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施涵

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《产业生态学报》

2000 年冬, 第 4 卷第 2 期, 9-34 页

题目: 英国地质形态学研究的人文内涵

作者: Ian Douglas 和 Nigel Lawson

关键词: 建筑与建筑拆除废物, 隐性物流, 地貌变化, 材料流分析, 采矿

摘要: 将物质从自然环境转移到城市和工业环境对景观会产生两类较大影响: 将物质从某处地表移去(地质形态变化)以及混凝土和其他材料在城市或工业区的大量积累(城市形态变化)。所以, 工业活动改变自然景观, 进而可以看作作为一个地理和地形变化因素。在全球范围内, 每年通过矿物开采过程, 人为的物质转移达到 57,000 Mt, 这超过了每年由河流带入海洋的泥沙总量(22,000 Mt)三倍多。取决于是否将采矿剥离物回填到露天煤矿, 英国每年的物质转移量在 688 到 972 Mt 之间。每年经河流进入海洋的泥沙仅有 10Mt, 而河水种溶解的物质大约 40Mt。这样, 人为转移的物质超过自然转移的物质近 14 倍。通过产业生态学的过程研究, 直接挖掘、城市开发和废物倾倒等活动是目前导致英国景观变化的最主要因素。这些地形变化增加了成本。产业生态学能够增进对伴随这些变化的隐含成本的认识。这种认识将会帮助更好地规划, 鼓励各地开展物质再使用, 并发现那些减少地形影响和成本的关键措施。

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The Human Dimensions of Geomorphological Work in Britain

Ian Douglas and Nigel Lawson

KEYWORDS:

construction and demolition waste, hidden materials flow, landform change, materials flow analysis, mining

SUMMARY:

The transfer of materials from the natural environment to the urban and industrially built environment produces two broad impacts on the landscape: a removal of materials from the earth's surface (a change in geomorphology) and the accumulation of a stock of concrete and other materials elsewhere in cities and industrial zones (a change in urban morphology). Thus, industrial activity transforms natural landscapes and, in doing so, has to be considered to be a geological and geomorphological agent. On the global scale, the deliberate shift of around 57,000 Mt (megatons)/yr of materials through mineral extraction processes exceeds the annual transport of sediment to the oceans by rivers (some 22,000 Mt/yr) by almost a factor of three. On the island of Britain, the total deliberate shift of earth-surface materials is between 688 and 972 Mt/yr, depending on whether or not the replacement of overburden in opencast coal mining is taken into account. The export of sediment to the oceans by rivers is only 10 Mt/yr whereas the export of materials in solution is about 40 Mt/yr, making the deliberate materials shift nearly 14 times larger than the shift caused by natural processes. Processes examined by industrial ecology, such as direct excavation, urban development, and waste dumping are those most driving changes in the shape of the British landscape today. These transformations pose added costs. Industrial ecology will produce an understanding of the hidden costs associated with these transformations. Such an understanding will help in planning and encouraging the reuse of materials everywhere and in identifying the key areas for intervention to reduce off-site geomorphological impacts and costs.

《产业生态学报》

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题目: 实施欧盟污染综合防治法令的荷兰模式: 使用生命周期评价开展综合技术评估

作者: Leo Breedveld

关键词: 最佳可得技术 (BAT), 氯硷生产, 欧盟污染综合防治法令 (IPPC 法令), 造纸, 磷酸生产, 简化生命周期评价 (LCA)

摘要: 参照欧盟污染综合防治法令 (IPPC), 传统的环境法规可以使用产业生态学的框架工具加以改进。IPPC 的目的是通过使用最佳可得技术在整体上更好地保护环境。从根本上讲, IPPC 要求欧盟成员国在给新的工业项目发放许可时, 必须综合审查资源、能源、废物和各种环境媒介的污染排放。这与传统环境法规仅关注单个生产设施的单一环境媒介的做法形成鲜明的对比。为了将所有因素考虑进去, 需要进行一个综合技术评估, 但目前还缺乏这类评估的标准方法。本文介绍了一种使用 LCA 对 IPPC 的最佳可得技术进行综合评估的系统方法, 它要求对技术的环境、经济和社会因素等方面的总体评估。这种系统的环境评估方法成功地应用到本文所介绍的相关案例。本文建议 IPPC 技术评估可以忽略加权。由欧盟各成员国根据本国情况自主决定加权步骤为实现 IPPC 法令倡导的附属和弹性原则提供了最大的可能。

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A Dutch Approach to the European Directive on Integrated Pollution Prevention and Control: Using Life Cycle Assessment for the Integrated Assessment of Technologies

Leo Breedveld

KEYWORDS:

best available techniques (BAT), chloralkali production, European Directive on Integrated Pollution Prevention and Control (IPPC directive), paper production, phosphoric acid production, streamlined life-cycle assessment (LCA)

SUMMARY:

In light of the European Directive on Integrated Pollution Prevention and Control (IPPC Directive), traditional environmental regulation can be improved using the framework of industrial ecology. The objective of the IPPC Directive is to achieve a high level of protection of the environment as a whole (Article 1) by applying the best available techniques (BAT). In essence, the IPPC Directive obliges member states of the European Union to include considerations such as resources, energy, waste, and multimedia emissions when permitting industrial installations. This is a marked contrast to traditional environmental regulation that focuses on individual media of an individual site. In order to take all considerations into account, an integrated assessment of technologies is needed, for which a standard method is currently lacking. In this article, a systematic approach is introduced for the integrated assessment of IPPC technologies using life-cycle assessment (LCA), a form of environmental assessment that can be broadened to an overall assessment of environmental, economic, and social aspects. This systematic approach has proven to be successful for the environmental assessment of the described cases. It is suggested here that weighting can be omitted for the evaluation of IPPC technologies. Leaving the weighting step to competent authorities of member states and allowing them to consider local issues provides maximum opportunity for the subsidiarity and flexibility principles of the IPPC Directive.

《产业生态学报》

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题目: 作为一种文化现象的产业生态学: 论规范化立场的客观性

作者: Frank Boons 和 Nigel Roome

关键词: 行为研究, 意识形态, 隐喻, 规范性, 客观性, 社会科学

摘要: 从 Braden Allenby 近期在本杂志上发表的一篇专栏文章出发, 我们认为产业生态学领域的研究人员应当反映本领域规范性的一面。我们认为通过对诸如认识论、应用隐喻的内在规范性特点, 以及本学科的研究与其实际应用关系等内容进行明晰的探讨有利于该学科的发展。

在《文化和产业生态学》一文中, Allenby 提出并阐述了一些产业生态学的关键问题。我们认为他的观点忽略一些与本学科发展息息相关的问题。本文旨在进一步召开关于什么是产业生态学而什么不是产业生态学的讨论。

我们首先归纳了 Allenby 的推理思路。我们围绕着客观性概念, 以及他所提出的有关客观科学、规范性立场、观点和一时的热点之间关系的问题来分析他的分析。虽然 Allenby 强烈号召产业生态学应当保持客观性、避免规范性的立场, 我们认为关于一个学科领域应该包括什么内容、不应该包括什么内容的立场本身就是规范性的。虽然科学力求采用客观的方法, 但科学家们却很少不采取这种规范性立场。这些立场需要公开明确以便开展广泛的争论。Allenby 还指出产业生态学的理论研究应当与其实际应用相互独立。而我们认为这两方面相互结合大有裨益。

我们担心 Allenby 的观点阻碍了产业生态学研究的重要核心问题的讨论。我们讨论了与客观性概念有关的几个关键问题, 并提出了一个关于产业生态学的文化和意识形态研究的日程表。

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Industrial Ecology as a Cultural Phenomenon: On Objectivity as a Normative Position

Frank Boons and Nigel Roome

KEYWORDS:

action research, ideology, metaphor, normative, objectivity, social science

SUMMARY:

Taking a recent column by Braden Allenby in this journal as a starting point, we argue the need for researchers in the field of industrial ecology to reflect upon its normative aspects. We argue that the field will advance through an explicit discourse on such issues as epistemological positions, the inherent normative nature of using metaphors, and the way in which the field of study relates to the field of practice. In 'Culture and Industrial Ecology,' Allenby raises, and begins to address, some critical questions that define the field of industrial ecology. We suggest that his arguments dismiss too lightly issues that are central to this developing field. The purpose of this reply is to open up for further discussion what industrial ecology is, and what it is not. We begin by summarizing Allenby's line of reasoning. We explore his arguments around the notion of objectivity and the questions he raises about the relationship among objective science, normative positions, opinions, and fads. While Allenby makes a strong plea for industrial ecology to maintain objectivity and avoid normative positions, we contend that any positions on what should or should not be included in a field of study carry normative intent. Although science might seek to be objective in its method, scientists are rarely free of such normative positions. These positions need to be explicit and open to debate. Also, Allenby position implies that industrial ecology, as a field of study should be separated from industrial ecology as a field of practice. We argue that the interrelation of these fields provides important advantages. Our main concern is that Allenby's position forestalls discussion on important issues at the heart of the field of study. We examine some key issues around the concept of objectivity and propose an agenda for research on the cultural and ideological aspects of industrial ecology.

《产业生态学报》

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题目: 意大利经济的材料流分析

作者: Ottilia De Marco, Giovanni Lagioia 和 Elsa Pizzoli Mazzacane

关键词: 主要材料流分析 (MFA), 直接物质输入 (DMI), 隐流 (HF), 物质效率, 资源流, 总物质需求 (TMR)

摘要: 本文分析了 1994 年意大利经济活动的物流状况, 并与世界资源研究所 (WRI) 牵头组织德国、日本、荷兰和美国进行的类似研究的结果进行比较。为进行国别对比, 我们分析评估了意大利国内生产的物质量以及进口的材料和商品量。我们还就国内生产量、进口和出口等因素评估了各种物流 (包括隐流) 的大小。

我们的分析表明, 意大利 1994 年的总物质需求量 (TMR) 是 1609Mt, 其中的 727Mt 为直接物质输入 (DMI)。经过与其他国家的 TMR 和 DMI 进行对比, 意大利人均物流和单位 GDP 物流均低于美国、德国和荷兰。本文还对上述结果进行了分析。虽然上述研究存在明显的局限性, 但研究发现仍可以为制定环境政策提供有益的启示。

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Material Flow Analysis of the Italian Economy

Ottilia De Marco, Giovanni Lagioia and Elsa Pizzoli Mazzacane

KEYWORDS:

bulk-materials flow analysis (MFA), direct material input (DMI), hidden material flow (HF), materials efficiency, resource flows, total material requirement (TMR)

SUMMARY:

This article analyzes the mass of the materials that flowed through the Italian economy during 1994 and compares the results with a similar analysis of Germany, Japan, the Netherlands, and the United States published by a collaboration headed by the World Resources Institute. In order to perform this comparison, we have evaluated the mass of the materials produced within the country and the mass of the imported materials and commodities. For the domestic production, imports and exports, we have also evaluated the mass of the materials that accompany—'hidden flows'—each physical flow. Our analysis indicates that, in 1994, Italy experienced total material requirements (TMR) of 1,609 million metric tons (Mt), of which 727 Mt was used as direct material input (DMI). A comparison with other developed countries shows that the TMR and DMI flows, measured in mass per person and in mass per GDP unit, are, in Italy, lower than the corresponding figures evaluated for the United States, Germany, and the Netherlands. An interpretation of these results is presented. The analysis may give information useful for environmental considerations, although the limits of such an approach are made clear.

《产业生态学报》

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题目: 生命周期评价与排放的时间分布: 开展基于在用车辆的分析

作者: Frank Field, Randolph Kirchain 和 Joel Clark

关键词: 铝, 汽车, CO₂ 排放, 交换分析法, 时间, 钢材

摘要: 虽然 LCA 的优点之一就是该方法以产品为中心, 但是这样做的前提可能与环境问题的现实相矛盾。本文通过一系列的数学推导证明, 所有在用的产品 (而不仅是单个产品) 常常是更恰当的分析单位。这种以所有在用车辆为基础的评价方法为比较替代产品所产生的污染负荷提供了更广阔的分析视野, 并且还可以省略以产品为导向的 LCA 方法所必须的一些简化处理。我们通过对以钢材为主与以铝材为主的汽车的污染排放这样一个例子, 来对比两种不同分析方法的结果。这种评价方法结果表明, 滞后时间 (例如使用轻型铝制汽车到一定时间后所节省的能源才能抵消因生产铝材而多消耗的能源) 要比由以产品为导向的 LCA 所预测的时间长得多。这种基于在用车辆的分析方法明确地将时间作为一个比较型 LCA 的关键因素, 并且提出分析人员在选择合适的时间尺度中扮演什么角色的重要问题。此外, 由于将时间做为 LCA 的一个重要尺度, 在不同时段上发生的环境影响将得到更加直接和一致的处理。

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Life Cycle Analysis and Temporal Distributions of Emissions: Developing a Fleet-based Analysis

Frank Field, Randolph Kirchain and Joel Clark

KEYWORDS:

aluminum, automobile, carbon dioxide (CO₂) emissions, crossover analysis, fleet, steel

SUMMARY:

Although the product-centered focus of life-cycle assessment has been one of its strengths, this analytical perspective embeds assumptions that may conflict with the realities of environmental problems. This article demonstrates, through a series of mathematical derivations, that all the products in use, rather than a single product, frequently should be the appropriate unit of analysis. Such a 'fleet-centered' approach supplies a richer perspective on the comparative emissions burdens generated by alternative products, and it eliminates certain simplifying assumptions imposed upon the analysis by a product-centered approach. A sample numerical case, examining the comparative emissions of steel-intensive and aluminum-intensive automobiles, is presented to contrast the results of the two approaches. The fleet-centered analysis shows that the 'crossover time' (i.e., the time required before the fuel economy benefits of the lighter aluminum vehicle offset the energy intensity of the processes used to manufacture the aluminum in the first place) can be dramatically longer than that predicted by a product-centered life-cycle assessment. The fleet-centered perspective explicitly introduces the notion of time as a critical element of comparative life-cycle assessments and raises important questions about the role of the analyst in selecting the appropriate time horizon for analysis. Moreover, with the introduction of time as an appropriate dimension to life-cycle assessment, the influences of effects distributed over time can be more naturally and consistently treated.

《产业生态学报》

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题目: 西欧卡车轮胎的动态综合分析

作者: Pieter J.H. van Beukering 和 Marco A. Janssen

关键词: 动态模拟模型, 产业代谢, 生命周期评价 (LCA), 再循环, 情景分析, 轮胎

摘要: 从产业代谢的视角来分析评估汽车轮胎, 我们有可能发现新颖、实用的减少轮胎环境影响的途径。这既可以集中采取技术措施, 例如选择材料、设计产品和回收材料, 也可以考察制度和社会障碍和激励, 例如开放废物交易市场或者改变消费者行为。本文介绍了一个的包含西欧卡车轮胎地全生命周期并且评价其环境和经济影响的动态模型。该模型模拟了不同的情景, 例如更长的轮胎使用寿命、更好的轮胎压力维护、更多使用便宜的亚洲轮胎, 以及更多使用节能轮胎 (“生态轮胎”) 等。初步研究结果表明, 在各种影响因素中, 由于轮胎对汽车燃料效率的决定作用, 95% 的环境影响来自于轮胎使用阶段。保持较好的轮胎维护以及使用生态轮胎比使用耐用轮胎和廉价的亚洲轮胎具有更大的经济和环境效益。分析结果意味着有关轮胎的环境政策应该从其生产和废物处置阶段转移到轮胎使用阶段。分析结果还表明试图 4 倍甚至 10 倍地提高轮胎生产的材料使用效率还不如改进轮胎质量及其维护更加重要。

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A Dynamic Integrated Analysis of Truck Tires in Western Europe

Pieter J.H. van Beukering and Marco A. Janssen

KEYWORDS:

dynamic simulation modeling, industrial metabolism, life-cycle assessment (LCA), recycling, scenario analysis, tires

SUMMARY:

By evaluating tires from a perspective of industrial metabolism, potential novel and practical ways to reduce their environmental impact can be found. This may be achieved by focusing on technological issues such as choosing materials, designing products, and recovering materials, or by looking at institutional and social barriers and incentives such as opening waste markets or changing consumer behavior. A model is presented for the life cycle of truck tires in Western Europe that is dynamic in nature and values both environmental and economic consequences. Various scenarios are simulated including longer tire lifetimes, better maintenance of tire pressure, increased use of less-expensive Asian tires, and increased use of fuel efficiency-enhancing tires ('eco-tires'). Tentative results indicate that, among other things, more than 95% of the overall environmental impact during the life of a tire occurs during the use of the tire, due to the impact of tires on automotive fuel efficiency. Better maintenance of tire pressure and use of eco-tires produce greater environmental and economics benefits than more-durable and/or less-expensive (Asian) tires. These results imply that the emphasis in environmental policies related to tires should shift from the production and the waste stages to the consumption stage. It also suggests that the focus on materials throughput and associated improvements through factor 4 or factor 10 advances in reduction in mass are less important than the quality of the tires and their management.

《产业生态学报》

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题目: 提高汽车用铝对于美国汽车再循环设施的经济影响

作者: Jane E. Boon, Jacqueline A. Isaacs 和 Surendra M. Gupta

关键词: 铝, 汽车, 拆卸, 目标规划, 再循环, 废料

摘要: 汽车生产中更多地使用铝合金替代钢材, 是由于汽车制造商为了降低燃料消耗和减少尾气排放。现有的汽车再循环设施对于回收以钢材为主要材料的报废汽车已经十分成熟、有利可图, 然而不断增加的铝材料的使用却为汽车再循环系统的前期处理企业——拆车商和切割商——提出了新的挑战与机遇。我们使用目标管理方法, 建立了一个汽车再循环系统模型用来评估几种使用不同铝材含量汽车 (AIV) 再循环的物流和过程的盈利性。第一种情景模拟了高铝含量汽车 (AIV) 在当前汽车再循环系统下的回收过程。无论有色金属价格如何改变, 对第一种情景作出下列各种变化都会使汽车拆卸商和切割商盈利性发生相应的变化: 汽车的较大部件以零件形式拆掉; 拆车商卸下的零件含有较高铝成分; 拆车商卸下的聚合物数量增加; 拆卸成本增加; 汽车切割残渣和危险废物的处置费用增加; 切割商的加工成本增加; 不同的高铝含量汽车设计得到改进。这些益处也和使用一体化车身的钢材汽车所带来的好处相比较来强调利用现有回收设施再循环高铝含量汽车 (AIV) 所带来的影响。结果显示现有的汽车再循环系统能够在不产生严重经济冲击的前提下回收高铝含量汽车 (AIV)。

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Economic Impact of Aluminum Intensive Vehicles on the US Automotive Recycling Infrastructure

Jane E. Boon, Jacqueline A. Isaacs and Surendra M. Gupta

KEYWORDS:

aluminum, automobile, disassembly, goal programming, recycling, scrap

SUMMARY:

The use of aluminum alloys in automobile production is growing as automakers strive to lower vehicle fuel consumption and reduce emissions by substituting aluminum for steel. The current recycling infrastructure for end-of-life vehicles is mature, profitable, and well suited to steel-intensive vehicles; increased use of cast and wrought aluminum, however, will present new challenges and opportunities to the disassembler and shredder, who now comprise the first stages of the vehicle recycling infrastructure. Using goal programming techniques, a model of the auto recycling infrastructure is used to assess the materials streams and process profitabilities for several different aluminum-intensive vehicle (AIV) processing scenarios. The first case simulates the processing of an AIV in the current recycling infrastructure. Various changes to the initial case demonstrate the consequences to the disassembler and shredder profitabilities whenever the price of nonferrous metals changes; greater fractions of the vehicle are removed as parts; the parts removed by the disassembler have increased aluminum content; the quantity of polymer removed by the disassembler is increased; the disassembly costs increase; the disposal costs for shredder residue and hazardous materials increase; the shredder processing costs increase; and different AIV designs are considered. These profits are also compared to those achieved for a steel unibody vehicle to highlight the impact of introducing AIVs into the existing infrastructure. Results indicate that the existing infrastructure will be able to accommodate AIVs without economic detriment.

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题目: 改进独立家庭住宅的生命周期能源消耗、成本和策略

作者: Gregory A. Keoleian, Steven Blanchard 和 Peter Reppe

关键词: 建筑材料, 生态效率, 温室气体排放, 生命周期成本分析, 生命周期能源分析, 单个家庭住宅

摘要: 本文评价了当代美国面积为 2450 平方英尺 (228 平米) 住宅 (标准住宅) 的生命周期能源、温室气体排放和成本, 来发现住宅使用前 (建材生产和住宅建设), 使用中 (包括维修和改善), 和建筑拆除阶段存在的各种节能机会。房屋建设维护材料和设备共计 306 吨。就一个使用寿命为 50 年的住宅而言, 其使用阶段的能耗高达生命周期总能耗的 91%。本模型模拟了一个使用功能相当但采用了 11 项节能措施的节能住宅。这些措施导致了此节能住宅在整个生命周期的能耗 (6,400 GJ) 大幅下降, 而标准住宅的能耗高达 16,000 GJ。对于节能住宅而言, 材料的内含能量是很重要的; 使用前阶段能源消耗占整个生命周期的 26%。对一个考虑了未来能源价格因素的标准住宅而言, 其折现后的 (按照 4% 的利率) 的生命周期成本, 包括抵押贷款、能源、维护和改造费用在 426,700 美元至 454,300 美元之间。对于一个节能住宅而言, 节能减少的费用被较高的抵押贷款成本所抵消, 总生命周期成本在 434,100 美元至 443,000 美元之间。标准住宅在整个生命周期中排放的温室气体相当于 1,010 t CO₂ 当量, 而相应的节能住宅的 CO₂ 排放只有 370 tCO₂ 当量。

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Life Cycle Energy, Costs, and Strategies for Improving a Residential House

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KEYWORDS:

building materials, eco-efficiency, greenhouse gas emissions, life-cycle cost analysis, life-cycle energy analysis, single-family house

SUMMARY:

The life-cycle energy, greenhouse gas emissions, and costs of a contemporary 2,450 sq ft (228 m²) U.S. residential home (the standard home, or SH) were evaluated to study opportunities for conserving energy throughout pre-use (materials production and construction), use (including maintenance and improvement), and demolition phases. Home construction and maintenance materials and appliances were inventoried totaling 306 metric tons. The use phase accounted for 91% of the total life-cycle energy consumption over a 50-year home life. A functionally equivalent energy-efficient house (EEH) was modeled that incorporated 11 energy efficiency strategies. These strategies led to a dramatic reduction in the EEH total life-cycle energy; 6,400 GJ for the EEH compared to 16,000 GJ for the SH. For energy-efficient homes, embodied energy of materials is important; pre-use energy accounted for 26% of life-cycle energy. The discounted (4%) life-cycle cost, consisting of mortgage, energy, maintenance, and improvement payments varied between \$426,700 and \$454,300 for a SH using four energy price forecast scenarios. In the case of the EEH, energy cost savings were offset by higher mortgage costs, resulting in total life-cycle cost between \$434,100 and \$443,200. Life-cycle greenhouse gas emissions were 1,010 metric tons CO₂ equivalent for an SH and 370 metric tons for an EEH.