Procurement advice for sustainable energy

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Content

EXECUTIVE SUMMARY

This assignment focusses on sustainable energy procurement, aiming at strengthening Sida's efforts in their contribution to the SDG 2030 goal no 7. The UN SDG 2030 goals are strongly interdependent, hence measures to improve one aspect simultaneously contributes to achieving other SDG goals. Measures to ensure a higher degree of sustainable energy will therefore help tackling global challenges like poverty, food security, equal access to water, healthcare and education, climate change and equitable economic growth.

The goal of this report is to provide SIDA with advice on procurement requirements for sustainable energy in a Sub-Saharan context, primarily including the three countries Kenya, Uganda and Zambia. The scope of this assignment was three-fold:

1. Advice how Sida can apply Swedish procurement guidelines, based on the Swedish Procurement Agencies work
2. Advice how Sida can complement and develop this advice, with the ambition to amend and complement these advices to suit the African market and to find ways to verify and control compliance in South Saharan Africa
3. Explore the possibilities to use, and advice others to use, innovative procurement measures

Task 1 - Can Sida apply Swedish procurement guidelines?

The Swedish National Agency for Public Procurement's (UHM) database and its specific requirements have been analysed from a Sub-Saharan perspective. A centre piece of the UHM procurement requirements is life cycle costing calculations (LCC). LCC is immediately applicable also for sub-Saharan countries. There is a presentation available in English at UHM's website, and they provide an easy to use excel tool that is well documented. However, the tool has to be complemented with some data on each countries' power system in order to also show the CO_2 consequences. The other, functional specification requirements in the UHM database, have been found not to be adaptable for the Sub-Saharan region.

Apart from the LCC requirement we also recommend Sida to examine if the overarching structure for the UHM procurement requirement database can be applied and utilised in the Sub-Saharan region.

Task 2 - What other requirements could Sida lean on?

Sida could apply South African and Ecodesign Minimum Energy Performance standards, MEPS, to formulate energy-related requirements in all procurements.

Furthermore, the LEAP award has a transparent selection process and testing methods. Sida should be able to recommend, but not require, the award-winning products for off-grid applications. It would be advantageous if requirement levels could be developed based on the work done by LEAP.

The Green Star certification scheme has been adapted to African climate and is in the process of being introduced in several African countries. We recommend SIDA to refer to Green Star for larger buildings such as hospitals in contracts etc.

We also recommend Sida to refer applicants to the national building codes referring to renewable energy sources and energy efficiency.

We have not found any requirements regulating waste management in Kenya, Uganda and Zambia. Used PV equipment and batteries will become a problem in the future in absence of a waste management plan. As is required in Europe, it would be a good idea to see the creation of recycling plants for waste electronic equipment being started in Africa. A clause in Sida contracts could be ”A plan for treatment of the plant/product after end of life should be submitted in the reporting to Sida.”

Recommended addition to all Sida contracts or agreements

As a summary of task 1 and task 2 we recommend Sida to add the following sentence in the “procurement” paragraph in all relevant Sida agreements: “Renewable energy sources, best possible energy and resource efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using Life Cycle Costing, LCC, see Appendix XX.”

Input parameters for the Life Cycle Costing calculations (lifetime and discount rate, determines the calculation of future costs to present value) should be recommended by Sida.

Table 1: Life Cycle Costing and South African and Ecodesign Minimum Energy Performance, MEPS, are recommended in the following format.

	Type	Requirement	Rating system
Building system/components	Air Conditioners	Class B	SAEEL
	Ventilation units		ecodesign
	Lighting		ecodesign
White goods	Dishwashers	Class A	SAEEL
	Electric Water heaters	Class B	SAEEL
	Electric Ovens (Small & M)	Class A	SAEEL
	Freezers	Class C	SAEEL
	Fridges	Class B	SAEEL
	Fridge-freezers	Class B	SAEEL
	Storage Water Heater	Class B	SAEEL
	Tumble Dryers	Class D	SAEEL
	Washer-dryers	Class A	SAEEL
	Washing Machines	Class A	SAEEL
Brown goods	Audio-visual, standby	<1W	SAEEL
Other	Electric motor		ecodesign
	External power supplies		ecodesign
	Power transformers		ecodesign
	Water pumps		Ecodesign

If LCC is not practical to use, Minimum Energy Performance Standards, MEPS, can be used for products like appliances, motors etc. If MEPS do not exist for the specific country the South African MEPS, SAEEL, can be used. For items not covered by South African MEPS EU MEPS can be used. See table below (active 2018).

Task 3 – Can innovative procurement be applied in a Sub-Saharan context?

Innovative procurement can be defined as a complete tendering process, with the purpose to support and speed up the development and market introduction of a new technology or service. The procurement is done by a purchaser group consisting of agent/project manager, an expert and buyers, for example farmer coops.

A number of prerequisites are necessary for the process, and a checklist is provided. We have also identified a possible way forward and proposed some projects that can be suited for Sub Saharan conditions.

Project - "We-effect" and farmers coop

Our proposal is that the NGO We-effect Zimbabwe forms a purchaser group consisting of farmer co-operatives. The product area should be products and systems for agriculture. The most promising product or system may be a PV milk cooling and transporting system utilizing ice. Other products to continue with can be PV-water pumps, crop drying equipment, biogas generators and egg incubators. It should be up to the purchaser group to prioritize.

Project B2B

Cooking for individual households is a significant problem not just in Sub-Saharan Africa. We have found a possible solution, the PV induction cooking. The most promising purchaser group would be Gogla members who together could start an innovative procurement. If the project works out well other low voltage DC PV appliances could be considered.

Project Global LEAP Awards, a stepwise approach.

This is not an entire innovative procurement project. It is limited to procurement specifications with performance requirements. These should be based on the products for which awards are being awarded.

Sida organization

It is recommended that Sida develops a team of in-house experts assigned the task to implement innovative procurement. Sida needs to take initiatives, support, advice, follow up and evaluate innovative procurement projects.

1. BACKGROUND

Sida is working on behalf of the Swedish parliament and government with the mission to reduce poverty in the world. Through their work and in cooperation with others they contribute to implementing Sweden's Policy for Global Development (PGU). The aim of this policy is to enable people living in poverty to improve their lives.

Among other tasks Sida supports sustainable energy investments in Sub-Saharan Africa, and the UNs sustainable development goal 7 (SDG7) is a centre piece in this work. The SDG 7 have three main sub-goals:

- By 2030, ensure universal access to affordable, reliable and modern energy services
- By 2030, increase substantially the share of renewable energy in the global energy mix
- By 2030, double the global rate of improvement in energy efficiency

There are currently numerous Swedish development strategies for Africa (bilateral, multilateral, regional and global) with goals related to targets as expressed in SDG 7 (sustainable energy for all). Sida's goal is to leverage capital investments in the sector and therefore, an increasing portion of the support involves incentivising the private sector to act and operate in the energy sector for universal access, more renewable energy and energy efficiency.

In order to reach the SDG7 goals investments in sustainable energy solutions needs to be multiplied, a wide range of measures needs to be implemented, and stakeholder cooperation needs to be further improved. Energy efficient procurement is an important measure when aiming at cost-efficient investments in sustainable energy. Expressing energy efficiency and renewable energy requirements more firmly in all kinds of procurements can substantially help reaching the SDG7 goal.

Therefore, Sida is looking to formulate requirements or advice that can be tailored to suit the African countries and be applied in Sida's own procurements and agreements but more importantly in procurements and agreements settled by other parties that Sida finance.

This kind of procurement advice for sustainable energy already exist in Sweden and Europe. The advice is often relatively straightforward measures, basically ready to use also in Africa south of Sahara. The scope of this assignment is three-fold, and the first task is to advice how Sida can apply Swedish procurement guidelines, based on the Swedish Procurement Agencies work. The second task is to advice how Sida can complement and develop this advice, with the ambition to amend and complement these advices to suit the African market and to find ways to verify and control compliance in South Saharan Africa. Sida would also like to explore the possibilities to use, and advice others to use, catalytic/innovative procurement measures. The

third task of this assignment is therefore to present advice regarding how Sida can support processes for innovative procurement. For this assignment Sida has framed the task to include the three countries Kenya, Uganda and Zambia.

This assignment has been carried out by a team from Anthesis Group with a background in innovative procurement.

For the Terms of Reference see Appendix 1.

Project team

This project has been carried out by Agneta Persson, Egil Öfverholm, and Mark Hawker, Anthesis Group. Monica Gullberg har been Sida's main representative in the work. In addition, Samer Al Fayadh, Anders Arvidson, Magdalena Svensson, Adam Öjdahl, Lena Berglöw Elm, and Susanne Berggren, Sida, have been involved in the project.

2. KNOWLEGDE TRANSFER POSSIBILITIES FOR PUBLIC PROCUREMENT REQUIREMENTS

Expressing energy efficiency and renewable energy requirements more firmly in all kinds of procurements can substantially help reaching the SDG7 goal, and the first two tasks of this assignment has been to analyse to what extent already existing energy efficient procurement frameworks could be tailored also to suit in African countries. Task 1 was to analyse and advice on if and how the Swedish Procurement Agency's (UHM) could be used in the three African countries Kenya, Uganda and Zambia. The second task has been to advice how Sida can complement and develop this advice, with the ambition to amend and complement these advices to suit the African market and to find ways to verify and control compliance in South Saharan Africa. Since the results from these two tasks are closely linked together, we report them in a common chapter.

2.1. Task 1 - The UHM requirements

Task 1: Is it possible to use the Swedish National Agency for Public Procurement's (UHM) requirements in SIDAs Sub-Saharan activities?

Advantages of using UHM requirements are:

- The requirements are within Swedish standards of procurement practice
- They are transparent
- They are updated and developed in a process were the stakeholders are involved
- They are complying with the legal requirements of national support legislation (State aid rules)

In this assignment we have analysed each UHM requirement with a set of filters in order to see to what extent they may be applicable in a Sub-Saharan context.

2.1.1. About the UHM requirements

The Swedish Procurement Agency (UHM) has an overall responsibility for developing and supporting public sector procurement carried out by contracting authorities and entities. Their task is to work for an effective and socially and environmentally sustainable public procurement to the benefit of the society and the participants of the markets.

UHM provides support to contracting authorities, entities and suppliers in Sweden. The aim of UHM's procurement rules is to ensure that contracting authorities use public funds to finance public purchases in the best possible way by seeking out and taking advantage of competition at the relevant market in order to get the best deal.

UHM has worked with sustainable energy procurement for many years, and they have structured their requirements in a database with different product categories. This database has its origins long before the EU Ecodesign directive was implemented.

Today the Ecodesign requirements are implemented in Swedish law, hence compliance with those requirements is mandatory. But ecodesign does not cover all kinds of energy using products. The UHM procurement requirements are voluntary, and the UHM database in many cases fills the gaps between Ecodesign requirements. This means that the UHM requirement database in the energy context is not a comprehensive set of requirements.

In the typical UHM process of developing requirements, a group of stakeholders including representatives from UHM, experts, contractors, property owners and others define and decide on the design of the requirements. Thus, it is safeguarded that the requirements are relevant to both the purchasers and the suppliers.

2.1.2. Content and criteria in the UHM database

Building related requirements is a major focus for the UHM database. The database contains procurement requirements for the following areas:

- Multifamily buildings
    - New construction and renovation
- Commercial buildings
    - New construction and renovation
- Household appliances
- Air filters
- Indoor lighting
- Outdoor lighting
- Electricity and Professional kitchen

In this analysis we have excluded the UHM requirements for schools, temporary buildings, indoor swimming pools, construction and forestry. The reasons for exclusion are lack of data or irrelevance.

For each area in UHM's database a set of specific requirements are set up, e.g. Heat loss and Airtightness. The criteria are analysed in Appendix 2. We have also prepared an excel file with links to each requirement in the data base.

2.1.3. Filter applied in the analysis of the UHM database

UHM has developed requirements in several main areas. In this assignment we have analysed the possibility of using their energy related requirements in the area "Building and property" in a sub-Saharan context.

The filters applied in the analysis are:

- Adaptivity to south Saharan climate
- Refers to EN or ISO standard
- Available in English
- Possible conflict with local building codes
- Relevance
- Relation to Ecodesign
- LEED or other
- Appropriateness for various types of SIDA agreements

2.1.4. Analysis of the UHM criteria

Adaptivity to Sub-Saharan climate reflects that several requirements in the UHM database are developed for heating of buildings in a Swedish climate. In Kenya, Zambia and Uganda the heating demand is limited. East Africa has a mixture of climates – the lowlands are hot and humid – the highlands are cold to the point you need warm clothing. Eastern Kenya ranges 9°C to 27°C and most of the eastern highlands are cool. You have 3 sizeable cities there (Nairobi, Nakuru, Kisumu). The lower east is equatorial 23°C to 35°C (Mombasa). Uganda and Zambia have similar climates.

Due to the climate differences Swedish UHM requirements on heat loss, heat pumps, refrigerators and freezers (for the last two criteria due to the difference in indoor temperature between Sweden and the three African countries) are not possible to use in these countries. The UHM requirements on airtightness, U-values and heat exchangers could be relevant for “western type” mayor buildings such as large office buildings, hotels etc. with mechanical systems for cooling. But the definitions and requirements in the UHM database cannot be used for this purpose without considerable adaptions to African contexts.

Furthermore, the UHM criteria in several cases refer to Swedish agreements and regulations (e.g. the AMA rules) or Swedish standards. This makes it very difficult for a procurement body in the three countries chosen for this assignment to understand and adapt the requirements. ISO or EN standards on the other hand should be possible to use.

Some of the requirements in the UHM database are only presented in Swedish. A translation is of course possible, but for now this means that we have discarded the requirement presented only in Swedish.

Another important matter is that there is a conflict between some of the UHM criteria and the building codes in Kenya and Zambia. These conflicts have mostly been identified between the UHM requirements and the requirements in the areas of ventilation and lighting, chapter NN31 in Kenya and SANS 10400-O in Zambia.

Regarding criteria for ventilation, lighting and appliances Ecodesign has in many cases a better coverage, and is much more documented than the UHM database.

When it comes to LEED and BREEAM, the requirements are structured in a different way than in the UHM database, they are therefore discussed in the presentation of the assignment's task 2.

The conclusion is that it has proved not to be relevant to analyse the requirements of the UHM database in relation to SIDA agreements. This is instead discussed in task 2.

2.1.5. LCC, Life Cycle Costing

In the UHM procurement requirement, Life Cycle Costing (LCC) calculation is an overarching principle, and UHM has developed an excellent Excel tool for LCC (it is found here)

An LCC calculation shows that the initial investment is only one (and often not the largest) of several cost parameters connected to purchasing and owning a product. A rough distribution could be 10% capital, 60% energy and 30% maintenance as the breakout of the life cost of typical generating assets. In addition to the initial investment, an LCC-tool also includes all relevant costs during the user phase and the end phase. It includes Operating costs, including energy, fuel or water usage, Cost of maintenance and Cost of disposal.

We propose that LCC should be an overarching principle also in Sida's requirements. The reasons for this are that LCC:

- Is easy to use
- It reduces the importance of investment cost
- It promotes renewable energy sources and energy efficiency
- It is recommended by Green Star, UHM, EU and several other relevant actors.

More details on LCC calculations are presented in chapter 2.3.

2.1.6. The UHM database structure and process is useful

Although the individual procurement requirements compiled in the UHM database hold limited knowledge transfer values, it would be possible and valuable to introduce the UHM database structure filled with national requirements to Sub-Saharan countries. This could be a complement to the national building codes and to MEPS for central and local governments.

2.1.7. Recommendations Task 1

We recommend Sida to use UHM's LCC requirement and tool.

This is the only UHM requirement immediately applicable for sub-Saharan countries is LCC. There is a presentation available in English, UHM provides an easy to use excel tool and the tool is well documented. However, it has to be complemented with some data on each countries power system in order to also achieve CO2 consequences.

We also recommend Sida to see if the UHM structure for the procurement requirement database can be applied and utilised.

2.2. Task 2 – Complementary sources for energy performance requirements

In task 1 the discussion was limited to the UHM database area "Buildings". In task 2 the scope is broadened to include energy performance procurement requirements for electricity using equipment and small-scale renewable energy sources relevant in the three countries chosen for this assignment. The industrial sector is not included. In this section we present the relevant energy performance criteria that have been identified.

2.2.1. Labelling and MEPS

National energy efficiency standards and labelling (EESL) programs have existed since the 1970s and now operate in more than 80 countries around the world, covering more than 50 different types of appliances and equipment in the commercial, industrial and residential sectors according to the International Energy Agency (IEA). While the design and coverage of EESL programs vary according to national circumstances, they provide the cornerstone of most national energy efficiency and climate change mitigation programs.

LCC is not suited for mass-produced products like appliances, motors, pumps, fans etc. It would be too cumbersome to do an LCC calculation for every single purchase. Instead labelling and Minimum Energy Performance Standards (MEPS) have been developed by countries, organizations or regions. A MEPS is a specification, containing several performance requirements for an energy-using device, that effectively limits the maximum amount of energy that may be consumed by a product in performing a specified task.

Examples are:

- Ecodesign
- Energy Star
- South African MEPS
- Top runner program Japan

- SEEP India
- CEL China
- Energy Rating in Australia

A problem with these systems is that the various underlying definitions and standards make comparisons very difficult. Not least standards for measuring varies between these systems. As a result, a buyer in one country could have problems understanding the energy performance of a product imported from another country. If you visit an appliance shop in any of the three countries discussed in this report you will find labels from EU, Ghana, South Africa and possibly other labels on the products displayed. A problem for Sida is that implementing for example an Ecodesign purchasing requirement will exclude appliances with other labels meeting comparable performance but at a lower cost.

An international overview of MEPS and labels shows that Kenya is in the process of implementing a system. See Appendix 3. Actors in Africa are CLASP and GEF, Global Environment Facility often with UNDP as financier.

Ecodesign

Ecodesign consists of labelling and MEPS for the European union, but it has also been spread to a number of non-EU countries (USA, Australia, Brazil, China and Japan) with legislation similar to the EU's Ecodesign and Energy Labelling Directives. At present ecodesign covers these products;

- Air conditioners and comfort fans
- Air heating and cooling products
- Circulators
- Computers
- Domestic cooking appliances
- Electric motors
- External power supplies
- Household dishwashers
- Household tumble driers
- Household washing machines
- Industrial fans
- Lighting products in the domestic and tertiary sectors
- Local space heaters
- Heaters and water heaters
- Power transformers
- Professional refrigerated storage cabinets

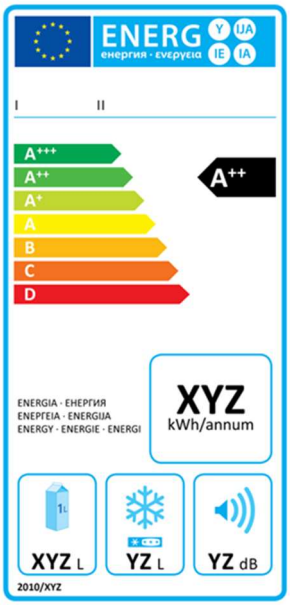


Figure 1; The EU Ecodesign label. Source: EU commission.

- Refrigerators and freezers
- Simple set-top boxes
- Solid fuel boilers
- Standby and off mode electric power consumption
- Televisions
- Vacuum cleaners
- Ventilation units
- Water pumps

All Ecodesign requirements are very well-documented. Most of the product requirements are possible to use with only limited changes. However, for some of the products a problem with using the ecodesign requirements for Sub-Saharan countries is that the referenced ambient temperature for fridges and freezers is different from European conditions, now 24C. Ghana refers to 32°C ambient temperature.

Kenya, labels and MEPS

The study Development and Implementation of a Standards and Labelling Programme in Kenya with Replication in East Africa for Kenya and EAC countries by Global Environment Facility has proposed criteria for selecting products:

- High-energy consumption nationwide.
- Industrially manufactured and standardized products.
- Availability of intervention opportunities.
- Savings potential of the product.

These products were selected (the ones within the limits of this study)

- Industrial motors - efficiency class 2
- Domestic refrigerators - EU C-level
- Air conditioners - EU C-level
- Lighting

South Africa, labels and MEPS

The Appliance Standards and Labelling Programme for South Africa was initiated in 2010 and is a collaborative initiative with the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) and the Department of Trade and Industry, all under the overall custodianship of the South African Department of Energy. The energy classes for appliances are different from others, so an A or 4 star performing appliance may not be the same according to the South African standards even though they are based on Ecodesign.

Appliance Category, MEPS	
Air Conditioners	Minimum Energy Efficiency Rating of Class B
Audio-visual Equipment	In passive standby mode 1W and 3W set-top boxes
Dishwashers	Minimum Energy Efficiency Rating of Class A
Electric Ovens (Large)	Minimum Energy Efficiency Rating of Class B
Electric Ovens (Small & M)	Minimum Energy Efficiency Rating of Class A
Freezers	Minimum Energy Efficiency Rating of Class C
Fridges	Minimum Energy Efficiency Rating of Class B
Fridge-freezers	Minimum Energy Efficiency Rating of Class B
Storage Water Heater	Minimum Energy Efficiency Rating of Class B
Tumble Dryers	Minimum Energy Efficiency Rating of Class D
Washer-dryers	Minimum Energy Efficiency Rating of Class A
Washing Machines	Minimum Energy Efficiency Rating of Class A

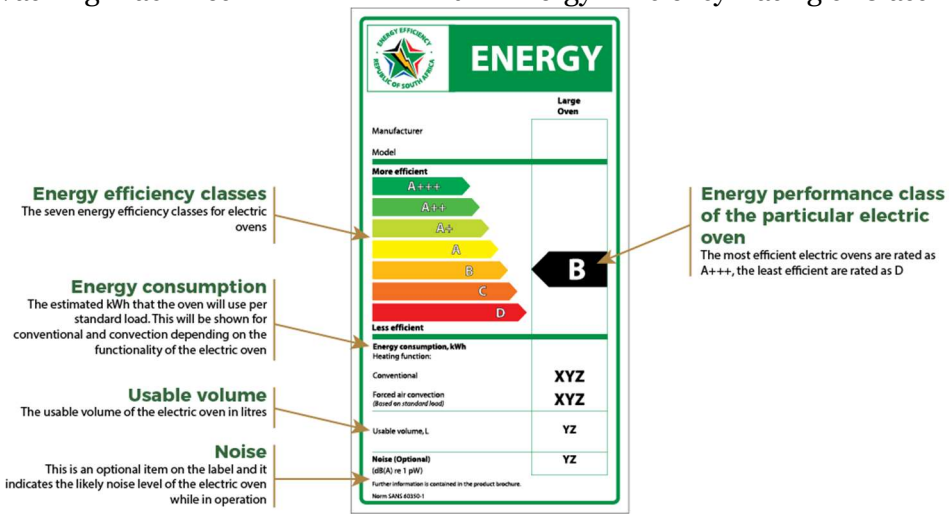
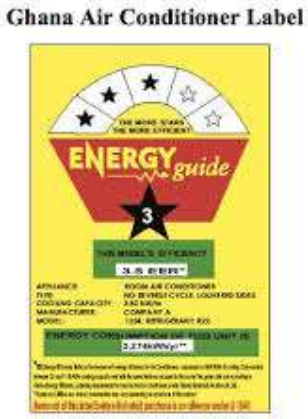


Figure 2: South African energy-efficiency label.

Ghana, labels and MEPS

Ghana's government established Africa's first appliance energy efficiency standards and labelling programme in 2000. The programme currently covers CFL, household refrigerators and air conditioners, and Ghana's Energy Commission plans to expand the programme to cover motors and television sets. The minimum energy efficiency standard for air conditioners to be acceptable in Ghana is an Energy Efficiency Ratio (EER) of 2.8 Watts of cooling per Watt of electricity input. For UK Building control expected EER would be 4.5.

For CFLs the minimum efficacy is 33 lumen per Watt. These energy performance requirements are rather low. As a comparison in Europe the corresponding performance would be 69 lumen per Watt for a CFL and 100 lumens per Watt for an LED equivalent.



Ghana Standards Board recommended an adaptation European Standards in 2008:

- IEC 62552:2007 for the characterization and testing of household refrigerating appliances
- Product and standard level definitions as implemented in the European Union as defined by European Council Directives 92/2/EC and 2003/66/EC
- Only ST and T class refrigerating appliances should be allowed for import
- The Ghana one-star, two-star, three-start, four-star and five-star levels should be set equal to the European levels C, B, A, A+, and A++ respectively for the ST class refrigerating appliances, and to European levels D, C, B, A, and A+ for the T class refrigerating appliances respectively. More energy use is allowed for T class appliances because they are tested at a higher temperature (32 degrees C) compared to ST class appliances (which are tested at 25 degrees C).

Figure 3: Ghana air conditioner label. Source CLASP.

Comparison between Ecodesign and Sub-Saharan MEPS

The above presented energy-performance requirements have been compiled in Table 2. The table gives a rough comparison as the naming of specific MEPS varies. MEPS in brackets are planned. Kenya has decided, but not implemented the MEPS.

Table 2: Comparison between Ecodesign and Sub-Saharan MEPS.

Ecodesign	South Africa	Ghana	Kenya
Air conditioners and comfort fans	Yes	Yes	Yes
Air heating and cooling products			
Circulators			
Computers			
Domestic cooking appliances	Yes		
Electric motors		(Yes)	Yes
External power supplies			
Household dishwashers	Yes		
Household tumble driers	Yes		
Household washing machines	Yes		
Industrial fans			
Lighting products		Yes	Yes
Local space heaters			
Heaters and water heaters	Yes		
Power transformers			
Prof. refrigerated storage cabinets			
Refrigerators and freezers	Yes	Yes	Yes
Simple set-top boxes			
Solid fuel boilers			
Standby and off mode	yes		
Televisions		(Yes)	
Vacuum cleaners			
Ventilation units			
Water pumps			

2.2.2. Performance criteria for cookstoves

Clasp is developing performance criteria for Ghana which could lead to an energy efficiency increase from 10 to 50 percent.

Comment: This has nothing to do with electricity but could have a huge impact on local environment and health as well as efficient use of resources such as wood and charcoal and poverty alleviation.

In addition to these appliances Sida has suggested farming and small business products to be considered, such as pumps, cool storage, welding etc. see Appendix 4.

2.2.3. Beyond the grid

We have not been able to find requirements for off-grid appliances. The market is small scale and fragmented. A few years ago, LED-enabled off-grid solar lighting emerged, paving the way for new class of energy-efficient appliances becoming available. Smarter designs, technological spill overs from developed energy markets, and falling costs are enabling the emergence of new classes of energy-efficient appliances built with off-grid energy systems in mind. These super-efficient off-grid appliances, such as televisions, fans and refrigerators, use a fraction of the power required by mainstream versions, reducing the overall costs of providing service. For example, Global LEAP-supported research shows that coupling solar home systems with super-efficient appliances, including a TV, fan, mobile charger, and LED lights, requires 75 percent less power and reduces overall costs by as much as 50 percent.

The global LEAP award states that high-quality, energy-efficient appliances are essential to the growth of off-grid energy markets: they create demand for off-grid energy while reducing energy costs. However, many off-grid solar companies struggle to identify and source outstanding appliances or to find clear and timely paths to market.

The Global LEAP Off-Grid Appliance Procurement Incentives program addresses the challenges by providing incentives to appliance manufacturers and off-grid solar distributors that partner to distribute large quantities of best-in-class appliances. The second round of the incentives will be open to companies that distribute winning and finalist products from the 2015-16 and 2016-17 Global LEAP Awards for outstanding off-grid refrigerators, televisions (TVs), and fans in Bangladesh, **Kenya**, Tanzania, **Uganda**, and Rwanda.

Comments: The LEAP award has a transparent selection process and testing methods. SIDA should be able to recommend, but not require, the award-winning products for off-grid applications. It would be advantageous if requirement levels could be developed based on the work done by LEAP.

2.2.4. Diesel gensets (DG)

Diesel gensets (DG) has the cheapest installation cost of local electricity production and therefore is popular. However, over a lifetime it is most probably more expensive than renewable energy supply (RES). A hierarchy of generation could be:

1. PV's plus batteries
2. Big Wind Turbines plus batteries
3. CHP of Generators on Biofuel/Biogas
4. Diesel Gensets lowest on hierarchy

A relevant question is whether it is possible for SIDA to restrict procurement of DG within its funded projects. One solution would be to add DG to the list of "Grounds for exclusion of financial cooperation with Sida". However, that would incur a long list of exemptions, such as backup for hospitals, hybrid micro/mini PV systems to overcome periods of low solar insolation and in cases where time is essential, and the DG is temporary. SLU has in its report "Study on sustainability performance standards and safeguard systems for energy, 2015" recommended SIDA to exclude non-renewable energy resources, Appendix 6.

Comment: The best solution for Diesel Gensets off grid is probably to require LCC calculations. But then there is a problem with hybrid systems. What share of the operation based on DG is acceptable in a plant?

2.2.5. Buildings

The types of buildings relevant for this study are one-family dwellings, schools, cottage hospitals and small offices for local administration.

For assessment of energy-performance of whole buildings there are a number of certification schemes available, e.g. Green Star Africa, BREEAM, LEED and to a certain extent EUs NZEB. A description of these systems, with the exception of Green Star Africa, is given in Annex 9, Rating systems for buildings.

Green Star Africa

The Green Building Council South Africa works in collaboration with emerging Green Building Councils throughout Africa and allows the adaptation of the Green Star tools for certification in the respective countries. Each country develops a Local Context Report which is then reviewed by the Green Building Council of South Africa. Once approved, this allows for projects within the specific countries to be certified using a Green Star tool, with some adaptations identified in the Local Context Report. Green Star was originally developed by the Green Building Council Australia (GBCA) and was licensed to GBCSA in 2008 for use in South Africa.

Green Star has been extensively adapted for the local African climatic, social and economic context, which makes it the rating system of choice for property owners in

Africa. Green Star certified buildings are now found in Ghana, Rwanda, Namibia and Kenya, with upcoming registered projects in Nigeria, Uganda, Tanzania and Mauritius to follow. as well as Zambia.

To rate a building overall environmental impact, the Green Star rating tools award points across nine categories, Management, Indoor environment, energy, transport etc. Each category has a number of credits within it that each address specific green building aspects and actions. Each credit has points associated to it and a project team will target certain credits in each category. The targeted credits are then assessed, and a score is calculated. Weighting factors that are specific to each different tool are then applied to the score card to get the final rating. The weighting differs per tool to reflect the distinct environmental concerns in the different building sectors. The credits within the energy category target an overall reduction in energy consumption and a reduction of greenhouse gas emissions associated with energy generation.

A Green Buildings Association has now been established in Zambia 2015.

Comment: The Green Star certification scheme has been adapted to African climate and is in the process of being introduced in several African countries. We recommend SIDA to refer to Green Star for larger buildings such as hospitals and offices in contracts etc. There is even a provision for major tenants within Green Star.

Building codes

Kenya's building code is at present going through a major restructuring process with the aim of incorporating the EU Eurocode instead of the old British Standards. The restructuring process should be finished by 2021. However, there is a useful passage on RES in the 2006 version of the code:

NN31.5 **Solar and Other Renewable Energy Sources**

(a) All new housing developments or alterations and extensions to existing buildings should have solar hot water heating installations for bathroom use. No new housing development should be allowed to use the national grid electricity for hot water heating in bathrooms.

(b) New developments should consider generating electricity from stand alone photovoltaic installations (comprising of wall cladding and roofing etc) and from wind power in suitable locations.

Uganda has a comprehensive chapter, no.5, on PV in its code for electrical installations in buildings.

Comments: SIDA could inform applicants of the existence of these chapters in the national codes.

2.2.6. Procurement rules

Procurement rules in the three countries

The procurement rules in the three countries this project is focussing on are similar and general. They do not include environment issues or specific requirements on energy performance or renewable energy sources.

Procurement rules in organizations involved in Sub-Saharan countries

IFC has procurement rules on resource efficiency and greenhouse gas emissions in its procurement rules, Resource Efficiency and Pollution Prevention (2012). There are no specific requirements however.

We have not been able to find any specific energy-related requirements in UNDP's procurement rules.

Power Africa has developed a procurement handbook, but it does not include any specific energy-performance related requirements.

Comesa has developed a Regulatory Framework for off-grid establishment, but we have found no requirements on energy efficiency in their procurement guidelines.

2.2.7.NDC Nationally Determined Contributions

NDC – **Kenya:**

- is focused on expansion in geothermal, solar and wind energy production, other renewables and clean energy options.
- Enhancement of energy and resource efficiency across the different sectors.
- Make progress towards achieving a tree cover of at least 10 percent of the land area of Kenya.
- Clean energy technologies to reduce overreliance on wood fuels.
- Low carbon and efficient transportation systems.
- Climate smart agriculture (CSA) in line with the National CSA Framework.
- Sustainable waste management systems.

The plan is not more specific than this. Thus, we see no contributions to procurement requirements.

NDC - **Zambia**, is focused on RES and efficiency as one of three areas.

Renewable Energy and Energy Efficiency	Program involves implementing - Fuel switch (diesel/HFO to biodiesel) - Fuel switch (coal to biomass) - Switch from existing isolated diesel to mini-hydro - Introduce and increase blending of bio-fuels with fossil fuels and where possible substitution with bio-fuels - Off grid RE to non-electrified rural – P.V and Wind - On grid expansion program to support economic growth and grid extension through inter-basin water transfer - Grid extension to non-electrified rural areas	To promote the switching from conventional and traditional energy sources to sustainable and renewable energy sources and practices, and use of off grid renewable energy technologies for rural electrification as decentralized systems.	- Improved health impacts due to child and maternal mortality and retention of medical personnel - Improved education impacts due to longer hours of study and advanced teaching methods, safety, creation of opportunity for girl child and women's education - Improved food security due to increased agriculture production resulting from use of irrigation especially for women - Increased rural development impacts due to increased economic activities through SMEs - Reduced indoor air pollution and load shedding - Reduced GHG impacts and improved air quality - Reduced energy deficits

However, efficiency or energy-performance procurement requirements are not mentioned.

NDC – **Uganda** plans to:

- Increase the efficiency in the use of biomass in the traditional energy sector
- Promote renewable energy and other energy sources
- Increase efficiency in the modern energy sector, mainly electricity supply
- Ensure the best use of hydropower by careful management of the water resources
- Climate proof investments in electricity power sector

Even for Uganda there is no mention of efficiency in the energy end use sector or of requirements for procurement.

2.2.8. Conditions for waste management

Life Cycle costing can be used for waste management and is included in the UHM LCC tool. Green Star also includes waste management. The European parliament in May 2018 noted that "the Ecodesign Directive provides significant potential for improving resource efficiency that is still untapped and stressed the need to set up of minimum resource efficiency criteria covering, inter alia, durability, robustness, reparability and upgradability, but also sharing potential, reuse, scalability, recyclability, possibility of remanufacturing, content of recycled or secondary raw materials, and the use of critical raw materials". Even when EU is ready for a more circular economy for waste it will probably not have a great impact on Sub-Saharan countries.

UNDP has a program, UNDP Low emission capacity building (LECB) programme, reaching out to among others Kenya, Zambia and Uganda. However, it does not focus on electronic waste.

Kenya has no law regulating electronic waste. Government facilities e-waste goes to a Waste Electrical and Electronic Equipment site. Most citizens usually just dispose of their e-waste in dustbins, on the streets or in gardens or even dump it into a water body.

Zambia has in addition its own e-waste imported waste to cope with.

Uganda has adopted an e-waste policy.

Comment: We have not found any requirements regulating waste management in these three countries. Used PV equipment and batteries will become a problem in the future without a waste management plan. Studies to analyse the problem have been initiated. As is required in Europe, it would be a good idea to see the creation of recycling plants for waste electronic equipment being started in Africa

A clause in a Sida contract could be ”A plan for treatment of the plant/product after end of life should be submitted in the reporting to Sida.”

2.2.9. Sida agreements and procurement

We have analysed relevant Sida agreements in relation to energy-performance procurement. A compilation of the occurrence of procurement demands is presented in Appendix 5. There is a wide range of procurement requirements, from non-existent to very detailed. This is of course depending on the goals of the individual agreement.

We **recommend** the following text integrated into the contract/agreement: “Renewable energy sources, best possible energy and resource efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using Life Cycle Costing, LCC, see Appendix XX.”

The reference to Appendix XX, (in this report Appendix 11) includes details on how the general sentence should be fulfilled. We have tested an integration of this sentence in some different types of contracts/agreements, examples are given in Appendix 7.

2.2.10. National support regulations, “State aid rules”

The aim of the national support regulations is to secure that government financing does not lead to unfair competition among vendors in a procurement process. LCC calculations and the Ecodesign requirements fulfils the national support regulations’ demands as they have been developed or recommended by the European union. There may however be an issue when Ecodesign is adapted to non-European countries like South Africa for example. However, the South African energy performance requirements seem to be less ambitious than those in than Ecodesign, at least currently.

The legal matters have to be analysed further, but the scope of our assignment does not include to make a legal interpretation of the national support regulations (“State aid rules”).

2.2.11. Are the recommendations valid also for other countries in the Sub-Saharan region?

From a technical point of view there should be no problem to implement the recommendations also in other countries in the Sub-Saharan region than Kenya,

Uganda and Zambia. The only identified issue is ambient temperature for freezers and fridges when applying the requirements, we propose. There is a variety of climates in the region. However, the South African labels and MEPS should be sufficient.

From a legal aspect including procurement laws there may be a conflict in the future if a country introduces MEPS which are in conflict with those that are proposed in this report. The reason for a different MEPS system could be to protect the national industry. This is a conflict in Europe when it comes to ecodesign requirements.

In conclusion, for the time being we believe that our recommendations are valid for the whole of the Sub-Saharan region.

2.3. More on LCC Calculations

In the UHM procurement requirement Life Cycle Costing (LCC) calculation is an overarching principle, and it is also utilised in several other tools and certification schemes mentioned in this chapter. UHM has developed an excellent Excel tool for LCC (it is found here)

An LCC calculation shows that the initial investment is only one (and often not the largest) of several cost parameters connected to purchasing and owning a product. In addition to the initial investment, an LCC-tool also includes all relevant costs during the user phase and the end phase. It includes Operating costs, including energy, fuel or water usage, Cost of maintenance and Cost of disposal.

The basic formula is as follows:

$$LCC = C + PV_{RECURRING} - PV_{RESIDUAL\text{-}VALUE}$$

Where:

- LCC is the life cycle cost
- C is the Year 0 construction cost (hard and soft costs) Proposed standard value 10 years
- $PV_{RECURRING}$ is the present value of all recurring costs (utilities, maintenance, replacements, service, etc.)
- The discount rate used in $PV_{RECURRING}$ determines the calculation of future costs to present value. The calculation rate shall be based on the calculation rate the organization uses for investments and might be nominal as well as real. The internal rate of return is often used for LCC-calculations.
- $PV_{RESIDUAL\ VALUE}$ is the present value of the residual value at the end of the study life

LCC does not normally include externalities but under certain conditions it is possible to include them.

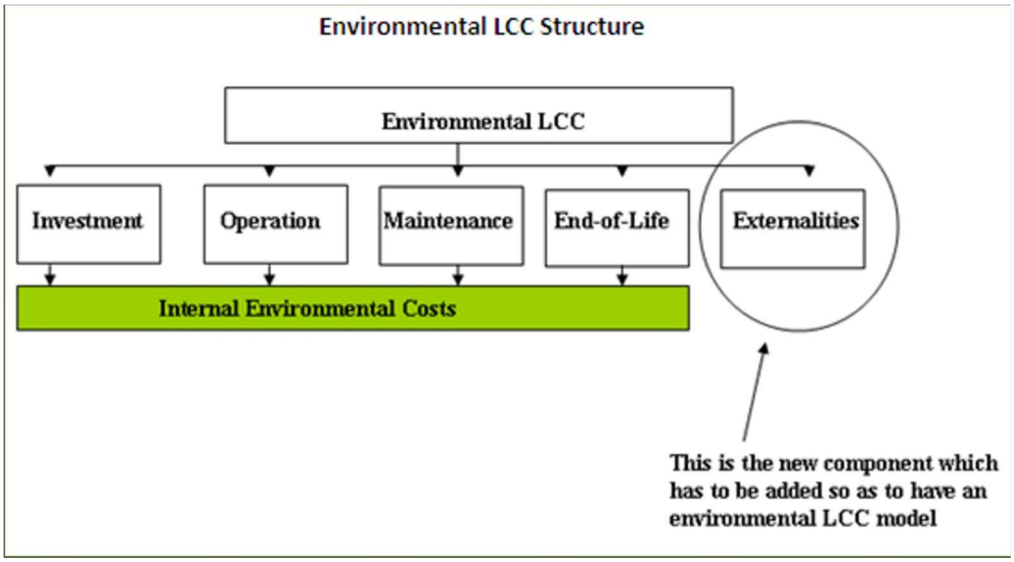


Figure 4: EU visualization of LCC and externalities.

There are several reasons for recommending Sida to use LCC:

- Is easy to use
- It reduces the importance of investment cost
- It promotes renewable energy sources and energy efficiency
- It is recommended by World Bank, UHM and several other relevant actors.

However, there are some difficulties that need to be avoided. For example, when using LCC to compare a diesel genset with a PV plant. A low utilisation rate contributes to a more positive evaluation of the DG, whereas the need for access to electricity is immense. The LCC calculation therefore will need either to settle a relatively higher reference utilisation rate, or in some other way include externalities to take account for the "positive impact" of delivering excess power. This example illustrates that LCC must be used with care.

Another problem is that there of course are possibilities to manipulate a life cycle cost calculation. The expected lifetime, the maintenance costs and the discount rate can all be set to a value to promote the desired outcome. Therefore, we suggest that the LCC calculation made for a specific project should be complemented with a calculation with fixed values for lifetime and discount rate. Even utilisation rate for DGs should be decided by Sida see proposal above.

2.3.1. LCC calculation examples

We have produced three LCC calculation examples, which are presented in annex 10. The calculations are not based on real projects and simplified so not all entry fields are filled. Data input is as much as possible based on sources from dealers of products. The general UHM excel version has been used with a rather conservative assumption of interest rate, 5% and lifetime, 10 years. Even so the sustainable alternatives come out as clear winners.

Diesel gensets and PV

The example shows that it is possible to use LCC for diesel gensets (DG) and PV. However, in this case there are many variables and caution is recommended. The LCC cost of the PV system became 57% of the DG and PV CO_2 emissions were as low as 3% of the DG. It should be added that the investment cost for the DG was 60 000 SEK and for the PV system 300 000 SEK.

Outdoor lighting

A comparison is made between a standard LED streetlight and an integrated PV-battery-LED fixture. In this case the light output is not exactly the same but the function, getting enough light at the right time, should be fulfilled. LCC for the PV light became 53% of the standard lamp powered with diesel genset. The investment cost for the standard LED fixture was 350 SEK and for the PV version 1160 SEK

PV LED lighting vs kerosene lamps

PV LED lamps are becoming quite common. A comparison with the standard kerosene lamp has been made. Even when transportation costs for kerosene are omitted the solar option comes out favourable, 37% of the kerosene. The light output of the LED lamp is considerably higher.

The examples show that it is possible to use the LCC for different applications and the tool UHM has developed is suited for the task. The investment cost for the kerosene lamp was set to 30 SEK and for the PV lamp 360 SEK.

2.3.2. Cost-Benefit Analysis (CBA)

The objective of the European Union CBA guide reflects a specific requirement for the Commission to offer practical guidance on major project appraisals. Its main objective is to illustrate common principles and rules for application of the Cost Benefit Analysis (CBA) approach into the practice of different sectors. CBA is an analytical tool to be used to appraise an investment decision in order to assess the welfare change attributable to it. The purpose of CBA is to facilitate a more efficient allocation of resources, demonstrating the convenience for society of a particular intervention rather than possible alternatives.

The CBA guide is focused on major projects and is therefore too ambitious for the scale of projects discussed in this report.

2.4. Summary Recommendations Task 2

The LEAP award has a transparent selection process and testing methods. SIDA should be able to recommend, but not require, the award-winning products for off-grid applications. It would be advantageous if requirement levels could be developed based on the work done by LEAP.

For stand-alone or back-up power generation the best solution is probably to require LCC calculations. But then there is a problem with hybrid systems. What share of the operation based on DG is acceptable in a plant?

The Green Star certification scheme has been adapted to African climate and is in the process of being introduced in several African countries. We recommend SIDA to refer to Green Star for larger buildings such as hospitals in contracts etc.

We also recommend Sida to refer applicants to the national building codes referring to renewable energy sources and energy efficiency.

We have not found any requirements regulating waste management in these three countries. Used PV equipment and batteries will become a problem in the future without a waste management plan. As is required in Europe, it would be a good idea to see the creation of recycling plants for waste electronic equipment being started in Africa. A clause in a Sida contract could be ”A plan for treatment of the plant/product after end of life should be submitted in the reporting to Sida.”

For insertion into contracts or agreements:
Relevant Sida agreements should include the following sentence in the paragraph “procurement”: “Renewable energy sources, best possible energy and resource efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using Life Cycle Costing, LCC, see Appendix XX.” (in this report Appendix 11).

3. TASK 3 - INNOVATIVE PROCUREMENT

This assignment focusses on sustainable energy, the UN SDG 2030 goal no 7. However, many of the global challenges we face, like poverty, food security, equal access to water, healthcare and education, climate change and equitable economic growth are interdependent. Hence improvements of one aspect will help achieve the other goals. Analysis show that a more efficient energy use increases our possibility to achieve all the 17 Sustainable Development Goals.

The third task of the assignment has been to explore the possibilities to use, and advice others to use, catalytic/innovative procurement measures. In this chapter advice regarding how Sida can support processes for innovative procurement is presented. For this assignment Sida has framed the task to include the three countries Kenya, Uganda and Zambia.

3.1. Innovative procurement – advice

Innovative or catalytic procurement or technology procurement. There are many names for almost the same process and we will use the name Innovative procurement. However, if you want to search for documents you will have to use all three names.

A thorough description of catalytic procurement can be found in the Sida report ”Catalytic procurement of energy services for rural businesses” by Gullberg and Bakiri and the Sida report “Feasibility study catalytic procurement of renewable energy Zambia” by Persson & Gullberg.

Instead of describing innovative procurement in detail this report will focus on a checklist for prerequisites and the innovative procurement process. Finally, suggestions will be given on a way forward with some projects suited for Sub Saharan conditions.

The goal for this report is to explore possibilities to use innovative procurement to acquire energy efficiency from a perspective of sustainable environment, climate and economy. The report focuses on the energy aspect.

3.2. Prerequisites

3.2.1. What is innovative procurement?

A common definition is that it is a complete tendering process, with the purpose to support and speed up the development and market introduction of a new technology or service. The aim of innovative procurement is to introduce new products, systems, processes or services to the market that better satisfy the market demand than those already available on the market.

3.2.2. When to use innovative procurement?

If the local, regional or global market lacks a product, or the available products do not meet desired performance specifications, and it is possible to gather enough purchasing power, innovative procurement is a way to go. If these conditions are not met, we advise using other tools, such as research, contests, minimum energy performance standards (MEPS), labelling information campaigns etc.

3.2.3. What should the goal of an innovative procurement be?

It should be to introduce the desired product on the market in a sustainable way. This means that after the initial procurement process the product should be able to exist on its own merits. In other words, it should be far enough up the "S curve" for market uptake. A goal cannot just be meeting the technical performance of the desired product, it should also meet requirements of affordability for designated customers, for example poor people on the countryside.

3.2.4. Do standards for testing and verification exist?

This is not always the case. Then it becomes important for the innovate procurement agent/carrying out organization to provide a transparent verification process before the procurement process is started and to communicate this method in the procurement documents.

3.2.5. Procurement rules

Several innovative procurement projects have been carried out in Sweden and internationally by the Swedish Energy Agency and before them NUTEK, all within the national procurement legislation ("State aid rules"). It is not possible within the framework of this assignment to determine or with a high degree of certainty say that there would be no obstacles for innovative procurement in regard to Sub Saharan countries' legislation. But we have looked into the laws of the three countries in scope of this project.

In Zambia the Public Procurement act seems to be in accordance with other countries. Kenya's and Uganda's Public procurement and asset disposal act is rather similar. Nothing contradicting to innovative procurement has been found, and we have no reason to believe that these rules would be more prohibitive towards innovative procurement than the Swedish national procurement legislation ("State aid rules"). And the Swedish law permits innovative procurement.

3.2.6. National chambers of commerce and trade organizations

Trade organizations representing industry are from Swedish and European experiences often conservative. Their role is to protect their members' interests, also those who are lagging behind regarding energy efficiency and performance.

Experience from the Swedish and international innovative procurements we have carried out is that it is better to consult manufacturers directly when gathering information.

3.2.7. Funding – from SIDAs perspective

How can a government agency, like Sida provide funds for innovative procurement? One problem is that in the beginning of the process it is not possible to say what the detailed outcome will be for performance of the product or what the final cost will be. One way of dealing with this dilemma is to use a two-step approach were Sida asks a presumptive agent/project manager. If Sida chooses to use innovative procurement, they need to carry out a pre-study for the desired product in order to outline possible performance increases and costs. One way to solve the dilemma is to ask the presumptive agent/project manager to carry out the pre-study. Sida could then, in the second step, finance the agent for their own costs and reserve money for the testing and financing part of the first series. The cost of the first series is the difference between the procured product and a corresponding conventional product. The number of products in the first series is dependent of the product as such and the market situation. This cost could be calculated in the pre-study. It is important that Sida assigns a member of staff in charge of the project with time allocated to follow the project closely.

3.3. Process

For Sida the process needs to start by scanning the region for products in need for development and or cost reductions. Some proposals for suitable products are presented in the next section. Sida also needs to decide if innovative procurement is the right tool to use. Questions to be answered are e.g.:

- Can awards, like the Global Leap award, or an information campaign be used?
- Are there MEPS and labelling activities going on in the region
- Is R&D needed or is it enough with pilot projects?

Then, after a tender process an organization (agent) for the pre-study has to be selected. One organization that may be suitable as agent is We-effect, and other possible agents need to be identified.

3.3.1. Pre-study

An agent/leader needs to be identified and asked to define products/systems, the performance of the products/systems currently available on the market, possible performance increase in relation to cost, the market situation, buying power, affordability for the target consumer and standards for testing. What is needed to reach a point in market penetration were the product will exist on its own merits? This could include market campaigns, training, labelling, blogging, financing of first

series etc. Another important knowledge to acquire is how the market works, which are the stakeholders and influencers (retailers for example), how is product information disseminated and so on. Possible purchaser groups should also be suggested. In some cases, were major products are contemplated such as white goods, Sida also would have to look for financing partners. They could come from other countries or organizations.

3.3.2. How to build up purchasing power, purchasing groups

The type of product envisaged will of course determine relevant end consumers. They are often too many, scattered and fragmented to form a purchaser group. To solve this problem is necessary to find deputies. These could be organizations consisting of building owners, hospital owners or school owners. In Sweden such groups have been active. Products related to their needs are ventilation, lighting, smart buildings, cooling, etc. For sub-Saharan countryside cottage hospitals (light and medicine cooling), schools (lighting) and offices for local administration (lighting, PC power) are some of the products that might be considered.

In regions where co-operations among villages exist there is a possibility to form a purchaser group. Off-grid PV is an obvious system to purchase, other examples are PV-street lamps, and PV water pumps.

Farming cooperatives exist in for example eastern Zambia. In Uganda there are several thousand of cooperatives. In Kenya there is an organization called Farmlink which on their homepage provides links to cooperatives. We-effect has good contacts with farmer cooperatives in Tanzania.

Mobile phone operators might not seem to be an obvious choice for energy efficiency products, but these operators have a strong customer relation and mobile phones need to be charged, so one idea is to include a PV charger with the mobile. And why not make the PV charger a little more powerful so it can supply power for some lighting too?

3.3.3. How to organize, finance and incentivize purchaser groups?

The organization should be taken care of by the agent/project manager. Innovative procurement projects in Sweden have been carried out with a financing part from none (companies and organizations) up to offering reimbursement for lodging and meals at meetings and an occasional field trip. Over time the governmental input has been reduced to only cover meals at purchaser group meetings.

In a Sub-Saharan context reimbursement for lodging, meals at purchaser group meetings, travel costs and filed trips might be justified at least in the start-up phase. Reimbursement for loss of income is not recommended. It is important that all of the participants in one way or another contribute themselves. See e.g. rules for Sida contribution to attendees of the TREESPA project. In order to incentivize and add to

credibility for the innovative procurement it is also important that Sida is present at the first project meeting and then follow up with occasional attendance.

Selection of participant organizations in purchaser groups should be made by Sida based on proposals by the agent/project manager. Organizations should be selected on basis of the procurement power they possess, but also on their interest in innovation. The personal qualifications of a person representing her/his organization is also important. It needs to be a person with technical insight but the person also needs a mandate and full back up by his/her organization. In the first meeting it could be advantageous to invite the participating persons CEO or corresponding.

The incentive for the buyer is of course to get the product/system they need. Capacity building is an important side effect of innovate procurement that should not be forgotten. During the process the participant simultaneously can learn a lot, get access to expertise and get to know other persons in the same situation – networking!

For Sida and the agent/project manager, endurance is of essence. In Sweden it took a year for the first purchaser group to fully understand what they were supposed to do. Therefor more meetings are required during the start-up phase of an innovative procurement project. In addition to buyers at least one technical expert should be attending all purchaser group meetings. The expert should be impartial with no ties to industry but understand manufacturing processes and have insight in testing and standards. The success of the procurement will very much depend on this expert. The purchaser group size should not exceed 15 persons to keep it manageable.

A purchaser group could be formed around a single product, for example a PV-solar home systems, tier 4. However, it could also be formed around a whole group of products such as agriculture products, incorporating milk coolers, egg incubators, crop drying and PV-water irrigation.

Combining or coordinating purchaser groups from different countries can be successful. They don't need to meet all the time, but often enough to joint build a significant purchasing power. Another concept is to form a small "core" purchaser group and offer products from the first series to other buyers in the country/region, with or without grants from Sida.

To create a purchaser group is the most difficult task of an innovative procurement. It will take time and demand perseverance for all parties involved. We have experience problems whit lacking engagement from purchaser group participants in some innovative procurement projects carried out in Sweden, and it also happened in the Treespa project. One solution to this problem is to create "permanent"/solid purchaser groups which last over time. One of the largest Swedish purchaser groups has been operating since 1991 and is still very active. Another of the large Swedish purchaser groups have been active since 2000.

Requirements for an agent/project manager: basic technical knowledge, but also insights into economics, legislative matters and regulations, local conditions and marketing. An organizational talent is also required from the agent/project manager. Funding varies with project size and past experience, possibly some hundred working hours per year may be needed but more time during the start-up phase of the innovative procurement. The agent manages the purchaser group meetings, develops the specifications with functional and administrative requirements for the innovative procurement together with the buyer group and the expert, keeps in contact with all relevant stakeholders in the process, compiles and analyses the incoming tenders, and administers all follow-up actions. The administration also includes chairing purchaser group meetings, keeping minutes and, sending out invitations to meetings and reporting to the main organization, in this case Sida. In short, the agent/project manager handles all of the project administration.

3.3.4. Specification and Functional requirements

The specified requirements should be expressed on a functional level in order for tendering companies to work out the details. In this way the desired product can be adapted to suit the manufacturers' production processes and hence meet the requirement of low cost. Usually the requirement is expressed in benefit/kWh. For example, the benefit for a fridge could be litres of cooled volume. More examples are given in appendix 2a (second column).

It is often the case in innovate procurement projects that there is an uncertainty whether a functional requirement is cost-effective or not. In these cases, a division between mandatory and desired requirements can be used. Using both mandatory and desired requirements is also a method of distinguishing achieved tenders from each other. The requirement specification can also include other than energy performance requirements. This should be requirements essential or desirable for the consumer or society. For example, regarding noise, water consumption, certain chemicals, ease of use, low maintenance costs, online features etc.

3.3.5. Dialogue with industry

It is of utmost importance to treat tendering companies equally. The same information must be given at the same time to each company participating in the tendering process. However, in the early stages of an innovative procurement process you have to gather information on which level to set the performance criteria. The desired product must be possible to manufacture, and often it is only the manufacturers who know if the criteria are possible to meet. Information gathering must be done with some caution. After a winner of the innovative procurement project has been selected the purchaser group works closely together with this manufacturer in order to agree on details. (In case more than one winner was selected, the purchaser group works with all of them.)

3.3.6. The prototype

In most cases the winner(s) will be asked to deliver a prototype for testing and verification. If the testing fails a dialogue starts with the winner(s), and improvements are proposed. Input from the purchaser group expert is essential at this stage. If the prototype still does not meet the requirements the innovative procurement process will have to be started all over. This is very rare, and it has never happened with the Swedish projects.

3.3.7. The first series of products

The buyers in the purchaser group agree on how many products they are prepared to purchase. This is the most difficult part of the process since buyers seldom in advance will commit themselves to by a product (one to two years), unknown when, and only with possible specifications. Not even grants to the buyers will help. The solution is to, in the contract with the winner, say that the **intention** is to buy a specific amount of the product. At the time mass-production starts, the buyers usually come to decision and by the products. In Sweden it has only happened in one case that the buyers did not by the winning product. The size of the first series of products is also dependent of the winning company's development cost, initial higher manufacturing cost and type of market.

The idea is that the grants to the buyers should compensate the buyers for a higher cost of the first series. Thus, the grant will, indirectly, compensate the manufacturer for some of their development cost. Once the tenders have been analysed and compared to a conventional product the size of the grant can be determined. Note that no money grants should be given directly to the manufacturer. In innovative procurement projects dealing with large systems laboratory tests are not possible, instead verification needs to be done through monitored and analysed pilot installations. Thereafter production of the first series can commence.

3.3.8. Information

Information activities is an important part of an innovative procurement project, and should be integrated into the project. Information is needed to attract buyers to the purchaser group, before the tendering in order to make companies aware of the project, to announce the winner(s) and then for the rest of the project to attract more buyers. Articles in trade journals and technical journals are also advised.

3.3.9. Training

In cases were installations are made by local contractors, training courses are advised. Sometimes the manufacturer manages this.

3.3.10. Schedule/Time table

An innovative procurement project could last from two to five years. It is important to give the industry enough (but not too long) time to develop the product. It happens that manufacturers already have plans for, or have discussed, the type of product specified, but this is usually impossible to know in advance.

3.3.11. Budget

The cost of an innovative procurement project varies depending on type of product, market matureness, possibilities to coordinate etc. A rough estimate of the cost for a typical innovative procurement project is:

- Pre-study, 100 – 500 hours
- Agent/project manager200 to 500 hours per year
- Testing 0 to 500 000 SEK
- Purchaser group 50 000 to 100 000 SEK per year
- First series of products 0 to 1 000 000 SEK
- Dissemination of information 100 000 to 200 000 SEK
- Project evaluation 100 000 to 300 000 SEK
- Unforeseen costs 15 percent of total cost and
- Sida staff 50 to 100 hours per year

The pre-study should include a cost estimate for the whole project.

3.3.12. Follow up and evaluation

The evaluation of the innovative procurement project should always be performed by an expert with experiences from similar projects.

3.4. If innovative procurement is not possible to use

An alternative approach can be to create a purchaser group and purchase BAT, best Available Technology, and share experiences within the group. The goal would be to secure high quality and low cost. The Global Leap Award could be a good source when searching for suitable products. Another possible source is labelled products.

3.5. Two technology procurement examples

3.5.1. The tap water mixer technology procurement

A technology procurement on energy-efficient tap water mixers for residential buildings was carried out in Sweden 2000-2002. The procurement was a joint project between the Swedish Energy Agency and the City of Stockholm. The project

included a complete technology procurement process with feasibility study, forming a purchaser group, development of requirement specification, tendering process, evaluation pilot case with monitoring, evaluation, first series financial support and dissemination activities.

The purchaser group included representatives for both multi-family and single-family property owners: The purchaser group was very active, which was one of the reasons for this project to be very successful. Gustavsberg AB was winner awarded in December 2002, and after the award more or less all of the market for tap water mixers for residential purposes has followed Gustavsberg's example.

The tendering document specified requirements on energy end use, water demand, technical requirements on pressure, noise, and easy installation and maintenance, health and safety aspects, ergonomic requirements, and user friendliness.

The dissemination activities included information sheets, articles in the trade press, grants for users for the first production series (both single-family and multi-family property owners). The evaluation of the project showed that the grants for users for the first production series was important for the market uptake.

3.5.2. The international Copying machine innovative procurement

The Swedish agency for technical development, NUTEK, initiated an innovative procurement task under the IEA DSM agreement, 1994 to 1999, with Hans Westling as the operating agent. Several countries participated in this task. A tumble drier for clothes with the energy use cut by half (the first "Class A" drier), electric motors with losses reduced by 20-40 percent and a "copying machine of the future" where the energy use was reduced down to 25 percent were the concrete results. The reason for going international with these procurement projects was that it within the NUTEK procurement programme had been observed that some products need to be produced in so large series that the market demand from one country not is enough to attract interest from multinational companies. Another advantage working internationally was the possibility to engage the best experts in the world.

Participants in this innovative procurement were:

- Denmark, Danish Energy Agency
- Finland, Motiva
- Korea, KEMCO
- Netherlands, NOVEM
- Spain, ENHER, ADEA and ENDESA
- Sweden, Swedish National Energy Administration (STEM, earlier NUTEK)
- United Kingdom, DETR, BRE and ETSU

- United States, U.S. Department of Energy (DOE) and the Environmental Protection Agency (EPA) and
- The Commission of the European Union, DG XVII, Energy.

3.6. Innovative procurement in the Sub-Saharan context

3.6.1. Possible products for innovative procurement

In this paragraph some products possible for innovative procurement in a Sub-Saharan context are discussed.

12 or 24 volt DC efficient products for solar home tier 1 to 5

There are at least 100 suppliers of PV systems over Africa. The fastest expanding suppliers are the PAYG package companies. Some of the companies delivering PV systems also deliver low-voltage lamps and appliances. These types of appliances are also used in e.g. camper vans and sailing boats. One problem is that they are not produced in the same volumes as standard 230 volt AC appliances, and that is reflected in their cost. Quality assurance systems such as labelling and MEPS do not exist.

PV lanterns

These are abundant and available at the market at reasonable cost. But how is their performance and quality assurance with regards to e.g. light quality and system lifetime?

PV milk coolers

We-effect in Tanzania has pointed out the potential for small dairy farms to reach a wider market if the milk could be kept cool. This type of product has also been suggested for innovative procurement in the Sida report ”Catalytic procurement of energy services for rural businesses”. A prototype PV milk cooler using ice for cooling and keeping a low temperature during transport is existing. It has been developed by the Universität Hohenheim, and it looks very promising for Sub-Saharan conditions.

Egg incubators

The need for egg incubators has been advocated in the report Feasibility study catalytic procurement of renewable energy Zambia.1 However, the market for low

[1] Gullberg M and Bakiri, Catalytic procurement of energy services for rural businesses

voltage incubators is worldwide, and products at reasonable costs are, specially from China, are already existing.

Biogas generators

Bio-gasifiers of the sizes 30-50 m3 are currently produced in Sub-Saharan countries, though not in all of the counties. However, there are no applications with electricity generators fed by bio-gasifiers. To customize biogas generators and install them at bio-gasifiers is a potentially suitable area for an innovative procurement.

PV-water pumps

There already exist an abundance of products, mostly from China, and implementation going on at the Indian countryside of these systems. However, quality, maintenance and lifetime may be an issue. Currently there is an ongoing Global Leap awards PV water pumps project. The winners will be announced by summer 2019.

Cook-stoves

Efficiency for access has recently produced a document on cook-stoves. It does not dwell deeply into energy efficiency but does categorize and relates to household income etc. One interesting path to pursue for innovative procurement is PV cooking. With the decreasing costs of PV and batteries, and the possibility to use induction could make such a product cost-efficient. Finding a suitable purchaser group might be more challenging. One great advantage is that cooking can be done indoor without health hazards, it would also reduce the households' need for time to collect wood. Predicted cost 3 000 SEK.

3.6.2. Possible Agents/project manager organizations

In this section some actors who may be suitable as innovative procurement agents/project managers are identified.

We-effect

We-effect runs independent pilot projects that demonstrates best practises in several developing countries. Their support includes practical climate change adaption interventions that increase resilience.

Global LEAP awards

The Global LEAP Awards is an international competition aiming at identifying and promoting the world's best off-grid appliances, accelerating market development and innovation. It has become a source of accurate, actionable information on quality and energy performance of off-grid appliances. The competitions they have carried out so far are:

- 2013-14: LED room lighting and TVs
- 2015-16: TVs and fans
- 2016-17: TVs, fans, and refrigerators

Currently (2018-19) they are running competitions on refrigerators, solar water pumps, and the Off-grid Cold Chain Challenge. CLASP serves as operating agent for several projects. CLASP is an international non-profit organization. CLASP was first established in 1999 to mitigate the growing energy demand from the use of appliances, lighting, and equipment in the developing world not least Africa.

Beyond the grid for Zambia

The Power Africa Beyond the Grid Fund for Zambia (BGFZ) is a programme aiming to increasing energy access in rural and peri-urban areas. The BGFZ aims to bring modern energy services to at least 167 000 households – translating to one million Zambians – by 2021.

3.6.3. Some information sources on Sub-Saharan companies manufacturing energy-efficient products

In this section some Sub-Saharan organisations who have information on companies supporting energy-efficient products are listed.

AECF

The AECF is a development institution which supports businesses to innovate, create jobs, leverage investments and markets in an effort to create resilience and sustainable incomes in rural and marginalized communities in Africa. They focus on agriculture and agribusiness. Renewable energy and adaptations to climate change are two of the focus areas.

PFAN

The Private Financing Advisory Network is an actor in the climate finance space addressing the barriers to success for small and medium sized enterprises (SME) in developing countries and emerging economies.

Innovations against poverty

Innovation against poverty is a Sida programme aimed at challenging the private sector to develop products, services and business models that can contribute to fight poverty and climate change. The programmes objective is to serve as a catalyst in order to develop products, services and market systems that benefit people living in poverty, rather than helping a single company to do better business.

REEEP

The Renewable Energy and Energy Efficiency Partnership develops innovative, efficient financing mechanisms to advance market readiness for clean energy services in low- and middle-income countries.

3.6.4. Partners in finance

Financing is crucial for innovative procurement projects, and so is finding suitable financing partners. Assigned by Sida the consultancy company Ramböll prepared an

extensive report on co-funding partners in 2015.[2] The reports information on financing partners report is still valid, hence we therefor refrain from delving further into this subject.

3.6.5. Utilities

Off grid operations for utilities could be one solution to introduce electricity to rural communities. The utilities have the necessary skills to do so, but problems occur if the customers do not pay their bills. Unless the system is online (internet) there is no way for the utility to shut off electricity. One way to go is the PAYG solution. But it has not been within the frames of this report to investigate.

3.6.6. Are our recommendations valid also for other countries in the Sub-Saharan region?

For innovative procurement as such we are not aware of any legal or procurement differences between the three countries; Kenya, Zambia and Uganda vs the rest of Sub-Saharan Africa.

3.7. A way forward, proposal

In this section we propose four different innovative procurement approaches that could be considered for funding or co-funding by Sida.

3.7.1. Project - “We-effect” and farmers’ cooperatives

We-effect has a well-established network with farming cooperatives in Zimbabwe. They also have significant knowledge on rural demands. Our proposal is that Sida contracts lets We-effect Zimbabwe do a pre-study and then if positive ask We-effect to form a core purchaser group consisting of the most interested and largest cooperatives. The product area for the assignment should be products and systems for agriculture. Products envisaged are PV milk coolers as previously described under ”Products”, PV-water pumps, crop drying equipment, biogas generators and egg incubators. It should be up to the purchaser group to prioritize between the products. However, we see the PV milk cooler as the most promising concept.

3.7.2. Project Global LEAP Awards, a stepwise approach.

This proposal does not include an entire innovative procurement project, but is limited to producing procurement specifications, like MEPS but voluntary. The performance requirements should be based on the products for which awards are

[2] Analysis of renewable energy project preparation facilities in Sub-Saharan Africa, Ramböll, 2015

being (or will be) awarded. In a second phase of this project it may be possible to find a purchaser group.

3.7.3. Project B2B

Cooking is a significant problem for individual households not only in Sub-Saharan countries. We have identified a promising solution, the PV induction cooking. The most promising purchaser group would be Gogla members, who jointly could start an innovative procurement. It may be difficult for Sida to fund such an organization. So, a solution for Sida could be to fund an agent and expert, for example CLASP, which then would work together with Gogla. If the project is successful development of other low voltage DC PV appliances could be considered. The idea emanates from India, so a cooperation with BEE, Bureau of Energy Efficiency, may be a possibility.

3.7.4. Future products suited for innovative procurement

The Efficiency for access EforA a UK R&D Grants Programme is currently launching Round 1 with the following technologies:

1) Cross-cutting horizon and enabling technologies.

- New ways of integrating or accessing at lower cost brushless DC motors
- Advanced electric cooking
- Advanced refrigeration technologies
- Connectivity & Internet of Things (IoT) e.g. as a catalyst for improved appliance performance or affordability
- Interoperability & compatibility
- Agricultural processing

2) Near-to-market products

These are existing products for which demand is strong and clear, but efficient products are only available in low volumes and at relatively high cost. These R&D projects will focus on the potential to significantly accelerate their availability, affordability, efficiency or performance.

- Refrigerators
- Solar Water Pumps
- Fans
- Rice and multi-cookers

3) Additional R&D needs identified by EforA include R&D into:

System design cost and efficiency optimization and modelling

- Affordable, efficient motors

- Improved mechanical reliability
- Improved local reparability
- Modularity/interoperability of components
- Water pumps that can be run using multi energy sources (e.g. solar, biomass, diesel, etc.)
- Low cost and durable sensors for use with off-grid appliances
- Low cost and durable controllers for use with off-grid appliances
- Portable and durable small-scale solar water pump systems
- Improved saline water tolerance of solar water pumps
- Standardised and open data collection and communication software and protocols
- A universal/interoperable appliance PAYG platform
- Power supplies that can interpret the needs of both supply and demand ends

It is recommended that Sida cooperates with EforA regarding products emanating from the programme in order to feed into purchaser groups for development into specifications with functional requirements.

3.8. Sida organization

It is recommended that Sida develops a team of in-house experts assigned the task to implement innovative procurement. The Swedish Technical Development Agency (NUTEK) and later the Swedish Energy Administration (STEM) had an organization of up to 30 persons plus consultants to implement its innovative procurement program. This size is probably not relevant for Sida, given the possibility to fund external organizations, but one or two experts assigned to this task is essential. Sida needs to take initiatives, support a, advice, follow up and evaluate.

4. REFERENCES

References are included as links integrated in the report

EU Commission, European Union CBA guide

Gullberg M and Bakiri, Catalytic procurement of energy services for rural businesses

Persson A & Gullberg M, Feasibility study catalytic procurement of renewable energy Zambia, 2015

Persson A, Teknikupphandling som styrmedel – metodik och exempel, Statens energimyndighet, 2004

APPENDIX 1 TERMS OF REFERENCE

Procurement advice for sustainable energy in Africa

Information about Sida

Sida is a government agency working on behalf of the Swedish parliament and government, with the mission to reduce poverty in the world. Through our work and in cooperation with others, we contribute to implementing Sweden's Policy for Global Development (PGU).

We implement the Swedish development policy that aims to enable people living in poverty to improve their lives. Another part of our mission is reform cooperation with Eastern Europe. The third part of our assignment is to distribute humanitarian aid to people in need of assistance.

We carry out enhanced development cooperation with a total of 35 countries in Africa, Asia, Europe and Latin America. Our selection of cooperation countries is based on political decisions made by the Swedish government.

Sida's mission is to allocate aid and other funding. Our operations are managed by the government's guidelines, describing the goals for each year's operations and the size of the development aid budget.

Our staff members and their expertise assist the government with the assessments and the information it needs, in order to decide and implement its development assistance policy. We participate in the advocacy work for Sweden's prioritised issues within the international development cooperation field, and we are in constant dialogue with other countries and international organisations. Part of our assignment is also to report statistics and disseminate information about our operations.

Our work is financed by tax money and we administer approximately half of Sweden's total development aid budget. The other part is channelled through the ministry for Foreign Affairs. All our work should be performed in a cost-effective way with a strong focus on results.

Sida has more than 700 employees, located in our three offices in Sweden as well as in our cooperation countries.

For more information, refer to www.Sida.se

Introduction to the assignment

Sida supports sustainable energy investments in Sub-Saharan Africa. There are currently numerous Swedish development strategies for Africa (bilateral,

multilateral, regional and global) with goals related to targets as expressed in SDG 7 (sustainable energy for all). The SDG 7 have three main sub-goals:

- By 2030, ensure universal access to affordable, reliable and modern energy services
- By 2030, increase substantially the share of renewable energy in the global energy mix
- By 2030, double the global rate of improvement in energy efficiency

Sida's goal is to leverage capital investments in the sector and therefore, an increasing portion of the support involves incentivising the private sector to act and operate in the energy sector for universal access, more renewable energy and energy efficiency. It is electric energy that is mostly in focus in current Sida interventions.

Supporting private sector activities highlights the need to more firmly express the conditions for support. Therefore, Sida is looking to formulate requirements or advice that can be tailored to suit the African countries and be applied in Sida's own procurements and agreements but more importantly in procurements and agreements settled by other parties that we finance.

In Sweden and Europe, there exist procurement advice for energy. These are often relatively straightforward measures, basically ready to use also in Africa south of Sahara. Part of the ambition with this assignment is therefore to work with procurement advice related to energy that are compiled and presented by the Swedish Procurement Agency. Furthermore, it will be an ambition to amend and complement these advices to suit the African market and to find ways to verify and control compliance in South Saharan Africa.

Sida can also use – and advice others to use – catalytic/innovative procurement measures. This assignment therefore entails to guide Sida in developing methods and code of conduct for innovative procurement.

While the title refers to procurement advice, there are other arrangements when Sida can also benefit from having prepared formulations and work processes regarding the conditions for financing. The list of where and how advice can be applied include – but is not limited to:

- In Sida's own procurements for the fulfilment of development strategies in Africa.
- When Sida writes agreements for issuing Swedish State Guarantees; that is – including terms and conditions for the validity of the risk sharing guarantee.
- When Sida agrees to provide grant money for others to use in challenge funds of energy supply or end use services or equipment.

- When Sida agrees to provide grant money for others to use in public-private development projects with focus on energy supply or end use services or equipment.
- When Sida agrees to provide grant money for others to use in procurement of energy supply or end use services or equipment, sometimes to achieve objectives within other intervention areas such as health, education, peace keeping or democratic governance.
- In dialogue, when Sida provides advice, training and capacity building in the energy sector or in other sectors as well.

Tasks

Sida has identified a few tasks for external consultants to carry out, leading the way towards formulations for procurement advice when investing in sustainable energy in Africa.

The out-put is generally expected to be very short and concise formulations, linking as much as possible to other established sources, easy to grasp and use and possible to update with reference to the changing context in Sub-Saharan Africa.

To reach at this, Sida has framed the task to include only three countries. Our suggested three countries are Kenya, Uganda and Zambia, although this will finally be agreed upon at the start up meeting.

The tasks are:

Task 1: Advice how Sida can apply Swedish procurement guidelines, based on the Swedish Procurement Agencies work.

Task 2: Advice how Sida can complement and develop these advice

Task 3: Advice regarding how Sida can support processes for innovative procurement.

Task 1: Advice how Sida can apply Swedish procurement guidelines

For the three agreed countries, please regard how sustainable procurement advice listed on the Swedish Procurement Agency's (UHM) web-page about sustainable procurement in real estate can be applicable and effective for transitioning the national energy sector towards sustainability.

As an introductory activity and preparation for the start meeting with Sida, the consultant will be asked to prepare a list of selected advice that can be relevant for reaching a more sustainable energy sector in Sub-Saharan Africa.

To the extent possible, please track the Swedish guidelines back to international directives or similar, with the view to describe how these relate to the above mentioned African countries.

Thereafter, the task entails to describe for what different types of agreements and procurements within the energy supply and end-use sectors that these advices may be directly applicable. Please regard the kind of agreements that are used for channelling development funding into the energy sector such as e.g. power purchase agreements, public procurement (different sectors), private procurement, challenge funds, loans, grants, subsidies, bank guarantees or other incentives.

Task 2: Advice how Sida can complement and develop the Swedish advice

More than copying the Swedish advice, there are most certainly other relevant advice that can be useful to achieve the transition towards a sustainable energy sector in Sub-Saharan Africa. Please consider what other advice could be instrumental to complement with, including for example:

- Exclude/reject investments in diesel gensets or other equipment running on fossil fuels
- Refer to specific minimum energy performance standards on equipment, when possible – can be voluntary MEPS, legislated MEPS, national or international.
- Refer to specific building codes, when possible – can be voluntary like "Green Building", LEADS or BREEM, can also be legislated in minimum building codes.
- Set conditions for recycling of waste products.

For the advice, including both the Swedish and you recommended complementary advice, please analyse some aspects on how these can be developed to become even more useful:

- Analyse how the advice can be applied and verified in the three selected countries.
- Analyse how the advice and specifications can possibly be extrapolated to other countries in the SSA.
- Please also comment on whether you can foresee any specific deviations from the rule and any required further conditions or investigations.
- Describe how regulations and policy statements support/specify the advice; e.g. COMESA, NDC's, PPA templates, national procurement regulations, and other. To reach at a reasonable focus and frame for this task, it is suggested that the consultant presents a list of policy documents to be reviewed and that can be finally settled at the follow up meeting with Sida (see tentative time plan below).

Task 3: Advise regarding how to implement processes for innovative procurement.

There is a paramount need to develop new solutions in sub-Saharan Africa. Processes that drive the need for new solutions are for example the immense urbanisation pace and the expected modernisation of the agricultural sector. To pro-actively support the development of new, innovative and well-tailored energy services, Sida aims to support innovative procurement, for example pre-industrial or pre-commercial procurement of technology or procurement of technology and service in combination, the procurement of an energy service provider based on a specified demand or the proactive and co-creative formulation of conditions for bank guarantees.

In Sweden and many other countries, these are processes that have been applied and that have driven new and more sustainable solutions to enter the market. Se for example UHM web-page about pre-commercial procurement. Auctions are as well increasingly used in many countries to invite bidders for solving semi-defined problem areas in new and effective ways.

Sida also has a few good examples of where targeted procurement has been used, e.g. the social impact procurement model applied in Zambia for the "Beyond the Grid Fund" https://www.bgfz.org/.

This task entails to advise Sida about how we can be more effective in supporting innovative solutions in the energy sector, including procurement or similar transparent processes. Challenges that need be analysed are:

- Swedish and European procurement rules and what can be hindering such innovative procurements, including e.g. EU state aid rules (Statsstödregler)
- Advice and good practice in the dialogue with expected industry partners.
- Advice and good practice in dialogue with "purchaser groups" – especially for those markets where Sida aim to operate and that includes target groups with very limited understanding of the possibilities they can have. (Also in markets where technological solutions for value adding processes are not developed because they have not yet been in the suppliers' field of view, e.g. many agricultural businesses in Sub-Saharan Africa; mobile and off-grid based solutions; DC-equipment, "back-stopping" and emergency equipment to be embedded in existing but weak distribution grids, e.g. for island mode; rapid urbanisation trends with new settlements, poor infrastructure, hygiene and transportation facilities.)
- Advice and good practice in the dialogue with national chambers of commerce and similar national trade organisations that will strive for local solutions rather than international.
- The large funds to be decided on with somewhat unspecified final results, the institutional budgeting and rules for fund management.

- Appropriate formulations of specifications (what to ask for in e.g. auctions…) for different areas of energy supply and energy efficient use of energy, e.g. the SE4All Multi Tier Framework or other.

APPENDIX 2 – DETAILED INFORMATION FROM THE UHM DATABASE REQUIREMENTS

Heat loss W/m² (A_{temp})= 20, 19 or 14 W/m². The purpose is to reduce heat losses (or gains) through the building shell. This criterion is only suited for buildings in the Swedish climate zone. A criterion like this does not exist in the three countries building codes. The criterion is not specified in any international standard. – UHM not applicable.

Airtightness, l/m²,s=0,3, 0,25 or 0,2 (new buildings), 0,5, 0,4 or 0,3 (existing buildings). The purpose is to minimize air leakages through the building shell in order to minimize heat losses (or gains). This criterion is only suited for buildings in the Swedish climate zone. Air tightness is mentioned in the building codes of the three countries but only in combination with fire and water. There is a reference to a standard, SS-EN 13829 – UHM not applicable.

Daylight factor, %, 1,2 for Multifamily buildings and >2 for Commercial buildings. The purpose is to maximize daylighting. Relevant for the three countries and specified in the Kenyan building code to >2%. The UHM criteria has only a reference to a Swedish standard, SS 914201 - UHM not applicable but an ISO standard, ISO 10916:2014 could be used. LEED incorporates daylighting.

Glare, candela/m², <2000 for new commercial buildings. The purpose is to increase visual comfort. Relevant for the three countries. Glare comes from windows and lighting. There is an ASE (1000,250h) threshold of 10 % mentioned in LEED. However, there is no reference to standards from UHM.

Maximum Solar Heat Gain, W/m² It is up to the building owner to set a threshold. The purpose is to reduce the build-up of heat on sunny days. There is no UHM reference to a standard. There exists an ISO standard, ISO 19467:2017 and there is a LEED criterion as well as a mention in the current Kenyan building code.

U-value windows, W/m²,K, 0,9/0,8. This threshold is related to heating and Swedish climate. It is not relevant for cooling loads. (Another optimization has to be done).

Window air leakage, <1/3 class 4. No Swedish text in UHM. A reference is given to SS EN 12207. The criterion might be relevant for buildings with cooling.

Service areas, this requirement is not relevant.

Ventilation system, pressure drop, UHM only in Swedish. In order to reduce electricity demand for the ventilation system. There is no specific threshold and no reference to standard. Ecodesign demand does exist. The criterion is relevant for electricity.

Air ducts tightness new buildings, Class C or D AMA. Only Swedish no reference to standards. The criterion is relevant for electricity and energy for heating or cooling.

Air ducts tightness, renovation, Class C or B, AMA. Only Swedish no reference to standards. The criterion is relevant for electricity and energy for heating or cooling.

Air ducts insulation, W/m^2,K, <0,8 or 0,3, AMA. Only Swedish no reference to standards. The criterion is relevant for energy for heating or cooling. Not specifically mentioned in the three countries building codes.

Control system, energy, only reference to AMA, Swedish text. The criterion is relevant for electricity and energy for heating or cooling. No efficiency reference in the three countries building codes.

Control system, ventilation, only reference to AMA, Swedish text. The criterion is relevant for electricity and energy for heating or cooling. No efficiency reference in the three countries building codes.

SPF efficiency, ventilation units, kW/m^3/s, 1,5/ 1,3 Multifamily houses, <1,3 Commercial buildings. Only in Swedish. The ecodesign definition is not the same as the UHM definition (system boundaries). The criterion is relevant for electricity. Not specifically mentioned in the three countries building codes.

Heat exchanger efficiency, %, 75/85 Multifamily houses, 70/65/80//85 Commercial buildings. Reference to EN. The criterion is relevant for heating and possibly cooling? Not specifically mentioned in the three countries building codes.

Ventilation with Heat pump, kW/m^3/s, <0,6. Probably not applicable in the three countries.

Glazed areas, W/m^2, K, 1,1/1,0 This means entrances etc. Only relevant for Sweden.

Fan unit without heat exchanger, SPF kW/m^3/s, <0,4. Here are references to both EN and ISO standards, ISO 13349: 2010. It is unclear if these definitions are in accordance with ecodesign. The criterion is relevant for electricity. Not specifically mentioned in the three countries building codes.

Lifts, may be relevant.

U-average for climate shell protection for low ambient temperatures is not relevant.

Washing machine, A++/A+++, included in Tier5, possible priority.

Medium and fine filter, pressure drop minimization, priority?

Microfilter, pressure drop minimization, priority?

Light sources, UHM is primarily focused on fluorescent light. No mention is made of quality aspects of LEDs, such as CRI. Furthermore, demands on efficacy for LEDs are outdated.

Luminaires, lm/W (integrated LED), 65 This threshold is probably not optimized in relation to costs for PV and batteries.

Outdoor light sources, ecodesign A or reference to Swedish law.

Outdoor ballasts – relevance? Are they old separately?

Renewable sources, certificate of origin – why? UHM mostly related to Swedish law and Swedish circumstances. Text only in Swedish. UHM not useful.

Refrigerators and freezers, Relation to ecodesign? Environment temperatures differ. Therefor Swedish or EU criteria are not useful in SSA.

Griddels, priority?

Plate dispensers and trolleys, priority?

Boiling pans, priority?

LCC, This is useful with some African examples

APPENDIX 2A, EXCEL COPY UHM REQUIREMENTS

	The National agency for Public Procurer	Building and property				e		e	e	e	e
		Multi family houses		Commercial buildings		Household apg	Air filter	Indoor light	Outdoor ligl	Electricity	Professional kitcl
	Sustainability criteria	new	renovation	new	renovation						
Buildings	Heat loss W/m2 (Atemp)	20/19/14		20/19/14							
	Airtightness, L/m2,s	0,3/0,25/0,2	0,5/0,4/0,3	0,3/0,25/0,2	0,5/0,4/0,3						
	Daylight factor %	1,2		>2							
	Glare, candela/m2			<2000							
	Maximun Solar Heat gain, Wm2	minimize		minimize							
	U-value, window, W/m2, K	minimize	0,9/0,8	minimize	0,9/0,8						
	Window air leakage	<1/3 class 4		<1/3 class 4	<1/3 class 4						
	Service areas	no separate heating syst.		no separate heating sys.							
	Ventilation system, pressure drop	minimize, SEE SPF		minimize see SPF							
	Air ducts tightness	class C or D		Class C or D							
	Air ducts tightness, renovation		Class C or B		Class C or B						
	Air ducts insulation, W/m2,K	<0,8 or 0,3	<0,8 or 0,3	<0,8 or 0,3	<0,8 or 0,3						
	Control system, energy			see document							
	Control system, ventilation	document		see document	see document						
	SPF efficiency vent unit, kW/m3/s	1,5/1,3	1,5/1,3	<1,3	<1,3						
	Heat exchanger efficiency, %	75/85	75/85	70/65/80//85	70/65/80//85						
	Ventilation with Heat pump, kW/m3/s	<0,6	<0,6	<0,6	<0,6						
	Glaced areas, W/m2, K		1,1/1,0		1,1/1,0						
	Fan unit without heat exch. SPF kW/m3/s		<0,4		<0,4						
	Lifts		Class EI3		EI3						
	U-average for climate shell		na		na						
Household a	Washing machine					A++/A+++					
Filters	medium and fine filter						See document				
	microfilter						See document				
Lighting	Lightsources							See document			
	Luminaires, lm/W (integrated LED)							65			
	Outdoor lightsources								Ecodesign or A		
	Outdoor ballasts								See document		
Electricity	Renewable sources									See document	
Prof. Kitche	refrigerators and freezers										See document
	Griddels										lid
	Plate dispensers and trolleys										See document
	Boiling pans %										85/90
	LCC					yes		yes	yes		yes

Filter applied

2		The National agency for Public Procurer			Possible conflict with building codes							Other systems		
3			EN/ISO standarc	Only Swedish clima	Kenya	Zambia	Uganda	Relevance	Priority	Flexibility	Practical?	Cost?	Ecodesign	LEED & Gr	Other
4		Sustainability criteria			LEED 4 builc	LEED 2 buildings									
5	Buildings	Heat loss W/m2 (Atemp)	no	yes	no heating c	no heating c	no heating (	no	na						
6		Airtightness, L/m2,s	SS-EN 13829	yes	na, only wat	na, only wa	na, only den	no	na						
7		Daylight factor %	no, SS 914201		>2	no specific c	no specific c	yes	?					Daylight % floor area	
8		Glare, candela/m2	no		.-	.-	.-	yes						REQEQ8r1	
9		Maximun Solar Heat gain, Wm2	ISO		BS 13830	.-	.-	yes						SHGC	
10		U-value, window, W/m2, K		yes	.-		.-	?							
11		Window air leakage	yes SS EN 12207	cooling?	.-	.-	.-	?							
12		Service areas	no					no							
13		Ventilation system, pressure drop		?	NN31	SANS 10400	.-	yes					yes		
14		Air ducts tightness	no	no	NN31	SANS 10400-	.-	yes							
15		Air ducts tightness, renovation			NN31	SANS 10400-	.-								
16		Air ducts insulation, W/m2,K		no	NN31	SANS 10400-	.-								
17		Control system, energy					.-								
18		Control system, ventilation	no	no			.-	yes							
19		SPF efficiency vent unit, kW/m3/s	yes, ISO 13349:	no	NN31	SANS 10400-	.-	no					yes		
20		Heat exchanger efficiency, %	yes SS-EN 308:1	no	NN31	SANS 10400-	.-	no					yes		
21		Ventilation with Heat pump, kW/m3/s		yes			.-	no							
22		Glaced areas, W/m2, K		?			.-	no							
23		Fan unit without heat exch. SPF kW/m3	yes ISO 13349: 2010.		NN31	SANS 10400-	.-	yes					yes		
24		Lifts					.-	yes							
25		U-average for climate shell			na	na	na	no							
26	Household a	Washing machine					.-						yes		
27	Filters	medium and fine filter	yes EN 779:2012		no criteria	no criteria	.-								
28		microfilter	yes EN 1822-2009.		no criteria	no criteria	.-								
29															
30	Lighting	Lightsources			NN31	SANS 10400	flourescent,	yes					yes, labeling directive		
31		Luminaires, lm/W (integrated LED)			NN31	SANS 10400-	.-	yes							
32		Outdoor lightsources					sodium vap	yes							
33		Outdoor ballasts					.-	yes							
34	Electricity	Renewable sources			NN31.5		section 5	yes							
35	Prof. Kitche	refrigerators and freezers	yes EN 441	yes	.-	.-	.-	no					yes		
36		Griddels			.-	.-	.-								
37		Plate dispensers and trolleys			.-	.-	.-								
38		Boiling pans %			.-	.-	.-	yes							
39															
40		LCC			.-	.-	.-								

APPENDIX 3 - ENERGY STANDARDS AND LABELLING PROGRAMMES – GLOBALLY 2013

Product	Albania	Argentina	Australia	Bangladesh	Bolivia	Brazil	Canada	Chile	China	Costa Rica	Egypt	European Union	Ghana	India	Indonesia	Iran	Israel	Japan	Jordan	Kenya	Korea	Lebanon	Malaysia	Mexico	Namibia	New Zealand	Nigeria	Pacific Islands	Pakistan	Peru	Philippines	Russia	Kingdom of Saudi Arabia	Singapore	South Africa	Sri Lanka	Chinese Taipei	Thailand	Tunisia	Turkey	United Arab Emirates	USA	USA - California	Vietnam
Air Compressors									M							M																											
Air Conditioners - Central and/or 3 Phase			M				M		M			P				M	M				M			M		M	P				V	M		P						P		M	M	
Air Conditioners - Room	M	M	M	P	P	M	M		M	M	M	M	M	V	P	M	M	V	P	P	M		P	M	P	M	P	P	P		M	V	M	M	P	M	M	P	M	P	M	M		P
Air Conditioners - Split System	M	M	M		P		M		M			M						V		P	M	V	P	M	P	M			P		M	V	M				M			P		M		
ACs, Single-packaged central & heat pumps			M				M		M			M						V	P					M		M														P		M		
Audio Equipment									M			M																				V			P								M	
Ballasts			M	V			M		M	M		M			P	M			P	P	M		M			M			P						P		M	M		M		M		V
Boilers							M		M			M				M					M			M						M							M		P		M	M	
Chillers			M						M					P	M	M	P									M											M					M		
Clothes Dryers							M					M					M																P	P								M		
Clothes Washers	M	M		P	P		M		M		M	M				M	M		P		M		P	M	P					P				P			M		M		P		
Combination Washer Dryers							M																																				
Computers			M						M			M						V								M					V												
Cooktops/hobs				P		M			M							M		V			M			M	P																		
Copiers									M			V				M		V														V											P	
Dehumidifiers							M														M															M					M		
Dishwashers							M					M				M	M		P		M										V			P				M		M		
External Power Supplies			M						M			M					V		P		M					M												M		M	M	
Fans - All Types				M			M		M			M		P	P	M	M		P				M						P							M			P		M		P
Fax Machines									M																																		
Freezers		M	M			M	M			M	M	M	M			M	M	V	P		M				P	M	P	M		M		V			P			M	M		M	M	
Furnaces							M									M														M											M	M	
Heat Pumps							M		M									V								P									P							M		
Heaters - Gas Central																		V																									
Heaters - Space												M				M	M	V			M																					M	M	
Heaters - Vented Gas Fireplaces																																										M		
Irons				P					M							M																												
Lamps					P	M	M		M	M		M		V			M	V	P	P				M	P	M	P	P			M			P		M	M	M		M		M		M
Lamps - Compact Fluorescent			M	P		M	M	P	M			M	M	M	M	M			P	P	M	V		M		M	P		V	M			P	P		M	V		M			V	
Lamps - Incandescent			M			M	M	P					M			M			P		M		M	M							M		P	P		M		M	M		M	M	M
Lamps - Transformers			M																																								
Lighting Systems									M			M			M									M		M									M						M	M	M	M
Microwaves				P					M									V																								M		
Monitors			M						M										P							M					V			P									P	
Motors				P		M	P	M	M			M				M								M				P								M					M		
Motors - 3 Phase		P	M	P		M		M	M		M			P	M	M		P	P	M		V	M		M			M						P	M	V		M		M		P
Multifunction Devices												V				M		V																P									
Printers									M									V													V												
Pumps									M			M		P		M					M			M															M					
Pumps - Swimming Pool			V																						P																		
Ranges/Ovens						M	M		M	M		P					M	V						M	P						V			P						M			
Refrigerators - Commercial			M				M		M			P			P	M		V		P	M			M		M														M	M	P	
Refrigerators and Refrigerator/Freezers	M	M	M	M	P	M	M	M	M	M	M	M	M	V	M	M	M	V	P	P	M	V	P	M	P	M	P	M	P	M		V		M	P	P	M	M	M	M		M		P
Rice Cookers				P					M						P			V			M																						P	
Scanners																															V												P	
Set Top Boxes			M						M			M					M		P						M										P						V		P	
Solar Water Heaters	M	M			P				M								M		P			V													P								M	
Standby Power			M				M					M					M	V	P		V														P				M		M	M		
Televisions - CRT			M	P					M			M			P			V	P		M		P		P	M				P	V			P				M		M	M		
Televisions - Flatscreen			M	P					M			M			P			V	P		M		P		P	M				P	V			P				M		M	M		
Transformers			M				M		M		M			V		M	M	V			M			M		M															M			P	
Vacuum Cleaners												M				M					M																								
VCRs and DVD Players												P						V																	P								M	
Water Chillers and Dispensers							M		P												M																							
Water Heaters - All Types			M			M	M		M	M	M	M				M	M	V			M			M	P	M				M		V					M				M	M	M

M=Mandatory V = Voluntary P = Proposed, Sources: EES and MAIA CONSULTING

APPENDIX 4 THE AGRICULTURE SECTOR

Sustainable energy and the efficiency dimension_Sida

TABLE 1 EXAMPLES OF ELECTRICITY END-USES EVOLVING IN EACH OF THE THREE MAIN GLOBAL STATISTICS SECTORS (INDUSTRIAL, TRANSPORT AND OTHER) FOLLOWING A MODERNISATION OF THE AGRICULTURAL VALUE CHAIN.

Agricultural value chain	Farming →	Processing →	Transportation →	Vending
Energy end use sector (OECD)	**Other**	**Industrial**	**Transport**	**Other**
Type of energy end use	Irrigation	Lighting	Vehicles	Lighting
	Cattle keeping	Drying	Cool storages	Dry storages
	Heating	Graining		Cool storages
	Lighting	Milling		
	Dry storages	Pressing		
	Cool storages	Cooling		
		Cutting		
		Vacuum packaging		
		Other packaging		

APPENDIX 5 COMPILATION OF SIDA AGREEMENTS IN RELATION TO PROCUREMENT

01 Grant Agreement between Sweden and another Country
9 Procurement
Choose one of the alternatives below:

Alt 1 There will be no procurement during the implementation of the Project/Programme.

Alt 2 The Government shall be responsible for all procurement under the Programme/Project in accordance with its applicable procurement rules, guidelines and procedures.
Additional safeguards will be applied such as ……. [specify]

Alt 3 The Government shall perform and is accountable for all procurement under the Project/Programme in accordance with its procurement rules, guidelines and procedures. Additional safeguards will be applied such as ……. [specify]
The Government shall, upon request, provide Sweden with relevant documents/information on its procurement practices, decisions and actions taken, including details and copies of contracts that they have awarded.

Alt 4 The Government shall procure all items required for the Project and in accordance with the ……Annex 2 The following deviations from the no-objection procedures are: [specify]

Alt 5 The Government will carry out all procurement under the Programme/Project through a procurement agent, which shall procure all items required for the Project/Programme and to be financed by Sweden in accordance with the …… [specify] Annex 2.
The Government shall contract the agent in accordance with [specify applicable procurement rules]. The Government shall submit the draft contract with the agent to Sweden for [chose: prior no objection/information].

Alt 6 Sweden will perform all procurements which will be required for the Project/Programme and for the benefit of the Government. Sweden shall perform the procurements in accordance with the agreed procurement plan and in accordance with its own procedures and national procurement legislation in Sweden. The procurement plan will include details for each procurement including the agreed procedures for consultations with the Government.

2 draft Agreement Sida Gov of Tanzania Rural Energy Agency 18 Nov
Article 8 – Procurement
8.1 The Government shall be responsible for all procurement under the Programme in accordance with its procurement rules, guidelines and procedures stated in the Tanzania Procurement Act 2011. Further, the Government shall prepare and furnish to Sweden for approval annual procurement plans detailing the procurement activities to be undertaken during the period covered by the plan, including the relevant procuring entity (i.e. the REA's Procurement Unit), procurement methods to be used and draft contracts intended to be used for the procurements. These annual procurement plans shall be submitted to Sweden by 15th March each year.

8.2 As some funds in the Programme will be used for procuring Technical Assistance, and the details and budget for this Technical Assistance is not yet determined, the Government shall provide Sweden with the draft contract for Technical Assistance for approval.

8.3 The Government shall, upon request, provide Sweden with relevant documents/information on its procurement practices, decisions and actions taken, including details and copies of contracts that they have awarded.

8.4 The Parties may agree that Sweden, as a part of the Swedish contribution, shall provide a procurement expert to support Tanzania in the procurement.

8.5 Any goods and equipment procured under this Agreement will be solely utilised by the Programme staff and for Programme purposes only and shall become the property of the Government upon the termination of the Programme, unless otherwise agreed between the Parties.

02 NGO Project Core Support - General Conditions – *should be possible to supplement with procurement*

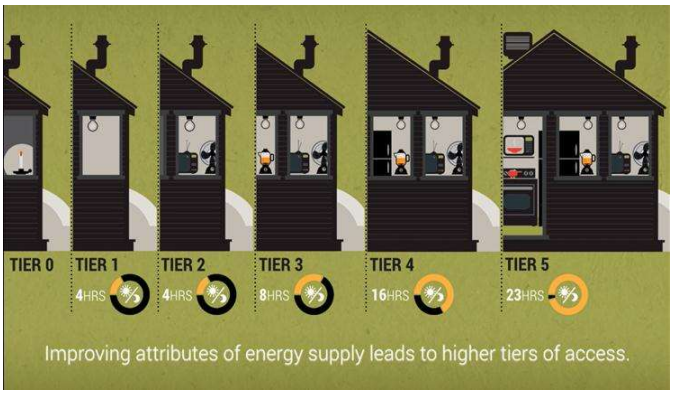
2_-_wb_-_progress_and_challenges_in_implementing_the_multi-tier_framework
Measuring energy access tiers WB – *definition of lmhr/day*

05 Procurement, common procurement rules - *RES and efficiency missing*

Agreement PFAN global o SSA ut 180808, UNIDO
ARTICLE 7 PROCUREMENT
Procurement of goods shall be carried out in accordance with the internal established procurement regulations of UNIDO, including international competitive bidding when relevant.
Swedish suppliers of goods and services shall be given the same opportunities to participate in the bidding as other suppliers. Local and regional suppliers of goods and services shall be encouraged to submit tenders.

Appendix X - Self declaration by tenderer – not applicable, only for criminals

Beyond-Connections-Introducing-Multi-Tier-Framework-for-Tracking-Energy-Access, definition multi tier



BGFZ_Guidelines_for_assessment and approval of changes and additions to product offerings under BGFZ_FINAL VERSION
Definitions, specifications;

i. An ESS designation at a given tier level will only be considered if all Function and Service availability thresholds are met or exceeded by the

changed or added product. Function & Service availability criteria of the multi-tier matrix are:

1. Lighting (number of discrete LED lamps)
2. Appliance support (to include no more than 1 mobile phone charge point)

ii. For Productive Use (P) tier categorization from tier P3 onwards, lighting functions and services may be substituted by productive use functions and services (e.g., water pumping, drying, cooling, etc.) provided there is appropriate justification and explanation of the productive use and other specification thresholds are achieved.

iii. In the event that service availability and quality of a given product exceeds the minimum threshold of a given tier level, but power availability (Watts per ESS) of the amended or new product are below, the ESP must demonstrate that power availability gaps are minor compared to the minimum threshold (in exceptional and well justified cases within 20% of the given tier level) outlined in the multi-tier matrix and that the quality and functionality of the available functions and services of the product are at least of the same quality of other products in that tier or of the predecessor product.

iv. Power availability criteria are:

1. Panel Capacity (in Watts per ESS)
2. Availability per day (Watt-hours per day, i.e. the minimum daily supply capacity of the new product offering available for consumption by the customer)

v. Quality criteria are:

1. Brightness of lighting as measured in lumens

Availability and adequacy of other functions and services: measured in the number of hours of power to e.g. charge phones or run other applications over and above the minimum lighting threshold.
Measure lumen in situ?

cba_guide, Guide to Cost-Benefit Analysis of Investment Projects Economic appraisal tool for Cohesion Policy 2014-2020

Deutsche Bank _Summary of Project Document, *Excellent, see appendix*

Draft Agreement - REACT SSA-12 Aug

4. Article 4 – Procurement

4.1 The Cooperation Partner´s own Procurement Regulations, The AECF procurement policy approved by the AECF Board in May 2017, together with this Agreement shall apply to the procurement of goods, works and services financed by this Grant Agreement and carried out internally within the Cooperation Partner and for any procurement carried out by any Third Parties.

4.2 Tender documentation, including all published procurement notices, shall be prepared in the English language.

4.3 At the request of either of the Parties, consultations shall be held on any matter relating to procurement.

Sida may carry out checks on procurements. The check may take the form of a procurement audit. The Cooperation Partner shall provide Sida with all the necessary documentation and information.

Grant Agreement v6 BTGF clean, Zambia, REEEP
Article 4 – Procurement

4.1 Procurement under the Power Africa Beyond the Grid Fund for Zambia must be performed in line with the general EU directive procurement principles of competition, proportionality, transparency, equality and consistency. These principles shall apply for all procurements carried out by the Cooperation Partner of any ESPs and for any procurement carried out under the BGFZ by ESPs within the ambit of their own validated procurement rules.

4.2 Tender documentation, including all published procurement notices, shall be prepared in the English language.

4.3 At the request of either of the Parties, consultations shall be held on any matter relating to procurement.
Sida shall have the right to carry out checks on procurements concerning ESP selection and ESP procurements. The checks may take the form of a procurement audit. The Cooperation Partner shall provide Sida with all the necessary documentation and information concerning the procurement of ESPs and ensure access to Sida regarding ESP procurement documentation and possible procurement audits.

4.4 Before procurements are published, inviting ESPs to bid, Sida shall approve the procurement and the tender documents with an internal decision and a written confirmation to the Cooperation Partner. Without this approval, the Cooperation Partner must not proceed with the procurement.

4.5 The signing of contracts between the Cooperation Partner and ESPs are subject to Sida's written no-objection. The Cooperation Partner must not sign any contracts before Sida's no-objection is received. The no-objection shall be issued when the BFGZ Steering Committee ("BSC") has approved recommendations for which ESPs are to be contracted, preferably grouping all contracts for a procurement round into one approval.

4.6 The signing of contracts between the Cooperation Partner and third party suppliers under the BGFZ exceeding the value of 500,000 euro are subject to Sida's written no-objection. The Cooperation Partner must not sign any such contract before Sida's no-objection is received.

Grounds for exclusion of financial cooperation with Sida,
Sida does not finance activities that include:

- Production of weapons, ammunition or products used as a platform for weapons and military strategic products
- Production of illegal drugs
- Production of tobacco and tobacco products
- Extensive production of alcoholic beverages
- Commercial gambling/betting activities
- Destruction of areas with high conservation/environmental value
- Promotion or production of pornography
- Promotion or production of racist or antidemocratic media
- Promoting or production of chemicals not approved within the EU.

Standardized_PPA_for_Large_Scale_Generators_more_than_10MW

Comment: No efficiency requirements found

Trine Guarantee Agreement - 8 March 2018 in (1)

9.5 Annual Results Report

Annually each year on the date of the Effective Date, if that is a Business day or the next following Business day if that is another day, the Arranger shall deliver to the Guarantor the Annual Results Report. The Arranger shall consider if the indicators could be reported based on sex disaggregated data, e.g. female led households as customers, females employees and female ownership. The Annual Results report shall include following indicators:

1. (a) the characteristics of the Qualifies Borrowers[2];
2. (b) the total amount of the Qualified Loans;
3. (c) The Wp[3] of active solar home systems and mini-grids;
4. (d) Number of installed solar home systems and micro grid connections for each Tier using the multi-tier approach to measuring energy access as defined by SE4ALL;
5. (e) Number of people reached with renewable energy services;
6. (f) Numbers of customers in default;
7. (g) CO2 equivalent emissions avoided and methodology used for calculating avoided CO2 emissions;
8. (h) An indicator reflecting the time it takes for a borrower to replace a faulty system that is under warranty;

(i) The Arranger's annual financial result; and

(j) The Guarantee's effect on attracting investors (e.g. number of investors, volume invested and frequency with which investments are made).

2 Name of borrowing company, Total annual revenues, Total number of customers, Number of employees, Women owned (Yes/No)

3 Watt peak or nominal power of active solar panels.

10.5 Environmental matters

The Arranger shall, and shall take reasonable steps to procure that the PSP and any relevant third party will, comply with all local environmental laws, regulations and all requisite permits applicable within the Relevant Jurisdictions (including Sweden and England).

APPENDIX 6 RECOMMENDATIONS FROM SLU

Study on sustainability performance standards and safeguard systems for energy Final draft 20151120 (2), SLU

As input to this process we propose that Sida should:

- exclude investments and support to non-renewable energy sources and technologies
- use the IFC performance standards as the key point of reference but also address some of its weaknesses in the dialogue with IFC and in project/programme assessment and monitoring.
- aim for application of best practices for the respective energy systems. For hydro power
- the World Commission of Dams principles should be applied including use of
- independent review panels
- aim for community participation throughout the process, including in monitoring of Environmental and Social Management Plans (ESMP),
- identify and act on opportunities to strengthen E&S outcomes including gender and use of country capacity and systems.
- promote cross-sectoral collaboration including better integration of environment ministries and agencies in the core planning of energy projects/programmes. (in projects where governments are involved in a significant way).
- ensure that monitoring and follow-up of projects and mitigation activities are agreed in contracts and budgeted for. Third party independent reviews or third party audited information should be encouraged.
- allow the use of other established MDB safeguard procedures such as AfDB's or those of the European Investment Bank (EIB) as points of reference if these are preferred by key partners while raising the same issues as listed above.

APPENDIX 7 AGREEMENT EXAMPLES WITH SUSTAINABLE PROCUREMENT

Agreement state to state

2 draft Agreement Sida Gov of Tanzania Rural Energy Agency 18 Nov
Article 8 – Procurement
8.1 The Government shall be responsible for all procurement under the Programme in accordance with its procurement rules, guidelines and procedures stated in the Tanzania Procurement Act 2011. Further, the Government shall prepare and furnish to Sweden for approval annual procurement plans detailing the procurement activities to be undertaken during the period covered by the plan, including the relevant procuring entity (i.e. the REA's Procurement Unit), procurement methods to be used and draft contracts intended to be used for the procurements. These annual procurement plans shall be submitted to Sweden by 15th March each year.

8.2 As some funds in the Programme will be used for procuring Technical Assistance, and the details and budget for this Technical Assistance is not yet determined, the Government shall provide Sweden with the draft contract for Technical Assistance for approval.

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8.4 The Parties may agree that Sweden, as a part of the Swedish contribution, shall provide a procurement expert to support Tanzania in the procurement.

8.5 Any goods and equipment procured under this Agreement will be solely utilised by the Programme staff and for Programme purposes only and shall become the property of the Government upon the termination of the Programme, unless otherwise agreed between the Parties.

8.6 "Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using LifeCycle Costing, LCC, see appendix XX" for advice.

Example SIDA
9 Procurement
Choose one of the alternatives below:
Alt 1 There will be no procurement during the implementation of the Project/Programme.
Alt 2 The Government shall be responsible for all procurement under the Programme/Project in accordance with its applicable procurement rules, guidelines and procedures.
Additional safeguards will be applied such as ……. [specify]
"Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using LifeCycle Costing, LCC, see appendix XX" for advice.

Alt 3 The Government shall perform and is accountable for all procurement under the Project/Programme in accordance with its procurement rules, guidelines and procedures. Additional safeguards will be applied such as ……. [specify]

”Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using LifeCycle Costing, LCC, see appendix XX” for advice.

The Government shall, upon request, provide Sweden with relevant documents/information on its procurement practices, decisions and actions taken, including details and copies of contracts that they have awarded.

Alt 4 The Government shall procure all items required for the Project and in accordance with the ……Annex 2 The following deviations from the no-objection procedures are: [specify]

”Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using LifeCycle Costing, LCC, see appendix XX” for advice.

Alt 5 The Government will carry out all procurement under the Programme/Project through a procurement agent, which shall procure all items required for the Project/Programme and to be financed by Sweden in accordance with the …… [specify] Annex 2.

The Government shall contract the agent in accordance with [specify applicable procurement rules]. The Government shall submit the draft contract with the agent to Sweden for [chose: prior no objection/information].

”Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using LifeCycle Costing, LCC, see appendix XX” for advice.

Alt 6 Sweden will perform all procurements which will be required for the Project/Programme and for the benefit of the Government. Sweden shall perform the procurements in accordance with the agreed procurement plan and in accordance with its own procedures and national procurement legislation in Sweden. The procurement plan will include details for each procurement including the agreed procedures for consultations with the Government.

Agreement with challenge fund

Example REACT

“Article 4 – Procurement

4.1 The Cooperation Partner´s own Procurement Regulations, The AECF procurement policy approved by the AECF Board in May 2017, together with this Agreement shall apply to the procurement of goods, works and services financed by this Grant Agreement and carried out internally within the Cooperation Partner and for any procurement carried out by any Third Parties.” ”Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using LifeCycle Costing, LCC, see appendix XX” for advice.

Overview of SIDA agreements and goals (in Swedish only). Source: Monica Gullberg, Sida, 2018

Typ av stöd	**Exempel på hållbarhetskrav**	**Exempel på avtalstyper**	**Exempel på beställargrupper (med fattigdomsperspektivet i fokus)**
1. **Access** - Ways in which Sida support access:			
1.1. Grid extension, nätutbyggnad, *t.ex i Tanzania och Mocambique*	Minimikrav på vissa komponenter, t.ex. transformatorer. Skallkrav eller börkrav	Avtal stat till stat, som sedan leder till offentlig upphandling i mottagarlandet. Internationella leverantörer kontrakteras (t.ex. fr Spanien, Kina, Indien, Tyskland etc.)	
1.2. Densification (nya anslutningar i befintligt nät), *t.ex i Tanzania* Sociala stöd program för fattiga hushåll. I vissa fall ingår t.ex. 2 lampor.	Krav på lampor. Krav på återvinning. Skallkrav eller börkrav.	Avtal stat till stat, som sedan leder till offentlig upphandling i mottagarlandet. Internationella leverantörer kontrakteras.	Fattiga hushåll (överrepresentation av ”women-headed”, ofta en. ensam kvinna med barn **eller** hushåll med äldre generation och barnbarn – föräldrarna har dött i sjukdom eller konflikt).
1.3. Off-grid supply *t.ex. REACT – Kenya och en massa länder, Beyond the Grid Fund – Zambia och en massa länder, Tanzanian REA/REF. Genom våra humanitära stödinsatser som budgeteras och planeras regionalt för Afrika söder om Sahara finns stora summor till humanitära insatser i både Kenya och Uganda – alltså finns stöd till flyktingläger här som inte syns i den bilaterala statistiken på Openaid.se, utan i statistik för REGIONALT SSA!*	.		

1.3.1. Solar Home Systems	LCC-jmfr med diesel gen-set? Eller jmfr med nätet? Krav på ingående komponenter, tex. Solpaneler, batterier Krav på lampor. Krav på ytterligare produkter, även Direct Current t.ex. kylskåp, air conditioning, svets Krav på återvinning av ingående komponenter. Skallkrav eller börkrav.	Bankgaranti för utlåning till en viss typ av projekt (portföljgaranti). Avtal med icke vinstdrivande organisationer som ”mäklar” projekt och sedan bedömer subsidienivå, typ BGFZ. Avtal med Challenge Fund förvaltare, typ REACT. Vi skulle kunna önska i avtal med multilateral välgörenhetsorganisation, så som Röda Korset, FN-organisation, t.ex. UNHCR, UNICEF, etc., att när de gör sedan upphandling enligt sina regler – att de väljer mer hållbara lösningar. Ofta har de ramavtal. Ofta har *de kort planeringshorisont (akut humanitär hjälp).*	Hushåll: landsbygd och urbana slumområden. Vårdcentraler/förlossning Skolor Administration; förvaltning, demokrati och mänskliga rättigheter, grundläggande information för små företag (om t.ex. väder, konflikter, logistik/transport, marknadspriser). Flyktingläger. Nomader Flyktingar ”på drift” (tror ej att det är så aktuellt i Kenya och Uganda – tror det är mest flyktingläger, men i SAHEL-området finns stora grupper).
1.3.2. Mini Grids	LCC-jmfr med diesel gen-set? Eller jmfr med nätet? Krav på ingående komponenter, tex. Solpaneler, batterier Krav på lampor. Krav på ytterligare produkter, t.ex. motorer, kylskåp, AC, svets Krav på återvinning av ingående komponenter. Skallkrav eller börkrav.	-Stat till stat för vidare ”Result Based Funding”. -Bankgaranti för utlåning till en viss typ av projekt (portföljgaranti). -Avtal med icke vinstdrivande organisationer som ”mäklar” projekt och sedan bedömer subsidienivå, typ BGFZ. -Avtal med Challenge Fund förvaltare, typ REACT. -Vi skulle kunna önska i avtal med multilateral välgörenhetsorganisation, så som Röda Korset, FN-organisation, t.ex. UNHCR, UNICEF, etc., att när de gör sedan upphandling enligt sina regler – att de väljer mer hållbara lösningar. Ofta har de ramavtal. Ofta har *de kort planeringshorisont (akut humanitär hjälp).*	Hushåll (se ovan) Hälsoministeriet, upphandlingsavdelningen: Vårdcentraler/förlossning,Sjukhus. Utbildningsministeriet upphandlingsavdelningen: Skolor Kommuner; upphandling av t.ex. gatubelysning Jordbruk, djurhållning, bevattning Mejerier Småskalig tillverkningsindustri; möbler, textil etc. Flyktingläger
2. **Renewable** - Ways in which Sida support renewable:			
2.1. Large power plants, e.g. Hydro Power Plants, Large Scale Solar, Geothermal	CBA-varianter?	Statlig nätägare avtalar i Power Purchase Agreement. Investerare behöver finansiering (Eget kapital och Lån) Sida kan i	

Power Plants *(not much success yet)*		sällsynta fall bidra med gåvomedel till eget kapital, men prioriterar Bankgaranti till utlåning.	
2.2. Off-grid supply			
2.2.1. Solar Home Systems	Se ovan	Se ovan	
2.2.2. Green Mini Grids	Nolltolerans mot dieselanvändning? Eller krav på minimering av dieselanvändning; kräver beräkningsmodell, finns förslag t.ex. Världsbanken. Krav på transformatorer?	Se ovan	
2.3. Back-up/reservaggregat för viktiga byggnader med nätanslutning	Nolltolerans mot dieselanvändning? Eller krav på minimering av dieselanvändning; kräver beräkningsmodell.	Vet ej	Viktiga statliga myndigheter, Flygplatser, Universitet, Sjukhus och Turistnäring
3. **Efficiency** - Ways in which Sida (could) support efficiency.			
3.1. Belysning och annan el-utrustning; datorer, AC, motorer, kyla	Produktkrav Återvinningskrav	I insatser inom olika sektorer. t.ex. distriktsadministration (små kontor på landsbygden) hälsa, jordbruk, utbildning, flyktingläger	
3.2. Byggnader.	LCC& produktkrav		
3.3. Industri	*Ej aktuellt i uppdraget*		
3.4. Systemet	*Ej aktuellt i uppdraget*		

APPENDIX 8 PROCUREMENT REQUIREMENTS, SOUTH AFRICAN MEPS

South Africa has put in place regulations that require appliances sold in South Africa to meet Minimum Energy Performance Standards (MEPS). MEPS define the minimum level of energy performance that an appliance must meet or exceed before it can be sold

Possible energy savings, South African MEPS

Appliance	Energy Savings (TWh)		% of Total	
	2020	2030	2020	2030
Refrigerator	0.01	0.03	1%	1%
Refrigerator-Freezer	0.42	1.19	19%	21%
Freezers	0.00	0.00	0%	0%
Washing Machines	0.00	0.00	0%	0%
Dryers	0.02	0.03	1%	1%
Dishwashers	0.02	0.06	1%	1%
Oven	0.01	0.03	1%	0%
Split AC-Cooling Only	0.02	0.05	1%	1%
Split AC-Reversible	0.15	0.35	7%	6%
Window AC-Cooling Only	0.00	0.00	0%	0%
Window AC-Reversible	0.00	0.00	0%	0%
Geyser	1.49	3.82	70%	69%
Total	**2.15**	**5.55**	**100%**	**100%**

This is the equivalent of 2 X 800MW coal power stations running for two years

Source: Theo Covary, UNDP

Time plan for South African MEPS

Appliance	Pre MEPS	MEPS	2018 Review
Audio Visual (Standby only)	None	<1w	<0,5W by 2020 & expand scope
Refrigerators and Fridge Freezers	C	B	Move to Class B by 2020 and A+ by 2022
Freezers	E	C	Move to Class B by 2020, A by 2022 A+ by 2024
Washing Machines and Washer Dryers	B	A	Retain MEPS level
Tumble Dryers	E	D	Move to Class C by 2020
Dishwasher	A	A	Retain
AC	Unknown	B	Move to Class A by 2020 (review approach)
Ovens (Small and Medium)	B	A	Retain and introduce MEPS for large ovens A by 2020
Electric Water Heaters	D	B	Retain
Residential Lighting		None	Introduce technology neutral specifications

Theo Covary, UNDP

Kenya example

NN31. ENERGY EFFICIENCY & THERMAL COMFORT

NN31.1 All new buildings or alterations and extensions to existing buildings should make provision for adequate natural lighting, natural cooling and natural ventilation.

NN31.2

(a) Passive and natural cooling methods should be considered as part of should follow the fundamental steps of prevention of heat gain (protection) and the provision of cooling (heat dissipation).

(b) Prevention of heat gain should include careful planning and design of building layout, landscaping and appropriate choice construction materials together with sun shading and other controls of heat gains.
(c) Provision of cooling includes the natural removal of any heat gains from outside, internally generated heat from people, lighting, equipment and any other processes within the building through the various forms of natural ventilation.

Passive and Natural Cooling

All external glazed areas including windows, other wall glazed areas, atriums and other roof glazed areas should be fully sun-shaded against direct sun rays from 9:00AM to 4:00PM throughout the year.

Natural Lighting

1. a) All habitable spaces should be provided with natural light.
2. b) All new buildings or alterations and extensions to existing buildings should allow for daylight factor of not less than 2% in office spaces and well in excess of this figure where there are special requirements e.g. in drawing offices.
   Where natural lighting is not possible, energy efficient light fittings should be installed at the time of construction.

Solar and Other Renewable Energy Sources

1. (a) All new housing developments or alterations and extensions to existing buildings should have solar hot water heating installations for bathroom use. No new housing development should be allowed to use the national grid electricity for hot water heating in bathrooms.
2. (b) New developments should consider generating electricity from stand-alone photovoltaic installations (comprising of wall cladding and roofing etc) and from wind power in suitable locations.

APPENDIX 9 RATING SYSTEMS FOR BUILDINGS

BREEAM
BREEAM is a sustainability assessment method for master planning projects, infrastructure and buildings. BREEAM does this through third party certification of the assessment of an asset's environmental, social and economic sustainability performance, using standards developed by BRE, British Research Establishment. BREEAM measures sustainable value in a series of categories, ranging from energy to ecology. Each of these categories addresses the most influential factors, including low impact design and carbon emissions reduction; design durability and resilience; adaption to climate change; and ecological value and biodiversity protection. Each category is sub-divided into a range of assessment issues, each with its own aim, target and benchmarks. When a target or benchmark is reached, as determined by the BREEAM assessor, the development or asset score points, called credits. The category score is then calculated according to the number of credits achieved and its category weighting. Once the development has been fully assessed, the final performance rating is determined by the sum of the weighted category scores.

Comment: We have not found any certified BREEAM buildings south of Sahara. It is expensive to go through the BREEAM process. BREEAM is more suited for exclusive buildings in the centre of major cities.

LEED
LEED (Leadership in Energy and Environmental Design) is available for virtually all building project types, from new construction to interior fit-outs and operation & maintenance, LEED provides a framework that project teams can apply to create healthy, highly efficient, and cost-saving green buildings. LEED certification is a globally recognized symbol of sustainability achievement. It was developed by the non-profit U.S. Green Building Council (USGBC). Under LEED, there are 100 possible base points distributed across six credit categories: "Sustainable Sites", "Water Efficiency", "Energy and Atmosphere", "Materials and Resources", "Indoor Environmental Quality", and "Innovation in Design".

Buildings can qualify for four levels of certification: Certified: 40–49 points, Silver: 50-59 points, Gold: 60-79 points and Platinum: 80 points and above.

In Kenya there are currently 8 certified buildings and 15 in process. They are mostly business, bank and educational buildings. In Uganda we can only find the US embassy, and in Zambia there are two LEED certified buildings in Lusaka, one bank and the US embassy.

Comment: It can be argued if LEED is suited for rural Africa. One source estimates that almost half of the points that can be earned are not relevant. LEED is more suited for exclusive buildings in the centre of major cities.

Near Zero Energy Building, NZEB, an EU directive
Nearly zero-energy building means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;" Annex I in the EU

directive, article 1 stipulates that “The energy performance of a building shall be determined on the basis of the calculated or actual annual energy that is consumed in order to meet the different needs associated with its typical use and shall reflect the heating energy needs and cooling energy needs (energy needed to avoid overheating) to maintain the envisaged temperature conditions of the building, and domestic hot water needs.” In addition, the principle of cost optimality is applicable, which gives guidance for the energy performance requirements of new buildings, existing buildings undergoing major renovation, and retrofitted or replaced elements that form part of the building envelope.

The directive gives no specific energy performance requirements due to varying climate over Europe. It is up to each country to define NZEB.
In the Sub-Saharan context, a tier1 to tier 5 building would be a NZEB.

Comment: The concept as such could be used as a goal, in Sub-Saharan buildings, but it would be difficult to follow up.

APPENDIX 10, LCC

A. LCC, Diesel genset and PV

Example, comparing diesel genset with a PV installation beyond the grid in Sub Saharan Africa. Observe that the result below are not generic. There are several variables which, with other input data, would lead to different results. For example, transport cost of diesel oil is dependent on distance to nearest terminal and the condition of the roads. Setting another lifetime, discount rate, maintenance, solar insolation etc will also change the LCC outcome. The LCC tool thus has to be used with care.

The LCC calculation below lacks CO2 emissions for the PV system. This is due to input limitations of the UHM tool. The CO2 emission for the PV system caused during production are in this case 460 kg per year.

Input data

Diesel genset - 5kW, low speed (1 500 rpm), water cooled, lifespan 15 000 hours. Transport and installation cost are appreciated to the same cost as the hardware. CO_2 emissions are from this paper. Cost of fuel is under the heading “Costs of disposable supplies”

PV includes cost for panels, battery, inverter, installation etc and are based on an IRENA study. CO_2 emissions are from IPCC.

Output

As expected LCC costs for the 10-year period the PV installation is more cost effective, and probably even more so for the following 10 to 20 years as the solar panels have a life expectancy of 20 to 30 years.

The National Agency for Public Procurement

General LCC-tool for procurement

Version 1 .2
Date: 2016-11-23

Introduction | LCC-tool | Tool parameters | Result | Climate impact factors

Calculation conditions (specified by the CA)

PROJECT:	diesel genset
DATE:	nov 2
ADMINISTRATOR:	eö

1.1	Quantity		1	qty
1.2	Usage time		10	year
1.3	Discount rate		5,00%	
1.4	Price of energy	Electricity (choose from list)		sek/kWh
1.5	Annual price change (optional)			
1.6	Climate impact from energy consumption (optional)		1,27	kgCO2/kWh
1.7	Financing cost if leasing or renting			sek/year/piece

Data from supplier

	Name			Diesel genset, 30kWh/day 5kW	pv 30kWh/day, 5kW
	Investment costs				
2.1	Price		sek/piece	30 000	300 000
2.2	Cost of delivery, installation and operation start-up		sek/piece	30 000	
2.3	Adjustment costs		sek/piece		
	Operation and maintenance costs				
3.1	Energy usage	Electricity	kWh/year/piece	10 950	
3.2	Costs for disposable supplies		sek/year/piece	65 700	0
3.3	Service and maintenance costs		sek/year/piece	600	3 000
3.4	Labour costs		sek/year/piece		
	Other costs				
4.1	Insurances, taxes and fees		sek/year/piece		
4.2	Renting or leasing costs		sek/year/piece		
4.3	Licenses		sek/year/piece		
4.4	Disposal costs		sek/piece		
4.5	Residual value		sek/piece		

Result

			Diesel genset, 30kWh/day 5kW	pv 30kWh/day, 5kW
5.1	**TOTAL COST (present value)**	sek	**571 951**	**323 165**
5.2	**Operating costs per year**	sek/year	0	0
5.3	**Climate impact per year**	kgCO2e/year	13 907	0

B. LCC, outdoor lighting

Two installations are compared, one street lamp with LED connected to a local Diesel Genset and one stand-alone LED fixture with PV and battery. Pole and electricity connection between the LED lamp and the DG Installation are not included. Transport from China and installation are not either.

Input

The PV fixture has a light output of 1300 lm and is motion controlled.

The LED fixture has an output of 3000 lm (we could not find a LED street lamp with lower light output). It is not motion controlled.

The National Agency for Public Procurement

General LCC-tool for procurement

Version 1 .2
Date: 2016-11-23

Introduction | LCC-tool | Tool parameters | Result | Climate impact factors | R

Calculation conditions (specified by the CA)

PROJECT:	streetlamp
DATE:	
ADMINISTRATOR:	

1.1	Quantity		1	qty
1.2	Usage time		10	year
1.3	Discount rate		5,00%	
1.4	Price of energy	Electricity (choose from list)	3,00	sek/kWh
1.5	Annual price change (optional)			
1.6	Climate impact from energy consumption (optional)			kgCO2/kWh
1.7	Financing cost if leasing or renting			sek/year/piece

Data from supplier

	Name			LED with diesel genset	PV, battery, LED
	Investment costs				
2.1	Price		sek/piece	350	1 160
2.2	Cost of delivery, installation and operation start-up		sek/piece		
2.3	Adjustment costs		sek/piece		
	Operation and maintenance costs				
3.1	Energy usage	Electricity	kWh/year/piece	110	
3.2	Costs for disposable supplies		sek/year/piece		
3.3	Service and maintenance costs		sek/year/piece		46
3.4	Labour costs		sek/year/piece		
	Other costs				
4.1	Insurances, taxes and fees		sek/year/piece		
4.2	Renting or leasing costs		sek/year/piece		
4.3	Licenses		sek/year/piece		
4.4	Disposal costs		sek/piece		
4.5	Residual value		sek/piece		

Result

			LED with diesel genset	PV, battery, LED
5.1	**TOTAL COST (present value)**	sek	**2 887**	**1 518**
5.2	**Operating costs per year**	sek/year	329	0
5.3	**Climate impact per year**	kgCO2e/year	0	0

Output

Even in this case the renewable installation has a lower LCC cost.

C. LCC, PV LED vs Kerosene lighting

Kerosene lamps is the common light source in homes without electricity. The following is an example from India.

Typical kerosene lamps deliver between 1 and 6 lumens per square meter (lux) of useful light

Measured energy use among kerosene lanterns varied by a factor-of-ten, from 0.005 to 0.042 litres per hour (corresponding to 6 to 53 litres per year). The simplest wick-based lanterns (most common among the poorest households) exhibit the highest costs per unit of light output

A typical kerosene lamp on the Indian market costs 240 INR = 30 SEK and uses 30g kerosene per hour. Which would correspond to 53 l/year if the lamp is used 3,5 hours per day. The cost for kerosene is set to 25 INR/litre.

A PV-battery-LED lamp costs up to 3000 INR = 360 SEK according to the Indian report "Kerosene to PV subsidy swap". Light output up to 400 lumens is not uncommon.

The National Agency for Public Procurement

General LCC-tool for procurement

Version 1 .2
Date: 2016-11-23

Introduction | LCC-tool | Tool parameters | Result | Climate impact factors

Calculation conditions (specified by the CA)

PROJECT:	kerosine
DATE:	nov 2018
ADMINISTRATOR:	eö

1.1	Quantity		1	qty
1.2	Usage time		10	year
1.3	Discount rate		5,00%	
1.4	Price of energy	Electricity (choose from list)		sek/kWh
1.5	Annual price change (optional)			
1.6	Climate impact from energy consumption (optional)			kgCO2/kWh
1.7	Financing cost if leasing or renting			sek/year/piece

Data from supplier

	Name		Kerosene	PV, Battery, LED
	Investment costs			
2.1	Price	sek/piece	30	360
2.2	Cost of delivery, installation and operation start-up	sek/piece		
2.3	Adjustment costs	sek/piece		
	Operation and maintenance costs			
3.1	Energy usage: Electricity	kWh/year/piece		
3.2	Costs for disposable supplies	sek/year/piece	159	
3.3	Service and maintenance costs	sek/year/piece	1	14
3.4	Labour costs	sek/year/piece		
	Other costs			
4.1	Insurances, taxes and fees	sek/year/piece		
4.2	Renting or leasing costs	sek/year/piece		
4.3	Licenses	sek/year/piece		
4.4	Disposal costs	sek/piece		
4.5	Residual value	sek/piece		

Result

			Kerosene	PV, Battery, LED
5.1	**TOTAL COST (present value)**	sek	**1 262**	**471**
5.2	**Operating costs per year**	sek/year	0	0
5.3	**Climate impact per year**	kgCO2e/year	0	0

Output

Both the light amount and LCC cost are favourable for solar lamps.

APPENDIX 11 PROCUREMENT REQUIREMENTS

To be included in agreement/contract between SIDA and the applier;
"Renewable energy sources, best possible energy and resource efficiency should be applied for procurement of products or systems. The requirement can be fulfilled by using Life Cycle Costing, LCC, see Appendix XX." for advice.

Text in appendix XX;
In order to attain "Renewable energy sources and best possible energy efficiency should be applied for procurement of products or systems" the following methods/criteria should be used were applicable. If corresponding local or regional criteria exist they should be applied instead.

Main recommendation, use Life Cycle Costing, see the Swedish National Agency for Public procurement UHM tool. Input parameters;
Lifetime, 10 years

The **discount rate** determines the calculation of future costs to present value. The calculation rate shall be based on the calculation rate the organization uses for investments and might be nominal as well as real. Often the internal rate of return is used for LCC-calculations.

If LCC is not practical to use. Minimum Energy Performance Standards, MEPS, can be used for products like appliances, motors etc. If those do not exist for the specific country the South African MEPS, SAEEL, can be used. For items not covered by South African MEPS EU MEPS can be used. See table below (active 2018).

	Type	Requirement	Rating system
LCC			UHM
Building system/components	Air Conditioners	Class B	SAEEL
	Ventilation units		ecodesign
	Lighting		
White goods	Dishwashers	Class A	SAEEL
	Electric Ovens (Large)	Class B	SAEEL
	Electric Ovens (Small & M)	Class A	SAEEL
	Freezers	Class C	SAEEL
	Fridges	Class B	SAEEL
	Fridge-freezers	Class B	SAEEL
	Storage Water Heater	Class B	SAEEL
	Tumble Dryers	Class D	SAEEL
	Washer-dryers	Class A	SAEEL
	Washing Machines	Class A	SAEEL
Brown goods	Audiovisual	1W/3W	SAEEL
Other	Electric motor		ecodesign
	External power supplies		ecodesign
	Power transformers		ecodesign
	Water pumps		ecodesign

Beyond the grid. For applications with PV appliances with DC, 12 or 24 volts could be desirable. See LEAP awards for efficient products. Recommendations can also be found in the Ugandan and Kenyan building code

For major **buildings** the GREEN STAR requirements should be applied.
Waste management should be applied.

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