficiency And Methods Of Measurements Of Agricultural Productivity And Makes A Comparison Of The Use Of Energy In The Developed And Developing Countries. Five Chapters And 11 Appendices. World Bank Discussion Paper No. 277. This study examines the structure and trends of energy demand in China, India, Indonesia, the Republic of Korea, and Thailand. Chapters focus on energy efficiency and conservation in the industrial, transportati

Berkshire Encyclopedia of Sustainability 4/10

Fertilizer Trends

Energy in Farm Production

The Role of Fertilizer in Sustaining Food Security and Protecting the Environment to 2020

Energy Use in Agricultural Productivity

Controlled Release Fertilizers for Sustainable Agriculture

In this discussion paper [the authors] review past trends in fertilizer use, estimate future needs, and assess technical and policy measures for dealing with environmental and energy concerns related to fertilizer use

The objectives of this conference were to assess the energy/food situation; identify

world agricultural production, fertilizer outlook, and fertilizer marketing patterns; consider factors to improve energy efficiency in fertilizer production and use; assess the impact of public and private technology developments; and conclude with a dealer panel discussion on management and marketing at the retail level.

This guide has been developed for Asian companies who want to improve energy efficiency through Cleaner Production and for stakeholders who want to help them. It includes a methodology, case studies for more than 40 Asian companies in 5 industry sectors, technical information for 25 energy equipments, training materials, a contact and information database.--Publisher's description.

Report

Canadian Industry Program for Energy Conservation

Energy and Fertilizer

Energy Consumption, Conservation, and Projected Needs for Texas Agriculture

Present and Future Energy Needs on Family Farms

Yearbook of Agriculture

Global food production and challenges. The basis for food production - plant nutrients. Food and plant nutrients. Plant nutrient demand. Balanced crop nutrition. Nutrient sources. Nutrients from soil reserves. Nutrients from organic manures. Biological nitrogen fixation. Aerial deposition. Mineral fertilizers. 'Biofertilizers' and growth enhancers. The global challenge - to feed the people. Population growth and food availability. Population growth. Food supply. Food production in different regions. Food from the ocean. Future prospects. Sustainable food production - constraints and opportunities. General overview. Soil productivity and land availability. Forests and deforestation. Freshwater and irrigation. Fertilizer use and demand. Plant breeding. Crop losses. Agriculture without fertilizers and pesticides - organic agriculture. Weather and climate - the greenhouse effect, the ozone layer and agriculture. Policy and economy. Soil productivity, fertilizer use and the environment. Concerns related to fertilizer use. Soil: the essential resource. Soil formation and development. Nutrients in soil. Soil organic matter. Fertilizers and soil life. Soil degradation. Soil erosion. Soil mining. Soil acidification. Other forms of degradation. Nitrogen. General overview. Nitrogen: chemistry and forms. Nitrogen fixation. Microbial conversions of fixed N. Human impacts on the nitrogen cycle. Nitrogen in soil - sources and utilization by plants. Nitrogen losses from agriculture. Atmospheric emission and deposition of ammonia and nitrogen oxides. Management practices to improve NUE and minimize losses. Nitrate and health. Phosphorus. General overview. Phosphorus in soil and availability to plants. Phosphate losses. Agricultural management to reduce losses. The remaining nutrients - potassium, sulphur, magnesium, calcium, micronutrients. Potassium. Sulphur. Calcium and magnesium. The micronutrients. Other elements in fertilizers. General overview. Cadmium. Radioactive elements. Other elements. Eutrophication of fresh and marine waters. General overview. Nutrient sources and transport. Eutrophication of fresh waters. Eutrophication of the marine environment. Food quality, environmental and sustainability aspects of fertilizer use in agriculture. Produce quality. General overview. Nutrient management and produce quality. Produce quality and human and animal health. Nutrients and plant diseases. General overview. Primary and secondary nutrients. Micronutrients. Other factors. Biodiversity in intensive agriculture. Energy use in agriculture. Farm work and energy. Use of non-renewable energy. Energy efficiency in agriculture. Fertilizer production - emissions and use of energy and resources. General overview. Mining activities. Energy and raw material use in fertilizer production. Emissions from production. Solid waste. Safety and occupational health. Non-renewable nutrient and energy resources. General overview. Mineral resources. Energy - fossil fuels. Life-cycle analysis for food production. Productivity and sustainability challenges. World cereal production - challenges and opportunities. Wheat. General overview. Yield and major constraints. Future challenges. Rice. General overview. Yield and

major constraints. Sustainability and environmental problems. Future challenges. Maize. General overview. Maize in various climates. Yield and major constraints. Soil fertility and fertilizer use. Future challenges. Agricultural productivity in various regions - constraints and opportunities. North America - Canada and the USA. Latin America. Western Europe. Central Europe and the former Soviet Union. South and South-East Asia. Oceania - Australia and New Zealand. Africa. Sustainability in agriculture and associated primary industries, which are both energy-intensive and crucial for the development of any country. Increasing scarcity and resulting high fossil fuel prices combined with the need to significantly reduce greenhouse gas emissions, make the improvement of energy efficient farming and increased use of renewable energy essential. This book provides a technological and scientific endeavor to assist society and farming communities in different regions and scales to improve their productivity and sustainability. To fulfill future needs of a modern sustainable agriculture, this book addresses highly actual topics providing innovative, effective and more sustainable solutions for agriculture by using sustainable, environmentally friendly, renewable energy sources and modern energy efficient, cost-improved technologies. The book highlights new areas of research, and further R&D needs. It helps to improve food security for the rapidly growing world population and to reduce carbon dioxide emissions from fossil fuel use in agriculture, which presently contributes 22% of the global carbon dioxide emissions. The book provides a source of information, stimuli and incentives for what and how new and energy efficient technologies can be applied as effective tools and solutions in agricultural production to satisfy the continually increasing demand for food and fibre in an economically sustainable way while contributing to global climate change mitigation. It will be useful and inspiring to decision makers working in different authorities, professionals, agricultural engineers, researchers, and students concerned with agriculture and related primary industries, sustainable energy development and climate change mitigation projects.

Ending hunger, achieving food security and promoting sustainable development are at the top of the list of United Nations (UN) sustainable global development priorities. In the times of high population growth and increasing pressure of agricultural systems, efficiency in use of natural resources has been at the epicenter of sustainable agriculture. The concept of 'Input efficiency' implies production of high quantity and quality of food, from using only finite natural resource inputs, in the form of mainly land, water, nutrients, energy, or biological diversity. In this book editors provide a roadmap to the food, nutritional, and environmental security in the agricultural systems. They share insight into the approaches that can be put in practice for increasing the use efficiency in the cropping systems and achieve stability and sustainability of agricultural production systems. This book is of interest to teachers, researchers, climate change scientists, capacity builders and policymakers. Also the book serves as additional reading material for undergraduate and graduate students of agriculture, agroforestry, agroecology, and environmental sciences. National and international agricultural scientists, policymakers will also find this to be a useful read.

Environmental considerations of selected energy conserving manufacturing process options
Final Technical Report

Efficient Use and Conservation of Energy - Volume II

Potential for Industrial Energy-Efficiency Improvement in the Long Term

Energy Efficient Fertilizer Production with the Pipe-cross Reactor

Global Opportunities for the U.S. Energy-efficiency Industry

This last volume of the Energy in World Agriculture series is in many ways the series' Alpha and its Omega. It addresses the broad issues related to the use of energy in agricultural production, and also characterizes and quantifies the energy involvements of many agricultural production technologies. It is

a compilation of descriptive and analytical information and design principles and data of energy use in this field. A significant aspect is the relationship between energy and agricultural productivity, increased knowledge and resulting improved management of energy-consuming operations on the farm. Information provided here has not been published elsewhere before. Throughout the book are examples of the important role that energy inputs have played in increasing productivity of the world's agricultural systems. Together with a revived interest in energy for agricultural production due to increases in energy costs, this volume meets that interest with valuable information and insights.

Comprehensive Energy Systems provides a unified source of information covering the entire spectrum of energy, one of the most significant issues humanity has to face. This comprehensive book describes traditional and novel energy systems, from single generation to multi-generation, also covering theory and applications. In addition, it also presents high-level coverage on energy policies, strategies, environmental impacts and sustainable development. No other published work covers such breadth of topics in similar depth. High-level sections include Energy Fundamentals, Energy Materials, Energy Production, Energy Conversion, and Energy Management. Offers the most comprehensive resource available on the topic of energy systems Presents an authoritative resource authored and edited by leading experts in the field Consolidates information currently scattered in publications from different research fields (engineering as well as physics, chemistry, environmental sciences and economics), thus ensuring a common standard and language

*Energy and Greenhouse Gas Emissions in China
Growth, Transition, and Institutional Change
Energy Conservation in Agricultural Production
Energy Demand in Five Major Asian Developing Countries*