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GPP CRITERIA

WASTE WATER INFRASTRUCTURE

Draft

Report for the European Commission
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CONTENTS

LIST OF ABBREVIATIONS AND ACRONYMS

BOD	Biological Oxygen Demand
CBA	Cost-Benefit Analysis
COD	Chemical Oxygen Demand
CPR	Construction Product Regulation
DDT	Dichloro-diphenyl-trichloroethane
DEHP	Di(2-ethylhexyl)phthalate
DS	Dissolved solids
EIA	Environmental Impact Assessment
EMAS	Eco-Management and Audit Scheme
EMP	Environmental Management Plan
EN	European Standard
EPD	Environmental Product Declaration
EQS	Environmental Quality Standards
ETC	Emission trading scheme
EU	European Union
FIDIC	International Federation of Consulting Engineers
GHG	Green House Gases
GPP	Green Public Procurement
HCL	Hydrogen chloride
IPPC	Integrated Pollution Prevention and Control
ISO	International Organization for Standardization
KPI	Key Performance Indicator
kWh	Kilo Watt Hours
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
mg	Milligram
N	Nitrogen
Nm^3	Normal cubic meter
NO_x	Nitrogen oxide
NPV	Net present value
P	Phosphorus
PAH	Polycyclic Aromatic hydrocarbons
PE	Person Equivalent
PFOS	Perfluorooctane Sulfonic Acid
RB	River Basin
RBMP	River Basin Management Plan

RES	Renewable Energy Sources
SO_2	Sulfur dioxide,
UWWTD	Urban Waste Water Treatment Directive
VOC	Volatile Organic Compounds
WFD	Water Framework Directive
WWTP	Wastewater Treatment Plant

1 Introduction

This document provides the EU GPP criteria for waste water infrastructure projects. The accompanying Technical Background Report provides full details on the reasons for selecting these criteria and references for further information.

The document includes the following sections:

Section 1 gives an introduction to the purpose and general idea of using GPP criteria for waste water infrastructure projects.

Section 2 shortly describes the type of waste water infrastructure that is considered and included in the GPP criteria.

Section 3 provides an overview of the main key environmental impacts related to waste water infrastructure projects.

Section 4 shortly describes the different stages in developing a waste water infrastructure project and describes the GPP related activities at the different stages. The section includes a "decision tree" that illustrates the activities in each stage and gives an example of an evaluation model that can be used in connection with tendering of a waste water infrastructure project.

Section 5 describes the use of Life cycle costs. It presents the key concepts and how they can be used for GPP of waste water infrastructure.

Section 6 describes the selected GPP criteria recommended for waste water infrastructure projects including definition of award criteria, methods for verification and explanatory notes.

Section 7 provides relevant European legislation and information sources.

GPP criteria and technical background reports for other product groups can be found here: http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

In general EU GPP criteria are proposing two levels of ambition:

Core GPP criteria address the most significant environmental impacts, and are designed to be used with minimum additional verification effort or cost increases compared to a purchase without green criteria.

Comprehensive GPP criteria are intended for use by authorities who seek to purchase the best environmental products available on the market, and may require additional administrative effort or imply a certain cost increase as compared to fulfilling the core criteria.

The application and use of GPP criteria for waste water infrastructure is quite different from other GPP criteria. The reason is that these GPP criteria relate to:

1 Big and often complex infrastructure

2 An area with different levels of legal requirements (EU and national) for the effluent depending on actual location of the projects and the environmental sensitivity of the receiving water bodies.

3 Projects that themselves are having a positive environmental impact compared to a situation where the project is not implemented. Still the discharge of the remaining content of substances is the main contributor to the overall total potential environmental impact from wastewater treatment plants.

The use of GPP criteria for waste water infrastructure shall therefore be seen as an opportunity for waste water managing authorities to supplement the basic specifications with some additional requirements to ensure that waste water infrastructure projects are built and operated as environmental friendly as possible or, if public authorities wish so, opens up for solutions that fulfil even stricter values for the treated waste water.

The main environmental impacts/effect categories linked with wastewater treatment plant projects are nutrient enrichment, toxicity, global warming and acidification.

1.1 Use of this GPP guidance

Procurement of waste water infrastructure is a complex process. In most cases the procuring organisation will need technical support to undertake the whole tender process from initial feasibility studies to the final selection of a contractor.

Waste water infrastructure is typically owned by the local municipality and though larger municipalities might have a general procurement unit, they are unlikely to cover all the technical issues of waste water infrastructure.

In many cases, a more effective and efficient procurement process will be achieved by using technical support from a multidisciplinary engineering, environmental and economic advisor. This guidance on GPP criteria therefore include the requirements that the procuring unit should asked from a technical advisor. This is described in more detail in Section 4.

In defining the GPP criteria, it is often relevant to consult with national and international technical standards. It is not possible to make references to all the relevant standards. In many cases there are national industry standards that are either obligatory to comply with or they describe best practice. Similarly, there are guidance and best practice documents on cost assessment which are not repeated in this guidance (please refer to Technical Background Report Section 7.3.1).

It means that this guidance is supplementary to existing technical guidance on design of waste water infrastructure and guidance on assessment of costing.

The present document describes the recommended GPP criteria that can be used in tendering waste water infrastructure projects and how and when the criteria are used in the different stages of the development of a project.

1.2 Analytical tools for assessment of environmental impacts

Due to the complexity of waste water infrastructure projects it is recommendable to use analytical frameworks and tools in the assessment of the expected environmental impacts of such projects when considering GPP criteria in public procurement. These tools may include LCC, LCA and multi criteria models where financial, technical and environmental assessments are combined. These tools support the public authority to evaluate the most important environmental impacts. This assessment can be done in four ways:

1 Monetary valuation of the environmental impacts and using the monetary values as indicators for the relative importance of all the environmental impacts (LCC tools)

2 Normalisation[1] where all the potential environmental impacts gain the same unit and are related to an average person's contribution (LCA tools)

3 Weighting where the most significant impacts can be ranked according to the seriousness of the impact categories (LCA tools)

4 Overall weighting where economic, technical and environmental aspects are weighted in relation to each other. (Multi criteria tools)

An example of a selection model utilising multi criteria tools is described in Section 4.5.

[1] According to Life Cycle Assessment methodology descriptions, normalisation is defined to be the potential impact potentials divided by the corresponding normalisation references. The normalisation references are the specific potential impacts which society imposes on the environment each year.

2 Waste Water Infrastructure

These EU GPP criteria described in Section 6 include recommendations for the procurement of waste water infrastructure. It addresses the planning, design, construction, operation and decommissioning of sewerage networks, wastewater and sludge treatment plants defined as:

Sewerage system/networks used for collection and transportations of domestic, industrial and commercial/institutional waste water may comprise of pipe network, retention basins and pumping stations. Sewerage systems are normally classified as combined (designed for handling of waste water and storm water) or separate systems (designed for handling of waste water only).

Waste water treatment is the process of removing contaminants from domestic, industrial and commercial waste water. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Waste water treatment generally involves three stages, called primary, secondary and tertiary treatment.

- *Primary treatment* typically involves screening, grit and grease removal and sedimentation of suspended solid materials. The settled and floating materials are removed and the remaining liquid may be discharged or subjected to secondary treatment.

- *Secondary treatment* removes dissolved and suspended biological matter including organic matter, nitrogen and phosphorus and might involve both biological and chemical processes. Secondary treatment may require a separation process to remove the micro-organisms from the treated water prior to discharge or tertiary treatment.

- *More stringent treatment (also known as tertiary treatment*) is additional treatment that follows primary and secondary processes. It is employed when primary and secondary treatment cannot accomplish all that is required. The purpose of tertiary treatment is in most of cases to have additional nitrogen or phosphorus removal or, where required, removal of pathogens and/or removal of specific hazardous substances.

› The EU Directive on waste water treatment[2] establishes the way through which all treatment plants in the EU must deliver primary, secondary and more stringent treatment (the latter for the removal of nutrients).

Sewage sludge treatment describes the processes used to manage and dispose of the sludge produced at waste water treatment. It typically involves one or more of the following processes: thickening, stabilisation, dewatering, drying and/or incineration.

The Technical Background report provides short descriptions of the waste water infrastructure technologies most commonly used within and outside the EU.

The GPP criteria can be used in tendering procedures for the construction of new waste water infrastructure, operation of waste water infrastructure, as well as for renovation and maintenance contracts.

[2] Ref. http://ec.europa.eu/environment/water/water-urbanwaste/index_en.html.

3 Key environmental impacts

The proposed GPP criteria are designed to reflect the key environmental impacts. The approach is summarised in Table 3-1. The order of the environmental impacts does not necessarily translate to the order of their importance.

Key Environmental Impacts	GPP Approach
› Energy consumption especially in the operation phase	› Purchase equipment with low energy consumption/high energy efficiency › Increase the energy efficiency of electricity and heat producing units[3] › Reduce energy consumptions in buildings › Promote use of renewable energy sources
› Emission of nutrients with the treated waste water › Emission of pathogens and or hazardous substances (e.g. heavy metals, pharmaceuticals, organic priority substances etc.) with the treated waste water	› Favour the waste water treatment efficiency of the treatment plants
› Emissions from sludge incineration	› Favour the flue gas treatment efficiency of the sludge incineration plants
› Water consumption	› Incentivise the reduction of water consumption › Promote reuse of water and use of grey/rain water

Table 3-1: Approach for developing the GPP criteria for waste water infrastructure

In relation to hazardous substances, it should be stressed that their removal in wastewater treatment plants is, under normal circumstances, not necessarily

[3] E.g. gas boilers and gas engines.

considered to be the preferred option. The Impact Assessment (SEC(2011) 1547 final), accompanying the Commission proposal for a directive amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy, states: "Although one possible measure would be end-of-pipe treatment (improvement of UWWTPs), source-control measures might be more cost-effective. They could contribute to reducing the need for and cost of end-of-pipe treatment."

The problem is on the other hand that municipal waste water often still contains significant quantities of hazardous substances as specified in the Technical Background Report and it can be expected that they will also be there in the future but with lower and lower concentrations. Even for chemicals that are phased out it will take several years before they do no longer exist in the waste water.

Eutrophication caused by remaining nutrients and the toxicity of the hazardous substances when they are present in the effluent are usually considered amongst the most important impacts. Therefore the GPP criteria for waste water infrastructure include requirements related to reduction of both nutrients and hazardous substances (see Section 6).

4 Project stages and GPP related activities

In this chapter the different stages in developing a waste water infrastructure project and the GPP related activities at the different stages are described.

The overall differences between core and comprehensive criteria are described and recommendations for when to use to the different criteria are given.

A "decision tree" is inserted which illustrates the activities and decisions that have to be made by the public authority in each project development stage if they want to include GPP criteria in development and tendering of the project.

Furthermore, an example of an evaluation model that can be used in connection with tendering of a waste water infrastructure project is inserted including economic, technical and environmental criteria for evaluation and selection of a wastewater treatment project.

4.1 Process and methodology for GPP criteria

An overview of the different phases for development and implementation of a wastewater infrastructure project and how the GPP criteria can be used are shown in Figure 4-1 below.

Figure 4-1 Project development and how to use GPP criteria in the different phases

For more precise timing of the activities and when the different decisions have to be made by the public authority during the project implementation, please see the "decision tree" in Section 4.4.

The core and comprehensive criteria are developed for use in all phases of development and implementation of wastewater infrastructure projects. Nevertheless the single steps in the procurement process need to be addressed with specific criteria for the actual needs and possibilities for incorporating environmental issues. Each project is unique, therefore, some criteria might have to be strengthened, others omitted.

This process description is prepared as guidance for the public authorities which want to procure waste water infrastructure. The steps and application are described in the following.

4.1.1 Initial stages

The initial stages include general outline, feasibility study and to some extend conceptual design[4]. Common for these stages is that several solutions to the actual problem are discussed.

The decisions made during the initial stages have great impact on the economic and environmental performance of the project. Thus, it is very important to incorporate sustainability considerations very early in the process.

For wastewater treatment infrastructure, the following issues need to be considered:

- The number and locations of the treatment plants
- The effluent standards to be achieved. Distinction should be made between the basic requirements in the UWWTD (i.e. primary, secondary and more stringent treatment for the removal of nutrients) and additional requests (for instance bathing water quality in the receiving water bodies or treatment of specific hazardous substances)
- The sludge treatment requirements (e.g. level of sludge treatment and methods for sludge disposal)

The effluent standards are the most important issue to consider as the main objective of the infrastructure is to improve the treatment of waste water.

At this initial stage the procurement authority should consult with the relevant environmental authority to make sure that also possible future changes to the effluent standards are taken into account.

In the EU, the effluent standards are established by the Urban Wastewater Treatment Directive (UWWTD). Other pieces of EU legislation may nevertheless require more stringent treatment to minimize the effects on receiving waters, e.g. the Bathing Water Directive and the Water Framework Directive (WFD).

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[4] Conceptual design outlines the main technical structures and their functions for the wastewater infrastructure components.

While the UWWTD requirements are known and their implementation follows common patterns all around the EU, and, similarly, it is known whether the receiving water body is designated as a bathing water site, the requirement that could follow from the WFD are in a different situation. First, these requirements will necessarily depend on the circumstances under which the recipient waters are. And second, in practical terms, they might still not be determined when the decision to build a plant has to be taken.

The WFD require the development of a River Basin Management Plan (RBMP) and it should have been approved by the end of 2009. The programme of measures (PoM) for achieving the objectives should be made operational by the end of 2012 and this programme should include the considerations on the additional need for treatment at each point source. Through the consultation with the environmental authorities responsible for the RBMP and those responsible for the treatment requirement to the wastewater treatment plant (if that is a different authority), the specific requirements on BOD, nutrients and priority substances should be decided on.

Requirements beyond the UWWTD will typically depend on the situation in the receiving water body. If there are specific pollution problems or is it a designated area (bathing water, Natura 2000 site etc), then there probably are additional requirements.

The question if specific treatment requirements should be included in the technical specification or as award criteria should be answered during the planning and feasibility stage. If it is clear, when considering the RBMP, that additional treatment is necessary for compliance with the WFD then these treatment requirements need to be part of the technical specification.

If it is however considered to be *desirable* to achieve a better quality of the effluent, but not *necessary* according to legislation and specified in the discharge permit then it might be relevant to include GPP criteria of nutrients and/or hazardous substances in the award phase. For example using an LCC approach where the nutrients are valued at a reference price determined as the lowest costs of treatment at alternative sources, then additional treatment would be favourable only if it can be done at the treatment plant in question at lower costs than by any alternative measure. In this way the LCC promotes a cost-effective solution to nutrients removal.

In the conceptual design phase the project will be further developed and the type of waste water treatment, demands and efficiency of primary, secondary and perhaps more stringent treatment facilities, type of sludge treatment etc. will be determined.

In this initial stage it is also relevant to determine other environmental criteria as for instance demands on construction materials and energy consumption giving rise to environmental impacts which should be addressed and is thus incorporated in the GPP criteria.

In the initial phase a model for weighting the environmental impacts in proportion to economic consequences of the project should also be considered. This model can

be further developed as the project develops and ultimately be used during tender evaluation when actual offers for the project have been submitted. An example of a selection and evaluation model is given in Section 4.5.

In Table 4-1 below GPP related activities in the initial stage of a waste water infrastructure project are listed.

Table 4-1 GPP related activities - initial stage

Selection of consultant with relevant experience in sustainable design, LCA and LCC calculations for waste water infrastructure projects
Determination of effluent standards (WWTPs) and/or emission standards (sludge incineration) that goes beyond the EU and national standards
Determination of other relevant environmental criteria for selection of the waste water infrastructure
Selection of GPP criteria relevant for the project
Determination of selection model and weighting of the different criteria (economic, technical and environmental criteria)
Life Cycle Assessment (LCA) and/or Life Cycle Costing (LCC) calculations for different options

In Section 4.4 a decision tree has been developed illustrating the different activities and decisions that has to be undertaken in the different phases of the project, if GPP criteria shall be incorporated in the project.

4.1.2 Preparatory stage

The preparatory stage is also called the preliminary design stage.

The site of the wastewater treatment plant, sludge incinerator, sewage pipes etc. has typically been decided in the previous initial stages. Furthermore, the overall function of the waste water infrastructure facilities has been decided e.g. treat waste water to specific effluent demands, to incinerate sludge, etc.

In the preparatory stage the more specific technical solutions are considered and decided like: is it best to have chemical precipitation or biological removal of phosphorous? Which aeration system is the most appropriate in an activated sludge wastewater treatment plant? Should the sludge be treated on site or at an external sludge treatment plant?

The answers to these questions in the preparatory stage can be supported by setting up a *selection model* which includes economic, technical and environmental performance/GPP criteria for the specific project as described in Section 4.5. This selection model can further be developed during the detailed design and tender stage and be used as a *contract award model*.

The calculation of potential environmental impact can be done based on LCA and assessment of the total economic impact can be based on LCC calculations.

In this stage, for instance, energy consumption can be assessed of parts of the wastewater treatment plant, the entire wastewater treatment plant, sludge incinerator or sewage system. In this way the potential environmental impacts from energy consumption, water consumption etc. for different technical solution can be calculated and assessed.

These analyses can help a public authority to identify the best environmental solutions to technical problems.

In Table 4-2 below GPP related activities in the preparatory stage of a waste water infrastructure project are listed.

Table 4-2 GPP related activities - preparatory stage

Modification/adjustment of the GPP criteria relevant for the preparatory stage
Adjustment of the selection model and weighting of the different criteria (economic, technical and environmental criteria)
LCA and/or LCC calculations for different technical solutions

The GPP related activities and decisions to be made by the public authority in the preparatory stage are further explained in the decision tree, Section 4.4.

4.1.3 Detailed design/tender documents stage

In the detailed design/tender documents stage the necessary design, technical specifications and tender documents for the waste water infrastructure project will be developed ready for submission to the tenderers. The detailing level of the design and technical specifications will depend of the contract form.

If the contract is tendered as a works contract based on a detailed design (for instance FIDIC Red Book - http://fidic.org/), the tender documents will include precise specifications of the different project components and there will be limited possibilities for the tenderers to offer other solutions. Therefore the weights of GPP award criteria in this stage of the project implementation should be limited.

If the project shall be tendered based on a design-build contract (for instance FIDIC Yellow Book) it will be more open for the tenderers to offer innovative solutions and the weights of GPP award criteria can be higher.

The tender documents shall include a clear and transparent specification of the GPP award criteria and how the proposed offers will be evaluated and scored during the tender evaluation. An example of a selection model for a WWTP project is given in Section 4.5.

Table 4-3 GPP related activities - detailed design/tender document stage

Modification/adjustment of the GPP criteria relevant for the detailed design/tender document stage
Adjustment of the selection model and weighting of the different criteria (economic, technical and environmental criteria)
LCA and/or LCC calculations for different technical solutions

The GPP related activities and decisions to be made by the public authority in the detailed design/tender documents stage are further explained in the decision tree, Section 4.4.

4.1.4 Tendering stage

The tendering stage include submission of tender documents, the tendering period, i.e. tenderers time for preparation of offers, tender evaluation and award of the successful tender.

In the tender documents the GPP award criteria and the weight for the individual criteria and scoring mechanism (evaluation model) must be clearly stated allowing the tenderers to identify and react to the demands and wishes of the procuring public authority. Furthermore the needed data related to the evaluation model calculations shall be clearly specified.

Table 4-4 GPP related activities - tendering stages

GPP criteria and overall evaluation model presented in the tender documents
Collection of data related to selected GPP criteria for calculation environmental impact
Assessment and verification of selection criteria for the tenderers/contractors
LCC calculations
Selection/evaluation model calculations (economic, technical and environmental criteria)
Selection of successful contractor with the best economic-technical-environmental offer

The GPP related activities and decisions to be made by the public authority in the tendering stage are further explained in the decision tree, Section 4.4.

4.1.5 Construction phase

The European Commission is currently developing new EU GPP criteria for office buildings which are scheduled for publication by early 2013[5]. They can be used in the future as regards criteria for the tendering of the administrative buildings.

At present, it appears not possible to give recommendations on the procurement of green building materials and construction products in the framework of the GPP criteria on waste water infrastructure projects.

During the commissioning of the waste water infrastructure it is of paramount important that the performance/GPP criteria included in the tender documents are fulfilled by the contractors and the performance/GPP criteria are documented.

4.1.6 Operation phase

During the operation phase there are a few environmental aspects left to consider.

It must be ensured that the specifications guaranteed by the contractor are fulfilled. For example, when the contractors guarantee certain treatment efficiency it must be verified during operation of the wastewater treatment plant or sludge incinerator. If the promised treatment efficiencies are not fulfilled it can have a significant impact on the total economic and environmental impact.

During the operation phase there must also be focus on the energy consumption, water consumption and consumption of chemicals. Often this is done via the yearly reports where the consumption is indexed in relation to m^3 treated waste water (for wastewater treatment plants), ton of sludge (sludge incineration) or m^3 transported waste water (for sewage networks).

A public authority can use the GPP criteria for waste water infrastructure to verify the intended and promised performances (see the text about verification in the GPP Criteria for Waste water Infrastructure).

Table 4-5 GPP related activities - operation phase

Test and verification of GPP criteria related to the operation phase like: › Test and verification of energy consumption for the entire plant and/or for individual equipment › Test and verification of energy consumption in buildings › Test and verification of waste water treatment efficiency for the selected substances › Verification of chemical consumption

[5] The criteria will be published here:
http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

- Test and verification of flue gas treatment efficiency for the selected substances
- Verification of water consumption

4.1.7 End of life phase

During the tender phase where the contractors have provided information about the construction materials, information about the construction materials' faith after use, i.e. at decommissioning, has also been given. Thus, this information must have been incorporated during the detailed design or working design where the materials have been chosen. So, for end of life, the GPP criteria are also effective but are typically not applied actively during the end of life for waste water infrastructure

4.2 Core GPP criteria

The core GPP criteria are designed to tackle the key environmental impacts and are designed to be used with a limited additional verification effort and little or no cost increases.

The efficiency to deliver the levels of quality for the effluents defined by the EU Directive on waste water treatment, as a result of primary, secondary and more stringent treatment (the latter for the removal of nutrients), have to be incorporated in the core GPP criteria.

The use of LCC could bring about cost reductions.

Not all public authorities have the capacity to define core GPP criteria for all type of waste water infrastructure technologies. Some public authorities can therefore have a demand for sourced expert advice to define core GPP criteria.

4.3 Comprehensive environmental GPP criteria

The comprehensive criteria are intended for those public authorities who wish to choose the best option/project based on environmental considerations.

It must be mentioned that not all of the contributors to potential environmental impacts from emission of treated wastewater are incorporated in the core criteria, inter alia because data collection on treatment efficiencies of pathogens and hazardous substances can be time consuming and demand the involvement of experts. Nevertheless, if these aspects contribute significantly to the total potential environmental impact from the wastewater treatment plant concerned, public authorities should be encouraged to use the comprehensive criteria.

Fulfilling the comprehensive criteria will require an extra effort for the contractors. Managing and handling the information from the contractors will also require

additional administrative effort and costs for the public authority. Here as well, the use of LCC could bring about cost reductions.

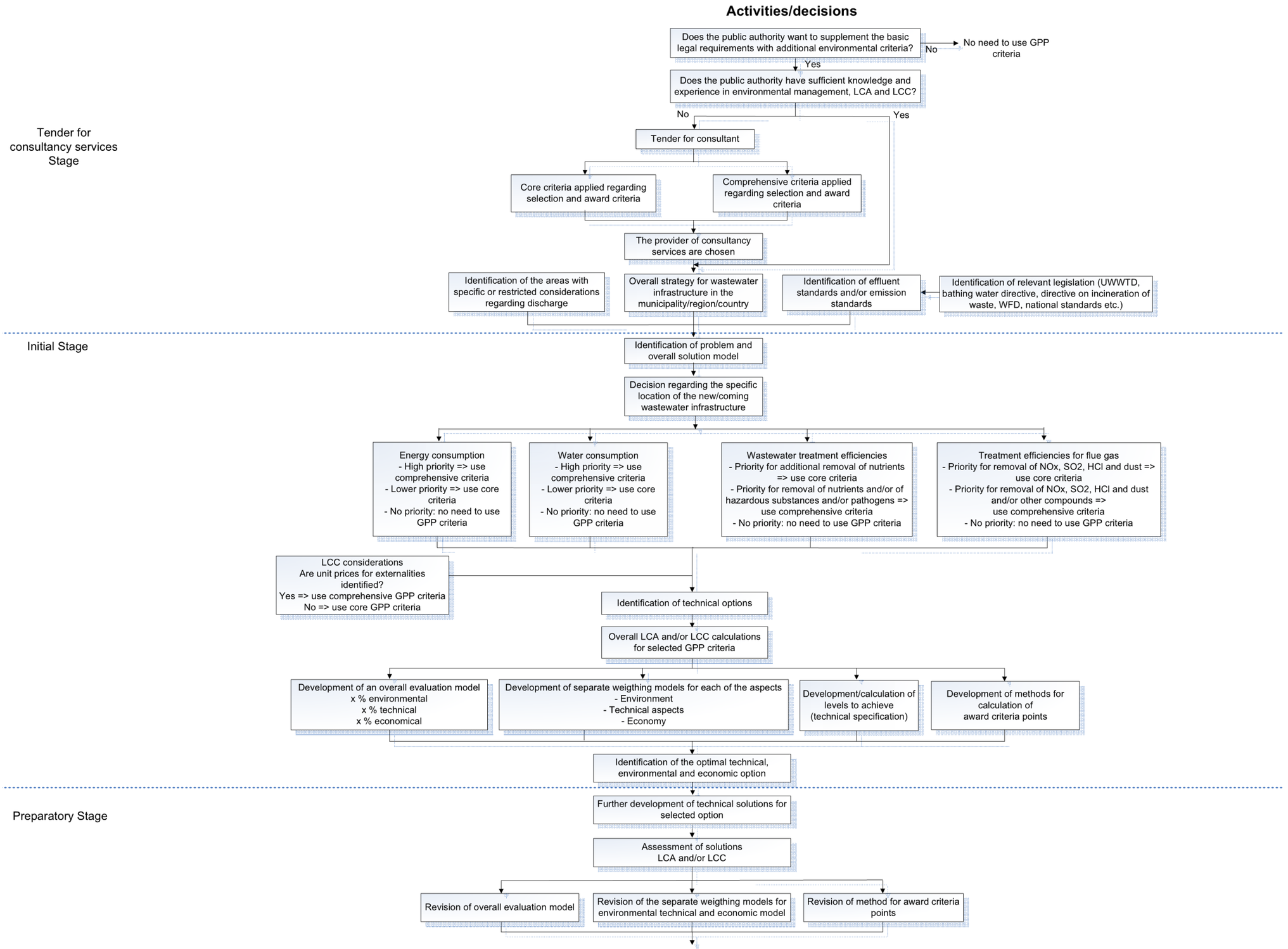
Some of the comprehensive criteria are quite complex and do require detailed expertise in environmental aspects. Some public authorities may in some cases have a demand for sourced expert advice in dealing with GPP criteria.

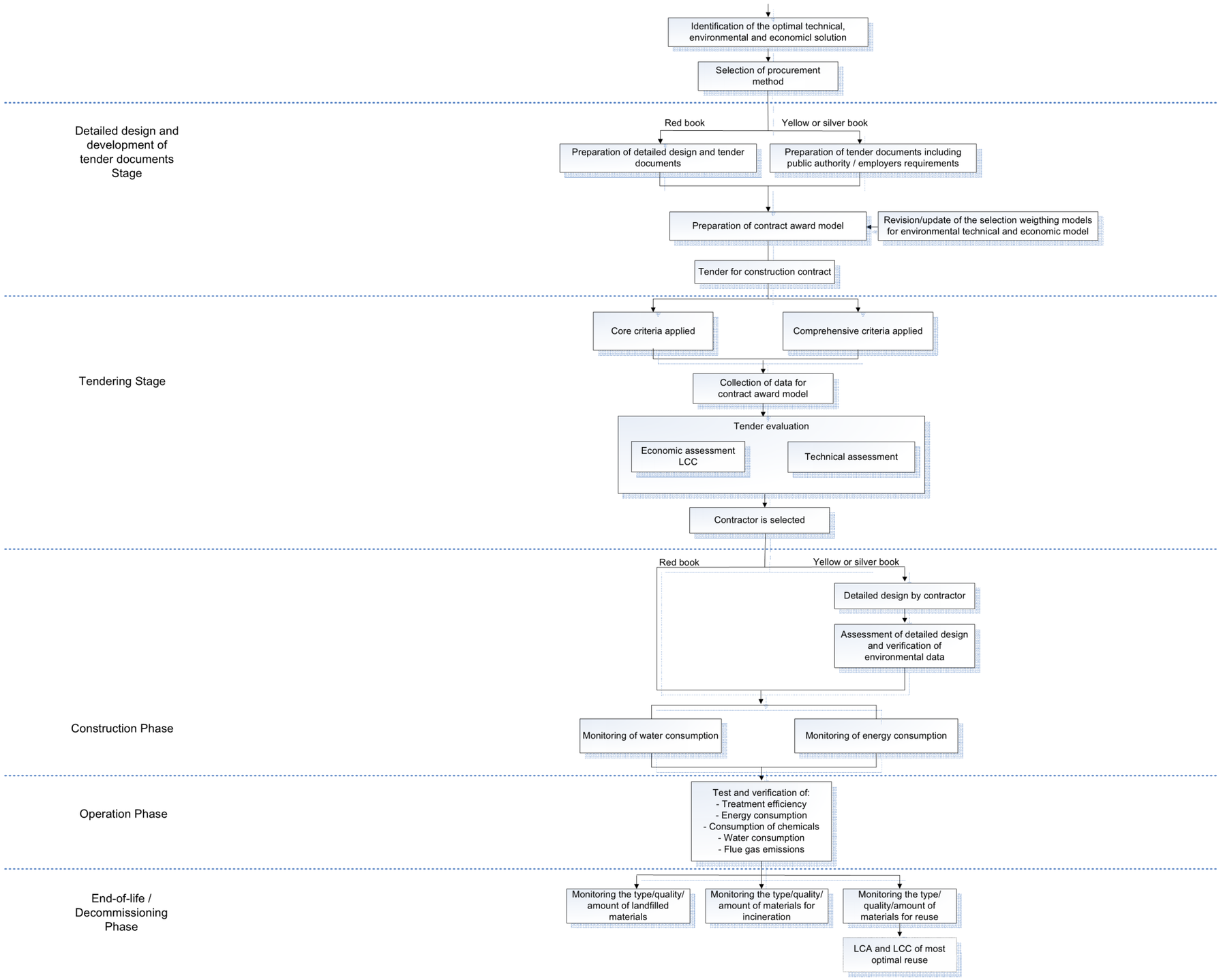
If the procurement authority decided that impacts from hazardous substances are important enough to make use of the related removal efficiencies as criteria, then there is a large need for detailed and extensive knowledge.

It must be stressed that it is not necessary that public authorities are implementing all of the criteria. The whole set of possible criteria must be assessed by the public authorities to identify those relevant for the actual project in question. An example is the comprehensive requirement for pathogens which are intended for use when the public authority wants to ensure the bathing water quality in the receiving stream, lake, sea etc.

4.4 Decision tree

The decision whether to use core or comprehensive environmental GPP criteria and whether to conduct Life Cycle Assessments or Life Cycle Cost analysis are illustrated in the below decision tree that can be used by public authorities and consultants when deciding on which GPP approach to use.


Activities/decisions
Tender for consultancy services Stage
Initial Stage
Preparatory Stage
Does the public authority want to supplement the basic legal requirements with additional environmental criteria?
No
No need to use GPP criteria
Yes
Does the public authority have sufficient knowledge and experience in environmental management, LCA and LCC?
No
Yes
Tender for consultant
Core criteria applied regarding selection and award criteria
Comprehensive criteria applied regarding selection and award criteria
The provider of consultancy services are chosen
Identification of the areas with specific or restricted considerations regarding discharge
Overall strategy for wastewater infrastructure in the municipality/region/country
Identification of effluent standards and/or emission standards
Identification of relevant legislation (UWWTD, bathing water directive, directive on incineration of waste, WFD, national standards etc.)
Identification of problem and overall solution model
Decision regarding the specific location of the new/coming wastewater infrastructure
Energy consumption
- High priority => use comprehensive criteria
- Lower priority => use core criteria
- No priority: no need to use GPP criteria
Water consumption
- High priority => use comprehensive criteria
- Lower priority => use core criteria
- No priority: no need to use GPP criteria
Wastewater treatment efficiencies
- Priority for additional removal of nutrients => use core criteria
- Priority for removal of nutrients and/or of hazardous substances and/or pathogens => use comprehensive criteria
- No priority: no need to use GPP criteria
Treatment efficiencies for flue gas
- Priority for removal of NOx, SO2, HCl and dust => use core criteria
- Priority for removal of NOx, SO2, HCl and dust and/or other compounds => use comprehensive criteria
- No priority: no need to use GPP criteria
LCC considerations
Are unit prices for externalities identified?
Yes => use comprehensive GPP criteria
No => use core GPP criteria
Identification of technical options
Overall LCA and/or LCC calculations for selected GPP criteria
Development of an overall evaluation model
x % environmental
x % technical
x % economical
Development of separate weigthing models for each of the aspects
- Environment
- Technical aspects
- Economy
Development/calculation of levels to achieve (technical specification)
Development of methods for calculation of award criteria points
Identification of the optimal technical, environmental and economic option
Further development of technical solutions for selected option
Assessment of solutions
LCA and/or LCC
Revision of overall evaluation model
Revision of the separate weigthing models for environmental technical and economic model
Revision of method for award criteria points


Identification of the optimal technical, environmental and economicl solution
Selection of procurement method
Detailed design and development of tender documents Stage
Red book
Yellow or silver book
Preparation of detailed design and tender documents
Preparation of tender documents including public authority / employers requirements
Preparation of contract award model
Revision/update of the selection weigthing models for environmental technical and economic model
Tender for construction contract
Tendering Stage
Core criteria applied
Comprehensive criteria applied
Collection of data for contract award model
Tender evaluation
Economic assessment LCC
Technical assessment
Contractor is selected
Red book
Yellow or silver book
Detailed design by contractor
Assessment of detailed design and verification of environmental data
Construction Phase
Monitoring of water consumption
Monitoring of energy consumption
Operation Phase
Test and verification of:
- Treatment efficiency
- Energy consumption
- Consumption of chemicals
- Water consumption
- Flue gas emissions
End-of-life / Decommissioning Phase
Monitoring the type/quality/ amount of landfilled materials
Monitoring the type/quality/ amount of materials for incineration
Monitoring the type/ quality/amount of materials for reuse
LCA and LCC of most optimal reuse

4.5 Selection model

An example of a selection model for a waste water treatment project is described in this section.

The model includes economic, technical and environmental criteria with different weights, which can be used by a public authority in procuring a wastewater treatment plant.

The final selection of economic, technical and environmental criteria for the actual wastewater treatment project and the weighting between the different items will depend on local conditions and the priority of the items by the contracting authority.

Furthermore the weighting between the different items might depend on the way the project is tendered. If the project is tendered based on a detailed project prepared by the public authority, there will typically be limited possibilities to vary the offered solution and hence the weight for price will typically be relatively high (70-80%) and the weightings for technical and environmental items relatively low (for instance 10-15% for technical items and 10-15% for environmental items). If the project is tendered as a "design-build contract" there will typically be room for a higher variation in the proposed solutions and technical and environmental weights are higher.

The financial assessment of the received offers will be done on the basis of life cycle costs calculated using the core or comprehensive model (see Section 5.7 below). The offer with the lowest LCC will be given 10 points. Prior to the tendering phase the public authority will have to determine a maximum acceptable life cycle cost which will be given 0 points in the financial assessment. The maximum acceptable LCC cost will be relative to the lowest received LCC offer and will be dependent on the exact nature of the project. For the example calculation, the maximum acceptable LCC was set to 1.5 times the lowest LCC. All offers between this maximum acceptable LCC and the offer with the lowest LCC will be given points relative to the 0 points for the maximum and 10 points for the minimum LCC.

The below model example shall therefore just be used as inspiration for the authority in setting up a selection model.

Example of Selection Model (WWTP project)

Cells to be filled out by the Public Authority

Financial assessment	Weight:	Point:	Score (= Weight x Point x 10):
	40%		
Construction cost			
Operation and maintenance cost			
NPV			
LCC		0.0 - 10.0	
Point for the evaluated tender price will be calculated as follows:			
Point = 10-((Lx-L1)/(Lh-L1)*10)			
L1 = lowest LCC	3000000	10	
Lx = LCC for option x	3500000	6,67	
Lh= highest acceptable LCC=1.5*L1	4500000	0	

Technical assessment	Weight:	Point:	Score (= Weight x Point x 10):
Wastewater treatment process and technology	**15%**		**0 - 15**
Proven technology	8%	0.0 - 10.0	0 - 8
Reliability	5%	0.0 - 10.0	0 - 5
Flexibility to cater for inlet quantity and quality variations	4%	0.0 - 10.0	0 - 4
Extent and quality of process and performance guarantees	3%	0.0 - 10.0	0 - 3
Plant and Equipment	**10%**		**0 - 15**
Quality & performance of equipment	7%	0.0 - 10.0	0 - 7
Plant design and layout	3%	0.0 - 10.0	0 - 3
Ease of operation and maintenance	3%	0.0 - 10.0	0 - 3
Process control and automation	2%	0.0 - 10.0	0 - 2
Other environmental impacts	**5%**		**0 - 15**
Architectual design and visual impact	2%	0.0 - 10.0	0 - 2
Odour control measures	2%	0.0 - 10.0	0 - 2
Noise control measures	1%	0.0 - 10.0	0 - 1

Each of the above tender evaluation criteria for Technical Assessment is given points from 0-10 according to the following applicable weight point system:

10	Excellent
9	Very good - Substantially better than expected/described
8	Good - Above expectation
7	Satisfactory - Responsive
6	Almost satisfactory
5	Unsatisfactory - Below expected level
3-4	Unsatisfactory - Clearly below expected level
1-2	Non-responsive
0-1	Unsatisfactory

Environmental assessment	Weight:	Point:	Score (= Weight x Point x 10):
Wastewater treatment efficiencies	**20%**		
Treatment efficiency of COD		0.0 - 10.0	
Treatment efficiency of BOD		0.0 - 10.0	
Treatment efficiency of total nitrogen		0.0 - 10.0	
Treatment efficiency of total phosphorous		0.0 - 10.0	
Treatment efficiency of lead and its compounds		0.0 - 10.0	
Treatment efficiency of mercury and its compounds		0.0 - 10.0	
Treatment efficiency of nickel and its compounds		0.0 - 10.0	
Treatment efficiency of Di(2-ethylhexyl)phthalate (DEHP)		0.0 - 10.0	
Treatment efficiency of naphthalene		0.0 - 10.0	
Treatment efficiency of nonylphenols and octylphenols		0.0 - 10.0	
Treatment efficiency of benzo(a)pyrene (to represent the Polycyclic Aromatic hydrocarbons (PAHs)		0.0 - 10.0	
Treatment efficiency of tramadol and primidone		0.0 - 10.0	
Treatment efficiency of pathogens		0.0 - 10.0	
Energy performance requirements	**6%**		
Total energy consumption per m3 wastewater		0.0 - 10.0	
Energy consumption for aeration systems (kg oxygen transferred to the water per kwh used)		0.0 - 10.0	
Sludge dewatering equipment (kwh per tons sludge dewatered)		0.0 - 10.0	
Treatment efficiencies of flue gas treatment	**3%**		
Treatment efficiency (energy consumption per ton sludge)		0.0 - 10.0	
Treatment efficiency of nitrogen dioxide		0.0 - 10.0	
Others	**1%**		
Total use of water		0.0 - 10.0	
Consumption of precipitation chemicals		0.0 - 10.0	

The tender evaluation criteria for treatment efficiencies are given points from 0-10 according to the point system:

10	50% under legislative level
9	45% under legislative level
8	40% under legislative level
7	35% under legislative level
6	30% under legislative level
5	25% under legislative level
4	20% under legislative level
3	15% under legislative level
2	10% under legislative level
1	5% under legislative level
0	Level according to legislation

The environmental criteria regarding water consumption and consumption of precipitation chemicals are awarded points according to the same scheme:

10	50% under this level
9	45% under this level
8	40% under this level
7	35% under this level
6	30% under this level
5	25% under this level
4	20% under this level
3	15% under this level
2	10% under this level
1	5% under this level
0	Level according to average level at similar wastewater infrastructure in the country/municipality/region etc.

5 LCC considerations

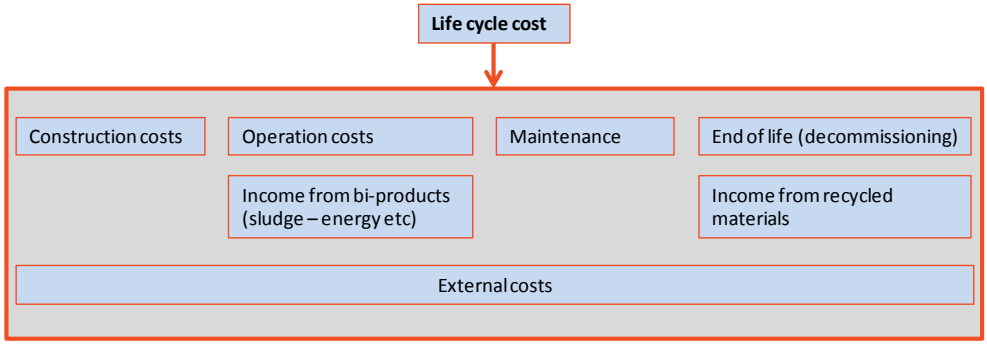
5.1 LCC concepts

Life cycle cost analysis (LCC) is an approach to include all relevant costs over the lifetime of a project. In the literature there are different definitions of LCC and there are also other concepts of cost assessments that are closely linked to LCC. For example, financial assessments and cost-benefit analysis are assessment concepts that cover many of the same aspects as LCC.

We will use the following definition of LCC in this guidance:

- LCC covers all costs in each life cycle (see Figure 5-1), meaning all expenses incurred by the public authority. It includes also income from selling sludge or energy.
- The LCC suggested under the core GPP criteria is a purely financial LCC assessment, while the LCC suggested under the comprehensive GPP criteria is an economic assessment where the externalities are included.
- The coverage of external environmental costs will be limited to what is feasible for a given project. The guidance includes the recommendations for what to include.

Figure 5-1 Elements covered by life cycle costs (LCC)



The meaning of the terms financial and economic assessments is set out below.

- The **financial analysis** consists in comparing revenue and expenses (investment, maintenance and operation costs) recorded by the concerned economic agents in each project alternative. The financial analysis applies market prices to estimate revenue and expenses.

- The **economic analysis** aims at identifying and comparing economic and social benefits accruing to the economy as a whole (including for example environmental impacts). The economic analysis applies shadow prices to estimate costs and benefit impacts[6].

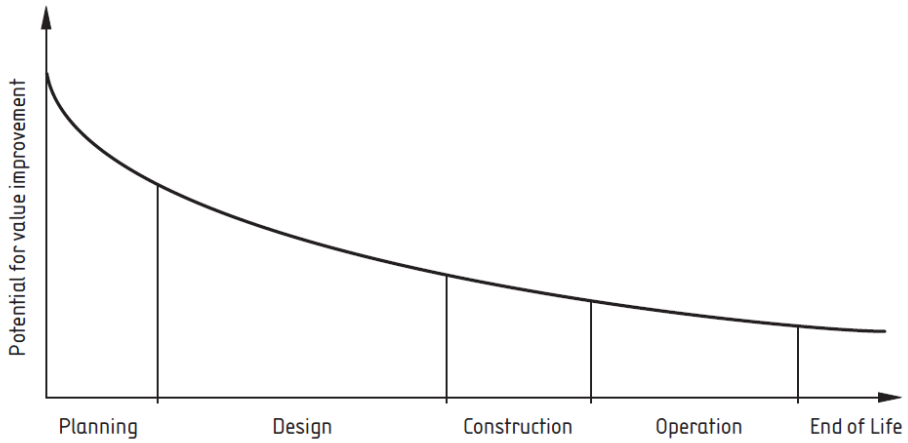
5.2 The benefit of using LCC

Life cycle costing of waste water infrastructure can be a good means for minimizing environmental impacts through green public procurement while keeping costs low. Estimations of lifecycle costs suggest that often the total operational costs exceed the initial investment costs. Therefore taking this into account is important in making the right decision for example when balancing a more expensive investment with lower operational costs or longer life time against an alternative with lower initial investment costs but higher operational costs.

The value of undertaking LCC at different stages of the project cycle is shown below. Figure 5-2 shows at the investment planning stage where more options are available, there is potential for a large value improvement. Further down the project cycle, there is less freedom to choose and hence less improvement potential from LCC calculations.

[6] In many economic analyses, market prices are used to estimate investment and operational costs. Hence, the main difference between the financial and economic assessment is the inclusion of environmental and other external costs in the economic assessment.

Figure 5-2 Value improvement potential from LCC at different project cycle stages



Source: ISO/DIS 15686-5.2 Part 5: Life cycle costing

The fact that the potential benefit is largest in the initial stages does not mean that the use of LCC should be restricted to those stages. The LCC can typically be more simple and easy to apply in the later stages so the costs of undertaking the LCC also decreases from the planning stage to operation stage. For more details about the use of LCC see the Technical Background Report.

5.3 LCC process

5.3.1 General considerations

Life cycle cost considerations can be used in all types of procurement contracts for waste water infrastructure, equipment or for consulting services. Section 4.1.1 in this document describes the initial consideration on the legislation that determines the technical standards for specific wastewater infrastructure. In terms of using LCC in the procurement process it is recommended to:

- Use LCC in the initial stage to consider relevant solutions including alternative technologies; and
- Use LCC in the tender for works or equipment to consider alternative technologies and equipment where relevant.

Typically three types of FIDIC contracts are used for the implementation of wastewater infrastructure projects, namely FIDIC Red Book, Yellow Book and Silver Book contracts (see Section 4 in the Technical Background Report). The **Red Book** is applied for building or engineering works designed by the purchasing authority. While the works may include elements of contractor-designed civil, mechanical, electrical and/or construction works, the purchasing authority has full control over the type of waste water infrastructure to be used and will do an evaluation of each offer. In tenders based on the **Yellow Book** the purchasing authority typically prepares a conceptual design defining the main wastewater treatment technologies and design parameters which provides a high degree of

control and the possibility for clear GPP criteria. The **Silver Book** is applied for establishing projects on a turnkey basis with the Contractor assuming total responsibility for the design including choice of technology and execution of the project. While the purchasing authority has little influence on the design of the plant it is still able to set clear GPP criteria to be fulfilled by the Contractor. Depending on the choice of contract used for a specific project the need for and comprehensiveness of life cycle costing will differ.

A detailed LCC calculation model should be developed by the public/procuring authority or by the consultant hired for the tender preparation phase. The LCC model should be easy to follow by the contractors bidding for the construction work. Whether the tendering is based on the FIDIC Red, Yellow or Silver book, the bidders should prepare input to the LCC calculation based on specific "calculation" principles that are developed by those preparing the tender documents. The actual completion of the LCC calculations will be done in the tender evaluation stage based on the input provided by the bidders. This approach insures that the bids are comparable with regard to the estimated LCC.

5.3.2 Specific considerations

The guidance for the use of life cycle costing distinguishes between a core and comprehensive approach. The core criteria approach includes only the financial lifecycle costs of a project, including costs of investment, operation and potential decommissioning of the waste water infrastructure. The comprehensive approach to life cycle cost calculations in addition incorporates external costs as far as they can be monetised. In the case of waste water infrastructure these potential external costs could be the emission of nutrients, hazardous materials, the emission of GHGs, traffic disruptions from construction etc.

Table 5-1 Core and comprehensive GPP criteria for LCC

Level of criteria	**Included cost elements in the LCC**
Core criteria (financial LCC)	Investment costs + operational costs + maintenance costs + decommissioning costs
Comprehensive criteria (LCC including environment and other external costs)	Investment costs + operational costs +maintenance costs + decommissioning costs + external costs

It is suggested to make the decision on whether to apply LCC and in what form in the following way:

- If a consultant or technical advisor is to be selected to support the procurement process, he should be able to undertake LCC assessments. The requirements are described in the Sections on Selection and Award Criteria for tendering for consultancy services at the initial stage (master plan, feasibility study)

› The decision whether to conduct a pure financial LCC or to include the external costs has to be taken on a case-by-case basis depending on the exact nature of the project, the willingness to tackle environmental externalities and on the availability of data on potential external costs. The decision trees presented in Section 4.4 will serve as a decision tool for public authorities or consultants facing the decision between a core and comprehensive LCC analysis.

Table 5-2 LCC elements by type of waste water infrastructure

Waste water facilities	**Main alternatives to consider in LCC**	**Life cycles**	**External effects**	**Other considerations**
Collection system	Use of different materials, dig or no-dig technology	Construction phase important Operational costs are typically low - life time of collection system is important	Embedded energy materials Traffic disruptions during construction phase	
Waste water treatment systems	Alternative treatment technologies Level of treatment	Construction and operational phases are important	Discharges of pollutants could be important and should be considered. This includes the following: › CO_2 emissions; › Emission of nutrients; › Hazardous substances; › Air pollutants › Traffic disruptions	Cost of land acquisition/use could be important Decommissioning could be relevant
Sludge treatment	Alternative treatment technologies	Construction and operational phases are important	Energy consumption/ production in operational phase	Cost of land acquisition/use could be important - income from sludge treatment/disposal should be included

Source: Consultant's assessment

The important elements of the LCC as part of GPP of waste water infrastructure compared to "traditional" procurement are:

› Inclusion of the operation phase where life time of the infrastructure and its component is important; and

› Inclusion of the environmental impacts, where the challenging element is to define the prices on the specific environmental impacts.

The challenge of considering the operational costs in the procurement process is related to the verification of the lifecycle costs. Operational costs and life time of individual component of the waste water infrastructure[7] can be difficult to verify. Potential bidders will have an incentive to state as low operational costs as possible. The data on operation and maintenance needs to be reviewed during the tender evaluation process.

The only source regarding expected life time of waste water infrastructure and its individual components is expert experience supported potentially by benchmark data if available.

5.3.3 Estimation and monetisation of environmental impacts

Environmental impacts can be valued using two different overall approaches:

› Estimation of the damage costs or
› Estimation of alternative reduction costs.

Estimation of the damage costs typically requires that all physical impacts can be identified and monetised. It is therefore often difficult to establish reliable damage cost estimates, though progress is constantly being made. In most cases it will be more relevant in the procurement LCC assessments to apply the second approach, which is to estimate the alternative reduction costs.

Estimation using alternative reduction costs can be used in situation where there is a defined policy goal for the environmental quality or total emission. This approach secures a consistent valuation of the environmental impacts across different sources and sectors. It is recommended as the approach to be used for the majority of environmental impacts.

An overview of the suggested approach and possible data source by type of environmental and other external impacts are presented in Table 5-2.

[7] Life time:
http://shop.dwa.de/dwa/shop/produkte.nsf/1A34AF1A8F92595DC12579A4001ECE52/$file/vorschau_DCCC-Guidelines.pdf

Table 5-3 Estimation of external effects - approach and data sources

Externality	**Estimation approach**	**Data sources**
CO_2 emissions	Cost of alternative reduction (based on EU ETS price)	EU ETS prices including possible forecasts of the future price.
BOD and emission of nutrients (N and P)	Cost of alternative reduction	River Basin Management Plans and the associated Programme of Measures.
Hazardous substances	Cost of alternative reduction/removal	Require specific assessment of local costs.
Air pollutants	Cost of alternative reduction	CBA of EU air quality and air emission legislation include costs per kg of pollutant for each Member State.
Traffic disruptions	Damage costs	Specific local assessment unit value of travel time from national transport planning institutions.

5.3.4 LCC model

The tender material should include an LCC model where the bidding contractors provide input on financial costs and for the external effects provide typically physical units. The model could look like the following:

Table 5-4 Illustration of LCC model

Life cycle phases	**Cost element**	**Unit**	**Unit price**	**LCC**
Construction	Construction costs	Monetary	NA	
	External impacts during construction	Physical (km roads affected, emissions etc)		Unit * unit costs
Operation	Operation costs	Monetary	kWh Man power Chemicals	
	Maintenance costs	Monetary + frequency recurrence	Man power Equipement	
	External Impacts during operation	Physical (emissions)		Unit * unit costs
Decommissioning	Demolition costs	Monetary	NA	

Life cycle phases	Cost element	Unit	Unit price	LCC
	Cost of disposal of demolition waste	Quantity of materials		Unit * unit costs
	Income from recycled material	Quantity of materials		Unit * unit costs

	Data provided by the bidding contractor
	Data provided by the organisation preparing the tender documents

5.4 Further guidance on LCC

The concept of LCC is coming out of the engineering or quantity surveying tradition while CBA originates from economics. It means that existing guidance material on how to do cost assessment and how to do cost-benefit analysis will be relevant to consult. For example the DG REGIO CBA guide is very relevant and it is recommended to consult this guidance. The DG REGIO CBA guide gives practical advice on many issues related to financial and economic calculations and assessment and it should always be consulted as part of the option appraisal or feasibility study.

Elements covered by different type of guidance:

Type of assessment	Where to find guidance
Costing of investment	Quantity surveying/engineering costing guidance and manuals
Costing of operation	Quantity surveying/engineering costing guidance and manuals
Costing of external costs	Partly CBA guidance, specific elements included in this guidance
Discount rates, price levels, financial or economic prices	CBA guidance (see for example the DG REGIO CBA guide)

6 GPP Criteria

The core and comprehensive GPP criteria for waste water infrastructure projects are presented in the following pages. They are divided into criteria for the consultancy service contract (6.1), the construction/operation/decommissioning contract (6.2) and the Life Cycle Cost (6.3), as indicated below:

- 6.1 GPP criteria for consultancy services (consultancy service contract)
- 6.2 GPP criteria for construction contract (construction /operation /decommissioning contract)
  - 6.2.1 Energy performance requirements
  - 6.2.2 Water consumption
  - 6.2.3 Waste water treatment efficiencies
  - 6.2.4 Treatment efficiency for flue gas treatment
  - 6.2.5 Contract performance clauses
- 6.3 Life Cycle Cost considerations

The following GPP criteria for other product groups can be relevant to include in tendering of the administrative buildings of a waste water infrastructure:

- Office building (to be adopted in early 2013)
- Indoor lighting
- Heating systems
- Sanitary tap ware (taps and showerheads)
- Office IT equipment
- Toilets and Urinals
- Paints and varnishes (to be adopted in 2013)

GPP criteria and technical background reports for other product groups can be found here: http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

6.1 GPP criteria for consultancy services (core and comprehensive criteria)

GPP criteria

Introduction

The criteria for tendering for consultancy services (engineers, architects, planners) describe the elements that are important for the whole GPP procurement process. Whether the procuring organisation decides to tender for external technical support or is able to source the expertise within its organisation, the description of the criteria allow the procurer to understand what is required and thereby to inform the decision about tendering for external technical support.

One crucial element for the success of the project is that, during the initial stages of the process, alternative solutions are considered. To explore alternative options and to do the technical, environmental and economic assessment of these options, multidisciplinary competences and expertise are required.

Selection criteria

Exclusion of certain engineers/planners/architects

The engineers/planners/architects and contractors must comply with the specific exclusion criteria. The purpose for these criteria is to ensure that the companies have not violated environmental law and convicted of grave and professional misconduct (Articles 53 and 54 of Directive 2004/17/EC and Article 45 of Directive 2004/18/EC.

Experience of the engineers/planners/architects

Depending of the specific waste water infrastructure project the selection criteria can include one or more of the following experiences and technical capacities:

- Experience in planning and design of waste water infrastructure (specific items within sewer systems, waste water treatment and sludge treatment should be specified)

- Experience in incorporating energy efficient process equipment
- Experience in environmental impact assessment and environmental management including incorporation of measures to reduce the total environmental impacts from discharge of waste water into the receiving water bodies
- Experience in performing Life Cycle Assessment (LCA) and ability to prioritise potential environmental impacts
- Experience in setting up and calculating Life Cycle Cost (LCC)

Verification	The above mentioned experience and technical capacity must be documented by a list of previous relevant projects of similar nature within the last 3-10 years.

Award criteria

The criteria for awarding the consultancy service could include:

The award criteria could be based on consultants understanding of the assignment and the suggested approach. Hence, the consultants should be asked to provide the following:

- Understanding: The consultant should describe how he understands the issues involved in the procurement. What kind of project - renovation/new construction etc. How the project links to the overall water quality regulation and planning for example the River Basin Management Plans developed as part of the Water Framework Directive.
- Methodology: The consultant should describe the specific approach to:
  - Identify alternative solutions
  - Estimate the financial LCC of the alternatives
  - Assess the environmental impacts using an LCA approach
  - Collect data on unit costs for environmental impacts to be included in the LCC
  - Comparing alternative technological options/alternatives.

- Organisation and team: The consultant should describe the team that is to undertake the study and how they will interact.

Regarding cost assessment and LCC approach the bidder should in the methodology describe in more details how cost assessment will be undertaken:

- Coverage of financial costs such as
  - Pre-construction and construction phase
    - Land acquisition for waste water infrastructure (if not happened before)
    - Capital investment costs
  - Operational phase
    - Manpower costs for operation and maintenance,
    - Energy costs,
    - Cost of chemical input during operations,
    - Transport costs,
    - Spare parts, etc.
    - Income from sludge disposal (if the project includes sludge treatment)
  - Decommissioning phase
    - Costs of demolition
    - Cost of disposal of demolition waste
    - Income from recycled materials

The consultant's approach should also reflect the data sources for cost estimation and the estimation techniques to be applied.

Cost data sources could include:

- Historical costs
- Supplier information
- National price books
- Benchmarks

- Expert estimates

Cost estimation techniques include:

- Unit cost functions (typically some form of cost functions related total costs to capacity)
- Detailed activity based costing (based on technical design estimates of activities and quantities)

The award of a consultancy contract is typically based given technical points for each section and weighting technical points and the price offered. The procurer could also specify the budget available and award the contract to the bidder providing the best proposal.

Weights could be specific as:

- Understanding 30%
- Methodology 40%
- Team and organisation 30%

Verification	The bidding consultants' proposals covering experience, understanding of the project, and methodology on how to execute the project and the proposed project organisation and the project team are the means of verification.

Explanatory notes

The engineers, planners and architects are important players when public authorities have decided to build waste water infrastructure. The reason is that they typically set the frame for the plant and buildings and thus also decide on many of the construction materials. Judging the experience of the engineers, planners and architects requires experience from the contracting authority. It may be appropriate to bring in external expertise and set up a jury that combines common knowledge to assess the experience statements of competing companies. This list is indicative and can be expanded/reduced to fit the situation. It will be necessary for the public authority to determine what appropriate past experience means.

6.2 GPP criteria for construction contract (core and comprehensive criteria)

GPP criteria

Introduction

The construction contracts are defined to cover:

› Construction and/or operation of wastewater treatment plants, sewage systems and sludge treatment plants minimising energy, water and chemicals consumption and using environmentally friendly construction materials and products during the entire life cycle; or

› Renovation and/or operation of wastewater treatment plants, sewage systems and sludge treatment plants minimising energy, water and chemicals consumption and using environmentally friendly construction materials and products during the entire life cycle.

Selection criteria

Exclusion of certain contractors
The contractors must comply with the specific exclusion criteria. The purpose for these criteria is to ensure that the companies have not violated environmental law and convicted of grave and professional misconduct (Articles 53 and 54 of Directive 2004/17/EC and Article 45 of Directive 2004/18/EC).

Experience of the contractors in environmental construction
Depending of the specific waste water infrastructure project the selection criteria can include one or more of the following experiences and technical capacities:

› Experience in construction of waste water infrastructure with focus on reduction of environmental impacts (specific items within sewer systems, waste water treatment and sludge treatment should be specified).

› Experience in operation of waste water infrastructure with focus on reduction of environmental impacts (specific items within sewer systems, waste water treatment

and sludge treatment should be specified) › Experience in environmental management of a construction site	
Verification	The above mentioned experience and technical capacity must be documented by a list of previous relevant projects of similar nature and size within the last 3-10 years. Possible means of proof of experience in environmental management of a construction site include EMAS and ISO 14001 certificates or equivalent certificates issued by bodies conforming to Community law or the relevant European or international standards concerning certification based on environmental management standards. Other means of evidence provided by the company that can prove the required technical capacity will also be accepted.

Explanatory notes

Judging the experience of the construction company requires experience from the contracting authority. It may be appropriate to bring in external expertise and set up a jury that combines common knowledge to assess the experience statements of competing companies. This list is indicative and can be expanded/reduced to fit the situation. It will be necessary for the public authority to determine what appropriate past experience means.

6.2.1 Energy performance requirements

Core GPP criteria

Technical Specifications

The waste water infrastructure must fulfil the requirements for energy consumption and efficiency for the total energy consumption for the entire wastewater treatment plant /infrastructure (see explanatory notes)	
Energy consumption	The overall energy demand of the waste water facility is not higher than X (see explanatory notes). Unit, wastewater treatment plants: kWh/p.e. or kWh/m^3 waste water treated. Unit, sewage system: kWh/m^3 transported waste water. Unit, sludge treatment plants: kWh/tonne sludge or kWh/m^3 sludge.
Energy efficient training	Before the plant is taken in operation, employees working with the operation of the plant including process equipment must receive training from the contractors regarding the energy management of the plant or the equipment delivered (depending on the type of contract). The training must cover an explanation of the overall energy management, monitoring of energy consumption and how to improve the energy efficiency to ensure continuous minimum energy consumption for the required processes.
Verification	For energy consumption: The tenderer must provide documentation and give guarantees for the overall energy consumption and/or for the energy consumption for specific equipment depending on the type of tender. The verification must be based upon both factory tests for the equipment delivered and on-site tests when the equipments are installed.

	For training: The tenderer must outline the content of the training in energy management.

Award criteria

Points will be awarded for:

Lower energy consumption than that demanded in the technical specifications, based on the overall energy demand for the entire waste water facility or for energy consumption for specific equipment.

Points will be awarded on the basis of a sliding scale between the best and worst bids.

Comprehensive GPP criteria

Technical Specifications

The waste water infrastructure must fulfil the requirements for energy consumption and efficiency for the total energy consumption for the entire plant and for some individual treatment facilities or equipment depending on the type of tender. Additional demands for energy efficiency could be related to % of self-production of power and heat, low-energy or Passive House standard for buildings, standards for control and monitoring of energy consuming equipment and used of localised renewable energy sources.

Energy consumption	The overall energy demand of the waste water facility is lower than the maximum defined in the technical specification (see explanatory notes). Unit, wastewater treatment plants: kWh/p.e. or kWh/m^3 waste water treated. Unit, sewage system: kWh/m^3/m head transported waste water. Unit, sludge treatment plants: kWh/tonne sludge or kWh/m^3 sludge.

Energy efficient process equipment	Establish minimum standards which the contractor must comply with for specific process equipment like (see explanatory notes): › Aeration systems/blowers [kg oxygen transferred to the waste water per kWh used] › Total pump efficiency [%] › Mixers [kWh per m^3 tank volume] › Sludge dewatering equipment [kWh per tonne sludge dewatered] › Sludge dryers [kWh per tonne sludge dried] › Gas utilisation equipment (boilers and generators) [kWh per m^3 gas] › Sludge incinerators [kWh per m^3 sludge incinerated]
Energy source	A minimum of [X] % of energy demand must be provided by localised renewable energy sources (l-RES). l-RES means renewable energy source generating capacity within the plant site itself (e.g. solar panels, biomass boilers, wind turbines etc.).
Energy efficient training	Before the plant is taken in operation, employees working with the operation of the plant including process equipment must receive training from the contractors regarding the energy management of the plant or the equipment delivered (depending on the type of contract). The training must cover an explanation of the overall energy management, monitoring of energy consumption and how to improve the energy efficiency to ensure continuous minimum energy consumption for the required processes.
Verification	For energy consumption: The tenderer must provide documentation and give guarantees for the overall energy consumption and/or for the energy consumption for specific equipment like aeration system efficiency depending on the type of tender. The verification must be based upon both factory tests for the equipment delivered and on-site tests when the equipments are installed. Factory test and/or on-site test can be used for verification of the energy consumption and efficiency for the specific process equipment depending on the type of tender. On site verification will be based on measurement of kWh consumed, flow and pressure.

	For training: The tenderer must outline the content of the training in energy management.

Award criteria

Points will be awarded for:

Lower energy consumption than demanded in the technical specifications, based on the overall energy demand for the entire waste water facility, for some selected specific process equipment (aeration systems/blowers, mixers, sludge dewatering equipment, sludge dryers, gas utilisation equipment, sludge incinerators) and/or for buildings (including heating, cooling, hot water, ventilation and electricity).

Points will be awarded on the basis of a sliding scale between the best and worst bids.

Explanatory notes

General note	It is recommended to evaluate which would be the best phase for including each of the proposed environmental criteria, e.g. architect's design competition, tendering procedure according to Red Book or Yellow Book construction works, see Section 4. For Red Book tender based on detailed design energy consumption criteria for specific equipment is mostly utilised, whereas in Yellow Book contracts both the overall energy consumption criteria and specific equipment criteria can be utilised.
Localised RES (l-RES) percentage	The contracting authority will need to determine the appropriate minimum % of l-RES. This will largely depend on the climatic conditions and the experience with l-RES installation. Typically this should be between 5-20%.
Energy consumption standards	Typical values for energy consumptions for well-operated waste water treatment are 20-40 kWh/p.e./year. The value depends however of many factors like type of treatment (primary/secondary/tertiary), treatment technology, hereunder especially if the plant have gas utilisation with power production, size of plant, composition of incoming waste water etc. Good total energy efficiency for waste water pumps is typically 60-70%, corresponding to an energy consumption of approx.

	4.5-4 W per m^3/h per m head. For mixing of large water volumes in process tanks, digester etc. a good energy efficiency is 2-3 W per m3 volume. For minor tanks the energy efficiency is 3-6 W per m3 volume. Efficient energy consumption for sludge dewatering is approx. 40-60 kWh/tons dissolved solids (centrifuges). Other sludge dewatering equipment can have lower energy consumption. For sludge drying and sludge incineration the energy consumption will be very type and equipment dependent. The choice of net, final or primary energy[8] demand will depend on the indicators used for defining energy performance provided in national legislation. When evaluating the incoming bids contracting authorities must verify the correct use of the applicable calculation method. This might need external/internal expert input.
Standards for factory tests	ISO 9906:2012 specifies hydraulic performance tests for customers' acceptance of rotodynamic pumps (centrifugal, mixed flow and axial pumps) and include also standards for electrical power measurements. EN60034-30:2009. Rotating electrical machines - Part 30: Efficiency classes of single-speed, three-phase, cage-induction motors (IE-code)
Energy conservation measures	EPA 832-R-10-005. Evaluation of Energy Conservation Measures for Wastewater Treatment Facilities. September 2010

[8] Net energy: Energy that is available to consumers for use in appliances and systems. For buildings the calculation considers only the building properties and not those of the heating/cooling system and results in the net energy use. To perform the calculation of net energy for buildings, data for indoor climate requirements, internal heat gains, building properties and outdoor climatic conditions are needed.
Final energy: Energy consumption measured at the final use level. For buildings, energy inflow measured at the gate of the building
Primary energy: Energy consumption measured at the natural resource level/primary energy content.

6.2.2 Water consumption

Core GPP criteria

Technical Specifications

The overall water efficiency demand of the waste water facility is not higher than X (see explanatory notes) of the following units:

- Cleaning of grids, membranes etc. at the wastewater treatment plant (m3 water used per 1000 m3 waste water treated)
- Scrubber in relation to a sludge incinerator (m^3 water used per Nm^3 - normal cubic meter)
- Cleaning of installed pipes (m3 water used per 100 m installed pipe[s])

For water consumption in office/administration building (taps and showerheads, toilets and urinals) new EU GPP criteria are being developed (to be adopted in 2013).

Verification	Tenderers must provide technical data sheets for the products to be installed that verify compliance with the specifications. The bidder must indicate the water consumption for the sludge incinerator. The bidder must point out the installations at the wastewater treatment plant where treated waste water is used for cleaning. The bidder must inform of the fresh water consumption per m^3 treated waste water. For renovation and installation of pipes the bidder must indicate the number of flushes and indicate the water consumption per m pipe installed.

Award criteria

Points will be awarded for water savings measures that go beyond the above mentioned specifications.

Comprehensive GPP criteria

Technical Specifications

The tenderer must fulfil the specific requirement regarding water consumption saving measures specified in the technical specifications. These could specification of maximum water consumption for the following treatment units:

- Cleaning of grids, membranes etc. at the wastewater treatment plant (m3 water used per 1000 m3 waste water treated)
- Scrubber in relation to a sludge incinerator (m3 water used per Nm3)
- Cleaning of installed pipes (m3 water used per 100 m installed pipes)
- For water consumption in office/administration building (taps and showerheads, heating systems, toilets and urinals, paints and varnishes) new EU GPP criteria is being developed (to be adopted in 2013).

Verification	Tenderers must provide technical data sheets for the products to be installed that verify compliance with the specifications. The bidder must indicate the water consumption for the sludge incinerator. The bidder must point out the installations at the wastewater treatment plant where treated waste water is used for cleaning. The bidder must inform of the fresh water consumption per m^3 treated waste water. For renovation and installation of pipes the bidder must indicate the number of flushes and indicate the water consumption per m pipe installed.

Award criteria

Points will be awarded for:

1. Rainwater and grey-water use

Tenderer must provide a proposal on how to maximise the use of rainwater and grey-water in the technical water supply of the plant.

Points will be awarded based on the proposals submitted. The proposals will be rated according to the following criteria:

- Design and quality of the technology including adaptability to the building design.
- Estimated percentage of overall water supply from rainwater and grey-water sources.
- Maintenance costs and durability of the product (installation and maintenance costs).

Verification	The tenderers must provide calculation and documentation for the amount of rainwater and grey-water used at the waste water facility.

2. Use of water for pipe installation

The tenderer must provide a proposal of how to reduce the consumption of fresh water for the flushing of pipes after installation. The proposals will be rated according to the following criteria:

› The number of flushes after installation › Estimated water consumption in percent of a water consumption of [x[9]] m^3 per meter installed pipe	
Verification	The tenderers must provide calculation and documentation for the use of water for pipe installation.
Explanatory notes	
Rainwater and grey-water use – specifications or award phase	It is also possible to set minimum percentages of overall water supply from rainwater and grey-water sources, however the potential will vary considerably according to climatic conditions. Therefore local expertise would be needed to set appropriate levels.
Water consumption standards	Water consumption for wastewater equipment depends very much on actual technologies. Below are given typical values for some equipment. Further information can be found in different wastewater handbooks. Screens. Very depended on technologies. Some systems like micro screens use continuously backwashing. Water consumption 0 - 5% of throughput wastewater. Chemical scrubbers for odour control. Water consumption2-3 l/sec per m3 airflow/s.

[9] The public authority must insert the average or lower water consumption used for flushing pipes after installation based on experiences from other similar projects.

6.2.3 Waste Water treatment efficiencies

Core GPP criteria

Technical Specifications

These criteria concerning treatment efficiencies are only relevant for those scenarios including treatment of waste water.

The wastewater treatment plant must fulfil the effluent standards specified in the Urban Waste water Directive or more strict standards specified in national regulations.

Demands on effluent standards	The effluent standards in the Urban Waste water Directive are stated in the Technical Background Report, Section 2.7.2. Typical effluent standards are: < 125 mg COD/l < 25 mg BOD/l < 35mg SS/l < 15 mg Total nitrogen/l (sensitive areas) < 2 mg Total phosphorus/l (sensitive areas) For some wastewater treatment plant there could be more strict national values for the above parameters and/or additional effluent standards for e.g. pathogens, heavy metals, organic hazardous substances etc.
Demands on maximum chemical consumption	g precipitation chemicals (typically iron or aluminium salts) per m^3 treated waste water, or g precipitation chemicals per kg total phosphorus in the inlet
Verification	Tenderer must provide documentation for that the offered technology can fulfil the demanded effluent standards and should

	be asked to sign a specific process performance guarantee. The fulfilment of the effluent standards shall be verified through a sampling and analysing program according to the requirements stated en the UWWTD or in national standards. The tender must provide verified calculations about the consumption of precipitating agent(s) per kg removed phosphorous in the treated waste water. The assumptions and results from these calculations must be identical to the input information for design of the wastewater treatment plant.
Award criteria	
Points will be awarded for:	
1. Improved treatment efficiency for BOD	
Unit	< xx mg BOD/l
Verification	Tenderer must document the predicted treatment efficiency of the wastewater treatment plant by indicating the percentage between [insert the concentration of BOD which must be obtained by law] and 0. Points will be awarded in proportion to the percentages proposed.
2. Improved treatment efficiency for total-nitrogen	
Unit	< xx mg total nitrogen/l
Verification	Tenderer must document the predicted treatment efficiency of the wastewater treatment plant by indicating the percentage between [insert the concentration of total nitrogen which must be obtained by law] and 0. Points will be awarded in proportion to the percentages proposed.

3. Improved treatment efficiency for total-phosphorous	
Unit	< xx mg total phosphorus/l
Verification	Tenderer must document the predicted treatment efficiency of the wastewater treatment plant by indicating the percentage between [insert the concentration of total phosphorous which must be obtained by law] and 0. Points will be awarded in proportion to the percentages proposed.
4. Reduced use of precipitating agent(s) per kg removed phosphorous	
Unit	g precipitation chemicals (typically iron or aluminium salts) per m^3 treated waste water, or g precipitation chemicals per kg total phosphorus in the inlet
Verification	Tenderer must calculate and document the consumption of precipitating agent(s) per kg removed phosphorous from the waste water by indicating the percentage between the ratios between the traditional uses of precipitating agent(s) divided by the national legal concentration of phosphorous in the outlet from the wastewater treatment plant. Additional points will be awarded in proportion to the percentages proposed. The bidder must provide the documentation for the calculation of the ratio between the traditional uses of precipitating agent(s) divided by the national legal concentration of total phosphorous in the outlet from the waste water treatment plant.

Comprehensive GPP criteria

Technical Specifications

Please refer to technical specification as outlined under core criteria.

Award criteria

Just like the core criteria the comprehensive criteria concerning treatment efficiencies are only relevant for those scenarios including treatment of waste water.

The comprehensive criteria for the waste water treatment efficiency are - ***in addition to the core criteria (see above)*** - treatment efficiencies for heavy metals, pharmaceuticals, priority substances and pathogens.

In principle, all the current 33 and the proposed 15 new priority substances in WFD can occur in urban waste water. However, in reality many of them will rarely be detectable or least only be present at very low levels because of their origin or their properties and, hence, for such substances it will not be very relevant to establish requirements to performance of WWTPs in relation to lowering their concentrations in the effluent.

In consideration of the context and objectives of the GPP criteria only few indicators from the list of relevant hazardous substances have been included in the GPP criteria for which documentation of WWTP performance could be required.

Volatile substances are omitted because they typically will be removed from the water phase by stripping during the treatment processes or shortly after discharge, and also leave out substances posing special analytical challenges (e.g. brominated flame retardants).

Relevant indicator substances include the following heavy metals (and their compounds):

- Cadmium and its compounds
- Lead and its compounds
- Mercury and its compounds
- Nickel and its compounds.

and the following selected among the organic priority substances:

- Di(2-ethylhexyl)phthalate (DEHP)
- Naphthalene
- Nonylphenols and octylphenols
- Benzo(a)pyrene (to represent the Polycyclic Aromatic hydrocarbons (PAHs)

The substances in **bold** are the priority hazardous substances for which an obligation to cease discharges into surface waters exist. It may therefore be relevant to focus

<table>
<tr><td colspan="2">particularly on these substances.

A public authority must specify or indicate the typical content of substances in the incoming waste water if possible. Based on this knowledge it is possible to point out the substances or groups of substances which are important and thus also the relevant comprehensive criteria.

If the wastewater treatment plant is required to have a discharge permit, it is highly relevant to initiate a dialogue with the supervisory authority about the future discharge limits for the waste water plant.

In some cases there are demands for the discharge of pathogens on the grounds of bathing water requests for the receiving water body. In this case it is relevant to use the comprehensive criteria about pathogens.

Points will be awarded for:</td></tr>
<tr><td colspan="2">1. Improved treatment efficiency for pharmaceuticals (tramadol and primidone)</td></tr>
<tr><td colspan="2">Tenderer must calculate and document the predicted treatment efficiency of pharmaceuticals in the wastewater treatment plant by indicating the percentage between 100 and 0 (100% being the inlet concentration). Points will be awarded in proportion to the percentages proposed.</td></tr>
<tr><td>Verification</td><td>1. Tenderer must declare and provide documentation for the treatment efficiency for tramadol in the treated waste water.

2. Tenderer must declare and provide documentation for the treatment efficiency for primidone in the treated waste water.

< µg/l or percentage reduction</td></tr>
<tr><td>Note for purchaser</td><td>Tramadol and primidone are used as indicator substances for discharge of pharmaceuticals.</td></tr>
<tr><td colspan="2">2. Improved treatment efficiency for pathogens</td></tr>
<tr><td colspan="2">Tenderer must calculate and document the predicted treatment efficiency of pathogens the wastewater treatment plant by indicating the percentage between 100 and 0 (100% being the inlet concentration). Points will be awarded in proportion to the percentages proposed.</td></tr>
</table>

Verification	1. Tenderer must declare and provide documentation for the treatment efficiency for E.coli in the treated waste water. 2. Tenderer must declare and provide documentation for the treatment efficiency for enterococci in the treated waste water. < nos/100 ml or percentage reduction
Note for purchaser	E.coli and enterococci are used as indicator substances for discharge of faecal contamination.
3. Improved treatment efficiency for heavy metals	
Tenderer must calculate and document the predicted treatment efficiency of heavy metals the wastewater treatment plant by indicating the percentage between 100 and 0 (100% being the inlet concentration). Points will be awarded in proportion to the percentages proposed.	
Verification	1. Tenderer must declare and provide documentation for cadmium and its compounds 2. Tenderer must declare and provide documentation for lead and its compounds 3. Tenderer must declare and provide documentation for mercury and its compounds 4. Tenderer must declare and provide documentation for nickel and its compounds < µg/l or percentage reduction
Note for purchaser	For assessment of the discharge of heavy metals it is proposed to select the above mentioned indicator substances for which documentation of wastewater treatment plant performance could be required.
4. Improved treatment efficiency for organic priority substances	
Tenderer must calculate and document the predicted treatment efficiency of organic priority substances the wastewater treatment plant by indicating the percentage between 100 and 0 (100% being the inlet concentration). Points will be awarded in proportion to the percentages proposed.	

Verification	1. Tenderer must declare and provide documentation for the treatment efficiency for di(2-ethylhexyl)phthalate (DEHP) in the treated waste water. 2. Tenderer must declare and provide documentation for the treatment efficiency for naphthalene in the treated waste water. 3. Tenderer must declare and provide documentation for the treatment efficiency for nonylphenols and octylphenols in the treated waste water. 4. Tenderer must declare and provide documentation for the treatment efficiency for benzo(a)pyrene (to represent the Polycyclic Aromatic hydrocarbons (PAHs) in the treated waste water. < µg/l or percentage reduction
Note for purchaser	For assessment of the discharge of hazardous organic priority substances it is proposed to select the above mentioned indicator substances for which documentation of wastewater treatment plant performance could be required.

6.2.4 Treatment efficiency of flue gas treatment

Technical Specifications

The sludge incineration plant must comply with the Directive on incineration of waste (2000/76/EC) and the BREF document for Waste Incineration from August 2006.	
Demands on emission standards	The emission standards in the Directive on incineration of waste are stated in the Technical Background Report, Section 9.2.6. Typical emission standards (24 hour average) are: < 40 mg SO_2/ Nm^3 < 100 mg NO_X/ Nm^3 < 8 mg HCl/ Nm^3 < 5 mg dust/Nm^3 For some incineration plants there could be more strict national values for the above parameters and/or additional emission standards for e.g. mercury, PAHs, cadmium, zink etc.
Verification	1. Tenderer must declare and provide documentation for the treatment efficiency for SO_2 in the emitted flue gas. 2. Tenderer must declare and provide documentation for the treatment efficiency for NO_X in the emitted flue gas. 3. Tenderer must declare and provide documentation for the treatment efficiency for HCl in the emitted flue gas. 4. Tenderer must declare and provide documentation for the treatment efficiency for dust in the emitted flue gas. Verification of the fulfilment of the guaranteed emissions standards shall be done according to the requirements specified in the directive on incineration of waste (2000/76/EC) or according to national standards.

Core GPP criteria

Award criteria

Award criteria are given for the improved performance.

Tenderer must calculate and document the predicted treatment efficiency of SO_2, NO_X, HCl and dust by indicating the percentage between 100 and 0 (100% being the inlet concentration). Points will be awarded in proportion to the percentages proposed

The points are awarded on the basis of a sliding scale between best and worst bids.

Comprehensive GPP criteria

Award criteria

The comprehensive criteria for the treatment efficiency of the flue gas filter are - ***in addition to the core criteria (see above)*** - treatment efficiencies for more substances e.g. mercury etc.

An example of the comprehensive criteria for the flue gas filter in a sludge incineration plant is:

The concentration of mercury and its compounds (as Hg) must not be higher than 0.05 mg/Nm3 measured by a non-continuous sample.

The specification for the treatment efficiency of the flue gas filter must incorporate the following compounds:

- Mercury
- PAHs
- Total cadmium and thallium (and their components expressed as the metals)
- Zinc

Award criteria are given for the improved performance.

Points are given for reducing the emission below limit values of the substances listed in the above mentioned specification included for the comprehensive criteria.

The points are awarded on the basis of a sliding scale between best and worst bids.

6.2.5 Contract performance clauses

Core GPP criteria

The requirements to the construction and output of the WWTP as such include a number of environmental aspects that will need to be specified in the contract as contractual deliveries. Performance clauses are in the following understood as requirements to the manner in which this delivery takes place, be they construction or operating activities. Together with the specification of the contractual deliveries the performance requirements constitute what the constructor/operator must "do" according to the contract.

The relevant aspects of environmental performance, such as minimizing odours, waste generation, noise or energy use, are essentially similar whether the contract concerns construction or operation. Identical types of GPP criteria can therefore apply but the concrete performance levels would normally need to differ given the fact that there are different requirements concerning for example energy use during the construction phase as compared to annual energy needs during operation.

Current best practices on how to design the contractual requirements for environmental performance is not a matter of using specific type of clauses in the contract as such. The requirements will for the purpose of precision normally be spelled out in annexes to the contract. Best practices are reflected in the FIDIC standard contracts in the Red and Silver Book standard contracts (see Section 4 in the Technical Background Report and below in "Life Cycle Cost Considerations" for explanation of these contracts).. The standard contract includes in both cases a general environmental clause which refers to more concrete requirements in the Employers Requirements (in the case of the Yellow or Silver Book) or the Specifications (in the case of the Red Book).

The general environmental clause in the Yellow and Silver Book essentially includes an overall requirement for the builder/operator to take all reasonable steps to protect the environment affected by his activities on and off the site. This is then followed up by the specific obligation to ensure that emissions, surface discharges and effluent from his activities do not exceed the values indicated in the Employers Requirements or in applicable laws. The Environmental Management Plan (EMP) will according to this approach become an integrated part of the Employers Requirements/Specifications, which is the FIDIC term for the technical specifications of the contract. Concretely speaking, the EMP will thus together with the performance requirements to construction and/or operation become part of the annexes to the contract. and form part of the technical specifications annexed to the contract.

In this context, the EMP defines the environmental performance level in a verifiable manner. For this purpose, the essential elements of the EMP are typically as follows:

- The identified environmental impacts and targets, which may differ according to circumstances but which would be defined in EIA's or other planning

documentation for the project. Impacts/targets that would be recurring in most projects concerning construction or operation would be water and energy use, use of renewable/reused materials, materials recycled/recovered, impact on flora or fauna, impact on local traffic and noise/odour emissions.

- The Key Performance Indicators defined for measuring the impacts. On this point there are various methodologies available and illustrative examples are provided in the table below.

- The concrete performance levels required for addressing these various impacts. Such performance levels can as mentioned earlier be set in the competitive tender process with performance levels being part of the award criteria.

- An important question is which performance requirements should be opened up for competition rather than merely established up front in the contract. Essentially, the question is where "empty spaces" should be left in the draft contract to be filled out by the levels of performance offered by the winner. To allow optimal and transparent competition, the award criteria should be quantifiable and verifiable. Thus, competition could concern the highest percentage of reuse of waste generated during operation or lowest levels of concentrations of Hydrogen Sulphide for the purpose of optimal reduction of odours. Themes for completion should not allow too much variation since this will make it difficult or even impossible to compare bids. This would be the case if the bidders were required to compete on who can produce the best EMP. One EMP could be focused on reduction of energy use whereas another could put emphasis on waste management.

The contract should allow for regular updating to take account of needs for higher performance levels or even new types of environmental impacts. This would as regards operating contracts in any case be a natural consequence of any required environmental management with progressively higher targets for the private operator.

The key performance indicators and performance levels regarding for example water and energy use can be relatively straightforward to establish. Essentially, it would be a matter of setting a certain levels of consumption expressed in quantitative terms (for example kWh when it comes to energy). The following table shows types of performance indicators relevant for both the construction and operation phase and levels that should be used for impacts that are less obvious:

Type of impact	**Key Performance Indicators**	**Performance Levels**
Odour	The plant shall not course troublesome odour problems inside or outside the plant.	The concentration of Hydrogen Sulphide (H_2S) shall be less than xx ppb at the boundary of the site and xx ppb within the site.
Noise	Maximum acceptable noise level	Daytime (08 to 20 hrs) max xx dB(A) Night time (20 to 08 hrs) max xx dB(A)
Local traffic	Percentage change in road traffic to and from the site during rush hours over a certain period.	A certain maximum percentage in traffic increase.

Other areas, such as waste management, include more scope for using different performance indicators. An EMP could in this respect include for example the following:

- An overall indicator of x tonnes of waste generated annually during operation or per €100k construction value coupled with an indicator for reducing waste generation by x% over a certain amount of years.
- A maximum of x tonnes of waste sent to landfill and a minimum of x tonnes of waste being reused or recycled.
- A minimum of x % of materials used during construction/operation derived from reused or recycled material.

Verification	The verification of contract performance clauses can for obvious reasons not be covered at the tendering stage, but only in the course of the actual execution of the contract. The means for verification would be the monitoring/reporting routines established in the contract and other contractual measures for performance control. They should be applied to ensure that measuring according to the KPI's is correct and that the performance is in accordance with the various impact levels established in the EMP.

Comprehensive GPP criteria

The performance clauses should focus on the same environmental impacts as the core clauses. The scope for adjusting the criteria over the duration of the project will be wider in the case of comprehensive criteria, including the possibility for not just an adjustment of performance levels but also the inclusion of additional environmental impacts. This may become relevant in especially projects of a longer duration.

Verification	Monitoring /reporting routines according to the general performance control procedures of the contract should be applied to ensure that measuring according to the KPI's is correct and that the performance is in accordance with the various impact levels established in the EMP.

Explanatory notes

The specific types and levels of performance included in contract performance clauses may have been defined already in the procurement phase in either the draft contract being part of the tender dossier or by application of the award criteria used during the procurement process, see further in Section 2.6 of the Technical Background Report.

For example, the maximum energy use during the construction or operation of a wastewater plant might have been used as an award criterion and the contract performance clause would in that case include the level of the winning bid as a requirement. An undertaking concerning a certain maximum energy use might alternatively have been included in the draft contract from the outset. In the first case, the draft contract would include an empty space as regards maximum energy used to be filled out as result of the tender process.

When it comes to the specific contract clauses on environmental performance there are many options. There are in practice examples of specific clauses concerning design life, water and energy use and odour discharges. However, to ensure effective and comprehensive coverage of all aspects of environmental impacts identified, the approach with a general clause coupled with an environmental management plan as outlined above is increasingly being used. This approach will facilitate any adjustments of the performance requirements over time.

To back up monitoring and reporting contractual obligations, it is crucial to establish contractual sanctions that can be triggered even in minor cases of infringement by the builder/operator of these obligations, including those relating to environmental performance. The traditional sanctions regarding compensation and termination have little effect in long-term contracts. Compensation normally requires proof of neglect and will normally involve a costly judicial procedure. It would only be relevant in case of significant infringements and would typically signify a rupture of the co-operation between the parties. Termination is equally a sanction that would only be relevant in case of significant infringements. None of these sanctions are adequate to address the minor deviations from established performance levels that may occur. It has therefore become normal in for example WWTP contracts to set up a system of smaller fines, also known as liquidated damages.

The fines are often linked to a system of minus-points, whereby a certain amount of performance failures concerning for example excessive energy use over a certain period triggers a certain amount of minus-point. If such minus –points reach a certain level over a period, for example annually, then fines or reduction in payments are applied. Such a system can be built around any performance indicators of the contract to be “activated” in case of any shortcoming. A system of graduated sanctions is a logical complement to verifiable performance criteria and monitoring/control procedures.

Contract clauses concerning environmental protection include in addition to specific performance clauses also clauses of a more general nature for the purpose of safeguarding environmental concerns. One example is a step-in right for the public party allowing it to unilaterally arrange for remedial action to be paid by the private party in case of immediate and serious danger to the environment. Another general provision requires the private party to indemnify the public party for any liability in case of breach of environmental legislation. Furthermore, there could as regards investment obligations be clauses to cover needs for reinvestments arising out of new environmental requirements rather than just wear and tear. As regards environmental liability there could be contractual terms requiring compulsory insurance for the private party to cover any environmental liability.

6.3 Life Cycle Cost GPP criteria for construction contracts

Introduction

Section 5 in this document includes an introduction to the use of LCC. It explains the concept of LCC and how it is suggested to be applied. The process is to do initial LCC calculation during the initial stages (see the Decision Tree in Section 4.4). At initial stage, it should be decided how to use LCC in the tendering process. The key elements that should be developed before tendering of the works include:

- Decision on the use of either core or comprehensive CPP criteria for LCC
- Develop LCC evaluation model

The decision regarding core or comprehensive is about whether unit prices for the environmental and other external effects are available. Only if they are available, the LCC will include the external costs otherwise it will include the financial costs at the life cycle phases (construction, operation, maintenance and end-of-life).

A detailed LCC calculation model should be developed by the purchasing authority or by the consultant hired for the tender preparation phase. The LCC model should be easy to follow by the contractors bidding for the construction work. Whether the tendering is based on the FIDIC Red, Yellow or Silver book, the bidders should prepare input to the LCC calculation based on specific "calculation" principles that are developed by those preparing the tender documents. The LCC evaluation model will specify the unit prices and how the overall LCC is estimated. The general formula for the LCC regarding the external costs are:

Physical units of emission * unit price per unit of emission = total external costs of emission.

Those bidding would provide the physical units and the actual completion of the LCC calculations will be done in the tender evaluation stage based on the input provided by the bidders (see Section 5.3.4 on the LCC model).

The following sections include the description of the specific elements to include in the LCC and the type of information that bidders for construction work should provide and the unit prices/costs that those preparing the tender material should include.

Core GPP criteria

Award criteria for tendering for works

The core GPP criteria is suggested to include the following LCC elements:

Life cycle	Description of financial costs
Construction	Land acquisition Materials Equipment Civil works
Operation	Consumables (e.g. chemicals) Spare parts Energy Staff costs (salary rates provided)
Decommissioning	Due to the special nature of WWTP infrastructure the decommissioning cost is likely not to be relevant to include in core criteria. The material input in WWTP infrastructure is typically not easy to recover and recycle and hence has no high decommissioning value. Depending on the individual case it might however be advisable to include decommissioning costs in the life cycle cost analysis.
Total LCC	Total financial costs of life time of construction elements and equipment based on life time and discount rate provided

Providing an estimate of the construction costs is a standard procurement element.

The operational and maintenance elements that the bidders can provide estimates for relate to:

- Consumables (e.g. chemicals)
- Energy
- Spare parts

› Man power (optional)

The bidder should provide the following information:

	Name/description	Quantity	Price quote
Consumables	e.g. type of chemicals	e.g. kg per year	e.g. price quotes from the suppliers of the consumables
Energy	e.g. electricity	e.g. No of kWh per year	Procurer will have to specify price
Spare parts	e.g. Replacement of pump	e.g. no of pumps of type xx every 10 year	e.g. suppliers price quote
Man power	Monitoring of operation	e.g. 1000 hours per year	Procurer will have to specify price

Operational cost is less of a standard element and it is more difficult to provide a reliable estimate. If the project is a renovation or upgrading of existing facilities, the specific need for man power cannot be estimated by the bidders. The procurer should decide whether to exclude man power requirement or whether specific operational functions related to the construction elements can be defined and if that is the case then the bidder provide an estimate of the number of hours for those functions.

Life time of material and equipment could be based on the following assumptions which are expert estimates as there are no data sources for life times. Please note that products with different durability might have quite different lifetimes and this list hence only provides rough estimates. Furthermore, if the life times of specific types of equipment vary significantly then the equipment category might be divided into individual elements and components.

	Life time in years
Pipes	60
Buildings, tanks	40
Equipment (e.g. pumps, mixers, blowers etc.	15

Source: Consultants experience

The bidders could be asked to specify the lifetime of individual components of the infrastructure and provide the basis for their estimated lifetimes. During the tender evaluation, sensitivity analysis should be undertaken to test if the ranking of alternative bids based on the LCC depends on the lifetime estimates provided by the bidders. If the ranking is sensitive to the bidder's estimates of life times, the procurer could ask for additional information to support the estimated lifetimes. Discount rate: 5% (this is the rate recommended by the European Commission for the programming period 2007-2013 it its Guide to Cost Benefit Analysis of Investment Projects. However, depending on specific macroeconomic conditions, the sector and the nature of the investor (e.g. PPP projects) a different discount rate might be applicable)	
Verification	Energy and consumable use in operation phase: See above under criterion for **Energy performance requirements** Treatment efficiencies: See above under the criterion for **Waste water treatment efficiencies**

Comprehensive GPP criteria

Award criteria for tendering for works

The comprehensive GPP criteria is suggested to include the following LCC:

Life cycle	Cost element	Description
Construction	Financial	Land acquisition, materials, equipment and civil works
	External	External costs of disruption during construction, e.g. traffic disruption (if relevant)
Operation	Financial	Consumables used in operation (e.g. chemicals) Spare parts and estimated maintenance and repair works Energy Staff costs (salary rates provided)
	External	Emission of organic water pollutants (BOD) Emission of nutrients (nitrogen and phosphorus) Emission of priority hazardous substances Emission of hazardous substances in flue gas Emission of CO2
Decommissioning		Due to the special nature of WWTP infrastructure the decommissioning cost is likely not to be relevant to include in core criteria. The material input in WWTP infrastructure is typically not easy to recover and recycle and hence has no high decommissioning value. Depending on the individual case it might however be advisable to include decommissioning costs in the life cycle cost analysis.
Total LCC	Financial	Total financial costs based on life time of construction elements and equipment based on life time and discount rate provided
	External	Total external costs as net present value over the same lifetime and with the same discount rate as for the financial costs

	Total	Sum of financial and external LCC costs

Financial and external costs provided by potential bidders should be based on unit costs provided by the public authority. Below the principles for how to estimate unit costs are described. In most cases they depend on local conditions and therefore it is not possible provide specific unit costs that can be applied. In cases where values are provided, please note that these are only rough estimates and actual values will have to be calculated based on the specific nature of the project and its input materials. The Technical Background Report provides more details on unit cost estimates.

Life time of material and equipment could be based on the following assumptions which are expert estimates as there are no data sources for life times. Please note that products with different durability might have quite different lifetimes and this list hence only provides rough estimates. Furthermore, if the life times of specific types of equipment vary significantly then the equipment category might be divided into individual elements and components.

	Life time in years
Pipes	60
Buildings, tanks	40
Equipment (e.g. pumps, mixers, blowers etc.	15

Source: Consultants experience

The bidders could be asked to specify the lifetime of individual components of the infrastructure and provide the basis for their estimated lifetimes. During the tender evaluation, sensitivity analysis should be undertaken to test if the ranking of alternative bids based on LCC is sensitivity to the lifetime estimates provided by the bidders. If ranking is sensitive to the bidder's estimates of life times, the procurer could ask for additional information to support the estimated lifetimes.

The discount rate to be used should be the same as for other projects in the particular country in order to have a consistent assessment. The Ministry of Finance or a similar institution will typically have developed the discount rate to be used. See for example DG REGIO CBA guide for further guidance on use of discount rates.

For the calculation of the external costs the following information could be used:

Traffic disruptions

External costs from traffic disruptions due to waste water infrastructure works should be estimated using the value of travel time savings (VTTS) methodology. The value of travel time savings describes the opportunity cost of the time that travellers spend on their journey. Delays in travel times due to waste water works will cause external costs proportional to the VTTS. The VTTS is measured in Euros per person-hour or per vehicle-hour and VTTS values for different Member States are dependent on a number of factors, wage levels being one of them. The Ministry of Transport in the respective Member State could be consulted regarding estimates for VTTS as well as

the Harmonized European Approaches for Transport Costing and Project Assessment (HEATCO). To calculate the external costs caused by traffic disruptions estimates of the VTTS, the average additional travel time due to the construction works, the number of disruption days and the volume of traffic are needed.

GHG emissions

External costs from emission of CO_2 can be calculated using unit price/costs per CO_2-equivalent. This unit price can be based on either a national agreed value if it exists or on international averages. The suggested approach to be used in the calculation of the external costs of CO_2 emissions in LCC is to apply an estimate of the marginal costs of achieving the national target for reduction of GHG emissions. This approach is for example used by the UK. The UK Department on Energy & Climate Change recommends this approach based on the abatement costs needed to meet the emission reductions targets. It calculates estimates of abatement costs that will be needed to reach the emission limits that each country has agreed to meet. Based on this approach the estimated costs for the UK lie between 30 and 75 Euros per ton of CO_2 in 2020. National equivalents can be calculated for other Member States. Alternatively, the estimated social cost of carbon calculated by the IPCC that lies between 3 - 70 EUR per ton or the current market price for CO_2 allowances under the EU emissions trading scheme could be used.

Emissions of BOD and nutrients:

For the calculation of the external costs of BOD, nitrate and phosphorus emissions the following table can be used. The values for outlet concentrations are provided by bidding contractor. The marginal cost for alternative reduction is based on data from a RBMP or similar where cost-effectiveness assessments of BOD and nutrient removal have been done. The costs are the marginal reduction costs at the level of BOD and nutrients removal where the objectives for the relevant water body are achieved.

	Actual outlet concentration mg/l	**Marginal cost for alternative reduction EUR per kg**	**Total external costs EUR per year**
BOD			
N			
P			

As the local conditions vary there are recommended values to be applied. It is important to consult with the RBMP responsible authority to investigate the relevance of including these emissions and the appropriate unit costs to apply.

Emission of priority hazardous substances:

Emissions of priority substances could be included in the LCC if it has been determined to be an environmental problem that should addressed at this particular point

source and if there are unit costs available to calculate the costs. Source control is the most cost-effective way to reduce emissions of hazards substances. As mentioned in Section 3, there could be situations where it is local problem that needs to be addressed in a short term perspective.

The tender material should include the inlet concentrations and the bidder should provide the treatment efficiency by substance. In the tender evaluation process, the LCC will be estimated based on the data on treatment efficiency provided by the bidders. The unit costs should be based on the costs alternative removal costs. If for example the emissions are up-stream to a water supply intake, the costs could be based on the treatment costs at that water supply. If no unit costs are available, how to include the discharge of these substances are described in Section 6.2.3.

Table 6-1 LCC of priority hazardous substances

Examples of substances	**Inlet concentration**	**Estimated treatment efficiency**	**Estimated emissions**	**Unit costs by substance**	**Cost of emissions**
	µg/l	**% removal**	**Kg/year**	**EUR per kg**	**EUR per year**
Cadmium					
Lead					
Mercury					
Nickel					
Di(2-ethylhexyl)phthalate (DEHP)					
Nonylphenols					
Octylphenols					
Benzo(a)pyrene					
Total					

Air emissions

If the project includes sludge treatment, the emissions of hazardous substances in the flue gas from sludge incineration could also be included in the LCC. The format for

the cost assessment will be that the bidders provide data on the flue gas emissions and the LCC costs are estimated during the tender evaluation process.

Table 6-2 LCC of priority hazardous substances

Examples of substances	**Estimated emissions**	**Unit costs by substance**	**Cost of emissions**
	Kg/year	**EUR per kg**	**EUR per year**
SO_2			
NO_X			
HCl			
Dust			
Mercury			
PAHs			
Cadmium and thallium (and their components)			
Zinc			
Total			

The costs of the emissions should be marginal reduction costs of alternative measures to reduce the emissions. For air emission, updated values used in relation to assessment of EU's policy on air quality could be used. See for example EU air pollution - CBA.

Final LCC estimation

Based on these elements the comprehensive LCC can be calculated during the tender evaluation.

Life cycle phase	Type of cost	Bid no 1	Bid no 2	Bid no 3 etc	etc
Construction	Financial				
	External				
Operation	Financial				
	External				
Decommissioning	Financial				
	External				
Total LCC	Financial				
	External				
	Total	**LCC for bid 1**	**LCC for bid 2**	**LCC for bid 3**	**etc**

The total LCC for each bid should then be included in the evaluation model see Section 4.5.

Verification	Energy and consumable use in operation phase: See above under criterion for **Energy performance requirements** Treatment efficiencies: See above under the criterion for **Waste water treatment efficiencies** Air emissions: See above under the criterion for **Treatment efficiency of flue gas treatment**

7 Relevant European legislation and information sources

7.1 Public Procurement regulation

Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors

Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts

7.2 Horizontal Environmental regulation

Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (EIA)

Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control)

Regulation (EC) No 1221/2009 of the European Parliament and of the Council of 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS

Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (Seveso II -directive)

Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage

Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Eco label

7.3 Water specific regulation

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (WFM directive)

Directive 2008/105/EC of the European Parliament and of the Council of 16 December 2008 on environmental quality standards in the field of water policy (EQS-directive)

Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration

Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption

Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality

Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources

Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (UWWT directive)

7.4 Waste, energy-saving regulation and other regulation of relevance

Council Directive of 12 June 1986 on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture

Regulation (EC) No 106/2008 of the European Parliament and of the Council of 15 January 2008 on a Community energy-efficiency labelling programme for office equipment

Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles

Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings

Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011 laying down harmonised conditions for the marketing of construction products.

7.5 Other sources

Communication (COM (2008) 400) “Public procurement for a better environment”

Buying Green - A handbook on green public procurement. EU, 2011

EPA 832-R-10-005. Evaluation of Energy Conservation Measures for Wastewater Treatment Facilities. September 2010

Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems is the result of collaboration between the Hydraulic Institute, Europump, and the US Department of Energy's Office of Industrial Technologies (OIT). DOE/GO-102001-1190 January 2001

7.6 Internet sources

http://ec.europa.eu/environment/gpp/helpdesk.htm

http://ec.europa.eu/environment/gpp/studies_en.htm

http://ec.europa.eu/environment/gpp

http://www.euneptune.org/Publications%20and%20Presentations/D4-3__NEPTUNE.pdf

www.ig-passivhaus.de

www.minergi.ch/index.php?standards-6

www.passivhaus.org.uk/index.jsp?id=669

www.cepheus.de/eng

www.europeanpassivehouses.org

www.en.wikipedia.org/wiki/Low-energy_building