

3rd International Conference on Sustainable Development Indicators
in the Minerals Industry, Milos Island, Greece, 17-20 June, 2007

Development of sustainability indicators for the assessment of alternative management systems of spent, portable batteries

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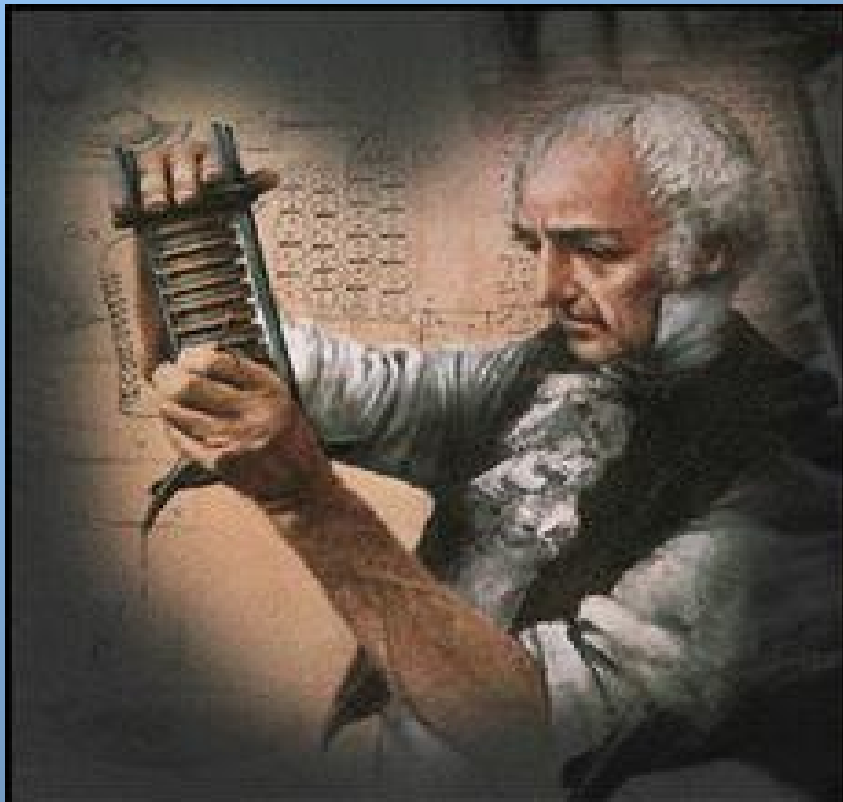
Outline

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Alessandro Volta - 1800 A.C.



Introduction

Sustainable Development Indicators

- Tools for the monitoring and evaluation of complex projects (e.g. municipal or industrial WASTE MANAGEMENT)
- Basic requirements for the assessment of these schemes: multi-criteria analysis for co-evaluation of environmental, economical and social parameters, i.e. the three pillars of sustainability
- Potential concerns regarding the use of SDIs: (a) subjectivity in their selection, (b) lack of sufficient, reliable data for their calculation, (c) co evaluation of different parameters without assigning relative significance and contribution.
- An Indicator to assess and monitor Sustainability, should be SMART, i.e. Specific, Measurable, Achievable, Relevant and Time-framed (A guide to the Project Management Body of Knowledge, PMBOK Guide, 2000)

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ALTERNATIVE MANAGEMENT SYSTEMS OF WASTE PORTABLE BATTERIES

Sustainable management of used Batteries and accumulators within the objectives of the EU Environment framework program on waste management, *reduce, reuse, recycle, reduction of dangerous species in the waste stream*

Potential adverse impacts related to waste B. management are mainly attributed to the presence of heavy metals, Pb, Cd, (Hg) in their composition, in cases classified as Dangerous wastes

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DIASBAT

- A Greek funded research project -
Development of an Integrated Alternative
System for the Environmentally Compatible
Management of Used Portable Batteries and
Accumulators, 2003-2006

*Partners: GERMANOS S.A, ESDKNA, IGME,
ECHMES, NTUA, ENVIRONPLAN*



The DIASBAT Research Team

Batteries' producer & trading companies:
GERMANOS
(PROJECT LEADER)



Association of Communities and Municipalities in Attica (**ACMAR**)



Research Institutes:

- Institute of Geology & Mineral Exploration (**IGME**)
- National Technical University of Athens (**NTUA**)



Environmental Consultants:

- **ECHMES Ltd**
- **ENVIROPLAN**



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Greek status at the period of DIASBAT Project implementation (2003-2006) regarding spent portable batteries management

- Specific collection targets for spent portable B&A, expressed in the form of indicators, had to be achieved in Greece according to the relevant national legislation (Presidential Decree 115/2004)
- The Directive 2006/66/EC on Batteries and Accumulators was under development and collection as well as recycling targets for spent portable B&A, expressed in the form of indicators, were prepared
- DIASBAT consisted the first, experimental, Alternative Management System for portable B&As in Greece
- The Greek Association for the Collection and Recycling of Portable Batteries started to operate nationally in 2005 (www.afis.gr)

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Activities performed within the DIASBAT Project

- Overview of the Greek and European Legislation, on spent batteries collection and recycling systems
- *Overview of the indicators employed for the evaluation of the effectiveness of long-run European Collection Systems & Recycling Networks, Selection of indicators applicable to monitor the sustainable performance of DIASBAT*

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Activities performed within the DIASBAT Project, contin.

- Establishment of batteries' collection networks including: school areas, retail stores of Germanos SA, units of the Greek Institute of Geology and Mineral Exploration (IGME). Batteries lots collection, and separation to define composition.
- Feasibility study of a potential Alternative Waste Portable B&A Management System to operate at a National scale. Extensive study to predict the expected annual collection rates, number and location of collection points, costs per stage of the system operation. Comparison with mature European Management systems based on Sustainable Performance Indicators

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Effectiveness Indicators (EIs) for the assessment of European SPBMS

Alternative Waste Management Systems comprise of four distinct steps: *Collection, Sorting/pre-processing, Recycling of usable materials, Disposal*

For light weighted consumer products, such as portable B& As collection stage the core of such systems. Extensive collection networks. Limited number of B& A recycling facilities in the world, and in Europe.

Therefore, the performance of alternative B&A waste management systems in Greece and other European countries is focused on mainly monitoring the collection stage

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Effectiveness Indicators (EIs) for the assessment of European SPBMS

Directive 2006/66/EC

Member States shall achieve, Enforcement date 26/9/2008, the following minimum collection rates:

- > 25% by 26 September 2012,
- >45% by 26 September 2016

Indicator for the effectiveness of batteries collection and compliance with the Directive's requirements after year 2008 :

Collection rate during the year N (%): $\frac{\text{Collection during the year N}}{\text{Sales average of the 3 last years}}$

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Batteries Collection targets in Greece

Greek Presidential Decree 115/2004

Collection targets to be achieved in Greece by the end of
year 2006: 30% of all spent Batteries,

This target should also be separately achieved for B.
containing more than 0,0005% Hg by weight.

expected to be modified following the harmonization of Dir.
2006/66

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Review of Effectiveness Indicators (EIs) for the assessment of European SPBMS, Indicators established by the European Portable Batteries Association

Description of Sustainable Performance, Effectiveness Indicators	Unit
General EIs - Country Status	
National Sales of B&A _{yearx} /Population _{yearx}	g/capita
Collected Waste B&A _{yearx} /Population _{yearx}	g/capita
Collected Waste B&A _{yearx} /National Sales of B&A _{yearx}	%
Collected Waste B&A _{yearx} /National Sales of B&A _{average of years x-3, x-2, x-1} (Directive 2006/66)	%

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Review of Effectiveness Indicators (EIs) for the assessment of European SPBMS, Indicators established by the European Portable Batteries Association, e.g Austria, Belgium, Switzerland, Netherlands, Germany

Description of EI	Unit
EIs - Association's Financial Information	
$\text{Income}_{\text{yearx}} / \text{National Sales of B\&A}_{\text{yearx}}$	€/t
$\text{Expenses}_{\text{yearx}} / \text{National Sales of B\&A}_{\text{yearx}}$	€/t
$\text{Income}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t
$\text{Expenses}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t
$\text{Advertisement Cost}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t
$\text{Administrative Cost}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t
$\text{Collection - Transportation Cost}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t
$\text{Pre-sorting \& Sorting Cost}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t
$\text{Recycling Cost}_{\text{yearx}} / \text{Collected Waste B\&A}_{\text{yearx}}$	€/t

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Review of Effectiveness Indicators (EIs) for the assessment of European SPBMS, Indicators established by the European Portable Batteries Association

Description of EI	Unit
EIs - Association's Operation Features	
Number of Collection Points _{yearx} /10.000 Habitants _{yearx}	No
Collected Waste B&A _{yearx} /Number of Collection Points _{yearx}	Kg/point
Collected Waste B&A _{yearx} /Network Population _{yearx}	g/person

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Use of Indicators in the DIASBAT Project

EIs for the assessment of DIASBAT collection networks

Indicators related with the operating features

- Total weight of collected batteries / collection point (school and/or IGME's department) / time-period action
- gr of collected batteries / capita (student or employee) / time-period action

Above Indicators used to compare performance, Criteria for comparing the assessment of the DIASBAT collection networks

- Comparison elementary, high and senior high school students - impact of age.
- Comparison among urban and semi-urban areas, - impact of spatial distribution of collection points.
- Comparison among public and private schools - environmental awareness, based on the economic level of students families, the provision of environmental education in schools etc.

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Discussion

- Within DIASBAT the average collection rate recorded at schools ranged from 30 to 300 g/person/year
- Higher efficiency of collection network at primary schools, in semi-urban areas, in areas with lower income, at schools where the project objectives were amply communicated and also in schools that joined the network on their own initiative
- Environmental sensitisation significant to the successful implementation of an alternative waste management system.
- Monitoring Indicators at the retail shops network demonstrated that the collected quantities directly related with the population of the area where the collection point was located
- The collection network set up by IGME, provided an average annual rate of 238,5g/person, very close to the average European collection rate of 235g/person

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Indicators for major European portable waste B&A management
Associations - 2005 &

Indicators calculated for the DIASBAT proposed alternative systems,
Feasibility study

Description of Indicator	Range for 9 European Associations, 2005	Average	DIASBAT - Proposed Systems
-Total expenses of the Association, €/t of collected B&A	1.100 - 3.900	1.800	2.334 - 2.566
-Cost of advertisement, €/t of collected B&A	1 - 1.900	400	443
-Administrative cost, €/t of collected B&A	20 - 850	220	278
-Cost of collection-transportation, €/t of collected B&A	300 - 700	400	663-895

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Indicators for major European portable waste B&A management Associations - 2005 & Indicators calculated for the DIASBAT proposed alternative systems, Feasibility study, continued

Description of Indicator	Range for 9 European Associations, 2005	Average	DIASBAT - Proposed Systems
-Cost of batteries pre-sorting & sorting, €/t of collected B&A	0 - 250	180	0-283
-Cost of recycling/disposal, €/t of collected B&A	300 - 3.000	600	508-950
-Number of collection sites per 10,000 persons	3 - 23	11	15,6
-kg of collection, per collection site per annum	26 - 200	93	41

Collection rate achieved at IGME:

238,5 g/person/y vs European Average: 235/person/year

Conclusions

- To monitor the compliance of member states with the prevailing EU legislation, the Directive 2006/66/EC on B & A and waste B & A, employs a Collection Rate Indicator (Collected Waste B&A_{yearx} / National Sales of B&A_{average of years x-3, x-2, x-1}). This indicator may be used by any alternative national spent B&A management system to comparably assess its performance.
- The specific operation features of a proposed waste B&A collection network are objectively described with: a) the number of collection sites per 10,000 persons, this indicator is directly related with the spatial and population distribution of the country; b) the kgs of annually collected waste B&A per collection point, related with the logistics and functionality of the network, and population of the catchment area.
- The indicator expressing the collected quantity of waste B&A in g / capita/time period, is preferably used to compare the progress of a specific system.

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Conclusions

- The use of sustainable performance Effectiveness Indicators for the assessment of EU networks of collection and recycling of spent portable batteries can lead to well documented conclusions for the further optimisation of the systems performance and comparison
- To effectively monitor the waste management schemes, the proposed indicators need to be used by the system operators, policy makers and other stake holders with an integrated perspective, taking into account environmental benefits and impacts as well as social and economic criteria, within the framework of the sustainable development principles

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