Project Sustainability Management: A Roadmap for Sustainable Development

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Introduction

The term *sustainable development* was popularized in the 1987 United Nations report *Our Common Future*.[2] This landmark report showed that over the last century our collective ability to produce growth and prosperity has also had significant unintended effects on the world's resources and ecological systems. These effects appear to be growing so large and so negative that they may compromise the ability of future generations to meet their needs. To reverse these trends, the report called for a new form of economic development—sustainable development—that would enable society to meet today's needs while conserving resources and natural systems for future generations.

Recent information assembled by leaders of the scientific and engineering community suggests strongly that our current quality of life may not be sustainable in the long term. In their new report of the Millennium Ecosystem Assessment, the Board of Directors state that "…nearly two-thirds of the services provided by nature to humankind are found to be in decline worldwide."[3] The reason for this decline is that our current model for production and consumption is using up resources and ecological carrying capacity faster than they can be replaced or replenished. As a result, we are jeopardizing the ability of nations and future generations to maintain or improve their quality of life.

The concept of "sustainable development" is changing the way people think about development in the built environment and its effect on the environment and society. Sustainable development defines a path forward on which society can maintain and improve the quality of life without jeopardizing the ability of future generations to do the same. To these ends, the International Federation of Consulting Engineers (FIDIC) Sustainable Development Task Force has been developing tools for engineers and other practitioners working in the built environment, to help them make substantive contributions to society's progress toward sustainability. The Task Force is broad based, composed of practitioners from both the developed and less developed countries.

The Task Force realized that achieving conditions of sustainability will be long journey, spanning many decades. It will require more or less a complete overhaul of society's existing infrastructure, replacing it with structures, processes, systems and technologies that are less energy and resource intensive, use less toxic materials, produce less waste, and otherwise protect the environment and society. Furthermore, all this must be

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[2] The World Commission on Environment and Development. 1987. *Our Common Future.* Oxford, UK: Oxford University Press.

[3] *Living Beyond Our Means,* Statement of the Board of Directors of the Millennium Ecosystem Assessment, Pre-printer Draft, Page 4.

accomplished in a manner that is both cost effective and workable in both the developed and in the less-developed nations.

An essential role for engineers

Engineers will be essential in making progress toward sustainability. Absent some unprecedented multi-national agreements and huge investments, progress toward sustainability will be made incrementally, project by project, driven by individual project owner objectives, motivations, and actions. Progress will occur only as new and more sustainable designs and technologies are invented, tested and applied by engineers on individual projects, incorporating the project owner's goals, resources and aspirations.

Unfortunately, there has been little understanding or guidance on what constitutes a sustainable project. Adding some environmentally-friendly features to a project or increasing stakeholder involvement may improve public relations, but may do little to address the real issues of sustainable development. Furthermore, in the absence of definitive guidance, many non-governmental organizations and public interest groups are applying their own definitions of sustainability to project and organizational performance, based on their particular agendas and interests. As a result, project owners, practitioners and stakeholders alike are being exposed to a confusing array of sustainability goals and indicator systems, each proclaiming to be a sound and capable gage of sustainability progress. Regrettably, none of these systems provide a clear connection between the overall goals of sustainability and the projects that can move society towards those goals.

Project sustainability management

Recognizing these issues, the Task Force developed a framework and a process for setting project sustainability goals and measuring progress. Embodied in the Project Sustainability Management (PSM) Guidelines,[4] the framework is designed to ensure that a project's sustainability goals are aligned and traceable to recognized and accepted whole society goals and priorities. To these ends, the Task Force developed a core set of sustainable development project goals and indicators that map back to the goals established by Agenda 21. The Task Force reasoned that as a global agreement adopted by countries representing 98 percent of the world's population, Agenda 21 was the valid expression of the world's sustainability concerns. Thus, it can and should form the basis for setting project sustainable development goals and creating indicators of sustainable performance.

The PSM process is also designed to customize sustainable development project goals and indicators to suit local conditions and priorities. For example, for projects in the developing world, the PSM process calls for the use of the World Bank's Equator Principles to derive additional goals and indicators that reflect the special concerns and policy safeguards specific to the developing world.

[4] International Federation of Consulting Engineers, *Project Sustainability Management Guidelines,* See www.fidic.org/psm These guidelines contain a full description of the PSM process, as well as the list of PSM core goals and indicators.

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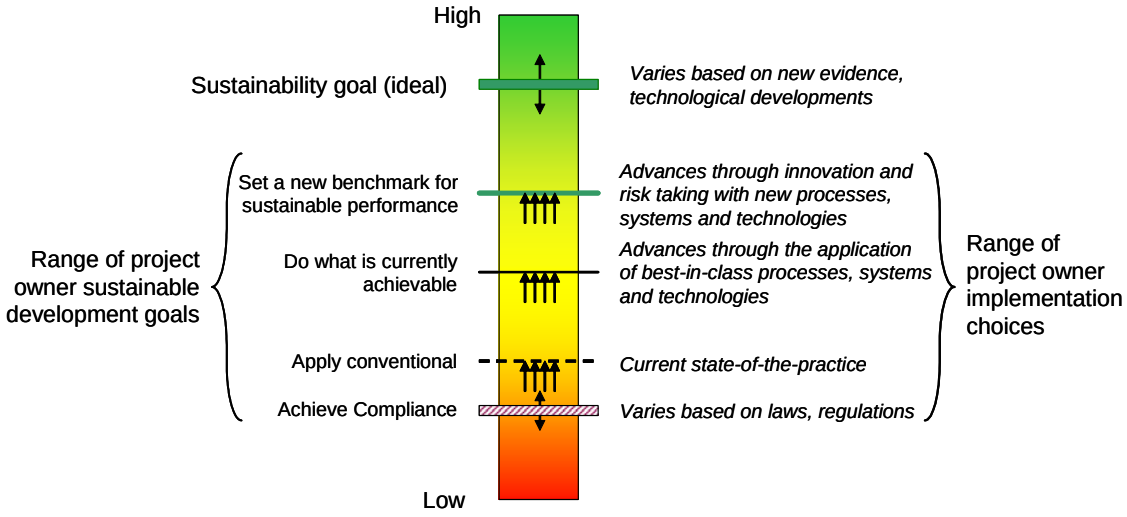

Figure 1: Conceptual model of sustainable development project goals, indicators and engineering practices.

Over the past year, members of the Task Force have been writing articles and making presentations about PSM to a variety of government agencies, professional engineering societies and engineering trade associations. The Task Force's strategy is to spread the concepts of PSM throughout the engineering, government and business community, and to obtain feedback about the efficacy of the process and the completeness of the PSM goals and indicators. Live and web-based seminars were held throughout the year, each of which was well received. In fact, one seminar participant reported that his company had been selected for a US$30 million project based in part on his proposal to use PSM as a way of creating a project that verifiably contributes to sustainability.

PSM II: the beginnings of a sustainability roadmap

While disseminating information about PSM and obtaining feedback, the Task Force decided to revisit the PSM Guidance. Although the Guidance was published only one year ago, the Task Force recognized that the Guidance represented a first step in the development of a comprehensive program for delivering sustainable projects. Further development would be needed in the areas of sustainable development goals and engineering practices. To these ends, the author has drafted an expanded table of project sustainability goals and indicators.[5] Specifically, the table:

- Shows the relationship of PSM goals to the Millennium Development Goals.[6]

[5] See Table: Project Sustainability Management II: Sustainability Roadmap at the end of this paper.
[6] The Millennium Development Goals (MDGs) are the world's time-bound and quantified targets for addressing extreme poverty in its many dimensions-income poverty, hunger, disease, lack of adequate shelter, and exclusion-while promoting gender equality, education, and environmental sustainability. They

- Considers other measures and priorities for sustainable development such as offered by the Global Reporting Initiative,[7] LEED,[8] and the Copenhagen Consensus.[9]
- Offers some suggested revisions to the PSM indicators, including modified wording as well as additional indicators.
- Lists the current state of the practice, plus suggested additional practices considered to be more sustainable, in order of increasing levels of sustainability.
- Offers minimum standards, referencing official publications of the UN and other internationally recognized groups.
- Notes how each of the PSM goals and indicators can be addressed, either through changes to policies and/or programs or through new designs and/or technologies. The Task Force found that out of the 45 PSM goals and indicators, 11 can be addressed by changes to policies and programs, as opposed to new technologies or processes.

In addition to the proposed changes and expansions to the PSM goals and indicators, it is important to recognize the differences in priorities among the nations in which sustainable projects will be delivered. Clearly there is much room for debate. However, it seemed to the author that the approaches for sustainable development will have a different emphasis depending on a country's current level of development. For example, sustainable projects delivered in low or low-middle income countries will be more concerned about providing for basic needs such as clean water and sanitation. In contrast, a high-income country will be more concerned about becoming more eco-efficient. For countries in transition from low-middle to upper middle income, the focus would shift to creating a more reliable and durable infrastructure, designed to be resistant to extreme weather conditions and other natural disasters. Such differences are depicted in Figure 2.

This does not mean that the low or low-middle income countries should ignore the principles of eco-efficiency. Further, it does not mean that the upper-middle or high income countries should ignore the needs of low income communities within their borders. It simply offers a model for setting priorities for moving towards sustainability in the most effective way.

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are also basic human rights-the rights of each person on the planet to health, education, shelter, and security. See http://www.unmillenniumproject.org/goals/goals02.htm

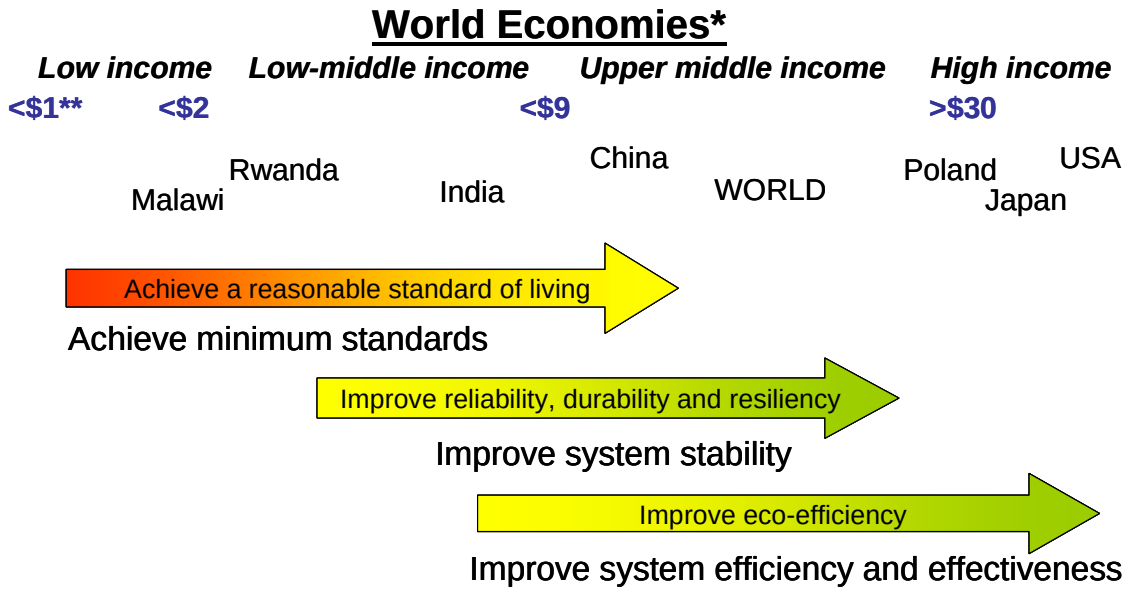
[7] The Global Reporting Initiative (GRI) is a multi-stakeholder process and independent institution whose mission is to develop and disseminate globally applicable Sustainability Reporting Guidelines. See http://www.globalreporting.org/index.asp

[8] LEED (Leadership in Energy and Environmental Design) Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings. Members of the U.S. Green Building Council. See http://www.usgbc.org/DisplayPage.aspx?CategoryID=19

[9] The Copenhagen Consensus project originated from a staff group headed by the former Director of Environmental Assessment Institute Bjorn Lomborg in late 2002. The basic idea was to improve prioritization of the numerous problems the world faces, by gathering some of the world's greatest economists to a meeting where some of the biggest challenges in the world would be assessed.

Creating an environment for innovation

Lastly, it must be noted that at this juncture most of the structures, processes, systems and technologies needed to achieve sustainability have yet to be invented. Therefore, a prerequisite for success is the creation of an environment for innovation: working conditions in which learning and creativity are fostered and celebrated, in which engineers are free to try out new approaches, test new technologies, and replace old ways with new and more sustainable alternatives. Openness and transparency are the essential ingredients of this environment. Project owners and engineers and must engage key stakeholders in dialogue throughout the project development, design and delivery process.



*Source: World Bank list of economies, July 2005, http://www.worldbank.org/data/countryclass/classgroups.htm
** GDP in US$ per person per day

Figure 2: Pathway towards sustainability: Three initiatives

Under conditions of openness and trust, project owners can apply new technologies and approaches, seeking to "raise the bar" on project sustainability performance, creating new benchmarks to which others can aspire. Under these conditions, PSM provides a way for ensuring that advances in one dimension of sustainability on a project are not accomplished at the expense of others, making the net result sustainability neutral or negative.

Conclusion

Making our development sustainable is the most important challenge of the 21st century. It presents incredible opportunities for engineers engaged in building facilities and the related infrastructure. Yet today, many in the engineering community are on the wrong side of the issue, preferring to implement and defend what they know, rather than to invent and apply new and more sustainable technologies, systems, policies and programs.

Those who only know how to build highways fight smart growth initiatives. Others, who are more imaginative, design and build healthy communities with integrated forms of transportation – challenging work commanding higher margins. Those who are still living mentally in the command and control regulatory era only help their clients stay in compliance. Others see compliance as a benchmark for minimum performance. To them, sustainability is a catalyst for innovation and breakthrough performance.[10]

Society still holds engineers in high regard in serving its needs and working out its problems. It expects engineers to anticipate the important changes taking place relative to the built environment, and deliver the appropriate responses. Society thinks we have the knowledge and tools to begin to address the problems of a non-sustainable world. Society is now beginning to wonder if and when we intend to use them.

[10] For more information, see Bill Wallace, *Becoming Part of the Solution: The Engineer's Guide to Sustainable Development*, American Council of Engineering Companies, Washington, DC, 2005. www.acec.org.

Project Sustainability Management II: Sustainability Roadmap

Theme	Sub-Theme	Title	Project Life Cycle Goals		Indicators (revisions)	Current State of the Practice	More Sustainable Practices ⇩⇩⇩	Demonstration
			Planning, Design, Construction	Operation, Reuse, Deconstruction				
SOCIAL								
Equity	Poverty (3) [11]	Local capacity building[12]	Make material improvements in education and employment opportunities for low income workers, local companies.	Make material improvements in education and employment opportunities for low income workers, local companies.	SO-1: Proportion of local workers, companies employed on the project delivery or operation, as compared to other workers, companies. NEW: Extent to which the project improves economic conditions.	Meet applicable laws and regulations regarding hiring, subcontracting practices.	• Hire local workers, companies to the extent practical. • Train and hire local workers, companies, focusing on low income populations, disadvantaged communities. • Build local capacity to deliver projects, operate and maintain facilities.	Show how the project will improve economic conditions, giving priority to low income populations, disadvantaged communities. *(Policy, Program)*[13]
	Gender equality (24)	Equal pay, equal opportunity for women, minorities	Achieve equal pay and equal opportunity for men and women.	Achieve equal pay and equal opportunity for men and women.	SO-2: Existence of hiring and wage policies related to minorities and women employees. SO-3: Proportion of minorities, women hires. SO-4: Wage comparison of minorities, women compared to standards.	Meet applicable laws and regulations regarding hiring and wages.	• Established programs for providing equal job opportunities, equal wages. • Proactive efforts to educate minorities and women for jobs of increasing responsibility.	Show the scope and effects of hiring and wage policies and programs, compared to local and industry averages. Note: includes minorities as well as women. *(Policy, Program)*

[11] Numbers in parenthesis refer to the applicable chapter in Agenda 21.

[12] Titles in bold indicate that the project life cycle goals coincide with the Millennium Development Goals.

[13] (Policy/program) or (Technology/process) refers to how this aspect of sustainability will be predominantly implemented. That is, will it likely be implemented through a change in policies or programs, or will it likely be implemented though the application of new technologies or processes.

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	Sanitation	Access to sanitation	During construction, upgrade sanitation to minimum protection standards: protection of people, animals, crops, water sources from contact with human wastes.	Upgrade sanitation to minimum protection standards: protection of people, animals, crops, water sources from contact with human wastes. Enhance efficiency, effectiveness and reliability of sanitation systems.	SO-5: Proportion of population with access to adequate ~~sewage treatment~~ sanitation.	Meet applicable laws, regulations, codes regarding the construction and operation of sanitation facilities.	• Minimum standards: Protect people, animals, crops, water sources from contact with human wastes. • Upgrade facilities for better reliability, efficiency, effectiveness, resiliency in natural or man-made disaster events.	Show how the facility meets or exceeds minimum protection standards. Show increases in system reliability, efficiency, effectiveness, resiliency, compared to standard practices, industry norms. (Technology, process)
	Drinking water	Access to safe drinking water	During construction, upgrade access to safe water for workers and affected population.	Upgrade systems for providing access to safe water to minimum standards.	SO-6: Proportion of population with access to safe drinking water	Meet applicable water supply laws, regulations and codes.	• Minimum standards: Provide reasonable access to and supply of safe drinking water. Urban: 200 meters. Rural: reasonable.[14] • Upgrade facilities for better reliability, efficiency, effectiveness, resiliency in natural or man-made disaster events.	Show how the facility meets or exceeds minimum protection standards. Show increases in system reliability, efficiency, effectiveness, resiliency, compared to standard practices, industry norms. (Technology, process)
Health (6)	Healthcare delivery	Availability of healthcare	Materially improve the health of the work force.	Materially improve the health of the work force.	SO-7: Proportion of population with access to primary health care facilities. NEW: Child mortality. Maternal health. Rates of HIV/AIDS, malaria.	Meet applicable laws, regulations and codes regarding health care.	• Provide basic health care services for employees. • Provide extended health care services, proactive wellness programs, health education programs for employees.	Show the scope and effects of health care programs compared to local and industry averages. *(Policy, Program)*

[14] Reference: UN Commission on Sustainable Development, Indicators of Sustainable Development: Framework and Methodologies, DESA/DSD/2001/3, P. 80.

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	Occupational safety and health	Prevention of occupational accidents and diseases	Zero reportable occupational accidents and diseases	Zero reportable occupational accidents and diseases	SO-8: Record of safety and health performance during construction and operation.	Meet applicable laws, regulations and codes regarding safety and health.	• Minimum standards: Compliance with the UN International Labor Organization (ILO) Code of Practice on occupational accidents and diseases.[15] • Proactive programs to prevent occupational accidents and diseases.	Demonstrated record of occupational safety and health. *(Policy, Program)*
Human rights	Child labor	Excluding child labor	Adhere to policy excluding child labor as defined by the ILO Convention 138. Age range: 14-18 years, depending on working conditions, level of development.	Adhere to policy excluding child labor as defined by the ILO Convention 138. Age range: 14-18 years, depending on working conditions, level of development.	SO-9: Record of the use of labor during project construction and facility operation.	Meet applicable laws and regulations regarding child labor.	• Follow ILO Convention 138.	Demonstrated adherence to ILO Convention 138. See http://www.ilo.org/public/english/standards/norm/whatare/fundam/childpri.htm *(Policy, Program)*
Housing (7)	Living conditions	Adequate living space	Provide adequate living area. Suggested: 5 sq. meters per person. Reference: Appendix A.	Provide adequate living area. Suggested: 5 sq. meters per person. Reference: Appendix A.	SO-10: Proportion of persons living with adequate floor area per person.	Meet applicable laws and regulations regarding living area.	• Minimum standard: 5 sq. meters per person.	Project specific. Measured area per person. See Appendix A. *(Policy, Program)*
Population (5)	Population change	Reducing, eliminating slum conditions	Improve conditions beyond slum threshold.	Improve conditions beyond slum threshold.	SO-11: Change in number and proportion of populations in formal and informal settlements affected by the project. NEW: Number and proportion of populations living below the slum threshold.	Meet applicable laws, regulations and codes regarding living conditions: access to water and sanitation, housing quality, overcrowding, security of tenure.	• Minimum standard: above threshold of slum definition: (1) access to water, (2) access to sanitation, (3) structural quality of housing, (4) overcrowding and (5) security of tenure.	Project specific. See reference in Appendix A. Projects involving formal and informal settlements need to show how conditions were improved above minimum standard. *(Policy, Program)*

[15] Reference: http://www.ilo.org/public/english/protection/safework/cops/english/

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			Planning, Design, Construction	Operation, Reuse, Deconstruction				
Culture	Cultural heritage	Preserving and protecting cultural property	Preserve and protect cultural property.	Preserve and protect cultural property.	SO-12: Assessment of impacts on local culture, historic buildings.	Meet applicable laws, regulations and codes regarding preservations of cultural property.	• Protect and enhance cultural property on the project site or related to project.	Show how cultural property was identified, assessed and protected during all project phases, and in operation. *(Policy, Program)*
	Involuntary resettlement	Equity in population displacement	Minimize involuntary displacement of local populations. Share project benefits with resettled population.	Minimize involuntary displacement of local populations. Share project benefits with resettled population.	SO-13: Degree to which the project displaces the local population. NEW: Degree to which project benefits are shared with displaced population.	Meet applicable laws, regulations and codes regarding population resettlement.	• Minimize involuntary displacement of local populations. • Minimize and share the project benefits with resettled populations.	Show the efforts made to minimize involuntary resettlement. Show how project benefits are shared with resettled populations. *(Policy, Program)*
	Bribery and corruption	Reduction, elimination of corrupt practices	Do not initiate nor accede to corrupt practices. Bribery and corruption are no longer considered business as usual.	Do not initiate nor accede to corrupt practices. Bribery and corruption are no longer considered business as usual.	SO-14: Efforts to monitor and report bribery and corruption. NEW: Programs for managing business integrity.	Meet applicable laws, regulations regarding bribery and corruption.	Implement a business integrity management system. Reference: FIDIC *Business Integrity Management System (BIMS) Guidelines.*[16]	Demonstrate the existence of policies and programs for business integrity management. Show effectiveness of the program through monitoring and enforcement. *(Policy, Program)*
ENVIRIONMENTAL								
Atmosphere (9)	Climate change	Reduction of greenhouse gas emissions	Reduce substantially the quantity of greenhouse gas (GHG) emissions, in the design of the project design and during construction.	Reduce substantially the quantity of greenhouse gas (GHG) emissions. Operate and maintain the facility in accordance with the design. Strive for continuous improvement.	EN-1: Quantities of GHGs emitted in all phases of project, and in operation.	Meet applicable laws and regulations regarding reduction of greenhouse gas emissions.	• Design for energy efficiency. • Survey project for GHG emissions. Proactive programs to reduce or eliminate GHG emissions.	Demonstrate how the design of the project reduces GHG emissions. (Technology, process)
	Ozone layer depletion	Reduction of ozone-depleting substance emissions	Reduce substantially the quantity of ozone-depleting substances emissions, in the design of the project design and during construction.	Reduce substantially the quantity of ozone-depleting substances emissions. Operate and maintain the facility in accordance with the design. Strive for continuous improvement.	EN-2: Quantities of ozone-depleting substances used in all phases of project, and in operation.	Meet applicable laws and regulations regarding reduction of ozone emissions.	• Minimize use of ozone-depleting substances • Survey project for use of ozone-depleting substances. Programs to reduce or eliminate.	Show how the use of ozone depleting emissions were identified, then reduced or eliminated. (Technology, process)

[16] Business Integrity Management System (BIMS) Guidelines, ISBN 2-88432-025-3

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	Air quality	Air pollution emissions reduction	Reduce substantially the quantity of air pollution emissions, in the design of the project design and during construction.	Reduce substantially the quantity of air pollution emissions. Operate and maintain the facility in accordance with the design. Strive for continuous improvement.	EN-3: Quantities of key air pollutants emitted in all phases of project, and in operation.	Meet applicable laws and regulations regarding air pollutant emissions.	• Design to reduce air pollution emissions. • Application of technologies and/or programs to reduce or eliminate key air pollutant emissions.	Demonstrate that air emissions from the proposed facility were identified, assessed and reduced or eliminated through appropriate design and operation. (Technology, process)
	Indoor air quality	Indoor air pollution emissions reduction	Reduce substantially the quantity of indoor air pollutant emissions in the design of the project design and during construction.	Reduce substantially the quantity of indoor air pollutant emissions. Operate and maintain the facility in accordance with the design. Strive for continuous improvement.	EN-4: Quantities of indoor air pollutants	Meet applicable laws and regulations regarding indoor air pollutant emissions.	• Use of low or no VOC materials in the design, construction and operation. • Application of technologies and/or programs to reduce VOC emissions.	Demonstrate that VOC materials used the proposed facility were identified, assessed and reduced or eliminated through appropriate design and operation. (Technology, process)
Land (10)	Agriculture (14)	Preservation of arable land	Increase or maintain the amount of arable and permanent crop land area in the design of the project and during construction.	Operate and maintain the facility so that it increases or maintains the amount of arable and permanent crop land area.	EN-5: Proportion of arable and permanent crop land affected by this project.	Meet applicable laws and regulations regarding the protection of arable and permanent crop land.	• Maintain or improve the portion of arable permanent crop land, if applicable.	Project specific. Show how arable and permanent crop land was maintained or enhanced. (Technology, process)
		Fertilizer use reduction	Design facilities and infrastructure in a manner that reduces or eliminates the need for fertilizers.	Operate and maintain facilities and infrastructure in a manner that reduces or eliminates the need for fertilizers.	EN-6: Quantities of fertilizers used compared to norms	Meet applicable laws, regulations and codes regarding the application and use of fertilizers.	• Minimize the use of fertilizers. • Use organic agricultural methods that use little or no fertilizers	Project specific. Demonstrate how the use of fertilizers on the project were reduced or eliminated. (Technology, process)
		Pesticide use reduction	Design facilities and infrastructure in a manner that reduces or eliminates the need for pesticides.	Operate and maintain facilities and infrastructure in a manner that reduces or eliminates the need for pesticides.	EN-7: Quantities of pesticides used compared to norms	Meet applicable laws, regulations and codes regarding the application and use of pesticides.	• Minimize the use of pesticides. • Use organic agricultural methods that use little or no pesticides.	Project specific. Demonstrate how the use of pesticides on the project were reduced or eliminated. (Technology, process)
	Forests (11)	Preservation of forested land	Design facilities and infrastructure in a manner that maintains or increased the amount of forested land area.	Operate and maintain facilities and infrastructure in a manner that maintains or increased the amount of forested land area.	EN-8: Extent to which forests are used or affected in the development, design and delivery of the project.	Meet applicable laws, regulations and codes regarding the maintenance of forested land.	• Maintain or improve the amount of forested land, if applicable.	Project specific. Demonstrate how forested land area was protected or enhanced. (Technology, process)

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			Planning, Design, Construction	Operation, Reuse, Deconstruction				
		Sustainably-managed forests	Design and construct facilities and infrastructure in a manner that use to the greatest extent, wood from sustainably-managed forests.	Operate and maintain facilities and infrastructure in a manner that use to the greatest extent, wood from sustainably-managed forests.	EN-9: Extent to which wood from sustainability managed forests is used in all project phases as percent of total wood use.	Meet applicable laws, regulations and codes regarding the use of wood in design, construction and operation.	• Use only wood from sustainability-managed forests. • Mange the use of wood as part of an overall program to maximize use of renewable materials and reduce materials intensity.	Show how wood is sourced and used in the project and operation. This should be incorporated as part of an overall program to maximize use of renewable materials and reduce materials intensity. (Technology, process)
	Desertification (12)	Desertification reduction	Design and construct facilities and infrastructure in a manner that does not increase desertification.	Operate and maintain facilities and infrastructure in a manner that does not increase desertification.	EN-10: Area of land affected by the project that is affected by desertification.	Meet applicable laws and regulations regarding desertification.	• Decrease or do not increase the amount of land affected by desertification, if applicable.	Project specific. Demonstrate that the project decreases or does not increase desertification. (Technology, process)
Oceans, Seas and Coasts (17)	Coastal zone	Reduction of nutrient discharges to coastal waters	Design and construct facilities and infrastructure in a manner that does not contribute significantly to nutrient discharges to coastal waters	Operate and maintain facilities and infrastructure in a manner that does not contribute significantly to nutrient discharges to coastal waters	EN-11: Measurements of changes in algae concentrations in coastal waters adjacent to the facility.	Meet applicable laws and regulations regarding nutrient discharges.	• Reduce or eliminate nutrient discharges from project site to coastal waters, if applicable.	Project specific. Demonstrate the reduction or elimination of nutrient discharges to coastal waters. (Technology, process)
		Preservation of coastal ecosystems	Design and construct facilities and infrastructure in a manner that protects coastal ecosystems while having a positive effect on economic development.	Operate and maintain facilities and infrastructure in a manner that protects coastal ecosystems while having a positive effect on economic development.	EN-12: Changes in populations living in coastal areas. NEW: impacts on coastal ecosystems. Economic development.	Meet applicable laws, regulations and codes regarding the protection of coastal ecosystems	• Design and deliver the project in a manner that protect coastal ecosystems while delivering economic benefit to the affected communities.	Project specific. Show how the project is protective of coastal ecosystems while providing economic benefits to affected communities. (Technology, process)
Fresh water (18)	Water quantity	Fresh water use	Design and construct facilities and infrastructure in a manner that minimizes the use of fresh water, taking into account the total amount of fresh water.	Operate and maintain facilities and infrastructure in a manner that minimizes the use of fresh water, taking into account the total amount of fresh water.	EN-13: Measurements of fresh water usage on project during all phases, as compared to the total amount of fresh water available.	Use fresh water as needed, considering cost effectiveness.	• Application of technologies, systems and/or policies to reduce the use of freshwater, or enhance fresh water availability.	Show how the use of fresh water has been reduced as compared to standard practices and industry norms. (Technology, process)

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			Planning, Design, Construction	Operation, Reuse, Deconstruction				
	Water quality	BOD reduction	Design and construct facilities and infrastructure in a manner that does not degrade water quality.	Operate and maintain facilities and infrastructure in a manner that does not degrade water quality.	EN-14: Measurements of BOD on water bodies affected by project during all phases, and in operation.	Meet applicable laws and regulations regarding water quality.	• Application of technologies, systems and/or policies to maintain or enhance the quality of freshwater.	Show how the project and operation maintains or enhances the quality of fresh water. (Technology, process)
		Fecal coliform reduction	Design and construct facilities and infrastructure in a manner that does not degrade water quality.	Operate and maintain facilities and infrastructure in a manner that does not degrade water quality.	EN-15: Measurements of fecal coliform in freshwater bodies affected by project during all phases, and in operation.	Meet applicable laws and regulations regarding water quality.	• Application of technologies, systems and/or policies to maintain or enhance the quality of freshwater.	Show how the project and operation maintains or enhances the quality of fresh water. (Technology, process)
Biodiversity (15)	Ecosystem	Biodiversity enhancement	Design and construct facilities and infrastructure in a manner that at least maintains and preferably enhances biodiversity.	Operate and maintain facilities and infrastructure in a manner that at least maintains and preferably enhances biodiversity.	EN-16: Proportion of area affected by the project that contains key ecosystems. NEW: quality of biodiversity in the affected area of the project.	Meet applicable laws and regulations regarding biodiversity.	• Design, deliver and operate in a manner that protects and enhances biodiversity.	Demonstrate that biodiversity has been maintained or enhanced in the design, construction and operation. (Technology, process)
	Species	Abundance of key species	Design and construct facilities and infrastructure in a manner that at least maintains and preferably enhances the abundance of key species.	Operate and maintain facilities and infrastructure in a manner that at least maintains and preferably enhances the abundance of key species.	EN-17: Measurements of affect of project on the abundance of key species	Meet applicable laws and regulations regarding the abundance of key species.	• Design, deliver and operate in a manner that protects and enhances the abundance of key species.	Demonstrate that the abundance of key species have been maintained or increased as a result of this project. (Technology, process)
ECONOMIC								
Economic structure (2)	Economic performance	Enhancement of local economy	Provide benefit to the local economy.	Provide benefit to the local economy.	EC-1: Extent to which the project provides economic benefit to the local economy.	Design and operate the project such that is provides economic benefit to the owners.	• Design and operate the project such that is provides economic benefit to the owners, as well as material benefit to the community affected by the project.	Demonstrate material benefit of the project on the affected community. *(Policy, Program)*

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			Planning, Design, Construction	Operation, Reuse, Deconstruction				
Consumption and production patterns (4)	Material Consumption	Material intensity reduction	Design and construct facilities and infrastructure in a manner that uses less materials and maximizes the use of renewable materials.	Operate and maintain facilities and infrastructure in a manner that uses less materials and maximizes the use of renewable materials.	EC-2: Extent of use of materials compared to norms, other practices. NEW: Extent of use of renewable materials.	Meet applicable laws, regulations, codes regarding the use of materials.	• Design and operate the project in a manner that reduces the consumption of materials. • Design and operate the project in a manner that maximizes the use of renewable materials	Show how the project reduces the use of materials and maximizes the use of renewable materials as compared to standard practices and industry norms. (Technology, process)
	Energy use	Energy intensity reduction	Design and construct facilities and infrastructure in a manner that uses less energy.	Operate and maintain facilities and infrastructure in a manner that uses less energy.	EC-3: Extent of energy consumption compared to norms, other practices.	Use energy resources as needed, considering cost effectiveness.	• Design and operate the project in a manner that reduces energy consumption.	Show how the project reduces energy consumption as compared to standard practices and industry norms. (Technology, process)
		Use of renewable energy	Design and construct facilities and infrastructure in a manner that incorporates the use of renewable energy sources and waste.	Operate and maintain facilities and infrastructure in a manner that incorporates the use of renewable energy sources and waste.	EC-4: Extent of the use of renewable energy resources compared to norms, other practices.	Use energy resources as needed, considering cost effectiveness.	• Design and operate the project in a manner that maximizes the use of renewable energy sources and waste.	Show how the project makes use of renewable energy sources and waste as compared to standard practices and industry norms. (Technology, process)
	Waste Generation and Management (19-22)	Improving municipal/solid waste generation reduction	Design and construct facilities and infrastructure in a manner that reduces the quantities of industrial and municipal solid waste generated.	Operate and maintain facilities and infrastructure in a manner that reduces the quantities of industrial and municipal solid waste generated.	EC-5: Quantities of industrial and municipal wastes generated compared to norms, other practices.	Meet applicable laws and regulations regarding the generation of industrial and municipal solid waste.	• Reduce the amount of industrial and municipal solid waste generated.	Show how the project reduces the amount of industrial and municipal solid wastes as compared to standard practices or industry norms. (Technology, process)
		Municipal/solid waste disposition	Design and construct facilities and infrastructure in a manner that reduces the amount of industrial and municipal solid waste that is sent to disposal.	Operate and maintain facilities and infrastructure in a manner that reduces the amount of industrial and municipal solid waste that is sent to disposal.	EC-6: Disposition of industrial and municipal wastes compared to norms, other practices.	Meet applicable laws and regulations regarding the disposition of industrial and municipal solid waste.	• Reduce the amount of industrial and municipal solid wastes being sent to land disposal.	Show the management and disposition of industrial and municipal solid wastes. (Technology, process)
		Hazardous waste generation reduction	Design and construct facilities and infrastructure in a manner that reduces the amount of hazardous waste being generated.	Operate and maintain facilities and infrastructure in a manner that reduces the amount of hazardous waste being generated.	EC-7: Quantities of hazardous wastes generated compared to norms, other practices.	Meet applicable laws and regulations regarding the generation of hazardous waste.	• Reduce the amount of hazardous waste generated.	Show how the project reduces the amount of hazardous wastes as compared to standard practices or industry norms. (Technology, process)

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			Planning, Design, Construction	Operation, Reuse, Deconstruction				
		Improving hazardous waste disposition	Design and construct facilities and infrastructure in a manner that reduces the amount of hazardous waste being sent to disposal.	Operate and maintain facilities and infrastructure in a manner that reduces the amount of hazardous waste being sent to disposal.	EC-8: Disposition of hazardous wastes compared to norms, other practices.	Meet applicable laws and regulations regarding the disposition of hazardous waste.	• Reduce the amount of hazardous wastes being sent to long term storage or land disposal.	Show the management and disposition of hazardous wastes. (Technology, process)
		Radioactive waste generation reduction	Design and construct facilities and infrastructure in a manner that reduces the amount of radioactive waste being generated.	Operate and maintain facilities and infrastructure in a manner that reduces the amount of radioactive waste being generated.	EC-9: Quantities of radioactive wastes generated compared to norms, other practices.	Meet applicable laws and regulations regarding the generation of radioactive waste.	• Reduce the amount of radioactive waste generated.	Show how the project reduces the amount of radioactive wastes as compared to standard practices or industry norms. (Technology, process)
		Improving radioactive waste disposition	Design and construct facilities and infrastructure in a manner that reduces the amount of radioactive waste being sent to disposal.	Operate and maintain facilities and infrastructure in a manner that reduces the amount of radioactive waste being sent to disposal.	EC-10: Disposition of radioactive wastes compared to norms, other practices.	Meet applicable laws and regulations regarding the disposition of radioactive waste.	• Reduce the amount of radioactive wastes being sent to long term storage or land disposal.	Show the management and disposition of radioactive wastes. (Technology, process)
		Enhanced waste recycling and reuse	Design and construct facilities and infrastructure in a manner that maximizes waste recycling and reuse.	Operate and maintain facilities and infrastructure in a manner that maximizes waste recycling and reuse.	EC-11: Extent to which waste recycling and reuse is employed in all phases of the project, compared to norms, other practices.	Apply waste recycling and reuse practices considering cost effectiveness, applicable laws and regulations.	• Establish policies and practices for recycling and reuse of materials and wastes.	Show how the project employs recycled and reused materials, as compared to standard practices and industry norms. (Technology, process)
	Transportation	Travel and transportation effectiveness	Design and construct facilities and infrastructure in a manner that reduces the need for travel, and/or maximizes the most appropriate forms of travel and transportation.	Operate and maintain facilities and infrastructure in a manner that reduces the need for travel, and/or maximizes the most appropriate forms of travel and transportation.	EC-12: Measurements of transportation modes and distances people and materials in all project phases. Comparison to norms, other practices.	Use modes of travel and transportation considering cost effectiveness, applicable laws and regulations.	• Design the facility or infrastructure using local materials and equipment. • Operate the facility or infrastructure to minimize travel and/or long distance shipping of materials, equipment or supplies	Show the extent to which the project and operation has reduced the need for travel, and maximizes the appropriate forms of transportation. (Technology, process)

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			Planning, Design, Construction	Operation, Reuse, Deconstruction				
	Durability (Service Life)	Improved durability and resiliency	Design and construct facilities and infrastructure in a manner that delivers durable and resilient structure and systems.	Operate and maintain facilities and infrastructure in a manner that maintains or enhances durability and resiliency,	EC-13: Extent to which durable materials were specified. Design for extended service life. NEW: Design for durability and resiliency.	Design for durability and resiliency considering project owner needs, cost effectiveness.	• Design the facility to extend durability, resiliency, incorporating end user considerations. • Design the facility for maximum flexibility for reuse. • Design the facility for ease in deconstruction, demolition, recycling and disposal.	Show how the design and operation of the facility will extend durability. Show how the facility will be resilient to natural and man-made disasters, Show how the facility has been designed for maximum flexibility and reuse, deconstruction, demolition, recycling and disposal. (Technology, process)
	Care, Ease of Maintenance and Repair	Ease of maintenance and repair	Design and construct facilities and infrastructure in a manner that provides for ease of service and maintenance.	Operate and maintain facilities and infrastructure in a manner that provides for ease of service and maintenance.	EC-14: Extent to which the facility requires care and maintenance, compared to norms.	Design for east in care and maintenance, considering project owner needs, cost effectiveness.	• Design the facility for ease of care and maintenance, incorporating end user considerations.	Show how the facility was designed to incorporate ease of care and maintenance. (Technology, process)

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Appendix A

Indicators and thresholds for defining slums

CHARACTERISTIC	INDICATOR	DEFINITION
1. ACCESS TO WATER	Inadequate drinking water supply: (adjusted MDG Indicator 29)	A settlement has inadequate drinking water supply if less than 50% of households have an improved water supply: Household connection Access to public stand pipe Rain water collection with at least 20 liters/person/days available within an acceptable collection distance.
2. ACCESS TO SANITATION	Inadequate sanitation: (MDG Indicator 30)	A settlement has inadequate sanitation if less than 50% of households have improved sanitation: Public sewer Septic tank Pour flush latrine Ventilated improved pit latrine The excreta disposal system is considered adequate if it is private or shared by a maximum of two households.
3. STRUCTURAL QUALITY OF HOUSING	a. Location	Proportion of households residing on or near a hazardous site. The following locations should be considered: • Housing in geologically hazardous zones (landslide/earthquake and flood areas); • Housing on or under garbage-mountains; • Housing around high-industrial pollution areas; • Housing around other unprotected high-risk zones, e.g. railroads, airports, energy transmission lines.
	b. Permanency of structure	Proportion of households living in temporary and/or dilapidated structures. The following factors should be considered when placing a housing unit in these categories: • Quality of construction (e.g. materials used for wall, floor and roof) • Compliance with local building codes, standards and bye-laws
4. OVERCROWDING	Overcrowding	Proportion of households with more than two persons per room. The alternative is to set a minimum standard for floor area per person (e.g. 5 square meters)
5. SECURITY OF TENURE	Security of tenure (MDG Indicator 31)	• Proportion of households with formal title deeds to both land and residence • Proportion of households with formal title deeds to either one of land or residence • Proportion of households with enforceable agreements or any document as a proof of a tenure arrangement.

Source: UN-Habitat: "The Challenge of Slums," 6 October 2003.