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题目：从工程经济学到扩展㶲核算：由货币成本走向资源成本核算的可能途径

作者：Enrico Sciubba

关键字：能量转化，㶲经济学，㶲，外部性，资源核算，热力学

摘要：与传统的基于货币成本的方法不同，扩展㶲核算法 (EEA) 是一种根据资源当量价值来计算商品成本的方法。这样，分析人员可对一个复杂系统做出更全面更有意义的评价。EEA 方法的新颖性和独特优势在于它将所有劳动力、资本和环境防治成本均量化纳入系统㶲流平衡表，并通过资源进行衡量。EEA 法与 Sraffa 方法在结构上有一些相似之处。Sraffa 法是一种通过其它相关商品来表示一种商品生产的网络描述法，它从核算生产链中的不可避免的能量耗散（其经济学含义最早为 Georgescu-Roegen 所阐述）出发。同样，EEA 法还借鉴了 Daly 关于资源经济学的开创性研究成果和 Szargut 的累积㶲消耗方法。

本文讨论了如何使用扩展㶲流图来表述生产过程，并指出一些单纯采用货币流分析无法解决的问题可以通过 EEA 圆满解决。EEA 的主要缺点在于它对应用对象的时空特性有一些限制，很大程度上取决于其具体定义和特定的社会条件。本文在结论中讨论了 EEA 与其它方法（如生命周期评价和环境足迹分析）的互为补充和相互扩展情况。

Journal of Industrial Ecology

From Engineering Economics to Extended Exergy Accounting: A Possible Path from Monetary to Resource-Based Costing

Enrico Sciubba

KEYWORDS:

energy conversion, exergo-economics, exergy, externalities, resource accounting, thermodynamics

SUMMARY:

The article describes the extended exergy accounting technique (EEA), a novel method for computing the cost of a commodity based on its resource-base equivalent value (as opposed to its monetary cost) that enables the analyst to perform more complete and meaningful assessments of a complex system. The claim made here is that the novelty, as well as the decisive advantage, of EEA consists in its being entirely and uniformly resource based, thanks to the inclusion in the system balance of exergetic fluxes equivalent to labor, capital, and environmental remediation costs. In this respect, EEA owes some of its structural formalism to Sraffa's network representation of the economic production of commodities by means of other commodities, which it extends by accounting for the unavoidable energy dissipation in the productive chain (whose economic implications were first discussed by Georgescu-Roegen), to Daly's pioneering work in resource-oriented economics, and to Szargut's cumulative exergy consumption method.

The representation of a process by means of its extended exergy flow diagram is discussed in this article, and it is argued that some of the issues that are difficult to address with a purely monetary approach can be properly resolved by EEA. The main shortcomings of EEA are its intrinsic locality in time and space: They are demonstrated to be necessary and not casual consequences of its very definition and of the nonuniformity of societal conditions. In the conclusions, some indications are given as to the possibility of using this new technique to complement (and extend) other current tools, such as life-cycle assessment or environmental footprint analysis.

题目：瑞典耕地土壤中镉元素再分布的物质存量研究

作者：Sten Karlsson, Fredrik Fredrikson, John Holmberg

关键字：耕地土壤，镉，环境指标，不可更新资源，物料流分析(MFA)，物质流分析(SFA)

摘要：本文阐述了一种基于物质存量为基础来分析物质在环境中再分布状况的研究方法。该方法用于分析避免将来镉元素在瑞典耕地土壤中过度积累的各种要求及可能性。本文分析了人类未来利用镉的各种活动，来估算各种镉源潜在进入耕地土壤的流量。该研究还提出了为实现相应的镉累积目标所需削减的镉排放量，并与过去与目前镉污染治理的实际进展以及现有各种镉污染治理技术进行了比较。

　　这一基于物质存量的方法与传统的基于物质流分析情景分析相比，能够提供一些额外的重要信息，例如土壤内的镉存量对镉的长期积累具有重要影响。该方法还提供了一些重要指标，如镉削减指标等，从而在综合政策层面上弥补了现有环境法规和质量标准的不足。存量概念还有助于提出改进镉的再循环的措施。

　　本文研究表明，未来流入瑞典土壤中的镉有可能比过去大为减少，尽管这在很大程度上取决于瑞典以外地区的政策和行动。未来源于大气的镉沉降存在很大的不确定性，特别是那些小规模分散污染源，比如燃料燃烧和自然界中沉积的镉的二次扩散。此外，人们还必须采取措施限制镉通过矿物磷肥的形式进入土壤。

Future Redistribution of Cadmium to Arable Swedish Soils: A Substance Stock Analysis

Sten Karlsson, Fredrik Fredrikson, and John Holmberg

KEYWORDS:

arable soils, cadmium, environmental indicators, exhaustible resource, materials flow analysis (MFA), substance flow analysis (SFA)

SUMMARY:

This article describes a stock-based methodology designed to analyze the redistribution of substance stocks to environmental compartments. The methodology is then applied to investigate the requirements and possibilities for avoiding undesired future accumulation of cadmium in Swedish arable soils. A prospective decomposition analysis of human cadmium mobilization is thus performed to estimate the potential amounts that can end up in arable soils through different flows from the cadmium stocks identified. The requirements for cadmium abatement to achieve prescribed goals for accumulation limits are determined and compared with past and current achievements and with the varying qualities of possible abatement methods.

A stock-based methodology adds some important information to traditional scenario techniques based on substance flow analysis. The most obvious is that the fact that stocks are limited actually matters for long-term accumulation of cadmium in arable land. The methodology may also contribute certain indicators, for instance, on abatement requirements, which could serve as a complement to regulation and local quality measures on specific flows at an aggregated policy level.
The stock perspective also sheds new light on actions such as increased recycling.

Concerning the specific example used in the study, it is possible to achieve a future addition of cadmium in Swedish agricultural soils that is significantly lower than in the past, although the amount depends to a large degree on activities and policies outside Sweden. Considerable uncertainty exists regarding future depositions from air, especially that from distributed small-scale emissions from fuel burning and reemission of already deposited cadmium from natural media. Measures must also be taken to guarantee a continued low addition in the form of mineral phosphorus fertilizers.

题目：无铅电器的使用：政策分歧与知识不足

作者：Julie M. Schoenung, Oladele A. Ogunseitan, Jean-Daniel M. Saphores, Andrew A. Shapiro

关键字：电子废物，重金属，铅(Pb)，有害物质减量化(RoHS)，焊料，废旧电子电气设备(WEEE)

摘要：十多年来有关铅在电器中的使用争议很大。我们充分认识了铅的毒性，然而对铅的替代材料的毒性却知之甚少。随着电子废物数量的增长，人们试图通过法律手段和企业营销策略来减少电器对某些有害物质的使用。本文认为把环境立法置于工程和经济性之上，不顾目前关于替代材料的认识不足，可能会导致应用不良的材料来替换铅。弥补这些知识差距，需要评估和修改跨州和跨国电子废物的政策效果，检测替代焊料合金的可靠性，改进废物管理、电子产品设计、产品废弃等许多复杂方面的风险评估机制，仔细研究原料采掘过程的环境影响分配与评估方法，深入思考废弃产品的各种处理手段与风险。

不同行政区划内的政策差异可能加剧铅对环境和人体健康的影响。为解决这一难题，本文首先回顾了关于电器中使用铅金属的各类法规政策，随后评估了现阶段替代焊料的发展状况（包括产品设计、环境表现及风险评价等）。与以往的研究相似，本研究发现采用替代焊料来替换铅基焊料尚存很大的不确定性。为此，需要开展下列四项研究：替代焊料合金的工程可靠性、替代焊料废弃后的风险评估、确定原料开采环境影响的方法以及采用替代焊料的产品设计和废物管理的影响评价。此外，缩小政策差异与知识不足还有赖于在材料使用、产品市场开发和电子废物管理等领域的国际合作。

Adopting Lead-Free Electronics: Policy Differences and Knowledge Gaps

Julie M. Schoenung, Oladele A. Ogunseitan, Jean-Daniel M. Saphores, and Andrew A. Shapiro

KEYWORDS:

e-waste, heavy metals, lead (Pb), reduction of hazardous substances (RoHS), solder, waste electronic and electrical equipment (WEEE)

SUMMARY:

For more than a decade, the use of lead (Pb) in electronics has been controversial: Indeed, its toxic effects are well documented, whereas relatively little is known about proposed alternative materials. As the quantity of electronic and electrical waste (e-waste) increases, legislative initiatives and corporate marketing strategies are driving a reduction in the use of some toxic substances in electronics. This article argues that the primacy of legislation over engineering and economics may result in selecting undesirable replacement materials for Pb because of overlooked knowledge gaps. These knowledge gaps include the need for an assessment of the effects of changes in policy on the flow of e-waste across state and national boundaries; the need for further reliability testing of alternative solder alloys; the need for further toxicology and environmental impact studies for high environmental loading of the alternative solders (and their metal components); the need for improved risk assessment methodologies that can capture complexities such as changes in waste management practices, in electronic product design, and in rate of product obsolescence; the need for carefully executed allocation methods when evaluating the impact of raw material extraction; and for in-depth risk assessment of alternative end-of-life options.

The resulting environmental and human health consequences may be exacerbated by policy differences across political boundaries. To chart a way out of this conundrum, legislation and policies dealing with Pb in electronics are first reviewed. A discussion of the current state of knowledge on alternative solder materials relative to product design, environmental performance, and risk assessment follows; consistent with previous research, this analysis finds that there is great uncertainty in the trade-offs between Pb-based solders and proposed replacements. Four specific research needs are identified: the engineering reliability of alternative alloys, risk assessments of end-of-life alternatives, methodologies for allocating the impacts of raw material extraction, and assessments of the impacts of emerging technologies for product design and waste management. Bridging policy and knowledge gaps will require increased international cooperation on materials use, product market coverage, and e-waste end-of-life management.

题目：能耗效率可否每年持续改进 5%以上？

作者：Kornelis Blok

关键字：生态效率，居民能耗，制造业能耗，部门能耗，技术创新，交通能耗

摘要：终端能耗率每年减少 1%到 2%通常是可行的。那么，对新装备和新建筑而言 5%以上的更大改进是否可行？本文试图回答这一问题。

通过调查工业、住宅和交通部门的终端能耗状况，在未来的 10 到 20 年之内，新设备和新建筑能耗水平每年持续降低 5%以上是完全可能的。但这一趋势能否在更长时间内保持目前尚无定论。

能效的提高对社会总能耗的影响取决于两个因素——新增的耗能活动与生产资本置换率。综合考虑这两个方面，发达国家的绝对能耗在未来 50 年之内在现有水平上减少 50%也不是幻想。这需要付出相当的努力，但技术创新尚有余力实现这一目标。

Journal of Industrial Ecology

Improving Energy Efficiency by Five Percent and More per Year?

Kornelis Blok

KEYWORDS:

eco-efficiency, household energy, manufacturing energy, specific energy consumption, technological innovation, transportation energy

SUMMARY:

Reduction of specific energy consumption by 1% to 2% per year is typically what is considered feasible for end-use energy applications. This article tries to answer the question of whether much higher rates, for example 5% and more, are feasible for new equipment, installations, and buildings.

After examining some end-use functions in industry, buildings, and the transport sector, it is concluded that for the foreseeable future—that is, not more than 10 to 20 years into the future—such high rates of reduction of specific energy consumption are indeed possible. For the longer term, no definitive proof is available, but there are also no indications that such high rates could not be maintained.

The effect of the reduction of specific energy consumption on total energy use depends on the growth of energy-using activities and on the replacement rates of capital stock. Taking these into account, it is estimated that for industrialized countries a reduction of absolute total energy use by 50% in 50 years compared with the current levels is possible. Such a reduction requires a huge effort in innovation; however, the possibilities for stimulating innovation seem not to be exhausted yet.

题目：澳大利亚基础工业的物料存量与流量框架模型

作者：James A. Lennox, Graham Turner, Rob Hoffman, Bert McInnis

关键字：基础工业，产业代谢，质量守衡，物料流分析 (MFA)，实物投入-产出模型，资本年代模型

摘要：澳大利亚存量与流量框架(ASFF)模型不但展现了澳大利亚实物经济的历史图景，而且展望了 2050 乃至 2100 年的长期远景。模型获得的情景可用来研究当前和未来决策对人类实物方面可持续性的长远影响。本文介绍了 ASFF 所依据的方法及其一个关键模块——基础工业物流的动态实物投入-产出模型。

ASFF 模型的物料系统描述了物流及其在工业过程中的转化情况。该模型通过动态的投入-产出系数以及资本年代模型，可以对长期技术发展开展情景分析。因此，该模型包含大量参数，它们可以采用默认值，当然研究人员也可对此进行调整，来更好地模拟可能情景。物流模型综合自下而上的过程分析与自上而下的物流能流统计。本文通过几个实例说明了如何运用该模型模拟澳大利亚的重工业系统，并讨论了进一步发展物流模型的可能。

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Modeling Basic Industries in the Australian Stocks and Flows Framework

James A. Lennox, Graham Turner, Rob Hoffman, and Bert McInnis

KEYWORDS:

basic industries, industrial metabolism, mass balance, materials flow analysis (MFA), physical input-output model (PIOT), vintage model

SUMMARY:

The Australian stocks and flows framework (ASFF) is a tool for establishing a coherent historical picture of the Australian physical economy and for testing long-term future scenarios (up to 2050 or even 2100). These scenarios can be used to investigate the long-term physical consequences of current and future choices affecting the physical dimensions of sustainability. In this article we describe the methodology for and construction of a key component of ASFF: a dynamic physical input-output model of material flows in the basic industries.

The materials model in ASFF describes physical flows and their transformation by industrial processes. The model's structure permits scenario analysis of long-term technological change by permitting time-varying input-output coefficients and vintage models of capital stocks. As a consequence, the model contains a large number of parameters, which can be left at default settings or adjusted as the modeler sees fit, in order to simulate the widest possible range of physically realizable scenarios. The materials model is built using a methodology that integrates bottom-up process analysis with top-down statistics on material and energy flows. We present some examples showing how the materials model has been implemented to model Australian heavy industries. Several possibilities for further developing the materials model are also described.

题目：非物质化：不只是重量的问题

作者：Ester van der Voet, Lauran van Oers, Igor Nikolic

关键字：非物质化，环境影响，指标，生命周期评价(LCA)，材料，物料流分析(MFA)

摘要：本文介绍一项支持荷兰非物质化环境政策的研究。该研究旨在开发一种用于确定导致荷兰主要环境问题的物料的方法。在结合物流核算(MFA)和生命周期评价(LCA)两种常用方法的基础上，力求赋予物流一套环境影响权重。该方法被用于研究几种物料。研究所用 LCA 软件中的标准数据库提供了每千克物料的环境影响数据。这些单位质量物料的环境影响乘以物料在荷兰的年度总流量，即可表示每种物料的环境影响。

　　文章从非物质化这一研究背景出发，描述了研究方法及其应用情况，最后比较分析了基于影响和基于质量的两种不同指标体系。不同物料的单位质量环境影响可能相差多个数量级。总体看来，大宗物料的单位质量环境影响比小规模物料的对应值要小。因此，各种次材料的单位质量影响与总质量之乘积与单位质量影响或物料质量相比，在数量级上的差别要小得多。具有较大环境影响物料，既可能是用量较小但每千克环境影响极高的材料（如重金属），也可能是用量很大而单位质量环境影响又不太低的材料（如农业制品和塑料）。

Dematerialization: Not Just a Matter of Weight

Ester van der Voet, Lauran van Oers, and Igor Nikolic

KEYWORDS:

Dematerialization, environmental impacts, indicators, life-cycle assessment (LCA), materials, materials flow analysis (MFA)

SUMMARY:
This article contains the results of a study performed to support the Dutch environmental policy of dematerialization. The aim of the study was "to develop and apply a methodology to identify the materials that contribute most to the environmental problems in the Netherlands." The developed methodology combines aspects of material flow accounting (MFA) and life-cycle assessment (LCA) and aims at adding a set of environmental weights to the flows of the materials. The methodology was applied to a number of materials. For these materials, impacts per kilogram were extracted from a standard LCA database in combination with standard LCA software. These impacts per kilogram are then multiplied with the yearly throughput of each material in the Netherlands to obtain an indication of the environmental impacts associated with each material.

　　This article contains a discussion of dematerialization as background for the research, a description of the methodology followed by the results of its application, and a discussion of the comparison of impact-based versus mass-based indicators. Materials vary many orders of magnitude in their impacts per unit mass. In general, the impact per unit of mass of bulk materials is lower than that of materials used in small quantities. This implies that the variation in orders of magnitude of impact multiplied by mass is much less than either mass or impact per kilogram separately. High-priority materials based on impact multiplied by mass are either small-quantity materials with very high impacts per kilogram (such as heavy metals) or large-quantity materials with not-so-low impacts per kilogram (such as materials from agriculture and plastics).

题目：国民经济的生态足迹强度

作者：Richard York, Eugene A. Rosa, Thomas Dietz

关键字：生态效率，生态足迹(EF)，生态现代化，环境库兹涅茨曲线(EKC)，IPAT 等式，资源效率

摘要：至少有三种观点 - 产业生态学(IE)、生态现代化理论(EMT)和环境库兹涅茨曲线(EKC) - 强调通过改进生产系统，大幅减少经济发展的环境影响来实现人类社会的可持续发展。但单位效率的改进能否抵消生产规模扩大的环境影响？为此我们分析了不同国家单位国内生产总值(GDP)的生态足迹(EF)。EF 是一个广为认可的衡量人类环境压力的定量指标，一个国家的 EF 就是生产该国所消耗的资源和吸纳该国所排放污染的土地面积。我们的研究意外发现，不同国家间的单位 GDP 的 EF 值变化不大。这表示不同国家之间，特别是富裕国家之间的 EF 强度（或生态效率）的弹性有限。富裕发达国家的 EF 强度最低（或生态效率最高），但这不足以抵销其更大生产规模所导致的额外环境影响。由此可见，现代化和经济发展本身并不能实现人类社会的生态可持续发展。

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The Ecological Footprint Intensity of National Economies

Richard York, Eugene A. Rosa, and Thomas Dietz

KEYWORDS:

eco-efficiency, ecological footprint (EF), ecological modernization, environmental Kuznets curve (EKC), IPAT equation, resource efficiency

SUMMARY:

At least three perspectives—industrial ecology (IE), ecological modernization theory (EMT), and the "environmental Kuznets curve" (EKC)—emphasize the potential for sustainability via refinements in production systems that dramatically reduce the environmental impacts of economic development. Can improvements in efficiency counterbalance environmental impacts stemming from the scale of production? To address this question we analyze cross-national variation in the ecological footprint (EF) per unit of gross domestic product (GDP). The EF is a widely recognized indicator of human pressure on the environment. The EF of a nation is the amount of land area that would be required to produce the resources it consumes and to absorb the wastes it generates. The most striking finding of our analyses is that there is limited variation across nations in EF per unit of GDP. This indicates limited plasticity in the levels of EF intensity or eco-efficiency among nations, particularly among affluent nations. EF intensity is lowest (eco-efficiency is highest) in affluent nations, but the level of efficiency in these nations does not appear to be of sufficient magnitude to compensate for their large productive capacities. These results suggest that modernization and economic development will be insufficient, in themselves, to bring about the ecological sustainability of societies.

《产业生态学报》

题目：不确定条件下基于生命周期的固体废物管理

作者：P. Ozge Kaplan, Morton A. Barlaz, S. Ranji Ranjithan

关键字：决策，生命周期清单(LCI)，蒙特卡洛法，城市生活垃圾(MSW)，固体废物管理(SWM)，不确定性

摘要：开发一种低成本高环境效益的综合固体废物管理方法是一项复杂的任务。固体废物系统各单元(如收集、再循环和焚烧等)之间联系繁多，大量设计参数都影响最终的经济成本和环境排放。设计和操作参数的不确定必将导致成本和环境表现的不确定。本文所述的方法通过考虑输入参数的随机性，改进了现有综合废物管理决策支持工具(ISWM DST)(Solano 等，2002b)的性能。文章通过一个假设的典型城市案例阐述了该方法的不确定分析能力。分析结果显示更多的经济投入并不能保证将环境污染减少到预期的程度；某些固体废物管理策略值得推荐：在确定性的条件下可能与其它策略的效果差不多，但不确定条件下却具有更强的可靠性。决策者往往要负责评价各类固体废物管理方案的环境表现(如温室气体排放等等)，不确定性分析在这方面颇有帮助，可以促进 ISWM DST 在决策者中的应用。

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Life-Cycle-Based Solid-Waste Management under Uncertainty

P. Ozge Kaplan, Morton A. Barlaz, and S. Ranji Ranjithan

KEYWORDS:

decision making, life-cycle inventory (LCI), Monte Carlo, municipal solid waste (MSW), solid waste management (SWM), uncertainty

SUMMARY:
The development of integrated solid-waste management (SWM) strategies that are efficient with respect to both cost and environmental performance is a complex task. There are numerous interrelations among different unit operations in the solid-waste system (e.g., collection, recycling, and combustion), and a large number of design parameters that affect estimates of cost and environmental emissions. Uncertainty in design and operational parameters can lead to uncertainty in the estimates of cost and emissions. This article describes an extension of the capability of the Integrated Solid Waste Management Decision Support Tool (ISWM DST) (Solano et al. 2002b) to enable consideration of the effects of uncertainty in input parameters. The uncertainty analysis capability is illustrated using a hypothetical case study of a typical municipality. Results show that increased expenditure does not necessarily result in a reduction in the expected levels of environmental emissions and that some SWM alternatives may be more robust, although deterministic estimates of their expected performances are similar. The uncertainty analysis also facilitates use of the ISWM DST by policy makers responsible for evaluation of the expected effect of SWM practices on, for example, greenhouse-gas emissions.

题目：基于物流和能流管理的汽车表面处理决策支持模型

作者：Jutta Geldermann, Otto Rentz

关键字：汽车喷漆，决策模型，污染减排，生命周期评价 (LCA)，过程模型，中小企业(SME)，挥发性有机物(VOCs)

摘要：过去数十年中，表面喷涂行业在环境保护方面取得了很大进步，但仍有近 50%的工业溶剂污染来自喷漆过程。向企业发放排污许可证对小企业的环境保护收效不大。诸如高固体含量涂料、水基涂料和粉末涂料等的溶剂减量化喷涂技术无法大范围普及，也没有新的应用技术。成本与质量问题是无法推广这些生态友好技术的主要障碍。

最近，旨在大量减少工业溶剂排放的欧盟溶剂法规 (1999/13/EC)正式生效。但迄今为止，尚缺乏有效手段帮助小企业在控制成本的基础上，确定污染源，改进工艺来减少排污。

应用物流和能流管理工具，可以帮助企业管理人员了解成本结构和环境效益。本文介绍了一个基于计算机的物流能流管理工具——汽车表面处理计算机辅助物流能流管理模型 (IMPROVE)。作为一个详尽的商业咨询工具，它可以为编制生产计划提供实用指导。企业在其帮助下不但能满足各种环境法规的要求，而且能明确各种污染减排措施的效益。

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Decision Support through Mass and Energy Flow Management in the Vehicle-Refinishing Sector

Jutta Geldermann and Otto Rentz

KEYWORDS:

automobile coating, decision modeling, emission reduction, life-cycle assessment (LCA), process model, small and medium sized enterprises (SME), volatile organic compounds (VOCs)

SUMMARY:

In the past few decades, major advances in environmental protection within the coating application industry have been made. In spite of this technological progress, approximately 50% of industrial solvent emissions still come from the paint-application sector. The advances made in reducing emissions for plants requiring licensing have unfortunately had no influence on the environmental efforts of smaller companies. Solvent-reduced painting systems, such as high-solid paints, water-based coating, and powder coating have not been able to achieve acceptance, nor have innovative application technologies. The principal arguments against a conversion to these ecologically more favorable alternatives were related to cost and quality.

Recently, the EU Solvent Directive (1999/13/EC) went into effect, aiming to significantly reduce industrial-solvent emissions. Up until this point, however, instruments enabling smaller companies to determine their solvent emissions and to simultaneously develop process-improvement potentials while keeping costs in mind have been missing.

Using the mass and energy flow-management approach, cost structures and environmental benefits can be made transparent to the entrepreneur. The primary result of the research projects presented here is the computer-based mass and energy flow model called the individual computer aided mass and energy flow model for the vehicle refinishing sector (IMPROVE). It can be used as a detailed business-consultancy tool. Based upon this, practical guidelines were developed for easy orientation and activity planning. They can be used by companies to help them fulfill the requirements of environmental legislation and to display the benefits that can be achieved by various emission-reduction measures.

题目：关于环境损害权重的调查以及调查背景与受访者观点的对结果的影响

作者：Thomas M. Mettier, Patrick Hofstetter

关键字：生命周期评价(LCA)，生命周期影响评价(LCIA)，偏好，环境损害指标，生态指数 99，文化观点

摘要：当人们模拟产品系统的环境影响之时，常常会发展一些环境损害指标。这些指标互不兼容，无法相互比较。例如，人类统计寿命的减少与生态系统中部分物种所受的影响无法相比。但是，一些使用生命周期评价(LCA)的决策者倾向于单一指数，因为它比多指标评价体系更易于解释评价结果。这样需要有一种方法来综合不同类型的环境影响，因此 LCA 面临一个估值的问题。

　　本文介绍了一种综合来自开展和使用 LCA 人员的调查发现的非货币评价方法。该项调查重在比较生态指数 99（一个环境损害导向型评价系统）的三个环境要素——人类健康、生态系统质量和资源——的权重。尤其值得关注的是调查所处的背景和被调查人个人特点对其权重衡量的影响。结果显示环境损坏在欧洲层面上比在微观层面上易于比较。此外，虽然只有半数的受访者可明确确定其文化背景，但任一种文化观点对不同类型环境损害的评价与其它两种文化都大不相同。我们的结论是决定权重的过程中必须重点考虑调查背景的影响；另外，权重的选择偏好与每类受访者的典型文化观念息息相关。

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Survey Insights into Weighting Environmental Damages: Influence of Context and Group

Thomas M. Mettier and Patrick Hofstetter

KEYWORDS:

life-cycle assessment (LCA), life-cycle impact assessment (LCIA), bias, environmental damage indicators, Eco-indicator 99, cultural perspective

SUMMARY:

When one models impact pathways due to stressors that are caused by the provision of product systems, it results in indicators for environmental damages. These indicators are incommensurable and cannot be compared per se. For example, the statistical life years lost for a human population cannot necessarily be compared with the potentially affected fraction of species within an ecosystem. However, some decision makers who use life-cycle assessment (LCA) prefer a single index, because it facilitates interpretation better than a multi-indicator system. This requires a method for aggregating environmental damages of differing types, thereby confronting LCA with a valuation problem.

　　The article describes a nonmonetary approach to valuation in LCA that incorporates the findings of a survey among LCA practitioners and users. The survey focuses on the weighting of three safeguard subjects for Eco-indicator 99, a damage-oriented impact-assessment method: human health, ecosystem quality, and resources. Of particular interest here is what influence the context provided in the survey (framing) and an individual's characteristics have on his or her weighting of environmental damages. The results indicate that damages on the European level are easier to compare than damages on a micro level. Additionally, although only half of the survey participants could be classified unequivocally into one of three cultural perspectives, each perspective rated the damage categories presented to them significantly differently from the others. Our conclusions were that framing effects need to be more carefully considered in weighting procedures and that weighting preferences vary significantly according to a group's archetypical attitudes.