Rijkswaterstaat
Ministry of Infrastructure and the Environment

# Protocol for the use of DuboCalc in RWS Sustainable Procurement

DuboCalc as Sustainable Procurement tool

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## Summary

The Dutch House of Commons obligated the central authorities to implement 100% sustainable procurement as of 2010. Rijkswaterstaat complies with this by using the criteria for green public procurement of infrastructure drawn up by AgentschapNL. Rijkswaterstaat has recorded these criteria in its Broad Agreement Framework for Sustainable Procurement (BAF SuPr, *in Dutch:* RBA DuIn).

However, Rijkswaterstaat wants to go further than the AgentschapNL requirements. This ambition is being implemented by mandating the sustainability be one of the MEAT criteria.
One of the instruments used for this is DuboCalc. This protocol shows how DuboCalc is used by RWS for sustainable procurement.

DuboCalc is a calculation program that assesses works in the civil engineering sector on material use and energy consumption. DuboCalc calculates the Environmental Cost Indicator value(ECIv ) using the project data.

In short, the DuboCalc instrument can be used in three different ways:
1) To determine whether the environmental performance requirements are being met, as stated in the List of Requirements part I.
2) To determine whether the design process results in sustainability effects by demonstrably optimizing to a lower ECIv value for parts of the design, such as included in the requirements in the List of Requirements part II.
3) A permit criterion with which the contractor distinguishes himself by providing a solution with a lower ECIvv

By playing around with different designs, the provider can achieve an optimum price and ECIvv

DuboCalc assesses civil works on sustainability relatively simply and quickly, allowing steps to be taken to make the civil works more sustainable. The model's strength is that it is suitable for calculating the different objects occurring in civil engineering without having to enter too much information. Access to the state of the material is sufficient. When in future users have more experience with DuboCalc, it is possible to work with index numbers and to work probabilistically with the ECIv valuation.

In short, DuboCalc is used as follows.
Firstly, the contractor gathers various relevant details for the tender. He then enters these data into the DuboCalc calculation program. It is possible to calculate different solutions, achieving an optimal ECIv value. The contractor then demonstrates that the design to be realized meets the required or supplied ECIv value. The methodology that Rijkswaterstaat uses for assessment purposes is System-oriented Contract Management.

The calculation program is made available per tender, including the necessary database, with Rijkswaterstaat carrying out explicit version management.

# 1. Introduction

The protocol for the use of DuboCalc in RWS Sustainable Procurement establishes how the use of the DuboCalc instrument for Sustainable Purchasing by Rijkswaterstaat occurs in practice.
When carrying out sustainable procurement of public works, DuboCalc must be used in an unambiguous manner. It is important that tenders are assessed in a comparable way and that quality is safeguarded.
The protocol describes:

1. which sustainability requirements are specified.
2. how calculations are carried out
3. which data must be entered
4. how it is assessed
5. how to ensure that that which is promised is actually executed.

RWS works with various tender forms, such as D&C, E&C, DC&M and DCM&F, with DuboCalc allowing sustainable procurement.

## 2. Government Policy on Sustainable Procurement

There is a growing awareness worldwide that today's health and wealth should not come at the cost of the health and wealth of future generations. In that context, in late June 2005 the Dutch parliament adopted a motion to include sustainability, as a strongly weighing criterion, in all government purchasing and investments by 2010 at the latest.

The authorities set clear goals: the government wanted to achieve 100 percent sustainable procurement by 2010, which applied and still applies to Rijkswaterstaat. Municipalities aimed for 75 percent by 2010 and 100 percent by 2015. Provinces and waterboards had the aim of at least 50 percent by 2010.
The progress report "Sustainable Procurement 2010" shows that the authorities have comfortably achieved their goals. This means important objectives relating to the environment and social aspects have been realized.

True sustainable procurement demands greater ambition and goes further than just the minimum requirements. Both former State Secretary for the Environment Atsma and the Dutch Parliament have stated that they welcome the recommendations from business for a more ambitious approach to sustainable procurement.

The key specified minimum requirements remain as part of sustainable procurement, but the implementation of them will from now be seen as a minimum lower threshold for sustainable procurement.
One hundred percent sustainable procurement is defined in such a away that the purchases meet the criteria specified by AgentschapNL at that point in time for the product groups concerned. These sustainability criteria subject a product of service to a set of requirements on the one hand, and a set of wishes on the other.
In addition to minimum requirements, in line with the new Public Procurement Act, wishes and thus permit criteria for sustainable procurement are always also included in principle.

Sustainable procurement includes not just economic, but also social and environment-related aspects for purchasing goods, services and works. By purchasing sustainably the market is stimulated to supply more sustainable products.

Sustainable Procurement basically covers all phases of a project, from design to decommissioning. Purchasing thus covers not only the construction of a new civil works project but also subsequent phases, such as management and maintenance.

In May 2012, Mrs Mansveld, acting State Secretary of Infrastructure and the Environment (I&M in Dutch) sent a letter about sustainable procurement to all decentralized authorities. Tendering services are called to apply the procurement function strategically with an eye to aiming for the ambitious sustainability objectives. It is important in all phases of the procurement process to look for chances for sustainable and innovative solutions, where possible together with businesses parties. Specifically purchases that provide a substantial contribution to the organization's sustainability targets.

Depending on the project and the situation, DuboCalc is used to assess the requirements and wishes in the area of sustainability.

On agentschapnl.nl and on the website of the Dutch Public Procurement Expertise Centre, pianoo.nl, you will find a great deal of supplementary information.

## 3. Sustainable Civil Infrastructure

Public clients and market parties in the civil engineering works (railways, hydraulic works, roads and waterways are pushing sustainability in the sector to a higher level. They have bundled their strengths and developed a uniform way of working: the Sustainable Civil Infrastructure Approach.

The Sustainable Civil Infrastructure Approach is a practical way of working to make sustainability in civil engineering projects more concrete. But without prescribing in advance the *generic* sustainability requirements. The Approach wants to make best use of the chances of greater sustainability *per project*. This way of working means the project organization (clients/engineering consultancies) can follow a step-by-step plan for a project, drawing up and establishing sustainability ambitions and communicating them to the next project phase. By embedding sustainability so early on in a project, best use is made of the chances available. The DuboCalc instrument is one of the four indicated instruments that can be used for this approach.

For more information go to duurzaamgww.nl

## 4. Sustainable Procurement by Rijkswaterstaat

Rijkswaterstaat aims to reduce $CO_2$ emissions by 20% by 2020 relative to 1990, and to realize or commission infrastructure of a high environmental quality.

Procurement at Rijkswaterstaat is divided into four domains:

1. Civil engineering constructions and marine issues, such as the construction and maintenance of infrastructure, the fleet, salvaging, dredging and buoys.
2. Operations such as facility services and energy
3. Information processing and ICT, such as traffic management, geo-information and ICT hardware and software
4. Knowledge, such as engineering services and suchlike

For every domain, Rijkswaterstaat has established objectives and drawn up action plans. From the carbon footprint of Rijkswaterstaat, it turns out that far and away the greatest $CO_2$ emissions are related to construction and maintenance projects in infrastructural constructions, which is why this area gets the primary focus.

On 24 June 2011, State Secretary Atsma explained in a letter to the Dutch parliament how sustainable procurement in ground, road and water construction is given form[1]. Rijkswaterstaat follows precisely the way of working Atsma proposes. On 15 October 2011, the State Secretary once again presented his vision of sustainable procurement in a speech[2]. With reference to this vision, the management of Rijkswaterstaat decided on 27 April 2012 to assign sustainability as one of the three MEAT criteria for tendering construction projects.
The proposal was to establish the sustainable approach for civil engineering projects in early 2013 in the Green Deal 'DuurzaamGWW' (Green Deal Sustainable Civil Infrastructure).

When tendering, Rijkswaterstaat does three things to realize sustainable procurement:

- the contractor gets the room to provide innovative solutions as Rijkswaterstaat issues a solution-free tender via functional specifications.
- the providers who promise to carry out the project in an energy-efficient way (ambition level of $CO_2$ performance ladder) get a – fictional – deduction from their tender price, and;
- providers that offer an environmentally friendly product (calculated using DuboCalc) obtain a fictional permit advantage by applying the principle of the Economically Most Advantageous Tender (MEAT).

For more information go to rijkswaterstaat.nl → duurzaam inkopen

[1] http://www.rijksoverheid.nl/documenten-en-publicaties/kamerstukken/2011/06/24/kamerbrief-duurzaam-inkopen-23-6-20112-_2_.html
[2] http://www.duurzaamgww.nl/index.php/atsma-over-de-aanpak/

## 4.1 SBK, method to define environmental performance and the National Environmental Database

The environmental effects of a product, such as a road, a bridge or a building, viewed across the entire lifecycle, are assessed using an environmentally oriented lifecycle analysis (LCA). The result of an LCA is an environmental profile: a collection of different environmental effects, such as contributions to the 'greenhouse effect', depletion of resources, effects on human health, etc.

To ascertain the environmental impact of a product (a building or a road, bridge or any other infrastructural work) various calculation instruments are available in the Netherlands, such as GreenCalc, DuboCalc and EcoQuantum. These instruments use data from the same National Environmental Database. The determining method, including the national database, arose from combining existing instruments and databases. With the determining method and the national environmental database, the environmental impact of buildings and infrastructural works can be calculated clearly.

Stichting Bouwkwaliteit (SBK) was appointed on 14 April 2010 as the manager of the specification method "Material-related environmental performance of buildings and civil works" including the related National Environmental Database.

For more information, see the Stichting Bouwkwaliteit website: bouwkwaliteit.nl → Milieudatabase and milieudatabase.nl

## 4.2 DuboCalc in relation to the tender

Rijkswaterstaat, other clients, consultancies and contractors can use DuboCalc to assess the environmental performance of a tender and/or design.

Whether or not to use DuboCalc is considered for each individual tender. The basic principle for RWS is sustainable and innovative procurement on tendering. DuboCalc is designed to pursue this principle.

In short, the DuboCalc instrument can be used in three different ways:
1. A permit criterion in Most Economically Advantageous Tender methodology (MEAT) with which the contractor distinguishes himself by providing a solution with a lower ECIv. This is the standard application of DuboCalc;
2. To determine whether the environmental performance targets are being met (expressed in ECIv);
3. To determine whether the design process strives for sustainability effects by demonstrably optimizing to a lower ECIv for part of the design.

The ECIv value or environmental score calculated with DuboCalc can be used as quality criterion or performance criterion. In the first case, the maximum monetary value and the mutual quality of the offers determines the share of quality versus price. In the second case, a monetary value is linked directly to an extra unit of performance (€ per unit of ECIv). In the tender, Rijkswaterstaat will indicate how well sustainability scores in the MEAT criteria.

For more information go to rijkswaterstaat.nl → duurzaam inkopen

## 4.2 Market parties efforts

With DuboCalc, civil works are assessed for sustainability in a relatively simple and rapid way. The model's strength is that it is suitable for calculating the different objects occurring in civil infrastructure without having to enter too much information. The availability of a material state at the level of the framework is sufficient. The market gradually gains further experience. Based on that, the step can be taken to index-numbers calculation in terms of running the calculation process. Whether or not the index-number database is used is a decision to be made by each individual company.
Particularly in the start phase it is essential to ask how much effort this will require from market parties. In concrete terms, this means that there is demand for a clear scope in which environment performance flowing from the design is distinct and has a sustainable effect in the RWS area.

More information can be found at rijkswaterstaat.nl→ duurzaam inkopen

To keep tender costs low, it has been decided to use many default values so that not all details have to be sought. This decision will in some cases limit the distinctive capacity of the submitters.

# 5. The DuboCalc instrument

DuboCalc is a calculation program that assesses works in the ground, road and waterworks sector on sustainable material use and energy consumption. DuboCalc is based on the standardized methodology of lifecycle analysis (LCA). This gives a quantitative and objective answer to questions on sustainable construction by assuming a:

1. generally accepted calculation model (LCA conform ISO 14.040 series and CML2);
2. standardized database with environmental data of materials and processes (National Environment Database, NEN8006 and the specification method "Material-related environmental performance of buildings and civil works").

The DuboCalc instrument is comprised of two parts, namely: DuboCalc Project and DuboCalc Library.

## 5.1 DuboCalc Project

DuboCalc enables users to model works (in DuboCalc Projects). Moreover, the environmental impact of a Project and each of its parts (Variants, Elements, Items) can be calculated and analysed.

DuboCalc is based on the lifecycle analysis and using the data entered calculates the impact, converted into a price, that the project has on the environment. This is displayed as the Environmental Cost Indicator (ECIv).

To make the environmental impacts quantifiable, they are, using the DuboCalc program, converted into effects on the environment, expressed in $CO_2$ equivalents, $NO_x$ equivalents, etc. These impacts are then translated into shadow costs. This result is shown in the value of the Environmental Cost Indicator (ECIv).

## 5.2 DuboCalc Library

DuboCalc uses a library. The DuboCalc Library includes validated items. These items have four phases: construction (reclamation, production and building), use, maintenance and decommissioning. The items are compiled from the building blocks, materials and processes that are linked to the different phases of the item. The items originate from the National Environmental Database and are validated in line with the procedure from SBK.

By copying the items from the Library to the project setting, environmental impacts are added to the project calculation.

The DuboCalc database is updated periodically.

# 6. Process of using DuboCalc

DuboCalc can be used for the various different contract forms used at RWS. To use DuboCalc for a submission, a number of matters have to be arranged. What is needed precisely varies in accordance with the way in which the DuboCalc instrument is used.
Because in DuboCalc the entire lifecycle of the project is always included in the calculation, the approximation is basically the same for all contract forms. To demonstrate that the requirements have been met in the usage and maintenance phase, a D&C contract has to take place based on the calculations using the execution design. For a DB(F)M contract, it is possible to measure the energy use of the project and get the contractor to take management measures in the event of abnormalities.

| | Using DuboCalc for | | |
|---|---|---|---|
| | VS1 requirement | VS2 requirement | MEAT |
| sections | 6.1 and 6.4 | 6.2 and 6.4 | 6.3 and 6.4 |

Appendix A gives the process schedules of the procedure that must be followed to apply DuboCalc to Sustainable Procurement. The numbers stated in the schedules refer to the relevant sections.

## 6.1 Using DuboCalc for the requirement in the List of Requirements part 1

The List of Requirements part 1 establishes which performance requirements an object or project must meet.
It is necessary here that a reference or a scope is established. To this end, examine which parts (materials and energy use) of the works is expected to have the greatest environmental impact. It will be necessary for this to first make a few initial calculations using DuboCalc to determine the scale of the impact of these parts. When determining the scope pay attention to not only the construction phase, but also to the use and maintenance phase.
For those objects for which the impact turns out to be significant, further requirements can be formulated. This could be per object (e.g. the ECIv of a work of art may not contribute more than "Value") or for the total project. Indicate in any case what needs to be included in the ECIv calculation. If the environmental impact of the road markings is not relevant compared to other parts then it is better to leave these outside the scope. To describe the scope, use could be made of the structure of the RAW system. For example, everything in Chapter 31 is in the scope, but everything in Chapter 33 is not. This can be refined at section level to the level of the result descriptions.
Once the scope is established, DuboCalc can be used to determine what the ECIv is of the reference (object or project). This value can be included as a minimum requirement in VS1.

Appendix C includes a sample text for VS1.

## 6.2 Using DuboCalc for the requirement in the List of Requirements part 2.

The List of Requirements part II establishes which process requirements the contractor must meet.
When sustainability is not a suitable criterion for a permit, and there is also insufficient insight into the expected solution to be provided, to be able to formulate an ECIv value as a requirement, a process requirement can be added. One requirement included is that after a contractor has been awarded the work, he assesses, when working out the design using DuboCalc, the variants on sustainability and allows this to weigh in his decision-making process or leaves this decision to the client. This enables the client to choose for the socially most optimum variant. The DuboCalc calculation functions as a verification method in the criterion sustainability.

In the contract document, a financial stimulus must be established for the contractor to ensure sustainability counts towards the design process.

Appendix C includes a sample text for a requirement in VS 2.

## 6.3 Using DuboCalc for MEAT.

As contracting party of (infrastructure) works, supplies and services, Rijkswaterstaat uses the Most Economically Advantageous Tender (MEAT) permit criterion to obtain tenders with an optimum value/price ratio. For MEAT the winning tender is selected not only on tender price, but also on other criteria. The total MEAT value of a tender is expressed using a fictional tender price. To this end, the MEAT value of each criterion is ultimately expressed in monetary terms in euros. Depending on the value assigned to sustainability in the MEAT, a more sustainable solution is assigned a lower fictional tender prices and the tenderer will have a greater chance of winning the contract.

The tender and evaluation document establishes how the ECIv contributes to the EMAT criterion in evaluating the tender.
The ECIv value determined with DuboCalc can be used as quality criterion or performance criterion. In the first case, the maximum monetary value and the mutual quality of the offers determines the share of quality versus price. In the second case, a monetary value is linked directly to an extra unit of performance (€ per unit of ECIv). In the tender, Rijkswaterstaat will indicate how well sustainability scores in the MEAT criteria.

It is necessary for both methods that the scope is established. To this end, examine which parts (materials and energy use) of the works is expected to have the greatest environmental impact. It will be necessary for this to first make a few initial calculations using DuboCalc to determine the scale of the impact of these parts. When determining the scope, pay attention to not only the construction phase, but also to the use and maintenance phase.
Objects with a significant and distinct impact must be included as part of the scope. Indicate in any case what needs to be included in the ECIv calculation. If the environmental impact of the road markings is not relevant compared to other parts then it is better to leave these outside the scope. To describe the scope, use could

be made of the structure of the RAW system. For example, everything in Chapter 31 is in the scope, but everything in Chapter 33 is not. This can be refined at section level to the level of the result descriptions.

*6.3.1 Quality criterion*

For application as quality criterion, it is necessary that a reference is calculated. The maximum monetary value needs to be established that the criterion sustainability should be assigned. Determining the actual costs of a green or sustainable variant can be an indication of the value to be assigned. The ECIv's of the different tenderers are compared with each other. The value of the sustainability performance criterion of the tender with the lowest ECIv is the maximum amount. The value of the sustainability performance criterion of the tender with the highest ECIv is zero.

The value of the Sustainability performance criterion is determined using the following Formula:

$(ECIv_{max}-ECIv_{ins})/(ECIv_{max}-ECIv_{min})$ * $CS_{max}$ (To be completed by RWS)
In which:
$ECIv_{ins}$ :ECIv of the tender
$ECIv_{max}$ :ECIv of the tender with the highest ECIv
$ECIv_{min}$ :ECIv of the tender with the lowest ECIv
$CS_{max}$ :Maximum monetary value assigned to the criterion sustainability.

The fictional tender sum is determined by deducting the value of the sustainability quality criterion from the tender sum.

*6.3.2 Performance criterion*
For application as performance criterion it is necessary that the ECIv of a reference is calculated on the basis of the defined scope. The expected minimum ECIv for the project also needs to be estimated.
Then the maximum monetary value of the sustainability performance criterion needs to be determined.
The value of the sustainability performance criterion can be determined using the following Formula:

$(ECIv_{REF} - ECIv_{MIN})$ * Factor A = $VS_{MAX}$

In which:
$ECIv_{REF}$ = Reference value of the ECIv of the project
$ECIv_{MIN}$)= Minimum value of the ECIv of the project
Factor A = the value in euros that follows from the other values
$VS_{MAX}$ = Maximum value in euros assigned to the sustainability criterion

It is sensible to carry out a sensitivity analysis of the formula in advance. By determining the most probable, the minimum and the maximum cost prices of the project, and the ECIv belonging to these cost prices, it can be determined whether the tender with the highest value for the sustainability performance criteria also has the best price/quality ratio.

Appendix C includes sample texts for the tender and an evaluation document used for applying the ECIv as included in the EMAT criterion.

## 6.4 Testing ECIv

To ensure that the contractor actually does realize the ECIv agreed at tender, the contract must state at which moments and in which way the contractor must demonstrate that he meets the ECIv. For a D&C contract, that could well be at the moment that the execution design is ready or at delivery. For a DB(F)M contract, a request can be made to demonstrate the realized ECIv during use and maintenance, by measuring power consumption, for example.
RWS tests ECIv using System-oriented Contract Management (SCB). SCB is a method of contract management whereby RWS uses information arising from the contractor's quality-management system. Using an appropriate combination of tests (system, process and product tests) RWS establishes whether the contractor meets the contract agreements and requirements. More information on what SCB is all about and how it works can be found on the RWS website:

Rijkswaterstaat.nl → Systeemgerichte Contract Beheersing (SCB)&SCB anno 2011 (PDF)

Furthermore, the contract must state which measures are to be taken if the agreed ECIv is not met, with a fine of … per ECIv point exceeded, for instance.

# 7. Calculating with DuboCalc

The chapter describes the entire working process with DuboCalc step for step.

Section 7.1 gives the focus points for modelling (per phase). Sections 7.2 and 7.3 describe which action should be taken if Items are used that are not included in the DuboCalc Library. Section 7.4 shows in steps how to make a DuboCalc calculation.

For an explanation of how to operate the program, refer to the DuboCalc Starter Guide.

## 7.1 Modelling in DuboCalc

A user can compile any required civil works in DuboCalc Project using items available from the DuboCalc Library.

***Modelling means compiling a civil works from items***

A project should cover all the relevant information on the civil works. One of the key parameters for determining the ECIv value is the lifetime of the project.

To carry out a proper analysis of the environmental impact, it is important that the correct information is entered. Depending on the application of DuboCalc, the client indicates in the List of Requirements which parts of the work are part of the scope of the calculation to be carried out.

This considers not only the construction of the civil works. Usage (energy for lighting), maintenance and the decommissioning (demolition, for instance) are also responsible for part of the environmental effects.

**Pay close attention to the scope description in the tender from RWS and use this as the basis for the DuboCalc calculation.**
Descriptions in the tender documents take precedence over generic description.

The relevant focus points are given below per LCA:

*7.1.1 Construction phase*

The items in this phase include all processes and materials required to realize the works. Also the processes for transport from "factory" to construction site are included in this phase.

- Material choice
  Each material has its own environmental impact. Compare different materials with each other and determine the optimum material choice for a given design solution.
- Quantities
  A design that uses materials efficiently will have a low environmental impact. Of course the design must meet the other (functional and technical) requirements specified.
- Transport distances of bulk materials
  There are materials for which transport makes up a large part of the total environmental impact. These materials encompass default transport distances. The default distances can be altered. Because the contractor can change the distances, he can distinguish his tender by setting up his logistic processes in such a way that the negative environmental effects are the smallest (lower ECIv).
  If a contractor states transport distances himself, then it is important to check these, by stating the distances in the ground-flows plan, for example. The contractor also takes management measures to prevent the failure to achieve the agreed maximum ECIv value due to anomalous transport distances in practice.
- Materials to be removed
  Some projects require the removal of considerable values of material or earth, from a demolished structure, for instance, before construction can commence. These materials can be entered separately by 'ticking' the item as released material. A design that re-uses as much earth or released construction materials will score better as a rule.

*7.1.2 Usage phase*

In the library, items are available that only have a usage phase. This concerns Items for electricity of fuel usage, for instance.

- Energy consumption
  The contractor must indicate energy usage. To achieve the expected energy usage, the contractor must have made well-founded calculations. The results of this calculation make up part of the calculation of the ECIv. To check the entered values, the contractor is obliged to calculate fully

substantiated annual usages and make them demonstrable. The actual energy usage during a reference period or annually can also be measured.

Energy calculation
The contractor must search for optimum solutions to arrive at an energy efficient design. One key point is that the contractor with a D&C contract has to make it plausible that the annual usage calculated results from different alternatives studied. With a DBFM contract, the contractor must be able to show the resultant savings in, for example, measured annual reports. However, there is no specific methodology for energy efficient designs. Various focus points and guidelines can be mentioned though that serve to support the contractor.

More information on this can be found at Leidraad Energiezuinig ontwerpen van civiele kunstwerken of CUR/RWS.

Systems that generate electricity may deduct the power they produce from total electricity consumption.

Appendix B includes an example of an energy usage calculation of a civil-engineering construction.

*7.1.3 Maintenance phase*
In DuboCalc the environmental impact in the maintenance phase is determined by the number of times an item has to be replaced during the project's lifecycle. The number of replacements is calculated in DuboCalc as a breech.

Project lifecycle
One of the key parameters for the calculation of the ECIv is the project lifecycle. Always check whether the agreed lifecycle applied in the DuboCalc project document with the lifecycle stated in the tendering documents.

Lifecycle of items
The items in the library are calculated using a standard lifecycle. This lifecycle is based on normal use without carrying out interim lifecycle-extending maintenance.

If the Item permits, the default lifecycle can be deviated from, as long as the lifecycle applied is substantiated in line with requirements.

For hardened surfaces, the lifecycle should be substantiated with the CARE or OIA programs:

- CARE, version 2.20 in the case of adapting an existing hardened surface (redesign module);
- OIA from CROW, most recent version, in case of a new hardened surface construction.

The calculation in the model should be based on the parameters made available by RWS, such as traffic data and, in the case of redesigning, details of the construction.

*7.1.4 End of lifecycle phase*

This phase includes the environmental effects of the processes required for demolition, removal and treating (according to a predefined waste scenario) of the

materials that are released at the end of the project's lifecycle.
These processes are based on default value and cannot be changed by users.

## 7.2 Materials not included in the DuboCalc library

If a material is not included in the DuboCalc library, an Item can be used that best corresponds with the new material as alternative in the ECIv.

The Tenderer or Contractor also has the option of carrying the ECIv using the data (still) not included in the prescribed version of the DuboCalc Library. Sections 7.2.1 and 7.2.2 describe the conditions that must be met.

*7.2.1 Variable and permanent values in the calculation*

The ECIv calculation for each new Item encompassed the calculation of the environmental impacts of material reclamation through to the end of the lifecycle. The starting point of the calculation is:

1. The ECIv, from reclamation of the new Material up to the factory gate, is determined in line with the SBK procedure.
2. The Processes under the Construction phase are the same as the most comparable Item in the DuboCalc Library.
3. The properties of the Maintenance phase are the same as the most comparable Item in the DuboCalc Library.
4. The Processes and the environmental impact of the end of lifecycle scenario of the relevant Material type of the End of Lifecycle phase are the same as the most comparable Item in the DuboCalc Library.

The new Material stated under point 1 is thus material. The other data within the new Items must thus be based on an Item that is most comparable.

In the case of an alternative ZOAB, the Material ZOAB within the Item ZOAB is replaced with a new material.

*7.2.2 Method and quality requirements for the calculation of the Material*

The ECIv calculation per ton of Material should be drawn up and tested in line with the procedure provided by SBK. Basis documents that describe this can be found on the site of SBK: milieudatabase.nl --> basisdocumenten

Conditional upon the versions used in the agreement other than those in the references below, this means that the following documents are applicable:

1. The LCA should be drawn up in line with the Bepalingsmethode Milieuprestaties Gebouwen en GWW Werken (versie dd. 01-11-2011)

2. The LCA should be tested by an agency that complies with the conditions as described in SBK conditions for testing agencies: SBK-kwalificatie-eisen LCA-toetsingsbureau voor opname categorie 1 en 2 data in de Nationale Milieudatabase (v1.0)

It is possible to include the data in the National Environmental Database, so that the data will be included in a new version of the DuboCalc library. See section 7.3

## 7.3 Adding new items to the DuboCalc Library

The Items and underlying data used in DuboCalc originate from the National Environmental Database owned and managed by Stichting Bouwkwaliteit (SBK). Together with the sector and its branches, this organization strives for a high-quality and complete database. Of course, the sector is dynamic and new materials are constantly being developed, so the database is not always complete in every area.

New items can be submitted to SBK in line with the procedure as found on the website of the Nationale Milieudatabase

As and when new data are approved and included in the SBK civil materials database, the data will be included in the DuboCalc Library after release of that database version by SBK and available for the DuboCalc Project after release of the Library version.

## 7.4 Step-by-step plan of a DuboCalc calculation

Calculating with DuboCalc can be explained in three steps. These are listed below:

*7.4.1 Step 1 – Creating Project structure*

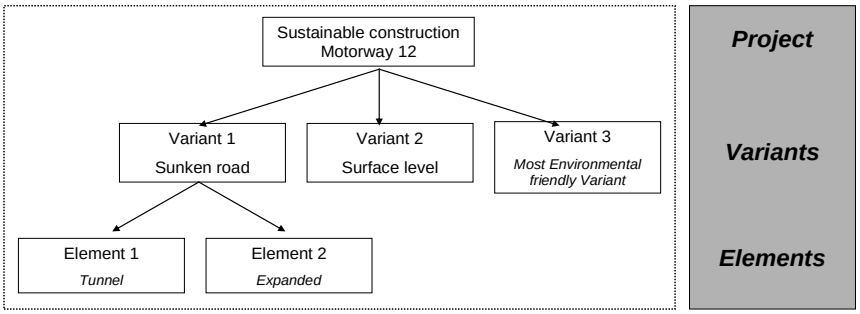
In DuboCalc a civil works (called Project in DuboCalc) is compiled (modelled).

The structure of the project is determined by the scope of the DuboCalc calculation and the requirements for the DuboCalc calculation stated in the List of Requirements.

Always enter the lifecycle of the project as indicated in the scope.

The structure of a project is compiled by first creating variants – the different options for executing the work.
A new variant possesses the following properties: a unity, quantity, lifecycle and waste scenario (see properties screen).

A variant is subdivided into the main parts of the works, which are called Elements in DuboCalc. It is possible to create a finer subdivision with a new layer of elements. The structure of a project is usually determined by the requirements stated in the List of Requirements.




*7.4.2 Step 2 – adding items*

Once the structure of the project has been determined, it can be completed with the items. The necessary information for this – materials and quantities – originates from a cost calculation, for instance.

Items are dragged from the Library to the project.
It is also possible to use the Search screen.
Fill in the quantity for each item. It is then possible for some Items to modify the default transport distances or the lifecycle (see 7.1).
It is always possible to go back a step and edit the structure of the project.
Except for the Items necessary for construction, the information for the usage phase must also be filled in. This relates, for example, to energy consumption for lighting or other systems.

*7.4.3 Step 3 – analysing environmental impact*

Once the items are added to the project and the properties have been checked, then it is time for the ECIv.

The calculation results can be analysed in different ways, for example by carrying out centre of gravity analyses.

It is recommended to run through the most important items and phases in the project again and to refine the information where possible. It is always possible to go back through the previous steps and edit the structure of the project and add or delete Items.

To gain an idea of the environmental impacts that cause objects, to the bottom right of the desktop you will see the Environmental Cost Indicator and the contribution that the object delivers to the Environmental Cost Indicator of the relevant variant. Moreover, carrying out analyses with DuboCalc creates greater feeling for the parts of a project that have the most influence on the environmental impact within each phase.

# 8. Availability and version management

## 8.1 Availability

DuboCalc is made (provisionally) available per tender to all tenderers, including a library. For comparability of the tenders it is important that all parties have the same data available. For this reason the issued version is only valid for that specific tender.

## *8.2 Version management*

Rijkswaterstaat has decided to use DuboCalc for its sustainable procurement. DuboCalc also needs to be kept up-to-date.
Two forms of maintenance are required:

1. In terms of software – updating new software and hardware developments. Solving any bugs.
2. Database maintenance – additions with new processes and materials, processing further insights, enabling new ways of construction, etc.

Furthermore, developments and the harmonization process (see Chapter 4) can lead to modifications.
Rijkswaterstaat implements explicit version management. The version number of the program and the database must be stated when tendering. It is therefore very important that the version numbers of the program and the database delivered or awaiting delivery are verified as they can differ.

The tendering document includes the following.

The following versions of the DuboCalc software and database are to be used in the tender:

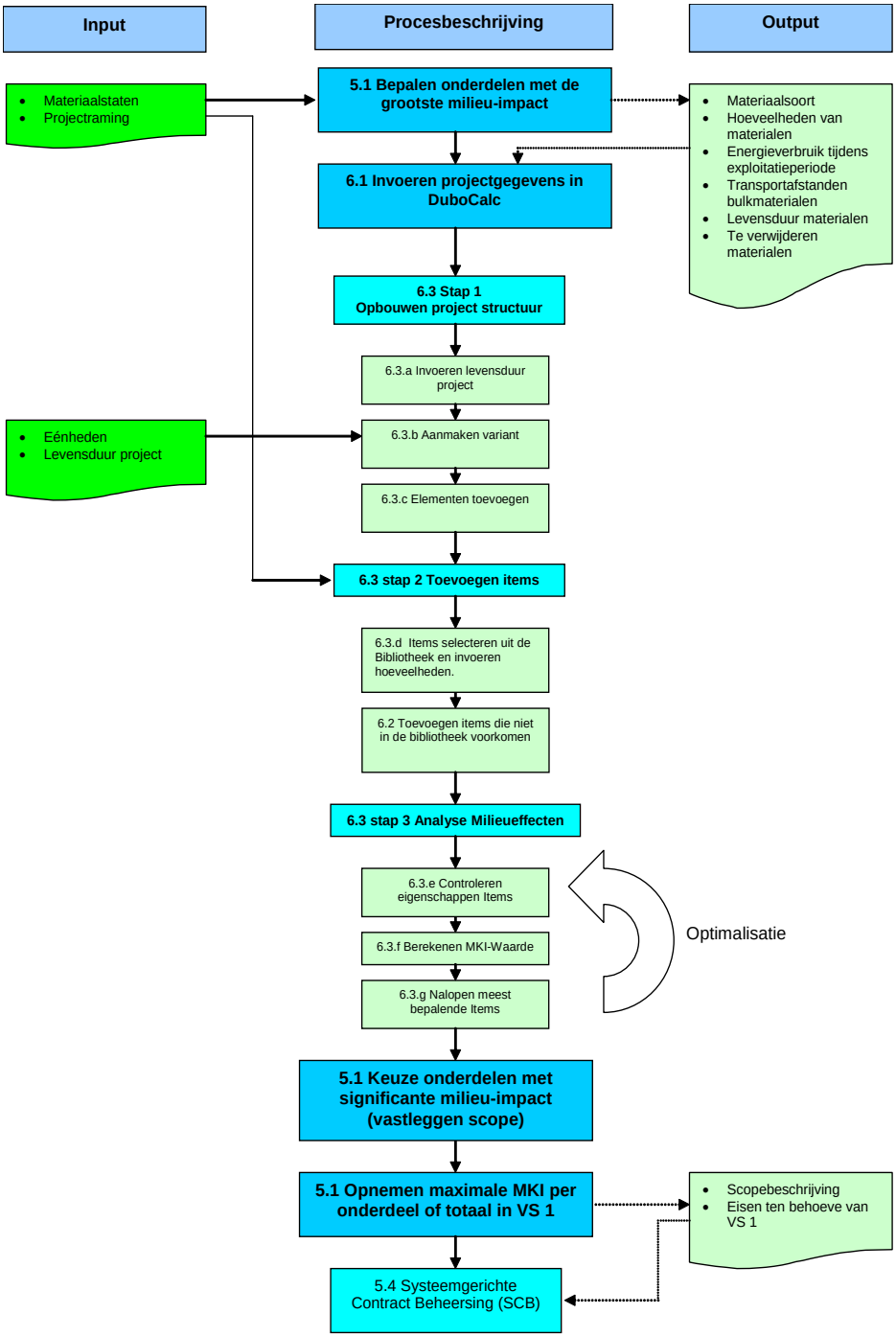
| | |
|---|---|
| Version number DuboCalc software | 2.2.1 |
| Version number DuboCalc database | 3.02 |

Working with an outdated version of the software or the database can lead to exclusion from the tendering process.

# Appendix A Process schedules

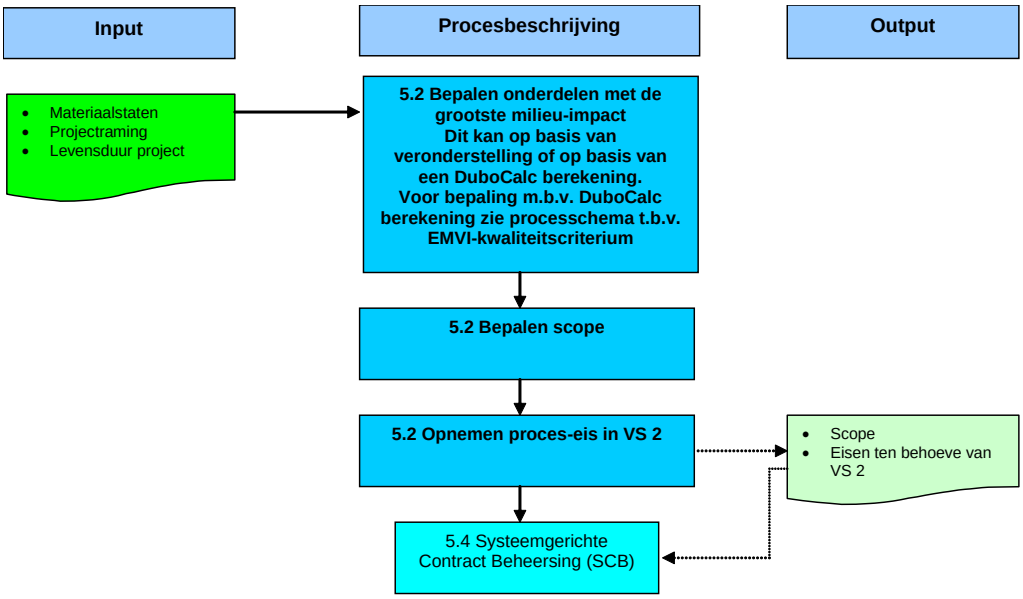
The numbers stated in the process schedules refer to the relevant sectio

Process description for requirement in VS1



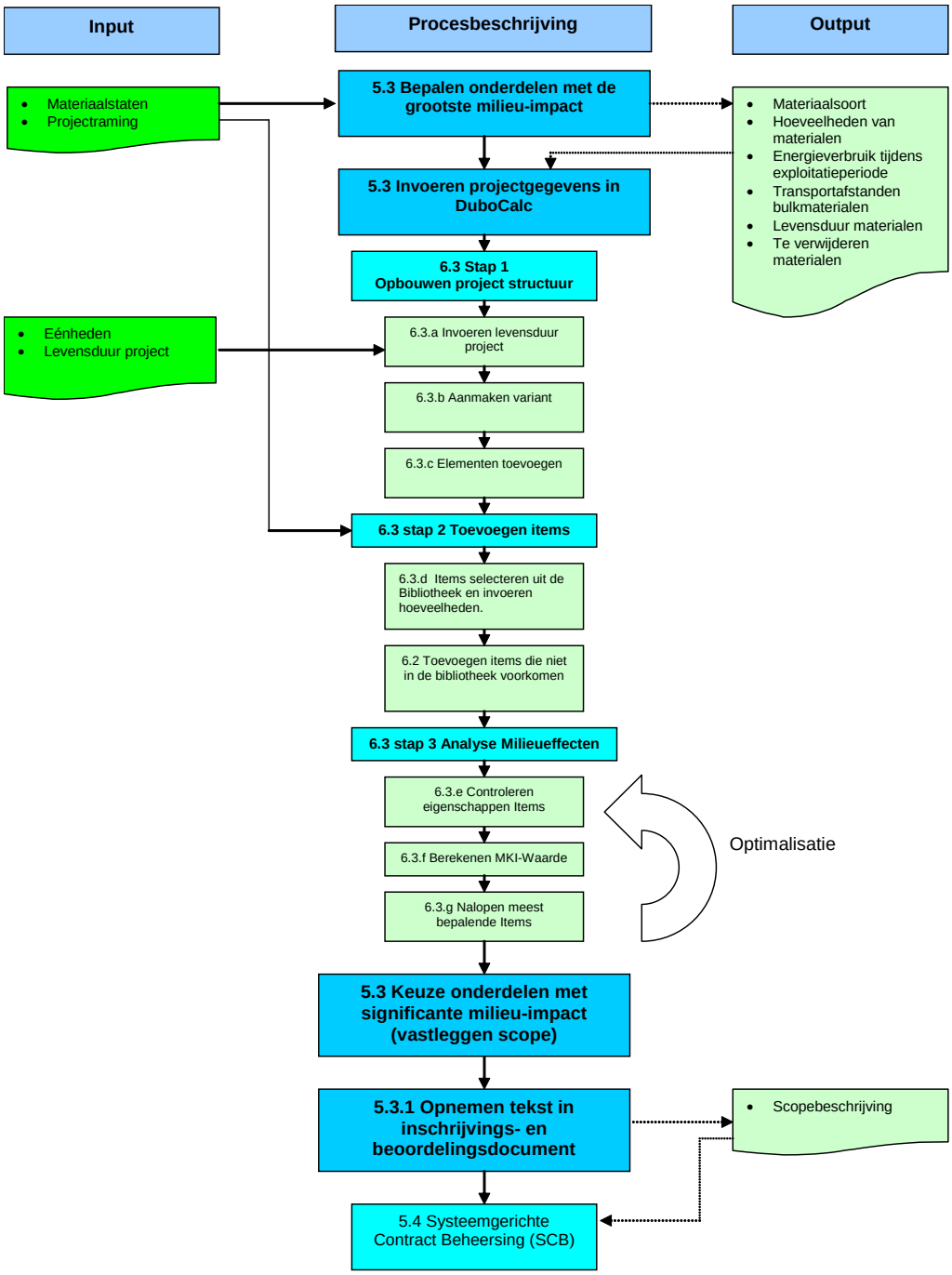
The numbers stated in the process schedules refer to the relevant sections.

Process description for requirement in VS2



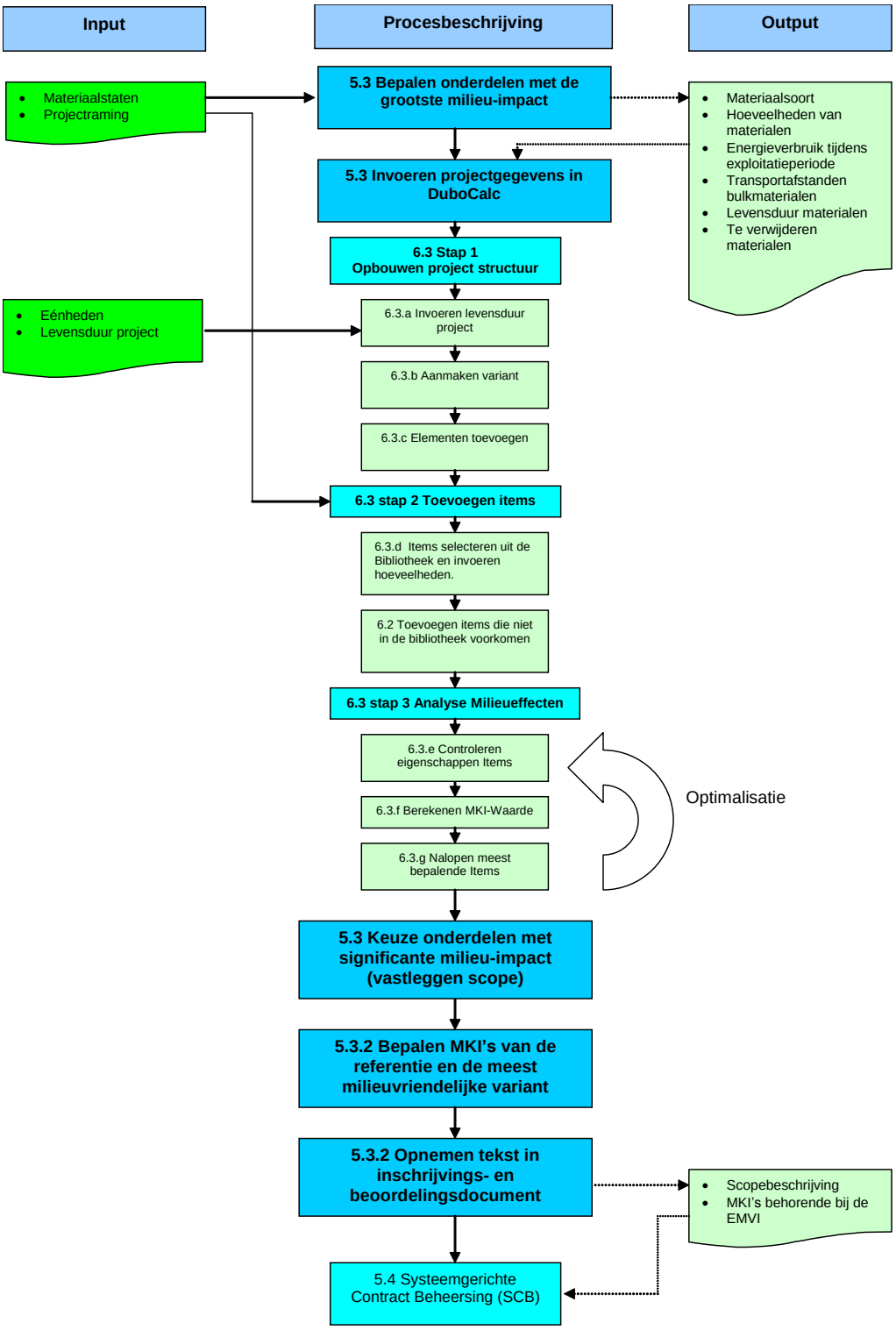
The numbers stated in the process schedules refer to the relevant secti

Process description for MEAT quality criterion



The numbers stated in the process schedules refer to the relevant sections.

Process description for MEAT performance criterion



# Appendix B Sample energy calculation

| Project identificatie: | | | | | | | | | | | | | | | | | | | Datum: 25-02-2009 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Omschrijving | | | | | Pn | x | tn | = | En | | Pst | x | tst | = | Est | | En + Est = Etot | | | Noodbedrijf | | | | | | | | |
| | (*1) | (*2) | (*3) | | Actief (normaal) | | | | | | Stand-by | | | | | | Actief + Stand-by | | | UPS | | | Brugbeweging | | | | | |
| | 1800 | 365 | 346 | | Vermogen | | Tijd | | Energie vebruik | | Vermogen | | Tijd | | Energie vebruik | | Energie vebruik(totaal) | | | | | | | | | | | |
| **VEBRUIKER** | | | | **Aantal** | **Pn** | | **tn** | | **En** | | **Ps** | | **tst** | | **Est** | | **Etot** | | **Wtot** | **UPS (Wst)** | | | **Brug** | | **Wh** | | | |
| Voorwaarschuwseinen | 1800 | | | 12 | 0 | W | 0,09 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 0,00 | kWh | 0 | - | W | | **0,00** | Wh | | | | |
| Draadloos sturing VWS | 1800 | | | 6 | 3,6 | W | 0,09 | uur | 3,43 | kWh | 0 | W | 0 | uur | 0 | kWh | 3,43 | kWh | 21,6 | - | W | | **1,91** | Wh | | | | |
| Landverkeerseinen | 1800 | | | 8 | 6 | W | 0,08 | uur | 7,27 | kWh | 0 | W | 0 | uur | 0 | kWh | 7,27 | kWh | 48 | - | W | | **4,04** | Wh | | | | |
| Stroombewakingsrelais LVS | | 365 | | 16 | 0,84 | W | 0,08 | uur | - | kWh | 3,84 | W | 24 | uur | 33,6384 | kWh | 33,64 | kWh | 17,28 | - | W | | **1,13** | Wh | | | | |
| HR dimtransformator (150VA) | 1800 | | | 1 | 10,5 | W | 0,08 | uur | 1,59 | kWh | 0 | W | 0 | uur | 0 | kWh | 1,59 | kWh | 10,5 | - | W | | **0,88** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***45,94*** | | ***97,38*** | | | | | | | | | |
| Slagbomen | 1800 | | | 8 | 550 | W | 0,00 | uur | 35,20 | kWh | 0 | W | 0 | uur | 0 | kWh | 35,20 | kWh | 4400 | - | W | | **10,00** | Wh | | | | |
| Slagbomen verlichting+ kn unit | 1800 | | | 8 | 10 | W | 0,08 | uur | 59,60 | kWh | 0 | W | 0 | uur | 0 | kWh | 59,60 | kWh | 400 | - | W | | **7,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***94,80*** | | ***4800*** | | | | | | | | | |
| Scheepvaartseinen (RD) (31v) | | | 346 | 4 | 6 | W | 12 | uur | 99,65 | kWh | 0 | W | 0 | uur | 0 | kWh | 99,65 | kWh | 24 | **14,00** | W | | **0,00** | Wh | | | | |
| Scheepvaartseinen (RD) (20v) | | | 346 | 4 | 3,5 | W | 12 | uur | 58,13 | kWh | 0 | W | 0 | uur | 0 | kWh | 58,13 | kWh | 14 | **14,00** | W | | **0,00** | Wh | | | | |
| Stroombewakingsrelais SVS | | | 346 | 4 | 0,84 | W | 24 | uur | 27,90 | kWh | 0 | W | 0 | uur | 0 | kWh | 27,90 | kWh | 4,32 | **4,32** | W | | **0,00** | Wh | | | | |
| Scheepvaartseinen (GR) (31v) | 1800 | | | 4 | 6 | W | 0,03 | uur | 1,44 | kWh | 0 | W | 0 | uur | 0 | kWh | 1,44 | kWh | 24 | - | W | | **0,80** | Wh | | | | |
| Scheepvaartseinen (GR) (20v) | 1800 | | | 4 | 3,5 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 0,00 | kWh | 14 | - | W | | **0,00** | Wh | | | | |
| Stroombewakingsrelais SVS | | | 346 | 4 | 0,84 | W | 16 | uur | 18,60 | kWh | 0 | W | 0 | uur | 0 | kWh | 18,60 | kWh | 4,32 | **4,32** | W | | **0,00** | Wh | | | | |
| Scheepvaartseinen (SP) (31v) | | | 346 | 4 | 6 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 0,00 | kWh | 24 | **14,00** | W | | **0,00** | Wh | | | | |
| Scheepvaartseinen (SP) (20v) | | | 346 | 4 | 3,5 | W | 8 | uur | 38,75 | kWh | 0 | W | 0 | uur | 0 | kWh | 38,75 | kWh | 14 | **14,00** | W | | **0,00** | Wh | | | | |
| Stroombewakingsrelais SVS | | | 346 | 4 | 0,84 | W | 24 | uur | 27,90 | kWh | 0 | W | 0 | uur | 0 | kWh | 27,90 | kWh | 4,32 | **4,32** | W | | **0,00** | Wh | | | | |
| HR dimtransformator (150VA) | | | 346 | 1 | 10,5 | W | 24 | uur | 87,19 | kWh | 0 | W | 0 | uur | 0 | kWh | 87,19 | kWh | 10,5 | **10,50** | W | | **0,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***359,56*** | | ***137,46*** | | | | | | | | | |
| Aanstraal-LED's sv borden dv1 | | | 346 | 3 | 4 | W | 12 | uur | 49,82 | kWh | 0 | W | 0 | uur | 0 | kWh | 49,82 | kWh | 12 | ****** | W | | **0,00** | Wh | | | | |
| Aanstraal-LED's sv borden dv2 | | | 346 | 3 | 4 | W | 12 | uur | 49,82 | kWh | 0 | W | 0 | uur | 0 | kWh | 49,82 | kWh | 12 | - | W | | **0,00** | Wh | | | | |
| Stroombewakingsrelais DVS | | 365 | | 4 | 0,84 | W | 12 | uur | - | kWh | 0,96 | W | 24 | uur | 8,4096 | kWh | 8,41 | kWh | 4,32 | **4,32** | W | | **0,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***108,06*** | | ***28,32*** | | | | | | | | | |
| LCD scada 19" | 1800 | | | 1 | 38 | W | 0,09 | uur | 6,04 | kWh | 20 | W | | uur | 0 | kWh | 6,04 | kWh | 58 | **Bij nood situatie automatisch uitschakelen** | | | | | | | | |
| PC besturing IBM | 1800 | | 346 | 1 | 130 | W | 0,09 | uur | 20,67 | kWh | 80 | W | 15,5 | uur | 429,04 | kWh | 449,71 | kWh | 210 | | | | | | | | | |
| PLC besturing | | | 346 | 1 | 50 | W | 16 | uur | 276,80 | kWh | 0 | W | 0 | uur | 0 | kWh | 276,80 | kWh | 50 | | | | | | | | | |
| in-gangen | 1800 | | | 8 | 4,2 | W | 0,09 | uur | 5,34 | kWh | 0 | W | 15,5 | uur | 0 | kWh | 5,34 | kWh | 33,6 | | | | | | | | | |
| uit-gangen | 1800 | | | 8 | 4,2 | W | 0,09 | uur | 5,34 | kWh | 0 | W | 15,5 | uur | 0 | kWh | 5,34 | kWh | 33,6 | | | | | | | | | |
| PC laptop scheepvaart registatie | | | 346 | 1 | 65 | W | 8 | uur | 179,92 | kWh | 90 | W | 6 | uur | 186,84 | kWh | 366,76 | kWh | 155 | | | | | | | | | |
| Geluid | 1800 | | | 1 | 0 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 10,00 | kWh | 0 | - | W | | **0,00** | Wh | | | | |
| Marifoon | | | 346 | 1 | 0 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 50,00 | kWh | 0 | - | W | | **0,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***1170,00*** | | ***540,2*** | | | | | | | | | |
| El. Motor (50% v.opg. Verm.) | 1800 | | | 2 | 27750 | W | 0,05 | uur | 4.495,50 | kWh | 0 | W | 0 | uur | 0 | kWh | 4495,50 | kWh | 55500 | **Gevoed vanuit BC** | | | | | | | | |
| Motor besturing hz | 1800 | | | 2 | 75 | W | 0,05 | uur | 12,15 | kWh | 0 | W | 0 | uur | 0 | kWh | 12,15 | kWh | 150 | | | | | | | | | |
| Rem mechanisch | 1800 | | | 2 | 260 | W | 0,05 | uur | 42,12 | kWh | 0 | W | 0 | uur | 0 | kWh | 42,12 | kWh | 520 | - | W | | **23,40** | Wh | | | | |
| signalering / sturing | | | 346 | 1 | 100 | W | 16 | uur | 553,60 | kWh | 0 | W | 0 | uur | 0 | kWh | 553,60 | kWh | 100 | - | W | | **800,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***5103,37*** | | ***56270*** | | | | | | | | | |
| Magnetron | | | 346 | 1 | 800 | W | 0,2 | uur | 55,36 | kWh | 0 | W | 0 | uur | 0 | kWh | 55,36 | kWh | 800 | **Bij nood situatie automatisch uitschakelen** | | | | | | | | |
| Koffiezetapparaat (senseo) | | | 346 | 1 | 1450 | W | 0,22 | uur | 110,37 | kWh | 0 | W | 0 | uur | 0 | kWh | 110,37 | kWh | 1450 | | | | | | | | | |
| Waterkoker | | | 346 | 1 | 1200 | W | 0,1 | uur | 41,52 | kWh | 0 | W | 0 | uur | 0 | kWh | 41,52 | kWh | 1200 | | | | | | | | | |
| Koelkast | | | 346 | 1 | 100 | W | 5 | uur | 173,00 | kWh | 0 | W | 0 | uur | 0 | kWh | 173,00 | kWh | 100 | | | | | | | | | |
| TV (lcd) | | | 346 | 1 | 150 | W | 10 | uur | 519,00 | kWh | 10 | W | 14 | uur | 0,14 | kWh | 519,14 | kWh | 160 | | | | | | | | | |
| Radio | | | 346 | 1 | 20 | W | 10 | uur | 69,20 | kWh | 5 | W | 8 | uur | 0,04 | kWh | 69,24 | kWh | 25 | | | | | | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***968,63*** | | ***3735*** | | | | | | | | | |
| Verlichting kelder | | | 346 | 2 | 40 | W | 0,3 | uur | 8,30 | kWh | 0 | W | 0 | uur | 0 | kWh | 8,30 | kWh | 80 | **Bij nood situatoe zo min mogelijk gebruiken** | | | | | | | | |
| Verlichting WC | | | 346 | 1 | 20 | W | 1 | uur | 6,92 | kWh | 0 | W | 0 | uur | 0 | kWh | 6,92 | kWh | 20 | | | | | | | | | |
| Verlichting keuken | | | 346 | 1 | 20 | W | 1 | uur | 6,92 | kWh | 0 | W | 0 | uur | 0 | kWh | 6,92 | kWh | 20 | | | | | | | | | |
| Verlichting app ruimte | | | 346 | 2 | 40 | W | 0,3 | uur | 8,30 | kWh | 0 | W | 0 | uur | 0 | kWh | 8,30 | kWh | 80 | | | | | | | | | |
| Verlichting bedienings ruimte | | | 346 | 4 | 40 | W | 4 | uur | 221,44 | kWh | 0 | W | 0 | uur | 0 | kWh | 221,44 | kWh | 160 | | | | | | | | | |
| Noodverlichting | | 365 | | 4 | 0 | W | 0 | uur | - | kWh | 40 | W | 24 | uur | 87,6 | kWh | 87,60 | kWh | 40 | - | W | | **0,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***339,49*** | | ***400*** | | | | | | | | | |
| Pomp koelwater | | | | 1 | 6200 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 6,20 | kWh | 6200 | **Bij nood situatie automatisch uitschakelen** | | | | | | | | |
| Ventilatie | | | | 1 | 134000 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 134,00 | kWh | 134000 | | | | | | | | | |
| Verwarming | | | | 1 | 720000 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 720,00 | kWh | 720000 | | | | | | | | | |
| Doorstroomapparaat warm tapwater | | | 346 | 1 | 4400 | W | 0,066 | uur | 100,48 | kWh | 0 | W | 0 | uur | 0 | kWh | 100,48 | kWh | 4400 | | | | | | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***960,68*** | | ***864600*** | | | | | | | | | |
| WCD kracht | | | | 1 | 0 | W | 0 | uur | - | kWh | 0 | W | 0 | uur | 0 | kWh | 0,00 | kWh | 0 | **Gevoed vanuit UPS** | | | | | | | | |
| UPS oplader | | 365 | | 1 | 300 | W | 24 | uur | 2.628,00 | kWh | 0 | W | 0 | uur | 0 | kWh | 2628,00 | kWh | 300 | | | | | | | | | |
| Boostcap oplader | 1800 | | | 2 | 20 | W | 4 | uur | 288,00 | kWh | 0 | W | 0 | uur | 0 | kWh | 288,00 | kWh | 40 | | | | | | | | | |
| Windmeter | | 365 | | 1 | 8 | W | 24 | uur | 70,08 | kWh | 0 | W | 0 | uur | 0 | kWh | 70,08 | kWh | 8 | - | W | | **0,00** | Wh | | | | |
| | | | | | | | | | | | | | | | ***Totaal*** | | ***2986,08*** | | ***348*** | | | | | | | | | |

**BEREKENING VAN HET ENERGIEGEBRUIK VAN ENERGIE NUL BRUG PER JAAR.**

Totaal energie verbruik per jaar 12136,60 kWh 243,78 W 1489,16 Wh

Totaal aantal zonnepanelen (+/-)(*4) 112 Stuks

# Appendix C SAMPLE TEXTS

### Sample text for a requirement relating to VS 1

### Environment

| ID | SYSTEM, ASPECT ENVIRONMENT, ECIV | Upper requirement | Lower requirement |
|---|---|---|---|
| *S5.5.01* | The ECIv of the system should be maximum (VALUE). | | |
| Source: | | | |
| Verification method: | | | |
| Explanation: | | | |

### Sample text for a requirement relating to VS 2

(Below Process requirements)
The Contractor should arrive at a design choice in a transparent way per Object, or cluster of Objects, whereby:

1. the Client must be involved early in the relevant design choices in the List of Requirements.
2. the Contractor must draw up an evaluation framework on the basis of which the design choice is made.

The evaluation framework should consist of at least:
….
Sustainability
…
A DuboCalc calculation functions as a verification method in the criterion Sustainability.

**Example for an MEAT quality criterion text**
When assessing which tenderer has the economically most favourable submission, the Sustainability performance criterion is assessed.

To assess the sustainability criterion the DuboCalc calculation program is added. The completed DuboCalc calculation program results in a Environmental Cost Indicator (ECIv).

The value of the Sustainability performance criterion is determined using the following Formula:

$(MKI_{max}\text{-}MKI_{ins})/(MKI_{max}\text{-}MKI_{min}) * CD_{max}$ (to be completed by RWS)
In which:
$ECIv_{ins}$ :ECIv of the tender
$ECIv_{max}$ :ECIv of the tender with the highest ECIv
$ECIv_{min}$ :ECIv of the tender with the lowest ECIv

The fictional tender sum is determined by deducting the value of the sustainability quality criterion from the tender sum.

The submission with the lowest fictional tendering price based on the calculation above is the economically most reasonable tender.

If two or more tenders have an equally low fictional tendering price, then the tender with the highest quality value becomes the economically most favourable tender. If the total quality value is then also equal, then selection takes place by lot.

**Example for an MEAT performance criterion text**

When assessing which tenderer has the Economically Most Advantageous Tender (MEAT), the Sustainability performance criterion is assessed.

To assess the sustainability criterion, the DuboCalc calculation program is added. The completed DuboCalc calculation program results in an Environmental Cost Indicator (ECIv).

The value of the Sustainability performance criterion is determined using the following Formula:

(*MKI*$_{REF}$(Completed by RWS)- MKI) * *Factor A* (Completed by RWS)

The 'Fictional tendering price' is obtained by reducing the tender price by the value of the sustainability performance criterion.
An increase in ECIv of 1 point thus creates an increase in the fictional contract price by *Factor A*. (Completed by RWS)
A decrease in ECIv of 1 point thus creates an decrease in the fictional contract price by *Factor A*. (Completed by RWS)

The submission with the lowest fictional tendering price based on the calculation above is the economically most reasonable tender.

If two or more tenders have an equally low fictional tendering price, then the tender with the highest quality value becomes the economically most advantageous tender If the total quality value is then also equal, then selection takes place by lot.