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Multiple resource evaluation guideline

Lignes directrices pour l'évaluation de ressources multiples

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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The committee responsible for this document is ISO/TMBG, *Technical Management Board Groups*.

Introduction

General

A current challenge in assessing the economic impact of large-scale environmental projects and solutions with an apparently low greenhouse gas (GHG) footprint is how to also account for these projects' and solutions' consumption of adjacent resources. For example, the supply of water faces degrading quality and volatile availability. Yet any project dealing with water would also have an impact on or be influenced by the supplies of energy and food/cropland.

There is a growing understanding[53] that future projects and solutions will need to be assessed and analysed based on a multiple-resource productivity framework. The aim of this International Workshop Agreement is to present the basis for such an analysis. The guidelines given in this International Workshop Agreement recognize that complex linkages between the supply of these resources make it harder to tackle without depleting one of the other resources. Existing solutions have been criticized because they focus on supplying one resource while negatively impacting another resource.

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Multiple resource evaluation guideline

1 Scope

This International Workshop Agreement serves as the basis for a multiple-resource productivity analysis, providing a means to identify and evaluate scalable resource solutions that can be categorized as multiple-resource productivity (MRP) solutions. MRP solutions are defined as solutions that can produce at least two MRP resources (water, energy, food/cropland) without consuming the other resources.

This standardized framework includes a guideline for the creation of a quantitative evaluation method for assessing a solution's feasibility and conducting economic cost-benefits analysis of various MRP solutions.

2 Background

The concept of sustainability evolved from the need to reduce negative impacts on the environment (relevant resources), economy and society. Tools developed according to this concept, such as Life Cycle Analysis (LCA) and Environmental Impact Report (EIR) tend to focus on the mitigation of hazards and damage and on a single material, element or compound.

Renewable energies are a symbol of this concept, as they represent the ability to derive energy from self-replenishing resources. However, when considering the creation of new resources, this concept, aiming to achieve real sustainability in the long term, is insufficient.

A new concept of looking at renewable resources (e.g. wastewater treatment, electricity production from solar energy) requires some new assessment tools to evaluate projects based on resources creation or consumption.

This concept coincided with a greater understanding of the interlinked water, energy and food/cropland resources, namely the "Nexus". Food growth requires energy, including energy for transportation to consumers, as well as water. Water requires land for treatment as well as energy for transportation and treatment. Energy requires land and, in many cases, water does too. Therefore, it is the growing understanding of researchers that the three resources are interlinked (coupled); in order to solve a problem concerning one resource, the other two should be taken into account, so that additional problems are avoided.

The new concept of sustainability that also understands the Nexus is called the MRP. The MRP suggests a methodology for a project evaluation based on the impact the project's alternatives may have on all three resources, and allows grading of alternatives based on that evaluation, which may be quantified when required.

Each solution enhances one resource while consuming another resource. The methodology requires that in order to evaluate sustainability correctly, the evaluation must consider a solution's impact on all relevant resources. Current evaluation systems are usually based on an economic translation of the resources "value". However, as some resources are subsidized due to historical/social/political reasons, the economic values attributed to the resources are often erroneous.

The required methodology is one that can allow for a project or a program to be evaluated according to its creation or consumption of resources.

A modelling of resource utilization that considers the environmental impact of such projects has been in use for some time. Models such as LCA that aimed to model the environmental impact of mineral usage have focused on a single resource, which, as mentioned above, is no longer sufficient. Decision makers around the world are attempting to resolve the simultaneous resource needs without creating long-term resource depletion.

Recent policies have focused on reducing the negative impacts of resource exploitation and have therefore been mostly considered as "mitigation" or "mitigation-oriented" types of models. However, with the growing understanding that mitigation only postpones the inevitable depletion or negative impact, the need to promote or reorient the exploitation towards a positive, beneficial point of view, has been slowly coming into focus. In addition, new solutions, technologies and business models have the potential to resolve the nexus between water, energy, and food/cropland. Therefore the viewing of a project as "creating" or "consuming" resources is now more compatible with current and future world trends.

Some preliminary work has been done, mainly dual resources analysis (e.g. water-energy; energy-land), but there is a growing need for a more comprehensive analysis, and also for a standardization of the analysis.

3 MRP suggested methodology

3.1 General

In this clause, the MRP methodology will be presented in practical terms, including its purpose and details.

The MRP is a guideline for the methodological evaluation and comparison of different solutions and projects. The guideline is a decision-making tool that is intended to standardize the evaluation and comparison process of decision makers around the world regarding infrastructure projects. It intends to make sure that the same sustainable outlook is shared by standards users, and allows for the possibility of accreditation of decision making processes and organizations utilizing such processes based on its parameters. It allows for a grading of comparable projects according to the guideline's basic assumptions, and allocates these projects into categories according to their grading.

In this clause the utilization of the MRP will be presented; discussion regarding the possibility of accreditation is under consideration.

3.2 Basic parameters

3.2.1 General

The three main components of the Nexus — water, energy and food/cropland — are the main parameters of the methodology underlying the MRP. Nevertheless, other parameters can be added to the Nexus, in two ways:

— adding another main parameter when needed;

— "fine tuning", i.e. introducing secondary parameters that can help adjust the project's grading and thus assist in decision making.

3.2.2 Water

The amount of water (in cubic meters or equivalent) consumed or created (as available water for consumption) is the relevant (basic) parameter in MRP. It should be noted that water can be produced in various qualities and quantities, and the relevant value for this parameter is utilization oriented. For example, 200 m^3 of potable water for municipal utilization will have the same impact as 200 m^3 of reclaimed water for irrigation purposes, even though their quality is different. For the creation of water, this parameter will be marked with a positive (+) mark. If, on the other hand, the project utilizes water (e.g. a steam production plant) the parameter will be marked with a negative (-) mark. If the project has a neutral water impact, then the parameter will be marked with a neutral (0) mark.

3.2.3 Energy

Energy utilization or creation (which is the second relevant basic parameter of the MRP), is measured in common energy units. The creation of energy, such as electrical power supply, is either through a grid or in a stored capacity. The energy component includes fuel as well as the infrastructure required for the production when analysing its impact on the other parameters. If energy is produced (e.g. in a power plant) this parameter will be marked with a positive (+) mark. If, on the other hand, the project utilizes energy (e.g. a desalination plant) the parameter will be marked with a negative (-) mark. The net energy to be produced or consumed during the relevant project's life duration will be calculated and used as explained in Annex A. If the project neither creates nor consumes energy, then the parameter will be marked with a neutral (0) mark.

3.2.4 Food/cropland (land)

Food availability is dependent upon land, but also upon energy and water. The latter two resources are the main parameters and are considered independently; therefore the production and availability of food mostly depend upon the availability of land and those two parameters. In this guideline, "food" and "cropland" are interchangeable terms.

There is some freedom of choice allowed with this parameter. For example, if food production is irrelevant to the project, other land parameters can be considered, such as land use for other types of agriculture (pulp and paper, furniture, textile and industrial crops in general) instead of the food component of this main parameter. Land made available for food production can be measured by the amount of food it can create, according to similarities in the region, or industrial crops where such an approach is appropriate, thus food creation is the third MRP basic relevant parameter. If the land is made available for these activities by the project (e.g. irrigation systems in arid areas), the amount of food to be produced will be marked with a positive (+) mark. If, on the other hand, the project utilizes or consumes food/cropland (e.g. a desalination plant) the parameter will be marked with a negative (-) mark. If the project has a neutral food/cropland impact, then the parameter will be marked with a neutral (0) mark.

3.3 Secondary parameters

3.3.1 General

When comparing different projects that seem to have similar grades, which therefore require further characterization and additional grading, secondary parameters are used.

Secondary parameters are not included within the main parameters, as their significance may differ from one place to another, and thus, to simplify the methodology, only clear-cut cases are used.

Such secondary parameters as employment and improved transportation are to be added when needed, in order to distinguish between projects with similar main parameter marks. This adjustment allows many projects to be compared and graded.

The relative importance of primary parameters as well as secondary parameters can vary from one place to another and they should be considered as the standard is being developed. Some examples are given in 3.3.2 to 3.3.4.

3.3.2 Resource security

The added or reduced security demand related to the project is as follows:

— if the security demand is increased (e.g. a new installation that requires security measures that were not previously required) it will be marked with a negative (-) mark;

— if the security demand is decreased (e.g. human resources for security replaced by more cost effective electronic systems) then it will be marked with a positive (+) mark.

NOTE In this International Workshop Agreement, "security" refers to the guarding of resource supply cost/effort.

3.3.3 Resource risk mitigation measures

Prior to a project being established, the potential risks relevant to the project should be assessed, and preventative mitigation measures should be taken accordingly.

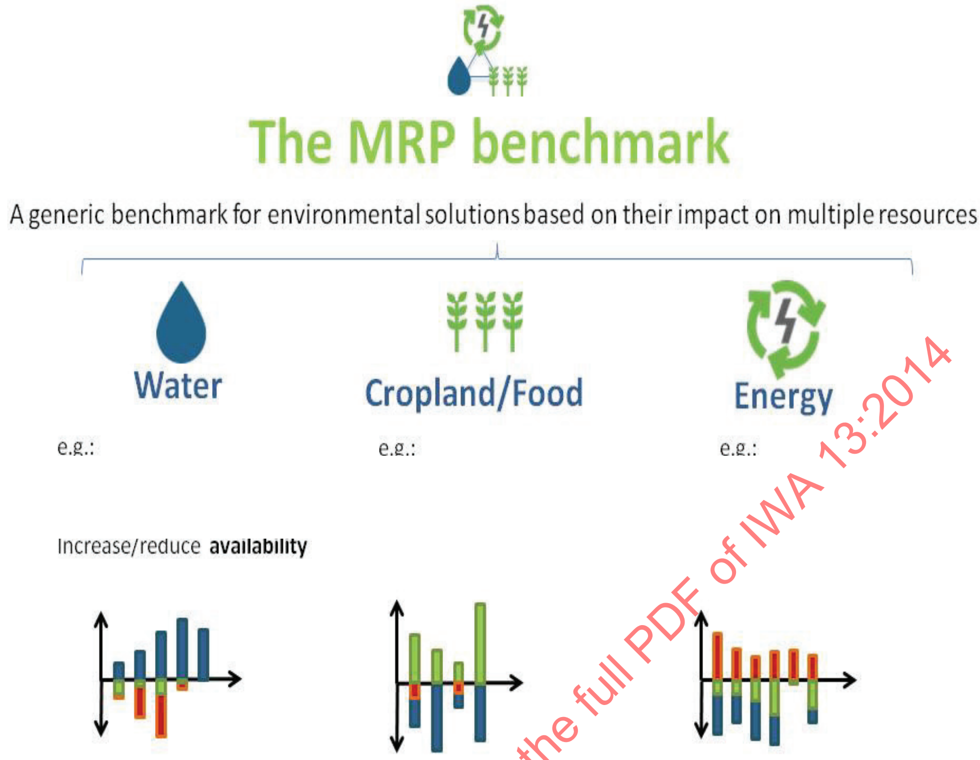
NOTE Additional mitigation will be calculated.

3.3.4 Environment

Environment is not considered as a major parameter by itself, as it is embedded in the other major parameters. Moreover, this parameter is discussed in other ISO standards dealing with environmental sustainability (e.g. ISO 13065) as well as water quality (documents that were developed within the framework of ISO/TC 147), air and land.

3.4 Methodology

The preliminary evaluation stage is calculating the impact of projects on each of the main parameters and creating a comparison table that maps the different impacts (see Figure 1). In Figure 1, the markings of (-/+/0) have been replaced by graphs showing the relative impact of the project on each parameter; impacts above the x-axis will be marked with a positive (+) mark while impacts below X -axis will be marked with a negative (-) mark.



Parameter	Colour	Evaluation
Water	Blue	Increase / Decrease quantity
		Increase / Decrease quality
		Increase / Decrease availability
Food/Cropland	Green	Larger / smaller volumes
		Increase / Decrease variety
Energy	Red	Produce / Consume energy

Figure 1 — Benchmark table

If the qualitative nature of the table does not present one project that is preferable to other projects, a more detailed evaluation should be conducted, comparing the numbers behind the marks (-/+/0) for each parameter in each project and grading the parameters in descending order.

If the process results in another tie, then the secondary parameters can be calculated to determine an appropriate solution.

4 Principles, criteria and indicators

4.1 General

This clause presents the principles of utilizing this guideline. For now, this clause is for discussion purposes only. Legal, social and economic issues are to be developed in accordance with ISO standards and policies.

4.2 Water availability and reliability — Methodologies and models for calculations

It is the purpose of this guideline to present the methodology for calculating how a specific project increases or decreases the availability and reliability of water supply (see 3.2.2). For this purpose the future standard will include a clause or clauses related to these topics.

4.3 Energy availability and reliability — Methodologies and models for calculations

It is the purpose of this guideline to present the methodology for calculating how a specific project increases or decreases the availability and reliability of energy supply (see 3.2.3). For this purpose the future standard will include a clause or clauses related to these topics.

4.4 Food availability and reliability — Methodologies and models for calculations

It is the purpose of this guideline to present the methodology for calculating how a specific project increases or decreases the availability and reliability of food supply (see 3.2.4), i.e. increased/decreased/neutral impact. For this purpose the future standard will include a clause or clauses related to these topics.

Annex A
(informative)

Example of an MRP analysis algorithm

An example of an algorithm for a multiple-resource productivity analysis is given in Figure A.1.

Project proposal: to calculate the impacts of the project on the three important resources (water, energy and food). For example: installing solar panels on 10 000 m^2 of arable land compared to installing solar panels on a 10 000 m^2 water reservoir cover.

MRP Solutions/ impacted resources	MRP annual economic impact per resource	MRP key Solution A (terrestrial PV)	MRP key Solution B (covered water reservoir with PV)
	kwh x USD/kwh	+	+
	m^3 x USD/m^3	0	+
	m^2 x USD/m^2	-	+
Total annual MRP benefits per solution (USD)		170k + 0 – 10K = 160k	170k + 10k + 10k = 190k

Key

+ positive impact
- negative impact
0 neutral impact

Example assumptions:

Annual energy impact = 1 700 000 kwh, power rate = USD 0,1/kwh (USD 170 000)

Annual water impact = 20 000 m^3, water rate = USD 0,5/m^3 (USD 10 000)

Annual food/land impact = 1 000 m^2, food/land rate = USD 10/m^2 (USD 10 000)

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Figure A.1 — Example MRP analysis algorithm

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