Basic and Advanced Requirements, All Regions






Sustainable Procurement Guidelines

GENERATORS & BATTERIES

PRODUCT SHEET

These procurement guidelines are part of a series. Additional guides are available at:
www.greeningtheblue.org and www.ungm.org

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Section 1: Introduction and Scope

Sustainable Procurement

"Sustainable Procurement practices integrate requirements, specifications and criteria that are compatible and in favour of the protection of the environment, of social progress and in support of economic development, namely by seeking resource efficiency, improving the quality of products and services and ultimately optimizing costs."[1]

The "Sustainable procurement guidelines for Generators and Batteries - Product Sheet" provides example criteria that may be used by United Nations staff to include sustainable choices in their tenders. This document forms part of a series of guidelines on sustainable procurement for use by UN agencies.

A Background Report is also available which presents the rationale behind the development of the criteria in this product sheet and provides additional guidance on implementing sustainable procurement in the United Nations.

Structure

Two sets of sustainability criteria are presented in the Sustainable Procurement guidelines:

- Basic sustainability criteria address the most significant environmental and social impacts, and are designed to be used with minimum additional verification effort or cost increases.
- Advanced sustainability criteria are intended for use by procurers who seek to purchase the best environmental and socially-responsible products available on the market, and may require additional administrative effort or imply a certain cost increase as compared to other products fulfilling the same function.

Exceptionally, in the case of these guidelines, no level of ambition has been included since it will be very difficult to establish. This would depend on the actual use of the product, which may differ from site and application.

The criteria are divided into the typical steps in a procurement action: tender subject matter, technical specifications, supplier qualification requirements, evaluation criteria, and contract clauses. For each criterion guidance is also provided on verifying compliance.

An example weighting matrix is provided in the Section 6. The criteria are also presented in the Section 7 in checklist form for use by requisitioners.

Regional applicability

It should be possible to use these criteria in all world regions.

[1] Definition adopted by the High Level Committee on Management Procurement Network.

Scope

This guideline covers generators and batteries as hereby defined. The maximum power for generators is set to 560 kW. This is the power range regulated by EU and EPA for non road generators. Generators with higher power are generally only relevant for diesel locomotives, large ships and power plants.

Diesel Generators

Usage:	Small to medium size power supply for emergency backup use for hospitals, clinics, remote location power supply and emergency situations.
Fuel:	Diesel, biofuel or petrol (gasoline). Generators operating on gas or other kind of fuel are not included.
Power range:	5 kW – 560 KW

Large power back up battery systems

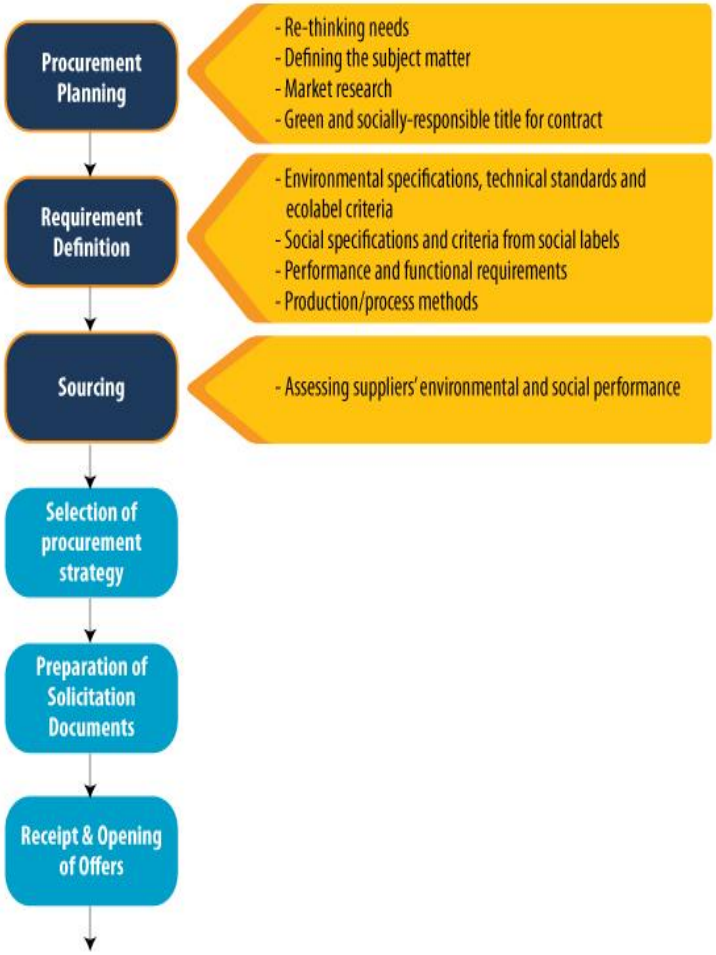
Usage:	Batteries included in the emergency generating sets or UPS systems for backup power (hospitals, computers etc.).
Voltage:	> 12 volt
Power range:	0.5 kW – 80 kW

Small power battery system for remote place electronic operations

Usage:	Power supply for electronics, for example communications systems at remote places. Batteries are generally purchased as an integrated unit together with solar panels or a small wind generator. This guideline is only for the battery pack.
Voltage:	12-24 Volt
Capacity:	0 Ah – 200 Ah

Section 2: Incorporating Sustainability into the UN Procurement Process

This diagram highlights the stages at which sustainable procurement interventions should be integrated.



A - Procurement planning

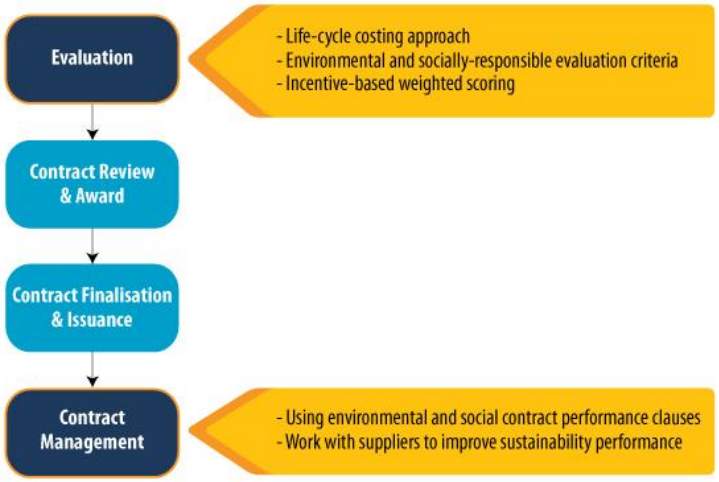
Procurement planning is essential to assess needs, define an appropriate budget and analyse the market to have a better idea of available products meeting sustainability criteria. The subject matter of the contract defines and, more importantly, communicates what the purchasing authority intends to purchase. Explicitly phrasing the subject matter of the contract in such a way that it integrates the sustainability goal to be achieved is an important first step to take in the tendering process. As all conditions stipulated in the other steps of the tendering process need to maintain a clear link to the subject matter of the contract, **clear and explicit wording of the subject matter is an effective way to ensure a sustainable purchase**.

B - Requirement definition

The tender specifications (or technical specifications) provide detailed information on the functionality, quality and other characteristics (e.g. packaging, disposal, etc.) of the product to be purchased. They provide the **opportunity to set minimum environmental and/or social requirements** which all bidders must meet.

C - Sourcing

Criteria for sourcing (or pre-selecting) suppliers, vendors and manufacturers assess the technical and professional qualifications of vendors to produce and/or supply the requested products. **Sourcing criteria can be included that assess the sustainability performance of bidders** to ensure that only bids from 'eligible' companies are considered in the evaluation stage. They can assess the bidding company's operations (and the companies it subcontracts or uses) as a whole, rather than only the end products purchased. The criteria included in this stage can address issues such as the availability of information on products, (sustainability) experience of the bidder, and security of supply. This can be a useful approach to improve the general environmental management and corporate social responsibility of companies contracted by the UN.



Source: Adapted from UNDP Environmental Procurement Practice Guide, 2008

D - Evaluation

Evaluation criteria are used to evaluate and compare the bids received which meet the minimum specifications (i.e. compliant bids). In sustainable procurement, it is essential to indicate that the contract will be awarded to the offer that provides "**best value for money**" – the term used if criteria other than just the price will be assessed when comparing bids. Evaluation criteria evaluate the performance of a bid both in terms of price and other criteria, such as environmental performance.

As with all phases of the tendering process, the tender documents published by the purchasing authority must clearly set out the various evaluation criteria that will be used to evaluate bids (such as price, technical quality, environmental quality, social performance, etc.) as well as the weight in percentage terms allocated to each aspect. **In sustainable procurement, evaluation criteria can be used to encourage higher levels of sustainability performance than those demanded in the specifications**, without risking significant increases in cost.

E - Contract management

Contract clauses are binding on any company winning the bid, and should therefore be possible for any company to comply with. **It makes sense to include sustainability criteria in the contract clauses only if they are not included in other sections of the tender**. Contract clauses also include reference to penalties for non-compliance with the specifications or for cases where a supplier has provided a false written guarantee.

Section 3: Sustainability criteria and verification

Sustainability criteria for Diesel Generators

SUSTAINABILITY CRITERIA	VERIFICATION
A - Procurement planning	
Generator matched to required performance, including primary fuel tank, housing and stack for dispersion of flue gases. To fully ensure that the generator complies with the needs, all relevant parameters must be specified. Minimum specifications should include: • Energy output in KW (Kilowatt) • Voltage output, two or three phases • KVA (KiloVoltAmpere) • A (Amperes) **Optional:** **Secondary fuel tank and fuel control** If the fuel tank included in the standard generator package does not have the necessary capacity, a separate secondary fuel tank and fuel control should be part of the tender. **Flue gas heat recovery system (Combined Heat & Power)** Generators can be purchased together with flue gas heat recovery system for generation of warm water or room heating. Such an option can be relevant at cold places and where the primary purpose of the generator is to deliver energy more continuously. **Flue gas emission control** If the generator is located in habited location and it is not possible by use of proper stack height to comply with immission contribution standards it may be necessary to purchase a system for flue gas emission control in the form of a filter and/or a catalytic unit. Flue gas cleaning may also be necessary to comply with new standards and will as such be mandatory as part of the generator system. **Spare parts** Type and number of spare parts must be specified in relation to number of operation hours between services. A spare part package must be based on the recommendations from the supplier. Spare parts for minimum 5000 running hours is recommended.	

SUSTAINABILITY CRITERIA	VERIFICATION
B - Requirement definition	
Construction and specification standards The generator set must be produced and performance specified according to the following standards (or equivalent): • Directive EC/2006/42 on Machinery • ISO 8528: Reciprocating internal combustion engine driven alternating current generating sets • BS 5000-15:1980: Rotating electrical machines of particular types or for particular applications. • BS 5514-1:1996: Reciprocating internal combustion engines. • ISO 3046-1:1995: Reciprocating internal combustion engines • BS 4999: General requirements for rotating electrical machines • VDE 0530 Safety of electric motors	Written documentation for compliance with listed standards or equivalent.
ISO 9001 quality management The generator set must be produced according to ISO 9001 quality management to ensure reliable operation or equivalent	Written documentation for compliance with IS0 9001 or equivalent.
Minimum requirements for equipment. To ensure proper function the following minimum requirements should be fulfilled. • 8 hour fuel tank • Fuel alarm • Protective shielding against unauthorized access • Manual start/stop • Manual emergency stop • Operation alarms • Leakage control and protection • Drip pan for collection of oil spillage	Written documentation according to datasheet of generator and/or additional information.

SUSTAINABILITY CRITERIA	VERIFICATION
• Anti vibration construction • Self protection system • Spare parts for minimum 5000 running hours	
Output power Output power must be specified for all relevant site allocations and operation conditions.	Output power must be specified at altitude 1000 m above sea level.
Operational manual The generator set must be delivered with a full and detailed operating and service manual. Must as minimum be in English, but a version in the local language may also be relevant.	Agreement on manual.
Fuel availability and fuel flexibility The flexibility of the generator with regard to type of fuel and fuel quality must be in compliance with the market situation for fuel at the location of operation. Fuel type and fuel quality according to the specifications given by the generator supplier must at all times be available. Delivery time must be in full compliance with expected needs. If local fuel quality is uncertain, it must be verified and used as part of the specification in the bidding paper for the generator supplier(s). It is very important not to use biofuel in diesel generators unless the generator is specified for such use. If diesel is delivered with a certain amount of biodiesel the maximum contents hereof must be in compliance with the generator specifications.	The quality of the available fuel at the site where the generator is to be installed must be in compliance with the fuel quality specified by the generator supplier Or The generator supplier must verify that the quality of the fuel available at the site where the generator is to be operated can be used for proper operation of the generator and comply with given guarantees of the generator/genset.
Fuel storage The fuel storage must have the necessary volume to operate the generator at full power in the maximum expected number of hours in an emergency operation. The capacity of the tank system (primary tank as part of the generator system and possible extra secondary tank) must have a capacity in accordance with the guaranteed maximum delivery time for fuel from the fuel supplier.	Written documentation that the capacity of the fuel storage complies with given information on expected site operation.

SUSTAINABILITY CRITERIA	VERIFICATION
The fuel storage must not have a capacity larger than what is used within 24 months. Fuel must be used and new fuel added frequently to avoid the risk of degradation of fuel (diesel-pest) that can harm the motor. Control that fuel capacity equals the number of maximum operational hours between fuel deliveries. Number of operational hours = Total tank capacity / (Fuel consumption per hour at full load) Fuel storage < (Number of operational hours within 24 months) x (fuel consumption / hr).	
Primary fuel tank as part of generator package. The primary fuel tank connected to the generator must have the necessary capacity to operate the maximum expected period at full power. The capacity is normally around 10 hour operation at full load. If more capacity is needed an additional secondary fuel tank will be needed.	See “Fuel Storage”
Secondary fuel tank and fuel control. If the fuel tank included in the standard generator package does not have the necessary capacity, a separate secondary fuel tank will be needed. The secondary tank must be specified with the necessary capacity in operation hours at full capacity. The tank must be delivered together with a fuel control system that measures the fuel level at the primary tank and that transfers fuel to the primary tank when necessary. The secondary fuel tank must be placed and installed according to national legislation. This must be specified in the order. It must specifically be ensured that the tank cannot result in contamination of soil and groundwater.	Written specification on fuel control system. Written specification on installation according to local rules where relevant.

SUSTAINABILITY CRITERIA	VERIFICATION
Overload capacity Due to the severity of operating conditions in the field, generator sets are often called on to deliver maximum output. Generator sets should have at least a 10 % overload capability beyond their nameplate rating. Appropriate size should be assessed by qualified personal before procurement Overload capacity / full load = minimum 1.1	Specification in datasheet
Reliability Generators must be purchased by suppliers who can show references from systems delivered for similar purpose as needed for the actual situation. Only generators with proven technology, meaning that same technology has been used successfully for a number of years (least 5 years) should be purchased. New, not proven technology, even if such technology is described to have some benefits compared to other technologies, must be avoided. If reliable start-up and operation is mandatory for critical use it can be necessary to purchase a pair for generators. Buying two generators can be relevant for remote place operation with long service response time and where reliability is of high importance.	Documentation from supplier for delivery of generators for similar use. Generator technology is a proven well known technology.
Housing for noise reduction If not delivered with the generators, housing should be included in the tender for noise control. The purpose of the housing is also to protect the equipment in general and protection against unauthorized access.	
Noise Generators placed in areas where people work or live must be placed in efficient noise reduction housing. The housing must be delivered by the generator supplier. If the housing is not delivered by the supplier the construction of the housing must be specified by the supplier in order to make sure that it complies with operation conditions for the generator and access in connection with service and maintenance. Noise level outside the housing should never exceed 80dB at a distance of 7 meter.	Written Specification of noise level outside housing.

SUSTAINABILITY CRITERIA	VERIFICATION
Compliance with emissions standards Compliance with • US EPA Clean Air Act on Non-road Diesel Equipment • EU, Emissions from non-road mobile machinery: • Directive 97/68/EC, Directive 2002/88/EC, Directive 2004/ 26/EC or equivalent	Written documentation from supplier that generator complies with EU / EPA regulations or equivalent.
Stack height and compliance with immission contribution standards Flue gas from generators contains a number of different components with harmful effects on people and environment. The flue gas outlet from the generator must be connected to a stack that ensures the necessary dispersion of the air pollution components in the gas as to comply with national and local limit values for immission contribution standards and ambient air quality standards.	Written documentation on that stack has the sufficient height to effectively disperse the flue gas to be in compliance with immission contribution standards. If national standards do not exist a maximum of 125 µg/m^3 for NO_2 as 99 % percentile 1 hour value can be recommended. In calculation of the immission contribution values it can be recommended to set the value of NO_2 to 50 % of the total NO_X concentration.
Environmentally-friendly packaging Generators are delivered in containers or in other solid constructions. Generators are generally produced far from the place where they are used. Resending packaging materials to the supplier is therefore not practical or environmentally friendly.	Generator must be delivered in a container that can be used for reallocation of the generator. This must be specified in the contract.
C - Sourcing	
Compliance with environmental legislation Bidders shall not be permitted to take part in a contract if they: Have been found guilty of grave professional misconduct, including non-compliance with environmental legislation, proven by any means which the contracting authorities can demonstrate; or have not fulfilled obligations relating to the payment of social security contributions in accordance with the legal provisions of the country in which he/she is established or with those of the country of the contracting authority.	Bidders must provide a declaration that they meet this criterion. Upon request, they may be asked to provide documentary proof to support this declaration.

SUSTAINABILITY CRITERIA	VERIFICATION
Production of the product according to international labour standards (self-declaration) The bidder shall provide proof that they and the manufacturers comply with the international working standards (ILO Core Conventions) listed below throughout the whole supply chain. The supply chain includes producers and manufacturers that are the subject of this contract. Furthermore it includes contracted labour (contract manufacturers) that may market, manufacture and/or provide goods and services that are used to manufacture and supply the final product. • Freedom of Association and Protection of the Right to Organise (No. 87) • Right to Organise and Collective Bargaining (No. 98) • Forced Labour (No. 29) • Abolition of Forced Labour (No. 105) • Discrimination (Employment and Occupation) (No. 111) • Equal Remuneration (No. 100) • Minimum Age (No. 138) • Worst Forms of Child Labour (No. 182)	The bidder is required to submit appropriate proof that these requirements have been met, such as a written self-commitment/declaration (such as a current industry code of conduct declaration) that the requirements are met, together with documented support of the implementation and monitoring of measures
Written corporate environmental policy The bidder and the manufacturer of the final product(s) are required to demonstrate the existence and public availability of a written corporate environmental policy, consistent with ISO 14001 (International Organisation for Standardisation), or equivalent.	Proof of compliance is the written corporate environmental policy, consistent with ISO 14001 (International Organisation for Standardisation), or equivalent. Any other appropriate means of proof will also be accepted.
D - Evaluation	
Lifetime costs The lifetime is important in relation to cost. The supplier must specify lifetime of the generator and other equipment. The lifetime costs depend both on the initial investment costs and annual costs for operation and service and eventual decommissioning and disposal costs.	Expected lifetime is described in contract for generator and other equipment. Bidders must provide the appropriate documentation that allows calculation of the lifetime costs. See section 7.1.

SUSTAINABILITY CRITERIA	VERIFICATION
For generators that are only expected to be used a few hours each year the investment cost and expected lifetime of equipment is the most dominant parameter for the lifetime costs. For generators that are expected to be used extensively operational costs may be the most important. Diesel engines are most fuel-efficient at a certain power level. Fuel is a major operating cost, and there are significant differences in fuel consumption rates between brands. Fuel consumption data for diesel generators are often given at 50 %, 75 % and 100 % of full load, either as g/kW or as litre oil/hour. For generators that are frequently used a few percentage points of better fuel economy can add significantly to the bottom line. It is important to calculate lifetime costs for different % of loads to compare proposals from different bidders. Before such calculations are made it is not possible to decide whether it is best to purchase a generator that has to operate at full load or to choose a higher priced generator that only needs to run on 75 % of full load. 75 points should be given to the bidder with the lowest lifetime cost. Other bids (b) should be given points as follows: Pb = 75 x (lowest price/bidders price) For calculation of lifetime costs see section 7.1.	

SUSTAINABILITY CRITERIA	VERIFICATION
Efficiency Energy efficiency is of high importance for generators that operate many hours each year both with regard to economy and release of carbon dioxide and other pollutants. The emission of carbon dioxide is directly related to the amount of fuel used. High efficiency is therefore important to reduce the amount of released carbon dioxide and hereby to reduce the global greenhouse effect. Highest efficiency will come with a correctly sized generator for the load. Datasheets for generators do not always specify the emission of carbon dioxide. In such case the carbon dioxide emission can be calculated by use of an emission factor for the fuel used. Common emission factor for diesel oil: 2.7 kg CO_2 / litre diesel oil Energy (Ee) efficiency is calculated as: Ee = Ekw / Fc Where: Ekw = Nominated output in kW at full load* Fc = Fuel consumption in litre at full load* *Other load values can also be used 5 points should be given to the bidder with the highest Ee. Other bids (b) should be given points as follows: Pb = 100 x (highest Ee/bidders Ee) For generators running on biodiesel extra 5 points is added. (Recommendations). For generators with emissions in compliance with stage IV in EU directive for Non Road Mobile Machine (NRMM) 5 point is added. (Recommendations). For generators equipped with heat recovery system 5 points extra are added. (Recommendations).	Bidders must provide the appropriate documentation that allows calculation of the efficiency of the generator. See section 7.1.

SUSTAINABILITY CRITERIA	VERIFICATION
Bio fuel 5 points is given for generators that also can operate on bio fuel.	Bidders must provide the appropriate documentation on whether or not the generator can operate on bio fuel. See section 7.1.
Heat recovery 5 points is given for generators equipped with heat recovery system.	Bidders must provide the appropriate documentation on the possibility of use of heat recovery system. See section 7.1.
Air Pollution 5 points is given for generators in compliance with EU stage IV or equivalent emission standard.	Bidders must provide the appropriate documentation on compliance with EU/EPA standards.
Noise Noise level outside the housing should never exceed 80 dB at a distance of 7 meter. With regard to noise in dB(A) at distance 7 m points can be added as follows. < 80 db(A): 0 points 75-80 dB(A): 1 points 70-75 dB(A): 2 points 65-70 dB(A): 3 points 60-65 dB(A): 4 points < 60 dB(A): 5 points	The bidder must present the technical sheet of the generator where this information must be provided.
E - Contract Management	
Service and maintenance, abroad and local, service response time All diesel engines require periodic maintenance to ensure good performance and reliability. Most generators require service between 300 hours of operation. Regular service intervals and service response time must be specified according to the needs. This may be different from customer to customer and the use of the generator. If service is carried out by a local company this company must be authorized by the supplier.	Written agreement on service and maintenance. A service contract must be signed with either the supplier or with a supplier authorized service company. The contents of the contract must be based on a combination of actual needs and supplier recommendations. The service contract should as a minimum include: • Annual service • Spare parts availability

SUSTAINABILITY CRITERIA	VERIFICATION
	• Service response time • Service costs
Spare parts availability It is important that spare parts are available. Need of spare parts must not result in unnecessary service response time. Necessary spare parts must be available either from the service company or be part of a spare part package delivered together with the generator. If spare parts are delivered as part of the generator delivery a spare part list must frequently be updated and new parts ordered form the supplier.	Written agreement on spare parts package and spare parts availability. Spare parts for minimum 5000 running hours.
Training and education Correct handling, use and service is very important for reliable operation of a generator. Required training and education for personnel responsible for the generator must be provided by the supplier.	Agreement on training course. Training manual for personnel.
Decommissioning A generator typically has a lifetime of more than 20 years. Decommissioning is therefore of minor importance. New generators are less polluting than old generators. Worn out generators must not be reused or sold for use at other places but must be broken down and its parts must be disposed or reused as metal according to EU or US standards. If the system contains underground oil storage tanks, such tanks should be emptied and removed. Local regulation may come into force.	Written agreement on decommissioning, if possible.
Leasing Leasing can be an alternative solution to purchasing a generator. Leasing can be relevant in cases where a generator will only be needed for a limited amount or years, for example 1-7 years. Leasing contracts can also be made with the possibility later to purchase the generator. Leasing contracts and conditions are different from supplier to supplier and a general rule for when leasing is the best solution cannot be given.	Compare lifetime cost for different solutions with / or without leasing. See section 7.1 for calculation method.

Sustainability criteria for large power back up battery systems

SUSTAINABILITY CRITERIA	VERIFICATION
A - Procurement planning	
Battery system It is important to choose the right battery for a specific purpose and environment in which it is to be used. See section 7.3 for general information on how to choose a battery. Next it is important that the battery is specified according to the needed performance. To fully ensure that the delivered battery system complies with the needs all relevant parameters must be specified. Recommended minimum specifications: • Power Rating [kVA/kW] • Voltage output [Volt] • Frequency [Hertz] • Two or three phases • Application [stand-by, prime duty, continuous] Minimum initial current delivery at specified temperature. Batteries can die due to technical failure or misuse. If reliability is crucial it can be recommended to purchase two parallel lines of batteries to ensure extra backup. **Battery rack** Batteries need to be installed in a safe way. Rack systems are often used. Systems are often part of a battery package delivery. **Ventilation system** Open cell batteries or valve batteries release hydrogen. Room with batteries must be ventilated effectively to prevent risk of fire or explosion. **Charging system and / or UPS** This may be part of the total delivery and must be specified. Modern batteries are advanced units and will always benefit from electronic designed for its specific use. Replacing batteries will often result in replacing the whole system including UPS.	

SUSTAINABILITY CRITERIA	VERIFICATION
B - Requirement definition	
Construction and specification standards The battery system must be produced and performance specified according to international standards There are numerous standards for different kind of batteries.	Check with battery datasheet or with other relevant information from supplier.
ISO 9001 quality management The battery set must be produced according to ISO 9001 (or equivalent) quality management to ensure reliable operation	Written documentation for compliance with IS0 9001 (or equivalent)..
Battery rack and enclosure Batteries must be delivered for safe installation and for protection against unauthorized access, including protection against accidental shortcut and high voltage risk.	Written documentation.
Training and education Correct handling, use and service is very important for reliable operation of a generator. Needed training and education for personnel responsible for the generator must be provided by the supplier.	Training manual for personnel.
C - Sourcing Suppliers	
Compliance with environmental legislation Bidders shall not be permitted to take part in a contract if they: Have been found guilty of grave professional misconduct, including non-compliance with environmental legislation, proven by any means which the contracting authorities can demonstrate; or have not fulfilled obligations relating to the payment of social security contributions in accordance with the legal provisions of the country in which he/she is established or with those of the country of the contracting authority.	Bidders must provide a declaration that they meet this criterion. Upon request, they may be asked to provide documentary proof to support this declaration.

SUSTAINABILITY CRITERIA	VERIFICATION
Production of the product according to international labour standards (self-declaration) The bidders shall provide proof that they and the manufacturers comply with the international working standards (ILO Core Conventions) listed below throughout the whole supply chain. The supply chain includes producers and manufacturers that are the subject of this contract. Furthermore it includes contracted labour (contract manufacturers) that may market, manufacture and/or provide goods and services that are used to manufacture and supply the final product. • Freedom of Association and Protection of the Right to Organise (No. 87) • Right to Organise and Collective Bargaining (No. 98) • Forced Labour (No. 29) • Abolition of Forced Labour (No. 105) • Discrimination (Employment and Occupation) (No. 111) • Equal Remuneration (No. 100) • Minimum Age (No. 138) • Worst Forms of Child Labour (No. 182)	The bidder is required to submit appropriate proof that these requirements have been met, such as a written self-commitment/declaration (such as a current industry code of conduct declaration) that the requirements are met, together with documented support of the implementation and monitoring of measures
Written corporate environmental policy The bidder and the manufacturer of the final product(s) are required to demonstrate the existence and public availability of a written corporate environmental policy, consistent with ISO 14001 (International Organisation for Standardisation), or equivalent.	Proof of compliance is the written corporate environmental policy, consistent with ISO 14001 (International Organisation for Standardisation), or equivalent. Any other appropriate means of proof will also be accepted.

SUSTAINABILITY CRITERIA	VERIFICATION
D - Evaluation	
Lifetime costs The lifetime costs depend both on the initial investment costs and annual costs for operation and service. 80 points should be given to the bidder with the lowest lifetime cost. Other bids (b) should be given points as follows: Pb = 80 x (lowest price/bidders price) For calculation of lifetime costs see section 7.3.	Bidders must provide the necessary information for calculation life time cost.
Maintenance and service Points should be given for ease of maintenance of battery system. Give points as follows: > 100 hours of maintenance/year: 0 points 50-100 hours of maintenance/year: 1 points 30-50 hours of maintenance/year: 2 points 20-30 hours of maintenance/year: 3 points 10-20 hours of maintenance/year: 4 points < 10 hours of maintenance/year: 5 points	Bidders must provide the necessary information for giving points.
Reuse/Recycling Points should be given for batteries that can be sent back to supplier for recycling. 10 points for systems where used and replaced batteries can be returned back to supplier or alternatively be recycled by a local system.	Bidders must provide the necessary information for giving points.
Environmentally-friendly packaging Points shall be awarded for products for which packaging materials can be separated into mono-material parts. 5 points for bidders who can provide a list of the different packaging and describe how material can be separated for mono-material for reuse.	Bidders must provide the necessary information for giving points.

SUSTAINABILITY CRITERIA	VERIFICATION
E - Contract Management	
Service and maintenance, abroad and local, service response time A battery system requires periodic maintenance to ensure good performance and reliability. Service must be based on the expected use of the batteries. This may be different from customer to customer and the use of the batteries. It is important to have a dialog with the supplier to set up maintenance program. The supplier will have the necessary expertise and support experience to define a maintenance program based on local operating conditions and reliability requirements. If service is carried out by a local company this company must be authorized by the supplier.	Written agreement on service and maintenance. A service contract must be signed with either the supplier or with a supplier authorized service company. The contents of the contract must be based on a combination of actual needs and supplier recommendations. The service contract should as a minimum include: • Annual service • Spare parts availability • Service response time • Service costs
Spare parts It is important that spare parts are available. The lack of spare parts must not result in unnecessary service response time. Necessary spare parts must be available either from the service company or be part of a spare parts package delivered together with the battery system. If spare parts are delivered as part of the battery system a spare parts list must frequently be updated and new parts ordered form the supplier.	Spare parts list must be included in contract or order. Agreement on spare parts for minimum 5000 running hours.
Disposal of used batteries Replaced batteries must be recycled in an environmentally friendly way, either by returning them to the supplier or by a local recycling system. Batteries must never be disposed in nature or incinerated as most types contain heavy metals. The European Union has in Directive 2006/66EC specified rules for handling and disposal of batteries. (Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC entered into force on 26 September 2006. Consolidated version.) Suppliers must take used batteries back or specify how to dispose replaced batteries in an environmentally safe way.	Written agreement with supplier to take back replaced batteries or use of local controlled system in compliance with EC 2006/66 or similar standards.

Sustainability criteria for Small power battery system for remote place electronic operations

SUSTAINABILITY CRITERIA	VERIFICATION
A - Procurement planning	
Battery specification It is important to choose the right battery for a specific purpose and environment in which it is to be used. See section 7.3 for general information on how to choose a battery. Next it is important that the battery is specified according to the needed performance. To fully ensure that the delivered battery system complies with the needs all relevant parameters must be specified. Batteries can die due to technical failure or misuse. If reliability is crucial it may be recommended to purchase two parallel lines of batteries to ensure extra backup. Specifications may include, but not necessarily be limited to: • Output voltage • Capacity in Ah • Capacity in kWh • Effect in kW • Minimum storage temperature • Maximum storage temperature • Minimum initial current delivery at specified temperature. **Charging system / wind turbine or solar cells** This may be part of the total delivery and must be specified. Modern batteries are advanced units and will always benefit from electronics designed for its specific use. **Security system** In some places it can be of high importance that the battery system and other equipment are secured against unauthorized access. This must be discussed and specified in connection with ordering a system for remote place operation. A backup system may also be necessary.	

SUSTAINABILITY CRITERIA	VERIFICATION
B - Requirement definition	
Construction and specification standards The battery system must be produced and performance specified according to international standards There are numerous standards for different kind of batteries.	Check with battery datasheet or with other relevant information from supplier.
ISO 9001 quality management The battery set must be produced according to ISO 9001 (or equivalent) quality management to ensure reliable operation	Written documentation for compliance with IS0 9001 (or equivalent).
Battery rack and enclosure Batteries must be delivered for safe installation and for protection against unauthorized access and theft	Written documentation in contract.
Training and education Correct handling, use and service is very important for reliable operation of a generator. Needed training and education for personnel responsible for the generator must be provided by the supplier.	Training manual for personnel.
C - Sourcing	
Compliance with environmental legislation Bidders shall not be permitted to take part in a contract if they: Have been found guilty of grave professional misconduct, including non-compliance with environmental legislation, proven by any means which the contracting authorities can demonstrate; or have not fulfilled obligations relating to the payment of social security contributions in accordance with the legal provisions of the country in which he/she is established or with those of the country of the contracting authority.	Bidders must provide a declaration that they meet this criterion. Upon request, they may be asked to provide documentary proof to support this declaration.
Production of the product according to international labour standards (self-declaration) The bidders shall provide proof that they and the manufacturers of the cleaning products comply with the international working standards (ILO Core Conventions)	The bidder is required to submit appropriate proof that these requirements have been met, such as a written self-commitment/declaration (such as a current industry code of conduct declaration) that the requirements are met, together with documented support of the

SUSTAINABILITY CRITERIA	VERIFICATION
listed below throughout the whole supply chain. The supply chain includes producers and manufacturers of all cleaning products that are the subject of this contract. Furthermore it includes contracted labour (contract manufacturers) that may market, manufacture and/or provide goods and services that are used to manufacture and supply the final product. • Freedom of Association and Protection of the Right to Organise (No. 87) • Right to Organise and Collective Bargaining (No. 98) • Forced Labour (No. 29) • Abolition of Forced Labour (No. 105) • Discrimination (Employment and Occupation) (No. 111) • Equal Remuneration (No. 100) • Minimum Age (No. 138) • Worst Forms of Child Labour (No. 182)	implementation and monitoring of measures
Written corporate environmental policy The bidder and the manufacturer of the final product(s) are required to demonstrate the existence and public availability of a written corporate environmental policy, consistent with ISO 14001 (International Organisation for Standardisation), or equivalent.	Proof of compliance is the written corporate environmental policy, consistent with ISO 14001 (International Organisation for Standardisation), or equivalent. Any other appropriate means of proof will also be accepted.
D - Evaluation	
Lifetime costs The lifetime costs depend both on the initial investment costs and annual costs for operation and service. 80 points should be given to the bidder with the lowest lifetime cost. Other bids (b) should be given points as follows: Pb = 80 x (lowest price/bidders price) For calculation of lifetime costs see section 7.4.	Bidders must provide the necessary information for calculation life time cost.

SUSTAINABILITY CRITERIA	VERIFICATION
Maintenance and service Points should be given for ease of maintenance of battery system. Give points as follows: > 10 hours of maintenance/year: 0 points 5-10 hours of maintenance/year: 10 points 3-5 hours of maintenance/year: 20 points 2-3 hours of maintenance/year: 30 points 1-2 hours of maintenance/year: 40 points < 1 hours of maintenance/year: 50 points	Bidders must provide the necessary information for giving points.
Reuse/Recycling Points should be given for systems that can be sent back to supplier for reuse and/or upgrading. 5 points for systems where used and displaced batteries can be returned back to supplier or alternatively be recycled by a local system.	Bidders must provide the necessary information for giving points.
Environmentally-friendly packaging Points shall be awarded for products for which packaging materials can be separated into mono-material parts. 5 points for bidders who can provide a list of the different packaging and describe how material can be separated for mono-material for reuse.	Bidders must provide the necessary information for giving points.
E - Contract Management	
Service and maintenance, abroad and local, service response time A battery system requires periodic maintenance to ensure good performance and reliability. Service must be based upon the expected use of the batteries. This may be different from customer to customer and the use of the batteries. It is important to have a dialog with the supplier to set up maintenance program. The supplier will have the necessary expertise and support experience to define a maintenance program based on local operating conditions and reliability requirements. If service is carried	Written agreement on service and maintenance. A service contract must be signed with either the supplier or with a supplier authorized service company. The contents of the contract must be based on a combination of actual needs and supplier recommendations. The service contract should as a minimum include: • Annual service

SUSTAINABILITY CRITERIA	VERIFICATION
out by a local company this company must be authorized by the supplier.	• Spare parts availability • Service response time • Service costs
Spare parts availability It is important that spare parts are available. Lack of spare parts must not result in unnecessary service response time. Necessary spare parts must be available either from the service company or be part of at spare parts package delivered together with the battery system. If spare parts are delivered as part of the battery system a spare parts list must frequently be updated and new parts ordered form the supplier.	Spare parts list must be included in contract or order. Spare parts for minimum 5000 running hours.
Disposal of used batteries Replaced batteries must be recycled in an environmentally friendly way, either by returning them to the supplier or by a local recycling system. Batteries must never be disposed in nature or incinerated as most types contain heavy metals. The European Union has in Directive 2006/66EC specified rules for handling and disposal of batteries. (Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC entered into force on 26 September 2006. Consolidated version.) Supplier must take used batteries back or specify how to dispose replaced batteries in an environmentally safe way.	Written agreement with supplier to take back replaced batteries or use of local controlled system in compliance with EC 2006/66 or similar standards.

Section 4: Implementation notes

A. Procurement Planning

Generator size

A generator should never be bought too small. Running a generator at its full maximum will lead to unnecessary wear and tear resulting in reduced lifetime. Similarly, generators should not be bought larger than necessary; both with regard to price and the fact that generators are most efficient in the range from 60 – 100 % of the specified maximum output.

B. Requirement definition

Ecolabels for batteries

There are different label systems on the market for batteries.[2] Eco labelling is of secondary importance when it comes to emergency backup systems or systems to be used at remote places. Reliability and lifetime are here of much higher importance. The same is the case for generators and electronic devices as UPS and charging units. For more information on ecolabels and environmental labels and their use in the UN procurement process, please consult: "A Guide to Environmental Labels for United Nations Procurers" published by UNOPS and UNEP, as part of the SUN initiative (May 2009)[3].

C. Sourcing suppliers

Compliance with environmental legislation

Where appropriate, the contracting authorities should ask bidders to supply relevant documents and, where they have doubts concerning the personal situation of a bidder, they may seek the co-operation of the competent authorities in the particular country.

The exclusion of such economic operators should take place as soon as the contracting authority has knowledge of a judgement concerning such offences. If national law contains provisions to this effect, non-compliance with environmental legislation or legislation on unlawful agreements in public contracts which have been the subject of a final judgement or a decision having equivalent effect may be considered an offence concerning the professional conduct of the economic operator concerned or grave misconduct.

Exclusion of suppliers on the basis of non-compliance with environmental legislation may prove impractical in situations where a strong legal framework and enforcement is not in place. The procurer will need to assess their own situation.

D. Evaluation

Where the market availability of products meeting the Specifications is less certain, the procurer may wish to use certain specifications as Evaluation/Award criteria instead, indicating that such characteristics are preferred but not required. It is advisable to do some small market research before procurement.

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[2] www.globalecolabelling.net/categories_7_criteria/list_by_code/1100.htm
[3] www.greeningtheblue.org/sites/default/files/Env%20Labels%20Guide_final_0.pdf

Section 5: Information sources

- European Commission GPP Training Toolkit: http://ec.europa.eu/environment/gpp/toolkit_en.htm
- United Nations (2004) “Consolidated List of Products Whose Consumption and/or Sale Have Been Banned, Withdrawn, Severely Restricted or not Approved by Governments” United Nations Publications
- UN High Level Committee on Management Procurement Network (HLCM-PN), Sustainable Procurement Statement, Revised 15th January 2009
- US proposal TIER IV of further stages of emission limit values. A working group within the GRPE - Working Party on Pollution and Energy (UNECE) is working with a world wide harmonized test procedure.
- EU directive 2004/26/EC on non road mobile sources machines http://eur-lex.europa.eu/LexUriServ/site/en/oj/2004/l_225/l_22520040625en00030107.pdf
- DIRECTIVE 2006/66/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 6 September 2006 on batteries and accumulators and waste batteries and accumulators and repealing Directive 91/157/EEC (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:266:0001:0014:EN:PDF)
- Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:152:0001:0044:EN:PDF)
- DIRECTIVE 2004/107/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air (http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2005:023:0003:0016:EN:PDF)
- WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulphur dioxide, http://whqlibdoc.who.int/hq/2006/WHO_SDE_PHE_OEH_06.02_eng.pdf
- The United States regulated by Environmental Protection Agency “Control of Emissions of Air Pollution From Nonroad Diesel Engines and Fuel” www.regulations.gov/search/Regs/contentStreamer?objectId=09000064800be203&disposition=attachment&contentType=pdf
- EPA Clean Air Act information page on Nonroad Diesel Equipment www.epa.gov/nonroaddiesel/2004fr.htm
- DIRECTIVE 97/68/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 1997 on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1998:059:0001:0085:en:PDF
- DIRECTIVE 2002/88/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 December 2002 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:035:0028:0081:EN:PDF

- DIRECTIVE 2004/ 26/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 April 2004 amending Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:146:0001:0107:en:PDF
- COUNCIL DIRECTIVE 2006/105/EC of 20 November 2006 adapting Directives 73/239/EEC, 74/557/EEC and 2002/83/EC in the field of environment, by reason of the accession of Bulgaria and Romania, http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_363/l_36320061220en03680408.pdf
- European commission webpage for Directives on emissions from non-road mobile machinery, http://ec.europa.eu/enterprise/sectors/mechanical/documents/legislation/emissions-non-road/index_en.htm
- ALOHA, www.epa.gov/oem/content/cameo/aloha.htm
- AIRMOD, www.epa.gov/scram001/dispersion_prefrec.htm#aermod
- Electropaedia, www.mpoweruk.com/battery_types.htm
- Standards for testing of batteries, www.mpoweruk.com/standards.htm#organisations

Section 6: Example of Weighting Matrix

This matrix provides a model which procurers may wish to use in the evaluation/award phase of the procurement processes. The matrix should serve as an example of how procurers can allocate bonus points for sustainability criteria when evaluating competing bids.

The evaluation criteria, for instance, in the form of the evaluation matrix, should be included as an annex in the tender documents published by the procurement/contracting authority.

As a rule of thumb, the total weighting given to sustainability criteria is recommended to be about 25 % of the total points given to all evaluation criteria.

GENERATORS		
Evaluation criteria	**Bonus points** Maximum = 100 points	**Score**
Lifetime cost	Max 75 points *	
Efficiency and environment		
Efficiency	Max 5 points	
Bio fuel	5 points	
Heat recovery	5 points	
Air pollution stage IV compliance	5 points	
Noise	Max 5 points	
SUM		

SMALL AND LARGE BATTERY SYSTEMS		
Sustainability evaluation criteria	**Bonus points** Maximum = 100 points	**Score**
Lifetime cost	Max 80 points *	
Maintenance and service	Max 5 points	
Reusable systems	Max 10 points	
Environmentally-friendly packaging	Max 5 points	
SUM		

*: Maximum points is given to the bid with the lowest lifetime cost. Other bids is given points as follows:

Max point x (Lifetime cost for best bid) / (Lifetime cost for actual bid)

In connection with the Guidelines, a spreadsheet has been developed for easy life cycle cost calculation. The same spreadsheet can be used for evaluation of sustainable procurement with regard to efficiency, environmental impact and environmental - and quality management systems. It is possible for the user of the spreadsheet to specify different weighting between cost and environmental parameters.

Section 7: Check-list

Check-list for selection of generators

The following check-list is designed to:

- Provide a quick overview of the criteria presented above
- Be used by UN procurers/requisitioners in assessing different offers

The Check-list only includes general headings and does not include the criteria themselves.

For specifications (or terms of reference for services) and sourcing criteria, the procurer should insert “yes” or “no” in the final column depending on whether the product or service meets the criteria presented above. For each award/evaluation criteria, the procurer should assess the performance of the product or service being evaluated and decide how many points should be awarded.

CHECK-LIST - GENERATORS	
B - Requirement definition	**Yes/No**
Compliance with operation criteria and defined needs	
Construction and specification standards. Compliance with listed standards (see list in section 2)	
ISO 9001. OEM is certified according to quality management ISO 9000	
General minimum requirement for equipment (see list in section 2)	
Output power. Specified at altitude 1000 m above sea level and in compliance with order.	
Installation. Agreement on installation and site acceptance test	
Operational manual and training manual. Manual in English and in local language if required	
Fuel. Fuel specifications are in compliance with available fuel quality	
Fuel storage. Volume of fuel storage is sufficient for maximum expected operation period at full load	
Overload capacity. 10%	
Reliability. Documentation for reliability for similar use.	
Noise. Generator is placed in a housing for reduction of noise impact on surroundings	
Compliance with US (EPS)/EU emissions standards	
Flue gas cleaning (option)	

Stack height. Compliance with air quality guideline limits and immission contribution limits.	
Packaging. Delivered in container for easy reallocation.	
C - Sourcing suppliers	**Yes/No**
Compliance with environmental legislation	
Production according to international labour standards	
Written Corporate environmental policy	
D - Evaluation	**Points**
Lifetime cost	
Efficiency	
Bio fuel	
Heat recovery	
Air pollution stage IV compliance	
Noise	
E – Contract Management	**Yes/No**
Service and maintenance. Agreement on service and service response time.	
Spare part availability. Written agreement on spare parts package and spare parts delivery time.	
Spare parts for minimum 5000 running hours.	
Disposal of oil. Storage and disposal according to SU-EPS/EU standards	
Expected lifetime and lifetime cost	
Training and education. Agreement on training course. Training manual.	
Decommissioning. Written agreement on decommissioning (if relevant)	
FAT. Written documentation for Factory Acceptance Test – if relevant	
Installation and SAT Written documentation for Site Acceptance Test – if relevant	

Check-list for Selection of Large Power Backup Systems

CHECK-LIST – BATTERIES FOR LARGE POWER BACKUP SYSTEMS	
B - Requirement definition	**Yes/No**
Compliance with operation criteria and defined needs	
Specifications according to international standards	
ISO 9001. OEM is certified according to quality management ISO 9000	
Installation for safe operation and unauthorized access	
Training manual and operational manual in English or local language	
C - Sourcing	**Yes/No**
Compliance with environmental legislation	
Production according to international labour standards	
Written Corporate environmental policy	
D - Evaluation	**Points**
Lifetime cost	
Maintenance and service	
Reusable systems	
Environmentally-friendly packaging	
E – Contract Management	**Yes/No**
Service and maintenance. Agreement on service and service response time.	
Spare part availability. Written agreement on spare parts package and spare parts delivery time.	
Spare parts for minimum 5000 running hours.	
Disposal of used batteries.	
Training and education. Agreement on training course. Training manual.	
FAT. Written documentation for Factory Acceptance Test – if relevant	
Installation and SAT Written documentation for Site Acceptance Test – if relevant	

Check-list for selection of batteries for remote place electronics

CHECK-LIST – BATTERIES FOR REMOTE PLACE ELECTRONICS	
B - Requirement definition	**Yes/No**
Compliance with operation criteria and defined needs	
Compliance with specifications in order	
Spare parts for minimum 5000 running hours.	
Construction and specification standards	
ISO 9001. OEM is certified according to quality management ISO 9000	
Installation for safe operation and unauthorized access	
Training manual and operational manual in English or local language	
C - Sourcing	**Yes/No**
Compliance with environmental legislation	
Production according to international labour standards	
Written corporate environmental policy	
D - Evaluation	**Points**
Lifetime cost	
Maintenance and service	
Reusable systems	
Environmentally-friendly packaging	
E – Contract Management	**Yes/No**
Service and maintenance. Agreement on service and service response time.	
Spare part availability. Written agreement on spare parts package and spare parts delivery time.	
Spare parts for minimum 5000 running hours.	
Disposal of used batteries.	
Training and education. Agreement on training course. Training manual.	
FAT. Written documentation for Factory Acceptance Test – if relevant	
Installation and SAT Written documentation for Site Acceptance Test – if relevant	

Section 8: Lifecycle approach

Life cycle cost for generators

The total life cycle cost of a generator system depends on:

- Investment cost for generator and other necessary equipment
- Lifetime of generator and equipment
- Annual costs for operation, service and maintenance of generator and equipment

The best expression for the life cycle cost is the equivalent annual cost (EAC):
EAC = [(Investment) / (lifetime in years)] + Annual cost for operational, service and maintenance

This formula can be broken down into costs for different equipment and can as such consist of few or many separate costs. It is recommended that the calculation of the lifetime cost is not made more complex than necessary.

The following formula can be recommended:
EAC = ICG / LTG + ISE / LTS + AFC x UFC + ASC

where:

ICG = Investment cost for generator and basic equipment (fuel tank, housing etc.)
LTG = Expected lifetime in years for generator and basic equipment
ISE = Investment costs for special equipment
LTS = Expected lifetime in years for special equipment
AFC = Annual fuel consumption in units
UFC = Unit fuel consumption price
ASC = Annual cost for service and maintenance, including spare parts, disposal of oil etc.

The above formula does not take account for capital costs. With an annual rate of interest of R % the formula is as follows:

$EAC = ICG / LTG_{T,R} + ISE / LTS_{T,R} + AFC \times UFC + ASC$

Where:

$LTG_{T,R}$ = Loan repayment factor = $[1 - 1/(1+R/100)^{LTG}]/ [R/100)]$
$LTS_{T,R}$ = Loan repayment factor = $[1 - 1/(1+R/100)^{LTS}]/ [R/100)]$

Table 7.1.1 gives recommendations on life cycle cost reduction for generators

Table 7.1.1 General recommendations for reducing life cycle cost for generators

Issue	Recommendation
Generator effect	The generator must be operated at an effect where fuel consumption/KW is at minimum. To make this possible the generator must be specified properly when ordering.
Fuel delivery	Use fuel with easy access and which does not require separate delivery.
Combined heat and power	If the generator is delivered with a heat recovery system the generated heat can replace use of energy from other sources.
Testing	Perform testing according to test procedure. Test only for the specified period.
Operation	Always operate the generator according to the recommendations from the supplier. Operators must have the necessary education and training.
Service and maintenance	Service and maintenance are very important in order to make a generator run efficiently and with least possible lifetime costs.

In connection with the Guidelines, a spreadsheet has been developed for easy life cycle cost calculation. The same spreadsheet can be used for evaluation of sustainable procurement with regard to efficiency, environmental impact and environmental - and quality management systems.

Life cycle cost for large battery systems and batteries for remote place electronic

The total life cycle cost of a battery system depends on:

- Investment cost for battery package and other necessary equipment
- Lifetime of battery system and equipment
- Annual costs for operation, service and maintenance of batteries and equipment

The best expression for the life cycle cost is the equivalent annual cost (EAC):
EAC = [(Investment) / (lifetime in years)] + Annual cost for operational, service and maintenance

This formula can be broken down into costs for different equipment and can as such consist of few or many separate costs. It is recommended that the calculation of the lifetime cost is not made more complex than necessary.

The following formula can be recommended:
EAC = ICG / LTG + ISE / LTS + ASC

where:

ICB = Investment cost for batteries and other basic equipment
LTB = Expected lifetime in years for batteries and basic equipment
ISE = Investment costs for special equipment
LTS = Expected lifetime in years for special equipment
ASC = Annual cost for service and maintenance, including spare parts, etc.

The above formula does not take account of capital costs. With an annual rate of interest of R % the formula is as follows:
$EAC = ICB / LTB_{T,R} + ISE / LTS_{T,R} + ASC$

Where:
$LTB_{T,R}$ = Loan repayment factor = $[1 – 1/(1+R/100)^{LTB}]/ [R/100)]$
$LTS_{T,R}$ = Loan repayment factor = $[1 – 1/(1+R/100)^{LTS}]/ [R/100)]$

Minimum life cycle cost is obtained by a combination of:

- Minimum investment cost
- Minimum service cost
- Maximum lifetime

Minimum life time cost is obtained by choosing the right battery according to the needed performance. The Annex 1 of the Background paper provides a detailed description of the batteries which should help choose the appropriate battery according to the needs.

Section 9: Glossary

When buying a generator it is important to specify relevant parameters that will ensure that the generator will comply with the needs when to be used. A generators performance is specified in the data sheet from the supplier. Not all given technical data may here be relevant for all users. The following provides general advice on how to read and understand the specifications and what is recommended to be mandatory. It is important to understand that the information given cannot or must replace a detailed analysis of what is needed for a specific usage and the corresponding dialog hereabout with the potential supplier(s).

How to read and understand generator specifications

Parameter	Description
Voltage	A generator has an output voltage that varies with the load and the corresponding current. Output voltage is specified at different values of amperes for both standby power and for prime power operation.
kW Kilowatt	Kilowatt is the energy that the generator delivers in the actual load. For DC current it will be the same as kVA. For AC applications this will not be the case. The power in kW will here depend on the actual nature of the electrical load that the generator has to supply electricity to. Suppliers often specify values of kW at a so called power factor of 0.8, meaning that the value of kW will be 80 % of the value given in kVA. When ordering a generator it is very important to analyze the needed power, both in the present situation both also in the years to come as not to purchase a generator with insufficient power. Generators are rated according to ISO 8528 for different kind of usage, continuous power, prime power, limited time running power and emergency standby power. All generators are rated for operation at normal air pressure at sea level. At higher altitudes air pressure is reduced and this will reduce the power of the generator. Other local conditions that may influence the performance of the generator is extreme heat, resulting in reduced cooling and hereby reduced output. Such special conditions must be specified to the potential supplier.
kVA Kilovoltampere	kVA or KiloVoltAmpere is the value of the multiplication of Volt and Ampere.
A Ampere	Value for current at corresponding voltage and kW. For a 3-phase generator the relation will approximately for a power factor of 0.8 be: Ampere = kW x 1000 / (Volt x 1,73 x 0,8).
COP Continuous Power	Constant load, unlimited running hours. This rating is appropriate for a generator set paralleled with an infinite bus e.g. a national electrical supply network or grid where the generator set is run at 100% load, 24 hours a day, 365 days a year and any surplus power is exported into the grid. Example is Combined

Parameter	Description
	Heat & Power (CHP) generator set.
PRP Prime Power	Variable load, unlimited running hours. This rating is appropriate for a generator set used to supply power 24 hours a day, 365 days a year where there is no supply network or grid available. Example is generator set located on an off-shore island or in the middle of a desert.
LTR Limited Time Running	Constant load, up to 500 hours per year. This rating is appropriate for a generator set used in classic standby power application where the generator set is used when the normally available electrical supply network or grid fails. 500 hours is considered the maximum length of time the generator set will be required to run in any one year. If the 500 running hours are reached within any one year period the generator set can continue to run but more servicing may be required as determined by oil sampling and inspection (rather than relying on the manufacturers normal service interval). Example is generator set on standby in a hospital for emergency power.
ESP Emergency Standby Power	Variable load, up to 200 hours per year. This rating is appropriate for a generator set used in standby power applications where the normally available electrical supply network or grid fails and where it has been determined that the load will be varying and the running hours will be less than 200 hours a year.
Overload operation time	Maximum possible overload, specified by value and time
Hz Generator frequency	The generator (also called alternator) must have the frequency used in the area/region where to be used. Most generators can be supplied with alternators with either 50 Hz or 60 Hz.
Voltage regulation	Voltage regulation is generally specified at steady state operation and at transients an given in percentage. Steady stage performance is typically < 1-2 %.
Start up time	Start up time is specified in seconds. A typical value for full load is 1-3 minutes and for 50 % load typically some seconds. For generators in combination with a large battery backup system this parameter is not critical.
Fuel tank capacity, hours	The built in fuel tank has typical a capacity for running the generator for 8 hours at 100 % load. It is recommended that this is minimum capacity and larger fuel tanks may be necessary.

Parameter	Description
Fuel alarm	Fuel alarm for low fuels stand.
Automatic fuel feeding	Automatic transfer (pumping) of fuel from a secondary tank to the primary tank included in the generator set when the volume here has reached a certain level.
Fuel consumption	Fuel consumption is typically specified a different effects as g fuel/kWh. The lowest fuel consumption (g/kWh) is normally at 75 % load.
Operation alarms	Most generators are equipped with a number of alarms when operations parameters are exceeded, here among temperature alarm - pressure - oil pressure etc. If the generator not is manually corrected a self protection system will be activated wit possible shut down of the generator.
Leakage control and protection	Usually a sealed construction under the generator fuel tank where a leak will be visually detected.
Self protection system	A system that automatically protects the generator, eventually by automatic shut down.
Emergency stop	A manually operated stop.
Protective shielding	Most generators used for emergency backup are self starting, meaning that stat up takes place without warning. All moving parts and electrical connections and terminals must therefore be protected for unauthorized and accidental contact.
dB(A) Noise level	Noise level is typically specified in dB(A) in a distance of 7 m from the outside of the generator. If the generator is located in a place where people work the noise limit should be maximum 80 dB(A) as to protect workers from long term induced hearing loss. For noise protection of residential areas it is recommended that generator is placed in a separate building or shielded by a effective separate noise isolation shielding.
Anti vibration damping and low	The purpose is to reduce vibration by use of absorbing mounting.

Parameter	Description
frequency noise reduction	
Stack noise reduction	If the generator is located close to residential areas it may be necessary to install the stack with a noise suppressor filter-
Cooling system Air cooling Water cooling	Small diesel generators are usually air cooled. Medium sized system can be air- or water cooled. Large generators are mostly (always) water cooled. A water cooled system requires more maintenance and control than and air cooled system – but water based systems are more effective. Other cooling agents can be used, here among hydrogen gas. The cooling system (including heat exchanger) must be able to give sufficient cooling under all operation conditions (for example high ambien temperature conditions).
Radio interference Telephone interference	The generator should not result in interference with radio and telephone signals. BS800, VED LEVELS G and N

How to read and understand battery specifications

When buying a battery system it is important to specify relevant parameters to ensure that the battery will comply with the needs. The performance of a battery is specified in the data sheet from the supplier. Performance will however depend on many local conditions, for example on temperature. Cycling frequency and electrical load will also greatly influence the performance, the same for service and maintenance. Not all given technical data in the datasheet may here be relevant for all users. The following provides general advice on what to specify and how to understand the technical data sheet. It is important to understand that the information given cannot or must replace a detailed analysis of what is needed for a specific usage and the corresponding dialog hereabout with the potential supplier(s).

Parameter	Description
KW Kilowatt	Kilowatt is the energy that the battery system can deliver in the actual load. The power in kW will here depend on the actual nature of the electrical load and the minimum acceptable voltage.
Nominal Voltage V	Reference voltage of the battery, also called “normal” voltage of the battery.
Open-circuit voltage V	The voltage between the battery terminals with no load applied. The open-circuit voltage depends on the battery state of charge, increasing with state of charge.
Terminal Voltage V	The voltage between the battery terminals with load applied. Terminal voltage varies with SOC and discharge/charge current.
Cut-off Voltage V	The minimum allowable voltage. It is this voltage that generally defines the “empty” state of the battery.
Capacity Ah	The total Amp-hours available when the battery is discharged at a certain discharge current (specified as a C-rate) from 100 percent state-of-charge to the cut-off voltage. Capacity is calculated by multiplying the discharge current (in Amps) by the discharge time (in hours) and decreases with increasing C-rate.
C-rate E-rate	A C-rate is a measure of the rate at which a battery is discharged relative to its maximum capacity. A 1C rate means that the discharge current will discharge the entire battery in 1 hour. For a battery with a capacity of 100 Amp-hrs, this equates to a discharge current of 100 Amps.

Parameter	Description
	An E-rate describes the discharge power. A 1E rate is the discharge power to discharge the entire battery in 1 hour.
Energy Nominal Energy Wh	The “energy capacity” of the battery, the total Watt-hours available when the battery is discharged at a certain discharge current (specified as a C-rate) from 100 percent state-of-charge to the cut-off voltage. Energy is calculated by multiplying the discharge power (in Watts) by the discharge time (in hours). Like capacity, energy decreases with increasing C-rate.
Cycle Life number for a specific DOD)	The number of discharge-charge cycles the battery can experience before it fails to meet specific performance criteria. Cycle life is estimated for specific charge and discharge conditions. The actual operating life of the battery is affected by the rate and depth of cycles and by other conditions such as temperature and humidity. The higher the DOD, the lower the cycle life.
DOD Depth of Discharge %	The percentage of battery capacity that has been discharged expressed as a percentage of maximum capacity. A discharge to at least 80 %. DOD is referred to as a deep discharge.
Specific Energy Wh/kg	The nominal battery energy per unit mass, sometimes referred to as the gravimetric energy density. Specific energy is a characteristic of the battery chemistry and packaging. Along with the energy consumption of the vehicle, it determines the battery weight required to achieve a given electric range.
Specific Power W/kg	The maximum available power per unit mass. Specific power is a characteristic of the battery chemistry and packaging. It determines the battery weight required to achieve a given performance target.
Energy Density Wh/L	The nominal battery energy per unit volume sometimes referred to as the volumetric energy density. Specific energy is a characteristic of the battery chemistry and packaging.
Power Density W/L	The maximum available power per unit volume. Specific power is a characteristic of the battery chemistry and packaging. It determines the battery size required to achieve a given performance target.
Maximum	The maximum current at which the battery can be discharged continuously. This limit is usually defined by the battery manufacturer in order to prevent excessive discharge rates that would damage the

Parameter	Description
Continuous Discharge Current A	battery or reduce its capacity.
Maximum 30-sec Discharge Pulse Current A	The maximum current at which the battery can be discharged for pulses of up to 30 seconds. This limit is usually defined by the battery manufacturer in order to prevent excessive discharge rates that would damage the battery or reduce its capacity.
Charge Voltage V	The voltage that the battery is charged to when charged to full capacity. Charging schemes generally consist of a constant current charging until the battery voltage reaching the charge voltage, then constant voltage charging, allowing the charge current to taper until it is very small.
Float Voltage V	The voltage at which the battery is maintained after being charge to 100 percent SOC to maintain that capacity by compensating for self-discharge of the battery.
Recommended Charge Current A	The ideal current at which the battery is initially charged (to roughly 70 percent SOC) under constant charging scheme before transitioning into constant voltage charging.
State of Charge SOC	An expression of the present battery capacity as a percentage of maximum capacity. SOC is generally calculated using current integration to determine the change in battery capacity over time.
Recommended Charge Current A	The ideal current at which the battery is initially charged (to roughly 70 percent SOC) under constant charging scheme before transitioning into constant voltage charging.
Internal	The resistance within the battery, generally different for charging and discharging, also dependent on the battery state of charge. As internal resistance increases, the battery efficiency decreases and

Parameter	Description
Resistance	thermal stability is reduced as more of the charging energy is converted into heat.
Maximum Internal Resistance Ohm	The resistance within the battery, generally different for charging and discharging.

Source: MIT: http://mit.edu/evt/summary_battery_specifications.pdf

SUSTAINABLE UNITED NATIONS

Sustainable United Nations (SUN) is a UNEP initiative that provides support to UN and other organisations to reduce their greenhouse gas emissions and improve their sustainability overall.

SUN was established in response to the call from UN Secretary General Ban Ki-Moon at the World Environment Day 2007 (5 June), to all UN agencies, funds and programmes to reduce their carbon footprints and “go green”. This call was echoed in October 2007 in a decision of the UN Chief Executives Board (CEB/2007/2, annex II) to adopt the UN Climate Neutral Strategy, which commits all UN organisations to move towards climate neutrality. Within this context, SUN is working with the UN Environment Management Group – the UN body coordinating common environmental work within UN – to provide guidance, and develop tools and models for emission reduction within organisations.

About the author: Knud Erik Poulsen (MSc. Chem.)

Knud Erik Poulsen has 25 years of experience as consultant within environmental matters for both enterprises and authorities. Professional country experience includes more than 15 countries within and outside Europe. Knud Erik Poulsen’s experience include a number of different industry branches, among others chemical industry, energy producing plants, waste incineration, fertilizer industry, steel industry, battery technology, surface coating industry and transportation. Special expertise areas include air pollution, risk assessments, Environmental Impact Assessment (EIA), Life Cycle Assessment (LCA), Environmental Due Diligence (EDD) and Best Available Technique (BAT).

About the Sustainable Procurement Guidelines

The UN operates to achieve the goals of peace, equality, sustainable development and respect for human rights. The way the UN manages its operations and procures products and services should reflect these goals.

Ensuring lowest environmental and most positive social impact of procurement does not only build on the international community commitments. It also manages the reputational risks associated with labour exploitation or environmental damage in the supply chain; it gives a strong signal to the market and encourages the innovative production of cleaner and more ethical products enhancing an economy based on social and environmental responsibility.

These guidelines are designed to assist UN procurers and requisitioners in their choice to include sustainability considerations in their procurement work. They are built on the recognition that market situations are different from one country to another and thus provide advice based on research made about availability of more sustainable products in world regions. Overall, the guidelines provide a comprehensive overview of the specific factors affecting the sustainability of a given product category and suggest a language and specific criteria to include sustainability in tenders.

Guidelines are specifically provided for the areas of:
- IT equipment
- Cleaning
- Furniture
- Stationary
- Vehicles
- Cafeterias, Food and Kitchen equipment.
- Freight Forwarding
- Generators and Batteries
- Carbon Credits

They are available at: **www.greeningtheblue.org** and **www.ungm.org**

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