MEDECINS SANS FRONTIERES

PACE MAKER

(intersectional version)

100 logistics answers to meet our climate and environment commitments

PACE MAKER - intersectional version:

> This adaptation of the MSF-OCP PACE MAKER into an intersection version is intended to enable it to be used by the other OCs. Some passages may not fit exactly with your context or operational priorities. In case of doubt, please contact your support teams,

>The guideline is built around the MSF-OCP climate and environment roadmap.
The logistics commitments in the roadmaps of OCA, OCB, OCBA, OCG and OCP are mostly identical or very similar.
Consult your specific roadmap if necessary:
OCA / OCB / OCBA / OCG / OCP / MSF CLIMATE HUB

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For over 50 years, MSF has been helping populations affected by natural disasters. Our emergency interventions linked to climatic hazards remind us every day that global warming is leading to the multiplication and intensification of extreme weather events.

We can no longer ignore the environmental and climatic emergency in which we find ourselves, and we must ensure that we do not contribute as an organization to exacerbating the problem.

MSF is committed to halving its greenhouse gas emissions by 2030 and reducing the environmental impact of its operations. In 2023, we published our climate and environmental roadmap, in which we set ourselves over thirty ambitious quantified commitments for reducing our environmental impact, while maintaining the same quality of care as we provide today.

For logisticians, this will require fundamental changes in the way we work, so that we can make better decisions every day in the field.

The PACE MAKER is a guide for logistics teams in the field. It aims to provide theoretical and practical answers to help you understand the main climate and environmental issues that concern you and to help you develop your practices with concrete answers.

The topics addressed in this guide cover the technical fields of logistics which are our greatest levers for reducing our impact while preserving or improving the quality of care for our beneficiaries.

These practical solutions, some of which are new today, become our new standards from now on. They will continue to evolve as we progress and as we learn to deliver more responsible, high-quality logistics services for our patients.

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CLIMATE AND ENVIRONMENT ROADMAP MSF-OCP

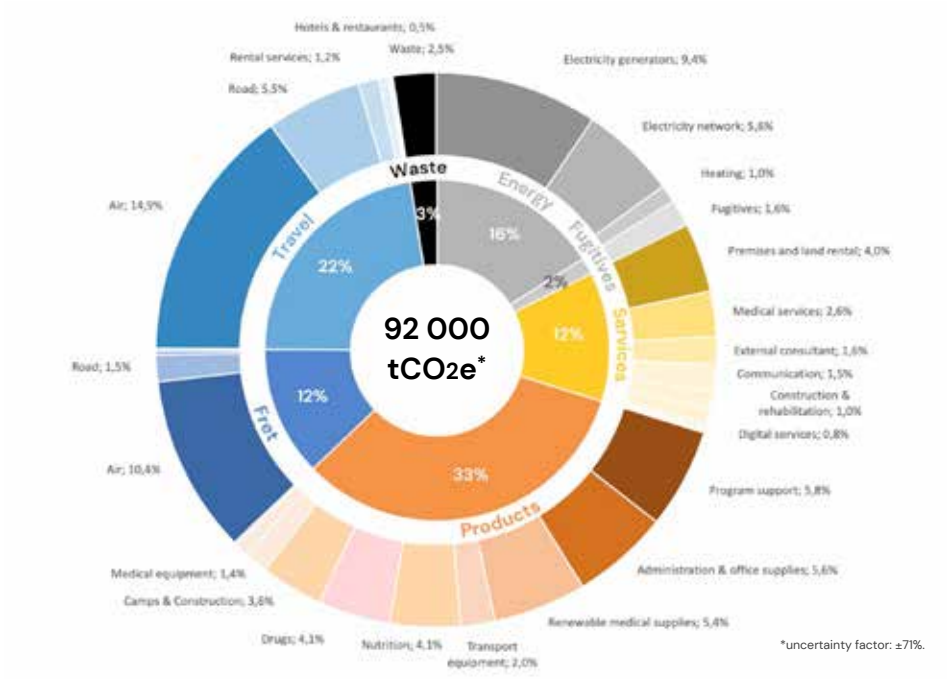
(-> FULL VERSION IN APPENDIX)

TWO OBJECTIVES

> **By 2030, divide our CO_2 emissions by 2** compared to **2019**, without carbon offsetting

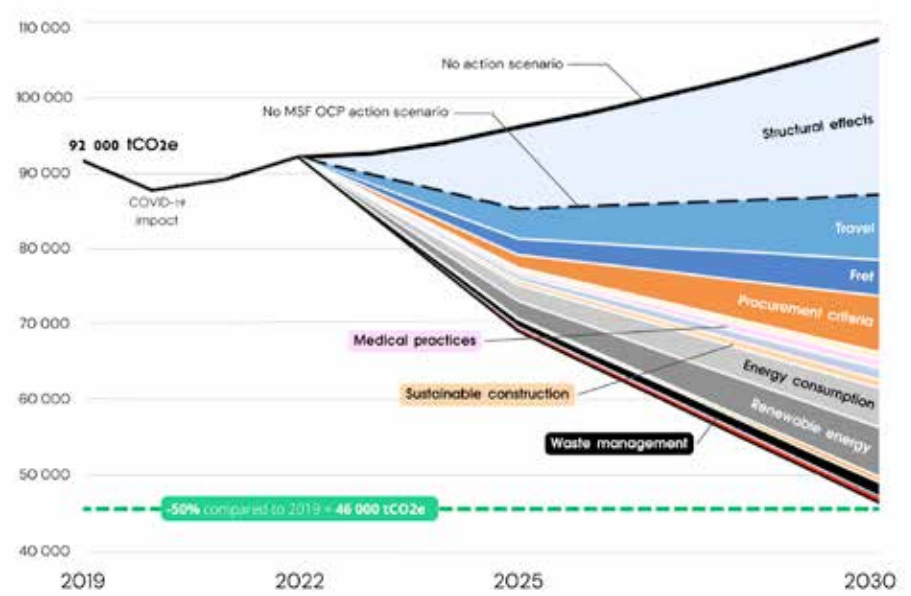
> Further reduce the **local environmental impact** of our activities

CO_2 EMISSIONS IN 2019



The 2019 reference carbon footprint takes into account all direct and indirect emissions.
All of our activity has therefore been translated into carbon equivalent, to give the result of 92,000 tonnes of CO_2 equivalent.

CO_2 EMISSIONS TARGET FOR 2030



THE PACE MAKER

The role of this logistics guideline is to make the link between the missions and the "Climate and Environment Roadmap", in order to facilitate implementation of the latter.

The book is divided into four technical families. Each section is composed of the main angles of attack and a set of simple and practical sheets to collectively meet our logistics commitments by 2030.

The Energy, Building and MFM sections are mainly concerned with the objective to reduce CO_2 emissions, whilst the Waste and Ecosystems section is mainly concerned with the objective to reduce the impact on the local environment.

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ENERGY SHEETS

BUILDING SHEETS

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GLOSSARY

ABBREVIATIONS

ESC	European Supply Center (APU, MSF Logistique, MSF Supply)
FEFO	First Expired First Out
FSM ERU	Faecal Sludge Management Emergency Response Unit
HTI	High Temperature Incineration
HVAC	Heating, Ventilation and Air-Conditioning
ICRC	International Committee of the Red Cross
IOM	International Organization for Migration
IRS	Indoor Residual Spraying
LLIN	Long Lasting Insecticidal Nets
MAP	Mise A Plat (annual planning exercise)
MFM	Motorized Fleet Management
MPPT	Maximum Power Point Tracker
MSF	Médecins Sans Frontières (Doctors Without Borders)
MTI	Medium Temperature Incineration
OCA	Operational Center Amsterdam
OCB	Operational Center Brussels
OCBA	Operational Center Barcelona
OCG	Operational Center Geneva
OCP	Operational Center Paris
OCs	Operational Centers
PACE	Programme Action Climat et Environnement (climate and environment action programme)
PC	Project Coordinator
PPE	Personal Protective Equipment
ROI	Return On Investment
RTR	Regional Technical Referent (OCG = RTS - Regional Technical Support)
UN	United Nations
WEEE	Waste from Electrical and Electronic Equipment
WFP	World Food Programme
WHO	World Health Organisation
WREC	Waste management and measuring, Reverse logistics, Environmentally sustainable procurement and transport, and Circular economy

VALUES

Complexity	Low	Medium	High
Cost	$	$$	$$$
	< 500 euros	500 - 5,000 euros	> 5,000 euros
ROI	Rapid	Intermediate	Long
	< 1 year	1 year - 5 years	> 5 years

SYMBOLS

Practical information, additional information

Caution

SPECIFICITIES PER OC

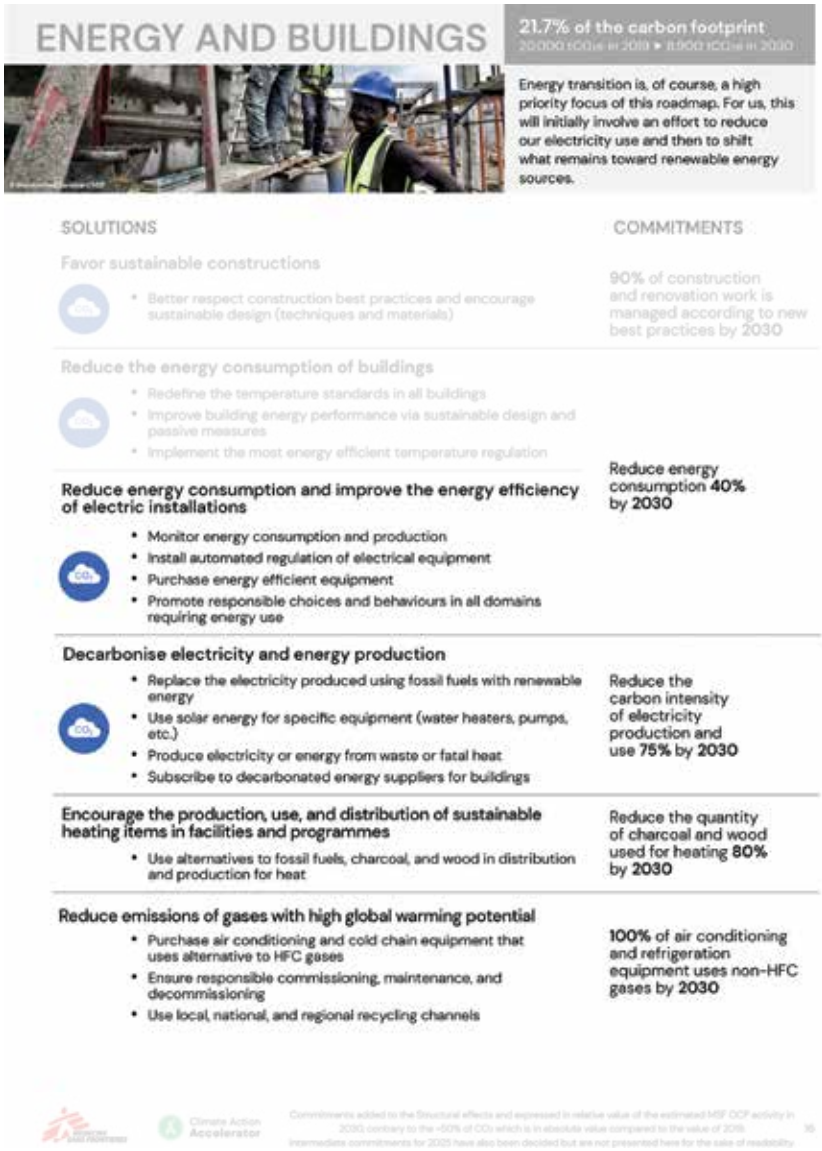
> Tool names:

	Energy follow up tool	Fleet and maintenance management tool
OCA	LRS	LRS
OCB	Telemetry	Track My Stuff
OCBA	MyFleet	MyFleet / Akiba / TrackMyStuff
OCG	Track My Stuff	Track My Stuff
OCP	MEMO	MEMO

> Article codes:
Some of the article codes in this guideline are not subscribed by all the OCs. Consult them on www.unicat.msf.org and refer to your RTR or Technical Referent if necessary (Technical Referent = Technical Advisor at OCA and Technical Team Leader at OCB)

ENERGY

MSF-OCP CLIMATE AND ENVIRONMENT ROADMAP
-> "ENERGY AND BUILDINGS" SECTION



N.B. see Building part for blurred points

MAIN ANGLES OF ATTACK AND PRINCIPLES TO ACHIEVE THEM:

MAIN ANGLES OF ATTACK:

> 100% of sites will be equipped with the appropriate energy measurement tools before the end of 2025, in order to be able to best choose and size energy sources and equipment
> 100% of purchased air conditioners will be of the inverter type
> Projects have been made aware of best energy practices
> MSF temperatures are known and respected by users of air conditioners
> The proportion of renewable energies in MSF's overall energy mix increases by 10% per year until 2030
> 100% of purchased equipment that uses refrigerant gas uses the least environmentally harmful gas available in the country

PRINCIPLES TO IMPLEMENT ON ALL MISSIONS TO ACHIEVE THIS:

> Measurement tools are ordered, installed, monitored by identified personnel and the data is entered monthly into the follow up tool
> Low power consumption equipment is preferred
> Energy best practices and MSF temperatures are communicated, reiterated and displayed
> Air conditioners are ideally locked on MSF temperatures
> Alternatives such as solar, synchronised generators etc. are considered during each budgeting / generator purchase
> The notion of return on investment is taken into account in budgetary decisions
> Purchasers are trained in technical specifications with an environmental impact (inverter, refrigerant gas, etc.) and technicians are equipped and trained in maintenance best practices

ENERGY SHEETS

A

REDUCE ENERGY CONSUMPTION AND IMPROVE THE ENERGY EFFICIENCY OF ELECTRIC INSTALLATIONS

1. Why implement monitoring of energy consumption and production?
2. What equipment is recommended to measure energy consumption and production?
3. What are generally the largest energy consumers on a project, in an office or at a guest house?
4. How to choose an air conditioner?
5. What are the expected temperatures by type of room / service?
6. How to ensure compliance with set temperatures on air conditioners?
7. How to automatically switch off air conditioners and other equipment in the office at night?
8. At what point is an automated central HVAC system interesting?
9. How to choose an electric water heater?
10. How to choose an electrical appliance?
11. How to choose a light bulb or tube?
12. How to ensure good lighting in the right places?
13. How to automate lights in certain places?
14. Why is inverter type equipment preferred?
15. What are the "energy" best practices to follow in MSF infrastructures?
16. What are the points to note at the pharmacy regarding unnecessary overconsumption?
17. Why does proper maintenance of air conditioners and fridges/freezers reduce energy consumption?

B

DECARBONISE ELECTRICITY AND ENERGY PRODUCTION

1. What are the alternatives to energy produced from fossil fuels?
2. What is an energy mix?
3. When is a solar installation relevant?
4. What type of solar installation to choose?
5. What type of battery to choose for a solar installation?
6. When to install a solar air conditioner?
7. When to install a solar pump?
8. When to install a solar water heater?
9. How to limit and manage waste from solar installations?
10. Why is correct sizing of a generator important?
11. What is the advantage of synchronising 2 generators?
12. When to use a city power grid phase selector?
13. What is the cost to use and the CO_2 emitted from a piece of equipment?

C

ENCOURAGE THE PRODUCTION, USE AND DISTRIBUTION OF SUSTAINABLE HEATING ITEMS IN FACILITIES AND PROGRAMMES

1. What are the alternatives to charcoal and wood for cooking and heating water?

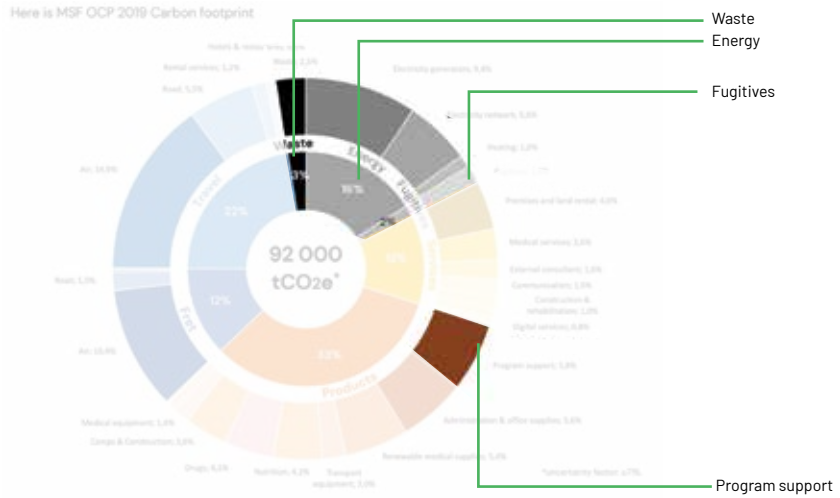
D

REDUCE EMISSIONS OF GASES WITH HIGH GLOBAL WARMING POTENTIAL

1. How to navigate the different refrigerant gases?
2. How to reduce refrigerant gas emissions at MSF?

"TRULY CLEAN ENERGY IS THAT WHICH IS NOT USED"

CO_2 IMPACT ON:



A-
REDUCE ENERGY CONSUMPTION AND IMPROVE THE ENERGY EFFICIENCY OF ELECTRIC INSTALLATIONS

WHY IMPLEMENT MONITORING OF ENERGY CONSUMPTION AND PRODUCTION?

OBJECTIVES

Reduce energy consumption, identify the best energy sources, save money

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

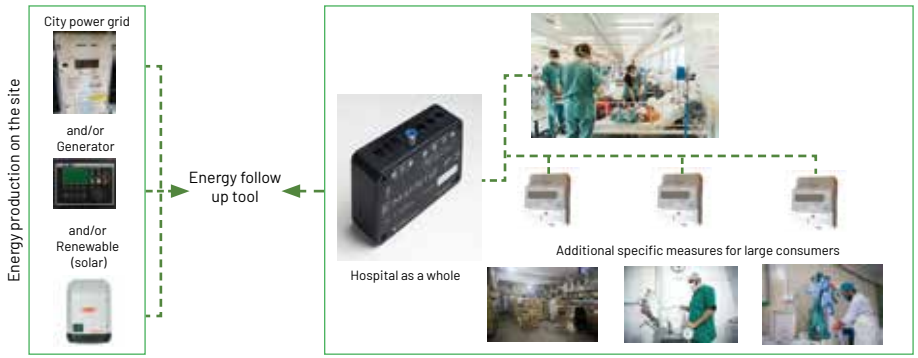
To optimise energy management on your project, there are 2 main areas of focus:

> Management of energy consumption: analyse the consumption and the peaks during a day / month / year, identify the main consumers, follow the evolution over time, etc. with the goal of finding solutions to minimise consumption whilst ensuring the quality level required for activities.

> Management of energy production: choose the best technical solutions for main energy production and backup, depending on your energy consumption together with the context, and size them correctly to optimise the investment, the operational costs and the environmental impact.

Monitoring of energy consumption and production is the first step to optimising this energy management. It's on the basis of the collected data that you can make the right decisions.

Example measurement tools on a hospital site:



Every MSF site (healthcare structure, pharmacy, office, guest house, etc.) is equipped with suitable measurement tools (**>>> see sheet Energy A-2**) and the data is entered monthly into the follow up tool to be able to take advantage of it.

This allows to:

> Optimise the selection and sizing of energy sources and equipment in order to best respond to operational needs, save money in the medium term and reduce our CO_2 emissions

> Rapidly determine if your installation can respond to an evolution of activity ***(e.g. extension of a medical service, supplying new energy intensive equipment, etc.)*** or identify the best solution to achieve this

> Reorganise the allocation of energy production resources at mission level if necessary

> Perform an energy performance diagnosis of buildings in order to ensure the optimisation of our energy consumption **>>> see sheet Building B-1**

> Enable exchanges with the RTR or the Technical Referents and best prepare for "Facilities are visited by an MSF electrician 6 months after opening and every 18 months (10 months for OCA) thereafter" -> Basics: Energy

> Define new deployment standards that are more environmentally friendly in the medium term, based on reliable data and feedback ***(e.g. 65kVA generator -> 33kVA generator + solar kit)***

> Monitor the impact of our efforts compared to the objectives of the MSF 2030 climate and environment roadmap

To be able to take readings and enter them into the follow up tool monthly, analyse the data, make good decisions and implement them, it is necessary to have suitable human resources. Determine how these responsibilities are shared within your Log team.
Reminder: the Energy Technical Policy specifies the minimum number of electricians required per projet or mission.

Take inspiration from your fuel consumption follow-up procedure to collect and enter your energy data on a monthly basis.

If necessary, ask your follow-up tool's support team to help you fill in and exploit the data.

For more information about energy data
>>> see sheet Energy B-2

CONCRETE EXAMPLE

An oversized generator can consume 3 to 5 times more fuel for the same energy consumption. 1 litre extra per hour 24/7 = ± 13,000 euros of diesel and 29 tonnes of CO_2 extra per year...

WHAT EQUIPMENT IS RECOMMENDED TO MEASURE ENERGY CONSUMPTION AND PRODUCTION?

OBJECTIVES

Collect reliable and useful data, streamline measurement tools to facilitate use and support

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

TABLE OF MOST COMMON MEASUREMENT TOOLS AT MSF

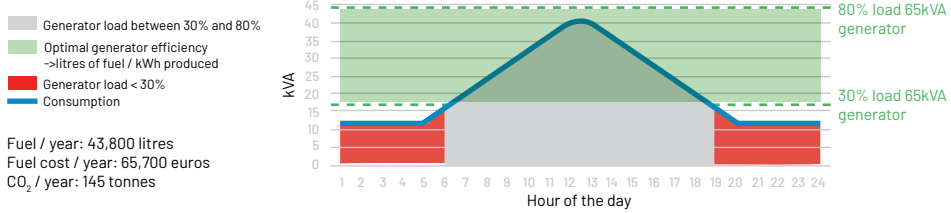
Equipment	MSF Code	Image	Remote access	Price (€)	Notes
Measurement tools requiring careful readings at defined intervals (such as fuel consumption follow up)					
Customer meter (mono phase / three phase depending on contract)	n/a		Rarely (only if online monitoring is available in the customer account webpage)	n/a	The customer meter shows the kWh. Calculation of energy supplied by the city power grid = kWh at end of month - kWh at start of month. The monthly invoice can also be used to collect the data, where appropriate.
Generator control panel (mono phase / three phase)	n/a		No	n/a	Allows the load and overloads (alerts) to be monitored. Recent models with the Deepsea panel give the consumption and the peaks.
Inverter or MPPT charge controller	n/a		Yes (if connected)	n/a	Generally allow the daily, weekly and monthly solar production to be seen directly on the screen of the inverter or MPPT charge controller.
Energy meter (mono phase)	PELECOMMW18		No	60	Recommended for monitoring small electrical installations or monitoring the specific circuit of energy intensive equipment ***(e.g. air conditioner)***. Allows the consumption and peaks to be monitored.
Energy meter (three phase)	PELECOMMW38		No	134	Recommended for monitoring small electrical installations or monitoring the specific circuit of energy intensive equipment ***(e.g. air conditioner)***. Allows the consumption and peaks to be monitored.
Measurement tools with automatic recording					
Emonio P3 (mono phase / three phase)	PELEMEASAEH		Yes (using WiFi) + recording on a memory card	1126	To install in all structures with multiple energy sources and visibility of presence of at least 1 year. Easily moved. In addition, energy meters can be interesting for monitoring specific installation (see above) circuits.
Socomec DIRIS A-40 (mono phase / three phase)	PELEMEASFS4		Yes (using LAN) + recording on a memory card	856	Similar equipment to that above. Allows direct reading. On the other hand, more difficult to move and requires a cable connection to the internet.

The selection of measurement tools for your project must be done in consultation with your RTR or Technical Referent.

Consider defining the split of responsibilities within your Log team for monthly data readings.
Ask for support from your RTR or Technical Referent for these tools, if necessary.
You can also consult the MSF Climate Smart platform.

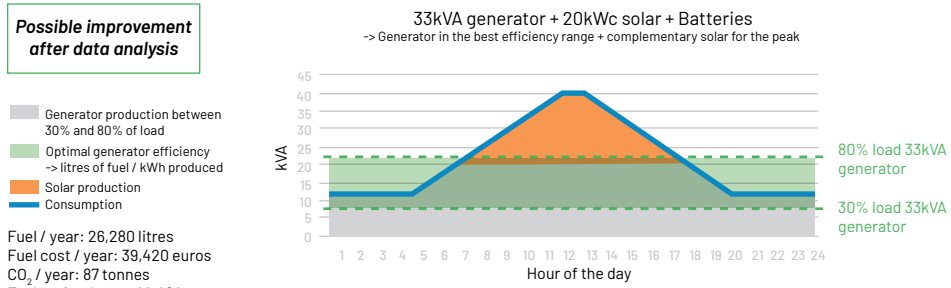
Example use of data

Initial situation



Fuel / year: 43,800 litres
Fuel cost / year: 65,700 euros
CO_2 / year: 145 tonnes

Possible improvement after data analysis



Fuel / year: 26,280 litres
Fuel cost / year: 39,420 euros
CO_2 / year: 87 tonnes
Fuel saving / year: 26,280 euros
ROI solar part: ±3 years

This change allows to:
> Have a smaller generator and therefore lower fuel consumption **>>> see sheet Energy B-10**
> Optimise the operating range of this generator between 30% and 80% load, to benefit from the best efficiency of litres of fuel / kWh produced
> Use solar energy for peak consumption during the day

In the initial situation with the 65kVA: the load is below 30% for 11h per day -> the efficiency is therefore comparable to a vehicle travelling 20km in first gear at 3,000 rpm... the distance can be travelled but at the cost of significant consumption for few kilometres and premature wear of the vehicle.

CONCRETE EXAMPLE

In Bangui in the Central African Republic, a DIRIS was installed at the electricity distribution board and energy meters in every building to make readings since 2018. This made it possible to re-evaluate and decrease the power of the generator, making significant fuel savings
>>> see sheet Energy B-10

WHAT ARE GENERALLY THE LARGEST ENERGY CONSUMERS ON A PROJECT, IN AN OFFICE OR AT A GUEST HOUSE?

OBJECTIVES

Prioritise actions to reduce energy consumption, save money

Complexity **Medium**
Cost **n/a**
ROI **n/a**

1- AIR CONDITIONERS

These alone account for between 50% and 80% of the electricity consumption of a project! Their number has been continuously increasing over the last fifteen years. At the same time, to cope with this increasing energy demand, the number of generators (and their fuel consumption) have also considerably increased.
Example: in 2010 an MSF office without air conditioning used a generator of ±11kVA whereas nowadays it needs to be ±65kVA.
Air conditioners are also responsible for emissions of gases with a high "global warming potential" into the atmosphere
>>> see sheets Energy D-1 & D-2.

However, MSF cannot manage without this indispensable technology in certain situations. On the other hand, there is considerable room for improvement in:
> The methodology to follow to identify the technical solution(s) to be implemented to reach the desired temperature (and therefore not to opt for air conditioners systematically!)
>>> see sheet Building B-6
> Compliance with best practices by users
>>> see sheets Energy A-5, A-15, A-16 and **Building B-2**
> Maintenance
>>> see sheet Energy A-17

2- WATER HEATERS

Conventional water heaters with a resistance powered by electricity to heat water are also very energy intensive. A current 200 litre model for a house consumes 2,400W during ±6 hours per day to heat this volume of water... that's equivalent to lighting 480 5W LED bulbs for 6 hours...
The choice of equipment has a significant impact on consumption
>>> see sheets Energy A-9 & B-8

3- APPLIANCES

In this category there are two types of equipment that need special attention: fridges/freezers and water coolers. In effect, their condition and/or their number can noticeably impact energy consumption
>>> see sheets Energy A-10 & A-17

4- LIGHTS

It's by their number that they influence energy consumption. The points of attention are:
> The type of bulb or tube
>>> see sheet Energy A-11
> The position and the number of lights
>>> see sheet Energy A-12
> Automation
>>> see sheet Energy A-13

Example distribution of energy consumption in an office or guest house

Air conditioners	65%
Water Heater	15%
Appliances	12%
Lights	5%
Others	3%

This classification allows a global vision. It is nonetheless important to implement monitoring of your own energy consumption and production to have a finer reading to prioritise your actions and monitor the impact
>>> see sheets Energy A-1 & A-2

CONCRETE EXAMPLE

At the hospital in Bangladesh, air conditioners account for 80% of the energy consumption.

HOW TO CHOOSE AN AIR CONDITIONER?

OBJECTIVES

Reduce the environmental impact of air conditioners, reduce the power of energy sources, save money

Complexity **Medium**
Cost **$$**
ROI **Rapid**

ATTENTION

Before choosing an air conditioner, have you:

> Followed the selection methodology of the best technical solution(s) to reach the MSF temperature?

>>> see sheet Building B-6

> Paid particular attention to the insulation of the room to be air-conditioned?

>>> see sheets Building B-9 to B-11

These points must be carefully evaluated because even if you choose an air conditioner, these other solutions can reduce the consumption of the air conditioner by 40%... which is not trivial, given that air conditioners account for 50% to 80% of the total consumption of a project.

STEPS TO CHOOSE AN AIR CONDITIONER

1- SIZING OF THE AIR CONDITIONER

This is an important step because an under-sized air conditioner leads to an over-consumption of energy, reduces the lifespan of the equipment and does not guarantee to be able to reach the desired temperature. Conversely, an over-sized air conditioner results in an unnecessarily expensive purchase.

To determine the size use the tool "Air Conditioning Calculation FR-ENG" -> there are numerous parameters to take into account

2- TECHNICAL SPECIFICATIONS OF THE AIR CONDITIONER

> Type of installation -> see table

> "Inverter" technology obligatory if available

>>> see sheet Energy A-14

> Reversible (heating/cooling) if necessary (-> if cold seasons)

> Refrigerant gas type R290 or otherwise R32 where the market allows it

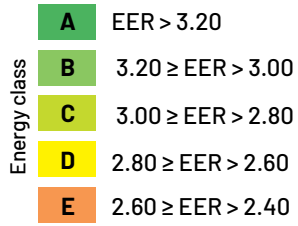
>>> see sheets Energy D-1 & D-2

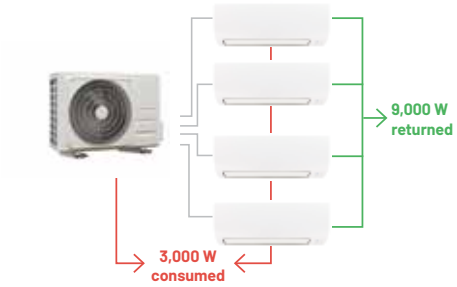
> Energy Efficiency Ratio (EER)*: generally between 3 and 4 for conventional air/air air-conditioners. The more it tends towards 4, the better its efficiency -> allows for offer comparison.
Check that the other technical specifications are the same when you compare the EER (e.g. climate class T1, T2, T3, etc.)

Type of installation		Use
Monobloc Window		Not recommended: inefficient and energy consuming
Mobile		
Split		Services, offices and guest houses
Monobloc "Cabinet"		Large pharmacies

3- LOCAL PURCHASING PROCEDURE

Take care to discuss the details of installation, guarantee, maintenance and availability of spare parts, depending on your situation.





* The Energy Efficiency Ratio (EER), which determines the energy class, compares the power consumed to the power returned when heating or cooling. The larger the difference, the more efficient the equipment is. In this example, the EER is 3 -> it consumes 3,000W to give 9,000W of cooling (take care to compare the same units of measurement -> see conversion tool in "Air Conditioning Calculation FR-ENG").

Always have your air conditioners installed and maintained by qualified people. This has a direct impact on their proper functioning (and therefore their energy consumption) and the risk of leaks of gas with high "global warming potential".

An air conditioner requires a monthly/quarterly maintenance plandepending on its location.
This is also a point to consider before opting for an air conditioner

>>> see sheet Energy A-17

CONCRETE EXAMPLE

In Monrovia, the pharmacy's 44kVA generator was overloaded. Instead of purchasing a 65kVA generator which would have consumed more fuel, they replaced the ON/OFF air conditioners with inverter models to reduce the energy consumption by 25% and avoid peaks.

WHAT ARE THE EXPECTED TEMPERATURES BY TYPE OF ROOM / SERVICE?

OBJECTIVES

Reduce energy consumption considerably, comfort of people, save money

Complexity **Low**
Cost **$**
ROI **Rapid**

Respecting MSF temperatures is the action with the most impact and the simplest to implement, in order to achieve the commitment of energy consumption reduction of the MSF climate and environment roadmap.

Air conditioners alone account for between 50% and 80% of the energy consumption of a project! A set-point temperature of 25°C instead of 20°C can halve consumption, depending on the context.

We can no longer allow ourselves to have air conditioners set to the minimum by default ***(e.g. 17°C)***, that are working with the windows or doors open and that are left on unnecessarily ***(e.g. in an office in the night)***.
We must make this change of habit collectively.

At a personal level, it is also good to know that temperature differences > 6°C between the inside and outside can result in increased fatigue, headaches, nausea and other more or less serious symptoms.

MSF TEMPERATURES BY ROOM / SERVICE	
ROOM / SERVICE*	**TEMPERATURES**
Office	25-32°C (if air conditioned)
Guest house	
Pharmacy**	25°C (min 15°C in cold climates)
Operating theatre	19-23°C
Intensive care	22-26°C
Radiology	<35°C

** This table includes services that are generally air-conditioned.*
For services that are not mentioned, contact your referent.

*** Standard to be adhered to*

It is therefore not necessary to switch on air conditioners if the temperature is equal to or below the temperatures in the table!

The temperature in a room is only one of 6 parameters that influence the thermal comfort of a person
>>> see sheet Building B-2

Temperatures in the services are defined by headquarters medical department, depending on the needs of patients, staff and the medical articles / equipment.

Logistics now assesses the best solution, on a case-by-case basis, to reach the MSF temperature, starting with passive measures then active measures if necessary
>>> see sheet Building B-6

Display this sheet together with **sheets Building B-2** and **Energy A-15** in MSF infrastructures, to make teams aware of MSF best practices.

CONCRETE EXAMPLE

One single air conditioner set 5°C below the recommended temperature potentially costs the mission an extra 1,000 euros every year if electricity is produced by a generator
>>> see sheet Energy B-13

HOW TO ENSURE COMPLIANCE WITH SET TEMPERATURES ON AIR CONDITIONERS?

OBJECTIVES

Reduce energy consumption, extend the lifespan of air conditioners, save money

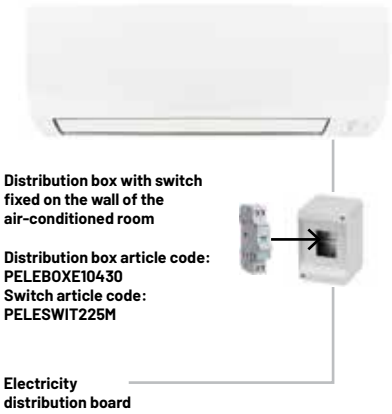
Complexity **Medium**
Cost **$**
ROI **Rapid**

Air conditioners account for between 50% and 80% of a project's energy consumption!
This major environmental footprint can be halved, depending on the context, by respecting best practices and adhering to MSF temperatures for all missions and headquarters
>>> see sheets Energy A-5, A-15, A-16 and **Building B-2**
Together we must all change our habits.
Further, this represents a considerable amount every year that is spent unnecessarily on energy, to the detriment of the beneficiaries
>>> see sheet Energy B-13

IF RAISING AWARENESS IS NOT SUFFICIENT, HERE ARE 2 TECHNICAL SOLUTIONS FOR CONTROLLING SET TEMPERATURES

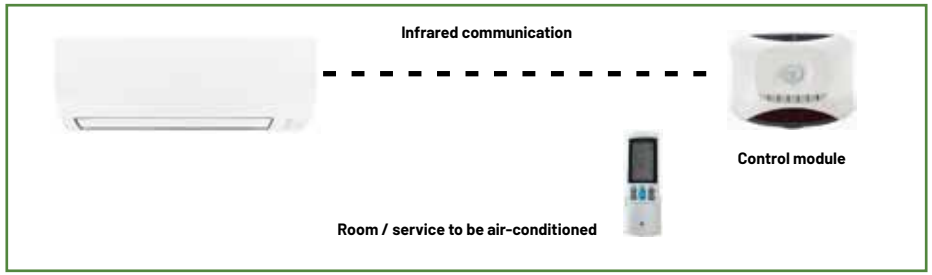
OPTION 1
An on/off switch for the users, instead of the remote control.

In this case, when the air conditioner is turned on with the switch on the power cable, the set temperature will always be that which has been pre-programmed by logistics with the remote control.



Use a suitable switch rated for the power of the air conditioner.
Conventional switches for lighting circuits are not suitable.
The MSF item opposite can be used up to 25 A

OPTION 2
Kit composed of a control module with movement detector to be installed in the air-conditioned room/service, a remote control and one or more open door/window sensor(s).



This kit can be used with any air conditioner equipped with a remote control to :
> Set a fixed set-point temperature,
> Automatically switch off the air conditioner if the door/window is open or if there is no movement in the room.

Article code -> contact your RTR or Technical Referent

To ensure that air conditioners are switched off during hours of absence (night, weekend, etc.) use programmable timer switches
>>> see sheet Energy A-7

Various devices that automatically switch off "split" air conditioners when a window is open are currently being investigated by the Technical Referents. This system is already installed in the windows at head-quarters, which uses a centralised HVAC system.

CONCRETE EXAMPLE

Option 2 will soon be installed in offices in Haiti.

HOW TO AUTOMATICALLY SWITCH OFF AIR CONDITIONERS AND OTHER EQUIPMENT IN THE OFFICE AT NIGHT?

OBJECTIVES

Reduce unnecessary energy consumption, save money

Complexity	**Medium**
Cost	**$**
ROI	**Rapid**

Many pieces of equipment are switched on day and night, even though they are only used, for example, during office hours. This is a considerable and unnecessary energy expenditure every year.
Example equipment that can be switched off during the night in the office: air conditioners, water coolers and heaters, printers, screens and computers, etc.

Simple solutions exist to avoid this wastage -> programmable timer switches

Draw up a list of equipment to automatically switch off at night

Does this equipment have a dedicated circuit on the electrical distribution board?

Module to put in the electrical distribution board.
Allows different programmes for each day of the week ***(e.g. different between weekdays and the weekend)***
MSF code : PELECOMMTL216

+/- 150 euros

Is this equipment on a circuit that cannot be switched off in its entirety and is the equipment provided (or might be) with a plug?

Allows only the same programme for all days of the week

+/- 10 euros

Allows different programmes for each day of the week ***(e.g. different between weekdays and the weekend)***

+/- 20 euros

In general, these timers support a maximum current of 16A (= ±3,500W) → pay attention to the quality of the item and to the sum of the loads you connect to it. The module for the electrical distribution board (left) can be used for more than 16A by adding a contactor → interesting for switching all the air conditioners in an office, for example.

Installing timers does not mean it's no longer necessary to pay attention during the time the equipment is powered. For example, continue to switch off air conditioners when you leave your office.

This sheet has focused on the office where there are always savings to be made, but the same logic can also be applied to other MSF buildings (care structures, guest houses, warehouses, garages, etc.).

CONCRETE EXAMPLE

In Yemen, the electrician will install a timer module + contactor in the electrical distribution board to switch off all the office air conditioners in the night and at weekends because the employees very frequently forget to do so. These oversights cause totally useless consumption peaks of 20,000W on the generator.

AT WHAT POINT IS AN AUTOMATED CENTRAL HVAC SYSTEM INTERESTING?

OBJECTIVE

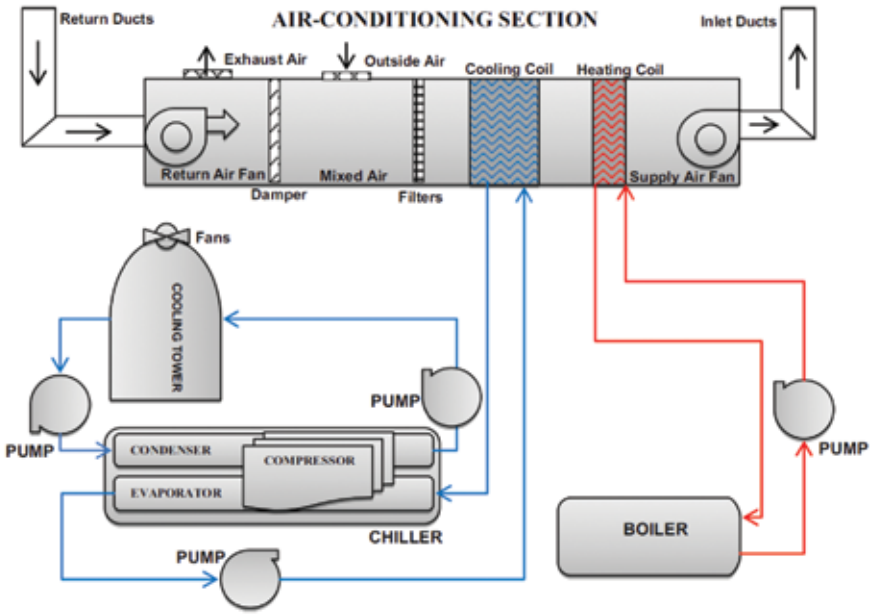
Reduce the energy consumption of large facilities

Complexity	**High**
Cost	**$$$**
ROI	**Long**

Centralised HVAC systems are reserved for very large structures, which are rare on MSF missions today.
They are more energy efficient than conventional splits but much more complex to install and maintain.

They simultaneously allow for improvement of the interior air quality and thermal comfort (hot or cold). They distribute the heated or cooled air from dedicated units at a central point to the different services/rooms using ducted ventilation throughout the building.

Set-point temperature management can be centralised and open door or window detectors can automatically cut off temperature regulation in the room.



The choice of this type of equipment must be made in consultation with the Cell and the Technical Referents. Maintenance must be sub-contracted.

CONCRETE EXAMPLE

For the moment, only a few hospitals, some rentals in buildings, headquarters and ESCs are equipped with a central HVAC system.

HOW TO CHOOSE AN ELECTRIC WATER HEATER?

OBJECTIVES
Select the right equipment for your needs, reduce energy consumption

Complexity **Medium**
Cost **$**
ROI **Rapid**

The water heater is generally the second largest consumer in a house after the air conditioning
>>> see sheet Energy A-3
Its selection is therefore worth special attention, to reduce energy consumption as far as possible.

WATER HEATER TYPES

STORAGE WATER HEATERS

⊕ Large hot water capacity
⊖ Energy-consuming

Suitable for: a whole house (bathroom, kitchen, etc.).
100 litre model = for 2 people
200 litre model = for 4 people

Points to note:
> "Steatite"* heating elements are preferred over immersion elements*. They are less sensitive to limescale, which has the effect of increasing the energy consumption when it covers the element
> Vertical models are preferred over horizontal models because the contact area between the hot water and cold is less significant
> They must, if possible, be installed close to the largest consumer of hot water (the bathroom) to limit the loss of hot water in the pipes

+/- 250 euros

Depending on your contract or availability of electricity and your consumption peaks over 24 hours, it can be useful to run this type of water heater at night -> 2400W consumption during ±6h for a 200 litre model
>>> see sheet Energy A-7

Night & Day Switch: PELECOMMN3220
Programmable Time Switch: PELECOMMTL216

Remember to switch off the circuit breaker of water heaters in dwellings or other property that is temporarily unoccupied!

Solar water heaters are preferred whenever the expected presence in the building is estimated to be over two years
>>> see sheet Energy B-8

INSTANTANEOUS WATER HEATER

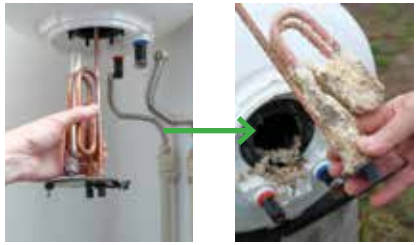
⊕ Only heats the hot water consumed, cheaper to buy,
⊖ Low flow, very energy-intensive over short periods (preferably on a city electrical network and to be avoided on a generator)

Suitable for: the kitchen in an office -> avoids continuously heating a storage water heater for very limited use

+/- 100 euros

*** Difference between "steatite" and "immersion" elements:**

STEATITE
no direct contact with the water
-> element in a sheath



IMMERSION
element in direct contact with the water
(generally cheaper)

Thermodynamic water heaters are another interesting alternative to conventional storage water heaters. At the moment, they are not very widespread in our mission countries but that should change by 2030.

CONCRETE EXAMPLE

In Yemen, the conventional storage water heaters at the hospital are powered during the day with solar energy production on the roof. This considerably reduces the consumption from the city electricity supply.

HOW TO CHOOSE AN ELECTRICAL APPLIANCE?

OBJECTIVES
Have equipment that meets our needs, reduce energy consumption, save money

Complexity **Low**
Cost **$**
ROI **Intermediate**

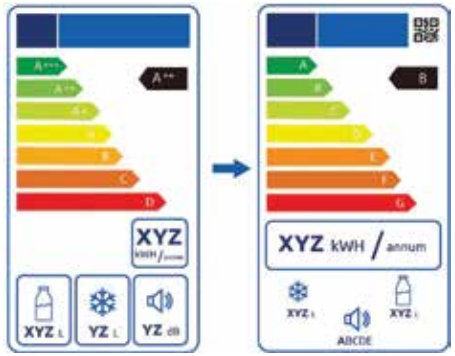
1- THE NEED

The starting point is the confirmation and identification of the need. It does not make any sense to purchase a 300 litre domestic fridge for an MSF 1-person apartment. The same goes for the sizing of the washing machine, the number of water coolers, etc.

EQUIPMENT / PERSONS	GUEST HOUSE / HABITATIONS				Office
	1 person	2 people	4 people	> 4 people	
Fridge & freezer combined	100 to 150L	150 to 250L	250 to 350L	> to 350L	± 150L
Domestic washing machine	5Kg	7Kg	10Kg	10Kg	n/a
Water cooler	Use fridge and a kettle				1 per floor

2- THE ENERGY LABEL

This label, which is quite common in mission countries, makes it possible to quickly assess and compare different equipment.
Be careful to compare the same scale of values. They can evolve over time or vary according to the country of manufacture. Example opposite: a fridge rated "A++" on the old scale has moved to "B" on the new.
Beware also of counterfeit labels.



Old scale **New scale**

3- TECHNICAL ASPECTS AND AFTER-SALES SERVICE

> Prefer "Inverter" type equipment (±25% lower energy consumption). This technology is widely used for fridges/freezers and washing machines
>>> see sheet Energy A-14
> For fridges/freezers and water coolers, choose equipment that uses refrigerant gas R600
>>> see sheets Energy D-1 & D-2
> Choose recognised brands to benefit from better quality and lifespan ***(example: poor quality door seal of a fridge/freezer = increased energy consumption over time)***
> Opt for brands offering after-sales service / availability of spare parts

Question the number of water coolers and avoid models with a small built-in refrigerator. It's an energy-intensive piece of equipment that often runs 24/7.

Consider installing timer switches on equipment that can be switched off at certain times (example: office water cooler at night)
>>>see sheet Energy A-7

Use "Eco" mode on dishwashers, domestic washing machines, etc.

Perform necessary maintenance on equipment to reduce energy consumption and guarantee its lifespan
>>> see sheet Energy A-17

CONCRETE EXAMPLE

A freezer in bad condition needs to run 24h/day to maintain -18°C whereas a freezer in good condition only needs to run for a few hours per day. The purchase of a new freezer can pay for itself within a year, depending on the case.

HOW TO CHOOSE A LIGHT BULB OR TUBE?

OBJECTIVES
Reduce energy consumption, save money

Complexity **Low**
Cost **$**
ROI **Rapid**

It is strongly recommended to use LED bulbs or tubes in all lights on your projects.
LED bulbs consume 50% less that fluorescent bulbs and 80% less than incandescent bulbs. If you multiply this difference by the number of lights on your project, the energy savings are considerable.

Example with equal brightness (1,200 Lumens):
> 100 lights with 100W incandescent bulbs = 10,000W
> 100 lights with 12W LED bulbs = 1,200W
-> 8,800W difference = the equivalent of ±4 air conditioners

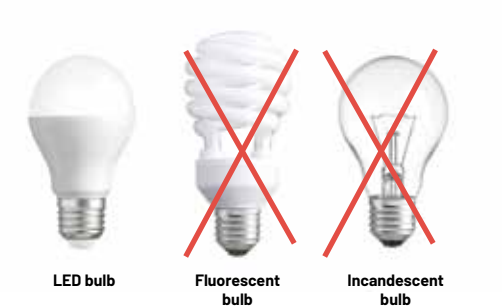
For bulbs, visually the difference is quite easy to see. Nonetheless, be careful not to confuse an LED bulb with an opaque incandescent bulb.
For tubes, the difference can be more difficult to spot.
In both cases, refer to the information on the box and/or the article.

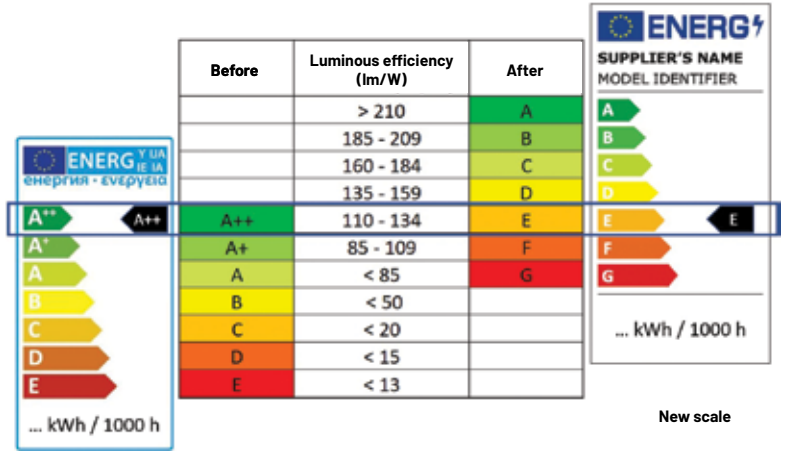
Once the LED range is identified, you should evaluate the energy performance of available articles. The energy label has become widespread in most countries. However, you must be careful to compare the same scale of values because the standards and the scales evolve over time -> see example opposite.

You can also evaluate the energy efficiency of an LED bulb or an LED tube by dividing the light output in "Lumens" by the power consumed in "Watts". Ideally, this value should be greater than 90 lm/W.

If the "lumens" are not mentioned on the article it is probably best avoided.

Choosing brands (Philips, Osram, etc.) can be a good approach but beware of counterfeits.
Build up your experience in terms of quality (lifespan, etc.) by testing the brands available locally.





Purchasing locally is preferred, availability and quality allowing. If not, go through your ESC → UniCat: PE-LELIGB

For outside lights, models with a small solar panel and integrated battery are an option to consider if there is no power supply or it is far away. These models recharge during the day and light up in the night.

CONCRETE EXAMPLE

The Madarounfa project in Niger realised that they bought LED bulbs with poor energy performance. They will soon replace these bulbs by LED bulbs with a better energy efficiency.

HOW TO ENSURE GOOD LIGHTING IN THE RIGHT PLACES?

OBJECTIVES

Work in good conditions, reduce energy consumption as needed, save money

Complexity **Medium**
Cost **$$**
ROI **Rapid**

LIGHTING REQUIRED

SPECIFICATIONS ON THE LED BULB OR TUBE

> Lumens (lm): light output
> Watts (W): power consumed (-> related to lumens to define energy efficiency: the goal is to have maximum lumens for minimum watts)
>>> see sheet Energy A-11
> Kelvin (K): determines the colour of the emitted light, from "warm" yellow ±3,000K (guest house, rest area, etc.) to "cold" blue/white ±5,000K (medical intervention rooms, hospitalization room, office, pharmacy, etc.)

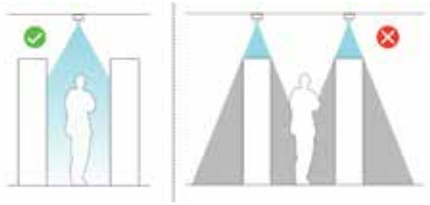
MSF LIGHTING STANDARDS

> Lux (lx): quantity of lumens necessary / m^2 depending on location (service, office, etc.). A 400 lumen bulb in an office light that illuminates $1m^2$ of the office provides 400 lux. The same bulb in the ceiling of a $10m^2$ room only provides 40 lux / m^2.

TYPE OF LOCATION	MSF LUX STANDARDS (=lumens/m^2)	EXAMPLE LIGHT
SERVICES AND ROOMS		
Corridors	150	Ceiling light 450lm every $3m^2$
Waiting room, laundry room, Log stock, guest house, etc.	300	Ceiling light 1,500lm every $5m^2$
Patient room, nursing-care, office, etc.	400	Ceiling light 1,500lm every $4m^2$
Operating theatre, maternity, laboratory, radiology, etc.	500	Ceiling light 1,500lm every $3m^2$
SPECIFIC LIGTHS		
Office lamp	400	Directional lamp 400lm
Mechanical, Biomed or Electrical workbench, etc.	1,000	Directional lamp/spotlight 1,000lm

ARRANGEMENT OF LIGHTS

A good arrangement of lights in relation to the layout and use of the room greatly influences working comfort and the number of lights necessary. In the case of a new construction or renovation it is therefore important to take account of this aspect when the electrical plans are created. In the case of an existing building, it will be necessary to organise the layout to best fit that available or to carry out improvement work.



LIGHTING CIRCUITS

> In the case of new constructions or renovations, it is recommended to divide lighting circuits over several switches, to avoid systematically turning on all the lights while some would be enough, depending on the natural sunlight available or the people present in the room
> In existing buildings, seal off, slightly unscrew or put a non-functioning bulb in unnecessary light fittings
> It is recommended to automate some circuits to avoid unnecessary consumption: exterior night lighting, corridors, sanitary facilities, etc.
>>> see sheet Energy A-13

Use as much natural daylight as possible to reduce the number of lights on during the day.

For more details → cf. Electricity Guideline (MSF/ICRC) section 6.6.6
Various smartphone apps exist to evaluate the existing lighting and to facilitate actions to undertake.

CONCRETE EXAMPLE

In the laboratory in Kinshasa, lights were placed under the shelves above the laboratory workers, to ensure optimal lighting at their workstations in addition to the general lighting of the room.

HOW TO AUTOMATE LIGHTS IN CERTAIN PLACES?

OBJECTIVES

Avoid unnecessary energy consumption, save money

Complexity **Medium**
Cost **$**
ROI **Rapid**

Automation of lights prevents them remaining on for no reason. Installation is relatively simple and inexpensive. The equipment is available from your ESC or often locally, if you have a supplier validated by the RTR or the Technical Referent.

MAIN TYPES OF AUTOMATION AT MSF

AUTOMATIC DAY/NIGHT SWITCH

The intensity of the natural daylight determines the position of the switch. It's the ideal item to control exterior night lighting. It will automatically turn on the lights at sunset and turn them off at sunrise.

MSF code: PELECOMMNA216

> Sensor cell to be placed outside (IP65) & module in the electrical distribution panel
> Maximum 1,000W or more with contactor
> Adjustable light level value
> Use to automate a large number of lights (with contactor)

MSF code: PELECOMMNL2FW

> Exterior use (IP55)
> Maximum 1,400W
> Adjustable light level value
> Use to automate up to 1,400W of exterior lighting

MOVEMENT DETECTOR

Detection of any movement turns on the lighting circuit for a preset duration. It is recommended for passageways ***(e.g. corridors, etc.)*** or areas where people are only present for a limited time ***(e.g. sanitary facilities, parking, etc.).***

MSF code: PELECOMMMLS

> For interior and sheltered exterior (IP44)
> Maximum 1,000W
> Adjustable from 10 seconds to 10 minutes
> Detects movements over 180°
> Optimal mounting height: 2.5m (detector orientation adjustable)

MSF code: PELECOMMMLS55

> For interior and exterior (IP55)
> Maximum 500W
> Adjustable from 5 seconds to 30 minutes
> Detects movements over 85°
> Optimal mounting height: 1.2m
> Can be mounted in place of a conventional switch, depending on position

Other models exist -> UniCat PELECOMMM

TIMER SWITCH

Finger pressure on the switch turns on the lighting circuit for a preset duration. This is an alternative to the movement detector.

MSF code: PELECOMMTS27M

> For interior and exterior (IP55)
> Maximum 300W
> Adjustable from 25 seconds to 15 minutes
> Can be mounted in place of a conventional switch

Automation of outdoor night lighting, hallways, sanitary facilities and locker rooms are generally the places to prioritise.

When ordering: check if you will mount protruding or recessed and order the Plexo protruding enclosures or Plexo recessed support plates accordingly.

Automation does not, however, eliminate the need to make teams aware of best environmental practices
>>> see sheet Energy A-15 → to be displayed in MSF facilities.

CONCRETE EXAMPLES

> Corridors in the Amman hospital have been equipped with movement detectors
> Outdoor night lights in Rutshuru work automatically with a day/night switch

WHY IS INVERTER TYPE EQUIPMENT PREFERRED?

OBJECTIVES

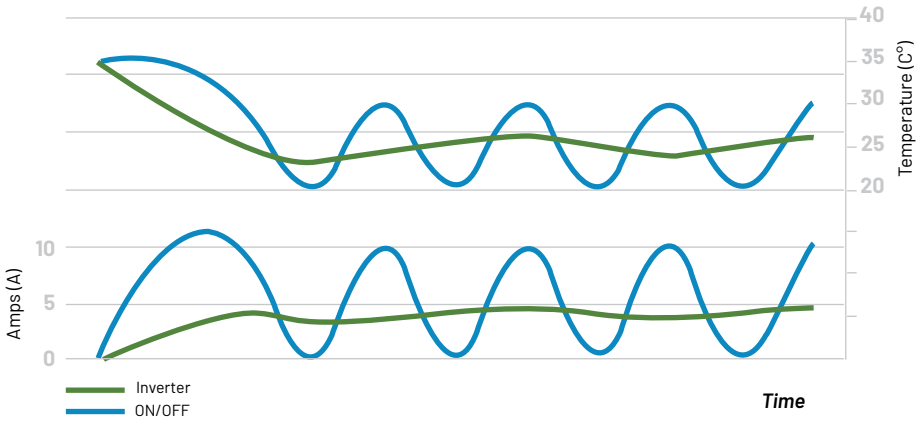
Reduce energy consumption, reduce consumption peaks for generators and/or solar installations, save money

Complexity **Medium**
Cost **$**
ROI **Rapid**

Equipment without an inverter functions in an "ON/OFF" manner, which has the following effects:
> Peaks at each startup -> which means the generator / solar installation needs to be oversized
> Increased overall energy consumption because it can only work at full power

Equipment with an inverter continually adapts its power as needed, which results in:
> No peaks at startup
> Consumption regulated depending on needs = consumption reduced by ±25%
> Longer lifespan
> More stable temperature

Room temperature and energy consumption



EQUIPMENT CONCERNED

More and more equipment is equipped with inverter technology. On our missions, this mainly concerns air conditioners (**>>> see sheet Energy A-4**), domestic fridges / freezers and washing machines (**>>> see sheet Energy A-10**).

AVAILABILITY AND PRICE DIFFERENCE

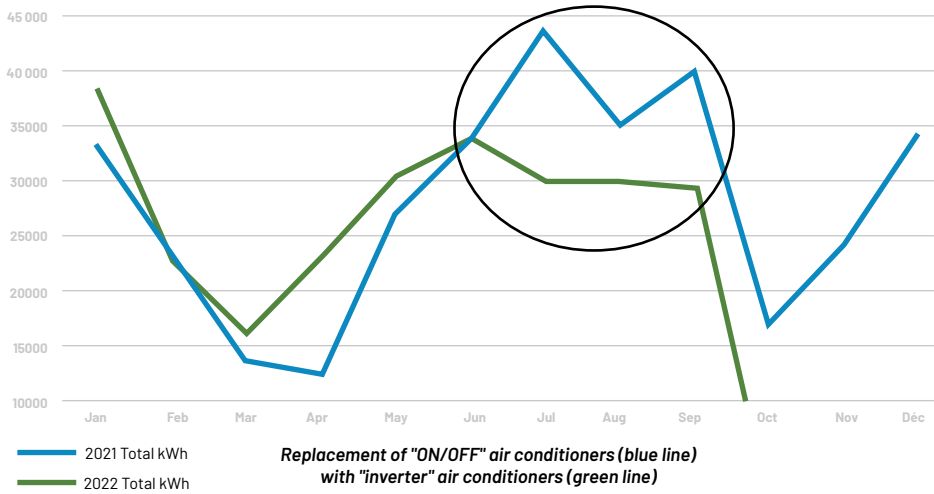
Nowadays, the vast majority of air conditioners are of the inverter type. It is nonetheless still possible to find some without inverter at generally lower prices -> they are to be banned!

Concerning the other types of equipment, both are widespread. Equipment with inverter are clearly preferred. In general, the word "Inverter" is visible on the equipment.

The price difference tends to decrease with the spread of inverter equipment and otherwise the return on investment is generally fast thanks to its reduced consumption.

An air conditioner with inverter does not mean, however, that it is "reversible" (hot/cold). This is an additional specification to check, depending on needs (→ if cold seasons).

Consumption comparison kWh 2021-2022 Project in Pakistan



Replacement of "ON/OFF" air conditioners (blue line) with "inverter" air conditioners (green line)

CONCRETE EXAMPLE

In Pakistan: the graph above clearly shows the reduction in electricity consumption (±25%) in the warm months of the year, since the replacement of "ON/OFF" air conditioners by inverter models.

WHAT ARE THE "ENERGY" BEST PRACTICES TO FOLLOW IN MSF INFRASTRUCTURES?

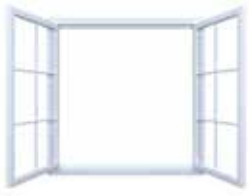
OBJECTIVES

Collaborate on a daily basis to make our environmental transition, reduce our energy consumption, save money

Complexity **Low**
Cost **$**
ROI **Rapid**

TEMPERATURE

> Natural ventilation by opening windows and/or fans (in services where this is allowed) is preferable -> ***a fan consumes ±40 x less than an air conditioner***
> When the above solutions are not enough to achieve thermal comfort, close the doors and windows then turn on the air conditioner for the recommended temperature
>>> see sheet Energy A-5
> Switch off fans or air conditioning when you leave the room (except pharmacy and appropriate medical services)



LIGHTING

> The last person to leave a room switches off the lights
> Choose natural daylight when it's sufficient

OFFICE EQUIPMENT

> Turn off your laptop at the end of the day (not just on standby)
> Switch off individual and/or communal printers
> Prefer power strips with switches on desks, to simply switch off all chargers, etc.

OTHER EQUIPMENT

Turn off water coolers and other equipment that can be switched off outside of normal hours.
Choose to install programmable timer clocks for this type of equipment.

VERIFICATION

The last person to leave the office, guest house, etc. checks that everything is properly switched off (air conditioners, lights, printer, water cooler, etc.) and that any possible windows, identified by logistics for nighttime cooling by natural ventilation, are open.

Adjusting your air conditioner to 25°C instead of 20°C can reduce consumption by ±50%, depending on circumstances.
Air conditioners account for between 50% and 80% of a project's energy consumption...
→ It's therefore important to stop setting them to the minimum temperature by default!
Temperature differences > 6°C between inside and outside are not recommended for health.

Display this sheet together with **sheets Energy A-5** and **Building B-2** in MSF infrastructures to make teams aware of MSF best practices.

CONCRETE EXAMPLE

MSF headquarters in Paris has central air conditioning that is regulated by the maintenance service at 26°C for all offices.

WHAT ARE THE POINTS TO NOTE AT THE PHARMACY REGARDING UNNECESSARY OVERCONSUMPTION?

OBJECTIVES

Reduce the energy consumption of the largest consumer of air conditioning, save money

Complexity **Medium**
Cost **n/a**
ROI **n/a**

IS THE TEMPERATURE SET TO THE MSF STANDARD?

The temperature of the pharmacy must be 25°C. There is therefore no need to cool further.
It is important to respect this rule, because the volume of a pharmacy is significant and the temperature needs to be maintained 24/7.

IS THE TEMPERATURE CONTROLLED AREA PROPERLY SIZED?

The air-conditioned volume must be consistent with the storage requirements, in order to limit unnecessary energy consumption.
Build some partitions (with insulation) if necessary!

ARE THE COLD CHAIN FRIDGES AND FREEZERS IN A SEPARATE, VENTILATED ROOM?

The compressors in this equipment release a considerable amount of heat (like the exterior unit of an air conditioner). It is therefore important not to place them in the 25°C temperature controlled room -> additional load on the air conditioner.
(As a reminder, MSF standard fridges and freezers are designed to work in an environment between 5° and 40°C and therefore don't need an air-conditioned room, except in extreme conditions).

ARE THE BEST PRACTICES KNOWN AND RESPECTED BY THE PHARMACY TEAM?

The pharmacy is the largest consumer of air conditioning at MSF, it's important that the best practices are complied with:
> No modification of the set temperature (-> 25°C in the pharmacy)
> Doors (and windows) are open for as little as possible
> The air conditioning is switched off if the pharmacy is empty (transit pharmacy, empty room, etc.)
> Any drop in performance or other air conditioning problem is reported to logistics as soon as possible

In addition
>>> see sheets Energy A-5 & A-15

If received goods / deliveries are frequent, evaluate the option of an airlock and/or an air curtain, to reduce the loss of cold air to the exterior
>>> see sheet Building B-16

CONCRETE EXAMPLE

An increasing number of MSF pharmacies set their temperature to 25°C (not lower).

WHY DOES PROPER MAINTENANCE OF AIR CONDITIONERS AND FRIDGES/FREEZERS REDUCE ENERGY CONSUMPTION?

OBJECTIVES

Reduce energy consumption, guarantee the expected lifespan of equipment, save money

Complexity **Medium**
Cost **$$**
ROI **Rapid**

The 2 main types of equipment where maintenance has a significant impact on energy consumption are air conditioners and fridges / freezers.

AIR CONDITIONERS

The filter & evaporator in the interior unit and the exchanger & compressor in the exterior unit must be cleaned according to the maintenance plan (monthly/quarterly). This is important for air quality and equipment efficiency. The dustier that these elements are, the more the equipment has to work to achieve the same result. Consumption can increase by up to 30%. This also has an impact on the equipment lifespan.
(Consult maintenance plans in your maintenance management tool).

Another point of attention is the refrigerant gas that circulates between the 2 units. Any handling during installation, maintenance or end of life must be done by qualified personnel. Most of these gases have a high environmental "global warming potential"

>>> see sheets Energy D-1 & D-2

Exchanger and compressor

Verification of gas pressure

Filter & evaporator

FRIDGES / FREEZERS

Whether it is a medical or non-medical fridge / freezer, the points of note to reduce consumption are the same:

- Install such equipment in a cool, ventilated room, away from sunlight
- Leave plenty of room around the equipment to ventilate the heat from the compressor
- Check the condition of door seals to ensure a good air-tight seal
- Defrost regularly
- Remove dust from the compressor (and the "mesh" at the back for non-medical models)
- Create inertia with bottles of water or ice packs, to reduce the effect of opening the door
- Set non-medical fridges to 4°C
- Inform users to open the door as infrequently as possible.

(Consult maintenance plans in your maintenance management tool).

To be able to follow MSF standard maintenance plans, the project must have the necessary personnel or establish a sub-contract with a qualified company. A dedicated job position is recommended for every 60 air conditioners.

If it is managed internally, think about equipping your teams → Toolkit, refrigeration cold chain / air conditioning KPR0ZFR0111 + CCLIT0OLL12P + CCLIT0OLL12S + CCLIT0OLL12- and to train them in installation and maintenance as necessary.
(The exact composition of the kit may vary depending on your OC -> consult your RTR or Technical Referent if necessary).

CONCRETE EXAMPLE

In Haiti, the Central African Republic, Liberia and South Sudan, there are full time job positions for air conditioner maintenance.

B-
DECARBONISE ELECTRICITY AND ENERGY PRODUCTION

WHAT ARE THE ALTERNATIVES TO ENERGY PRODUCED FROM FOSSIL FUELS?

OBJECTIVES
Reduce the carbon footprint of our energy consumption and production, development of renewable energy skills, save money

Complexity **Medium**
Cost **$$$**
ROI **Intermediate**

The 4 main alternatives are:

1- SOLAR POWER

"PHOTOVOLTAIC" SOLAR

This technology transforms sunlight into electricity, by means of panels formed of semiconductor cells
>>> see sheets Energy B-3 to B-7

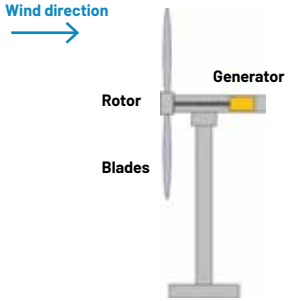
"THERMAL" SOLAR

This technology captures the heat of the sun, by means of a circuit of pipes filled with a heat transfer fluid exposed to the sun, that then heats a hot water cylinder that supplies the network of hot water to a building
>>> see sheet Energy B-8

The performance of both technologies depends on sunlight levels and the season but functions year round.
It is entirely possible to install both types on the same site because they are complementary. «Thermal» solar will reduce the need to produce electricity from «photovoltaic» solar.

2- WIND POWER

A wind turbine converts the kinetic energy of wind into mechanical energy, which is then converted into electricity. More specifically, the wind causes the blades attached to a rotor to turn, which drives an alternator.
Only works when there is wind.



3- HYDROPOWER

Hydropower (or hydroelectric power) generates electricity thanks to the force of water. This force depends either on the height of the falling water, or on the flow rate of water.
Its operation depends on the amount of water available.


Hydroelectric dam


Run-of-river plant

4- COMBINED HEAT AND POWER

This is a set of technologies in development that allow 2 types of energy to be produced simultaneously from one installation / piece of equipment.
It consists of, for example, recovering the "waste heat" from a generator's exhaust to produce hot water for the laundry room or sanitary facilities.
The same principle can be applied to the chimney of an incinerator.
Various projects are being studied at MSF to deploy this type of technology on our missions.

Solar is the main alternative encouraged by MSF to date. Its selection should be considered on a case-by-case basis. It can be complementary.

CONCRETE EXAMPLE

In 2023, the contribution of solar power in MSF-OCP's total solar/generator production is about 1%...
Our room for improvement is therefore significant!
The implementation of measurement tools (**>>> see sheets Energy A-1 & A-2**) will also enable this figure to be refined and monitored.

WHAT IS AN ENERGY MIX?

OBJECTIVES

Choose energy sources adapted to the context, reduce our environmental impact

Complexity **Medium**
Cost **n/a**
ROI **n/a**

The energy mix shows the different energy sources used and their proportion of the total. We mainly find fossil fuels (coal, gas, oil) and renewables (hydro, wind, solar) for electricity production.
This data can be at the global level (see opposite), from a country or from an organization, for example.

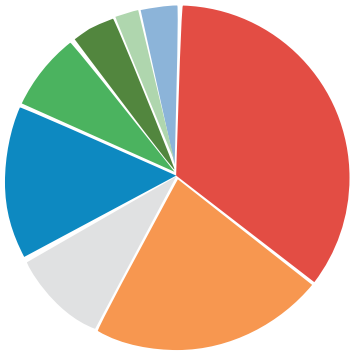
On our MSF missions, we generally find the city's power grid, generators, and solar power. Each of these 3 sources has a carbon footprint that is more or less significant.
Generators have a significant impact because of their use of fossil fuels, unlike solar power which only uses sunlight.

For the city power grid, this may be more difficult to define but statistics do exist. On the map opposite, we see that the city grid seems to be a good option in Kenya, whereas in Niger the choice of installing solar power makes sense from an environmental point of view.
Also check with energy suppliers to refine your data and guide you in your choices.

Every mission is able to see their energy mix and its evolution.
To do this, its necessary to have installed the appropriate measurement tools (**>>> see sheets Energy A-1 & A-2**), have configured these tools in the follow up tool and to make readings of the monthly production, consumption as well as peak consumption.

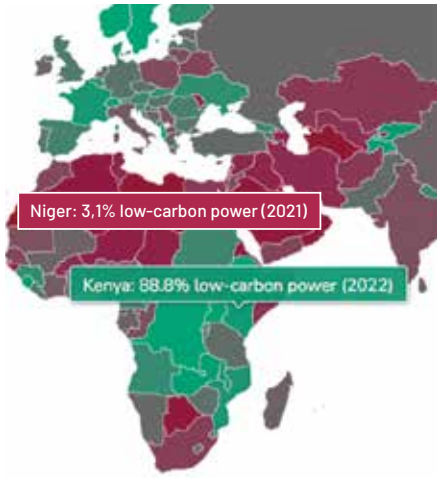
Based on this information provided each month, the follow up tool allows you to monitor:
> Energy consumption and production
> The energy mix (city power grid / generator / renewable)
> CO_2 emissions

World electricity production in 2022 : 28510 TWh



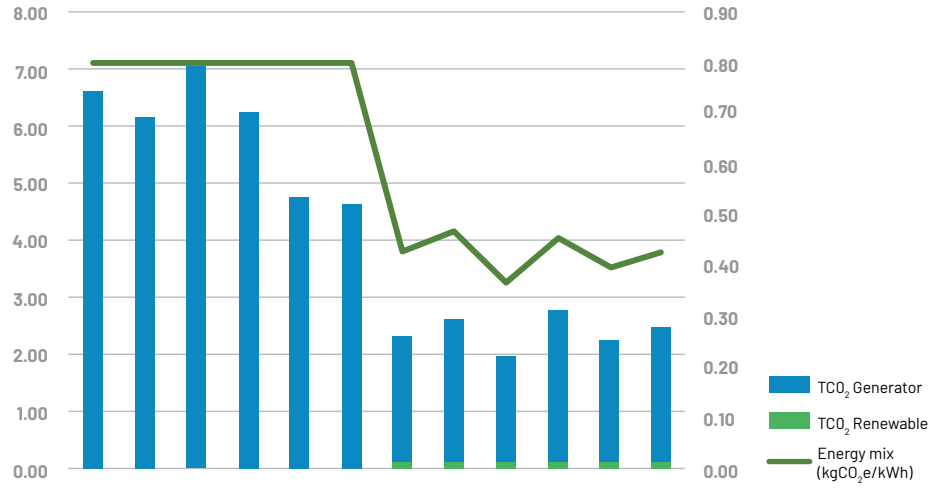
Coal	35,7%
Natural Gas	22,2%
Hydroelectric	15,1%
Nuclear	9,2%
Wind	7,6%
Solar	4,5%
Others	3,3%
Bioenergy	2,4%

Connaissance des Energies, Source : Global Electricity Mid-Year Insights, Ember



https://lowcarbonpower.org/map

In the example below, it can be seen that this project used only a generator until July with CO_2 emissions between 5 and 7 T/month. The second half of the year, the project uses a generator and solar power. The CO_2 emissions from the generator fall to 2.5T/month, the rest being produced by solar panels (thin green part at the bottom).
The energy mix (dark green line) shows the average CO_2/kWh based on the energy source used. The installation of solar allows this figure to drop from 0.8 to 0.4 $kgCO_2e$/kWh.



Do not hesitate to contact the support team of your follow-up tool if you encounter any difficulties in filling in or using the data.

CONCRETE EXAMPLE

To achieve its climate and environment roadmap target, MSF-OCP has set that all the projects and the headquarters must collectively reach an energy mix of maximum 0.5 $kgCO_2e$/kWh by 2030.

WHEN IS A SOLAR INSTALLATION RELEVANT?

OBJECTIVES

Opt for solar when it is relevant, choose the right technical solution

Complexity **Medium**
Cost **$$$**
ROI **Intermediate**

DECISION MAKING FLOWCHART

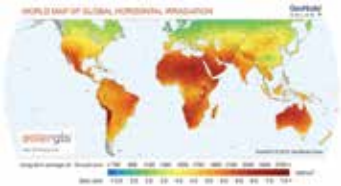
> If the need is > 10kWp: is there visibility of presence on the site for at least 2 years? (< 10kWp = considered easily movable, if required)

> Is there sufficient sunshine?

> Is there shade (trees, buildings, etc.)?

> Is the available space and orientation suitable?

> Are there any administrative formalities?

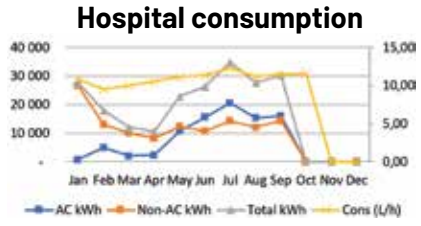


If OK →

> Is the current energy requirement optimised?
In other words, has work been done to reduce consumption?
(-> essential for any energy source but even more so for solar).

If OK ↓

> Is there monitoring of energy consumption and production, to be able to determine the best technical solution and its sizing?
>>> see sheets Energy A-1 & A-2



If OK ↓

What is the current energy source?

City power grid → What is the energy mix?

- **Acceptable** → Solar is not a top priority
- **Not acceptable** → Solar to be investigated **>>> see sheet Energy B-4**

Generator → Solar to be investigated **>>> see sheet Energy B-4**

Space allowing, an installation on the ground can be more interesting than on a sloping roof, to facilitate installation, maintenance and eventual disassembly at the end of presence on the site. However, be careful to secure the area.

For more information -> cf. Solar Guideline

CONCRETE EXAMPLE

In Sica, Central African Republic, an extension of activity requiring air conditioners lead to the installation of solar panels, to absorb this additional load during the day, instead of buying more powerful generators.

WHAT TYPE OF SOLAR INSTALLATION TO CHOOSE?

OBJECTIVES

Select the best technical response to the requirement and context, reduce fossil fuel consumption, save money

Complexity **High**
Cost **$$$**
ROI **Intermediate**

"DIRECT DRIVE" SOLAR

Generally used for powering specific equipment or to meet a limited energy requirement during the day without risk in the event of a cut-off.
Performance depends on the amount of sunlight. There is no battery for backup or storage.

Examples:
> Solar air conditioner
>>> see sheet Energy B-6
> Solar pump
>>> see sheet Energy B-7
> Medical solar fridge/freezer


Solar panels


Solar pump

SOLAR + BATTERIES + GENERATOR AND/OR CITY ("HYBRID")

Interesting installation for situations where there can be no risk of power cuts and / or there is a risk of variable amounts of sunlight.
The system primarily uses solar, stores the production surplus in the batteries and switches to the generator if the solar production is not sufficient and/or the level of battery charge is low.

Examples:
> Small hospital
> Power supply for a pharmacy (properly insulated) with cold chain and air conditioners


Solar panels

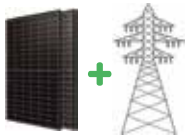

Lithium or lead gel batteries


Generator and/or city power grid as backup

SOLAR + CITY POWER GRID

Appealing installation for situations where the city electricity is expensive and/or carbon-based. Electrical consumption is primarily supplied by solar and uses the city power grid in combination when the sunlight is not sufficient and during the night.
Find out about the regulations regarding the injection of surplus solar production into the city grid.

Examples:
> Any MSF infrastructure with reliable city power


Solar panels **City power grid**

SOLAR + BATTERIES ("OFF GRID")

Interesting installation for situations where there is a need for electricity day and night, with or without a few energy-intensive consumers. Very rare at MSF because a backup is often necessary.

Examples:
> Health station
> Critical communication facility


Solar panels **Lithium or lead gel batteries**

GENERATOR + SOLAR

Interesting configuration to reduce the fuel consumption of the generator (because less load) and/or in situations in which there are consumption peaks during the day. The size of the generator can thus be limited (and therefore its consumption) and the peaks above its capacity covered by solar panels.

Examples:
> Healthcare structure with an electrical autoclave that needs to be powered for a few cycles per day
> Hospital with air conditioners only used during the day


Regular consumption **Peaks of consumption**

Other configurations are possible, depending on needs and the context.
Get in touch with your RTR or Technical Referent to define the best solution if necessary.
Include the notion of return on investment and the environmental impact in your proposal.
Solutions without batteries generally give a quick payback period, because of their "low" purchase cost.
But solutions with batteries are necessary in some cases. Particular attention must be given to the initial design and on-going management of the battery bank, otherwise their service life can be greatly reduced.

To choose the best solution, it's necessary to have energy consumption and production data `
>>> see sheets Energy A-1 & A-2.
A helpful tool for sizing a solar installation is available from your RTR or Technical Referent.

Kits of plug & play solar installations of various powers adapted to our activities will soon be available.

CONCRETE EXAMPLE

In South Sudan, a 22kVA generator that ran 24/7 in a guest house was replaced by solar panels and batteries to meet the need for 1kVA during the day and 6kVA at night -> fuel savings per year ± 17,500 litres. The ROI can therefore be quick.

WHAT TYPE OF BATTERY TO CHOOSE FOR A SOLAR INSTALLATION?

OBJECTIVES

Choose the right type of battery as needed, limit the environmental impact of batteries at the end of their life

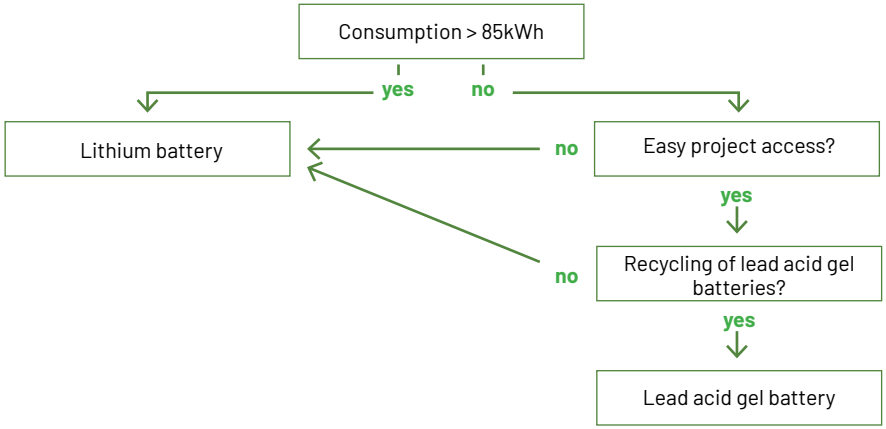
Complexity **Medium**
Cost **$$$**
ROI **Long**

BATTERY TYPES

	Lithium battery	Lead acid gel battery
+	Maintenance-free	Price
+	Capacity -> reduced volume	Maintenance-free
+	Deep cycling	Ambient T° range 5 to 35°
+	Lifespan	
−	Price (theoretically lifespan compensates for the price)	Environmental impact (if not recycled)
−	Ambient T° range 5 to 30° (-> often needs air conditioning)	Depth of charge cycle
−	Currently not recyclable in most missions (but less environmental impact than lead)	

Lead acid liquid batteries are not suitable for solar installations

If the best technical solution identified is an installation with batteries (**>>> see sheet Energy B-4)**, the choice of battery type can be defined as follows:



WHAT TO DO WITH LITHIUM BATTERIES AT END-OF-LIFE?

Lithium batteries are not currently recyclable in the vast majority of our mission countries. However, the sector is developing.
The MSF recommendation is to store them until a local solution is developed or to consider export solutions (regional or further).
Store them on a palette in a ventilated area, sheltered from the sun and rain, with adhesive tape on both terminals.
Lithium batteries that are damaged, swollen, etc. must be stored in a container with sand and treated as a priority to avoid fire risk.

Proper management of a bank of batteries (depth of discharge, temperature of the room, etc.) is essential to guarantee the desired performance and the expected service life.

A tool to help with sizing is available from your RTR or Technical Referent.

If you install an air conditioner to keep the temperature below the maximum functional temperature of the batteries, place the inverters in a separate room to avoid having to cool the warm air they give out, and properly insulate the battery room.

CONCRETE EXAMPLE

The coordination of MSF-OCP in Haiti is energy autonomous, thanks to their lithium battery solar installation. The city power grid and the generator are there as backup.

WHEN TO INSTALL A SOLAR AIR CONDITIONER?

OBJECTIVES

Reduce the power of generators and therefore fuel consumption, flexibility depending on the context

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

Solar air conditioners are generally interesting for small sites needing up to 5 air conditioners mainly during the day. Beyond that, a larger solar energy source for the entire site will generally be more appropriate.

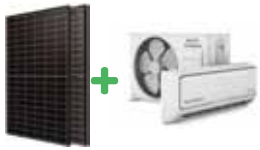
THEY MAKE IT POSSIBLE TO REDUCE:

> Generator fuel consumption
> Consumption peaks on the electrical installation
> Generator size, or avoid replacing it by a larger one when installing one or more air conditioners

THREE TECHNOLOGIES EXIST:

DIRECT DRIVE

Only sunlight powers the air conditioner. Its performance therefore varies depending on the position of the sun and the weather ***(examples: office, OPD, etc.).***



HYBRID

Primarily uses sunlight, complemented with another source as necessary (city / generator) to ensure the required temperature is reached ***(example: pharmacy, etc.)***.

AUTONOMOUS

The solar panels are accompanied by batteries which take over during the night, as necessary (more expensive solution for sites without another energy source where temperature control is important).

In all three cases, passive measures must have been implemented in advance, to reduce the sizing and load on the solar air conditioner(s):

> Protection against the sun's rays
>>> see sheet Building B-8
> Insulation
>>> see sheets Building B-9 to B-11
> Thermal inertia
>>> see sheet Building B-12

Ensure there is enough space for a proper installation of the solar panels (orientation, inclination, without shade, etc.).

All solar air conditioners are of the inverter type
>>> see sheet Energy A-14
The return on investment for direct drive and hybrid models is achieved after an average of 3 years.
This equipment is available locally, depending on the country, and from your ESC → UniCat CCLIAIRCS

CONCRETE EXAMPLES

> The pharmacy in Adré, Chad, is equipped with 2 hybrid solar air conditioners with 6 solar panels per air conditioner
> The hospital laboratory in Rutshuru, Democratic Republic of the Congo, is equipped with a solar air conditioner to reduce the demand peaks on the rest of the electrical installation

WHEN TO INSTALL A SOLAR PUMP?

OBJECTIVES

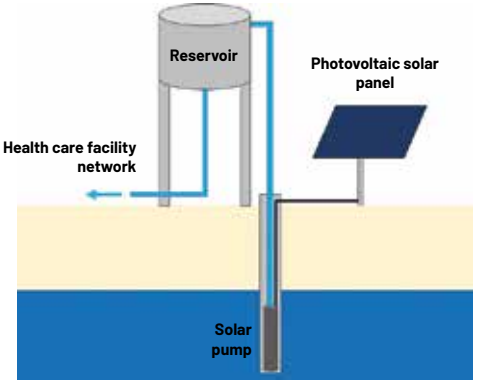
Reduce the power of generators and therefore fuel consumption, autonomous access to water

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

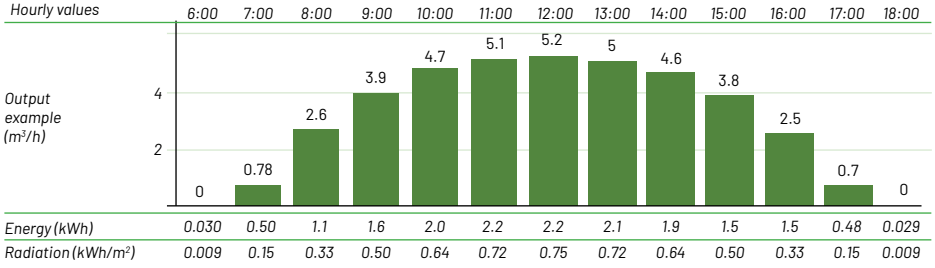
The solar pump should be considered as the choice to favour to the maximum. It is a simple, efficient, sustainable technology.

As well as giving autonomous access to water thanks to sunlight, it also reduces demand peaks on the rest of the electrical installation, and therefore potentially allows for a smaller generator or only solar power, depending on circumstances.

The vast majority of MSF solar pumps work "directly" without batteries. The pump's flow rate therefore varies depending on the sunlight.



This type of installation requires an adequately sized reservoir placed high up, to be able to provide water by gravity feed during the night, when the solar panels are not able to supply the electricity to pump the water.



Installations without batteries are preferred, to reduce the environmental impact and the cost.

Hybrid pumps also exist to ensure continued functioning when there is no sunshine.

Pump specifications depend on the technical data of the borehole or well (depth, refill rate, etc.). The choice must therefore be made in conjunction with Watsan.

CONCRETE EXAMPLE

In Ivory Coast, various health centres supported by MSF in the past have been equipped with a borehole together with a solar pump and water tower, to ensure access to water for medical activities and for the population of villages.

WHEN TO INSTALL A SOLAR WATER HEATER?

OBJECTIVES
Reduce energy consumption, save money

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

This type of equipment is preferred whenever the site allows it and there is visibility of on-site presence for at least 2 years.
It can considerably reduce energy consumption as well as the demand peaks on the electrical installation. By way of comparison, a conventional 200 litre electrical water heater consumes 2,400W for 6h / day
>>> see sheets Energy A-3 & A-9.

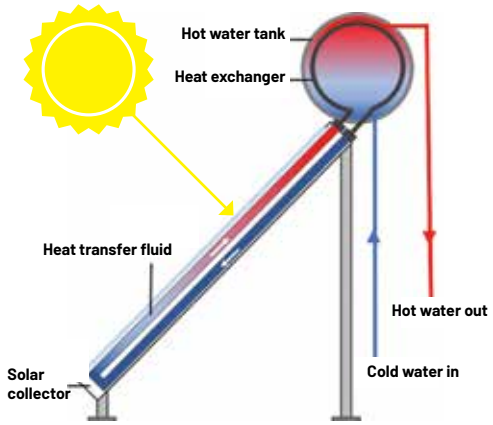
Simulation of return on investment

Type of equipment	Price (euros)	kWh/month	Price kWh	Cost/month
Solar water heater 200L	2,000	0	0	0
Electric water heater 200L	250	283	0.25	71
		ROI at the end of (month)		25

It should be sized according to the daily demand for hot water (number of washing machine cycles in the laundry, number of people in the guest house, etc.).

To create hot water, it warms a heat transfer fluid that circulates in the solar collector and sends it into the reservoir, to transfer its calories using an exchanger to the domestic hot water tank. Once the heat transfer fluid has cooled, it returns to the solar collector by gravity, and so on.

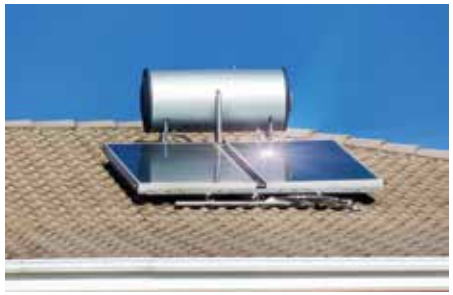
The domestic hot water circulates thanks to the pressure of the building's cold water supply. This cold water replaces the hot water in the tank as and when you use the hot water, and will then in turn be heated.



INSTALLATION AND TECHNICAL SPECIFICATIONS

> The solar collector must have the best orientation and inclination possible in relation to the sun and without shade (trees, etc.)
> Flat roofs make the installation, and possible dismantling at the end of on-site presence, much easier
> Models with an auxiliary electrical heater in case of lack of sunlight are recommended to avoid the risk of legionella (no risk if the water > 50°C). These models therefore need an electrical cable to be run to the solar water heater.


Model to mount on a flat roof


Installation on a sloping roof

A solar water heater is quite heavy when in use with the tank full of water. Before installation, check that your roof is capable of supporting this weight.

Solar water heaters are available for local purchase in most of our mission countries. Otherwise, make an international order with your ESC → various models are available → UniCat CCLIBOIL

CONCRETE EXAMPLE

The project guest house in Drouillard, Haiti, is one place amongst others where a solar water heater has been installed to supply the showers.

HOW TO LIMIT AND MANAGE WASTE FROM SOLAR INSTALLATIONS?

OBJECTIVES

Reduce the environmental impact of our "solar" waste, participate in the development of recycling channels in our mission countries

Complexity **Medium**
Cost **$$**
ROI **n/a**

The best way to reduce waste and environmental impact at the end-of-life of a solar installation consists of:
> Choosing and sizing the installation carefully at the start
> Ensuring proper maintenance and monitoring is done subsequently, to optimise energy production and service life of the various elements in the installation

Average lifespan of different elements:

> Solar panel: 25 years -> only needs to be cleaned with water
> Inverter: 10 years -> keep away from dust
> Battery: ± 5 years -> if cycling depths are respected and the ambient temperature is < 30°C for lithium batteries and < 35°C for lithium gel batteries.

Particular attention should be given to the necessity, or not, of having a bank of batteries in the solar installation. At the moment, it is these that cause the most constraints in terms of "solar" waste management
>>> see sheets Energy B-3 to B-7

Despite these various end-of-life waste products, MSF encourages the use of solar installations on its projects to reduce our global environmental impact.

WHAT ARE THE DIFFERENT TYPES OF "SOLAR" WASTE?

ELECTRONIC WASTE

Inverter

MPPT charge controller

Cables, etc.

Solar panel

BATTERY WASTE

HOW TO FIND THE BEST WAY TO MANAGE YOUR "SOLAR" WASTE IN YOUR MISSION COUNTRY?

> Check the regulations in force with the competent authority -> request the list of certified providers
> Consult the MSF GeoApp (*https://geo.geomsf.org/portal/apps/dashboards/home* > Waste Management Dashboard) -> mapping of MSF semi-industrial incinerators and validated service providers per country,
> Ask other OCs and actors present in the country (directly or via the Log Cluster)
> Consult the WREC site (*https://logcluster.org/en/wrec/green-logistics*) -> mapping of service providers by country (*https://logie.logcluster.org/?op=wrec*). For more information -> *Global.WREC@wfp.org*
> Search for service providers on the internet -> growing market (attention to quality of service)
> Check with distributors of solar equipment
> Contact the RTR or the Technical Referents for advice, information, history, etc.
> Send small pieces of electronic waste back to head office with "expats"

Once the best alternatives have been identified, set up a "solar" waste management procedure with the contacts of the selected service providers
>>> see sheets Waste A-3 & A-4

Only providers in the MSF GeoApp are already validated by MSF.

The recycling market is growing worldwide. MSF encourages waste storage whilst waiting for a recycling stream in the country and/or accumulating sufficient volume to export to a country able to recycle your waste. Various research projects are also underway at headquarters level → watsan R&D, etc.

For more information
>>> see Waste part

CONCRETE EXAMPLES

> In Nigeria, Kenya, Uganda, etc. recycling channels for lead acid batteries already exist
> In Kenya, a company also repairs lithium batteries that have reached end-of-life, by changing the dead cells

WHY IS CORRECT SIZING OF A GENERATOR IMPORTANT?

OBJECTIVES
Reduce fuel consumption, save money

Complexity **Medium**
Cost **n/a**
ROI **n/a**

An undersized generator (operating at > 80% capacity) risks not being able to respond to demand. Conversely, an oversized generator (operating at < 30% capacity) will have an unnecessarily high fuel consumption. In both cases, incorrect sizing will result in premature wear of the generator
>>> see sheet Energy A-2
It's therefore important from a financial and environmental point of view to take the time to find the right generator.

If it is a new generator, the power consumption assessment tool must be completed.
If it is a replacement generator, check the data from your measurement tools (**>>> see sheets Energy A-1 & A-2**) or otherwise use the power consumption assessment.
The main difficulty with sizing is in the consumption peaks during the day (energy-intensive equipment, temperatures, etc.) and/or over the year (seasonality, fluctuations in activity, etc.) -> hence the importance of having measurement tools to analyse them.
This analysis makes it possible to avoid simplistically sizing the generator according to the highest peaks which would have the effect of over-sizing and over-consumption of fuel most of the time.

Consumption peaks are generally caused by: air conditioners, pumps, water heaters, the laundry, sterilisation, etc.

To reduce the size of the generator and optimise its operating range to between 30 & 80% most of the time, it is necessary to:

> Question the need for and the amount of equipment ***(e.g. air conditioner, kettle, water cooler, etc.)***
> Smooth consumption wherever possible ***(e.g. timer switches on water heaters and borehole pumps so they run at night, etc.)***
>>> see sheet Energy A-7
> Use "inverter" models of air conditioners and electrical appliances (**>>> see sheet Energy A-14**)
> Evaluate the replacement of air conditioners, pumps and water heaters by solar models (**>>>see sheets Energy B-6, B-7 & B-8**)
> Consider hybrid installations (**>>> see sheets Energy B-3 & B-4**) or synchronised generators (**>>> see sheet Energy B-11**)

Also consider the rest of the generator fleet on the mission, to see if it is possible to optimise the composition by rearranging the assignment of different generators.

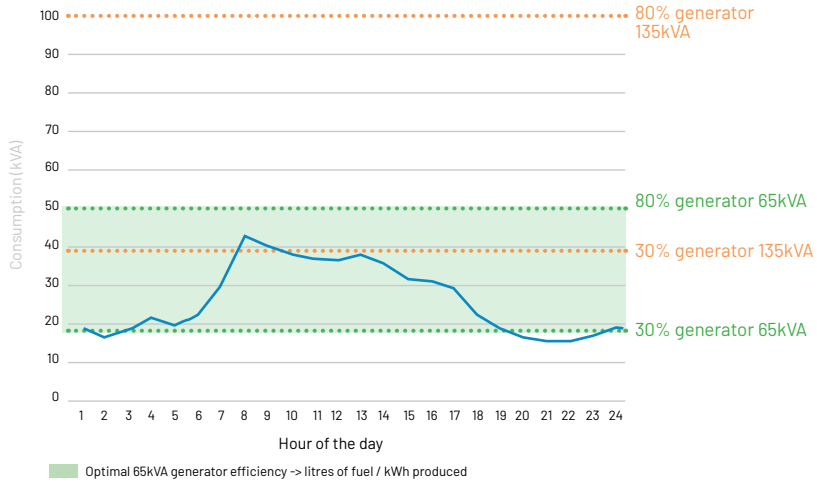
Try, as far as possible, in your choice of generator sizing, to anticipate the evolution of activity.

Differences in consumption

Generator model	Cons./hour (L)	Cons./year (L) at 24/7	CO_2/year (T)	Cost/year (1.5 euro/L)	Extra cost/year with model above
13,5 kVA	1.7	14,892	49	22,338	-
22 kVA	2	17,520	58	26,280	2,957
33 kVA	3	26,280	87	39,420	9,855
65 kVA	5	43,800	145	65,700	19,710
88 kVA	7	61,320	203	91,980	19,710
110 kVA	9	78,840	261	118,260	19,710
150 kVA	15	131,400	435	197,100	59,130
220 kVA	21	183,960	609	275,940	59,130
300 kVA	29	254,040	842	381,060	78,840
400 kVA	34	297,840	987	446,760	49,275

These values are only intended to give an order of magnitude and may vary depending on the % load.

Comparison load % on generator 135kVA vs. 65kVA in Bangui



CONCRETE EXAMPLE

In Bangui, the coordination of MSF-OCP changed their generator from 135kVA to 65kVA, based on gathered data from the measurement tools in place, and thus roughly reduced their fuel consumption by a factor of 2 -> see graph above.

WHAT IS THE ADVANTAGE OF SYNCHRONISING 2 GENERATORS?

OBJECTIVES

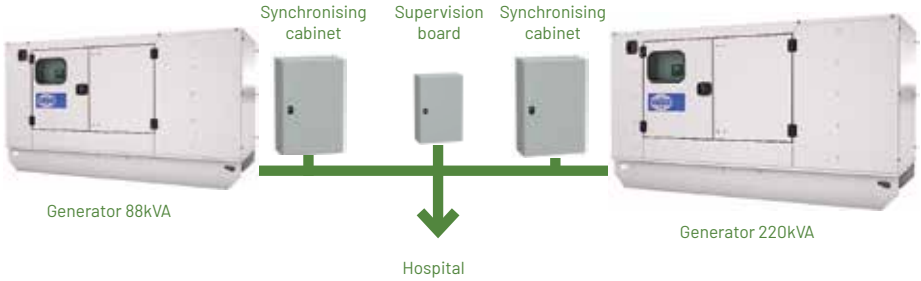
Reduce fuel consumption, save money

Complexity **High**
Cost **$$$**
ROI **Rapid**

The sizing of a generator is not always obvious. In effect, peaks of consumption over the day and/or a season cause an over-sizing for much of the time and therefore unnecessary fuel consumption.

To overcome this situation, some projects have 2 generators of different power that are synchronised together.
Depending on demand, the synchronising panel chooses the generator(s) to start up.
Synchronising can be considered from 65kVA.

EXAMPLE IN A HOSPITAL:
During the day, the 220kVA generator is sufficient for some of the time. When demand goes beyond its capacity, the 88kVA generator is started up to complement the 220kVA one, and is stopped when the peak demand has passed.
During the night, demand is reduced and only the 88kVA generator runs.



Assessment of fuel consumption between a synchronised installation (88kVA + 220kVA) and a simple one (300kVA)

88 kVA + 220 kVA				300 kVA			
Generator model	No. hours/day	Cons./hour	Total	Load	No. hours/day	Cons./hour	Total
88 kVA	6	7	42	< to 30%	6	12	72
220 kVA	10	21	210	50%	10	25	250
88 kva + 220 kVA	8	28	224	80%	8	29	232
Consumption / day (L)			476	Consumption / day (L)			554
Consumption / year (L)			173 740	Consumption / year (L)			202 210
				Difference in consumption / year (L)			28 470
				Financial saving / year (1L = 1.5 euro)			42 705

Return on investment

Synchronised solution	
Purchase price 88kVA	12,500
Purchase price 220kVA	25,000
Synchronising equipment	24,000
Technical visit	3,000
Total	64,500

Simple solution	
Purchase price 300kVA	40,000

Difference	24 500
Economy / month	3 559
ROI (in months)	7
CO_2 saved / year (T)	94

The feasibility study for a synchronised installation requires historical energy consumption and production data

>>> see sheets Energy A-1 & A-2

This type of installation is particularly recommended in contexts where air conditioners (or other large consumers) are not used during the night or for part of the year, depending on the season.

Generator + solar is another alternative, depending on requirements

>>> see sheet Energy B-4

CONCRETE EXAMPLE

The missions in Yemen, Nigeria and Haiti are already equipped with synchronised installations.

WHEN TO USE A CITY POWER GRID PHASE SELECTOR?

OBJECTIVES

Reduce use of generators, save money

Complexity **Medium**
Cost **$**
ROI **Rapid**

A phase selector optimises use of electricity from the city power grid, to avoid having to switch over to the generator.

TO BE ABLE TO INSTALL IT, THE FOLLOWING CONDITIONS MUST BE MET:

> Have a three-phase connection to the city grid
> Have problems with sporadic cut-outs or under- or over- voltage, on one or two of the three phases at a time
> Have a mono-phase generator and electrical installation
> Supply a small size site (medical centre, office, guest house, etc.)

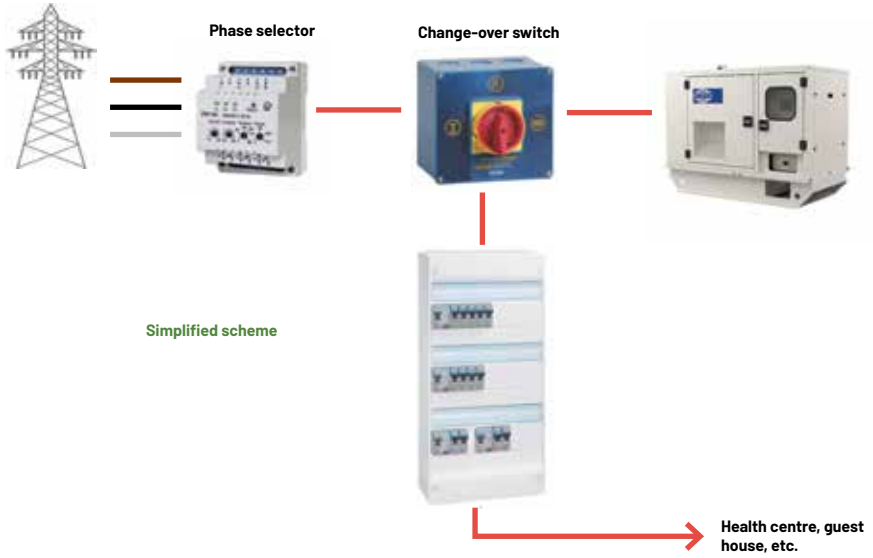
The phase selector continually chooses the most reliable phase from the city grid.
The acceptable voltage range is adjustable (generally between 195V-250V).

THE 2 MAIN ADVANTAGES ARE:

> Ensure fewer power cuts
> Avoid having to start up the generator when 1 or 2 phases of the city grid cut out, or have under- or over- voltage

The level of environmental advantage depends on the energy mix of the city power grid (**>>> see sheet Energy B-2**). The greener the latter is, the more interesting it is to install a phase selector to reduce generator use.

MSF article code: PELECOMMNR3 (Relay phase switch (Novatek PEF-301) 92 euros). It is recommended to consult your RTR or Technical Referent before ordering.



Simplified scheme

CONCRETE EXAMPLE

Several phase selectors are in the process of being installed in Democratic Republic of the Congo and in Chad, in offices and guest houses.

WHAT IS THE COST TO USE AND THE CO_2 EMITTED FROM A PIECE OF EQUIPMENT?

OBJECTIVES

Be aware of the financial and environmental impact of an existing piece of equipment or during selection of new equipment, raise user awareness of best practices

Complexity **Low**
Cost **n/a**
ROI **n/a**

The table below shows the impact of different equipment powered by generator / city power grid / solar energy:

				Generator		City power grid		Solar without battery*	
	Equipment	Power (kW)	Hours of operation / day (h)	Cost/year (euro)	CO_2/year (Kg)	Cost /year (euro)	CO_2 /year (Kg)	Cost/year (euro)	CO_2/year (Kg)
Air conditioner	Air conditioner set to 20°C, not switched off during absences	1.6	24	6,307	13,931	3,504	11,213	1,230	0.02367
	Air conditioner set to 20°C, switched off during absences	1.6	8	2,102	4,644	1,168	3,738	410	0.00789
	Air conditioner set to 25°C, switched off during absences	1.6	4	1,051	2,322	584	1,869	205	0.000394
	Air conditioaner set to 25°C, switched off during absences, insulated room	1.6	1.5	394	871	219	701	77	0.00148
Other	Fan	0.04	8	53	116	29	93	10	0.00020
	Water heater, 200 litre	2.4	6	2,365	5,224	1,314	4,205	461	0.00887
	Fridge/freezer, energy rating F	0.15	4	99	218	55	175	19	0.00037
	Fridge/freezer, energy rating B	0.15	2	49	109	27	88	10	0.00018
	Water cooler	0.45	4	296	653	164	526	58	0.00111
	Incandescent bulb	0.01	12	197	435	110	350	38	0.00074
	LED bulb	0.012	12	24	52	13	42	5	0.00009

** This calculation only takes into account solar on its own, without backup if there is no sun (-> no batteries, generator or city power grid).*

These values can vary from one place to another. They are intended to give an order of magnitude for the purpose of awareness.

We can see that:

> Respecting best practices when using an air conditioner has a large impact
>>> see sheets Energy A-5, A-15, A-16, A-17 and **Building B-2**

> Passive measures, like insulation, are to be considered in all temperature controlled buildings/rooms/services
>>> see sheets Building B-6 to B-12

> Active measures that are less energy intensive than air conditioning, like a fan, are to be considered whenever possible
>>> see sheets Building B-13 to B-17

> The energy efficiency of equipment can influence its impact by a factor of 2
>>> see sheets Energy A-4 & A-10

> The choice of bulb/tube type has a significant impact because of their quantity
>>> see sheets Energy A-11 to A-13

> Solar energy only produces full power for limited hours per day, and needs space for the solar panels. This energy source will often be used together with one of the other two energy sources.

Calculation of the impact for "resistance" type equipment (e.g. bulbs) and "motors" (e.g. fans, borehole pump) is relatively simple because you only have to multiply the hours of use x the power x the average cost per kWh or CO_2 emissions.

Regarding "compressor" type equipment (e.g. air conditioner, fridge/freezer, water cooler), the estimation of the hours of use is more complex because the main part of the consumption only occurs when the compressor is actively running. This is one reason why an air conditioner set to 25°C will consume significantly less than if it is set to 20°C → the equipment will be switched on in both cases but in the latter case the compressor will have to work more often...
→ Energy measurement tools allow you to monitor such consumption
>>> see sheets Energy A-1 & A-2

A calculation tool similar to the above table is available from your Technical Referent.

CONCRETE EXAMPLE

In Maiduguri, Nigeria, the pharmacy (insulated and equipped with 10 air conditioners) raised the set temperature by 4°C towards 25°C. Fuel consumption has been halved, resulting in savings of 18,100 euros and 40 tonnes of CO_2 per year.

C-
ENCOURAGE THE PRODUCTION, USE AND DISTRIBUTION OF SUSTAINABLE HEATING ITEMS IN FACILITIES AND PROGRAMMES

WHAT ARE THE ALTERNATIVES TO CHARCOAL AND WOOD FOR COOKING AND HEATING WATER?

OBJECTIVES

Reduce deforestation, desertification and CO_2 emissions, improve air quality, encourage local initiatives

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

On some of our projects, cooking and heating hot water are done with charcoal or wood. This local practice can contribute to deforestation and desertification, making the land more vulnerable to the weather and less fertile for agriculture (amongst other things).
Further, from the size of its projects, MSF is generally a large consumer and therefore speeds up these processes even more, and sometimes even destabilises access to these resources.

Diverse alternatives are being developed and are becoming more widely available in our countries of operation:

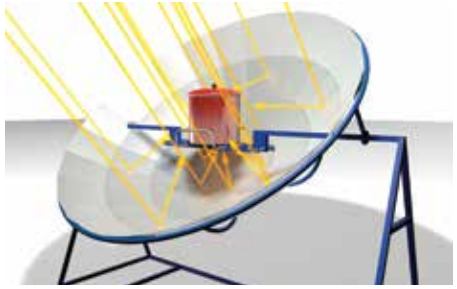
BIOMASS BRIQUETTES

These briquettes are made up of "waste" wood (natural remnants from agriculture or timber exploitation) or dry crops (coffee bean shells, etc.). They are then compacted to obtain briquettes with a high energy density.

However, be careful where your briquettes originate from. If they have travelled halfway around the planet to get to your mission country, their global environmental impact will be questionable compared to local charcoal or wood...

SOLAR OVEN

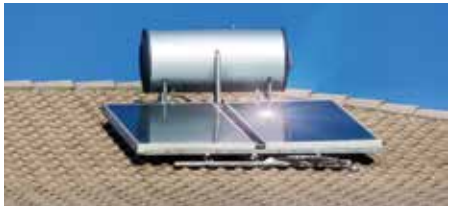
A solar oven concentrates the sun's rays to a point, to warm up the receptacle to be heated. Different designs and sizes exist. Temperatures between 100°C and 200°C can be reached, depending on the model, with plenty of sunshine. For over 10 years, various NGOs have been distributing solar ovens in refugee camps.



SOLAR WATER HEATER

This type of equipment heats up a tank of water thanks to the heat of the sun

>>> see sheet Energy B-8



If you have no alternative to charcoal or wood on your mission, choose suppliers who have a sustainable approach by replanting trees as their land is exploited. This will reduce the effect of deforestation and desertification, and helps to reduce CO_2 in the atmosphere (a young growing tree captures more CO_2 than an adult tree).

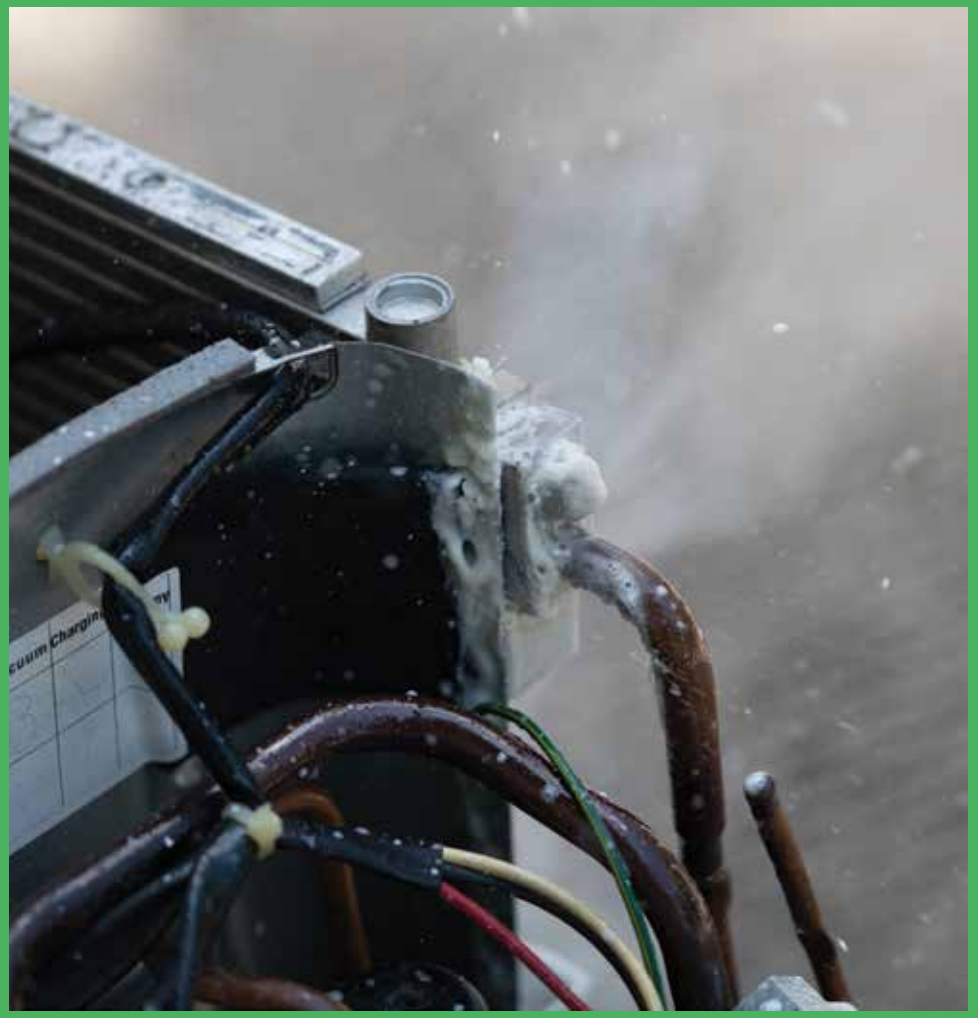
Whenever possible, optimise the performance of cooking stoves to reduce consumption of biomass briquettes, charcoal or wood (for more information → Technical Referent).

Keep an eye on the market and share results of your initiatives with headquarters, the Log Cluster, etc.

CONCRETE EXAMPLE

Solar Cookers International (SCI) is an organisation that collects, analyses and advocates to promote the use of solar ovens around the world. They provide many examples of the use of solar ovens in our mission countries.

D-
REDUCE EMISSIONS OF GASES WITH HIGH GLOBAL WARMING POTENTIAL



HOW TO NAVIGATE THE DIFFERENT REFRIGERANT GASES?

OBJECTIVE

Reduce as far as possible emissions of refrigerant gases with a high "global warming potential"

Complexity **Medium**
Cost **n/a**
ROI **n/a**

EQUIPMENT CONTAINING REFRIGERANT GASES AT MSF:

> Air conditioners
> Medical and domestic fridges / freezers
> Water coolers
> Vehicles with air conditioning (a/c)

MAIN GASES ON THE MARKET AND THEIR ENVIRONMENTAL EFFECTS:

Gas	Global Warming Potential (GWP)	Impact on the ozone layer - Ozone Depletion Potential (ODP)	Availability in mission countries	Type of equipment
HCFC22 OU R22	1,810	0.05	Less and less widespread	Air conditioner
R410A	2,088	0	Very widespread	Air conditioner
R134A	1,000	0	Widespread	Cold chain & vehicle a/c
HFC32 OU R32	675	0	Starts to be widespread	Air conditioner
R600	8	0	Widespread	Cold chain
R1234yf	4	0	Widespread	Vehicle a/c
R290	<5	0	Not widespread (inflammable)	Air conditioner

WHICH GAS TO CHOOSE WHEN PURCHASING EQUIPMENT:

(MSF 2023 recommendations)

AIR CONDITIONERS

Gases on the market:

> HCFC 22 or R22 : Prohibited

> R410A : To avoid (if possible)

> HFC32 or R32 : OK (if no R290)

> R290 : OK (if R290 and HFC32 or R32 not available -> R410A)

COLD CHAIN

Medical fridges / freezers (MSF standard)
> R600 -> OK

Domestic fridges / freezers / water coolers
> Gases on the market:
- R134A -> To avoid
- R600 -> OK

The gases with red values are extremely harmful for the environment and therefore to be avoided. That said, the regulations evolve at different speeds from one country to another. The goal is to always select the best solution available on the market and, in parallel, train technicians.

Each piece of equipment is designed to work with one specific type of gas → it is therefore not possible to change to or refill with a different type of gas (different pressures, etc.).

Each piece of equipment is always noted on its technical specification label. If you come across other types of gas, ask for support from your RTR or Technical Referent as necessary.

For vehicle air conditioning → see the vehicle's technical documentation to find out if you need R134A or R1234yf.

CONCRETE EXAMPLES

> In France, R410A will be prohibited from sale in 2025 and R32 in 2030 -> this will leave R290
> In Nigeria, R32 is starting to become available
> In Yemen, R22 is still widely available for sale

HOW TO REDUCE REFRIGERANT GAS EMISSIONS AT MSF?

OBJECTIVES

Reduce emissions as far as possible of refrigerant gases with a high "global warming potential", support local recycling channels

Complexity **Medium**
Cost **$$**
ROI **n/a**

1- CHOICE OF EQUIPMENT

The starting point to reduce gases with a high "global warming potential" in our equipment is to pay particular attention when purchasing, to avoid the most environmentally harmful
>>> see sheet Energy D-1
If this is an air conditioner replacement, it's also the moment to check if an air conditioner is really the best solution
>>> see sheets Energy A-4 and **Building B-6**
If this is a new purchase or replacement of a domestic fridge / freezer or water cooler: follow the selection criteria
>>> see sheet Energy A-10
Equipment ordered through your ESC adheres to MSF recommendations.

2- INSTALLATION AND MAINTENANCE OF EQUIPMENT

The installation and the maintenance are two critical moments where there is a risk of releasing gas into the environment. It is therefore essential to have providers or internal personnel who are suitably qualified and equipped.

If a piece of equipment loses pressure in its refrigerant gas circuit, there must be a leak (because it's a closed circuit).
Regularly refilling with gas is therefore not the solution, because you will release this gas into the atmosphere!
Leak detection is obligatory and MSF recommend replacing the equipment if the leak is difficult to access and/or repair.

Equipment maintenance (**>>> see sheet Energy A-17**) is, amongst other things, important to detect these leaks in time. It's also worthwhile asking air conditioner users to inform logistics if there is a drop in performance that might be due to a leak.

3- EQUIPMENT END-OF-LIFE

This is another critical moment in terms of the risk of emissions of harmful gases into the environment.
If there is a recycling channel for these gases in your mission country, it is essential to use it. However, in the majority of mission countries, there is not yet a recycling solution at the moment.
MSF recommendation: given that the recycling market is rapidly developing, the recommendation is to store the gas, either in a suitable canister, or to keep it encapsulated in the compressor and to store this without the rest of the equipment.
This approach allows the accumulation of a volume that can be considered for export to a country able to recycle these gases, or to wait until the recycling sector is developed within the country.

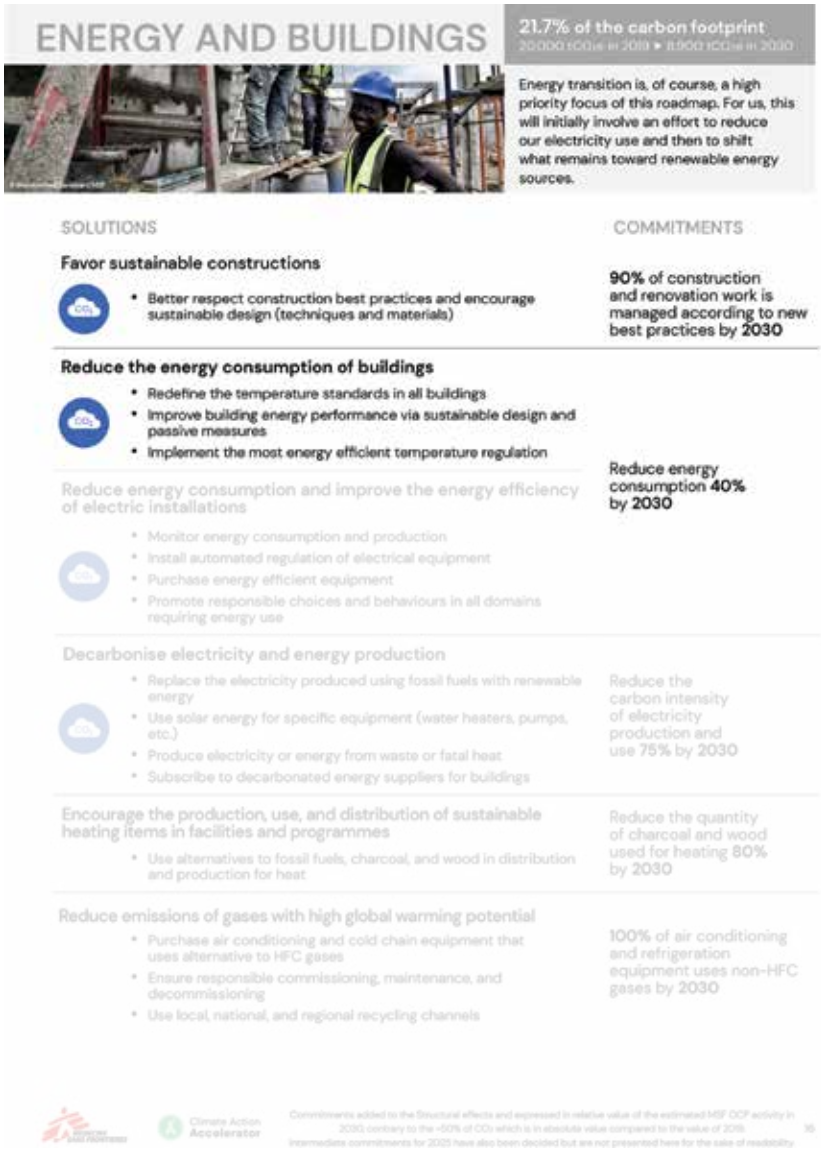
If the installation and/or maintenance and/or disassembly at end-of-life are managed internally, it is essential to be equipped with the necessary tools → MSF kit: KPROZFR0111 + CCLITOOLL12P + CCLITOOLL12S + CCLITOOLL12- and to train the teams as required.
(The exact composition of the kit may vary depending on your OC -> consult your RTR or Technical Referent if necessary).

CONCRETE EXAMPLE

Sometimes projects use about 13kg of R22 and R410A gas per month (equivalent to ±26T of CO_2) in their air conditioners during maintenance and recharging due to leaks. That is the equivalent each month of a 13.5kVA generator running 24/7 for 6 months...
If you regularly need to buy gas, investigate the cause!

BUILDING

MSF-OCP CLIMATE AND ENVIRONMENT ROADMAP
-> "ENERGY AND BUILDINGS" SECTION



N.B. see Energy part for blurred points

MAIN ANGLES OF ATTACK AND PRINCIPLES TO ACHIEVE THEM

MAIN ANGLES OF ATTACK:

> Construction / renovation projects adhere to the "construction process"
> Sustainable construction principles are integrated into every construction / renovation from the design / construction phase
> Temperature controlled buildings, starting with pharmacies, are properly sized, have an energy assessment and suitable passive measures to reduce energy consumption
> In general, if passive measures are not sufficient, active measures are evaluated from the least to the most energy-intensive (air conditioning as a last resort)
> Employees know the MSF temperatures as well as the parameters that influence thermal comfort
> Missions use the "green" checklist before renting a property

PRINCIPLES TO IMPLEMENT ON ALL MISSIONS TO ACHIEVE THIS:

> Missions know, understand the benefits of and use the "construction process"
> Energy measurement tools are in place to make building energy assessments together with the Technical Referents
> Technical support is requested to integrate as many passive measures as possible from the start of a project
> The notion of return on investment is taken into account in budgetary decisions
> Before purchasing or replacing an air conditioner, passive measures as well as less energy-intensive active measures (when necessary) are evaluated and preferred
> MSF temperatures and the parameters that influence thermal comfort are communicated, reiterated and displayed
> The "green" checklist is known and used by the Logs

BUILDING SHEETS

A

FAVOR SUSTAINABLE CONSTRUCTIONS/RENOVATIONS

1. What is a "sustainable construction" approach?
2. What are the points to note at each phase of a building's life to reduce its environmental impact?
3. What are the environmental impacts of different types of structure?

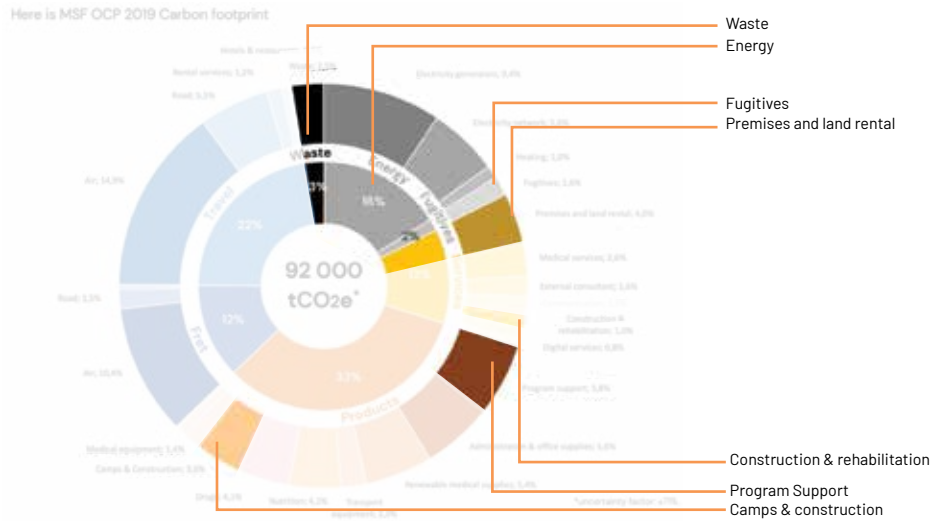
B

REDUCE THE ENERGY CONSUMPTION OF BUILDINGS

1. How to make an energy assessment of a building?
2. What is thermal comfort?
3. What impact does the climate have on the choice of technical solutions?
4. What are the expected temperatures for different types of room / service?
5. How to take temperature and humidity measurements?
6. What to do before opting for an air conditioner?
7. Passive measure: how to create natural ventilation?
8. Passive measure: how to protect against the sun's rays?
9. Passive measure: when to insulate a building?
10. Passive measure: which insulation to choose?
11. Passive measure: how to improve air-tightness?
12. Passive measure: how to create thermal inertia?
13. Active measure: mechanical ventilation - how to create air movement?
14. Active measure: mechanical ventilation - how to manage air renewal?
15. Active measure: when to choose an air cooler instead of an air conditioner?
16. Active measure: when to install an air curtain?
17. Active measure: in what contexts is the Canadian well an interesting solution?
18. What are the "green" points to note when renting a property?

"DO IT WELL FROM THE START TO NOT DO IT AGAIN LATER"

CO_2 IMPACT ON:



A-
FAVOR SUSTAINABLE CONSTRUCTIONS/RENOVATIONS

WHAT IS A "SUSTAINABLE CONSTRUCTION" APPROACH?

OBJECTIVES

Reduce the overall environmental footprint of a building, meet requirements, optimise user comfort from the start

Complexity **Medium**
Cost **n/a**
ROI **n/a**

The worldwide building and construction sector is responsible for 37% of CO_2 emissions and consumes 34% of global energy demand.

At MSF, our activities regularly lead us to construct or renovate to contribute to the success of our operations.

However, it can be stated that some of these constructions / renovations don't always bring the expected results. The reasons are varied and often not helped by the uncertain and evolving nature of our projects.

To limit this observation, which sometimes has significant environmental consequences, MSF advocates a "sustainable construction" approach.

Sustainable construction aims to reduce the environmental impact of buildings during their entire lifecycle. This can be divided into 3 main phases: "design / construction", "usage" and "end-of-life or post MSF"

>>> see sheets Building A-2 & A-3.

By paying particular attention to each of these phases, it is possible to best meet the requirements and comfort of users whilst limiting the environmental footprint of the building.

For the example opposite of an air conditioned building, we can see that:

> Integrating suitable passive measures ***(e.g. insulation)*** from the design / construction phase increases the footprint of this phase but considerably reduces that of usage afterwards

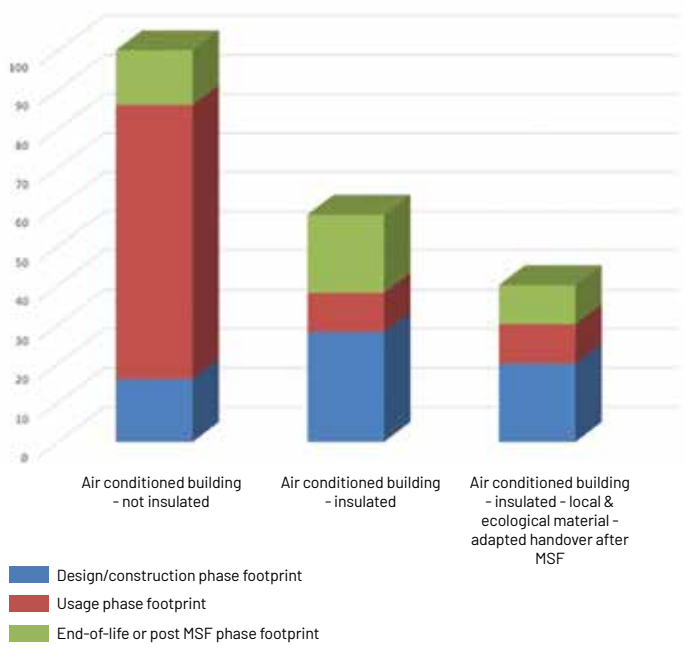
> Using local and ecological material, whenever possible and appropriate, reduces the footprint

> Taking account of end-of-life or "post MSF" from the design / construction phase optimises use of the structure over time ***(e.g. a building adapted for handover to another actor)***

In an emergency, temporary or semi-temporary structures are preferable. If a permanent structure is necessary there is (even in an emergency): a clear evaluation of needs, a feasibility study, an appropriate design and a high-quality implementation.

Quality of construction or renovation is one of the key elements to achieve the expected lifespan of the property and therefore "amortise" the environmental impact by a longer useful life.

Example total environmental footprint during a building's lifetime



To optimise the success of your construction / renovation project:
> Take advantage of support from Technical Referents
> Surround yourself with specialized profiles and / or competent service providers.

CONCRETE EXAMPLE

In Aweil, South Sudan, during the design of the pharmacy and log store, all of the following were integrated from the beginning: reduction of solar radiation by a white roof, use of local materials with good thermal inertia (CEB - compressed earth block), insulation & optimisation of the use of air conditioning & natural ventilation (with a consulting firm).

WHAT ARE THE POINTS TO NOTE AT EACH PHASE OF A BUILDING'S LIFE TO REDUCE ITS ENVIRONMENTAL IMPACT?

OBJECTIVE
Reduce the environmental impact of our structures during their entire lifespan

Complexity **Medium**
Cost **n/a**
ROI **n/a**

DESIGN / CONSTRUCTION PHASE

> Every construction / renovation project respects the construction process steps:
- Clear evaluation of needs
- Feasibility study (flood risk during the rainy season, market study, etc.)
- Appropriate design in relation to duration, type of activity, thermal comfort, modularity necessary over time, etc.
- High-quality implementation to ensure the expected lifespan of the structure (site supervision, HR skills, quality of materials, compliance with concrete setting times, etc.)

> The Technical Referents for Construction, Energy Efficiency, Energy and Watsan are consulted depending on the case and needs

> From the building design, a maximum of passive measures are integrated and preferred over active measures, to obtain the desired comfort level and reduce energy consumption. If passive measures are not sufficient, active measures are chosen from the least to the most energy intensive (air conditioner as last resort). The temperature controlled buildings / services / rooms receive special attention ***(e.g. pharmacy)***

>>> see Building sheets section "B"

> Any innovative solutions that help towards energy net zero buildings (that are heated and powered by the sun, that are cooled by the wind and lit by the sky) are encouraged

> Local (or regional) and ecological building materials are preferred if possible

> Construction waste is limited (choice of materials, minimise scrap offcuts, etc.)

> Remaining waste is sorted according to the possibilities of recycling, etc.

> In emergency cases, structures with a low footprint are preferable ***(e.g. reusable tents instead of plastic sheeting)***

> In the case of renting an existing property, the "green" checklist is used

>>> see sheet Building B-18

> End-of-life or "post MSF" is considered from the design / construction phase ***(e.g. building suitable for handover)***

USAGE PHASE

> Energy measurement tools are in place and the follow up tool is completed to monitor energy efficiency and to take the best decisions concerning energy consumption and production

>>> see sheets Energy A-1, A-2 and **Building B-1**

> Maintenance plans of the equipment concerned are respected

>>> see sheet Energy A-17

> General maintenance of the building is ensured, to avoid premature deterioration

> The property is optimally utilised, to avoid unnecessary construction

> With each evolution of requirements, the site is considered as a whole and the best solution is chosen depending on identified operational and technical needs. Passive measures are always integrated in these evolutions and preferred over active measures

> Tents and supplies are repacked and stored for reuse

END-OF-LIFE OR "POST MSF" PHASE

> In case of transfer of the site, ensure that the building and equipment are still suitable for the technical and financial capabilities of the one taking over -> train them in maintenance as necessary

> In case of project closure without handover, evaluate the possibility / suitability of sending equipment to other projects

> In case of mission closure, evaluate the possibility / suitability of sending equipment to neighbouring missions

> In case of demolition: disassembly and reuse of materials is preferred. Failing that, investigate the possibility of recycling of waste

The more the "design / construction" phase is done with care, the less the work and costs during the two other phases of the building's life.

CONCRETE EXAMPLE

In a prison hospital for tuberculosis patients in Ukraine, MSF led a project to renovate medical services and the laboratory during their presence. They integrated the financial and technical capabilities of the Ministry of Justice from the design phase, to guide the choice of technical solutions in order to optimise the use of the site after MSF's departure.

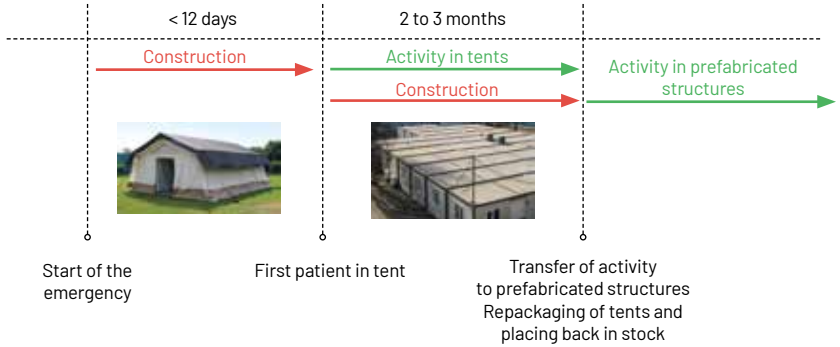
WHAT ARE THE ENVIRONMENTAL IMPACTS OF DIFFERENT TYPES OF STRUCTURE?

OBJECTIVE
Make the best choice at a given moment, based on identified needs and visibility over time

Complexity **Medium**
Cost **n/a**
ROI **n/a**

DURATION OF USE		TEMPORARY		SEMI-TEMPORARY				PERMANENT
TOTAL IMPLEMENTATION TIME*		< 12 DAYS		2 TO 3 MONTHS				> 6 MONTHS
Type of structure * From needs definition to delivery of the structure ** If appropriate materials and finishes *** If passive measures have been applied **** Depending on chosen techniques and materials		Tent	Insulated tent	Traditional / local	Wood	Metal framework	Prefabri-cated	Permanent/ masonry structure
								
Design / construction phase	Manufacturing CO_2 emissions							
	Transportation CO_2 emissions							
	Lifespan							
	Technicality							
	Hygiene							**
	Waste generated during construction							
	Cost							
Usage phase	Energy Efficiency							***
	Thermal comfort							***
	Maintenance							
	Modularity over time							****
End-of-life or "post MSF" phase	Handover							***
	Removable							
	Reusable after disassembly							
	Repurposing/upcycling if demolition							

There is no perfect solution that fits all scenarios. Identify as best as possible the most suitable solution or solutions for your context on a timescale based on the urgency of the need / comfort and on the necessary utilisation quality / and the budget
-> see example below



If your choice concerns a "permanent/masonry structure", make sure of the "long term" relevance to justify the impacts in red and orange (cement alone is responsible for 7% of global CO_2 emissions).

To limit the impact of "permanent/masonry structures", evaluate the possibilities of alternative materials to the classic "concrete posts & beams / breeze-blocks (cinder blocks)" → for example, compressed earth blocks (CEBs), fired earth bricks, etc.

From an environmental point of view, it is recommended, as far as possible, to use local / ecological materials and to evaluate the possibilities of renovation before starting on a new construction, whenever possible and relevant.

CONCRETE EXAMPLE

In South Sudan, it was decided to construct a permanent structure to manage peaks of malaria and various other recurrent annual epidemics, to improve the level of patient care and to stop putting-up and taking-down tents.

B-
REDUCE THE ENERGY CONSUMPTION OF BUILDINGS

HOW TO MAKE AN ENERGY ASSESSMENT OF A BUILDING?

OBJECTIVES

Have clear data to determine the need, implement appropriate technical solutions, reduce energy consumption, save money

Complexity **Medium**
Cost **$**
ROI **Rapid**

The energy that we consume on our projects can be divided into two groups:
> Energy necessary for the operation of the activity (biomedical equipment, etc.) = between 20% and 50% of consumption
> Energy consumed for "thermal comfort" (mainly air conditioners) = between 50% and 80% of consumption

In this "Building" section, reducing the energy consumption of our buildings concentrates mainly on this second category and targets, as a priority, temperature controlled buildings / services / rooms.

The starting point is the evaluation of the building's energy efficiency:

The Energy Performance Diagnosis (EPD) of a building is calculated by dividing the energy consumption to cool (or heat) this building by the number of m^2 concerned. This gives us energy efficiency in kWh/m^2.
Example: a 100m² pharmacy that consumes 20,000kWh/year = 200kWh/m² -> "D"

To be able to evaluate the EPD at MSF it's necessary to have energy measurement tools in place and fill the data in the follow up tool
>>> see sheets Energy A-1 & A-2

To identify the part of consumption used to cool the building:
> Add energy meters to the circuits that supply the air conditioners
> or deduct a % of the total consumption corresponding to other consumption (everything except air conditioners -> between 20% and 50% depending on the project)

From the starting point of the EPD it's possible to determine if it's necessary to improve the energy performance of the building and how. This work is done in collaboration with the Technical Referents.

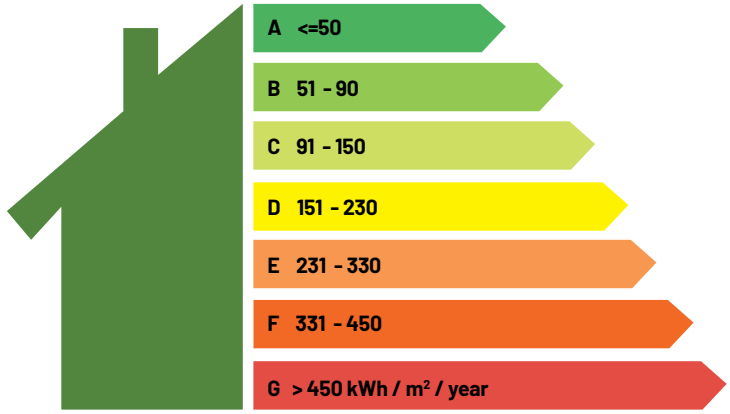
Depending on the case, additional parameters will need to be provided: type of construction, insulation in place, orientation, openings, vegetation, other surrounding constructions, temperature readings **>>> see sheet Building B-5**, etc.

The main technical solutions are:

Passive measures:
> Natural ventilation
>>> see sheet Building B-7
> Protection against solar radiation
>>> see sheet Building B-8
> Insulation
>>> see sheets Building B-9 to B-11
> Thermal inertia
>>> see sheet Building B-12

Active measures:
> Mechanical ventilation
>>> see sheets Building B-13 and B-14
> Air cooler
>>> see sheet Building B-15
> Air curtain
>>> see sheet Building B-16
> Canadian wells
>>> see sheet Building B-17

The implementation cost can be significant, depending on the solution(s) and the building size, a methodical approach is therefore needed. This approach will also help you budget for your proposal. Think about including the return on investment.



Due to the diversity of climates in our mission countries, a specific energy performance target will be more difficult to attain from one place to another, and will therefore have to be assessed on a case-by-case basis.

CONCRETE EXAMPLE

In France, the EPD has been in place since 2007 to encourage and prioritise energy performance efforts. At MSF, we're just getting started. Energy measurement tools (**>>> see sheets Energy A-1 & A-2**) will allow us to improve our ability to make energy assessments of our buildings.

WHAT IS THERMAL COMFORT?

OBJECTIVES
Use alternatives to air conditioning to obtain thermal comfort, reduce energy consumption, save money

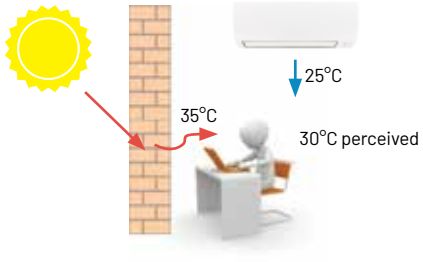
Complexity **Medium**
Cost **$**
ROI **Rapid**

Thermal comfort is an individual judgement, that seems right, of the feeling of hot or cold in the surrounding environment.
Ambient temperature is the most well-known element used to influence thermal comfort.
Example: set temperature of an air conditioner

There are however ***5 other parameters*** that influence thermal comfort and that allow air conditioning to be used less, or to do without it completely:

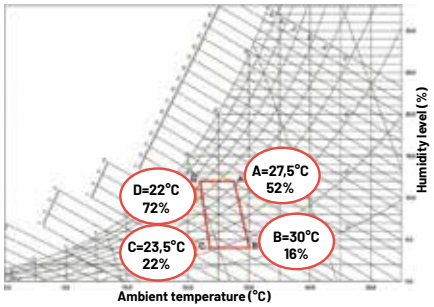
RADIANT HEAT FROM MATERIALS

All of the walls surrounding a person radiate their temperature towards them. The perceived temperature is the average between the temperature of the walls and the ambient temperature of the room.
Example: if a person has their desk next to an exterior wall exposed to the sun, they will perceive the temperature to be higher than the set temperature of the air conditioner. This person will tend to lower the set temperature to achieve thermal comfort, whereas moving their desk in the room, reducing the sun's rays, insulating the wall or working on the parameters below might be enough without consuming energy (or very little).



HUMIDITY LEVEL

A high humidity level limits the skin's ability for evaporative transpiration (sweating -> which cools the body down) because of moisture vapour saturation already present in the air. For this reason, the same ambient temperature is more difficult to withstand when the humidity level is higher. The red zone below shows the thermal comfort zone.
Various technical solutions exist to regulate the humidity level within this zone: dehumidifiers, humidity-controlled extractor fans, etc.
(To measure the humidity level, use a digital thermometer with humidity level reading or >>> see sheet Building B-5)



AIR CIRCULATION

Natural ventilation and/or the movement of air can create a flow of air that helps the body's evaporative transpiration (sweating).
Example: a fan can lower the perceived temperature by 3°C and consumes 40 x less than an air conditioner. If the temperature is 28°C, you will perceive 25°C.

ACTIVITY OF THE PERSON

The more a person is moving, the more they will want a feeling of coolness to achieve their thermal comfort.
Example: a patient lying-down will have a feeling of thermal comfort at a higher temperature than the medical staff who work in the service.

CLOTHING OF THE PERSON

Adapting, as far as possible, your clothes to the environment is probably the simplest and most logical thing to do.
Example: wearing a jumper with the air conditioning on doesn't make sense!

If you are together in a room with others, take account of these 6 parameters to find a compromise acceptable to all. Put those in need of cool in the cold air flow from the air conditioner and those who are chilly against the wall where the sun's rays shine, etc.

CONCRETE EXAMPLE

In the graph above, we can see that a temperature of 30°C is in the thermal comfort zone if the humidity level is low. Combining the parameters, you can even go up to 32°C with a flow of air, for example.

WHAT IMPACT DOES THE CLIMATE HAVE ON THE CHOICE OF TECHNICAL SOLUTIONS?

OBJECTIVE

Choose the best technical solution(s), depending on where you are and the season

Complexity **Medium**
Cost **n/a**
ROI **n/a**

Temperature, humidity levels, day/night differences, seasonality, etc. are the factors that influence the selection of solution(s) to implement, in order to improve our energy efficiency and thermal comfort.

Mountainous climate
- climate colder and more humid than in the surrounding plains

Temperate climates
- Continental climate (hot summers, cold winters, low rainfall)
- Ocean climate (cool summers, mild winters, high rainfall)
- Mediterranean climate (hot and dry summers, mild winters, autumn rainfall)

Hot or intertropical climates
- Desert climate (hot all year and very low rainfall)
- Tropical climate (hot all year, a dry season and a rainy season)
- Equatorial climate (hot all year, high rainfall all year)

TECHNICAL SOLUTION	TYPE OF CLIMATE	ENVIRON-MENTAL IMPACT	COST	SHEET
Natural ventilation	Any climate and hot season. Careful with dust -> e.g. Harmattan		$	Building B-7
Protection against the sun's rays	All hot climates (the opposite will be sought in cold climates)		$$	Building B-8
Insulation	Any climate with a temperature above (or below in cold climates) MSF temperatures (for all or part of the year)		$$$	Building B-9 to B-11
Thermal inertia	Any climate with temperature differences between day and night or with air conditioning		$	Building B-12
Mechanical ventilation: movement of air	Any climate with a temperature above thermal comfort		$	Building B-13
Air cooler	Hot and dry climates (for all or part of the year)		$$	Building B-15
Air curtain	Any climate with a temperature above MSF temperatures (for all or part of the year)		$$	Building B-16
Canadian well	Mainly temperate climates		$$$	Building B-17
Air conditioning (last resort)	Any climate with a temperature above MSF temperatures (for all or part of the year)		$$$	Energy A-4

For more information about passive measures -> cf. Passive Design Guide

Different solutions can be used during the year, depending on the season, the temperatures, thermal comfort, etc. or combined with each other so that the overall energy consumption is reduced over the year (e.g. air conditioners only during the hottest months).

The environmental impact of insulation materials can vary significantly depending on the material chosen.

CONCRETE EXAMPLE

An air cooler (much less energy intensive than an air conditioner) is a very interesting solution for hot and dry climates ***(e.g. Iraq)***. On the other hand, they should be avoided in hot and humid climates ***(e.g. Liberia)*** because they increase the humidity level in the room.

WHAT ARE THE EXPECTED TEMPERATURES BY TYPE OF ROOM / SERVICE?

OBJECTIVES
Reduce energy consumption considerably, comfort of people, save money

Complexity **Low**
Cost **$**
ROI **Rapid**

Respecting MSF temperatures is the action with the most impact and the simplest to implement, in order to achieve the commitment of energy consumption reduction of the MSF climate and environment roadmap.

Air conditioners alone account for between 50% and 80% of the energy consumption of a project!
A set-point temperature of 25°C instead of 20°C can halve consumption, depending on the context.

We can no longer allow ourselves to have air conditioners set to the minimum by default ***(e.g. 17°C)***, that are working with the windows or doors open and that are left on unnecessarily ***(e.g. in an office in the night)***.
We must make this change of habit collectively.

At a personal level, it is also good to know that temperature differences > 6°C between the inside and outside can result in increased fatigue, headaches, nausea and other more or less serious symptoms.

MSF TEMPERATURES BY ROOM / SERVICE	
ROOM / SERVICE*	**TEMPERATURES**
Office	25-32°C (if air conditioned)
Guest house	
Pharmacy**	25°C (min 15°C in cold climates)
Operating theatre	19-23°C
Intensive care	22-26°C
Radiology	<35°C

** This table includes services that are generally air-conditioned.*
For services that are not mentioned, contact your referent.

*** Standard to be adhered to*

It is therefore not necessary to switch on air conditioners if the temperature is equal to or below the temperatures in the table!

The temperature in a room is only one of 6 parameters that influence the thermal comfort of a person
>>> see sheet Building B-2

Temperatures in the services are defined by headquarters medical department, depending on the needs of patients, staff and the medical articles / equipment.

Logistics now assesses the best solution, on a case-by-case basis, to reach the MSF temperature, starting with passive measures then active measures if necessary
>>> see sheet Building B-6

Display this sheet together with **sheets Building B-2** and **Energy A-15** in MSF infrastructures, to make teams aware of MSF best practices.

CONCRETE EXAMPLE

One single air conditioner set 5°C below the recommended temperature potentially costs the mission an extra 1,000 euros every year if electricity is produced by a generator
>>> see sheet Energy B-13

HOW TO TAKE TEMPERATURE AND HUMIDITY MEASUREMENTS?

OBJECTIVE
Have reliable data over a defined period, in order to be able to make the best decisions on how to reach MSF temperatures
(>>> see sheet Building B-4)

Complexity **Medium**
Cost **$**
ROI **Rapid**

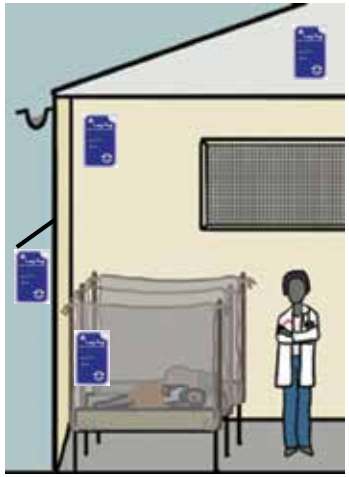
WHICH TOOL TO USE?

The LogTag Haxo-8 is the standard tool to take temperature and humidity measurements -> Uni-Cat PCOLMONIHLH (+ interface PCOLMONITL0 + software freely available on the LogTag website). It is recognizable by the small grey grid at the top left which measures the humidity.
If this model is not available on your mission, place an order and meanwhile start to take temperature readings with the classic model found in the insulated cool boxes of international cold chain orders. LogTags need to be configured before use (-> cf. Quick programming guide).

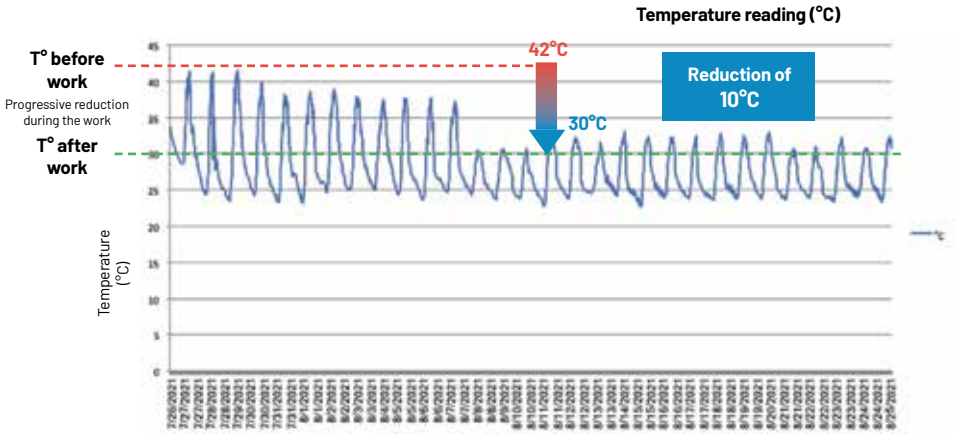
WHERE TO PLACE THEM?

There are 4 main locations to measure the temperature and humidity level:
> Outside in the shade, for reference / comparison values
> At the level of patients and employees
> At ceiling level
> In the false ceiling (if present)

If some walls are exposed to the sun, it is recommended to multiply the measurement zones to evaluate the impact.
Take care not to position them close to sources of heat or cold or in the flow of ventilation air, etc., as this will give false readings.
15 days of readings gives a representative image, but be careful with the effect of seasons, depending on your country.



ANALYSING THE DATA:
→ SEE CONCRETE EXAMPLE BELOW.



Insulating the roof against the sun's rays

Discuss the results of your readings with the Technical Referents, to find the best technical solutions.

CONCRETE EXAMPLE

In the Philippines, the pharmacy has been covered with palm leaves to reduce the effect of the sun's rays on the roof. LogTags made it possible to monitor the situation from the start and the impact after the work -> -10°C (see above). The air conditioner's energy consumption was considerably reduced to reach 25°C.

WHAT TO DO BEFORE OPTING FOR AN AIR CONDITIONER?

OBJECTIVES

Give preference to passive measures that are not energy intensive, then to active measures that are less energy intensive than an air conditioner. In case an air conditioner is used, do so appropriately

Complexity **Medium**
Cost **n/a**
ROI **n/a**

TEMPERATURE READINGS

The first thing to do is take temperature readings (ideally with a LogTag **>>> see sheet Building B-5 or**, failing that, with a more traditional thermometer) to compare with MSF temperatures
>>> see sheet Building B-4. This will show the size of the difference.

PASSIVE MEASURES AS A PRIORITY:

> Natural ventilation
>>> see sheet Building B-7
> Protection against the sun's rays
>>> see sheet Building B-8
> Insulation
>>> see sheets Building B-9 to B-11
> Thermal inertia
>>> see sheet Building B-12

Passive measures are the first solutions to explore to cool a building, because they don't consume any energy once installed.
This is a significant advantage in terms of environmental impact, money saving and daily management (no maintenance, etc.). They should be considered first and foremost in any construction/renovation project and in existing buildings to reach MSF temperatures
>>> see sheet Building B-4

In many situations, these passive measures can avoid the use of active measures ***(e.g. air conditioning)***.
And if your context does need active measures, these should be combined with suitable passive measures to limit the use of the active measures
Example: a pharmacy with a light coloured roof and good insulation (ceiling and walls) can reduce the consumption of the air conditioner by ± 40%. This is not trivial, given that air conditioners are responsible for between 50% and 80% of a project's consumption
>>> see concrete example on sheet Building B-5

IF PASSIVE MEASURES ARE NOT SUFFICIENT → ACTIVE MEASURES:

> Mechanical ventilation
>>> see sheet Building B-13
> Air cooler
>>> see sheet Building B-15
> Air curtain
>>> see sheet Building B-16
> Canadian well
>>> see sheet Building B-17
> Air conditioning as the last resort

IF AN AIR CONDITIONER IS THE CHOSEN TECHNICAL SOLUTION:

> Evaluate the possibility of solar air conditioning
>>> see sheet Energy B-6
> Choose a good air conditioner model
>>> see sheet Energy A-4
> Also provide fans and encourage their use instead of air conditioning, whenever possible
> Communicate and display MSF temperatures (**>>> see sheet Building B-4**), the parameters related to thermal comfort (**>>> see sheet Building B-2**) and energy best practices (**>>> see sheet Energy A-15**)
> Ideally lock the set-point of the air conditioner to the MSF temperature
>>> see sheet Energy A-6
> Implement the maintenance plan
>>> see sheet Energy A-17

The solution used can vary throughout the year (e.g. air conditioning during the hot months and mechanical ventilation with fans during the rest of the year, etc. → in this case, consider switching off the air conditioner's circuit at the electricity distribution board).

CONCRETE EXAMPLE

This methodology is already applied to construction projects. However, there is room for improvement in existing buildings!

PASSIVE MEASURE: HOW TO CREATE NATURAL VENTILATION?

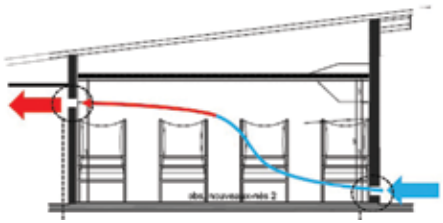
OBJECTIVE

Improve thermal comfort with energy-efficient technical solutions that are free to use

Complexity **Medium**
Cost **$**
ROI **Rapid**

Natural ventilation is suitable in contexts with a limited amount of dust, because there is no filtering of the air.

Its operation relies on a simple physical principle: hot air, which is lighter than cold air, rises and generates a natural draught of air in the building. A continuous flow of air is thus created.
This natural ventilation can:
> Reduce the temperature of interior spaces
> Contribute to airing
> Reduce the humidity level



The predominant wind direction must be considered in the positioning of air entrances and exits. In the diagram above, the wind must mostly arrive on the side of the blue arrow.

TYPE OF NATURAL VENTILATION		EFFECTIVENESS	DETAILS / EXAMPLES
Unilateral ventilation		Limited	One window open
Cross ventilation		Adequate	Tent 45m² open on 2 sides or 2 windows on opposite walls
Ventilation by chimney effect		Good	Logistics stock
Ventilated false ceiling (ideally plus insulation)		Very good	Pharmacy, medical service, office, guest house, etc.
Ventilation by chimney effect + ventilated false ceiling		Very good	Healthcare centre, office, guest house, etc.
Roof ventilation turbine		Optimises the chimney effect, with or without false ceiling	UniCat : CCLIVENTT

> Natural ventilation is not suitable for some medical services: operating theatre, sterilisation, radiology, etc. → consult your referents
> Ventilation of certain medical services must conform to specific rules (e.g. tuberculosis)
> In malarial areas, ventilation holes must be covered with mesh, like the other openings in the room

The roof ventilation turbine works without electricity. The turbine is turned by the chimney effect together with the wind, and thus the draw of air is increased to extract more hot air from the building.

CONCRETE EXAMPLE

At the hospital in Bangladesh, the false ceilings of services are ventilated and equipped with turbines to increase the effect. The roofs are also painted white to protect against the sun's rays

>>> see sheet Building B-8

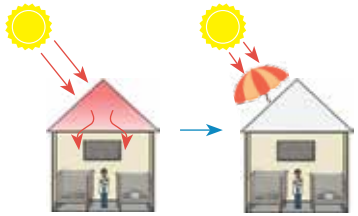
PASSIVE MEASURE: HOW TO PROTECT AGAINST THE SUN'S RAYS?

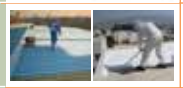
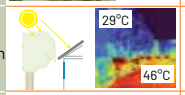
OBJECTIVES

Improve thermal comfort with relatively easy-to-implement technical solutions, reduce energy consumption where air-conditioners are used

Complexity **Medium**
Cost **$$**
ROI **Rapid**

Protecting a building from the sun's rays is one of the best solutions to limit the temperature rise inside and therefore reduce the energy consumption of any air conditioners.



SOLUTIONS AGAINST THE SUN'S RAYS			EFFEC-TIVENESS	DETAILS / EXAMPLES
	Solar film		Adequate	Film to glue to windows exposed to the sun. The MSF hospital in Amman is equipped with this.
	Shutters and blinds		Adequate	Prevents the sun from heating the rooms through the windows, depending on the position of the sun. Devices that can be placed outside are preferable, to avoid hot areas inside behind the glass.
	Roof colour		Good	Light colours reflect the rays, reducing heat gain (same logic for a vehicle). 
Shade on the roof and/or facades	Solar shading		Adequate	An awning adapted to the sun's trajectory prevents the sun's rays from penetrating inside the building. It can be made from shade netting, wood, sheet metal, etc.
	Vegetation		Adequate	Vegetation is another alternative to create shade along the length of facades. It can also be used to create shady areas outside. Think twice before cutting down a tree on the site!
	Roof overhang		Good	Extending the roof creates a significant shady zone along the entire facade.
	Shade netting for roof and walls		Good	Ideal in emergencies on tents or temporary structures. For any "double roof" assembly with shade netting (or anything else), it is important to leave an air gap between the roof and the shade netting to optimise the effect.
Buffer space	Veranda		Good	A veranda creates shade all along the facade, as well as a space with a more pleasant temperature for patients. But note that this type of solution decreases the natural light in the building.
	Ventilated false ceiling		Very good	Helps to keep the radiant heat in the attic. Requires ventilation and ideally insulation of the false ceiling. Ideal for: pharmacy, medical services, office, guest house, etc.
	Insulated false ceiling		Very good	Very effective solution but generally expensive. To be used for long term situations. Suitable for all types of building. Particular attention should be given to temperature controlled buildings/services/rooms to reduce energy consumption (e.g. pharmacy) **>>> see sheets Building B-9 to B-11**
	Double roof or roof insulated from the inside		Good	Example: palm leaves on the roof -> less expensive but need renewal over time. Protect against the sun's rays and give a certain amount of insulation, depending on the material -> see "concrete example" about a pharmacy (**>>>sheet Building B-5**). Interior roof insulation is another more expensive solution, but it is more durable **>>> see diagram on sheet Building B-9**

The creation of shady areas around the buildings also contributes to decreasing the overall site temperature, by limiting the phenomena of absorption / ground heat radiation → see illustration "Vegetation".

CONCRETE EXAMPLE

In Ivory Coast, several solutions were integrated from the design phase of the project to build a maternity hospital: sun shade veranda, ventilated false ceiling + installation of roof turbines afterwards.

PASSIVE MEASURE: WHEN TO INSULATE A BUILDING?

OBJECTIVES
Considerably reduce the energy consumption of air conditioners, thermal comfort, save money in the medium term

Complexity **Medium**
Cost **$$$**
ROI **Intermediate**

WHEN TO INSULATE?

Insulation creates a thermal barrier between the inside and the outside. It helps to limit the effect of the sun's rays in all types of building (>>> see sheet Building B-8 + diagram opposite) and to avoid thermal losses in the case of controlled temperatures ***(e.g. pharmacy)***.
Insulation is therefore to be considered in all construction and renovation projects. Particular attention should be given to temperature controlled buildings / rooms / services, to reduce energy consumption.
This type of work is generally expensive and can have a ± significant carbon footprint, depending on the type of material chosen and any possible transport. It is therefore important to ask the following questions before starting:

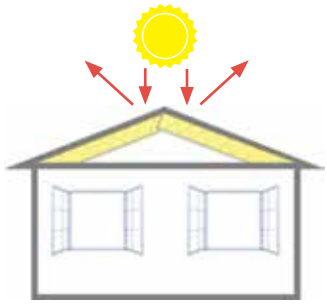
> Is there sufficient visibility of the length of time on the site to justify the investment?
> Has there been an energy assessment of the building (>>> see sheet Building B-1) with temperature readings (>>> see sheet Building B-5) and an analysis compared to MSF temperatures (>>> see sheet Building B-4)?
> Have the simplest passive measures been evaluated / implemented: natural ventilation (>>> see sheet Building B-7) and/or protection against the sun's rays (>>> see sheet Building B-8)?

WHAT STEPS TO TAKE TO CARRY OUT INSULATION WORK?

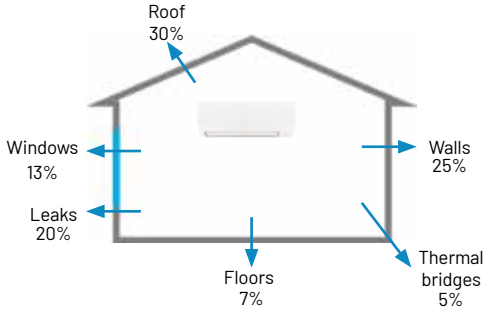
> Determine which building or area should be insulated -> reorganise / partition the space if necessary
> Identify the most appropriate type of insulation and the insulation performance required (thickness)
> Check if the structure that will hold the insulation is capable of supporting the extra weight
> Research insulation materials available for local purchase and compare with possibilities from your ESC
> Determine if the work will be implemented internally or sub-contracted (the quality of the implementation has a large influence on the effectiveness of the insulation!)

IMPORTANT CONCEPTS:

> Thermal losses: they are not the same from all the surfaces of a room (see diagram opposite). At MSF, an insulation project must insulate the ceiling / roof, and the walls are strongly recommended in the case of controlled temperatures
> Airtight sealing: certain relatively recent construction standards impose air tightness to increase the energy efficiency of the building. For buildings that do not meet these standards and which are air conditioned, particular care must be given to "leaks" (>>> see sheet Building B-11) and to air renewal (>>>see sheet Building B-14)
> Thermal bridges: these are any interruptions in the insulation layer ***(e.g. concrete floor between 2 levels in the case of interior insulation, poor junction of the insulation when installed, passage of electrical conduits or plumbing, etc.)***
> Interior or exterior insulation: when the whole building is to be insulated, exterior insulation is preferred because it better avoids thermal bridges and the interior walls create thermal inertia (>>> see sheet Building B-12). However, when it is necessary to insulate a particular service / room, the choice will be made case-by-case, depending on the surrounding environment, accessibility and the risks of thermal bridges.



Protection against the sun's rays in any type of building



Thermal losses in the case of controlled temperatures

Insulation of a building / room / service increases the risk of condensation (especially in humid climates). Consider including air renewal in your insulation project
>>> see sheet Building B-14

It is strongly recommended to collaborate with the Technical Referents for an insulation project because of its technicality, and anticipate the expense in your budget. Include the return on investment in your proposal.

CONCRETE EXAMPLE

According to the tools used to calculate thermal losses from walls & ceilings:
An air-conditioned pharmacy in a free-standing building of 50m^2 powered by a generator and having a temperature delta of 5°C for 12h/day to reach 25°C, will cost 5,050 euros per year to air-condition if the building (made from 20cm thick breeze/cinder blocks) is not insulated, and only 202 euros if a 20cm layer of glass wool insulation is added to the ceiling and the walls.
This calculation does not take into account the energy consumption necessary for air renewal (obligatory) as well as any possible leaks and thermal bridges.

PASSIVE MEASURE: WHICH INSULATION TO CHOOSE?

OBJECTIVES

Choose insulation most suited to the location, determine the right thickness relative to the defined insulation requirement, ensure correct installation

Complexity **High**
Cost **$$$**
ROI **Intermediate**

WITH INSULATION, THERE ARE 3 PRINCIPLE VALUES:

> "t" = thickness (m)
> "λ" = (lambda) thermal conductivity
> "R" = thermal resistance

To find the R-value of an existing building, add up the R-values of the different layers that it's composed of R = t / λ
To determine the necessary thickness in relation to a desired R-value and a given "λ": t = R x λ
The greater the R-value is, the thicker the insulation is and the better it is.

MSF recommends an R-value of at least 5 for roofs/ceilings and an R-value of 3 for walls -> consult your Referents to fine-tune your project in relation to your context.
Reminder: an insulation project must definitely insulate the ceiling/roof; the walls are strongly recommended in the case of controlled temperatures.

The availability of different types of insulation varies greatly from one mission to another. Preferably purchase locally, availability and quality allowing. Otherwise, go to your ESC -> UniCat : CBUIINSU / CBUISHEES

Most insulation is offered in different forms, depending on the type of surface to insulate:
> Rigid or semi-rigid panels
> Rolls
> Loose-fill or bulk (to be spread or blown with a suitable blower)
> To project

To avoid thermal bridges:
> Install "cross-over" by overlapping 2 layers of insulation, for panels and rolls
> Follow the installation guidelines (join polyurethane panels with adhesive tape, etc.)
> Prefer loose-fill/bulk or projection insulation, for irregular surfaces and shapes

Check if your insulation needs a vapour barrier to protect it from humidity. The risk of condensation rises with the relative humidity and the difference in temperature between inside and outside.

For more information about insulation -> cf. Passive Design Guide

It is strongly recommended to collaborate with the Technical Referents for an insulation project because of its technicality, and anticipate the expense in your budget. Include the return on investment in your proposal.

	Type of insulation*	Thickness (m) for "R" of 5	λ Lambda	Weight kg/m3	Resistance to humidity	Resistance to fire	Resistance to rodents	Resistance to insects	Emission of CO_2 during manufacture	Price
Insulation of plant-based origin	Wood wool 	0.2	0.04	55	Adequate	Non	Yes	Yes	Poor	$$
	Cellulose wadding 	0.19	0.038	35	Adequate	Certain	Yes	Yes	Poor	$$
	Palm leaves 	Not documented			No	No	No	No	Very poor	$
Synthetic insulation	Polyurethane 	0.12	0.025	40	Yes	Certain	Adequate	No	Very high	$$$
	Extruded polystyrene 	0.16	0.032	35	Yes	No	No	No	Very high	$$
	Expanded polystyrene 	0.17	0.035	20	Yes	No	No	No	High	$$
Mineral insulation	Glass wool 	0.17	0.035	27	No	Yes	No	Adequate	High	$
	Rock/mineral wool 	0.18	0.037	40	No	Yes	No	Yes	High	$
	Hollow breeze/cinder blocks 	4.2	0.84	Most structural materials have very limited insulation performance. They must however be taken into account when calculating a building's R-value.						
	Air layer 	An unventilated layer of air between two brick walls also provides an effective thermal insulation.								

This data needs to be checked with your supplier
** Other types of insulation exist, consult with your referents to evaluate their performance*

CONCRETE EXAMPLE

MSF-OCG have launched an insulation "campaign" in all of its pharmacies using mainly polyurethane panels.

PASSIVE MEASURE: HOW TO IMPROVE AIR-TIGHTNESS?

OBJECTIVES

Reduce the "leaks" responsible for thermal loss in air-conditioned buildings / services / rooms, reduce energy consumption, save money

Complexity **Low**
Cost **$**
ROI **Rapid**

A building full of "leaks" is comparable to a bucket with a hole in it... except that you don't see it. However, the over-consumption of energy is really there for cooling (or heating) the building.

There are various simple tricks to reduce these leaks and therefore improve the air-tightness. These measures are mainly aimed at temperature controlled buildings / services / rooms.

SEALING STRIP FOR WINDOWS AND DOORS ("DRAUGHT EXCLUDER")

As necessary, stick sealing strips on the frame or opening of your woodwork, to create a line of contact in the closed position and therefore reduce the leaks.

MASTIC OR EXPANDING FOAM

The joints between woodwork (windows/doors) and the walls must always be made airtight with a suitable interior and exterior sealant.

For larger holes, use masonry and then apply sealant or use expanding foam. Read the instructions before use.

AUTOMATIC DOOR CLOSER

Prevents outside hot air from entering the building ***(e.g. entrance door)*** or that the cooled air in a room doesn't escape ***(e.g. office)*** by forgetting to close the door. Check for correct adjustment of the device at installation and over time.

NON-RETURN/CHECK FLAP ON MECHANICAL VENTILATION DUCTS

Allows for air renewal at the desired times but blocks the flow of air at other times. Different models exist. Also limits unwanted intrusion by insects (mosquitoes, etc.).

All of these tips also have a positive effect on acoustic comfort by reducing the noise coming from outside.

Improving air-tightness also requires working in parallel on the renewal of air by mechanical ventilation, to ensure the quality of air within the building (even when using an air conditioner)

>>> see sheet Building B-14

CONCRETE EXAMPLE

In Qayyarah, Iraq, good air-tightness of an air-conditioned medical structure required improvements to the renewal of air, to avoid condensation from humidity in the facility.

PASSIVE MEASURE: HOW TO CREATE THERMAL INERTIA?

OBJECTIVES
Store cold (or heat) for slow return, thermal comfort, reduce energy consumption

Complexity **Medium**
Cost **$**
ROI **Rapid**

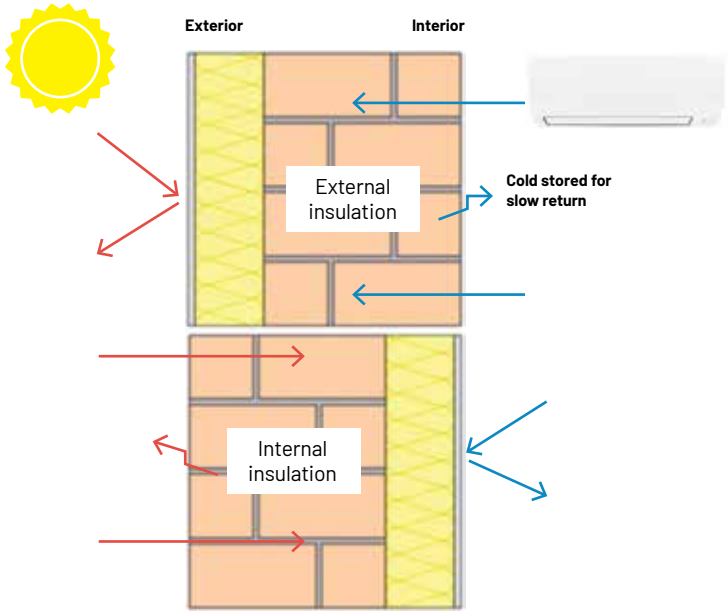
The principle of thermal inertia is to store cold (or heat) in a material at some time in the day, and benefit at another time of the day from a slow return. For this to work, the material must have a high mass (concrete, bricks, etc.).

In climates where there is a significant difference between daytime and nighttime temperatures, it is possible to create a thermal inertia effect by airing / ventilating the building during the night. Because of its mass, the building's material will store the coolness and return it to the interior during the day. This also helps to slow the penetration of external heat into the walls during the day.

Insulation can amplify thermal inertia if it is installed on the exterior side. The walls can then fully store the cold without being reheated by the heat outside
>>> see diagram opposite and **sheets Building A-9 to A-11**

Example: a building equipped with solar air conditioning, exterior insulation and a high interior thermal inertia can potentially maintain a pleasant temperature during the night without using air conditioning.

Walls that keep a pleasant temperature by thermal inertia also improve the thermal comfort of patients or employees near to these walls
>>> see sheet Building B-2



Collaborate with the Technical Referents for this type of project.

The principle of thermal inertia in a building is comparable with that used in the cold chain by placing ice packs in nearly empty fridges... a stock of Ringer's fluid in the pharmacy has the same effect.

CONCRETE EXAMPLE

At present, we are more often confronted by the inverse effect: when the exterior walls are neither insulated nor protected from the sun's rays, they radiate heat towards the inside for much of the night, requiring the use of an air conditioner for sleeping, for example.

ACTIVE MEASURE: MECHANICAL VENTILATION – HOW TO CREATE AIR MOVEMENT?

OBJECTIVES

Avoid or reduce the use of air conditioners, save money

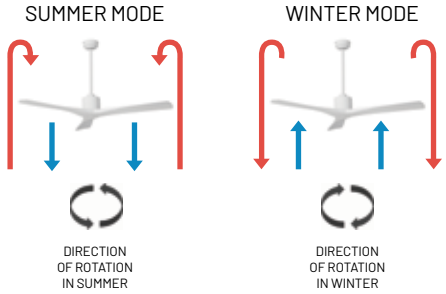
Complexity **Low**
Cost **$**
ROI **Rapid**

The creation of an airflow directed towards a person can give a feeling of freshness, thanks to enhancing the phenomenon of evaporative transpiration (sweating) of the skin. This simple movement of air (±2m/second) can lower the perceived temperature by 3°C whilst consuming 40 x less than an air conditioner. The use of a fan instead of an air conditioner can save 1,000 euros and 2t of CO_2 per air conditioner per year

>>> see sheet Energy B-13

Depending on the mission country, fans can be sufficient or cover the need for thermal comfort for part of the year. In the second case, it is recommended to define an annual schedule for the use of fans and air conditioning, according to the hottest months of the year. Consider switching off air conditioner circuits at the electricity distribution board, during the months that you only use fans.

The standing fan and the ceiling fan are the most common equipment for creating a movement of air.



The standing fan is the solution which is the simplest, most economical, mobile and fastest to set up.

Ceiling fans produce the most uniform movement of air in the room.
They have different "summer" and "winter" direction's of rotation. To check if you are in summer mode, see if the blades turn anti-clockwise.

Remember to switch off your fan when you leave the room, it does not actually cool the room, it just creates a feeling of thermal comfort when you are in it.

It is recommended to equip every air-conditioned room with a fan, and encourage users to only use the air conditioning when the fan does not offer the necessary thermal comfort

>>> see sheets Building B-2 & B-4

Mechanical ventilation increases the circulation of air in the room. This solution is not suitable for certain medical services where specific rules must be followed: burn victims, neonatology, tuberculosis, etc. → see Medical and Technical Referents

CONCRETE EXAMPLE

In a dry climate with a temperature of 30°C, the use of a fan can give a perceived temperature of 27°C, which is totally acceptable from a thermal comfort point of view

>>> see sheet Building B-2

ACTIVE MEASURE: MECHANICAL VENTILATION – HOW TO MANAGE AIR RENEWAL?

OBJECTIVES

Ensure the quality of the air breathed while limiting the load on air conditioners

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

Air renewal by mechanical ventilation is to some extent an amplified natural ventilation, that controls the renewal of air required in a given room / service.

On many of our projects, this renewal of air is done naturally if the building is not air-tight. The holes ("leaks") together with doors and windows open at times can be enough to ensure air renewal, if the location isn't air conditioned.

When air conditioners are installed, it is necessary to improve the insulation and air-tightness in parallel, to avoid unnecessarily high energy consumption

>>> see sheets Building B-9 to B-11

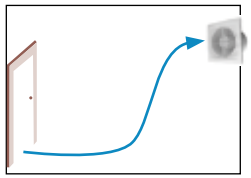
It's mainly in this case that it's necessary to put mechanical ventilation in place, to manage air renewal, in order to ensure air quality for the people present in the building.
Without this mechanical ventilation, the concentration of various pollutants and CO_2 from exhaled air rises rapidly.

Most common technical solutions:

Extractor fan: Simple and easy to install. Consider anti-mosquito mesh and a non-return/check flap.

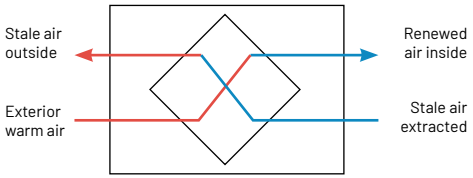
Extraction system, simple flow: Allows air to be extracted from multiple rooms simultaneously.

The extractor fan and the simple flow extraction system create a partial vacuum and therefore need to draw outside air from another location in the room / building.



Extraction system, double-flow

HVAC



Even if this equipment limits the renewal of air to the necessary level, and that some can partly cool the air introduced with the extracted stale air (double-flow extraction system and HVAC), the new air coming from outside will increase the load on air conditioners.

To reduce this extra air conditioner consumption due to air renewal, various solutions exist:

> If the volume of the room is substantial with few people in it, you can renew the air during the cooler hours in the night

Example: a 400m³ pharmacy with one person working in it for 8h per day, with a defined air renewal requirement of 45m³/person/hour, can renew the necessary 360m³ during the 3 coolest hours of the night, with a 120m³/hour extractor fan and a programmable timer switch

>>> see sheet Energy A-7

> If, on the contrary, there are many people in a small space, it is possible to filter some of the air and renew the rest.

Example: a 120m³ hospital room with 8 patients and 1 careworker present 24h/24, with a defined air renewal requirement of 25m³/person/hour, will have to spread the renewal of 5400m³ of air over the whole 24h. To avoid having to air condition 225m³/hour of new air coming from outside, some systems can filter part of the 225m³ and renew the other part with outside air.

> Selection of the system, its installation and its maintenance requires specialist technical skills
> Some services have to respect specific rules in terms of air circulation → see Medical and Technical Referents

CONCRETE EXAMPLE

In Europe, a new construction must respect a certain level of insulation and air-tightness, and be equipped with a system of air renewal to ensure air quality.

ACTIVE MEASURE: WHEN TO CHOOSE AN AIR COOLER INSTEAD OF AN AIR CONDITIONER?

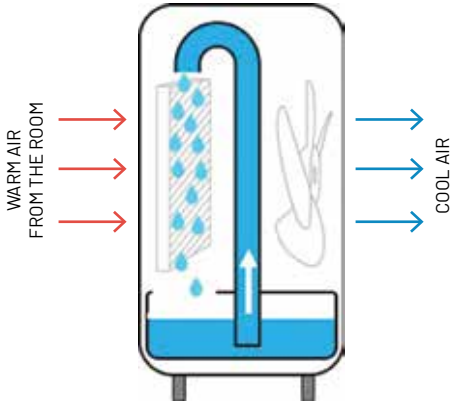
OBJECTIVES

Reduce energy consumption, reduce maintenance, save money

Complexity **Medium**
Cost **$$**
ROI **Rapid**

HOW DOES AN AIR COOLER WORK?

Warm air from the room is cooled and humidified by passing over a pad soaked with water, which evaporates over time.
It's an improved version of the technique of placing a damp towel in front of a fan to cool the blown air.
At 35°C, in a dry climate, it can provide a measured temperature of 28°C and perceived temperature of 26°C, thanks to the flow of air from the integrated fan.



ADVANTAGES COMPARED TO AN AIR CONDITIONER	DISADVANTAGES COMPARED TO AN AIR CONDITIONER
Uses up to 10 x less energy	Not possible to regulate to a set temperature
Doesn't use any refrigerant gas	Consumes water
Does not emit heat outside	Increases the humidity level in the room
Less expensive to purchase and to maintain	

WHERE TO USE AN AIR COOLER?

They are suitable for hot and dry climates. The lower the humidity level in the air, the more interesting the performance of the equipment will be. They are particularly suited for offices and guest houses.

It is not suitable for use in medical services and pharmacies.

WHICH MODEL TO CHOOSE?

The main points of attention are:
> The power: refer to the technical specifications to see the surface area covered by the equipment
> The size of the water reservoir: the larger it is, the less often it will need to be refilled
> The sound level: important when used in an office or a bedroom

UniCat : CCLICOOL (prefer local purchase if possible)

Refilling the water reservoir

Model for a bedroom ±100W

Model for a large office ±600W

Model for several rooms with ducting

Air coolers are not suitable for humid climates.

To avoid any risk of legionella, respect the maintenance (→ see technical instructions) and do not leave water in the reservoir that has reached a temperature above 25°C.

CONCRETE EXAMPLE

Missions in Afghanistan, Iraq, etc. are equipped with air coolers.

ACTIVE MEASURE: WHEN TO INSTALL AN AIR CURTAIN?

OBJECTIVES

Reduce energy consumption of air conditioners, better temperature control

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

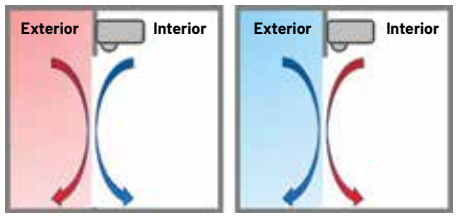
HOW DOES AN AIR CURTAIN WORK?

An air curtain directs a flow of air from top to bottom when opening a door to the outside, in order to reduce the loss of cold in summer or heat in winter ***(e.g. hospital entrance door)***.

It can also be used inside buildings before entering into a temperature controlled area ***(e.g. pharmacy, operating theatre, intensive care, etc.)***.

It additionally limits the intrusion of dust and various pollutants.

Air curtain = thermal protection



SUMMER **WINTER**

HOW TO CHOOSE AN AIR CURTAIN?

The main points of attention are:

> The width of the opening -> determines the necessary width of air flow
> The height of the opening -> determines the air flow required to reach the ground
> Fixing to the wall or ceiling -> visible or recessed model
> The control functions (automatic when the door is opened, etc.)

An air curtain can reduce the energy consumption of air conditioners by up to 80% in high traffic areas.

Don't hesitate to contact your technical referents to help you with selection.

CONCRETE EXAMPLE

This system is used in some Health Ministry hospitals in Haiti to reduce the use of air conditioners.

ACTIVE MEASURE: IN WHAT CONTEXTS IS THE CANADIAN WELL AN INTERESTING SOLUTION?

OBJECTIVES

Use an unlimited resource, reduce energy consumption, save money

Complexity **Medium**
Cost **$$$**
ROI **Long**

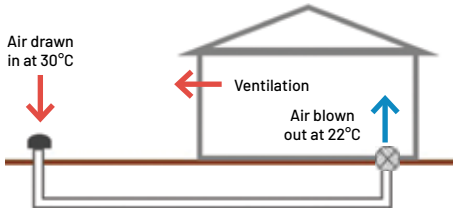
HOW DOES A CANADIAN WELL FUNCTION?

A Canadian well is a geothermal ventilation system that uses the thermal inertia of the ground over the seasons. This inertia is always "late" compared to the current season, so it allows the interior air to be cooled in summer and heated in winter.

More specifically, it draws in exterior warm air in summer and cools it by passing it through a series of underground pipes, generally placed between 1.5m and 2.5m below the surface. The cool air that comes out at the other end of the pipe inside the building can lower the temperature and renew the interior air. In winter, the effect is reversed: it draws in cold air from outside and it arrives warmed-up inside.

Canadian wells have very low running and maintenance costs, and use an unlimited resource.

This system might be sufficient on its own, or together with another technology that will therefore be less loaded ***(e.g. air conditioner)***.



Ground temperature lower than exterior air in summer

WHERE TO USE A CANADIAN WELL?

For it to function effectively, it's important to have significant temperature differences between seasons, in order to recharge "the battery" (= the ground).

It is therefore not recommended in tropical areas.

In terms of implementation, it requires lots of space that can be dug up to install the network of pipes.

This space cannot be used afterwards for other constructions.

Consult your Technical Referents to evaluate the feasibility for your project and the technical aspects.

CONCRETE EXAMPLE

MSF currently has only one Canadian well. Feedback is ongoing.

WHAT ARE THE "GREEN" POINTS TO NOTE WHEN RENTING A PROPERTY?

OBJECTIVES

Choose rental buildings that are acceptable from an energy point of view, identify improvement possibilities from the start

Complexity **Low**
Cost **$**
ROI **Rapid**

"GREEN" BUILDING CHECKLIST BEFORE RENTING	YES	NO
Thermal efficiency of the building		
Is there a significant difference between temperature readings without active measures in the building and the MSF temperatures?		
Are the volumes suitable for the requirements (especially temperature controlled rooms)?		
Is the building insulated (principally roof and walls)?		
Is the thickness and condition of this insulation sufficient?		
Can the roof and walls be insulated if necessary?		
Are there false ceilings?		
Do the structural materials have potential thermal inertia (concrete, brick, etc.)?		
Is the building's level of air-tightness acceptable (doors, windows, walls, etc.)?		
Do exterior doors close automatically?		
Is the building equipped with mechanical ventilation?		
Can the attic/roof space be ventilated?		
Is the roof a light colour?		
Can measures to protect against the sun's rays on the roof be implemented?		
Are there any walls exposed to the sun?		
Is it possible to limit the sun's rays on these facades?		
Are there any windows exposed to the sun?		
Is it possible to reduce the sun's rays through these windows?		
Are the windows double-glazed?		
Is there vegetation and/or shady areas around the building?		
Air Conditioners		
Are they correctly sized?		
Are they of the inverter type?		
Is their energy efficiency rating (EER) > 3?		
Are they reversible (if cold seasons)?		
Do they use the least polluting refrigerant gas available in the country?		
Is their general appearance OK and have they been maintained?		
Are the air conditioners on their own dedicated circuits, so that sensors and programmable timer switches can be installed?		
Hot water		
Is the hot water producing equipment suitable for requirements?		
Is it fairly new?		
Is it possible to install a solar water heater?		
Electrical appliances		
Do they have a good energy rating?		
Are they a suitable size for the number of users?		
Are they of the inverter type?		
Lighting		
Is the lighting of type LED?		
Are the number and layout of lights suitable for requirements?		
Are some circuits automated (outside, corridors, sanitary facilities, etc.)?		
Production of energy		
Is the energy mix of the city power grid acceptable?		
Are there solar panels on the site?		
Is there enough space and a good orientation to install them if necessary?		
Location		
Does the distance to other MSF sites allow for travel by foot and/or bicycle (security situation permitting)?		

This checklist can also be used to verify a building that has already been rented by MSF.

CONCRETE EXAMPLE

Use this checklist to identify the advantages and disadvantages of one or more rental properties.
Refer to the relevant sheets for more information and to see the impact level of these different points.

MOTORIZED FLEET MANAGEMENT

MSF-OCP CLIMATE AND ENVIRONMENT ROADMAP
→ "TRAVEL" SECTION

N.B. blurred points are handled by other departments

MAIN ANGLES OF ATTACK AND PRINCIPLES TO ACHIEVE THEM

MAIN ANGLES OF ATTACK:

> The proportion of city cars / minibuses or new-generation Land Cruisers will increase significantly compared to Land Cruisers with old engines until 2030
> The number of vehicle kms driven for a constant level of activity gradually decreases until 2030 by optimising movements
> Drivers are trained in eco-driving by 2030
> Land Cruisers, Hiaces and Hiluxes are equipped with a permanent oil filter wherever possible by 2030
> Missions assess sustainable mobility and public transport for commuting to work by 2030

PRINCIPLES TO IMPLEMENT ON ALL MISSIONS TO ACHIEVE THIS:

> The purchase of a new vehicle is done by selecting the least polluting vehicle that meets the operational needs:
- City cars / minibuses for the city, tarmac and good tracks
- Light 4x4s or new-generation Land Cruisers for tracks in poor condition
> Every vehicle purchase is validated by the Technical Referent beforehand
> The technical policy for fleet renewal is respected
> The organisation and rationalisation of movements is given particular attention with resources dedicated and adapted depending on the context
> The principles of eco-driving are understood and respected by the drivers
> Permanent oil filters are ordered and installed
> In contexts that allow it, sustainable mobility and public transport are encouraged by MSF

A

OPTIMISE THE SIZE, THE COMPOSITION AND THE MOVEMENTS OF THE VEHICLE FLEET

1 How to determine or reassess the size and the composition of the fleet of vehicles?

2 What type of vehicle to choose, depending on the type of road?

3 Which job position(s) to choose to manage the fleet and movements?

4 How to organise movements?

5 How can geolocation help to organise movements and limit consumption?

6 What are the alternatives to MSF vehicles during working hours?

7 Why train drivers in eco-driving?

8 Which environmental criteria should be taken into account when buying a vehicle?

9 What is the link between Euro standards and fuel quality on a mission?

10 When to use biofuels?

11 When to choose a vehicle with an internal combustion engine (petrol/diesel)?

12 What are the advantages of the new-generation Land Cruiser?

13 When to choose a hybrid vehicle?

14 When to choose a plug-in hybrid vehicle?

15 When to choose an electric vehicle?

16 What is the correct maintenance interval?

17 Why use a permanent oil filter?

18 How to choose "greener" tyres?

19 What to do with workshop waste?

B

REDUCE THE CARBON IMPACT OF COMMUTING

1 How to encourage "greener" journeys for commuting to work?

"

THE GREENEST KM IS THE ONE YOU DON'T DO...

"

CO_2 IMPACT ON:

A-
OPTIMISE THE SIZE, THE COMPOSITION AND THE MOVEMENTS OF THE VEHICLE FLEET

HOW TO DETERMINE OR REASSESS THE SIZE AND THE COMPOSITION OF THE FLEET OF VEHICLES?

OBJECTIVES

Reduce emissions of CO_2 and pollutants, optimise the use of the fleet available in a country, save money

Complexity **Medium**
Cost **$**
ROI **Rapid**

The evaluation of the size and the composition of the fleet must be done when a project opens and periodically on budget deadlines, in case of evolution of activities, etc. Logistics managers of each project are responsible for doing this for their area. The Logistics Coordinator / Fleet Manager is responsible for having the country vision and reorganising vehicle distribution per project as needed.

PRINCIPLES TO BE FOLLOWED

> For each type of movement, the least polluting vehicle meeting the need must be chosen (the Land Cruiser is therefore not the solution for all of our movements)
>>> see sheet MFM A-2
> No vehicle should be assigned specifically and exclusively to one activity, service, person or even project (apply the concept of pooling = 10 to 15% more vehicle availability)
>>> see sheet MFM A-4
> Movements must be evened out throughout the week as far as possible
> Recurring movements must be planned at the same time each week ***(e.g. shopping tour for the purchaser, etc.)*** if the security situation allows

The example from a project, below, lists the number of vehicles needed and the optimal composition that is the least polluting:

Type of movements	No. people	Monday				Tuesday				Wednesday				Thursday				Friday				Saturday				Sunday				Total Vehicles
		Before work	Morning	Afternoon	After work	Before work	Morning	Afternoon	After work	Before work	Morning	Afternoon	After work	Before work	Morning	Afternoon	After work	Before work	Morning	Afternoon	After work	Before work	Morning	Afternoon	After work	Before work	Morning	Afternoon	After work	
Outreach activities	6		LC	LC			LC	LC			LC	LC			LC	LC			LC	LC										
Purchasing	1		MB								MB								MB											
Distributions	3			CL																										
Kiss Coordination	8	MB or rental?				MB	MB												MB	MB										
Hospital shuttle	8	MB			MB	MB			MB	MB			MB	MB			MB	MB			MB									
Hospital ambulance	2		MB	MB			MB	MB			MB	MB			MB	MB			MB	MB										
Office shuttle	3	CC			CC	CC			CC	CC			CC	CC			CC	CC			CC									
Stand by (RDV PC, admin...)	1		CC	CC			CC	CC			CC	CC			CC	CC			CC	CC										
Weekend movements	7																					MB	MB	MB			MB	MB	MB	
Types of vehicles																														
City car	CC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1									1
Minibus	MB	1	2	1	1	1	2	2	1	1	2	1	1	1	1	1	1	1	3	2	1		1	1	1		1	1	1	2
Light 4x4	4L																													
Light Truck	CL			1																										
Land Cruiser	LC		1	1			1	1			1	1			1	1			1	1										1
Land Cruiser Pick Up	LP																													
		2	4	4	2	2	4	4	2	2	4	3	2	2	3	3	2	2	5	4	2	0	1	1	1	0	1	1	1	

Possible improvements in the above example:
> Even out the number of movements in the week: the movement of the purchaser on Friday morning by minibus could, for example, be moved to Thursday or Wednesday afternoon
> It's not necessarily appropriate to have a light truck for 1 movement per week. Could this trip be done with one of the minibuses? Would a rental be possible?

Optimal number and composition for the above example:
1 City Car / 2 Minibuses / 1 Land Cruiser + 1 vehicle as "safety factor" -> in this case 1 Land Cruiser is a consistent choice as it covers all types of movements of the project.

NECESSARY FLEET	
TYPE OF VEHICLE	**No.**
City car	1
Minibus	2
Light 4x4	
Light Truck	
Land Cruiser	1
Land Cruiser Pick Up	
Total	4
+ Safety factor 25%*	**5**

**Safety factor +25% = to cover maintenance, breakdowns, explos, etc.*

Sharing of travel and the vehicle fleet between OCs in coordination is strongly encouraged. This makes it possible to rationalise / pool certain movements and to have a greater variety of models available (shared truck, etc.).

It's recommended to choose one vehicle brand that covers all the necessary models for a project's fleet. The same logic should ideally be applied at the country level. It's sometimes useful to sell one or more vehicles to buy more relevant ones.

CONCRETE EXAMPLE

In the Central African Republic, the mission replaced Land Cruisers by minibuses to carry out the vast majority of the coordination and project journeys in Bangui (medical referrals, team transport, etc.).

WHAT TYPE OF VEHICLE TO CHOOSE, DEPENDING ON THE TYPE OF ROAD?

OBJECTIVE

Have a vehicle fleet suitable for operational needs that is the least polluting possible

Complexity **Low**
Cost **n/a**
ROI **n/a**

Our choice must be the Land Cruiser when no other less polluting vehicle, that meets the need, can travel properly on the type of roads that we have to go over for our operations.
In all other cases, city cars, minibuses or light 4x4s must be chosen in preference.

TOYOTA LAND CRUISER HZJ	
ADVANTAGES	**DISADVANTAGES**
Cross-country ability	Consumption / weight
Useable volume and load carrying capacity	Negative image for MSF if used in cities
Modularity (passengers / patients / cargo)	Frequency of maintenance (and therefore unavailable time for the project)
Possibility to transport a lying down patient	Price and running costs (e.g. 4 Land Cruiser tyres = 600 euros / 4 city car tyres = 300 euros)
Multi-purpose (explos, back up, etc.)	Volume of workshop waste
	Requires a special driving licence (11 seater)
	Lack of comfort in the back
	Envy (e.g. armed groups)

The proportion of kms made in city cars and minibuses, compared to Land Cruisers, has been constantly increasing for 10 years, thanks to collective efforts. As an example, MSF-OCP is close to 50%/50%.

Consider evaluating the need for "4x4 driving" training of drivers, and to equip the Land Cruisers with tyres and kits appropriate to the context, to take full advantage of the Land Cruiser's benefits when justified.

For movements in cities, on tarmac or on good tracks = city car or minibus





For movements on tracks in poor condition = light 4x4 or Land Cruiser if necessary




CONCRETE EXAMPLES

> In Goma, Democratic Republic of the Congo, airport movements are now done with a minibus instead of a Land Cruiser
> In Uganda, city cars are used in the city, an airport shuttle is in place with a minibus and travel over tracks in poor condition on projects is done with Land Cruisers
> In Kinshasa, airport movements are pooled between several MSF offices with a minibus shuttle

WHICH JOB POSITION(S) TO CHOOSE TO MANAGE THE FLEET AND MOVEMENTS?

OBJECTIVES

Have the least polluting fleet possible that is suitable for operational needs, ensure a smooth movement service, optimise and rationalise movements

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

To ensure an efficient utilisation of the vehicle fleet, the people responsible for the following 3 main activities must be identified: fleet management, organisation of movements and monitoring of movements. The job positions in charge of these 3 activities will depend on the size of the fleet and the context.

FLEET MANAGEMENT

This person is principally responsible for determining the size and composition of the fleet, evaluating and improving the organisation of movements, making regular orders and budgeting for the entire mission.
Job position: Fleet Manager (position to open from a certain number of vehicles in your fleet -> more details in the technical policy) or Logistics Coordinator. In both cases, the work will be done in collaboration with the Logistics Manager of each project.

ORGANISATION OF MOVEMENTS

This person is responsible for collecting the movement needs and planning them on the movement chart, taking care to always optimise / rationalise the movements and choose the least polluting vehicle that meets the need
>>> see sheet MFM A-2
Job position: Radio Operator / Movement Operator or Base and Facilities Officer or Logistics Supervisor or Logistics Manager.

MONITORING OF MOVEMENTS

This person is responsible for monitoring movements at pre-defined points of contact and recording the information in the dedicated register.
Job position: Radio Operation / Movement Operator or Base and Facilities Officer or Logistics Supervisor.

The position of Fleet Manager can be shared with other OCs if the workload permits → this will make it easier to validate the budget for the position.

Fleet Manager is a different job position to Workshop Manager.

CONCRETE EXAMPLE

On a mission with several projects and a fleet of 26 vehicles, you can imagine the following setup: a Fleet Manager under the Logistics Coordinator, a Logistics Supervisor on each project in charge of organising movements and a Radio Operator on each project for monitoring the movements.

HOW TO ORGANISE MOVEMENTS?

OBJECTIVES
Ensure a smooth movement service, optimise and rationalise movements, reduce consumption of fuel and spare parts, save money

Complexity **Medium**
Cost **$**
ROI **Rapid**

A- COLLECTION OF INFORMATION

1- Implement a system for collecting travel needs of the different project users ***(e.g. a shared Excel spreadsheet to be filled in a week in advance -> requester, day, time, destination, number of people and cargo, one-off movement or repeated each week, etc.)***
2- Implement a system for collecting travel needs between your project and coordination or other projects (with the same Excel spreadsheet, by weekly email, etc., to be defined with your partners)
3- Implement a system for collecting the needs in terms of maintenance and weekly checks
4- Be up to date on safety rules to be respected ***(e.g. 1 minibus at the guest house evenings and weekends, movement in a convoy of at least 2 vehicles on a certain route, etc.)***
5- Find out the number of vehicles that the project would like to have on standby for legitimate unforeseen events

B- PLAN THE MOVEMENTS FOR THE WEEK

On a large board at a strategic location for you, the drivers and the passengers + online if necessary:
1- Put down the fixed movements that are repeated every week, assigning the least polluting vehicle that meets the need ***(e.g. outreach activities every day, Kiss with coordination Monday and Thursday, purchaser shopping tour on Tuesday, minibus at the guest house evenings and weekends, etc.)***
2- Put down the requested one-off movements for the week, assigning the least polluting vehicle that meets the need ***(e.g. Project Coordinator meeting, etc.)***
3- Put down the weekly checks and maintenance to be done, depending on the free moments in the schedule (+ possible modifications of vehicle allocations already made)
4- Identify any vehicle(s) necessary as standby
5- If you don't have enough vehicles at certain times of the week, approach the most flexible requesters to propose a different moment in the week. If the problem keeps recurring, inform your supervisor

C- ANALYSIS OF MOVEMENT ACTIVITY IN ORDER TO OPTIMISE / RATIONALISE

1- Complete the movement evaluation sheet -> see Technical Referent
2- Share this sheet with your supervisor, the project Logistics Manager and the person in charge of vehicle fleet management for the mission (Fleet Manager or Logistics Coordinator) to optimise movement activity, communicate to users, etc.

No vehicle should be assigned specifically and exclusively to one activity, service, person or even project → apply the concept of pooling = 10 to 15% more vehicle availability.

Try to have as many repeated movements every week at the same time (if the security situation permits) → like that you just have to manage the one-off demands and legitimate unforeseen events.

Prioritise the pooling of movements between OCs or other stakeholders (airport shuttle, commuting, etc.) and, if possible, also pool fleet management and the movements as a whole between OCs and coordination.

Geolocation is encouraged by headquarters to optimise vehicle utilisation. Its use is increasingly widespread on MSF missions
>>> see sheet MFM A-5

CONCRETE EXAMPLE

The UN increasingly works with a vehicle fleet shared between the different agencies present in a city, to rationalise the number of vehicles and offer more flexibility in terms of available vehicle types.

HOW CAN GEOLOCATION HELP TO ORGANISE MOVEMENTS AND LIMIT CONSUMPTION?

OBJECTIVES

Ensure a smooth movement service, optimise movements, reduce consumption of fuel and spare parts, save money

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

WHAT ARE THE BENEFITS OF GEOLOCATION?

ON A DAILY BASIS:

> Optimise the organisation of your movements in real time (reduce the % of "empty" journeys, avoid double trips, etc.)
> Avoid speeding, which leads to over-consumption of fuel, by an audible beep in the car

WEEKLY:

> Make an analysis of movement activity thanks to the data collected: level of vehicle utilisation, number of km driven, journeys made by area, journey logic, timings, spread of journeys through the week, etc.
> Based on analysis of the data, work on the optimisation / rationalisation / pooling of movements
> Check that speed limits have been adhered to, in the context of road safety and fuel consumption

HOW TO CHOOSE A GEOLOCATION SYSTEM?

Two types exist: "real time" geolocation that allows the fleet to be monitored live + analysed periodically, and "recorders" that only allow periodic analysis. Contact your RTR or Technical Referent to assess the possibilities proposed by headquarters and / or evaluate local alternatives (available in most of our intervention countries).

The main points to note are:

> Type of geolocation: real time or recorder (choice depends on needs)
> Functionalities according to your needs and the offer from service providers:
- Alarm and / or SMS for vehicle outside area / time / border
- SOS button in the vehicle
- Alarm and audible beep in the car for excess speed
- Automatic weekly reports (including an "eco-driving" report, which is useful for working with the drivers >>> see sheet MFM A-7)

The use of a geolocation system is encouraged by headquarters. However, its use must be validated by the Head of Mission and the final choice of service provider must be validated by the Cell Logistics Manager after consulting with the Technical Referent.

WHO IS IN CHARGE OF WHAT WITH GEOLOCATION?

FOR DAILY USE:

There must be one person dedicated to monitoring and organising movements throughout the day. This person must be trained to use the platform.

FOR WEEKLY ANALYSIS:

The Logistics Coordinator / Fleet Manager and Logistics Manager of each project are responsible for analysing the data and defining any improvements to make with the teams. They are also responsible for any possible penalties in case of speeding

>>> see sheet MFM A-3

Everyone concerned (drivers, passengers, etc.) must be informed of the use of a geolocation system and the reasons for it must be explained.

It is thought that the implementation of real-time geolocation with the necessary human resources can have a significant impact on the number of kilometres driven and the fuel consumption.

CONCRETE EXAMPLE

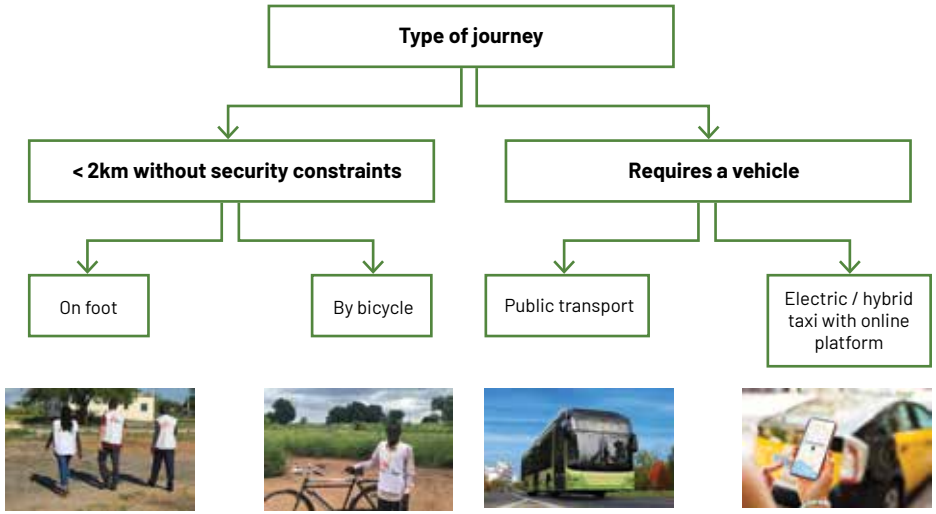
In Uganda, the implementation of geolocation with speeding detection reduced fuel consumption by 12% for one mission which drives 600,000 km / year -> ± 9,000 euros saving and ± 30 tonnes fewer CO_2 emissions / year.

WHAT ARE THE ALTERNATIVES TO MSF VEHICLES DURING WORKING HOURS?

OBJECTIVES

Reduce emissions of CO_2 and pollutants, employee health, flexibility / availability of movements

Complexity **Low**
Cost **$$**
ROI **Rapid**



Applicable in the field and in the capital.
Many of our MSF vehicle trips are less than 2 km! There is therefore a significant environmental impact to consider!
Walking and cycling are also excellent for physical and mental health. And why not use your journeys on foot to have a "walking meeting"?

Generally only available in capital cities.
Even if these solutions are limited in our intervention countries at the moment, things will change by 2030. These solutions should therefore be reassessed over time.

Every place is different, it's up to you to identify the best alternatives to MSF vehicles that you can use in your area. Think about including security parameters in your solutions (to be validated by the Project Coordinator / Head of Mission) and briefing new arrivals on best environmental practices.

The provision of bicycles by the employer means:
> Purchase of good quality bicycles (ideally from a shop which can also manage the maintenance and repairs)
> Providing helmets and locks
> Secure parking spaces on each site with basic tools (pump, spanner to adjust saddle height, etc.)

If you choose to use an online taxi platform with less polluting vehicles, have a meeting with the company to discuss "pro" or "premium" services which make the monitoring and payment of journeys easier.

The possibility to make journeys between offices, healthcare structures and guest houses by foot or bicycle is one of the criteria to take into account when choosing a site for these buildings. In addition to the positive environmental impact, it also means fewer journeys to organise, potentially no drivers needed outside office hours, no shuttle timetable constraints for users, etc.

CONCRETE EXAMPLES

> In Jordan, Tunisia, Congo Brazzaville, Cambodia, etc. some of the journeys between offices, healthcare structures and guest houses are, or were for the closed missions, made on foot and by bicycle
> The Jordan mission regularly uses an online hybrid taxi platform. The taxis are generally available within 3 minutes at a very competitive price. The vehicles and drivers meet MSF safety standards

WHY TRAIN DRIVERS IN ECO-DRIVING?

OBJECTIVES

Reduce fuel consumption and wear on vehicles, safer driving, less stressed drivers, save money

Complexity **Low**
Cost **$$**
ROI **Intermediate**

JOURNEY PREPARATION

> **Walk** when possible
= -100% consumption

> **Plan your route,** avoid detours and unnecessary stops

DRIVING STYLE

> **Do not warm up the engine** in the morning (even with a Land Cruiser)

> Drive with the **highest gear possible** (= the lowest engine speed possible)
= -**8%** fuel consumption.
Golden rule: shift up early and shift down late

> **Respect speed limits** for safety and fuel consumption

> **Avoid rapid acceleration** for fuel consumption and passenger comfort

> **Use engine braking** whenever possible. A good driver hardly ever uses the brakes

> **Read the road ahead** for a smoother ride and therefore lower consumption

> **Switch off the engine** if you stop for more than a minute (no idling with the engine running just for the air conditioning)

> Only use electrical equipment when it's necessary

> **Window open = +5%** consumption
Air conditioning = +10 to 25% consumption, depending on vehicle and journey
Golden rule:
< 65km/h = window open
> 65km/h = air conditioning
(if necessary)

MAINTENANCE AND CHECKS

> Check tyre pressures every week for safety and fuel consumption
-0.5 bar = +3% fuel consumption

> Respect maintenance intervals. **Air and oil filters not replaced = +10%** fuel consumption

LOADING OF VEHICLE

> Remove the roof rack when it's not used
Empty roof rack = +5 to 10%
Loaded roof rack = +35 to 40% fuel consumption

> Avoid **unnecessary excess weight**

Following eco-driving guidelines is even more important when using hybrid or electric vehicles, because of the limited power of the electric module (hybrid model) and the battery life!

"Eco-driving" training is recommended for all MSF drivers. Think about making the request with your superior, so that it can be added to the mission's training needs and budget → various training courses are in preparation at headquarters.

Display or place this sheet in the log office, in the driver's area, in the parking lot, inside vehicles (for the attention of passengers to justify your actions if needed), etc.

Data from a geolocation system in vehicles allows, amongst other things, to work on eco-driving with the drivers

>>> see sheet MFM A-5

CONCRETE EXAMPLE

In the period following training, fuel consumption is generally reduced by 10 to 15% and over time goes to 5% reduction -> hence the importance of reminder sessions and awareness on a daily basis!
For a fleet of 10 Land Cruisers this represents a saving of ± 2,250 euros and ± 7.5 tonnes less CO_2 / year.

WHICH ENVIRONMENTAL CRITERIA SHOULD BE TAKEN INTO ACCOUNT WHEN BUYING A VEHICLE?

OBJECTIVES

Limit the carbon footprint and waste of a vehicle from its consumption, use, maintenance, transportation and end-of-life

Complexity **Low**
Cost **n/a**
ROI **n/a**

STARTING RULE

Choose the least polluting vehicle that meets operational needs (>>> see sheet MFM A-2)

TO DO THIS:

More and more countries are using standardised labels that provide information about the consumption and CO_2 emissions of a new vehicle. There is also usually a scale from "A" to "G", which allows the vehicle to be compared to other offers in the current market (as for light bulbs, electrical appliances, tyres, etc.).

If the standardised labels are not used in the country, the technical specifications of the vehicle must be consulted to find the consumption and ideally the Euro standard
>>> see sheet MFM A-9

OTHER THINGS TO TAKE INTO ACCOUNT:

> Weight of the vehicle: the heavier it is, the more the vehicle consumes. This is particularly penalising for electric vehicles
> Wind resistance: the higher this is, the more the vehicle consumes. A simple empty roof rack on the vehicle increases consumption by 5 to 10%
> Width of tyres: the wider they are, the more the vehicle consumes because of rolling resistance
> Colour of vehicle: prefer white or light colours that reflect the heat. This will reduce the load on the air conditioning -> responsible for 10 to 25% of consumption (depending on vehicle and journey)
> Vehicle options: be content with versions that meet your needs. Superfluous options are a source of technical problems and unnecessary additional costs over time and can increase your consumption
> Maintenance interval: the longer it is, the less workshop waste there will be (and the more your vehicle will be available for the project)
>>> see sheet MFM A-16
> Workshop waste management: if the maintenance will be sub-contracted to the dealership, what is the quality level of waste management in their garage? -> the RTR or Technical Referent checks this point during their validation visit
> Importation route of vehicles and spare parts between the manufacturer and the dealership: the shorter it is, the less the transportation carbon footprint will be significant (for the same means of transport)
> Vehicle end-of-life: how is the recycling of different types of vehicles managed at end-of-life? ***(e.g. batteries from hybrid and electric vehicles)***

Searching the environmental performance of a vehicle on the internet can be misleading. In fact, the same vehicle with the same engine can have different emissions of pollutants according to the Euro standard it meets, depending on the country where it is marketed
>>> see sheet MFM A-9

Consult **sheets MFM A-11 to A-15** to evaluate different types of motors.

Find out about environmental standards currently in force and to come in your mission country before purchasing a vehicle, and follow the local car market (new brands, new hybrid or electric models, etc.).

CONCRETE EXAMPLES

> In the Philippines, standardised labels have been implemented to help and encourage clients to choose less polluting vehicles
> In Chad, some Toyota models are also starting to have these labels

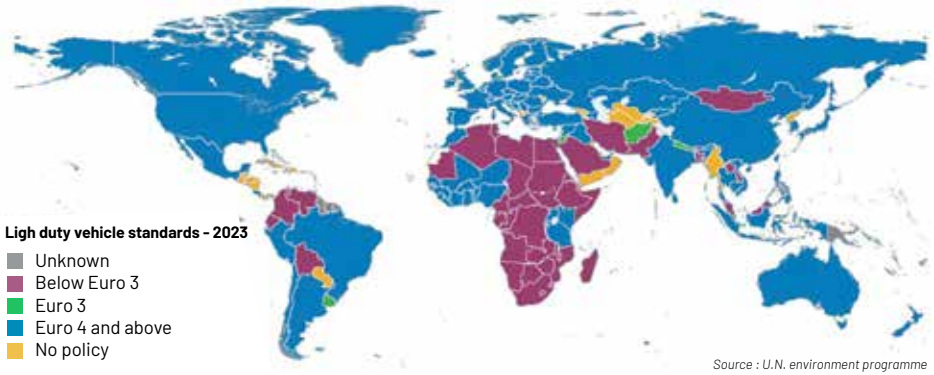
WHAT IS THE LINK BETWEEN EURO STANDARDS AND FUEL QUALITY ON A MISSION?

OBJECTIVES

Ensure compatibility of Euro standard / fuel quality, limit emissions of CO_2 and pollutants, comply with the regulations in force in each mission country

Complexity **Medium**
Cost **n/a**
ROI **n/a**

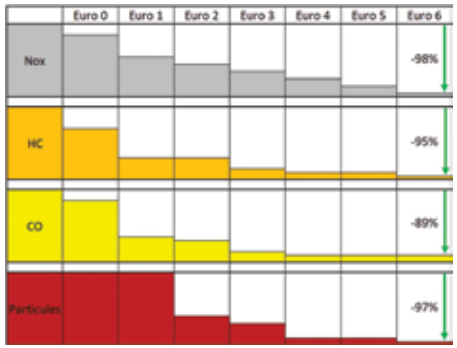
The "Euro" standards set maximum emission limits in g/km for vehicles and other motorised equipment. Their objective is to reduce atmospheric pollution due to road transport. This European standard is applied worldwide. However, the implementation of these standards, increasingly strict ranging from Euro 0 to Euro 6 at the moment, varies from one country to another-> see map.



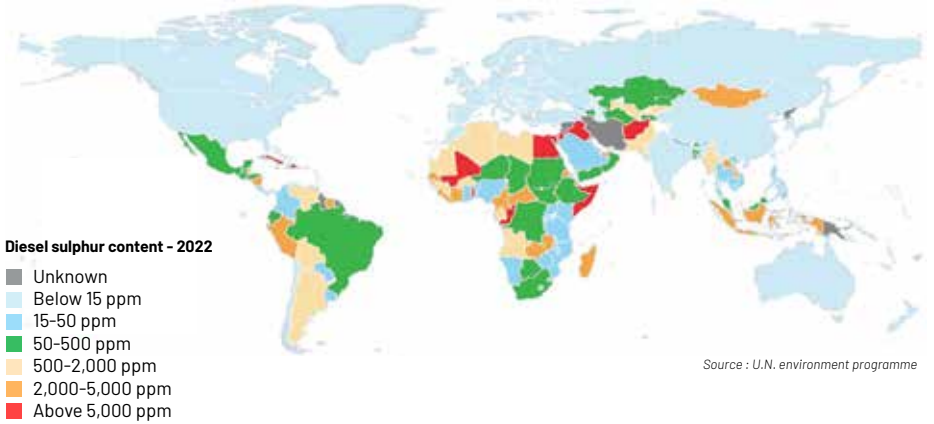
Source : U.N. environment programme

In general, countries have defined a progressive timetable for "Euro" standards spread over time. It's therefore important to know the "Euro" standard in force and those to come in the mission country before purchasing a vehicle.
Always opt for the highest "Euro" standard, to have the least polluting vehicle and avoid possible restrictions on use due to the evolution of "Euro" standards over time.

Toyota plans to upgrade its engines on Land Cruisers to meet these rising demands in terms of "Euro" standards. From 2024, Land Cruisers will be available with new engines classed Euro 4 (instead of Euro 0 at the moment).



The higher the Euro standard, the higher quality the fuel needs to be (→ essential for the anti-pollution systems on vehicles (and generators)).
In Mali, for example, the Euro standard in force is "Euro 4 or higher", but the available diesel has a sulphur content higher than 5000ppm, which makes it impossible to use vehicles above Euro 4. Contact the RTR or Technical Referent if necessary.



Source : U.N. environment programme

In your fleet renewal strategy, take account of the change of engine in the Toyota Land Cruiser from 2024.

At the moment, in the majority of countries, the new Euro standards that come into force only apply to new vehicles purchased locally or imported, and therefore not to our existing fleet.

CONCRETE EXAMPLE

The old generation pre-2024 Land Cruiser (Euro 0) is no longer authorised for sale or import in some of our mission countries (Kenya, Israel, etc.).

WHEN TO USE BIOFUELS?

OBJECTIVE
Use less fossil fuel

Complexity **Medium**
Cost **n/a**
ROI **n/a**

Biofuels are fuels made mostly from plant-based raw materials (rapeseed, soybean, corn, wheat, etc.), animal fats or waste fats. Two types exist: "bio" fuels for petrol and diesel engines. They can be diluted (5% to 10%) in normal fossil fuels offered at the pump (petrol and diesel) or used at greater strength in suitable equipment.

Their environmental advantage comes from reducing fossil fuel consumption.
Nonetheless, the impact of the intensive agriculture necessary to make these biofuels can be questioned, and their impact on the production and market for food crops.
To limit these effects, second generation biofuels are being developed. These seek, for example, to convert waste and non-food parts of plants grown for food into biofuels.

Biofuels are very rare in our mission countries but this may change in years to come.

ARE BIOFUELS SUITABLE FOR MSF MOTORISED EQUIPMENT?

Some of our current motorised equipment at MSF is not compatible with biofuels.
Before opting for this type of fuel, it is therefore essential to refer to the technical manual of the equipment or to contact your RTR or Technical Referent to check if your equipment is compatible and, if so, up to what % of dilution.

HOW TO FIND BIOFUEL?

If your mission country decides to offer biofuel, it will very likely be available at the fuel station pump. Pay particular attention to its name, the dilution % and inform Drivers, Logs, Watsans, etc. on its use or not.

Examples:
> As a general rule, our small motorised equipment (petrol motor pumps, etc.) do not work with Unleaded 95 E-10 and E85
> Most of our generators do not work with Diesel B10

EXAMPLE BIOFUEL DILUTIONS AT FUEL STATIONS IN FRANCE

	% OF BIOFUEL		TYPE OF VEHICLE*
PETROL			
SP95 and SP98	Up to 5% ethanol	Or up to 15% ETBE	Any petrol vehicle
SP95 - E10	Up to 10% ethanol	Or up to 22% ETBE**	Any petrol vehicle manufactured since 2000
Superéthanol E85	Between 65% and 85% ethanol		Only for adapted petrol vehicles
DIESEL			
Diesel B7	Up to 7% FAME***		Any diesel vehicle
Diesel B10	Up to 10% FAME***		Any diesel vehicle manufactured since 2000

** This example refers to vehicles in France*
*** Ethyl Tertio Butyl Ether*
**** Fatty acid methyl esters*

Not all motorised equipment is compatible with biofuel!

CONCRETE EXAMPLE

In 2023, only the French mission uses biofuel at MSF-OCP -> see table above

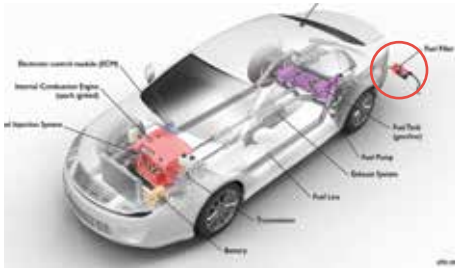
WHEN TO CHOOSE A VEHICLE WITH AN INTERNAL COMBUSTION ENGINE (PETROL/DIESEL)?

OBJECTIVE

Have vehicles suitable for contexts where hybrid or electric are not possible solutions

Complexity	**Medium**
Cost	**$$$**
ROI	**n/a**

Vehicles with internal combustion engines are powered by a motor that uses petrol or diesel.
These fossil fuels are non-renewable and polluting for the environment.
As an example, MSF-OCP travels +/-10,000,000 km/year with combustion engines. These journeys account for 5.5% of their CO_2 emissions.



Source: U.S. Department of Energy

ADVANTAGES	DISADVANTAGES
Purchase price	Air pollution and CO_2 emissions during use
Range	Maintenance interval
Availability	Workshop waste
Maintenance known & mastered	Fuel storage
	Noisy

To date, this type of engine remains, unfortunately from an environmental point of view, the most suitable solution in the majority of our intervention contexts.
However, amongst the range of combustion engines, there are many types of vehicle to choose from for our movements.
The Land Cruiser is not the solution for all of our types of journey. Our habits and attitudes must change.

The standard to follow:
> For movements in cities, on tarmac or good quality tracks = city car or minibus
> For movements on tracks in poor condition = light 4x4 or Land Cruiser if necessary

>>> see sheet MFM A-2

The purchase of a new vehicle is always done by selecting the least polluting vehicle that meets the operational need

>>> see sheet MFM A-8

The choice between a petrol or diesel motor will often depend on the offer from dealerships. If you use fuel stations, both alternatives are possible. However, choose diesel if you have to stock the fuel.

Besides the efforts focused on combustion engines, we should also evaluate hybrid and 100% electric alternatives, when the context, technical specifications and use of these types of motors allow it (especially in cities)

>>> see sheets MFM A-13 to A-15

In your fleet renewal strategy, take into account the change of engine in the Toyota Land Cruiser from 2024 (new-generation = ±30% lower fuel consumption)

>>> see sheet MFM A-12

Find out about environmental standards currently in force and to come in your mission country before purchasing a vehicle, and follow the local car market (new brands, new hybrid or electric models, etc.).

CONCRETE EXAMPLE

The Palestine mission has progressively moved from Land Cruiser -> to diesel hatchbacks -> to small petrol city cars and can potentially move to hybrid or 100% electric at future vehicle renewals.

WHAT ARE THE ADVANTAGES OF THE NEW-GENERATION LAND CRUISER?

OBJECTIVES
Reduce fuel consumption and emission of pollutants, save money

Complexity **Low**
Cost **n/a**
ROI **n/a**

WHY WILL TOYOTA CHANGE THE ENGINES IN THE LAND CRUISER IN 2024?

Toyota will offer the Land Cruiser at standard Euro 4, instead of the current Euro 0, in order to respond to the increasing demands of the "Euro"standard in the large majority of countries in the world
>>> see sheet MFM A-9

WHAT ARE THE CHANGES IN THE 2024 NEW-GENERATION LAND CRUISER?

> The diesel engine will change from a 4.2l diesel to a 2.8l turbocharged diesel-> more powerful, lighter, lower fuel consumption
> The fuel consumption will reduce by ±30%, going from 15l/100km with the current engine to 10l/100km with the new-generation engine
> Exhaust gas pollutant emissions will also greatly reduce thanks to various anti-pollution systems (common rail injection, EGR valve, catalytic converter), to meet the Euro 4 standard

WHAT ARE THE IMPACTS ON PURCHASE AND USE?

> Moving to Euro 4 means that the Land Cruiser can be purchased or imported in the majority of our mission countries
> Even if the new-generation Land Cruiser is less polluting than the current model, it remains more polluting than a city car, a minibus or a light 4x4. It's use, therefore, remains reserved for tracks in poor condition where no other less polluting vehicle, that meets the need, can travel properly
>>> see sheet MFM A-2
> Available fuel quality in your mission country must be compatible with the anti-pollution systems of the new Euro 4 engines. Decanting and use of the "magic filter" water separator must be scrupulously followed -> see Basics
Consult your RTR or Technical Referent before purchasing a new-generation Land Cruiser either locally or through your ESC.

WHAT IS THE IMPACT ON MAINTENANCE?

If maintenance is sub-contracted, there is no impact.
If maintenance is managed internally: the mechanics will need to be trained, the mechanical order help tool will be updated and missions will need a diagnostic scanner.

In your fleet renewal strategy, take account of the change of engine in the Toyota Land Cruiser from 2024 → avoid purchasing the old model as far as possible. Otherwise you'll be travelling for +/- 10 years or 180,000km in the most polluting version!

CONCRETE EXAMPLE

SAVING OF MONEY AND CO_2 WITH THE NEW-GENERATION LAND CRUISER ON AN MSF FLEET

Brand	Model	Engine	Consumption/100km (litres)	Price/l (euro)	No. km/year	Total
Toyota	Land Cruiser	Old model	15	1.5	20,000	**4,500**
		New-generation	10	1.5	20,000	**3,000**
					Saving / year / Land Cruiser	**1,500**
					Number of Land Cruisers on the project	**10**
					Savings / year of the Land Cruiser fleet	**15,000**
					Reduction in CO_2 emissions of the Land Cruiser fleet	**33T**

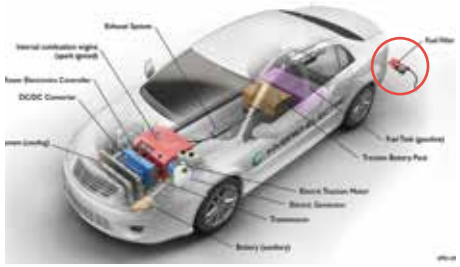
WHEN TO CHOOSE A HYBRID VEHICLE?

OBJECTIVES

Consume less fossil fuel in urban driving, return on investment

Complexity **Medium**
Cost **$$$**
ROI **Long**

Hybrid vehicles are powered by a combustion engine and an electric motor that uses energy stored in a battery.
A hybrid vehicle cannot be plugged-in to charge its battery; it is charged by recuperating energy from deceleration and braking, as well as by the combustion engine.
The additional power supplied by the electric motor allows for a smaller combustion engine. The battery can also power auxiliary loads and reduce consumption at standstill.
Together, these characteristics translate to better fuel economy without sacrificing performance.



Source: U.S. Department of Energy

ADVANTAGES	DISADVANTAGES
Fossil fuel consumption reduced by ±23% compared to the same model with only combustion engine	Price -> generally ±20% more expensive than the same model with only combustion engine
Reduced maintenance and longer lifespan	Range with 100% electric -> 2 to 3km, only at lower speeds
Unlike 100% electric vehicles, can continue to drive (with combustion engine) when battery is empty	> 50km/h = 100% combustion engine with a small increase in fuel consumption compared to non-hybrid model because of the weight of the battery
Brake pads wear down more slowly thanks to the regenerative braking that charges the battery	At end-of-life, vehicles with battery are, at the moment, more polluting than vehicles with only a combustion engine
Quiet at lower speeds	

Overall, a hybrid is more environmentally friendly. However, it requires a somewhat larger investment at purchase. Return on investment is generally achieved during the life of the vehicle, compared to the cost of a normal petrol or diesel vehicle. The example below shows that it takes 7 years to start being cost effective.

ROI CALCULATION: HYBRID VEHICLE COMPARED TO PETROL OR DIESEL VEHICLE (EURO)							
HYBRID VEHICLE							
Brand	**Model**	**Engine**	**Purchase price**	**Consumption/100km (litres)**	**Price/l**	**No. km/year**	**Cost/year**
Toyota	Yaris	Hybrid	20,000	4.1	1.5	20,000	1,230
PETROL OR DIESEL VEHICLE							
Brand	**Model**	**Engine**	**Purchase price**	**Consumption/100km (litres)**	**Price/l**	**No. km/year**	**Cost/year**
Toyota	Yaris	1.0 Petrol	17,000	5.5	1.5	20,000	1,650
				Hybrid vehicle use savings per year			**420**
				Return On Investment (in years)			**7**

With the price difference not being too large at purchase, a hybrid vehicle is an option to consider when acquiring a new vehicle. It is preferable for city driving, to make the most of its electrical system at low speeds.

Purchase of a hybrid vehicle requires: local purchase, sub-contracting of maintenance and training of drivers in driving with an electric motor.

Hybrid and fully electric vehicles are more interesting financially in countries where fuel is expensive.

Find out about environmental standards currently in force and to come in your mission country before purchasing a vehicle, and follow the local car market (new brands, new hybrid or electric models, etc.).

CONCRETE EXAMPLE

The Jordan mission replaces its fleet of city cars with hybrid models.

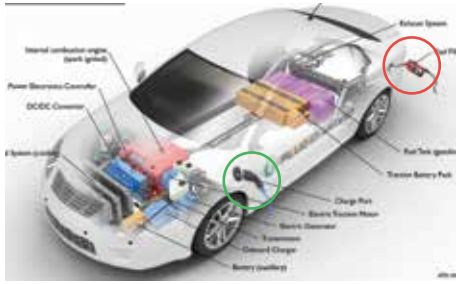
WHEN TO CHOOSE A PLUG-IN HYBRID VEHICLE?

OBJECTIVE

Consume less fossil fuel in urban driving over short distances between 2 recharges

Complexity **Medium**
Cost **$$$**
ROI **Long**

Plug-in hybrid vehicles use a battery to power an electric motor and a fuel, such as petrol, to power a combustion engine.
The battery can be charged using a wall socket or charging equipment, unlike a plain hybrid.
It is also charged by recuperating energy from deceleration and braking, as well as by the combustion engine.
The vehicle generally works on electrical energy until the battery is almost empty, then the vehicle automatically switches over to the combustion engine.



Source: U.S. Department of Energy

ADVANTAGES	DISADVANTAGES
Can drive with 100% electric as long as the batteries are not empty	Price -> generally 30% more expensive than the same model with combustion engine
Recharging time shorter than a 100% electric vehicle	Range with 100% electric -> ±50km for most models
Unlike 100% electric vehicles, can continue to drive (with combustion engine) when battery is empty	Higher fuel consumption in combustion engine mode because of the additional weight of the battery
Brake pads wear down more slowly thanks to the regenerative braking that charges the battery	Limited charging locations
	Environmental advantage limited or zero if electricity generation is polluting >> see sheet Energy B-2
	At end-of-life, vehicles with a battery are, at the moment, more polluting than vehicles with only a combustion engine

A plug-in hybrid represents a more substantial investment at purchase, and the return on investment is long compared to the cost of a petrol or diesel vehicle. The example below shows that 9 years are necessary for it to start being cost effective, if we do at least 70% of city driving using electricity (knowing that the electric range is ±50km).

ROI CALCULATION: PLUG-IN HYBRID VEHICLE COMPARED TO PETROL OR DIESEL VEHICLE (EURO)

PLUG-IN HYBRID VEHICLE

Brand	Model	Engine	Purchase price	Consumption/100km (kWh)	Price/kWh	No. km/year	% in city	Cost/year
Renault	Captur E-Rech plug In	Plug-in hybrid part	32,250	20	0.25	20,000	70%	1,456
							% highways	
		Petrol part		8.4	1.5		30%	

PETROL OR DIESEL VEHICLE

Brand	Model	Engine	Purchase price	Consumption/100km (kWh)	Price/kWh	No. km/year		Cost/year
Renault	Captur	1.4 Petrol	25,500	7.4	1.5	20,000		2,200

Plug-in hybrid vehicle use savings per year	**764**
Return On Investment (in years)	**9**

Plug-in hybrid vehicles are not recommended by MSF at the moment. The extra weight of the batteries increases the fuel consumption of the combustion engine by too much.

Purchase of a plug-in hybrid vehicle requires: local purchase, sub-contracting of maintenance and training of drivers in driving with an electric motor.

Consider the necessary recharging point(s), depending on the movements of the vehicle. Provide secure parking spaces.

Hybrid and fully electric vehicles are more interesting financially in countries where fuel is expensive.

Find out about environmental standards currently in force and to come in your mission country before purchasing a vehicle, and follow the local car market (new brands, new hybrid or electric models, etc.).

CONCRETE EXAMPLE

The recommendation above is based on a test carried out by a MFM Technical Referent, between a plug-in hybrid and a diesel engined vehicle, over an identical route consisting of highway and city driving.

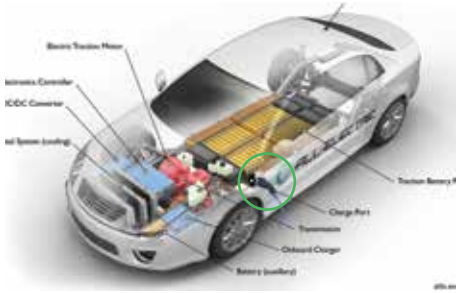
WHEN TO CHOOSE AN ELECTRIC VEHICLE?

OBJECTIVES

Do not consume fossil fuels during use, produce less workshop waste

Complexity **Medium**
Cost **$$$**
ROI **Long**

Fully electric vehicles, also called battery powered vehicles, have an electric motor instead of a combustion engine.
The vehicle uses a large drive battery to power the electric motor and must be connected to a wall socket or charging equipment.
The battery is also recharged by recuperating energy from deceleration and braking.
This type of vehicle therefore does not emit any exhaust gases and does not contain fuel, liquids and equipment such as an injection pump or fuel tank.



Source: U.S. Department of Energy

ADVANTAGES	DISADVANTAGES
No air pollution or CO_2 emissions during use (because no petrol or diesel engine)	Price -> generally 2 x more expensive than the same model with combustion engine
Very limited maintenance (no oils, liquids, filters, etc.) and therefore less import or local purchase of spare parts and less workshop waste	Range -> 200 to 350km for most models
Brake pads wear down more slowly thanks to the regenerative braking that charges the battery	Recharge time -> 8 to 10 hours using a domestic socket
Silent	The vehicle cannot be moved when the battery is empty, unlike hybrid vehicles
	Limited charging locations
	Weight (because of the battery)
	Environmental advantage limited or zero if electricity generation is polluting **>>> see sheet Energy B-2**
	At end-of-life, vehicles with a battery are, at the moment, more polluting than vehicles with only a combustion engine

Overall, electric vehicles are more environmentally friendly. However, they represent a more significant purchase investment and the return on investment is rarely achieved, compared to a petrol or diesel vehicle. The example below shows that it would need 17 years to start being cost effective, while the renewal of a city car is generally done after 8 years or 150,000km.

ROI CALCULATION: ELECTRIC VEHICLE COMPARED TO PETROL OR DIESEL VEHICLE (EURO)							
ELECTRIC VEHICLE							
Brand	**Model**	**Engine**	**Purchase price**	**Consumption/100km (kWh)**	**Price/kWh**	**No. km/year**	**Cost/year**
Renault	Zoe	100% electric	35,000	17	0.25	20,000	850
PETROL OR DIESEL VEHICLE							
Brand	**Model**	**Engine**	**Purchase price**	**Consumption/100km (kWh)**	**Price/kWh**	**No. km/year**	**Cost/year**
Renault	Clio	1.0 petrol	18,000	5.2	1.5	20,000	1,560
			2 x scheduled maintenance / year				300
			Electric vehicle use savings per year				**1,010**
			Return On Investment (in years)				**17**

The purchase of an electric vehicle in your fleet is therefore as-such clearly an environmental choice.
If you have the opportunity, the best choice for our mission contexts is generally a small light city car for movements in the city, with recharge at the office at night. Some countries have introduced incentives to make the purchase price of an electric vehicle more attractive.

Purchase of an electric vehicle requires: local purchase, sub-contracting of maintenance and training of drivers in driving with an electric motor.

Consider the necessary recharging point(s), depending on the movements of the vehicle. Provide secure parking spaces.

Hybrid and fully electric vehicles are more interesting financially in countries where fuel is expensive.

Find out about environmental standards currently in force and to come in your mission country before purchasing a vehicle, and follow the local car market (new brands, new hybrid or electric models, etc.).

CONCRETE EXAMPLE

In Nairobi, UN agencies and the ICRC test fully electric vehicles in their fleet for travel within the city (with recharging points using solar power), and the WFP is working on a pilot urban distribution project using small 100% electric trucks, with technical support from Renault.

WHAT IS THE CORRECT MAINTENANCE INTERVAL?

OBJECTIVES

Ensure the expected vehicle lifespan, reduce workshop waste generated by maintenance, save money

Complexity **Low**
Cost **$**
ROI **n/a**

Performing maintenance less often than recommended risks causing breakdowns, high costs and reducing the lifespan of the vehicle. On the other hand, performing maintenance more often than recommended increases costs, reduces vehicle availability and increases unnecessary workshop waste. It is therefore important to respect the maintenance intervals recommended by the manufacturers and by MSF for all types of vehicles and generators.

CITY CARS, MINIBUSES AND LIGHT 4X4S

The evolution of combustion engines and the increasing quality of fuels and engine oils allows manufacturers to have longer maintenance intervals.
Hybrid vehicles have even longer intervals because the electric part eases the load on the combustion engine.
Fully electric vehicles need very basic maintenance that is even further spaced out, because there is no engine oil, oil filter, fuel filter, etc. and therefore very little workshop waste.

OIL CHANGE INTERVAL	
TYPE OF VEHICLE	GENERALLY EVERY
City car diesel	10,000 - 15,000 km
City car petrol	10,000 - 15,000 km
Minibus	5,000 - 10,000 km
Light 4x4	5,000 - 10,000 km
Hybrid city car	30,000 km
Electric city car	60,000 km (review)

(These intervals are an average -> see the maintenance log book of your vehicle to know the exact interval)

TOYOTA LAND CRUISER

A Land Cruiser is immobilised for maintenance 2 x more often than a city car and, further, requires 2 x more engine oil at each oil change (11l vs. ±5l). The amount of workshop waste is therefore considerably more than for a city car! The same applies to tyres, for example: 1 Land Cruiser tyre = 15kg / 1 tyre for a city car = 6kg -> = 2 x weight of waste at end-of-life.
It is therefore important to only use Land Cruisers in situations where no other less polluting vehicle, that meets the need, can be used.

OIL CHANGE INTERVAL		
TYPE OF VEHICLE	POOR QUALITY OIL / FUEL	GOOD QUALITY OIL / FUEL
Land cruiser	5,000 km	10,000 km

(See maintenance log book for further details)

Remember that the primary way to manage workshop waste is to limit its production -> therefore to choose vehicles that produce the least by having the longest maintenance intervals.

Poor quality fuel and/or engine oil in your mission country can result in a need for more frequent maintenance intervals to guarantee the expected vehicle lifespan → see RTR or Technical Referent.

Choosing city cars instead of Land Cruisers also places fewer maintenance constraints on movement planning!

A permanent oil filter allows oil changes for Land Cruiser, Hilux and Hiace diesels to be further spaced out
>>> see sheet MFM A-17
It does not cancel the need for other maintenance tasks at 5,000km.

CONCRETE EXAMPLE

Comparison of waste, immobilisation and cost between a city car and a Land Cruiser over 150,000km:
> Oil change: city car: 50 litres / Land Cruiser: 165 litres
> Oil filter: city car: 10 pieces / Land Cruiser: 15 pieces
> No. of oil changes (= immobilisation): city car: 10 / Land Cruiser: 15
> Cost of oil changes: city car: 400 euros / Land Cruiser: 1,050 euros -> difference = 650 euros/vehicle

WHY USE A PERMANENT OIL FILTER?
(ONLY MSF-OCP AND MSF-OCG FOR THE MOMENT)

OBJECTIVES
Divide overall engine oil requirement by 4, no oil filter to change, less workshop waste, save money

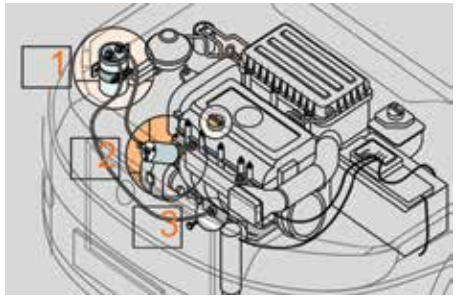
Complexity **Medium**
Cost **$$**
ROI **Intermediate**

MSF-OCP and MSF-OCG are deploying "NitiFilter" permanent oil filters.

The NitiFilter is a permanent, self-cleaning oil filter. It can be used in any vehicle with a combustion engine (petrol and diesel). At MSF, priority is given to Land Cruiser, Hilux and Hiace diesels, because their engines contain a greater quantity of oil and they need more frequent oil changes than city cars.

Engine oil **Oil filter**

How it works:
> The filter (2) is installed in place of the original oil filter
> Oil contaminants in the cleaning flow are collected by a purifier (1)
> The purified oil is returned to the sump (3)
> Maintenance is limited to a pressure test and simple cleaning of the purifier



On a Land Cruiser, the NitiFilter allows oil changes to be spaced out to every 20,000km, instead of every 5,000km with a normal oil filter. Further, you will no longer have a used oil filter in your workshop waste (= one of the most difficult waste items to recycle).

The use of a NitiFilter does not cancel the need to do the other maintenance tasks on a Land Cruiser every 5,000km.

A NitiFilter kit costs 544 euros. Its return on investment is realised after 8 normal oil changes = on average after 2 years (average lifespan of a Land Cruiser = 9 years)

Item code NitiFilter Kit: KTRAMMODNFL7
Item code Installer Field Module: KTRAMMODNFI
Installation and maintenance procedure: contact your RTR or Technical Referent

Remember to add NitiFilters and remove oil and oil filters from your budget.

CONCRETE EXAMPLE

Comparison of amount of workshop waste generated during oil changes, between a Land Cruiser without NitiFilter and a Land Cruiser with NitiFilter, over 180,000km:
> Engine oil: without NitiFilter: 396 litres / with NitiFilter: 99 litres
> Oil filter: without NitiFilter: 36 pieces / with NitiFilter: 0 pieces
This represents a saving of 334,000 euros and 155 tonnes of CO_2 over the entire MSF-OCP fleet of 250 Land Cruisers.

HOW TO CHOOSE "GREENER" TYRES?

OBJECTIVE
Reduce fuel consumption

Complexity **Low**
Cost **$**
ROI **intermediate**

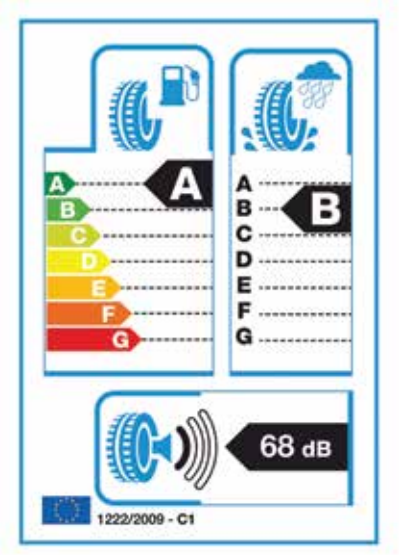
Depending on the regulations in force in your mission country, tyres may be evaluated on several criteria, including fuel consumption based on rolling resistance.
This difference in consumption can amount to 7% between a tyre classed "A" and a tyre classed "G".
It's therefore an important criteria to take into account, if it's available.
The difference in purchase price, generally a little more expensive, is usually compensated for by the economy savings in fuel consumption during the lifetime of the tyre.

Respecting correct tyre pressures also plays a very important role in fuel consumption, wear of the tyres and safety!
Example: 0.5 bar below the recommended pressure = +3% fuel consumption.
The correct pressures can be found in the vehicle log book and often also on a sticker on one of the vehicle's door posts.

The pressure can drop by 2.5 to 5% in one month and 20% after 5 months.

At MSF, the pressures must be checked every week by the driver with a pressure gauge during the weekly check. They must also be checked at each maintenance by the mechanic.

If you search for your tyres online, you will also find icons



The label is usually stuck on the tyre

Respecting the correct size, speed rating, load rating, type of structure and profile remain priorities when selecting a tyre.

Beware of counterfeit labels.

CONCRETE EXAMPLE

These labels are still relatively uncommon in our mission countries. They should nonetheless develop by 2030, as is already the case for electrical appliances, light bulbs, etc.

WHAT TO DO WITH WORKSHOP WASTE?

OBJECTIVES

Limit the environmental impact of our workshop waste, participate in the development of recycling streams in our mission countries

Complexity **Medium**
Cost **$$**
ROI **n/a**

WHAT ARE THE MAIN WORKSHOP WASTE PRODUCTS THAT ARE HARMFUL TO THE ENVIRONMENT?

HAZARDOUS WASTE:

> Tyres
> Batteries
> Used oil
> Oil and fuel filters
> Brake fluid and cooling fluid
> Refrigerants (-> air conditioner gas)
> Solvents (-> bodywork paint)
> Dirty paper and rags
> Packaging of hazardous products (oil drums, etc.)

OTHER WASTE:

> Any other parts replaced on motorised equipment by:
- Plastic (bumpers, etc.)
- Metal (shock absorber spring, etc.)
- Glass (windscreen, etc.)
- Cloth (seat covers, etc.)
- Paper (air filter in part, etc.)
- etc.

> Clean packaging of spare parts (cardboard boxes, etc.)

HOW TO FIND THE BEST WAY TO MANAGE YOUR WORKSHOP WASTE IN YOUR MISSION COUNTRY?

> Find out about the rules in force with the competent authority -> ask for the list of certified service providers
> Consult the MSF GeoApp (*https://geo.geomsf.org/portal/apps/dashboards/home* > Waste Management Dashboard) -> mapping of MSF semi-industrial incinerators and validated service providers per country,
> Ask other OCs and actors present in the country (directly or via the Log Cluster)
> Consult the WREC site (*https://logcluster.org/en/wrec/green-logistics*) -> mapping of service providers by country (*https://logie.logcluster.org/?op=wrec).* For more information -> *Global.WREC@wfp.org*
> Search for service providers on the internet -> growing market (attention to quality of service)
> Check with dealerships (Toyota, etc.)
> Contact the RTR or Technical Referent for advice, information, background, etc.

Once the best alternatives have been identified, implement a waste management procedure at the MSF garage that meets the needs of the service provider(s) (sorting / collection, etc.)

>>> see sheets Waste A-3 & A-4

WHAT ARE THE BEST PRACTICES AT THE GARAGE FOR MANAGING WORKSHOP WASTE?

> Work cleanly (waste liquid collector, filling funnel, etc.)
> Dedicate an area for workshop waste, covered and protected from water run-off, with suitable sorting containers in place
> Sort the waste according to the implemented waste management procedure, for collection by the service provider(s)
> Respect maintenance intervals (no "over-maintenance") and replace parts when necessary
> Make a point of discussing workshop waste at every visit of the RTR or Technical Referent

Only providers in the MSF GeoApp are already validated by MSF.

Bad practices to ban: draining oil from small engines onto the ground (motorised pump, etc.), dumping drained oil into gutters, into water or the environment, burning tyres, etc. Hazardous waste needs special attention!

>>> see sheet Waste D-4

If maintenance is sub-contracted, the RTR or Technical Referent also checks the quality of the waste management of the garage during its validation.

In 2024, a new job post will be dedicated to improving the management of workshop waste on our missions.

CONCRETE EXAMPLE

The WFP works with recycling companies for its tyres and batteries in 70% of its countries. They are also running a pilot project to recycle tyres by pyrolysis to obtain: diesel, metal and plastic pellets (-> material reused in construction).

B-
REDUCE THE CARBON IMPACT OF COMMUTING

HOW TO ENCOURAGE "GREENER" JOURNEYS FOR COMMUTING TO WORK?

OBJECTIVES
Reduce emissions of CO_2 and pollutants, employee health

Complexity **Medium**
Cost **$$**
ROI **n/a**

By 2030, to reduce the commuting kms that use fossil fuels by 60% (MSF commitment), employees need to be made aware of and motivated to the "green" cause, and a strong employer involvement is needed to encourage changes in habits.
It is possible... in the Netherlands, for example, the primary means of transportation is public transport followed by bicycle, walking and finally, in last place, the car.

WHAT ARE THE ALTERNATIVES TO INDIVIDUAL CARS?

(This classification goes from the least polluting to the most polluting, and therefore to be preferred in this order)

> Walking: it's free and healthy. The WHO recommends doing 10,000 steps per day (= 7.5km) to be in good physical and mental form

> Cycling: it's free after purchase and healthy. In towns, distances of less than 3km are generally travelled faster by bicycle than by car

> Public transport: it's a low-polluting means of transport by virtue of the number of places on board

> Employer shuttle: allows the journey to be optimised by virtue of the number of people in the vehicle. Pooling with other OCs or actors is encouraged

> Car sharing: also helps to optimise the journey and create links outside of work

All these alternatives also help to relieve congestion in cities during peak hours.






POSSIBLE EMPLOYER INCENTIVES:

> Sessions to raise awareness and discuss the MSF climate and environment roadmap
> Select all MSF buildings (hospital, office, guest houses, etc.) within an acceptable walking or cycling distance (= also fewer movements to organise)
> Financial incentives for purchasing a bicycle, helmet and lock + secure parking at the workplace
> Covering part of the cost of public transport
> Adapt working hours to suit public transport
> Set up an MSF minibus shuttle
> Financial incentive for car sharing

Every place is different. You are responsible for movements, buildings and human resources, it's up to you to establish the best combination together. Think about incorporating security parameters into your solutions (to be validated by the Project Coordinator / Head of Mission).

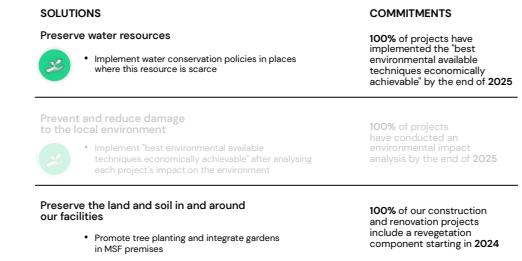
The same logic should be applied for journeys during working hours. For example: make bicycles available for employees to travel between different MSF buildings (e.g. office - hospital, office - guest house at lunchtime, etc.)
>>> see sheet MFM A-6

CONCRETE EXAMPLES

> At headquarters in Paris, the large majority of employees come by public transport, bicycle or on foot
> The European Commission aims to have 45% of its employees in Brussels come to work by public transport and 19% on foot or bicycle

WASTE AND ECOSYSTEMS

MSF-OCP CLIMATE AND ENVIRONMENT ROADMAP -> "WASTE MANAGEMENT" AND "LOCAL ECOSYSTEMS" SECTIONS



N.B. The blurred points will be developed later or by other departments

MAIN ANGLES OF ATTACK AND PRINCIPLES TO ACHIEVE THEM

MAIN ANGLES OF ATTACK:

> 100% of missions have a waste management plan in place
> 100% of missions have identified and validated:
- Recycling service providers for their hazardous and domestic waste
- A cement factory (or otherwise a suitable incinerator) for the incineration of non-recyclable hazardous waste
> 100% of sites concerned are equipped with the type of incinerator adapted to their activity. Alternative solutions which are more environmentally friendly are chosen whenever possible
> Particular attention is given to optimising combustion to minimise the toxicity of fumes
> When infiltration of wastewater leaving the pretreatment works is not possible, additional treatment is assessed on a case-by-case basis with the RTR or the Watsan Technical Referent
> The final destination of faecal sludge is known, validated and verified regularly
> Water consumption is controlled
> MSF sanitation facilities are checked and maintained
> Providers of collection, transport and disposal of faecal sludge are validated. Planned and random control visits are made during transport and at the final destination site
> One or more water meters are installed depending on the size of the network, data is entered into the monitoring tool, leaks are identified and repaired

PRINCIPLES TO IMPLEMENT ON ALL MISSIONS TO ACHIEVE THIS:

> The Watsan HR resources required to implement and maintain the waste management plan are sized to the context
> The tools to find, evaluate and validate service providers are known and used
> Our responsibility to minimise pollution of soil, water and air is taken into account in budgetary decisions (semi-industrial incinerators, technical sanitation solutions, etc.)
> Waste zone operators are trained in incinerator management and combustion optimisation

WASTE MANAGEMENT SHEETS

A

ENSURE THAT ALL STEPS OF WASTE MANAGEMENT ARE FOLLOWED IN THE BEST POSSIBLE WAY

1. How to manage waste production responsibly?
2. What are the different types of waste and their proportions?
3. What is the purpose of a waste management plan?
4. How to implement the waste management plan?
5. Who is in charge of what in the responsible management of waste?

B

AVOID AND REDUCE WASTE

1. What are the main logistics items that need expiry date monitoring?
2. How to make chlorine yourself?
3. How and when to repair equipment?

C

INCREASE LOCAL OR REGIONAL RECYCLING

1. How to identify recycling channels?
2. How to evaluate the quality of a recycling service provider?
3. How to organise the sorting and storage of recyclable waste?

D

LIMIT SOIL, WATER, AND AIR POLLUTION

1. What solutions exist to best manage different types of waste?
2. How to choose the medical waste management strategy?
3. How to manage hazardous pharmaceutical waste?
4. How to manage hazardous logistics waste?
5. How can cement plants help in the management of hazardous waste?
6. How to manage domestic waste?
7. What type of incinerator to choose depending on the project activity?
8. What is a shredder - sterilizer?
9. What are the risks associated with wastewater and faecal sludge?
10. What type of wastewater treatment / disposal to choose according to the site?
11. How to evaluate if standard pre-treatment works are well sized and functional?
12. How to evaluate if standard infiltration treatment works are well sized and functional?
13. What technical solution to choose for the disposal of faecal sludge?
14. How to evaluate if faecal sludge is managed responsibly on a project?

LOCAL ECOSYSTEMS SHEETS

E

PRESERVE WATER RESOURCES

1. How to control water consumption?

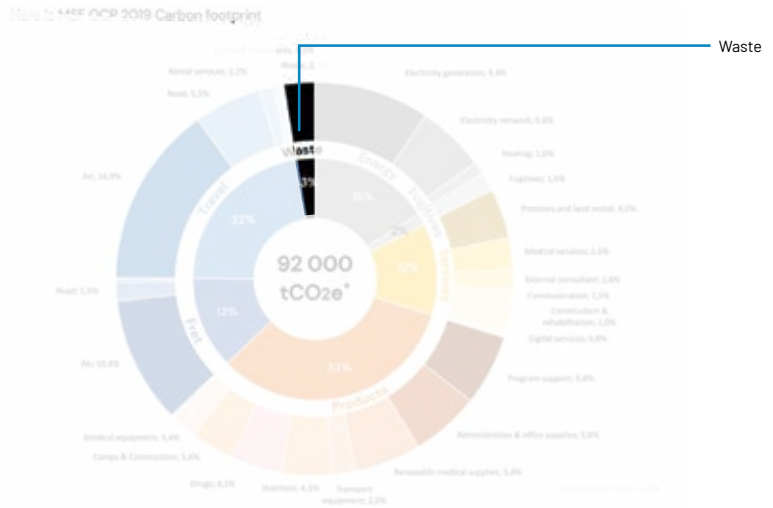
F

PRESERVE THE LAND AND SOIL IN AND AROUND OUR FACILITIES

1. What type of vegetation to plant?

> "GOOD WASTE IS THAT WHICH YOU DON'T CREATE"

CO_2 IMPACT ON:



A-
ENSURE THAT ALL STEPS OF WASTE MANAGEMENT ARE FOLLOWED IN THE BEST POSSIBLE WAY

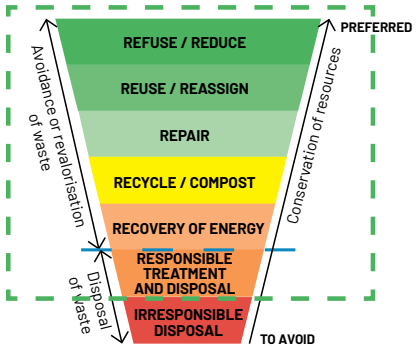
HOW TO MANAGE WASTE PRODUCTION RESPONSIBLY?

OBJECTIVE

Apply the right methodology to limit the amount of waste and best manage that which remains

Complexity **Low**
Cost **n/a**
ROI **n/a**

The methodology highlighted in this diagram avoids or reduces waste at source and then identifies the most environmentally friendly solution for the remaining waste, starting from the highest level and then downwards if the solution is not suitable for the waste and/or the context.
This diagram is referenced during the following sheets to highlight, for each situation, the level corresponding to the behaviour to adopt.



1- REFUSE / REDUCE

This first stage consists of avoiding the creation of waste as far as possible "Good waste is that which you don't create". This mainly involves confirming a need and/or its quantity together with searching for alternatives that generate less waste.
Example: say no to the purchase of plastic water bottles and opt for refillable water containers, install permanent oil filters to reduce workshop waste
>> see sheet MFM A-17
Respecting preventative maintenance plans is another way to reduce waste by extending the life of equipment.

2- REUSE / REASSIGN

Here the goal is to continue using equipment or an object as long as it is able to perform a function under good conditions.
Example: when a medical fridge must be replaced to comply with the renewal policy, it could be reassigned as a domestic fridge in the guest house.

3- REPAIR

This level consists of evaluating the possibility of repairing equipment or an object before throwing it away and buying a new one
>>> see sheet Waste A-4

4- RECYCLE / COMPOST

This level is in development everywhere. Every mission must identify local / regional / international recycling channels, depending on their waste, and implement a sorting and storage procedure accordingly
>>> see sheets Waste C-1 to C-3
Composting should be avoided in MSF structures (risk of vectors: rodents, etc.). However, waste suitable for making compost can be offered to the local agricultural sector or to composting and methane production channels.

5- RECOVERY OF ENERGY

Here the aim is to transform waste into energy:
Examples:
> Paper / cardboard waste can improve the mix of waste in MSF incinerators to optimise the combustion and therefore reduce the toxicity of smoke released into the air
>>> see sheet Waste D-7
> Hazardous waste such as tyres, used oil, etc. can be transformed into energy and partly replace the use of fossil fuels in cement furnaces whilst minimising the toxicity of fumes thanks to chimney filters (co-processing)
>>> see sheet Waste D-5

6- RESPONSIBLE TREATMENT AND DISPOSAL

If none of the above solutions can be applied, a mission must implement the best available and economically feasible environmental techniques, in order to minimise the impact of its waste during disposal. ***Example: semi-industrial incinerator, pre-treatment / treatment of wastewater before discharge into the environment, etc.***

7- IRRESPONSIBLE DISPOSAL

This practice is not allowed at MSF.
Examples: open-air waste incineration, discharge of hazardous waste into waterways or open landfills, etc.

The headquarters Medical and Supply Chain departments, as well as the ESCs, are working on optimising stock and order management together with the reduction of single-use medical and non-medical items to actively contribute to reducing our waste by 50% by 2030.

On distribution projects, the option to distribute money or coupons valid in nearby shops can better meet the beneficiary's needs, limit transport and avoid stock / waste management. Be careful to analyse the context as a whole (destabilisation of the local market, etc.).

Compliance with medical waste management procedures takes precedence over any non-validated alternatives to ensure the safety of people.

Donations (of non-hazardous equipment) are a way of avoiding waste but under certain conditions. The recipient of the donation must be able to:
> Use the content of the donation before any possible expiry date
> Dispose of the content of the donation in a responsible way at end-of-life

CONCRETE EXAMPLE

The hospital in Amman is an example to follow: the distribution of plastic disposable bottles and cups has been replaced by water dispensers with tanks + individual bottles (-6.8 tonnes / year), the replacement of black bin bags for domestic waste has been spaced out to reduce the number used (-3 tonnes / year), the available recycling channels have been investigated and sorting has been organised accordingly (54% of waste), non-recyclable waste suitable for methane production is transformed into biogas to generate electricity, etc.
The municipality of Amman requested information from MSF to draw on this model to improve waste management in their care facilities.

WHAT ARE THE DIFFERENT TYPES OF WASTE AND THEIR PROPORTIONS?

OBJECTIVES
Know how to classify waste, know the risks

Complexity **Low**
Cost **n/a**
ROI **n/a**

TYPE OF WASTE WITHIN MSF:

GENERAL MEDICAL WASTE	**SOFT**	*Bandage, Dressing, Syringe (w/o needle), Gloves, Packaging, Empty recipient*
	SHARPS	*Ampouls, Lancet, Blade, Glass vial, Needle, Scalpel, Catheter*
	ORGANICS	*Placenta, Blood & Body fluids, Organs, Amputated limbs,...*
HEALTH-RELATED SPECIFIC WASTE	**BIO-HAZARDOUS**	*Sample, Sputum, Petri dish, HEPA & bacterial filters,...*
	LABORATORY & DIAGNOSIS	*Viral load, Rapid test cartridge, Microcuvette,...*
	PHARMACEUTICALS	*Damaged or expired drugs, Cold chain rupture product*
	X-RAY	*Analog film developing chemicals, Film scrap, Silver derivatives,...*
	VECTOR CONTROL	*Pesticides, Left-over insecticides, LLIN*
	WATER TREATMENT	*Chlorine, Coagulants, Detergent,...*
	MOTORIZED FLEET	*Used Fluids, Batteries, Tires,...*
	WASTE FROM ELECTRICAL & ELECTRONIC EQUIPMENT WEEE	*IT, Radiocom, Batteries, Medical devices (after decontamination)*
	CONSTRUCTION	*Paint, Asbestos, Lead,...*
DOMESTIC WASTE	**RECYCLABLE**	*Plastics, Aluminum, Paper, PET, Cardboard,...*
	BIODEGRADABLE (non recoverable)	*Green waste, Wood*, Food leftovers,...* ** Non treated*
	COMPOSTABLE (recoverable)	*Food* leftovers, Green waste,...* **Except products of animal origin, dairy product, oils and fats*
	WASTEWATER	*Excretas, Grey water, Black water*
	GENERAL REFUSE	*Non recyclable, landfillable, burnable,...*

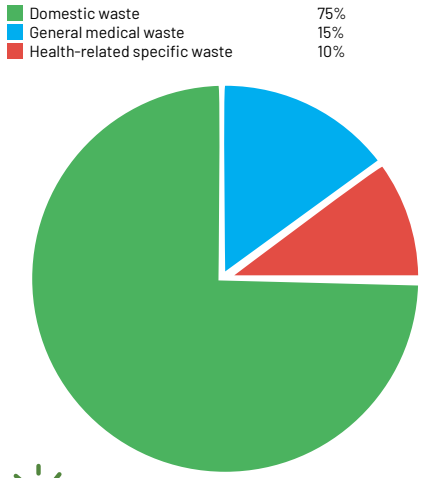
AVERAGE PROPORTIONS OF DIFFERENT TYPES OF WASTE ON A CONVENTIONAL MSF MEDICAL PROJECT:

Until now, waste management has mainly focused on "general medical waste".
The "mission waste management plan" (**>>>see sheets Waste A-3 & A-4**) now extends this management to all waste in the table opposite.

"***General medical waste***" represents a small part of the total but **requires special attention because of the risk of contamination** by blood or other bodily fluids. MSF rules must therefore be strictly respected
>>> see sheet Waste D-2 and Public Health Engineering in Precarious Situations Guideline page 6.1.

"***Health-related specific waste***" also represents a small part of the total but **requires special attention because of the significant environmental and health risk** in case of mismanagement of this waste. The MSF rules must be strictly followed (-> cf. MSF Guideline Hazardous waste management) and the recycling or energy recovery channels must be identified
>>> see sheets Waste C-1 to C-3 and D-3 to D-5

"***Domestic waste***" from care facilities, offices, etc. represents the vast majority of the total. This is an opportunity from an environmental point of view because many recycling, composting and energy recovery sectors are developing in our mission countries for this type of waste
>>> see sheets Waste C-1 to C-3, D-6 and D-13



A hazardous waste is characterised by its danger to the environment or health through its direct or indirect effects in the short, medium or long term → relevant categories at MSF: "general medical waste", "health-related specific waste" + "wastewater".

Infectious waste corresponds to waste that is contaminated by blood / bodily fluids → relevant categories at MSF: "general medical waste" + "bio-hazardous, laboratory & diagnosis" + "wastewater".

CONCRETE EXAMPLE

At the hospital in Amman, the logistics team identified recycling possibilities for the "domestic waste" part. After identification and validation of recycling channels, 54% of this waste is now recycled instead of ending up in landfill (= 40% of total waste).

WHAT IS THE PURPOSE OF A WASTE MANAGEMENT PLAN?

OBJECTIVES

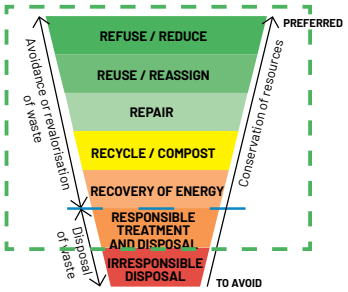
Know the risks associated with waste, implement the best available solutions for responsible waste management

Complexity **Medium**
Cost **n/a**
ROI **n/a**

RESPONSIBLE WASTE MANAGEMENT REDUCES ENVIRONMENTAL AND HEALTH RISKS

The most common risks are:
> Poisoning by ingestion, inhalation or skin contact
> Release of toxic pollutants into the air when waste is incinerated in unsuitable incinerators or in the open air
> Searching through landfills with risk of exposure / injury and misappropriation of hazardous substances such as medicines
> Contamination of drinking water resources by toxic and dangerous substances
> Ecological disturbances such as the destruction of organisms necessary for the treatment of wastewater or deterioration of aquatic life
> Development of resistance to certain substances (antibiotics, insecticides, etc.)

To avoid as many of these risks as possible, **MSF is committed to ensuring that 100% of its missions have a waste management plan.**



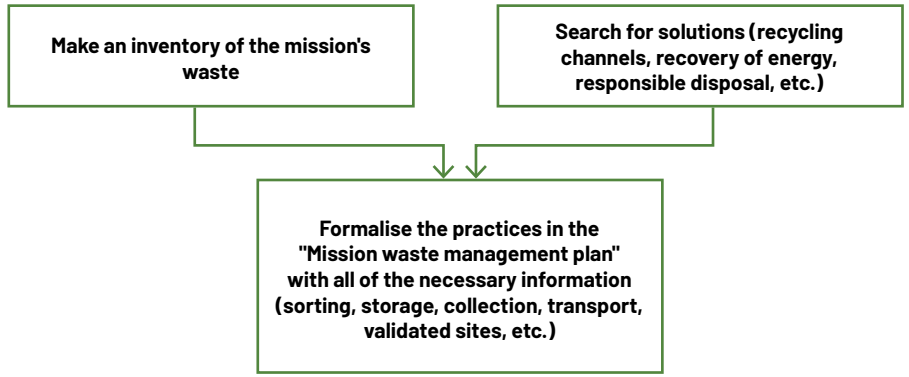
THE WASTE MANAGEMENT PLAN

MSF's activities generate several types of waste, for which different methods and solutions need to be identified, which in turn also depend on the context. There is therefore no single solution for all types of waste. Consequently, for each mission, a waste management plan must be defined and contain all of the necessary information to optimise waste management.

This plan is based on the following logic:

The Watsan HR resources required to implement and maintain the waste management plan must be sized according to the context.

The waste management plan makes it easy to consolidate data to assess opportunities for internal or external pooling.



CONCRETE EXAMPLE

All MSF OCs deploy a waste management plan.

HOW TO IMPLEMENT THE WASTE MANAGEMENT PLAN?

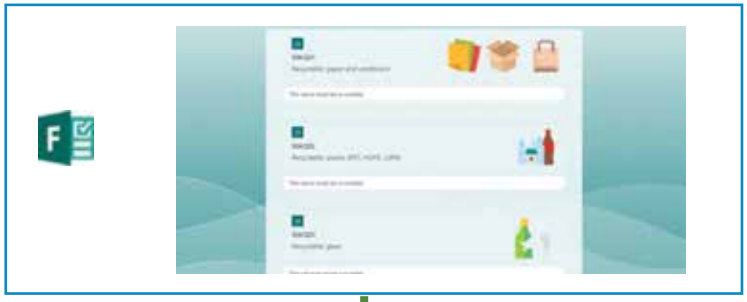
OBJECTIVES

Collect the information, analyse and define the priorities, implement and maintain the mission waste management plan

Complexity **Medium**
Cost **n/a**
ROI **n/a**

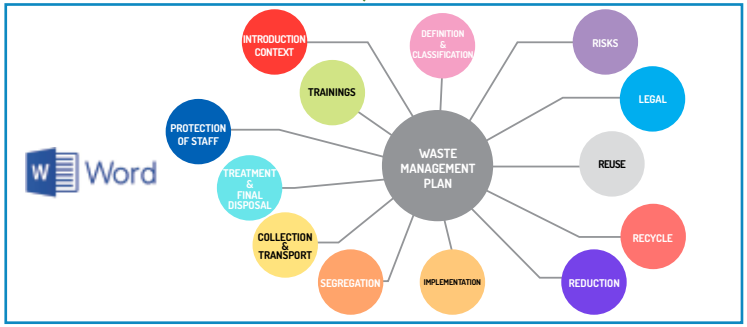
The implementation goes through 3 main phases:

1 INFORMATION COLLECTION FOR THE IN-DEPTH EVALUATION



2 ANALYSIS AND DEFINITION OF PRIORITIES

3 WHAT, WHY, HOW, WHO, WHEN → IMPLEMENTATION / MONITORING / IMPROVEMENT



PHASE 1

This phase is done using a standardised Forms form which allows all the necessary information to be collected through general, quantitative and performance questions.

PHASE 2

The standardised format of the questions mentioned above allows fast and simplified information processing in Power BI. Various dashboards allow scoring and highlighting of priorities. This data is accessible over time and makes it possible to compare results from one year to another, for example.

PHASE 3

The standardised layout of the waste management plan makes it easy to fill in all the information that must be included. It is written for the mission but has specific parts for each project (logic similar to that of a "security guideline").

It includes, amongst other things, the following information:

> Results of the above information collection and analysis phases
> Regulations in force in the country
> Identified and validated recycling / composting or energy recovery providers

>>> see sheets Waste C-1 to C-3 and D-5

> Procedures for sorting, storage, collection and transport, depending on service providers and/or internal procedures
> Technical solutions for the treatment and disposal of mission waste

>>> see sheets Waste D-1 to D-14

> HR resources involved and roles & responsibilities

>>> see sheet Waste A-5

> Budgetary aspects

Analysis in Power BI helps justify your improvement proposals for budget deadlines.

Contact your RTR or Watsan Technical Referent for the implementation of the waste management plan on your mission.

The waste management plan may vary from one OC to another, but the methodology is globally the same.

CONCRETE EXAMPLE

MSF-OCG carried out the collection and analysis phases in 81 facilities in 14 countries.

WHO IS IN CHARGE OF WHAT IN THE RESPONSIBLE MANAGEMENT OF WASTE?

OBJECTIVES

Identify responsibilities, facilitate implementation and monitoring

Complexity **Low**
Cost **n/a**
ROI **n/a**

TASK	WHO	SHEET
MISSION WASTE MANAGEMENT PLAN		
Act as owner of the document (responsible for its existence, implementation and monitoring)	Logistics Coordinator	**Waste A-3 & A-4**
Identify the HR necessary for implementing the mission waste management plan (+ its maintenance afterwards)	Logistics Coordinator + Logistics Manager + Watsan + support of the RTR or Watsan Technical Referent	
Complete the 3 phases of the implementation: gathering of information / analysis and definition of priorities / preparation of the mission waste management plan		
Validate mission waste management plan	Head of Mission + Medical Coordinator + Logistics Coordinator	
Mobilise teams for its implementation	Medical Coordinator + Logistics Coordinator	
REFUSE / REDUCE / REUSE / REASSIGN / REPAIR		
Validate / question a need and / or a quantity + look for or encourage the search for alternatives that generate less waste	Logistics Manager + Logistics Coordinator	**Waste A-1 & B-1 to B-3**
Identify and implement possible reuses / reassignments	Logistics Coordinator + Logistics Manager + technical profiles	
Identify opportunities for repair		
Validate a repair option	Logistics Coordinator + RTR or Technical Referent depending on the equipment	
RECYCLE / COMPOST / RECOVERY OF ENERGY		
Identify channels for recycling / composting / recovery of energy	Logistics Coordinator + RTR or Technical Referent + Logistics Manager + Watsan	**Waste A-1, C-1 to C-3 and D-5**
Validate service providers for recycling / composting / recovery of energy (+ reevaluate them periodically)	Logistics Coordinator + RTR or Watsan Technical Referent (+ Energy depending on the waste)	
Implement suitable containers, storage areas and means of transport	Logistics Manager + Logistics Supervisor or Base And Facilities Officer + Watsan	
Communicate about the implemented sorting of waste and check for compliance on a daily basis		
Check the quality of service of validated providers on a daily basis		
LOGISTICS ITEMS WITH EXPIRY DATE		
Manage / quantify stock and orders	Logistics Manager / Supply + Logistics Coordinator	**Waste B-1**
Apply the FEFO principle	Storekeeper	
Re-evaluate the expiry date of LLINs and insecticides with suppliers	Logistics Coordinator + Watsan Technical Referent	
Organise donations in case of overstock compared to the expiry date	Logistics Coordinator (+ Medical Coordinator in the case of LLIN)	
PREPARATION OF WASTE PRIOR TO FINAL MANAGEMENT		
Disinfect biomed equipment	Biomed	**Waste C-3**
Remove any type of battery and store properly before collecting	Electrician or Logistics Supervisor	
Recover refrigerant gas	Person in charge of air conditioning maintenance	
Overwrite IT data	IT	
Empty liquids in laboratory equipment + disinfection as required	Biomed & Laboratory Technician	
MEDICAL WASTE MANAGEMENT		
Identify the medical waste management strategy	Medical Coordinator + Logistics Coordinator	**Waste D-2, D-3 & D-5**
WASTE AREA (INTERSECTIONAL)		
Have an incinerator adapted to the activity or more environmentally friendly equipment if possible (shredder - sterilizer, etc.)	Logistics Coordinator + RTR or Watsan Technical Referent	**Waste D-7 & D-8**
Ensure sorting compliance at service level	Medical team + Logistics Manager + Logistics Supervisor + Watsan	
Perform the weighing and fill in the data in the register/ monitoring tool (-> essential to be able to carry out the steps of the mission waste management plan)	Waste Area Operator	
Check the combustion efficiency of incineration	Waste Area Operator + Watsan	
WASTEWATER		
Check the adequacy of the wastewater works in relation to the context	Logistics Manager + Watsan	**Waste D-10 & D-13**
Check the proper sizing and operation of wastewater works		**Waste D-11, D-12 & D-14**
Validate and verify the service in case of outsourcing the collection, transport and disposal of sewage	Logistics Coordinator + Watsan or RTR or Watsan Technical Referent	**Waste D-13 & D-14**

This list is non-exhaustive and may vary from mission to mission depending on the activities and HR set up.

CONCRETE EXAMPLE

In South Sudan, MSF has set up an intersectional waste area under the "lead" of MSF-OCA. The necessary investments have been made / planned to equip semi-industrial HTI incinerators which allow, among other things, to limit the toxicity of fumes as much as possible.

B-
AVOID AND REDUCE WASTE

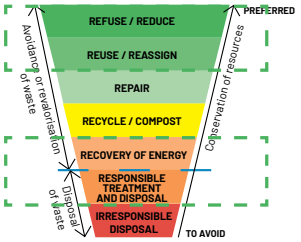
WHAT ARE THE MAIN LOGISTICS ITEMS THAT NEED EXPIRY DATE MONITORING?

OBJECTIVES

Anticipate expiry dates to avoid having to manage additional waste, reduce our overall waste volume

Complexity **Medium**
Cost **$**
ROI **Rapid**

Logistics items with expiration date are limited (unlike medical items).
However, most are classified as hazardous waste and therefore require specific treatment/disposal processes, with a greater or lesser risk of environmental impact.
It is therefore strongly recommended to monitor expiry dates to avoid creating and having to manage this type of waste.



The most common are:

1- LLINS

LLINs have a lifespan of 2 to 3 years depending on the manufacturer's specifications from the date indicated on the package and/or the net itself. Beyond that, the insecticide will theoretically lose its effectiveness.
In case of a significant amount of stock that reaches its expiry date, your Watsan Technical Referent may request an accurate lifespan assessment from the manufacturer. To do this, it is necessary to return a sample. This allows, depending on the case, to go beyond the theoretical duration and thus avoid hazardous waste.
In general:

> Ensure good collaboration with medical team to optimise distribution to beneficiaries because LLINs have a direct impact on public health
> Use your stock monitoring and medical data to manage your stock and quantify your orders. Use the FEFO principle for taking out stock
> Organise timely donations as needed

2- INSECTICIDES USED FOR IRS

The expiry date is visible on the packaging. As with LLINs, it is possible to have the manufacturer test the insecticide to re-evaluate the expiry date. Here too, a sample will need to be sent. This procedure is reserved for large stocks reaching their expiry date.
Good stock management and IRS planning is the best way to limit this type of waste.

Coagulants / flocculants used to lower water turbidity are stable over time and most of them do not have an expiry date (the product can be used as long as it works according to the jar test and the residual aluminium measured is within the norm).

Medicines represent the majority of our hazardous waste that has an expiry date
>>> see sheet Waste D-3 for the sharing of responsibilities between Meds and Logs.

3- CHLORINE NaDCC OR HTH

The lifespan is generally between 2 and 3 years (under good storage conditions) because the concentration of active chlorine decreases over time.
The "WataTest" chlorine concentration test (Uni-Cat: CWATTESTAWN) makes it possible to check whether the article can still be used for normal use (water treatment, etc.) or if it should be downgraded and follow MSF recommendations -> cf. Chlorine management.

4- JET A-1

Jet A-1 has an expiry date after which it is no longer good for aircraft use.
It is then possible to use it for our diesel vehicles and generators because its characteristics are close to diesel. The recommended mix is 30% Jet A-1 and 70% diesel. Attention, Jet A-1 has a sulphur content that is not suitable for Euro 4 vehicles and above
>>> see sheet MFM A-9

The insecticides used at MSF are toxic to aquatic organisms. LLINs should therefore not be used as fishing nets and the remnants of IRS insecticides should not be discharged into watercourses, lakes, sewers, etc.

These articles are generally used by many actors. Donations must therefore be organised in time if you are unable to use up your mission stocks. This will make good use of these items and avoid generating hazardous waste. Anticipate the donation sufficiently to allow the taker to use the stock in time to avoid them having to manage "your" waste.

CONCRETE EXAMPLE

In August 2022 in Liberia, a stock of 1,500 LLINs reached their expiry date. Two samples were returned to the supplier in Vietnam. The analysis concluded that the 2 LLINs were in full compliance with identical LLINs leaving the factory. Their lifespan was therefore extended by 2 years until August 2024.
The disposal of 1,500 LLINs was thus avoided.

HOW TO MAKE CHLORINE YOURSELF?

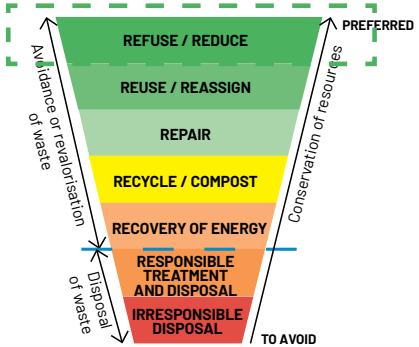
OBJECTIVES

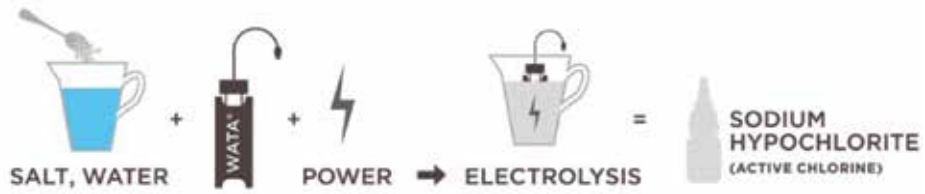
Produce the necessary amount of chlorine according to the immediate need, avoid the disposal of expired chlorine

Complexity **Medium**
Cost **$$**
ROI **Intermediate**

Transport and stock management of chlorine can be complicated. It can also have environmental impact when it is outdated and needs to be disposed of.
MSF has identified an alternative already used on several missions: the "Wata".

This device produces a 0.5% sodium hypochlorite solution (5g of active chlorine per litre) from clean water brine. It uses the process of electrolysis and requires only clear water (< 5NTU) and salt.





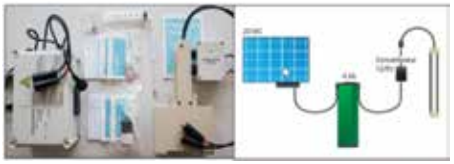
Several models are available depending on the amount of solution needed per day and the energy available:

Item code	Description	Cycle production time	Active chlorine volume (5g/L)	Drinking water production with 1 cycle	Disinfectant production with 1 cycle			Nominal power rating	Solar energy
					0.5%	0.1%	0.05%		
CWATDISIGX-	CHLORINE PRODUCTION (Maxi-Wata) set	2h	60L	300 000L	60L	180L	600L	720W	No
CWATDISIGN-	CHLORINE PRODUCTION (Mini-Wata) set	2h	0.5L	2 500L	0.5L	1.5L	5L	10W	No
CWATDISIGNS	CHLORINE PRODUCTION (Mini-Wata solar) set	2h	0.5L	2 500L	0.5L	1.5L	5L	10W	Yes (2 cycles / day)
CWATDISIGP-	CHLORINE PRODUCTION (Wata-Plus) set	2h	15L	75 000L	15L	45L	150L	180W	No
CWATDISIGPS	CHLORINE PRODUCTION (Wata-Plus solar) set	2h	15L	75 000L	15L	45L	150L	180W	Yes (2 cycles / day)
CWATDISIGS-	CHLORINE PRODUCTION (Wata-Standard) set	2h	2L	10 000L	2L	6L	20L	48W	No
CWATDISIGSS	CHLORINE PRODUCTION (Wata-Standard solar) set	2h	2L	10 000L	2L	6L	20L	48W	Yes (2 cycles / day)

THE ACQUISITION OF A WATA IS PARTICULARLY RECOMMENDED FOR:

> Healthcare facilities
> Community projects
> Places with constraints of supply or quality of available chlorine
> E-prep depending on the scenarios

Wata Plus solar



Complementary items:

CWATTESTAWN :
Used to check the chlorine concentration.

CWATDISIGA- :
Allows the chlorinated solution to be stabilised for use beyond 24 hours. It is nevertheless advisable to avoid spacing production too far apart.

The preparation of the chlorinated solution should be carried out in a clean and ventilated space.

Wata creates a maximum active chlorine concentration of 0.5%. It is therefore not suitable for 2% disinfection solutions used in the context of cholera.

Using a Wata is extremely simple. For more information consult your RTR or Watsan Technical Referent and visit *www.watatechnology.com*

CONCRETE EXAMPLES

> In Niger, MSF-OCP led a community water access project. For the water treatment part, solar Wata were installed to ensure daily chlorine production. This production allows the water to be disinfected at the water points in the jerrycans of the population (6ml chlorinated solution for 25L water).
In this case, it is therefore possible to process +/- 2,500 25L jerrycans with a 2 hour production cycle of a Wata Plus
> In Iraq, MSF-OCG installed a Maxi Wata to cover the chlorine needs of the hospital in Mosul

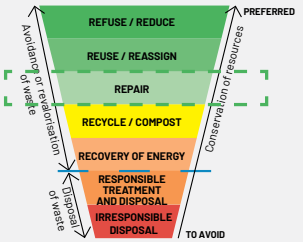
HOW AND WHEN TO REPAIR EQUIPMENT?

OBJECTIVES

Avoid creating waste when repair is possible, perform repairs under good conditions

Complexity **Low**
Cost **n/a**
ROI **n/a**

ATTENTION



The best way to avoid a breakdown (and therefore possible waste) is to respect the preventative maintenance of the equipment.
This maintains the level of performance and extends the life of the equipment.
All standard MSF maintenance plans are available in the maintenance management tool.
To ensure the proper execution of preventative maintenance it is necessary to:

> Carry out the inventory at the deadlines defined to know your fleet
> Set up preventative maintenance
> Have the necessary HR, trained and equipped
> Ensure availability of necessary spare parts
> Monitor the activity

Respecting preventative maintenance also helps to limit the energy consumption of certain types of equipment (air conditioners, etc.)

>>> see sheet Energy A-17

Equipment repair is very regulated at MSF because of the risk that a bad repair would cause to medical activity and personal safety.

Repairs must be carried out in strict compliance with MSF policies / protocols/ procedures, with quality spare parts and made or supervised by a competent and validated profile.

Rules to follow by technical family:

ENERGY

REPAIRS: by an internal or external electrician validated by MSF according to MSF electrical safety standards and existing support documents.
RENEWAL: depending on equipment and associated policy -> see Energy Technical Referent

MEDICAL COLD CHAIN

REPAIRS:
> By an internal or external technician validated by MSF following the procedures
> Authorised repairs are limited to replacement of electrical circuit components (except for the compressor) with original parts ordered from your ESC. If the repair is more complex, the equipment must be replaced
> Intervening in the refrigeration part is not permitted

RENEWAL:
> Fridge / Freezer = the manufacturer ensures a 10-year service life which may decrease according to the conditions in which it is used

It is forbidden to intervene on the refrigeration part of a medical fridge or freezer (refrigerant gas recharge, compressor replacement, etc.).

MFM

REPAIRS: in an MSF garage by a validated mechanic or a validated service provider.
RENEWAL OF FLEET:
> City car / minibus / light 4x4 = 150,000 km or 8 years
> Land Cruiser = 180,000 km or 10 years

These general numbers may vary depending on the context and your technical policy.

TELECOMS

REPAIRS: contact the Telecoms Technical Referent -> failure identification -> on-site repair or MSF headquarters service on a case by case basis.
RENEWAL: depending on the equipment (evolution of the range, availability of spare parts, etc.) and associated policy -> see Telecoms Technical Referent

BIOMED

REPAIRS: as indicated in the reference tool/ documentation (biomed referential, etc.):
> Return to the ESC after-sales service
> On-site repair by the Biomed or a locally validated service provider.

(Biomed equipment must always be disinfected before intervention)
RENEWAL: medical responsibility with Biomed support.

IT

REPAIRS:
> Still under guarantee: MSF headquarters after-sales service or with a locally accredited distributor
> After the guarantee: by a mission IT technician or with a validated repairer. (Take care with data confidentiality and to make a backup in case of repair of a laptop or smartphone).

RENEWAL:
> 4 to 7 years, depending on use and context and as long as it still compatible with appropriate security and systems updates

WATSAN

REPAIRS: by an internal or external technician validated by MSF with original spare parts ordered from your ESC or locally depending on the case.
RENEWAL: depending on the equipment -> see Watsan Technical Referent

In general, favour quality equipment and articles to avoid breakdowns / repairs / repurchase / waste.

Take into account the availability of spare parts depending on the equipment.

Repair is not limited to equipment. Evaluate on a case by case basis the feasibility in good conditions internally or externally (furniture, etc.).

CONCRETE EXAMPLE

Almost all MSF-OCP projects have one or more Biomed position(s) to ensure preventative maintenance according to the schedule in order to maintain the level of equipment performance. This ensures the safety and security of activities and reduces the amount of international freight for after-sales service repairs.

C -
INCREASE LOCAL
OR REGIONAL RECYCLING

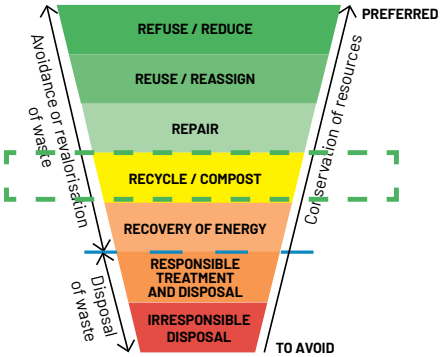
HOW TO IDENTIFY RECYCLING CHANNELS?

OBJECTIVES
Identify recyclable waste, find service providers

Complexity **Medium**
Cost **$**
ROI **n/a**

WHAT TO RECYCLE?

The first step is to make an inventory of present and future waste that can be recycled on the project / mission. The most common are:
> Paper / cardboard
> Plastic (certain types **>>> see sheet Waste D-6**)
> Aluminium and other metals
> Glass (except vaccine vials)
> Domestic organic waste
> WEEE
> Workshop waste
>>> see sheet MFM A-19



WHERE TO RECYCLE?

To optimise the environmental benefit, support local channels and reduce costs & complexity of procedures, it is recommended to:
> Start by looking for local / national recyclers
> Then regional in case of absence of recyclers or recyclers not meeting our requirements
> And finally, internationally if necessary
>>> see sheets Waste D-4 & D-6

HOW TO FIND RECYCLERS?

The recycling sector is developing in many of our mission countries. Here are the best ways to identify providers:
> Check the relevant regulations with the competent authority -> request a list of certified recyclers
> Consult the MSF GeoApp (*https://geo.geomsf.org/portal/apps/dashboards/home* > Waste Management Dashboard)->mapping of MSF semi-industrial incinerators and validated service providers by country
> Ask other OCs and actors present in the country (directly or through the Log Cluster)
> Consult the WREC website (*https://logcluster.org/en/wrec/green-logistics*) -> mapping of providers by country (*https://logie.logcluster.org/?op=wrec*). For more information -> *Global.WREC@wfp.org*
> Search for providers on the internet (attention to quality of service)
> Inquire with suppliers (dealerships, etc.)
> Contact the RTRs or Technical Referents for advice, information, history, etc.

N.B. Only providers in the MSF GeoApp are already validated by MSF.

HOW TO VALIDATE A RECYCLER?

The validation of a service provider is essential to ensure that its practices are in line with our environmental, health and safety requirements
>>> see sheet Waste C-2

Once the best alternatives have been identified and validated, a procedure for sorting and storage will be required
>>> see sheet Waste C-3

MSF GeoApp


WREC

100% of MSF missions must have a waste management plan which includes a section dedicated to recycling
>>> see sheets Waste A-3 & A-4

If no local / national solution is available, it is best to go through companies specialising in the export of waste who have agreements between two or more countries because the administrative formalities are very challenging to manage internally and often result in a refusal.

In certain mission countries, there is infrastructure that uses domestic organic waste and faecal sludge to make compost or biogas
>>> see sheet Waste D-13

For more information on management of batteries and WEEE → cf. Hazardous waste responsible management - Batteries and E-waste

CONCRETE EXAMPLES

> MSF-OCG has found domestic waste recycling channels on several of its missions (Kyrgyzstan, Iraq, etc.)
> In Kenya, MSF-OCP has identified and validated a service provider that recycles lead acid batteries and reuses the various elements for the manufacture of new batteries
> Since 2017, WFP has developed a wide range of partnerships with recycling providers in their countries of intervention (hazardous waste from the fleet of trucks, cardboard, plastics, metals, etc.)

HOW TO EVALUATE THE QUALITY OF A RECYCLING SERVICE PROVIDER?

OBJECTIVES

Prepare for and visit a recycler, validate and formalise the agreement

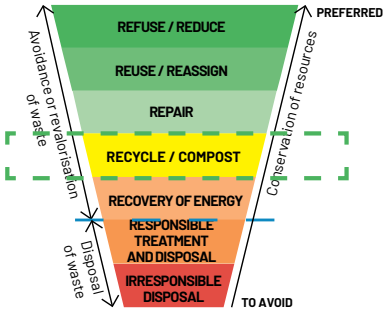
Complexity **Medium**
Cost **$**
ROI **n/a**

BEFORE THE VISIT

> Find the regulations in force in the country for the waste concerned with the competent authority (Ministry of the Environment, etc.)
> Ask the service provider by email:
- The services they offer (type of waste recycled, transport, export, etc.)
- Company licenses and permits
- Documentation on their recycling processes
- References from other clients working with them
- The possibility of making a visit to evaluate their services in order to validate their company for MSF's activities
- Any PPE to bring for the visit

If the provider refuses the above points, it is not necessary to continue the evaluation.

> Build the team that will conduct the visit -> at least 2 or 3 people including a Watsan profile to be able to collect all of the necessary information.



Some points in these questionnaires lead to disqualification:
> Presence of children working on site
> No PPE for people working on site
> Non-compliance with current regulations
> Minimum security measures not in place
> Lack of required pollution treatment devices (for fumes, wastewater, etc.)
> etc.

DURING THE VISIT

The assessment focuses on environmental, health and safety aspects to ensure that we will not contribute to environmental risks and/or risks for people working on and around the site.

Particular attention should be paid to the final destination of remaining waste or waste from recycling processes (especially for hazardous waste).

Use the information sheets and standard evaluation frameworks to conduct your visit -> available from your RTR or Technical Referent (read beforehand, to prepare for your visit).

AFTER THE VISIT

> Based on the visit and the evaluation framework, complete the visit report sheet which will serve as the basis for the validation of the service provider -> available from your RTR or Technical Referent
> Request any missing information from the service provider
> Responsibility for final validation is shared jointly between the Logistics Coordinator (operational validation: commercial and contractual aspects) and the RTR or Technical Referent (technical validation)
> Make positive or negative feedback to the provider and explain what led to this decision
> If the feedback is negative, search for local / national or regional / international alternatives as needed

FORMALISATION OF THE VALIDATION

> Prepare and sign the contract -> cf. Waste recycling service agreement
> Update the MSF GeoApp -> responsibility of the Technical Referent
> Inform WREC of the outcome of the evaluation so that they can also update their mapping (Global.WREC@wfp.org) -> responsibility of the Technical Referent
> Inform the mission country Log Cluster of the evaluation so that other actors are informed -> responsibility of the Logistics Coordinator

It is recommended to visit again every 2 years.

The validation of a recycler by MSF has effect only on the MSF OCs who validated it and conversely, a validation of one recycler by another actor does not imply a validation for MSF.
The providers on the MSF GeoApp are therefore validated for the OCs who have performed the validation while those entered on the WREC are for information purposes only and therefore require MSF validation beforehand.

MSF is a "small" producer of waste at the scale of providers. Use an intersectional approach for visits and the contractual aspect when possible.

CONCRETE EXAMPLE

In Nairobi, MSF-OCP has identified and validated a service provider that dismantles obsolete lithium batteries to replace defective cells. These batteries can thus be reused. Defective cells are exported to Europe for recycling.

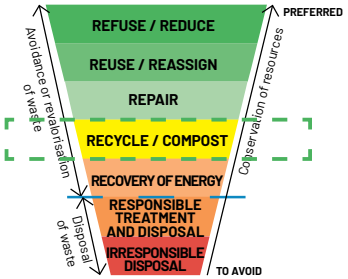
HOW TO ORGANISE THE SORTING AND STORAGE OF RECYCLABLE WASTE?

OBJECTIVES

Optimise sorting, ensure safe storage, facilitate collection

Complexity **Medium**
Cost **$$**
ROI **n/a**

The sorting and storage procedure will mainly depend on:
> The types of waste
> The validated providers
> Your storage capacity
> The collection frequency of the providers



DOMESTIC WASTE

> Paper / cardboard, plastic, aluminium, glass, organic domestic waste, etc.

A regular collection (weekly, etc.) by the provider is recommended to prevent the accumulation of waste and possible risks of vectors (especially for domestic organic waste).

Containers suitable for sorting must be put in place. Their size and number must be adapted to the number of users and at a distance deemed acceptable to find a container.
Containers for household organic waste must have a lid.

The way to sort waste must be clearly visible at each container.

If a temporary storage area is required it must be protected from sunlight, rain and water run-off.

RECYCLABLE HAZARDOUS WASTE

WEEE: IT, radio equipment, batteries, biomedical equipment, refrigerant gases, bulbs & tubes, solar panels, etc.
Garage waste: tyres, used oils, etc.

The collection of this type of waste by the service provider is generally more spaced out (it is advisable not to exceed 6 months).
A dedicated area is therefore necessary. This must be:
> Covered to provide protection from rain and sun
> Protected from water run-off
> Provided with a hard and impermeable floor to prevent the infiltration of liquids
> Ventilated
> Equipped with pallets, shelves, holding tanks, etc. to avoid storage on the floor
> Equipped with containers adapted to the waste and sorting method
> Equipped with safety measures (extinguishers, PPE, water point, signage, spill kit, etc.)

It is recommended to set up stock monitoring for this type of waste.

PRECAUTIONS BEFORE STORAGE

Some types of waste require attention before storage or direct delivery to a service provider:


WEEE


Garage waste


Batteries

> Biomed equipment must be disinfected -> responsibility of Biomed
> Batteries must be removed from equipment and tape must be stuck on the 2 terminals in case of prolonged storage
> Refrigerant gases must be recovered in a cylinder or encapsulated in the compressor (procedure available from the Energy Technical Referent)
>>> see sheets Energy D-1 & D-2
> Data on laptops, smartphones, hard drives, etc. must be overwritten -> responsibility of IT
> Relevant laboratory equipment must be emptied of any liquid (reagent or chemical) + disinfected as required -> responsibility of Biomed & Laboratory Technician

Compliance with sorting is essential to be able to correctly recycle different waste. Information must be clearly displayed and reiterated as needed over time.

In general, the service provider is responsible for the collection and transport of recyclable waste. However, MSF must verify that the means of transport is adequate for the type of waste transported to avoid, as far as possible, environmental and health risks during the journey
→ for more information, consult your RTR or Watsan and MFM Technical Referents.

Take care to organise your sorting and storage according to what has been defined with the validated providers.

On projects with an incinerator, solid waste (paper / cardboard, etc.) can be used to improve the mix of waste to incinerate and thus optimise combustion to limit the toxicity of fumes.

For more information on battery and WEEE management
→ cf. Hazardous waste responsible management - Batteries and E-wastes

CONCRETE EXAMPLE

The intersectional MSF garage in Nairobi sorts its waste according to the channels identified. The collection is ensured by a transport operator who delivers the waste to the various providers.

D-
LIMIT SOIL, WATER, AND AIR POLLUTION

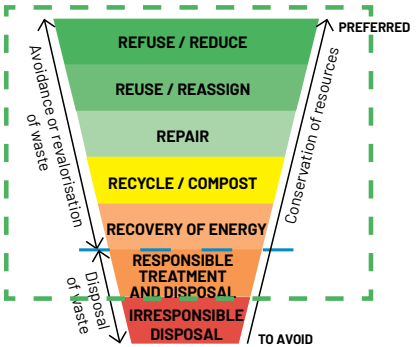
WHAT SOLUTIONS EXIST TO BEST MANAGE DIFFERENT TYPES OF WASTE?

OBJECTIVE

Know the solutions and their order of preference from an environmental point of view

Complexity **Low**
Cost **n/a**
ROI **n/a**

The choice of solution depends on the country's regulations and infrastructure as well as MSF rules.
Here are the most common recommended processes for our missions:



TYPES OF WASTE			TREATMENT	DISPOSAL
General medical waste	Soft	Bandage, compress, syringe (without needle), gloves, empty container, etc.	Incineration **>>> see sheet Waste D-7**	Ash pit
			Shredding - sterilisation **>>> see sheet Waste D-8**	Landfill (domestic waste channel)
	Sharps	Needle, scalpel, catheter, ampoule, lancet, blade, glass vial	Disposal directly in the sharps pit (+ crushing beforehand for glass vials)	
			Incineration (except glass vials)	Sharps pit
			Shredding - sterilisation	Landfill (domestic waste channel)
	Medical organic	Placenta, blood & body fluids, organs, amputated limbs, etc.	No processing or storage	Organic waste pit
Medical specific waste	Bio-hazardous	Sample, sputum, Petri dish, filters, etc.	Incineration	Ash pit
			Shredding - sterilisation	Landfill (domestic waste channel)
	Laboratory & diagnosis	Viral load and rapid test cartridges, microcuvette, etc.	Incineration	Ash pit
			Shredding - sterilisation	Landfill (domestic waste channel)
	Pharmaceuticals **>>> see sheet Waste D-3**	Expired or damaged medication, cold chain failure, etc.	Cement factory **>>> see sheet Waste D-5**	
			Incineration > 850°C or > 1100°C case by case	Ash pit
			Encapsulation, Neutralisation, Dissolution / Dilution	

To identify and validate recyclers
>>> see sheets Waste C-1 to C-3
For energy recovery in cement factories
>>> see sheet Waste D-5

Hazardous waste from analog radiology services is not covered because all MSF radiology equipment is now digital (if necessary → contact your Technical Referent).

TYPES OF WASTE			TREATMENT	DISPOSAL
Logistics specific waste	Vector control	LLIN and expired insecticides	Re-evaluation of expiry date **>>> see sheet Waste B-1**	
			Cement factory	
			Incineration > 1100°C (dosage -> see Technical Referent)	Ash pit
		Remains of insecticides and rinse water	Spray leftovers in sprayer and rinse water on exterior walls, latrines, etc.	
			If there's nothing left to spray, empty into a latrine pit or an infiltration trench away from water points (as a last resort!)	
	Water treatment and hygiene	Chlorine (after chlorine concentration test **>>> see sheet Waste B-1**)	Use for disinfection of non-medical surfaces (office floors, guest houses, etc.)	
			If amount of expired stock is not significant-> dilution	
			If amount of expired stock is significant -> encapsulation	
	Workshop waste	Used tyres, oils and filters, etc.	Recycling depending on available channels **>>> see sheets Waste C-1 to C-3**	
			Cement factory	
		Soiled waste (rags, containers, etc.)	Cement factory	
			Incineration > 850°C	Ash pit
	WEEE	IT, radio equipment, batteries, biomedical equipment, refrigerant gases, bulbs & tubes, solar panels, etc.	Recycling depending on available channels	
			Storage while a recycling sector develops	
			Encapsulation or landfill (as a last resort)	
Domestic waste	Recyclable **>>> see sheets C-1 to C-3**	Paper / cardboard	Recycling depending on available channels	
			MSF incinerator if needed to improve the waste mix	
		Plastic (certain types), aluminium, glass, etc.	Recycling depending on available channels	
	Domestic organic	Leftover food, organic waste, etc.	Composting (outside MSF structures)	
			Methane production -> biogas	
			Controlled landfill	
	Household rubbish	Non recyclable	Controlled landfill	

It is forbidden to use waste oils to treat wood against termites, etc. because these oils have a considerable impact on the environment when they enter into the soil and water courses (1 litre of used oil can pollute and impact the ecosystem of 1000m² of a body of water).

CONCRETE EXAMPLE

MSF-OCG has identified cement factories in Iraq, Uganda and Mozambique for the disposal of its hazardous waste (expired medicines, workshop waste, etc.).

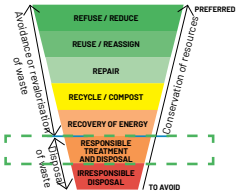
HOW TO CHOOSE THE MEDICAL WASTE MANAGEMENT STRATEGY?

OBJECTIVES

Evaluate all the alternatives, select the best option, pool when the context permits

Complexity **Medium**
Cost **n/a**
ROI **n/a**

Decision tree between the country's infrastructure, a validated service provider or an MSF (intersectional) waste area:



Ministry of Health - medical waste management legislation

Exists

Complies with WHO recommendations

Infrastructure exists and complies with WHO recommendations

Choice 1
Strategy with country's infrastructure:

> Contractual arrangements between the competent authority, the infrastructure and MSF
> No full delegation, implement monitoring
> Obtain a waste disposal letter of guarantee signed by authorities and infrastructure

Does not comply with WHO recommendations

Infrastructure does not exist or does not comply with WHO recommendations

Evaluate possibilities for infrastructure to meet WHO recommendations

Possible

Not possible

Does not exist

Presence of a validated provider that complies with WHO recommendations

Yes

No

Choice 2
Strategy with a validated service provider:

> Contractual arrangements between the provider and MSF
> No full delegation, implement monitoring
> Obtain a waste disposal letter of guarantee signed by the provider

Choice 3
MSF internal strategy:

> Define MSF strategy (Waste area / Intersectional waste area),
- Lobbying / support by WHO / MSF for the correct disposal of waste by the authorities

LOGISTICS ATTENTION POINTS IN CASE OF "CHOICE 1" OR "CHOICE 2"

> The distance between the project and the waste treatment / disposal site must be acceptable,
> Transport must be secure to avoid environmental and health risks as much as possible during the journey. In general, providers offer collection systems
> A temporary storage area adapted to the types of waste and frequency of collection must be arranged at the project level

The choice of strategy must always be made in accordance with the competent authorities and local regulations.

MSF is committed to identifying and implementing the best environmental available techniques economically achievable on 100% of its missions.

LOGISTICS ATTENTION POINT IN CASE OF "CHOICE 3"

> Intersectional waste areas are preferred where possible. This pooling generally optimises waste management, for example by the acquisition of equipment that is more efficient and environmentally friendly (HTI incinerators, etc.), through cost sharing and economies of scale.

The MSF GeoApp makes it possible to find the country's infrastructures and validated providers, as well as semi-industrial MSF incinerators
→ *https://geo.geomsf.org/portal/apps/dashboards/home*
→ Waste Management Dashboard

CONCRETE EXAMPLES

> In Lebanon, MSF uses the services of the NGO "Arcenciel.org" which collects and treats by shredding - sterilisation more than 80% of the country's medical waste
> In Jordan, MSF-OCP contracts the collection, treatment and disposal of this medical waste to a validated service provider. A container is dedicated to temporary storage between collections
> In Chad, Malawi and Somaliland, the Ministry of Health and MSF worked together to improve medical waste disposal procedures at the country level

HOW TO MANAGE HAZARDOUS PHARMACEUTICAL WASTE?

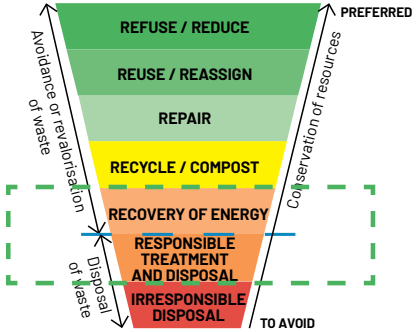
OBJECTIVES
Know the disposal methods and sharing of responsibilities between Med / Log

Complexity **Medium**
Cost **$$**
ROI **n/a**

WHAT ARE THE MOST COMMON ITEMS?

> Expired or damaged medicines,
> Articles having undergone a break in the cold chain
> Vaccines prepared but not used
> Laboratory reagents

This waste is called "hazardous" because they pose a risk to the environment (soil, water and air pollution) and to health (reuse by others and risks to the health of waste area operators).



Discuss with the medical team before taking any action.

Incineration possibilities > 850°C or > 1100°C for hazardous medical waste must be actively searched for, to minimise environmental and health risks → MSF is committed to identifying and implementing the best environmental available techniques economically achievable on 100% of its missions.

HOW TO SORT AND STORE THIS HAZARDOUS WASTE?
(May vary depending on the OC)

Destruction modes vary depending on the items. They must therefore be sorted as follows:

Group A	Tablets and capsules (DORA, DEXT)
Group B	Glass ampoules, vials and bottles (DORA, DINJ, DEXT, DVAC)
Group C	Tubes of ointment / gel (DEXT, DEXO)
Group D	Plastic bottles (DEXT, DORA) and pre-filled syringes (DINJ, DVAC)
Group E	Infusions (DINF)
Group F	Psychotropics and Narcotics if specific legislation
Group G	Anything that is not considered hazardous and that is destroyed at the hospital incinerator after use or expiry (SDRE, SINS, SMSU, SSDT, etc.) = "regular medical waste"
Group H	Sharps
Group I	Cytotoxics

All these items must be stored in a separate area called "Expired / damaged", and locked in the pharmacy.

WHAT ARE THE DESTRUCTION METHODS FOR THIS HAZARDOUS WASTE?

> Incineration: waste is incinerated at a temperature > 850°C or > 1100°C on a case-by-case basis
> Encapsulation: waste is packed in a drum which is then sealed and buried underground
> Neutralisation: (semi-)solid and powdery items are mixed with cement, lime and water. The resulting mixture is then discharged outside away from water points, in a hole or trench well away from the groundwater
> Dissolution / dilution: solid or liquid articles are mixed with water and then discharged into a closed wastewater system or in a watercourse with a large flow

Incineration is by far the preferred option because it limits environmental and health risks as much as possible.
Cement factories (**>>> see sheet Waste D-5**), the country's industrial incinerators and MSF's standard semi-industrial incinerators with burners (**>>> see sheet Waste D-7**) are therefore the main recommended solutions.

For more information on destruction methods → cf. MSF Guideline Hazardous waste management.

For the disposal of "Bio-hazardous" and "Laboratory & Diagnosis" hazardous medical waste, refer to your RTR or Watsan Technical Referent as needed.

WHO IS RESPONSIBLE FOR WHAT?
(May vary depending on the OC)

PHARMACIST:
> Sorts and stores items to be destroyed in the "Expired and damaged" area
> Lists items to be destroyed in a report with all required information
> Archives documents relating to destruction

MEDICAL COORDINATOR OR PHARMACY COORDINATOR:
> Inquires about the legislation in force in the country
> Contacts the competent health authorities
> Sends the inventory of products to be destroyed to the Pharmacy Referent at headquarters with a view to obtain a list of valid disposal solutions

LOGISTICS TEAM:
> Selects and implements disposal procedures taking into account local constraints and the list of disposal solutions obtained from the Pharmacy Referent at headquarters
> Organises secure transportation

PHARMACY REFERENT AT HEADQUARTERS:
> Gives the list of disposal solutions
> Provides disposal protocols as required

WATSAN TECHNICAL REFERENT:
> Provides disposal protocols as required
> Provides support to the Logistics Coordinator to put together batches by type of disposal (> 850°C, > 1100°C, dilution, etc.)

CONCRETE EXAMPLE

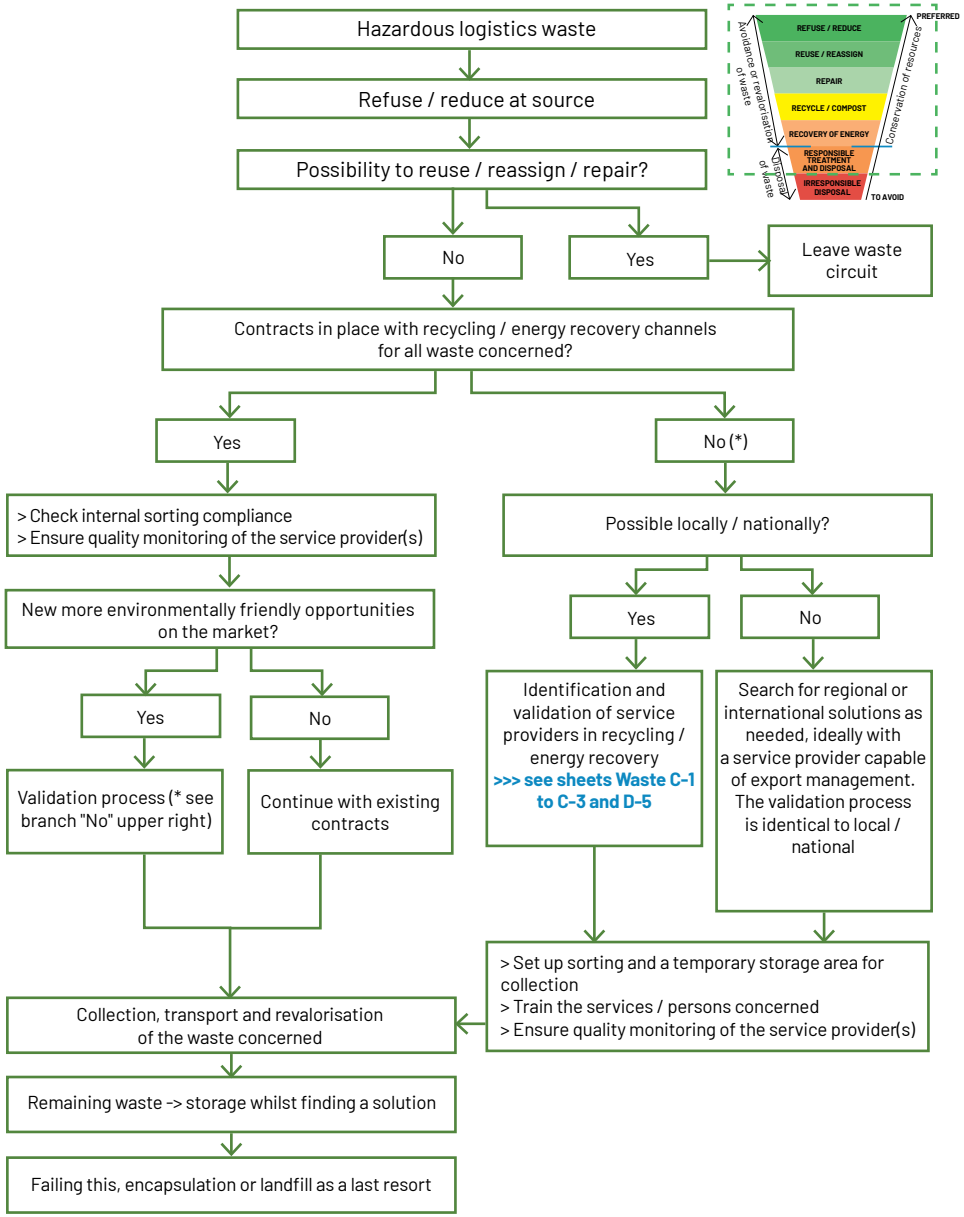
In Haiti, the project has obtained the agreement of the competent authorities to incinerate its hazardous pharmaceutical waste in the MSF-OCP semi-industrial incinerator which reaches a temperature > 1100°C.

HOW TO MANAGE HAZARDOUS LOGISTICS WASTE?

OBJECTIVES

Avoid as much as possible the encapsulation or landfill of logistics hazardous waste, check internal sorting and the external service, stay up to date about new opportunities

Complexity **Medium**
Cost **$$**
ROI **n/a**



This methodology for hazardous logistics waste must be applied at all MSF sites (health facilities, pharmacy, offices, workshops, guest houses, etc.).

The main hazardous logistics waste are from: vector control, water treatment and hygiene, the motorised fleet, WEEE and construction

>>> see sheet Waste A-2

To identify and validate recyclers

>>> see sheets Waste C-1 to C-3

For energy recovery in cement factories

>>> see sheet Waste D-5

CONCRETE EXAMPLES

> HULO is an organisation that, among other things, links international aid actors with local recycling networks. In the Democratic Republic of Congo, 150 tonnes of WEEE have already been recycled, partly locally and partly abroad

> In Kampala, the regional MSF intersection garage has identified channels for reprocessing hazardous workshop waste. An appropriate sorting and storage system has been set up. This garage also receives vehicles from other humanitarian organisations

HOW CAN CEMENT PLANTS HELP IN THE MANAGEMENT OF HAZARDOUS WASTE?

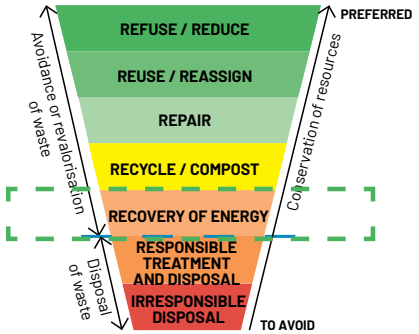
OBJECTIVES

Minimise the impact of hazardous waste, find and validate providers

Complexity **Medium**
Cost **$$**
ROI **n/a**

CEMENT FACTORY

The manufacture of cement is certainly a very energy-intensive process with a significant impact on the environment but in the context of hazardous waste management these infrastructures offer a great opportunity. Indeed, the high temperature of the furnaces (+/-1450°C) as well as the filters on the chimneys make it the best available and economically feasible environmental technique in the majority of mission countries for the treatment of such waste. This is called "co-processing" and it primarily relates to recovery of energy.



TYPE OF WASTE	
SUITABLE FOR CO-PROCESSING	**NOT SUITABLE FOR CO-PROCESSING**
Expired medicines	Contaminated medical waste
LLIN and expired insecticides	WEEE
Laboratory and Diagnosis waste	Whole batteries
Tyres	Unsorted domestic waste
Used oil and filters	
Contaminated workshop waste (containers, rags, etc.)	
Solvents	
Plastics	
Domestic organic waste	

Most of this waste is an excellent source of energy and can thus replace part of the fossil fuel needed to operate the furnaces. Collaboration can therefore be a win - win, depending on the waste.

HOW TO FIND CEMENT FACTORIES?

> Consult the MSF GeoApp (*https://geo.geomsf.org/portal/apps/dashboards/home* > Waste Management Dashboard) -> mapping of MSF semi-industrial incinerators and validated service providers by country
> Consult the site *www.cemnet.com* -> Plant Locations -> Countries -> select "Integrated" and "Clinker"
> Ask other OCs and actors present in the country (directly or through the Log Cluster)
> Consult the WREC site (*https://logcluster.org/en/wrec/green-logistics*) -> mapping of providers by country (*https://logie.logcluster.org/?op=wrec*). For further information -> *Global.WREC@wfp.org*
> Check with cement suppliers and on the internet
> Contact the RTR or the Watsan Technical Referent for advice, information, history, etc.

Only providers on the MSF GeoApp are already validated by MSF.

HOW TO VALIDATE A NEW PROVIDER?

> The visit must be carried out by the Logistics Coordinator and/or Logistics Manager + a Watsan profile if necessary
> Use the questionnaire for cement factories (-> cf. Health-related hazardous waste management within low- & middle-income countries page 121)
> The final validation is combined between the Logistics Coordinator (operational validation: commercial and contractual aspects) and the RTR or the Watsan Technical Referent (technical validation)
> Updating the MSF GeoApp is the responsibility of the Watsan Technical Referent

Cement factory rotary furnace at +/- 1450°C

The destruction of hazardous waste in cement factories is a highly regulated practice. Compliance with the regulations in force in the country as well as the administrative formalities must be scrupulously respected.

Recycling solutions take precedence over energy recovery when waste and context allow

>>> see sheet Waste A-1

MSF is committed to identifying and implementing the best environmental available techniques economically achievable on 100% of its missions.

Pharmaceutical companies, laboratories, industrial sectors, etc. regularly collaborate with cement factories to manage their hazardous waste.

An official report of the Holcim Group and the German GIZ on the benefits of co-processing is available from the Watsan Technical Referent to assist you in your dealings with cement factories as needed.

CONCRETE EXAMPLE

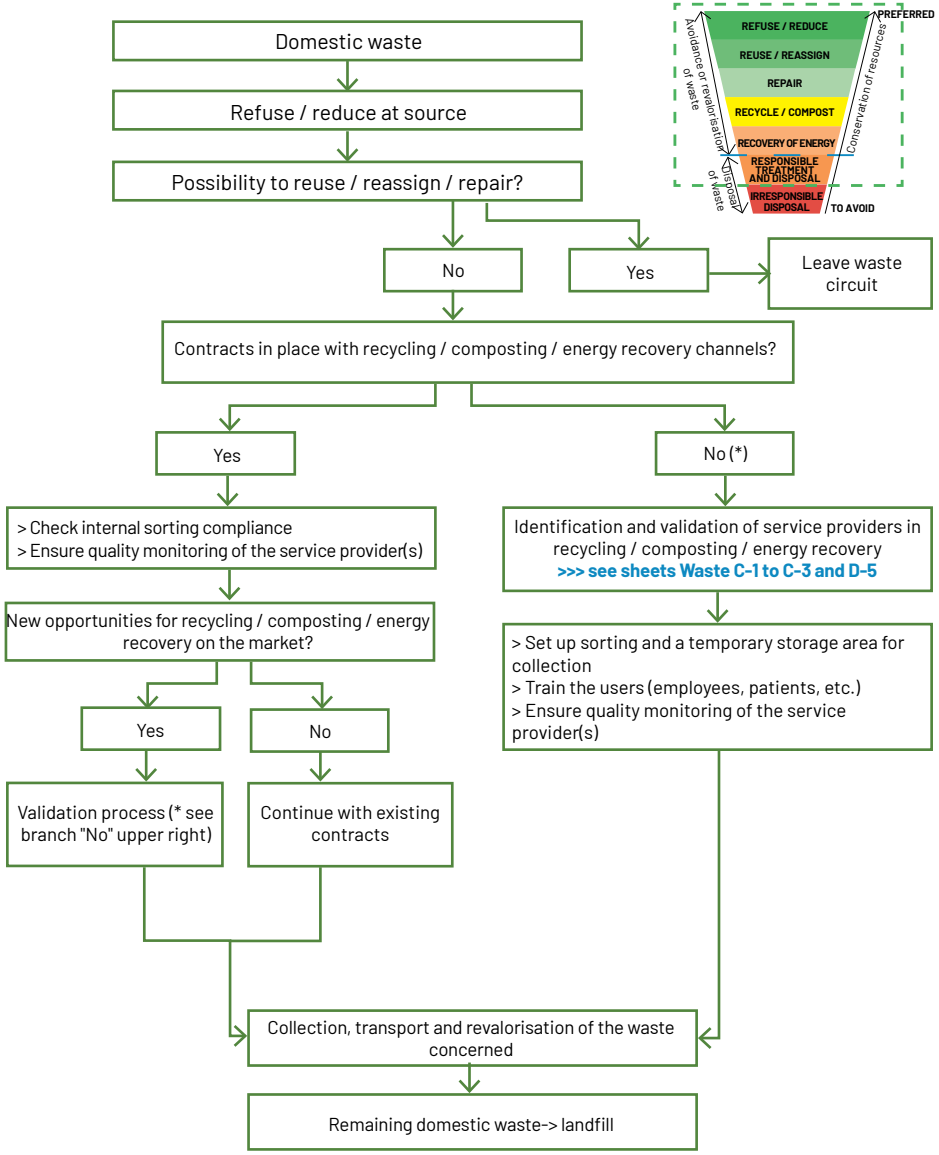
In Malawi, the MSF-OCP oncology project has signed a contract with a cement factory for the disposal of its hazardous waste including cytotoxics which are extremely harmful to the environment and health.

HOW TO MANAGE DOMESTIC WASTE?

OBJECTIVES

Avoid as much as possible the landfill of domestic waste that can be revalorised, check internal sorting and the external service, stay up to date about new opportunities

Complexity **Medium**
Cost **$$**
ROI **n/a**



This methodology for domestic waste must be applied at all MSF sites (health facilities, pharmacy, offices, workshops, guest houses, etc.).

Domestic organic waste must be collected in containers with lids and released daily from services to prevent vector proliferation (rodents, flies, etc.). Collection by the service provider must also be as frequent as possible.

The technology does not yet allow recycling of all types of plastic. In addition, the recycling possibilities as well as the sorting / collection system vary from one country to another.
The procedure to be implemented at project level will therefore depend on the country and the provider.

To identify and validate recyclers
>>> see sheets Waste C-1 to C-3

CONCRETE EXAMPLES

> In the Cox's Bazar camp in Bangladesh, all domestic waste (120 tonnes per day) is sorted and collected. Most of it is revalorised on the site: 60% of waste is turned into compost for local agriculture and 10% is recycled into raw materials for the manufacture of new plastic items (latrine slabs and pit rings, etc.). The remaining waste is buried in accordance with best practices
> In France, 26% of plastic is recycled, 43% is used for energy recovery and 31% goes to landfill. The goal is to reach 100% recycled plastic by 2025
> MSF-OCG has identified a semi-industrial composter that speeds up the composting process for all types of domestic organic waste

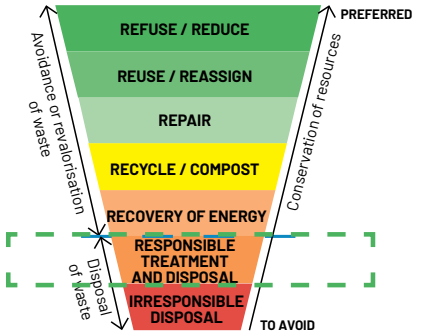
WHAT TYPE OF INCINERATOR TO CHOOSE DEPENDING ON THE PROJECT ACTIVITY?

OBJECTIVES

Select the best available technique according to the context, optimise combustion

Complexity **High**
Cost **$$$**
ROI **n/a**

In the absence of nationally validated medical waste treatment and disposal structures or geographical distance constraints, incineration remains the most suitable solution for most of the contexts in which MSF operates.
From this observation, it is our responsibility to select the equipment that will limit as much as possible the environmental and health impact in relation to the type of activity.
It is mainly the composition of the fumes released into the air that determines this impact.
The effects can be limited by optimising combustion. This optimisation mainly involves a high combustion temperature (> 850°C or > 1100°C post combustion, depending on the type of waste) and a minimum smoke retention time of 2 seconds in the secondary chamber.



ENVIRONMENTAL RISKS: release of toxic gases, fine particles, CO_2, etc. that pollute the air, soil and water.

HEALTH RISKS: respiratory, cardiovascular & neurological illnesses, cancer, etc.

	Technical solution		Type of activity / waste	Period of use	Perfor-mance	Environmental impact	Remarks
	Open-air incineration						Forbidden at MSF
Mono chamber	Temporary volume reducer		Opening / mobile	Short term	5 Kg/h		To replace as soon as possible
Mono chamber	Smart Ash reducer CWASIELASMAI-		Opening / mobile / E-prep	Short term	10 Kg/h		Fumes less harmful than a volume reducer
Double chamber	Intermediate Metal Burner		Health centre / small hospital	Intermediate solution	5-7 Kg/h		Useful whilst implementing a sustainable solution
Double chamber	De Montfort incinerator		Health centre / small hospital	Durable solution	5-7 Kg/h		Recommended minimum for health centres and small hospitals
Double chamber	Semi-industrial incinerator 850°C with burner - MTI		Hospital	Durable solution	20-50 Kg/h		Interesting performance / allows the incineration of certain expired medicines / consumes diesel
Double chamber	Semi-industrial incinerator 1100°C with burner - HTI		Hospital	Durable solution	20-50 Kg/h		Interesting performance / allows the incineration of all expired medicines / consumes diesel
	Cement factory furnace +/-1450°C (co-processing)		Hazardous waste: expired medicines, tyres, used oils, LLINs, insecticides, etc.	Sub-contracted	To be discussed		Chimneys fitted with filters for cleaning fumes before release

At MSF level, semi-industrial incinerators are the most suitable and environmentally friendly solution to date. Their use is therefore highly recommended despite a high cost of purchase and use.

ATTENTION POINTS FOR COMBUSTION OPTIMISATION

> Ensure the proper segregation of waste at the service level
> Preheat the incinerator
> Check that the expected temperatures are reached in both chambers
> Adjust the ratio of dry and wet waste to ensure a good burnable "mix" (set up dry waste collection at the office and base level as required),
> Look at the colour of the smoke -> the more transparent, the better the combustion
> Remove ash after each cycle, volume reduction should be +/- 90%

Waste management should be pooled whenever possible. The principle of economy of scale makes it possible to purchase more efficient and environmentally friendly equipment and/or to have more interesting volumes to approach service providers.

The distance to the population and the direction of the prevailing wind must always be taken into account in choosing the location of an incinerator, to avoid the health risks associated with fumes.

Incineration of hazardous waste significantly increases the toxicity of fumes. All missions must investigate the possibility of disposing of such waste in cement factories (co-processing)
>>> see sheet Waste D-5

Depending on the context, the shredder - sterilizer can be an interesting alternative to the incinerator
>>> see sheet Waste D-8

If used oils cannot be recycled or sent to a cement factory, the Smart Ash reducer allows the elimination of these oils by adding the article CWASIELASMA01

For incinerators already present in a structure that do not meet MSF standards, request the evaluation grid from your RTR or Watsan Technical Referent and a visit if necessary.

CONCRETE EXAMPLES

> Since 2015, an average of 2 semi-industrial incinerators have been installed each year on MSF-OCP projects, to give a total of 17 at the start of 2024
> There are 47 semi-industrial incinerators in all the OCs combined

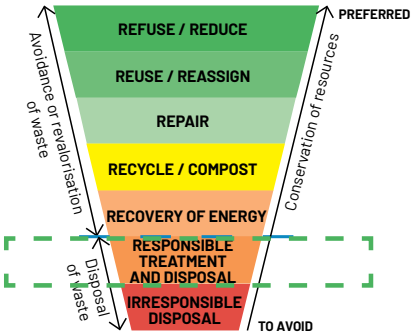
WHAT IS A SHREDDER - STERILIZER?

OBJECTIVE

Select a more environmentally friendly solution than incineration subject to meeting certain conditions

Complexity **High**
Cost **$$$**
ROI **n/a**

The shredder - sterilizer is an interesting alternative to the incinerator from an environmental point of view. The main advantages are that it does not emit toxic fumes and does not use fossil fuel (compared to semi-industrial incinerators with burner).



PRINCIPLE OF OPERATION

The waste is initially crushed / shredded to make it non-reusable and reduce its volume. Then it is sterilised to make it non-contaminating.

The ground-up material obtained at the end of the cycle can be disposed of with conventional domestic waste.

CHARACTERISTICS OF THE STERIPLUS 40 (CWATWAST4--)

Types of waste: soft medical and sharps
>>> see sheet Waste A-2

- Volume of the loading chamber: 40 litres
- Cycle duration: 40 mins
- Waste weight / cycle: 4 kg (= +/- 1 tonne / month)
- 380 V / 50Hz / 15kW (consumption / cycle = 5kWh)
- 10 l clean water / cycle (minimum flow rate 2 l / min)
- Weight: 585 kg

ADVANTAGES	DISADVANTAGES / POINTS OF ATTENTION
Overall a more environmentally friendly solution	Cost
Complies with international conventions on hazardous waste	Limited processing capacity per cycle compared to a semi-industrial incinerator with burner **>>> see sheet Waste D-7**
Does not expose operators, patients, teams, neighbourhood, etc. to toxic fumes	60% reduction in waste volume (against 90% for incineration)
Allows treatment of medical waste in countries where standard MSF incinerators are prohibited	The presence of an official distributor in the country is essential for maintenance, etc.
Compact and robust	Not suitable for all contexts (reliable electricity supply, clean water, technical skills of operators, etc.)
Cycle traceability	The ground-up material from sharps can still cause injury -> potentially problematic depending on the final disposal site (accessible open landfill, etc.)

This type of equipment requires strict compliance with waste separation at the service level to limit the volume to be treated to only the waste concerned.

The ground-up material obtained at the end of the cycle should ideally be integrated into a responsible domestic waste management channel.

Unlike incinerators, the shredder - sterilizer does not require the addition of extra dry waste to ensure good combustion. This dry waste, usually composed of clean paper, cardboard, etc., can therefore be sent to recycling channels instead of being incinerated.

CONCRETE EXAMPLE

MSF-OCG has been using shredder - sterilizers in Iraq since 2019. They started with a Steriplus 40 and then changed to the Steriplus 80 model to adapt to the volume of medical waste to be treated. Maintenance is provided by an official distributor of the manufacturer in Iraq.

WHAT ARE THE RISKS ASSOCIATED WITH WASTEWATER AND FAECAL SLUDGE?

OBJECTIVES

Understand the risks of not managing your wastewater and faecal sludge responsibly, know the technical solutions

Complexity **Low**
Cost **n/a**
ROI **n/a**

RISKS RELATED TO MACROPOLLUTANTS

Examples: suspended solids, organic matter, phosphorus and elements of the nitrogen cycle (organic nitrogen, ammonia, nitrite, nitrate, nitrogen gas) mainly from wastewater loaded with excrement and fertilisers.

Macropollutants tend to disrupt the ecosystem by bringing, for example, an overabundance of nutrients for a part of the aquatic environment causing the asphyxiation of certain organisms (e.g. algal blooms and the disappearance of fish). They also present health risks above certain concentrations.
Implementation of MSF's technical sanitation solutions limits these effects on ecosystems

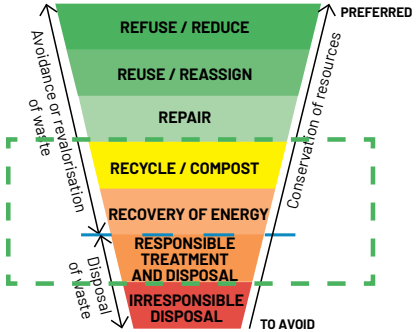
>>> see sheets Waste D-10 to D-14

RISKS RELATED TO MICROPOLLUTANTS

Examples: residues of medicines, insecticides, used oils, etc.

Micropollutants are toxic at very low doses (unlike macropollutants) and are much more difficult to treat. Many of these micropollutants are therefore released into the environment with the following effects: increased resistance to antibiotics and insecticides, hormonal disturbances (early menstruation, development of cancers, overabundance of female fish, etc.), etc.
The technical solutions to treat these pollutants are still very limited and expensive.
At the mission level, the best solution lies in the identification and validation of recycling or energy recovery channels, to limit as far as possible that our waste concerned contaminates the natural environment and particularly the aquatic environment

>>> see sheets Waste C-1 to C-3 and D-5



MICROBIOLOGICAL RISKS

Examples: excreta -> faecal-oral diseases (diarrhoea, cholera, typhoid fever, hepatitis A & E, etc.).

Wastewater contains various potentially pathogenic microorganisms, mainly of faecal origin. Their treatment is more or less difficult, depending on the context.
When wastewater infiltration is possible after pretreatment, the soil is responsible for eliminating the microbiological risk by filtering the water.
If infiltration is not possible, an alternative secondary treatment solution must be identified. If this wastewater remains accessible to the population after secondary treatment, tertiary treatment will also be required

>>> see sheet Waste D-10

Faecal sludge pumped during the emptying of latrines and septic tanks must also be given special attention because of the high concentration of pathogens

>>> see sheets Waste D-13 & D-14

As a general rule, proper verification and maintenance by identified and trained persons is essential to ensure the proper functioning of sanitation works

>>> see sheets Waste D-11 and D-12

Developments in chemistry (medicines, insecticides, disinfectants, petroleum derivatives, etc.) have considerably complicated wastewater treatment. Environmental and health impact studies are still in the early stages.

Certain medical activities generate wastewater that is particularly loaded with substances harmful to the environment and/or health. Examples: oncology department, laboratory, etc. → consult your RTR or Watsan Technical Referent to implement appropriate measures.

Depending on the type of activity and analytical capabilities, it may be recommended to perform wastewater tests at the end of treatment before discharge to the environment (physical, chemical and biological characteristics).
These tests also assess the quality of our technical sanitation solutions and validate the best options, in order to select the most suitable for a given context, based on field experience → consult your RTR or Watsan Technical Referent.

CONCRETE EXAMPLE

Around 10,000 people were killed by a major cholera epidemic that affected Haiti in 2010. The epidemic was imported by an international organisation and then propagated because of irresponsible disposal of its wastewater into a river.

WHAT TYPE OF WASTEWATER TREATMENT / DISPOSAL TO CHOOSE ACCORDING TO THE SITE?

OBJECTIVES

Minimise the environmental and health risks related to our wastewater, assess whether the standard technical solution can be used, if necessary identify one or more alternative solution(s)

Complexity **High**
Cost **$$$**
ROI **n/a**

In the absence or non-compliance of local sanitation infrastructure (obvious leaks, no treatment plant at the end of the network, etc.), the standard solution "grease trap for grey water and septic tank for black water followed by a soak away pit" can be implemented if:

> The water table is at least 1.5 m below the bottom of the works during the rainy season
> The soil infiltrates properly
> There is sufficient space on site for the grease trap(s), septic tank(s) and soak away pit(s)
> The distance between the soak away pit(s) and the water points (borehole, well, etc.) is at least 30 m

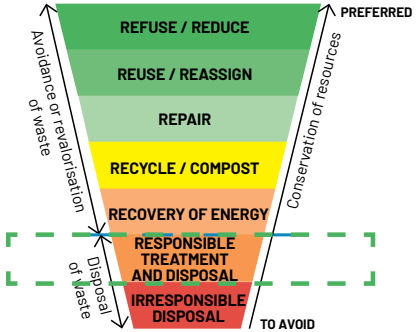
If one or more of these 4 conditions are not met an alternative solution must be chosen.

WATSAN R&D HAS IDENTIFIED SEVERAL SECONDARY AND TERTIARY TREATMENT SOLUTIONS THAT ARE CHOSEN BASED ON:

> Available space and topography
> The presence of an outlet (river, sewer, etc.) and the risk of exposure of the population
> The technical level of the teams
> Supply constraints

THE 3 MAIN TECHNICAL SOLUTIONS IDENTIFIED FOR SECONDARY TREATMENT ARE:

1- Bio-discs: succession of partially submerged discs that rotate to oxygenate wastewater and thus promote the work of bacteria to treat water
2- Plant filtration: succession of basins in which wastewater flows by gravity and where the treatment is provided by a collection of plants (reeds, rush, etc.) and bacteria



3- Lagooning: succession of basins in which wastewater flows by gravity and where the treatment is provided by a collection of microorganisms -> algae and bacteria

If water from secondary treatment is accessible to the population (not possible to infiltrate, urban environment with open drains, etc.) tertiary treatment will be required.

THE 2 MAIN TECHNICAL SOLUTIONS FOR TERTIARY TREATMENT ARE:

1- UV LED disinfection: wastewater is exposed to ultraviolet light that kills pathogenic microorganisms
2- The evapotranspiration zone: space sized and arranged to allow water to evaporate into the atmosphere (suitable for hot, windy, arid or semi-arid climates -> to avoid in contexts with a heavy rainy season)

N.B. This type of works must be selected in collaboration with the RTR or the Watsan Technical Referent. Find out about local regulations and comply with any administrative procedures before implementing a technical sanitation solution.

		SECONDARY TREATMENT			TERTIARY TREATMENT	
		Bio-disc	Plant filtration	Lagooning	UV LED disinfection	Evapotranspiration zone
Technical solution						
Space and topography		Compact	> Large > Slope / pumping required	> Very large > Terracing	Compact	> Large > Terracing
Discharge	**Pollution**	Very good	Very good	OK	-	"Zero discharge"
	µbio	Medium	Medium	Good	Good	
Technicality		Medium	Simple	Simple	Medium	Simple
Provisioning		> Container > Electromechanical	> Construction + terracing > Little material > No electricity > Plants	> Little material > No electricity	> Small amount of material > Fragile	> Little material > No electricity > Plants

All pre-treatment and treatment works must be properly sized and maintained to ensure proper operation
>>> see sheets Waste D-11 & D-12

Monitoring of drinking water consumption must be in place to be able to identify sudden increases in consumption which are sources of overload and therefore decrease in the efficiency of the sanitation system
>>> see sheet Ecosystems E-1

A grease trap and a septic tank are just pretreatments. It is the soil at the level of the soak away pit that performs the treatment during infiltration.

Effective pretreatment and secondary treatment is essential to ensure proper disinfection in tertiary treatment (same logic as chlorination of drinking water that requires turbidity < 5 NTU to be effective).

A responsible sanitation system is an investment. It is our responsibility to implement the appropriate technical solutions to minimise environmental and health risks. By way of comparison, the percentage for sanitation in the price of a m³ of water in France is greater than the drinking water itself...

CONCRETE EXAMPLE

At the Drouillard hospital in Haiti, the very high level of the water table as well as the discharge of wastewater in a drainage channel accessible to the population led the project to set up the following sanitation system:
> Pretreatment: grease traps and septic tanks
> Secondary treatment: bio-discs
> Tertiary treatment: disinfection by UV LED
All correctly sized and maintained.

HOW TO EVALUATE IF STANDARD PRE-TREATMENT WORKS ARE WELL SIZED AND FUNCTIONAL?

OBJECTIVES

Minimise the environmental and health risks related to our wastewater, perform the necessary maintenance

Complexity **Medium**
Cost **$**
ROI **Rapid**

GREASE TRAP

CHECKING THE SIZING:

The useable volume of the grease trap must allow a sufficient grey water retention time to separate grease / fat and solid sediment, to avoid clogging the soak away pit.

To do this the useable volume must be = 2 x the peak incoming hourly rate.

VERIFICATION OF THE WORKS AND ITS PROPER FUNCTIONING:

> Its shape should be rectangular and the inlet and outlet should be as far away as possible (increases retention time)

> The structure must be raised 10 cm from the ground to avoid infiltration of surrounding water run-off and be watertight (the water level must be at the bottom of the outlet pipe)

> Surface grease must be removed weekly and buried in a dedicated pit or the ash pit

> Solids accumulated in the bottom must be removed with a suitable and dedicated pump at a frequency to be defined depending on the project.

SEPTIC TANK

CHECKING THE SIZING:

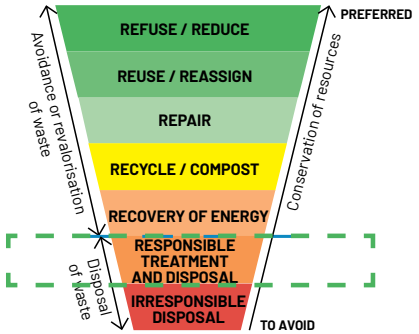
The useable volume of the septic tank must allow a black water retention time of 3 days, so that solid matter settles to the bottom.

To do this the useable volume must be at least = the amount of black water produced during 3 days.

VERIFICATION OF THE WORKS AND ITS PROPER FUNCTIONING:

> To minimise the concentration of suspended solids at the outlet, the septic tank must:

- Be divided into 2 interconnected compartments (the first must be 2 x larger than the second)



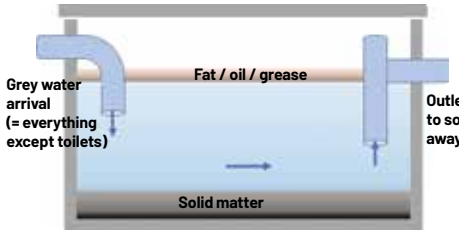
- Have an effective depth of 1.2 m to 1.7 m and its length should ideally be 2 to 3 x its width

> The structure must be raised 10 cm from the ground to avoid infiltration of surrounding water run-off, be watertight (the water level must be at the bottom of the outlet pipe) and be fitted with a ventilation pipe at least 2.5 m high

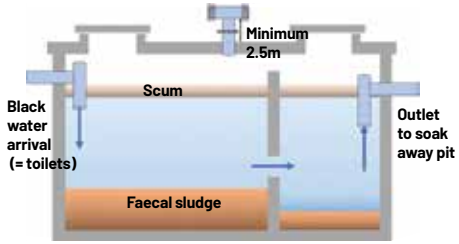
> Although faecal matter is broken down over time by bacteria, emptying is generally necessary every 1 to 5 years. In practice, this emptying is recommended when the sludge reaches 1/3 of the useful depth of the septic tank (test with a stick). The internal structure should not be cleaned and it is advisable to leave a small base of faecal matter to restart the biodegradation process

> A check of the sludge level in the structure is required every 6 months

> A septic tank should never overflow, which can happen if the infiltration works is clogged. The quality of the pretreatment can be controlled by observing the "clarity" of the water in the outlet pipe.



Grease trap



Septic tank

Any increase in activity or addition of water points / toilets leads to a potential scaling-up of wastewater works. An oversized design is advised to avoid later enlargements.

In health facilities it is not recommended to direct grey water from the grease trap to the septic tank (as in France, for example) because the large volume of grey water would disturb the retention time of black water in the septic tank.

It is especially important not to send grey water directly into the septic tank because the structure would quickly overload and grease on the surface would have the effect of asphyxiating the bacteria responsible for biodegradation of faecal matter.

The emptying of pretreatment works is important to ensure a sufficient volume for wastewater to be pre-treated before infiltration.

Proper maintenance of these works requires HR resources, training, dedicated equipment and suitable PPE.

Quality pretreatment is essential for the proper functioning of secondary / tertiary treatment works / devices

>>> see sheet Waste D-10

For further information → cf. Public health engineering in precarious situations, pages 3.48 & 4.15

It is possible to measure the amount of wastewater with specific wastewater meters → consult your RTR or Watsan Technical Referent as necessary.

CONCRETE EXAMPLE

In Rutshuru, the hospital's sanitation network tended to overflow despite a good sizing compared to the activity and proper maintenance. The problem was the number of people on the site. Following this observation by the Watsan RTR, the number of accompanying persons allowed per patient was limited to 1 as on most projects.

HOW TO EVALUATE IF STANDARD INFILTRATION TREATMENT WORKS ARE WELL SIZED AND FUNCTIONAL?

OBJECTIVES

Minimise the environmental and health risks related to our wastewater, perform the necessary maintenance

Complexity **Medium**
Cost **$**
ROI **Rapid**

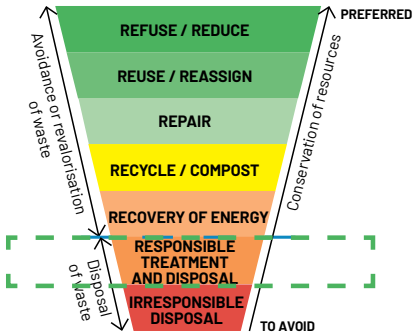
Soak away pit:

CHECKING THE SIZING

Sizing and shape depend on:

1- SOIL INFILTRATION RATE:
This varies depending on the soil structure:

SOIL TEXTURE	Infiltration rate of wastewater (l/m²/day)
Sand and loamy sand	50-33
Sandy loam and loam	33-25
Sandy clay loam, silt loam, clay loam, silty clay loam and silt	25-12
Sandy clay, silty clay and clay	16-4



Clay is not suitable for soak away pits and infiltration trenches.
A permeability test can confirm this data -> cf. Public health engineering in precarious situations, page 4.18

2- THE HEIGHT OF THE WATER TABLE:
The bottom of the works must be at least 1.5 m from the water table in the rainy season.
The easiest way to assess the water table height is to measure the depth of the water level in a nearby well or force a length of rebar into the ground and see if it comes out wet.

3- THE AMOUNT OF WASTEWATER TO BE INFILTRATED PER DAY:
On average, 80% of the drinking water supplied in a health facility ends up in the wastewater circuit. Based on your water consumption monitoring (**>>> see sheet Ecosystems E-1**) or failing that, minimum consumption by type of medical activity (-> Public health engineering in precarious situations, page 1.35), it is possible to calculate 80% of this value to obtain the amount of wastewater per day.

Based on this data, you can calculate if the vertical walls of the soak away pit are sufficient to properly infiltrate your wastewater using the following formula:

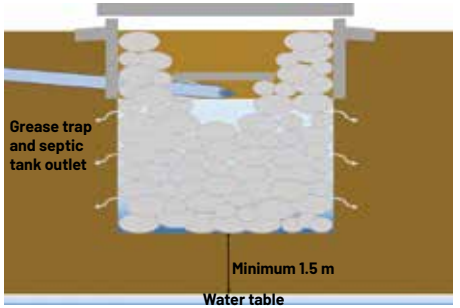
Surface of the walls below the pipe inlet level (m^2) = Daily volume of wastewater (l/day) / Soil infiltration rate (l/m^2/day)

Your soak away pit is correctly sized if the theoretical wall area obtained by calculation is = or < the actual surface area of the walls of your soak away pit.

N.B. The bottom of the soak away pit is not taken into account in the infiltration calculation because it gets quickly clogged up.

VERIFICATION OF THE WORKS AND ITS PROPER FUNCTIONING

> All grey and black water coming out of grease traps and septic tanks must be infiltrated in one or more soak away pits to finalise the treatment
> The bottom of the pretreatment and treatment works must be at least 1.5 m above the water table during the rainy season, be at least 30 m from water points (boreholes, wells, etc.) and if possible downstream of them
> A soak away pit clogs up over time, it is therefore necessary to check that the infiltration capacity remains sufficient
> Rainwater must not come into the soak away pit -> risk of overload / overflow



Soak away pit

Any increase in activity or addition of water points / toilets leads to a potential scaling-up of wastewater works. An oversized design is advised to avoid later enlargements.

Minimum water consumption by type of activity in "Public health engineering in precarious situations" (page 1.35) does not reflect the average consumption of a regular project. This is generally much higher (+/- 350 l/day/patient in a hospital). Attention therefore to the risk of under-dimensioning of the works according to the data used.

If the height of the water table is a problem for the use of a soak away pit, evaluate the option of infiltration trenches (→ "Public health engineering in precarious situations" page 4.25) or an alternative solution
>>> see sheet Waste D-10

CONCRETE EXAMPLE

At the Tabarre hospital in Haiti, the conditions to be able to infiltrate are met. The works were properly sized at the start and have been maintained for 10 years. The infiltration of wastewater has not posed any problem throughout this period.

WHAT TECHNICAL SOLUTION TO CHOOSE FOR THE DISPOSAL OF FAECAL SLUDGE?

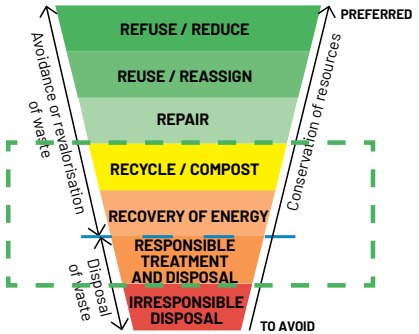
OBJECTIVES

Minimise the environental and health risks related to our faecal sludge, identify the best alternative on your project

Complexity **High**
Cost **$$$**
ROI **n/a**

Faecal sludge comes either from latrines or septic tanks.

In the case of latrines the faecal sludge is:
> Emptied with a pump if the latrine is to be reused
> Condemned in the pit with earth on top if the latrine is no longer used
> Emptied by hand after 2 years of non-use of the latrine, to use the dried sewage as compost -> emptiable twin pit latrine (-> cf. Public health engineering in precarious situations, page 3.41)



In the case of septic tanks:
They are emptied using a pump when the sludge reaches 1/3 of the useful depth of the septic tank in order to ensure sufficient retention time for black water in the works
>>> see sheet Waste D-11

Pumping, transport and disposal is usually carried out by a service provider or by MSF. It is our responsibility to ensure that the service or our internal process is in accordance with the regulations in force in the country and/or our MSF standards to minimise the environmental and health risks
>>> see sheets Waste D-9 & D-14

MOST COMMON TECHNICAL SOLUTIONS FOR FAECAL SLUDGE DISPOSAL

1- NEARBY SEWAGE TREATMENT PLANT:
Treatment infrastructure that aims to reduce the harmfulness of wastewater by biological and/or physicochemical means before their discharge into the natural environment (most often into a watercourse, lake, etc.). If distance allows and the infrastructure meets current regulations and our standards, this option is preferred

2- NON-PLANTED DRYING BED:
Basin with sand + gravel in the bottom and a pipe to drain liquids to secondary treatment. The solid part of the sludge is dried out in the basin. This process takes between 10 and 15 days. The basin must be cleaned before adding new faecal sludge. The dried sludge is not fully stabilised and still poses a health risk

3- PLANTED DRYING BED:
Plants ensure better elimination of liquids thanks to the permeability of the filter containing the roots. The accumulated sludge is removed every 5 to 10 years and does not require additional treatment

4- BURIAL TRENCH OR PIT:
This solution uses less ground space. However, its infiltration and evaporation capacity is generally lower

5- CO-COMPOSTING:
After the sludge has dried, it is mixed with other organic waste ("green" waste, etc.) to promote the bacterial composting process. The compost obtained can then be used in agriculture. This process is reserved for qualified service providers

6- METHANE PRODUCTION:
Faecal sludge is used to make biogas in a fermentation process using bacteria in an oxygen-free environment. Biogas is mainly used as fuel to make electricity or as domestic gas (cooking, etc.). The remaining "digestate" after the process can be revalorised in agriculture. This technique is developing more and more in various humanitarian organisations. It may be interesting for MSF to approach these organisations for the disposal of its faecal sludge. However, this type of works does present an explosion risk.

N.B. These types of works / processes must be selected in collaboration with the RTR or the Watsan Technical Referent. Inform yourself about the local regulations in force and comply with any administrative procedures before implementing a technical sanitation solution.

The management of faecal sludge should be assessed from the beginning of an activity.

To see if a site meets the MSF minimum requirements
>>> see sheet Waste D-14

Condemned latrines and twin emptiable pits are the simplest and nevertheless environmentally friendly solutions when technical conditions allow.

CONCRETE EXAMPLES

> The ICRC has developed an emergency faecal sludge treatment system (FSM ERU) that includes non-planted drying beds. The dried sludge is then incinerated and the percolate is treated
> MSF-OCP is planning a pilot project for a drying bed planted with reeds in Old-Fangak, South Sudan
> In Malakal camp, IOM uses faecal sludge pumped from camp latrines to make biogas. This gas is then used in collective kitchens

HOW TO EVALUATE IF FAECAL SLUDGE IS MANAGED RESPONSIBLY ON A PROJECT?

OBJECTIVES

Minimise the environmental and health risks related to our faecal sludge, check compliance with the minimum regulations

Complexity **Medium**
Cost **$**
ROI **Rapid**

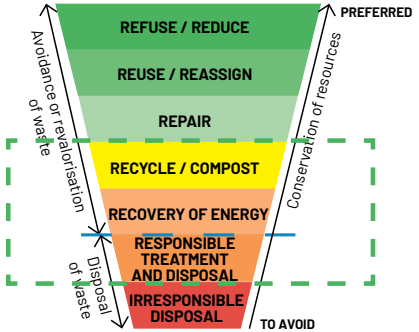
Faecal sludge management, whether subcontracted or managed internally, must meet the regulations in force in the country and/or our MSF standards.
The place of disposal (public or private) of sewage from a care facility must be validated by the competent authorities -> a written agreement must be signed.

MINIMUM RULES FOR COLLECTING AND TRANSPORTING FAECAL SLUDGE:

> Emptying latrines and septic tanks by hand is prohibited (except in the case of the twin pit latrine after 2 years non-use of the pit to empty)
> Suitable pumping equipment is used ***(e.g. Uni-Cat -> KWATKPUPLE-)***
> PPE is mandatory and a water point must be available for hygiene measures
> If collection and transport are subcontracted, the contract must clearly state the obligation to always empty the truck at the agreed place (GPS coordinates)
> The truck and its components / equipment (tank, pump, pipes, etc.) must be in good condition (no leak in the tank, etc.) and rinsed after use + disinfected during epidemics. Be careful where the rinse water flows.

MINIMUM RULES FOR FAECAL SLUDGE DISPOSAL SITES OF TYPE "NON-PLANTED DRYING BED", "PLANTED DRYING BED", "BURIAL TRENCH OR PIT" + "CO-COMPOSTING" AND "METHANE PRODUCTION", DEPENDING ON THE SITE:

> The site must be generally flat, at least 800 m from dwellings and at least 50 m from water points



> If infiltration is planned or if there is a risk of overflow, the bottom of the works must be at least 1.5 m above the level of the water table in the rainy season
> The infiltration and evaporation surface must be sufficient to prevent overflows (even in case of rain when the soil is saturated and there is less evaporation)
> The site must be fenced (against people and animals) and provided with appropriate signage
> Access must be possible for the vehicle used and the discharge must be able to be done homogeneously
> PPE is mandatory and a water point must be available for hygiene measures

POINTS OF ATTENTION FOR A SEWAGE TREATMENT PLANT:

> What standards / norms does the facility meet?
> What quality control measures are in place?
> What effluents are produced, how and where are they discharged or disposed of? Do they pose an environmental or health risk?
> Are the staff qualified and trained?
> Is the site fenced off with access restricted to staff and is there appropriate signage?

N.B. These lists are non-exhaustive. For example, geology and topography may influence some of the points above -> consult a Watsan profile as necessary.

KWATKPUPLE-

Sewage truck

Planned and random checks must be carried out during transport and at the faecal sludge destination site.

The equipment used for wastewater and faecal sludge must be dedicated only to this activity → never use this equipment for drinking water afterwards.

It is advisable to visit the faecal sludge disposal site during / after heavy rain to assess the risk of overflow of works and the location of flow in case of overflow.

For more information → cf. Public health engineering in precarious situations page 3.55

CONCRETE EXAMPLES

> In Cox's Bazar camp in Bangladesh, MSF-OCA has set up a faecal sludge treatment plant that recovers part of the camp's effluent to participate alongside other organisations in the responsible management of sludge
> In Myanmar, Solidarités International has set up a system for the responsible treatment of faecal sludge for the 80,000 people in Sittwe camp. The next step of the project is to reuse the water for irrigation

E-
PRESERVE
WATER RESOURCES

HOW TO CONTROL WATER CONSUMPTION?

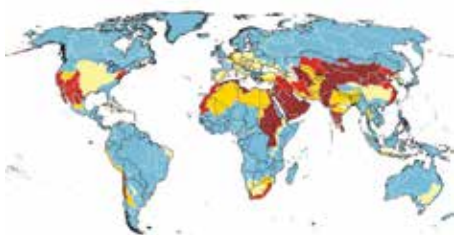
OBJECTIVES
Control water consumption, reduce the quantity of wastewater

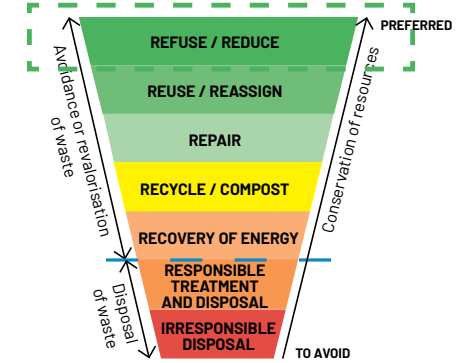
Complexity **Medium**
Cost **$**
ROI **Rapid**

Lack of water is a growing reality on the planet. In 2021, more than 2 billion people lived in water-stressed countries. This situation is expected to worsen further with climate change and population growth in some regions. Many of our mission countries are affected -> see map below.
MSF has decided to use water responsibly to limit, on its scale, the scarcity of this essential resource.

In order to be able to evaluate our consumption to identify those sites that are over-consuming or to spot a sudden increase in consumption due to a leak, it is recommended that every MSF site (care facility, office, guest house, etc.) is equipped with a water consumption meter. On large sites (hospitals, etc.) it is useful to add additional meters on the different branches of the network to refine the monitoring (e.g. identification of a leak at the level of a service, etc.).

The meters must be read at least monthly on a defined date and readings entered into a monitoring tool to be able to exploit them. For leak detection, a weekly reading is recommended.
On average, a level 2 or 3 hospital has a consumption of 350 l/day/patient. An investigation is necessary if this exceeds 500 l/day/patient.
Consult your RTR or Watsan Technical Referent to evaluate your results as needed.





Main meter for large network -> UniCat: CWATMEAE

Main meter for small network or secondary branches of a large network -> UniCat: CWATMEAE

Reducing water consumption also involves raising awareness among users! Example: cleaning of outdoor areas with large amounts of water every day should be banned in countries under water stress, apparent leaks must be communicated to logistics, etc.

Another advantage of reducing water consumption is that sanitation systems will be less stressed / overloaded and therefore there will also be less discharge of wastewater into the environment

>>> see sheets D-9 to D-12

No stress	(0-25%)
Low	(25-50%)
Medium	(50-75%)
High	(75-100%)
Critical	(>100%)

WHAT TECHNICAL SOLUTIONS EXIST TO LIMIT WATER CONSUMPTION?

1- LEAK DETECTION AND REPAIR

Leak of water = ±1500 l/day -> 550m³/year/leak

Leak from toilet cistern = ±600 l/day -> 220m³/year/toilet

Dripping tap = ±120 l/day -> 44m³/year/tap

Mobile flow meter to locate leaks -> available on loan from the Watsan Technical Referent

2- PRESSURE REDUCER

Optimises pressure and reduces consumption -> UniCat: CWATCBRETTFIF

3- PUSH TYPE TAP

Avoids taps left running (requires ±2 bars of pressure) -> UniCat: CWATPLUMTP

Use high pressure washers to clean vehicles in countries under water stress → consumes ±6 x less water than a normal hose.

If you are connected to city water, you already have a subscriber meter that you can use for monitoring. If you produce your own drinking water, install the required meter(s). These are simple to install and relatively inexpensive items → UniCat: CWATMEAE (purchase locally if possible).

CONCRETE EXAMPLES

> In Carnot, Central African Republic, the project renovated the entire hospital water network, following the observation that 60% of the drinking water produced was lost to leaks in the galvanized steel network dating from 1947
> In Aweil in South Sudan, the discovery of a sudden increase of 100 m³/day triggered a search for leaks and a return to normal consumption
> In Chiradzulu, Malawi, conventional taps have been replaced by push types, following the observation that many patients and accompanying persons did not turn off the taps
> In Niger, MSF-OCG has tested "Drop" taps, which significantly reduce water consumption

F -
PRESERVE THE LAND AND SOIL IN AND AROUND OUR FACILITIES

(Voir carnet d'entretien pour plus de détails)

WHAT TYPE OF VEGETATION TO PLANT?

OBJECTIVES

Preserve the land and soil, participate on our scale to limit CO_2 in the atmosphere

Complexity **Low**
Cost **$**
ROI **n/a**

Construction and activities on our projects have an impact on the ecosystem that surrounds us. We cut trees, disrupt the habits of animals, decrease the surface area of soils able to absorb rainwater, etc. with the effect of less CO_2 captured, less crop pollination, more soil erosion, etc.

The responsibility is obviously shared beyond MSF, but we can help limit the effects on our scale by planting vegetation in the spaces we use.

It is for this reason that MSF has decided that any construction / renovation project must incorporate a vegetative dimension from the design phase.
Existing structures are also encouraged to develop this aspect.

HOW TO CHOOSE THE TYPE OF VEGETATION?

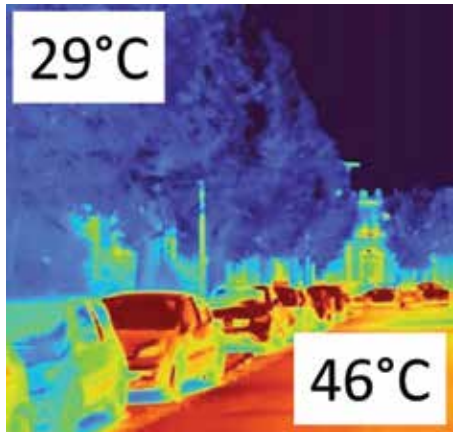
> In hot climates, choose leafy trees to protect buildings from solar radiation and create fresh areas outside

>>> see sheet Building B-8

> In temperate climates, favour trees that lose their leaves in winter to benefit from solar radiation

> Adapt the vegetation to the climate and the available water. Once well rooted they should ideally be able to develop further without watering

> In high precipitation climates, select trees that need a lot of water, to limit stagnant water that would otherwise be suitable for vector development, and with developed roots to stabilise the soil.



Fresh area under the trees

Ask for advice from Watsan and Construction Technical Referents as well as local people who can guide you (nursery growers, crop farmers, etc.).

Think twice before cutting a tree on an MSF site! If cutting is necessary, consider whether you can recover energy after drying (wood for hospital kitchen, etc.) and ideally replant one or more tree(s) elsewhere on the site.

Some types of vegetation can encourage the presence of vectors and are therefore to be avoided or maintained according to geographical locations and risks: the base of banana leaves is an ideal larval breeding site for Aedes ("tiger") mosquitoes after rain, low and dense vegetation favours the presence of snakes, etc. → maintenance can avoid these problems (cutting yellowed leaves on banana trees, mowing grass, etc.).

CONCRETE EXAMPLES

> In Katsina, Nigeria, the MSF-OCP emergency team was forced to cut trees for construction. For each tree cut, three trees were replanted on the site

> On the Ebola project in Katwa in the Democratic Republic of the Congo, the necessary constructions for the project were built in a way that avoided having to cut the trees present on the site

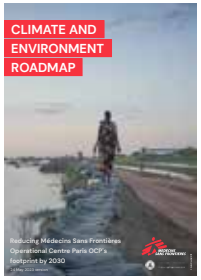
TO CONCLUDE

THE HUMAN FACTOR

The mainly technical topics that have been developed in this guideline are part of the solution to achieve our environmental goals.
Another considerable part is related to human behaviour. Environmental awareness and related best practices are therefore essential to achieve our collective commitments by 2030.

THE STARTING POINT

Initially, missions must embrace the MSF Climate and Environment Roadmap.
The next step will be to determine how the mission can contribute to this. What actions will be implemented by each department? The logistics branch of each project is invited to use this guide to define its actions.



COMMUNICATION AND INVOLVEMENT

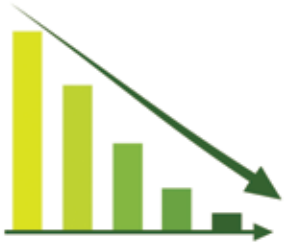
Subsequently, awareness must be maintained over time. This can be done by identifying a mission or project "green focal point", setting up "green minutes" in team meetings to discuss a sheet, a green topic at the time of the MAP and budget, a "green ideas box", moments of exchange with the teams to collect their ideas, etc.

VISUAL REMINDERS

It is recommended to display the best practices as a daily reminder.
Example: **sheet MFM A-7** ***in the driver's room,*** **sheets Energy A-5** ***and*** **A-15** ***as well as*** **Building B-2** ***in the offices, services, guest houses, etc.***

EVOLUTION MONITORING

To show that efforts pay off, rally anyone who is potentially recalcitrant and maintain the commitment of others, it is important to communicate the evolution of the mission's footprint by using the different data available (logistics follow up tools, evolution of budget lines, etc.).



INCENTIVES

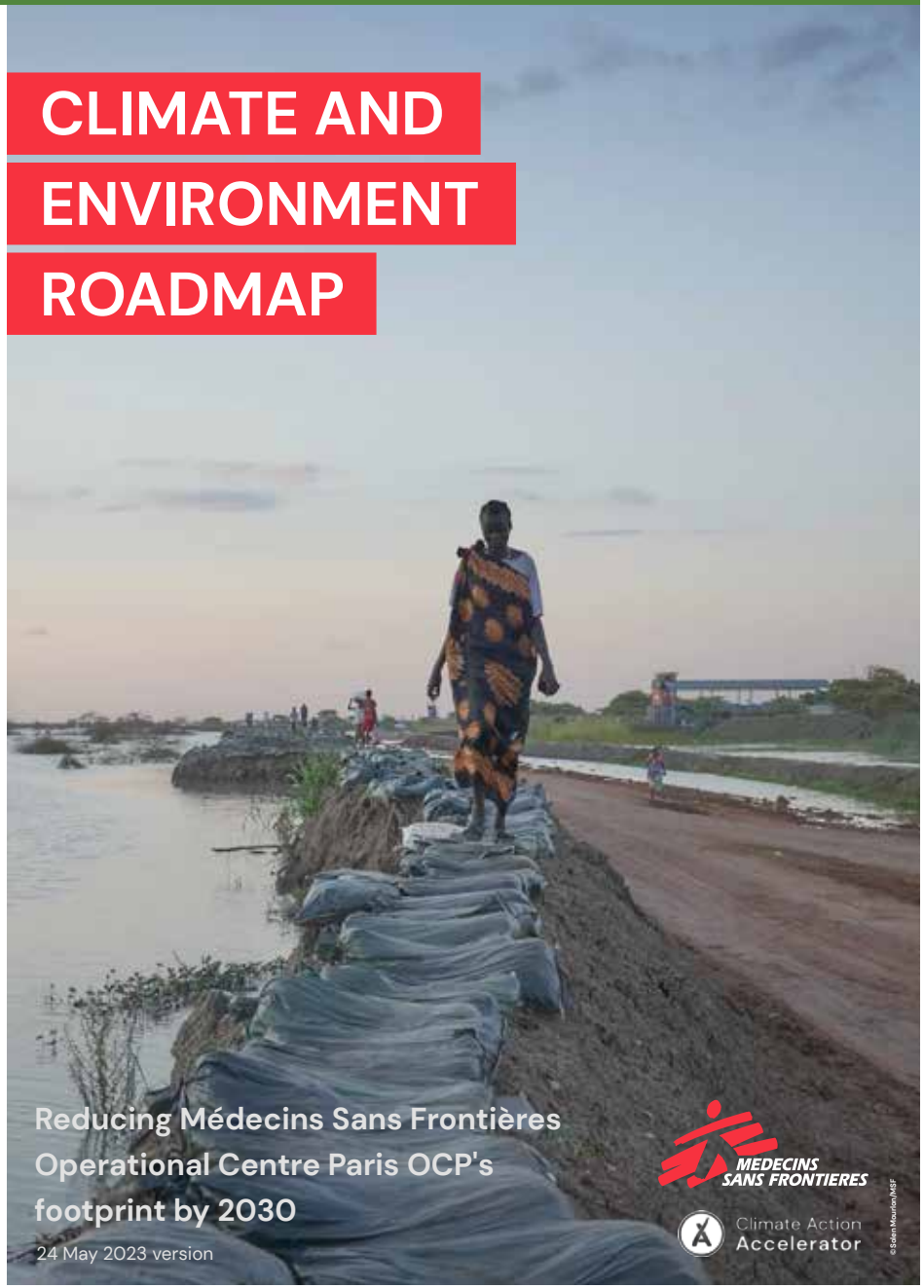
If the context and information permit, "competitions" to promote best practices can be imagined.
Example: periodic gift to the driver with the greatest reduction in consumption following the implementation of eco-driving, etc.

Highlight key figures and concrete examples in your communications on the subject.

Compliance with best environmental practices is often synonymous with more or less significant savings, depending on actions. Respect for the environment therefore also makes it possible to increase the share of the budget for the beneficiaries.
Example: difference in the annual cost of an air conditioner depending on its use
>>> see sheet Energy B-13

APPENDIX

CLIMATE AND ENVIRONMENT ROADMAP



Reducing Médecins Sans Frontières Operational Centre Paris OCP's footprint by 2030

24 May 2023 version

MEDECINS SANS FRONTIERES

Climate Action Accelerator

© Salah Mourony/MSF

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FOREWORD

For more than half a century, MSF has been helping populations affected by natural disasters. Floods, droughts, hurricanes – responding to these extraordinary events is one of MSF's typical domains of operation. But in recent years, MSF has mounted one climate-related emergency operation after another. Cyclones in Mozambique in 2018, unprecedented flooding in South Sudan in 2019 and 2020, historic and ongoing droughts in Madagascar and the Horn of Africa since 2020, etc.

And the scientific consensus is now established: global warming causes the frequency and the severity of extreme meteorological events to grow. Hence, we can no longer ignore the environmental and climate emergency in which we, and the rest of humanity, find ourselves.

Throughout our development, we have tried to provide "more care", by investing our skills and beliefs in ever-broader fields of intervention, and also to provide "better care", by practicing demanding, high quality humanitarian medicine whose cornerstone remains the medical precept "do no harm".

It is through this prism, still relevant, that we continue to analyse and dissect our medical action and humanitarian operations, and their consequences. We must also make sure that we are not, as an organisation, making problems worse. In other words, we must do our part in this vast endeavour and reduce the environmental impact of our own activities.

Our commitment to do just that is the subject of the environmental roadmap laid out below. MSF OCP (Operational Centre Paris) wants to further reduce the pollution generated by its field activities and is committed to halving its greenhouse gas emissions by 2030, as recommended by the IPCC (Intergovernmental Panel on Climate Change).

In partnership with the NGO Climate Action Accelerator, we have examined all of our practices and have set about thirty very ambitious quantitative objectives aimed at reducing our environmental impact while preserving our current high quality of care. This is going to require a change in the orientation and workings of various departments (Logistics, Supply, and Medical, in particular) and additional human resources will undoubtedly be allocated specifically for this purpose.

All this while continuing to move forward on other large-scale transformational efforts like our more ambitious goals regarding patients' rights and stronger HR policies in terms of team diversity, non-discrimination, compensation, and abuse prevention and treatment.

All of these projects are essential, and all force us to rethink broad swathes of our operation; doing all of them successfully at the same time will require us to set the right priorities at the right times.

Lastly, let's face it, embarking on an environmental transition is new for us. Hence our objectives are based on assumptions, estimations, and projections that we will undoubtedly have to revise, readjust, and re-estimate on the fly. But our course is set, and this is it.

Because providing medical assistance and delivering quality care while doing as little damage as possible to our environment is, henceforth, an integral part of our operations and of our goal of providing "better care".

Katrina Penney
MSF Australia President

Isabelle Defourny
MSF France President

Yuko Nakajima
MSF Japan President

Africa Stewart
MSF USA President

Thierry Allafort-Duverger
OCP General Director

MSF AND THE ENVIRONMENT

1980 Since the 1980s, we have been managing our medical waste to render it "non-contaminating, inaccessible, and non-reusable".

2009 Our Swiss colleagues did the first carbon footprint in the MSF Movement in 2009.

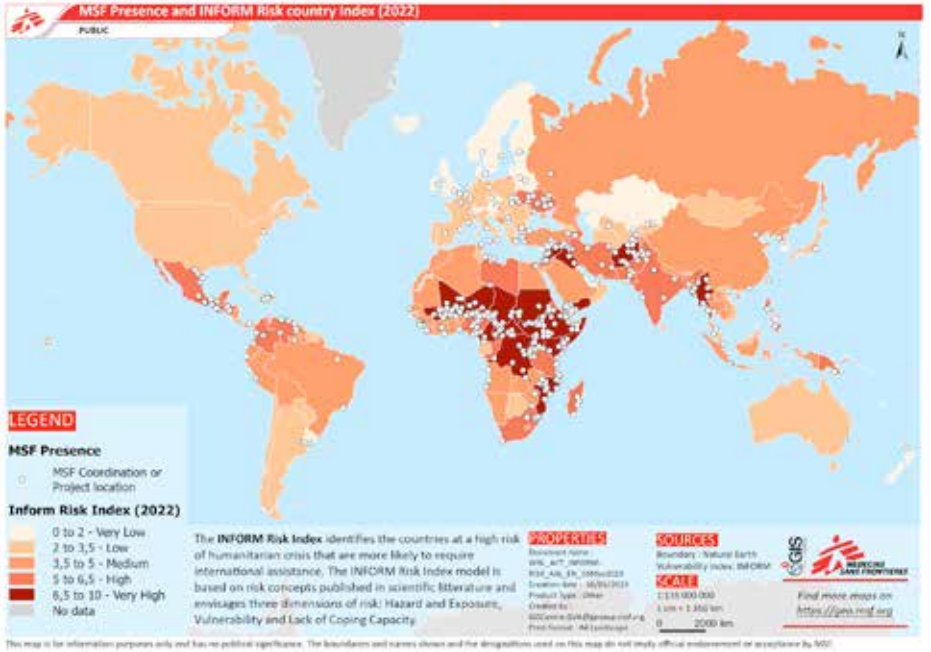
2020 In 2020, our extended Board of Directors, the Group Committee, made seven commitments aimed at reducing our environmental footprint, and a first small team was assigned to determine the scope of the task.

2021 In 2021, the MSF OC Geneva, Paris and Brussels committed to reducing their carbon footprint by 50% by 2030, in the framework of their partnership with Climate Action Accelerator. At MSF OCP, that triggered the large-scale effort that culminated in this roadmap. In their wake, the MSF Movement as a whole adopted the same target.

2022 In 2022, the MSF Movement signed the Climate and Environment Charter for Humanitarian Organizations: www.climate-charter.org.

The intersection between "MSF projects" and "Climate vulnerability"

· The map below shows the locations of MSF Movement projects - white circles - on one hand, and a country's INFORM Risk Index on the other, that takes into account, among other things, its vulnerability to climate change - the darker the colour, the more vulnerable the country. Quite clearly, many of our projects are located in countries with high levels of climate vulnerability.



REDUCING OUR FOOTPRINT

THE 4 KEY MESSAGES

We are changing our "way of being", not our "reason for being"

Our reason for being is not changing; it is humanitarian medical action. What is changing is the way in which we deploy our operations, which will become less harmful to the environment.

We will give ourselves the means to succeed – in terms of personnel, in particular

There will be many changes, which will involve large, long-term investments, particularly from the human standpoint; learning, training, and awareness-raising will be key to achieving our objectives.

We will have to make adjustments, but our course is set

We have taken a lot of highly ambitious commitments, often based on estimates, because this is a very new exercise for us; though we will have to adjust them often as implementation goes along, the course has been set and we will see it through.

Two dimensions: further reduce the local environmental impact of our activities and halve our carbon footprint compared to 2019, without carbon offsets

We are going scale-up our current efforts to reduce the pollution directly related to our activities locally and add a new dimension – our greenhouse gas emissions.

Some efforts will require particular attention due to the scope of the commitments and the scale of the organisational changes they will involve between now and 2030:

- A **50%** reduction in the overall volume of waste, plastics in particular
- Implementation of the "best environmental available techniques economically achievable" for waste management at **100%** of our missions
- A **35%** reduction in kilometres travelled for passenger air trips
- Decarbonisation of our supply chain (purchasing and freight) by about **30%**, mainly by adding environmental criteria to the selection process for products and suppliers
- A **40%** reduction in our electricity consumption and a **75%** reduction in the "CO_2 per kilowatt-hour" ratio for our electricity production and use.

NB: these commitments are in addition to the projected decarbonization for certain sectors (the "structural effects") and are expressed in relative value of the estimated MSF OCP activity in 2030, contrary to the -50% of CO_2 which is in absolute value compared to the 2019 value.

A collaborative process

This roadmap – developed in partnership with Climate Action Accelerator (CAA), an NGO that specialises in helping organisations reduce their footprint – defines the direction that MSF OCP will take to achieve its environmental and climate-related objectives by 2030. It offers a strategic framework for measuring and reducing our greenhouse gas emissions and local environmental damage and is the outcome of an internal participatory process at MSF OCP. Notably, when the process started, all "MSFers" were invited to contribute via a collaborative online platform, so that the entire organisation would be involved right from the start of the project.

Our strategy for reducing our environmental footprint

To reduce its footprint, MSF OCP, with CAA support, has identified 33 solutions specific to its activities. They cover all key areas of our operations: waste management, local ecosystems, travel, freight, energy, buildings, medical practices, fundraising, procurement of goods and services, digital and transversal practices. These are presented in detail in pages 11 to 19.

The solutions with the greatest reduction in local degradation are identified with a green badge, and those with the greatest carbon impact with a blue one. This does not, however, mean that the other solutions are unimportant; all 33 are needed to achieve our goals.

As our ambition to reduce our CO_2 emissions is precisely quantified, i.e. -50% compared to 2019, a preliminary estimation of our carbon footprint was necessary to target our efforts (see below), followed by a simulation of our "decarbonization trajectory" to show us the path to follow (page 9).

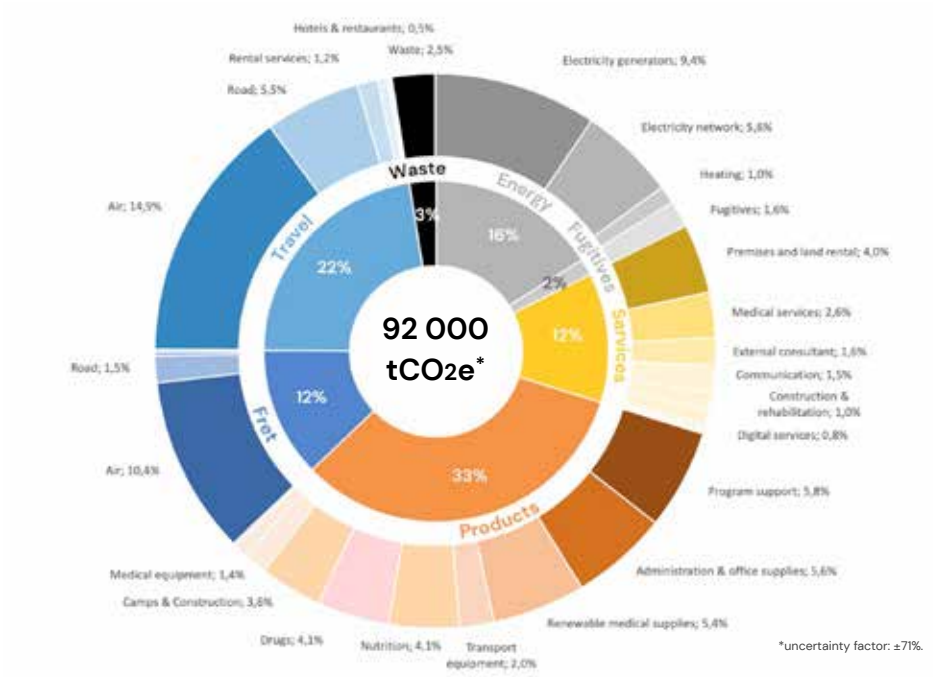
MSF OCP's 2019 carbon footprint

Our footprint is estimated to be 92,000 tCO_2e (metric tonnes of carbon dioxide equivalent). It was calculated for 2019 and quantified how many greenhouse gas emissions MSF OCP was responsible for. This included our headquarters in France and our activities in the thirty-six countries in which we worked; it encompassed 8,550 employees and a €334M budget (2019).

The methodology chosen for evaluating the carbon footprint of MSF OCP activities met international standards, followed the GHG (Green House Gas) Protocol, and included both direct (fuel use and energy purchases) and indirect (all other purchases of goods and services) emissions.

Since the science underpinning carbon accounting is relatively new and constantly improving, the "uncertainty factor" of the estimation is fairly high (about 70%). It does, however, allow organisations to identify their major sources of emissions and begin to take action.

Here is MSF OCP 2019 Carbon footprint



*uncertainty factor: ±71%.

The detailed footprint report is available at this adress: [OCP Carbon footprint report].

For MSF OCP, the major emissions categories are as follows:

Travel emissions (20,600 tCO_2e, 22% of the total footprint), two thirds of which can be attributed to plane travel by our personnel, and most of the remainder to our vehicles in the field.

Our **energy consumption** (14,700 tCO_2e, 16% of the total), with 59% of emissions coming from our generators, 6% from our heating systems, and 35% from local electricity purchases.

Freight transport (11,300 tCO_2e, 12% of the total), whose emissions come overwhelmingly from air freight (84%), despite the fact that it represents a smaller share of our shipment tonnage than does sea or road freight.

Waste treatment (2,300 tCO_2e, 2.5% of the total), mainly during the incineration of waste from our medical activities.

The so-called **fugitive** emissions (1,400 tCO_2e, 1.6% of the total), which are gases that leak from our freezers, refrigerators, and air conditioning systems, as well as some anaesthetic gases (isoflurane and sevoflurane).

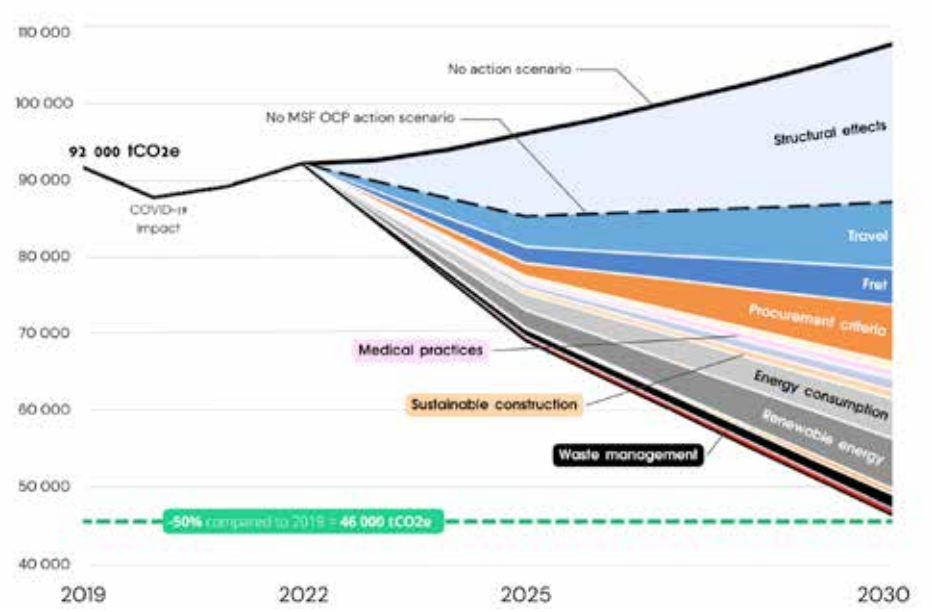
Last there are all the indirect emissions related to the **purchase of the goods and services** needed to keep our organisation running, from medications to pens, and even computers and customs fees. In fact, the production of those goods and the performance of those services necessarily emit CO_2, and when we buy them from our suppliers, we "import" them into our own carbon footprint. Altogether, this represents 41,600 tCO_2e, or 45% of the total.

MSF OCP's decarbonisation trajectory: 2019-2030

In a scenario in which neither MSF OCP nor our suppliers nor anyone take any action, our emissions would continue to increase over the next decade in proportion to the growth in our activities: this is the "no action scenario" curve in the graph below.

In a scenario where only MSF OCP does not take any specific action to reduce its footprint, our emissions would remain quite similar to what they are today: this is the "no MSF OCP action scenario" dotted curve. Reducing our emissions by half thus means significantly "decoupling" the change in emissions from the organisation's growth.

Here is our "decarbonisation trajectory", illustrating how different solutions contribute to halving our CO_2 emissions by 2030 compared to our baseline emissions in 2019.



What are the structural effects?

Structural effects are included in carbon footprint reduction trajectories to take into account the fact that, independent of an organisations' individual choices, society as a whole is decarbonising; for example, as a result of technological, infrastructure, and legislative changes, the "energy mix" used to produce electricity is shifting toward less carbon-intensive sources, increases in energy efficiency are having an impact on truck, boat, and plane emissions, and industry is switching to lower-emission production processes.

These factors are included when calculating the projected pathway by assuming a given annual emissions reduction for the selected categories. These structural effects – which our partners estimated to be -17% by 2030 – are added to the calculated emissions reductions that are expected to result from the organisation's low-carbon choices. A few examples:

- Electricity from the grid: 1.2% per year (Africa and Middle East Region)
- International sea and air transport: 2.0% per year
- Production of goods: 3.4%
- Services: 2.3%

These factors are based on trends that rely, in large part, on the IEA (International Energy Agency) analysis regarding historical, projected, and required emissions reductions for various sectors, and also on Ember (which gathers data from the IPCC and other agencies, including IEA data), and on the United Nations Sustainable Development Goals Indicators Database. CAA's choices for these numbers are fairly conservative compared to the projections and objectives in each of these sectors.

Uncertainty and readjustment

The decarbonisation trajectory, and more generally our environmental roadmap, spread out over several years. It then necessarily contains a lot of uncertainties: the carbon footprint calculation methodology itself, changes in MSF OCP's volume of activity, the effects of national decarbonisation policies, the rate at which photovoltaics are deployed in the regions where we work, and so on, are all factors that will require readjustment. Besides, as you can see, we still have to "go look for" few more tenths of a percent between now and 2030 to achieve that 50%.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WASTE MANAGEMENT

2,5% of the carbon footprint
2 300 tCO_2e in 2019 ▶ 900 tCO_2e in 2030


© Khaula Jamil

This topic is not new – in fact, it has long been one of our biggest headaches in the field. In many of our intervention contexts, medical waste streams and wastewater management infrastructure are rare or non-existent, and we ourselves have to set up a system that we feel is appropriate. What changes with this roadmap is that on one hand we are going to up our requirements and equipment a notch, and on the other reduce the amount and complexity of waste created going back to the source, while also considering CO_2 emissions.

SOLUTIONS	COMMITMENTS
Avoid and reduce waste • Reduce the use of single-use medical and nonmedical items and use reusable and biodegradable materials • Stop using plastic bags for dispensing our medications and replace them with reusable or biodegradable alternatives when applicable • Better enforce the donation before expiration policy • Promote the repair of electronic and electrical equipment	Reduce the weight of waste **50%** by **2030**
Increase local or regional recycling • Improve domestic waste sorting and evaluate local waste treatment streams • Promote the recycling of electronic and electric equipment	Recycling streams are identified at **100%** of projects by the end of **2025**
Ensure that all steps of waste management are followed in the best possible way • Establish and implement a waste management plan specific to each context	**100%** of MSF OCP missions have a waste management plan by the end of **2025**
Limit soil, water, and air pollution • Roll out sustainable waste disposal systems • Better monitor treatment quality in cases where hazardous waste management is outsourced • Better monitor and treat wastewater discharges from hospitals • Engage into research on the risks from hospital wastewater	**100%** of missions have implemented the "best environmental available techniques economically achievable" by **2030**

Commitments added to the Structural effects and expressed in relative value of the estimated MSF OCP activity in 2030, contrary to the -50% of CO_2 which is in absolute value compared to the value of 2019.
Intermediate commitments for 2025 have also been decided but are not presented here for the sake of readability.

LOCAL ECOSYSTEMS

This domain mostly impacts the environmental footprint (minor CO_2 impact)


© Florence Miettaux

In addition to reducing pollution and emissions, an environmental transition means considering the fact that the local ecosystems react and can be damaged if we take too many "resources" relatively to its capacity for regeneration. In this respect, we are going to take actions to identify and mitigate those risks and even, in some small way, to contribute locally to regeneration.

SOLUTIONS	COMMITMENTS
Preserve water resources • Implement water conservation policies in places where this resource is scarce	**100%** of projects have implemented the "best environmental available techniques economically achievable" by the end of **2025**
Prevent and reduce damage to the local environment • Implement "best environmental available techniques economically achievable" after analysing each project's impact on the environment	**100%** of projects have conducted an environmental impact analysis by the end of **2025**
Preserve the land and soil in and around our facilities • Promote tree planting and integrate gardens in MSF premises	**100%** of our construction and renovation projects include a revegetation component starting in **2024**

TRAVEL

22.4% of the carbon footprint
20,600 tCO_2e in 2019 ▶ 13,100 tCO_2e in 2030


© Christophe Da Silva/Hans Lucas

Unsurprisingly, passenger transport – by air, in particular – is a major source of CO_2 emissions. This is obviously due, primarily, to our operational model, which involves sending expatriate staff to field projects and using four-wheel drive vehicles to reach remote areas. As a result we have set extremely ambitious goals, which are going to involve both speeding up some large-scale efforts that are already underway (extending the length of missions, improving local staff access to positions previously reserved for "expats", using hybrid training modalities, etc.) and giving our staff tools that will help make fewer trips and lower fuel consumption an integral part of their day-to-day practices.

SOLUTIONS	COMMITMENTS
Reduce work-related air travel • Define a responsible travel policy • Review training locations and modalities • Develop tools that allow employees to choose low carbon-emission travel	Reduce work-related air travel kms **35%** by **2030**
Optimise the size, composition, and movements of the vehicle fleet • Further optimise vehicles usage in the missions where context and security allows it • Train the drivers on eco-driving • Purchase low-emission vehicles whenever possible	Reduce fuel consumption-related emissions **30%** by **2030**
Reduce the carbon impact of commuting to and from work • Promote public transport and sustainable transport, when context allows • Encourage partial remote work, particularly at headquarters	Reduce commute mileage that uses fossil fuels **60%** by **2030**

FREIGHT

12.3% of the carbon footprint
11,300 tCO_2e in 2019 ▸ 6,000 tCO_2e in 2030


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Successfully carrying out our activities requires a lot of products and equipment, which we sometimes have to purchase far from our field projects to ensure acceptable quality; shipping all that merchandise – by air, in particular – contributes significantly to our carbon footprint. And while we have already reduced the percentage of freight shipped by air in recent years, there is still room for improvement.

SOLUTIONS	COMMITMENTS
Reduce the amount of goods transported by optimising the quantities ordered • Improve forecasting to avoid overstock	Reduce overstock-related losses **80%** by **2030**
Increase the percentage of sea and road freight by better positioning goods • Ensure that storage locations are closer to use and distribution points • Increase supplier direct deliveries to hubs and missions	Reduce tonne-kilometres of air freight for emergency projects **20%** by **2030**
Increase the percentage of sea and road freight via better planning • Only use air freight in situations and contexts where it is absolutely unavoidable • Reduce field stock-outs requiring urgent re-supply	Reduce non-priority air shipments **80%** by **2030**
Optimise container shipments to a single destination • Consolidate shipments between the supply centres and the missions (it makes it easier to reach the optimal quantity for a sea shipment, and thus to avoid some air shipments)	Reduce tonne-kilometres of air freight **5%** by **2030**
Reduce air shipment of backorders • Align supply centres stock strategy with demand, improve follow up and communication on lead times, and review the backorder management	Reduce air shipment of backorders **50%** by **2030**
Select transport service providers with a lower carbon footprint • Include environmental criteria in the selection process	**60%** of freight is transported with lower-emission fuel by **2030**

Climate Action Accelerator

Commitments added to the Structural effects and expressed in relative value of the estimated MSF OCP activity in 2030, contrary to the -50% of CO_2 which is in absolute value compared to the value of 2019.
Intermediate commitments for 2025 have also been decided but are not presented here for the sake of readability.

MEDICAL PRACTICES

22.8% of the carbon footprint
21,000 tCO_2e in 2019 ▸ 18,000 tCO_2e in 2030


© Ahmed Kaka/MSF

Medical products and equipment are obviously central to our operations, and we have understandably gotten into the habit of "playing it safe", at the risk of occasionally overusing, and overprotecting. This "playing it too safe" is what we are going to address in our protocols and habits in order to reduce the amount of products needed for our activities and the potential risks of pollution, while maintaining the same quality of care.

SOLUTIONS	COMMITMENTS
Adopt medical protocols that have a smaller environmental impact • Switch to longer lasting medical material and alternative medical products, like recycled plastic items or anaesthetic gases and inhalers with lower "global warming potential" • Train medical staff on updated protocols and their environmental impact	Reduce the volume of medical items purchased and shipped **5%** by **2030**
Reduce the overconsumption or the unjustified use of medical items • Rationalise the selection, ordering, and distribution of drugs, the use of medical devices, and patient prescriptions • Optimise the ordering, use, and maintenance of medical equipment	Reduce overuse of drugs and medical devices **70%** by **2030** Reduce unnecessary medical supplies orders **70%** by **2030**
Increase the percentage of sea and road freight via better planning for medical orders • Only use air freight in situations and contexts where it is absolutely unavoidable • Reduce field stock-outs requiring urgent re-supply	Reduce non-priority air shipments **80%** by **2030**

Climate Action Accelerator

Commitments added to the Structural effects and expressed in relative value of the estimated MSF OCP activity in 2030, contrary to the -50% of CO_2 which is in absolute value compared to the value of 2019.
Intermediate commitments for 2025 have also been decided but are not presented here for the sake of readability.

ENERGY AND BUILDINGS

21.7% of the carbon footprint
20,000 tCO_2e in 2019 ▶ 8,900 tCO_2e in 2030


© Mohammed Sanabani/MSF

Energy transition is, of course, a high priority focus of this roadmap. For us, this will initially involve an effort to reduce our electricity use and then to shift what remains toward renewable energy sources.

SOLUTIONS	COMMITMENTS
Favor sustainable constructions • Better respect construction best practices and encourage sustainable design (techniques and materials)	**90%** of construction and renovation work is managed according to new best practices by **2030**
Reduce the energy consumption of buildings • Redefine the temperature standards in all buildings • Improve building energy performance via sustainable design and passive measures • Implement the most energy efficient temperature regulation	Reduce energy consumption **40%** by **2030**
Reduce energy consumption and improve the energy efficiency of electric installations • Monitor energy consumption and production • Install automated regulation of electrical equipment • Purchase energy efficient equipment • Promote responsible choices and behaviours in all domains requiring energy use	
Decarbonise electricity and energy production • Replace the electricity produced using fossil fuels with renewable energy • Use solar energy for specific equipment (water heaters, pumps, etc.) • Produce electricity or energy from waste or fatal heat • Subscribe to decarbonated energy suppliers for buildings	Reduce the carbon intensity of electricity production and use **75%** by **2030**
Encourage the production, use, and distribution of sustainable heating items in facilities and programmes • Use alternatives to fossil fuels, charcoal, and wood in distribution and production for heat	Reduce the quantity of charcoal and wood used for heating **80%** by **2030**
Reduce emissions of gases with high global warming potential • Purchase air conditioning and cold chain equipment that uses alternative to HFC gases • Ensure responsible commissioning, maintenance, and decommissioning • Use local, national, and regional recycling channels	**100%** of air conditioning and refrigeration equipment uses non-HFC gases by **2030**

FUNDRAISING

1.5% of the carbon footprint
1,400 tCO_2e in 2019 ▶ 1,300 tCO_2e in 2030


© MSF

The way in which we solicit our donors, both current and future, should also reflect our commitment to the environment, whether it's travel arrangements for our street fundraising teams, the amount of paper used for direct mail, or the environmental responsibility of our suppliers.

SOLUTIONS	COMMITMENTS
Choose Fundraising items, services and suppliers with a lower environmental footprint • Include environmental criteria in our selection process for products and services procurement • Identify alternatives that produce less carbon or waste for the most important services and items, including replacing plastic items	Reduce life-cycle emissions of goods and services purchased for fundraising **25%** by **2030**
Promote good practices and responsible behaviours related to fundraising • Create a best practices and guidelines handbook • Reduce emissions related to canvassers' travel via sustainable transport, local recruitment, and reducing the distance between mission sites • Reduce the quantity of transported goods thanks to a better definition of needs and alternative organisations • Reduce the volume of paper and electronic direct mail sent thanks to a better and optimised targeting of audiences and increased use of regular giving practices • Optimize the volume of paper and electronic mail sent, through more personalized targeting and relationship cycles, and by increasing the proportion of regular donations	Reduce the carbon intensity of fundraising activities **15%** by **2030**

GOODS AND SERVICES

44.9% of the carbon footprint
41,300 tCO_2e in 2019 ► 21,700 tCO_2e in 2030

Includes part of Medical Practices', Fundraising's and Buildings' emissions

© Remi Decoster

This broad category, which accounts for half of our emissions, includes all goods and services purchases except for energy and transport, and ranges from ballpoint pens to drugs, computers and leases. While the wide range of products, services, and suppliers, and the near-total absence – for now – of information about their environmental impact prevents us from being very specific in our goals, its importance requires our resolve.

SOLUTIONS	COMMITMENTS
Choose items, services and suppliers with a lower environmental footprint • Request visibility on products' carbon value and life cycle information • Include environmental criteria in procurement procedures • Identify lower carbon or lower waste generating alternatives for most important items	Reduce life-cycle emissions of goods and services **25%** by **2030**
Reduce goods packaging • Reduce product packaging or use more environmentally-friendly alternatives	Reduce tonne-kilometres transported **6%** by **2030**
Non-medical products: promote the procurement of locally or regionally produced items • Prioritise local or regional production for heavy or bulky nonmedical items, provided the quality can be guaranteed	Reduce the transported tonne-kilometres **5%** by **2030**
Medical products: bolster our supply centers efforts to "source" from medical suppliers closer to our operations	

DIGITAL


© MSF/Rowan Pybus (@Makhulu_)

The impact of digital – both in terms of climate impacts and of pollution generated during raw materials extraction or for end-of-life processing of equipment – is increasing worldwide, so we want to get into good habits quickly.

SOLUTIONS	COMMITMENTS
Rationalise the amount of data storage and transfer • Optimise growth data use and storage via "cold data storage" policies and regular deletion	Reduce available cloud data storage **90%** by **2023**
Reduce the carbon intensity of digital equipment and services • Expand the life cycle of IT and telecom equipment and reduce turnover rate • Mutualise personal and professional equipment when relevant • Purchase easily-reparable equipment and repair locally • Store data at eco-friendly data centres	Increase computer equipment service life cycle **50%** by the end of **2025**

TRANSVERSAL PRACTICES

It is essential that all staff members be involved in our environmental efforts, because each will have a role to play; the solutions in this category will enable every person to find some way to contribute.

SOLUTIONS	COMMITMENTS
Limit the growth in headquarters office space • Optimise office space by introducing co-working practices	Establish and implement a workstation use and optimisation policy by the end of **2025**
Promote best practices and responsible behaviours • Create a best practices guide regarding energy, waste, supplies, food, etc. for offices and facilities • Provide more eco-responsible meals (more organic, less meat, etc.) in offices and medical facilities	Develop and deploy a best practices handbook in **100%** of our offices and facilities by the end of **2025**

IMPLEMENT

Implementing this roadmap will require a significant, long-term effort.

Financial resources

From a financial standpoint, we estimate that we will have to allocate between 1 and 3% percent of our total annual budget each year during the initial phases of the project. This does not include the savings nor the avoided costs that some solutions will generate (travel, energy, etc.).

Investing in our personnel

Other critical aspect: supporting our personal through these changes, in terms of both building skills and changing mindsets, will involve a robust system of learning, training, and awareness-raising.

Accountability

Lastly, to anchor the environmental transition in the workings of our associative life, we will give an update on the implementation of this roadmap at each General Assembly and add a specific section to our annual report. This accountability exercise will enable every employee, every member of the association, and every donor to judge the progress being made and the steadfastness of our commitment.

ACKNOWLEDGEMENTS

MSF OCP

We would like to thank all staff and co-workers from MSF OCP, and more broadly from the entire MSF Movement, who participated in the development of this roadmap by taking part in interviews, questionnaires, and workshops, by offering solutions on the participatory platform, and by providing their technical insight on the feasibility of the solutions.

Climate Action Accelerator

We would like to thank the entire team for its support in producing this roadmap – in particular, in calculating footprints, modelling the trajectory, and producing the content presented.

Under the direction of

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24 May 2023 version

About Médecins Sans Frontières OCP - Operational Centre Paris

MSF is an independent, international humanitarian medical organisation that provides medical assistance to people whose lives or health are in danger, in France or elsewhere, mainly from armed conflict, but also epidemics, pandemics, natural disasters, or exclusion from healthcare.

OCP is one of 6 Operational Centres that deploy interventions under the MSF banner. MSF has grown considerably since its creation by a group of volunteers in 1971; it now employs more than 60,000 people each year in 70 countries.

The organisation's autonomy and independence is ensured by its funding, which comes from the generosity of private donors. In France, in 2021, 98.6% of MSF resources came from private sources.

About Climate Action Accelerator

The Climate Action Accelerator, a not-for-profit initiative, aims to mobilise a critical mass of community organisations in order to scale up climate solutions, contain global warming below 2°C and avoid the risk of dangerous runaway climate change. The aim is to help shift the aid, health and higher education sectors towards a radical transformation of their practices, pursuing emissions reduction targets (-50% by 2030) and a 'net zero' trajectory, in line with the Paris Agreement.

REDUCING OUR FOOTPRINT BY 2030

Further reduce the **local environmental impact** of our activities

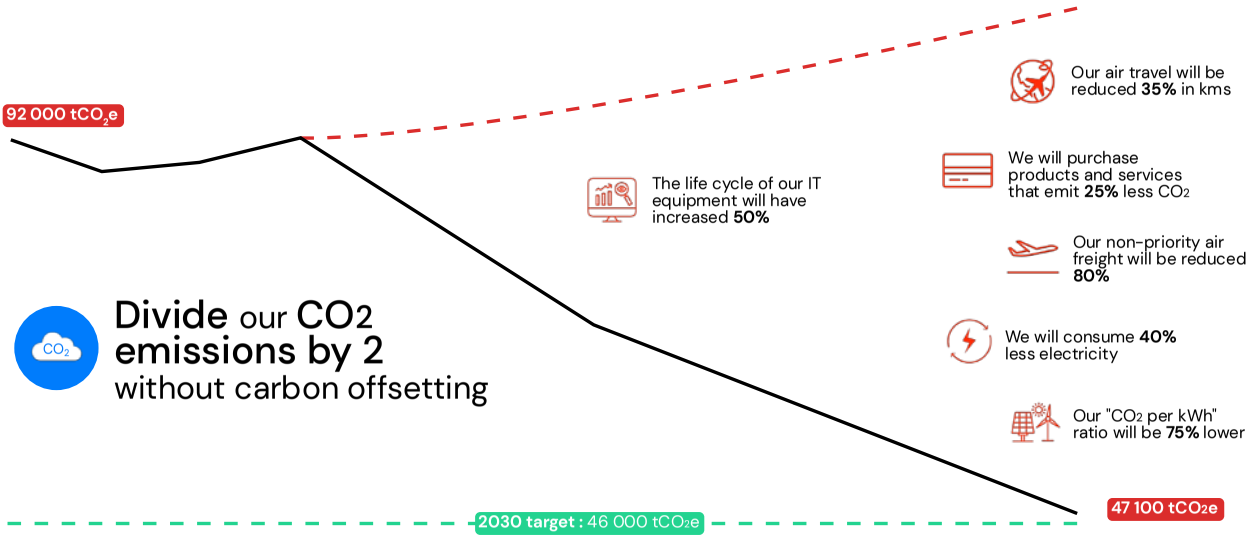
100% of our projects will have conducted an environmental impact analysis

We will generate **50%** less waste

Recycling streams will have been identified in **100%** of our countries of operation

The best environmental available techniques economically achievable for waste management will be in place on **100%** of our missions

2019	2022	by 2025...	by 2030...



Our air travel will be reduced **35%** in kms

We will purchase products and services that emit **25%** less CO_2

The life cycle of our IT equipment will have increased **50%**

Our non-priority air freight will be reduced **80%**

We will consume **40%** less electricity

Our "CO_2 per kWh" ratio will be **75%** lower

Divide our CO2 emissions by 2 without carbon offsetting

MEDECINS SANS FRONTIERES

Climate Action Accelerator

...and more than 20 other commitments will have been met

DÉPARTEMENT

LOG

PACE MAKER

(Programme Action Climat et Environnement -
Climate and Environment Action Programme)

2024 edition