ENERGY BEHAVIOUR CHANGE PROJECT REPORT PHASE 1:

A joint project between ICRC and MSF OCG, delivered by the MSF Sweden Innovation Unit

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ABBREVIATIONS

A	Amp (unit of electrical current strength)
AC	Air Conditioning unit
CO_2	Carbon Dioxide
CT	Current Transformer
DB	Distribution Board
HVAC	Heating, Ventilation and Air Conditioning
ICRC	International Committee of the Red Cross
IPCC	Intergovernmental Panel on Climate Change
kW	Kilowatt (unit of power)
kW-h	Kilowatt hour (unit of energy transmitted over a period of time)
LED	Light-Emitting Diode (low-energy input light source/bulb alternative)
MEI	Moving Energy Initiative
MSF	Médecins Sans Frontières
NILM	Non-Intrusive Load Monitoring
PV	Solar Photovoltaic system (solar panels converting sunlight into energy)
ROI	Return On Investment
TIC	Transformational Investment Capacity, MSF internal innovation fund
ToR	Terms of Reference
TP&N	Three-Phase and Neutral (method of electricity transmission across electrical grids)
W	Watt (unit of power)

1. Executive Summary

The aim of the Energy Sensitisation Project is to improve the understanding of what measures can be taken within ICRC and MSF operations to reduce energy use, and to change the staff mindset to one that more naturally performs energy-reducing behaviours without compromising on service delivery. During phase 1 of this project, we assessed the requirements for baseline monitoring and have proposed a set of strategies for effective behaviour change campaigns that could be implemented. We then recommend a step-by-step approach on how these could be applied to ICRC and MSF contexts, starting with localized pilot implementations.

The need for energy monitoring is highlighted and forefront. It is recommended that the two organisations develop a roadmap towards establishing a centralized monitoring system of at least the high-level energy consumption within premises; smart meters will facilitate the data collection. This monitoring provides the essential baseline data required before taking the next steps to reduce the organisations' carbon and environmental footprint, including the behavioural-based interventions recommended in this report.

Behaviour change campaigns are an ongoing activity that should accompany the organisations' implementation of structural energy efficiency strategies. The recommendations made in this report are based on best practices, comprising visual materials such as films, posters, emails, pledges, contracts, workshops, and verbal communications; and elaborating changes to the choice architecture, such as changing default settings on electrical appliances/devices, and providing more energy-efficient alternatives that will not compromise operations and staff comfort.

In ICRC and MSF contexts, a lack of good baseline data and monitoring capacity has been identified and is addressed in the recommended next steps. A roadmap and framework performing energy audits is put forward. Audits will ensure that any behavioural interventions are tailored to the specific location and operational environments where energy efficiency campaigns are being implemented.

2. Introduction

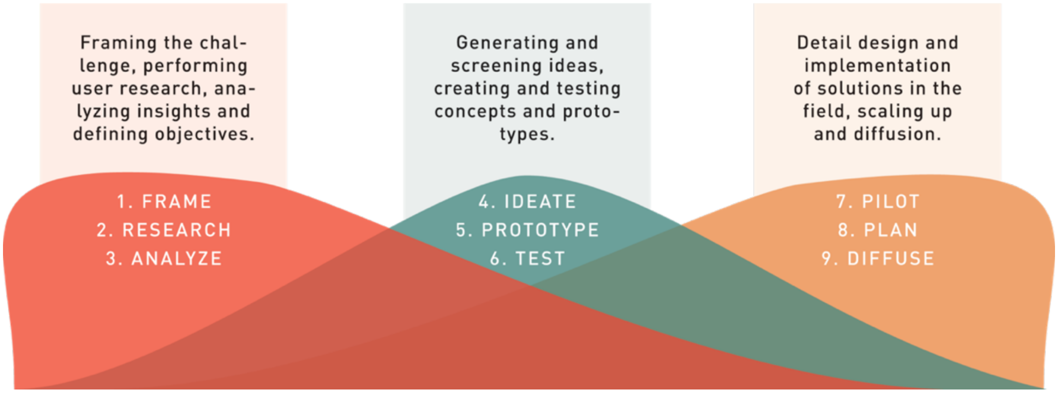
Behavioural change and lifestyle change are a key mitigation option for reducing energy service demand in buildings. Systematically tracking energy consumption will be critical in setting a baseline and then determining a course of action to improve buildings' energy performance through behavioural change campaigns. Improvements in monitoring technology will make it affordable and easy to install smart meters in the coming years, and it is recommended that the organisations develop a roadmap towards setting up a centralized energy monitoring system. Data monitoring, recording, analysis and transfer should be automatically performed by the energy monitoring system without the need for manual operations by staff at the location or remotely. A basic monitoring system to measure energy consumption at any given premises could cost as little as US$ 350.

A behaviour change campaign will focus on reducing energy consumption through positively influencing the behaviours and habits of staff. This can be achieved by increasing staff knowledge about energy and how to reduce consumption thereof ('energy literacy'), by motivating behaviour conducive to energy savings, and through adaptations to work environments that encourage energy-saving habits to take hold in the long term. Campaigns can comprise visual materials such as films, posters, emails, pledges, contracts, workshops, and verbal communications; but also changes to the 'choice architecture', such as changing default settings on devices and providing more energy-efficient alternatives that will not compromise operations or staff comfort.

The humanitarian sector has freely shared campaign materials and tools for addressing behaviour change that can be adapted to ICRC and MSF needs. In MSF contexts – and likely in ICRC contexts – behavioural change campaigns must be conducted alongside other efficiency upgrades and not in isolation of them, except in buildings already equipped with good energy infrastructure and energy performance. The next steps involve improving data availability and understanding of current energy consumption in buildings, identifying high-impact behavioural campaign topics, and developing campaigns and information materials. Changing habits, perceptions and expectations takes time, and behaviour change interventions should be continuously reiterated and adapted in the coming years to inform and support part of the organisational strategies implemented to reduce environmental footprints and, in some instances, operational costs.

3. Timeline and deliverables

It was originally proposed to divide the project into three phases, with a Go/No Go decision by ICRC and MSF at the end of each phase. This would roughly follow the SIU's innovation process. Although some of the details have changed, the overarching aim still follows the timeline below.



The following is primarily concerned with Phase 1 of this project.

Phase 1: Initiation – Q4 2019

Aims

- Better understand each organisations' expertise/resources related to the project.
- Analyse various solutions for monitoring energy consumption in buildings, taking into account the technical requirements of both organisations.
- Analyse various behaviour-based energy efficiency strategies that could be implemented in both organisations.
- Combine these findings into an energy-efficient package that can be piloted in ICRC and MSF field projects.

Key deliverables expected

- Scan the market for various monitoring systems that could provide MSF and ICRC staff with instant energy use feedback.
- A comprehensive package of behaviour-based measures that could be relevant to ICRC and MSF contexts.
- A comprehensive project plan for phase 2 implementation (technology used, methodology, budget, etc.)

Timeline

- **Jul-Sept**: Background information. Baseline data. Informational interviews with Stakeholders and Experts.
- **Aug-Sept**: Market Analysis of suitable monitoring systems that can provide instant energy use feedback. Potential field observation of staff energy use in buildings.
- **Oct-Nov:** Develop comprehensive package of behaviour-based measures that could be relevant and piloted in ICRC and MSF contexts. Draft and finalise project plan for phase 2 implementation.

Phase 2: Development – 2020

Aims (Dependent on Phase 1 Findings)

- Implement an energy monitoring system that provides immediate feedback in a minimum of four ICRC or MSF projects.
- Implement and accompany behaviour-based energy efficiency measures in both organisations.
- Compare results for the different measures and between organisations.

Key deliverables expected

- At least four separate pilots of various energy efficiency measures.
- Validation of a suitable energy consumption monitoring system and behaviour-based energy efficiency strategies that could be rolled out in other localities.
- Cost/benefit analysis of the different measures.
- Potential for publishing results in sector bulletins.

Phase 3: Implementation – Q1 2021 (TBC)

Depending on the findings of phase 2, phase 3 aims to roll out/upscale/implement a relevant behaviour-based energy efficiency strategy with a pertinent monitoring system sector-wide.

Key deliverables expected

- A significant, quantifiable reduction of environmental footprint and financial burden due to the energy waste in MSF and ICRC premises.

Project closing (TBC)

Capitalisation of knowledge and lessons learned based on the progress made in the preceding phases. Planned during Phase 2.

4. CONTEXT

In recent years, both ICRC and MSF began reflecting on how to reduce dependency on fossil fuel energy with the ultimate goal of reducing their environmental footprints and associated costs — thus enhancing power supply resilience.

Energy consumption in buildings is a key target of improving the rational use of energy, as it is estimated that building energy consumption accounts for 32% of all CO_2 emissions globally. It can be reasonably assumed that ICRC and MSF's building consumption also accounts for a significant amount of both organisations' primary energy resource usage, although this is likely to vary depending on the location and purpose of the buildings. Efficiency gains for buildings can be achieved through a number of strategies —such as the use of LEDs that require less energy than classic bulbs to deliver the same service— but also through changes to human behaviour.

During phase 1 of the Energy Sensitization and Behaviour Change Project, a shortlist of recommended and suitable energy monitoring systems for ICRC and MSF sites were identified and presented to the organisations. These recommendations are followed by an overview of potential behaviour-based service demand reduction techniques. Finally, the project reflects on input and learnings from observations made during past field audits that relate to behaviour change. The learnings from these audits are mostly incorporated in the sections *Considerations for ICRC and MSF Contexts* (p28) and *Next Steps* (p29). The next phase will build on these findings by implementing pilot tests at four sites, aiming to test metering and to identify target behaviours and suitable interventions that could be applied at scale within ICRC and MSF operations to reduce energy consumption.

4.1. SWOT Analysis Overview of the Pros and Cons for the Wider Project

Table 1: Project SWOT Analysis

Strengths	Weaknesses
• Focus on behavioural change is in line with IPCC identified key mitigation options. • Capital investment for the equipment is small. • Shared learnings across organisations. • Combined resources. • Potential for sector-wide impact. • Tests wider strategies articulated in reports such as Moving Energy Initiative. Will demonstrate their real ROI. • Will demonstrate where actors should focus their resources as strategies move towards sustainable measures. • Will provide practical guidance to field on how to implement monitoring and efficiency gains.	• Heterogeneity of missions and delegations poses challenges to identify scalable solutions. • Short implementation timespan (seasonal variations difficult to catch). • Dependency on support from and access to field level operations. • Implementing behaviour change can take long periods of time. • Behaviour change interventions should occur strategically, alongside or after structural and efficiency improvements. • The carbon / energy accounting systems need to be in place for tracking and monitoring progress. • The turnover of management staff is a weakness in follow-up and also threatens buy-in. • MSF presently has many initiatives, but lacks any global governance as of yet.
Opportunities	**Threats**
• Strong signal of organisational commitment to tackle environmental issues. • Identification of high ROI interventions that are widely applicable.	• Change to level of access due to political changes or disease outbreak in pilot region. • Unforeseen challenges with metering set-ups. • Lacking support from the pilot missions / delegations. • Project targets users and logistic departments, but neglects managerial decisions and procurement. • Jumping into easy 'technical solutions' without studying the life cycle will limit the impact of behaviour change measures.

5. Market Overview of Energy Monitoring Products

5.1. Monitoring Energy Consumption

The process of monitoring of energy use involves measuring how much, where, when, how, and why energy is being consumed at specific locations and across whole organisations. The objective of energy monitoring and management is to reduce costs, increase efficiency, and enhance sustainability.

Energy monitors are devices which measure actual electricity use in premises, showing current energy consumption and energy used over time. This will provide the organisation with quantitative data on how much, where and when energy is used (e.g. $, kW-h, Office Building 2, 9am to 8pm Monday 13th).

The 'why' and 'how' of energy use is more qualitative, and will be investigated in terms of context, choice of energy-using products, and the behaviour of those using those products, for example: need for cooling (dependent on climate, site, building construction, user perception etc.); make / type of AC chosen (cost, local availability, familiarity); user-determined temperature and times of operation based on personal preferences, etc. This data requires an understanding of these multiple contextual factors, including restrictions on the availability of technology and costs.

Changes to the choices of why and how –such as energy efficiency and behavioural change measures– can reduce energy consumption by up to 50%. The impact of those changes is measured by energy monitors, which show us real-time and historical actual energy usage. The change in overall energy consumption should be analysed in conjunction with other variables, most typically temperature variations and changes in operational volume. Without measuring energy consumption, it is not possible to ascertain how much energy is being used, by what devices and in what areas, and thus improvements cannot be quantified.

5.2. Key Assumptions for Testing Phase of Project

The aim is to monitor overall energy consumption and the main end-uses in ICRC/MSF premises remotely, with a view to developing a centralized energy monitoring system. Monitoring, recording, analysis and transfer of data should be automatically performed by the energy monitoring system without the need for manual operations by staff at the location or remotely.

Internet connectivity is intermittent in many locations, so monitoring devices require a minimum of 24 hours of internal data storage. We have thus excluded systems which are cloud-based without internal storage from this analysis.

Power quality is not of primary importance for the purposes of this project; however, it is recommended that current on three phases and neutral (4CTs) is measured, in addition to voltage measurement on all phases. (CT on live only with voltage measurement for single phase).

Electricity supplies and electrical installations are not always reliable, stable and properly installed to appropriate standards before energy monitors are installed and behaviour change interventions applied.

During the testing phase, additional monitoring will be needed to demonstrate actual impacts of behavioural change and energy efficiency measures, in addition to showing how much and when specific devices are consuming. Once these have been quantified in selected locations, it would not be necessary to install as many monitoring devices when scaling up energy monitoring across the organisation.

Monitoring systems will advance greatly in the next 5 years, allowing simpler installations and increased ability to monitor all locations and appliances (similar to the 'Internet of Things'). However, internet connectivity may not advance greatly in remote locations.

5.3. Energy Monitoring Devices

The primary objective of this project is to monitor energy usage to measure changes in consumption as a result of changes in behaviour. Monitoring devices must be capable of measuring instantaneous power (kW) in addition to energy use (kW-h) to provide a clear, easy to understand picture of energy consumption patterns over time.

Such information can reveal the maximum and minimum load, in addition to the times of day, week or year when the most energy is used. Once we identify how we use energy, we can then take steps to try to reduce this consumption through energy efficiency and behavioural change measures.

There is a large range of suppliers of energy monitoring systems, many of whom have multiple products from which to choose. This market overview did not consider all suppliers or products in the market, instead focusing on those products which appear to be most widely used for basic commercial energy monitoring (as opposed to industrial, engineering and control energy monitoring systems).

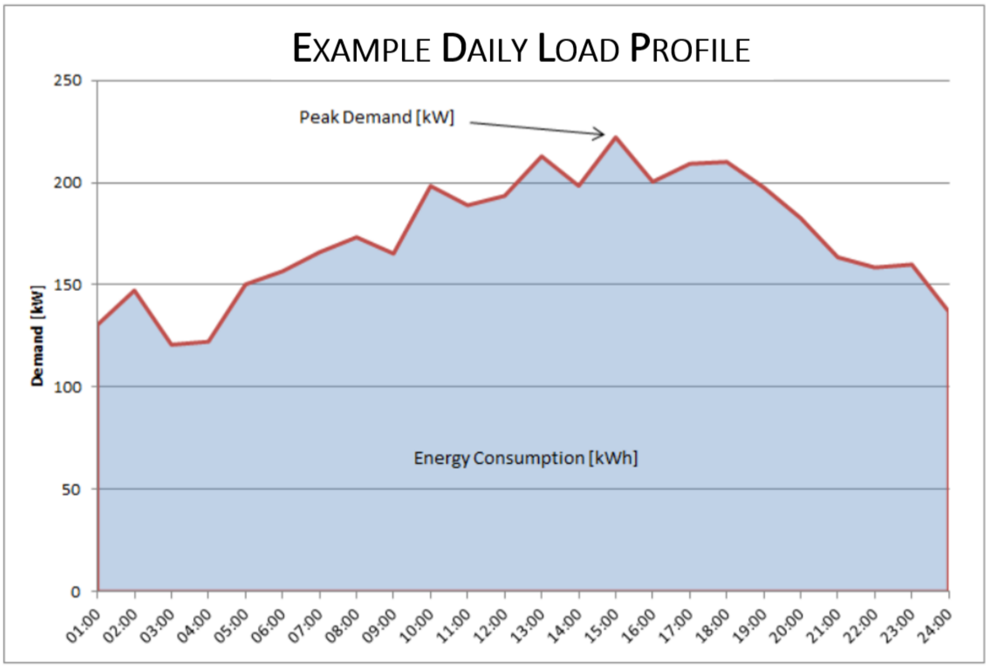


Figure 1: Example Daily Load Profile

In addition to measuring total energy consumption for a site or building, we can also measure the breakdown of use per room, circuit or device –depending on the level of detail we choose to invest in– with the aim of identifying outliers with unusually high energy consumption for which relevant measures for reduction can be defined. The more detail, the more accurate our energy picture will be – but also the more expensive the monitoring system.

In other locations, we would install monitors only at a macro level (site or building-level) to enable cross-comparison of impacts on behaviour facilitated by having the more granular data on device use as well as less specific location-wide behavioural data. It is also important in this pilot phase to collate valuable data on energy consumption for specific devices (e.g. demonstrate the actual consumption of ACs, computers, printers etc.) and show reductions in use following specific efficiency measures.

Systems can be used for any application from small single-phase installations to large three-phase installations. The device selection should consider the level of power quality required and local internet connectivity (WIFI or mobile network).

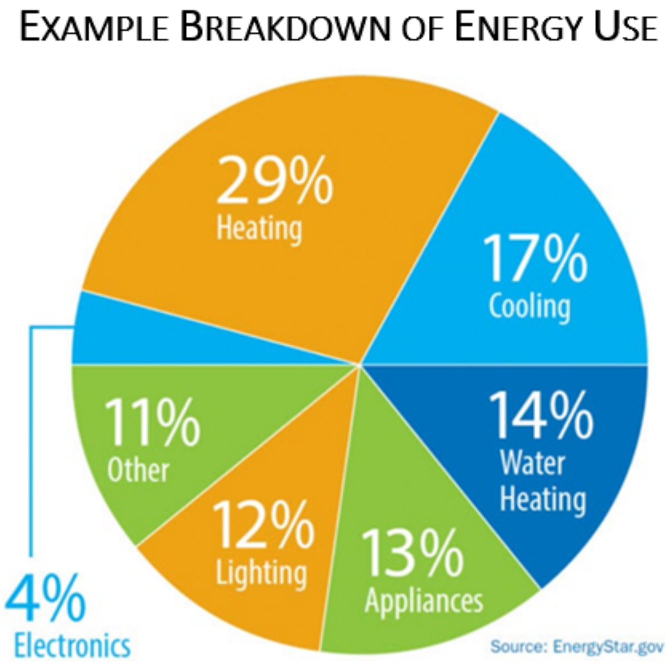


FIGURE 2: EXAMPLE BREAKDOWN OF ENERGY USE

The above graph is an example of measuring energy consumption for different uses, wherein we measure several data points or circuits to ascertain which items consume the most. We can then aim to focus on those areas which provide maximum ROI.

Which monitoring systems and the number of measuring devices installed will depend on the configuration of buildings in a location, in addition to the way in which those buildings are wired. In some cases, circuits are per office or per floor; in others, they are wired by type of appliance, e.g. AC/lighting/sockets each have individual circuits.

Individual consumption will be difficult to measure in most locations, as working and livings spaces are predominantly shared, staff can work across multiple locations, and staff turnover can be high. While it may be possible to monitor actual changes in behaviour of individuals or groups, the measurement of changes in energy consumption as a result of those changes in behaviour will represent a wider group.

Premises connected to the grid will already have an electricity meter, along with electricity bills which show the monthly electricity usage and cost.

For diesel generators, a system that accurately records the amount of diesel used and energy output per generator would provide valuable information on costs and efficiency. Generators with control panels permit monitoring of the total kW-h produced and thus monitoring of total energy consumption, and could be manually recorded daily, weekly or monthly.

Recommendations for quantity and location of energy monitors:

- Installation of an energy monitoring device at the main electricity supply (grid and diesel generator) in all locations to provide overall power and energy consumption data. This will record power supplied from grid connections, solar PV and diesel generators.

- Installation of energy monitoring devices in key buildings, distribution boards or key circuits to provide more granular data for these locations / circuits.

- Installation of device-level monitoring in selected locations for the testing phase, providing direct feedback to staff on their energy use and the effects of the energy efficiency or behavioural change measures. Devices to undergo this level of monitoring should be selected based on frequency of use and expected high level of energy consumption.

- Low/No-cost option: Manual data collection of electricity meters and generator displays to be carried out in selected locations (kW-h/hours of operation - daily/weekly). Collect electricity bills for all premises in locations where we intend to pilot this project, even if monitors are not installed. While we don't get an accurate picture of load profile, we would be able to record the total quantity of energy consumed which could be used as a basic indicator of variations in consumption resulting from specific actions. Measurement of diesel consumption per generator would also be useful.

Recommendations for minimum parameters for energy monitors:

- At least 24 hours of data storage on a device to protect against intermittent internet connection and reduce risk of data loss. We have excluded systems which are cloud-based without internal storage.

TABLE 2: CRITERIA FOR ASSESSING MONITORING SYSTEMS

PARAMETER
SUBJECT TO JUDGEMENT
Value for money
Ease of use
Ease of installation
ESSENTIAL
Real-time feedback energy use in kW & kWh
Internal off-line data storage on device for store/forward function
3-Phase measurement: Current: L1, L2, L3
Voltage Reference Measurement: at least one phase: V1, V2 or V3
Display of current per phase, power per phase, total power, energy per phase, total energy (kW & kWh - real-time and historical)
System has own software to enable data transfer, analysis and display in multiple formats
Layperson-friendly interface to access & display energy use information
API for data transfer to external software system over multiple protocols
Ability to download data to excel, .csv files
Network connectivity, one or several of the following: Ethernet, WLAN, GPRS/3G/4G

Security features to prevent access to data by external parties
Able to withstand voltage surges of 600V minimum
Convenient, but not Essential
Individual circuit disaggregation
Appliance-level disaggregation
NILM – Non-Intrusive Load Monitoring
Power Quality
3 phase measurement: Voltages TRMS V1, V2, V3, V12, V23, V31
3 phase measurement: Effective Power & Energy L1-3, Sum
3 phase measurement: Reactive Power & Energy L1-3, Sum
3 phase measurement: Apparent Power& Energy L1-3, Sum
3 phase measurement: Power factors
3 phase measurement: Voltage Harmonics
3 phase measurement: Current Harmonics
3 phase measurement: Frequency (min. range 45-65Hz)
3 phase measurement: Peak values with time stamp
3 phase measurement: Peak detection, 1 second or less
4-quadrant measurement (in case we feed into the grid)

5.4. Power Quality

Organisations must monitor power quality to ensure that incoming electricity supplies are stable and will not damage servers, PCs and other equipment. It is also important to measure the power quality on the load side to determine if electrical installations are functioning correctly and ensure that loads are balanced.

Many basic energy monitors are designed with the assumption that both the electricity supply and the electrical installation are reliable, stable and properly installed to high standards; this is not the case in many locations where ICRC and MSF operate, with poor quality electricity supply and low-standard installations all too common. Current measurements on neutral cables can exceed those on live phases. These issues can lead to increased energy use through losses, in addition to damaged equipment, shocks and fires. It is paramount to verify that electricity supply and use follows normal patterns, and subsequently to take necessary action to remedy any issues, before we begin addressing energy efficiency measures or considering investment in renewable energy systems, such as Solar PV.

If the incoming power supply is stable, we propose that we would only need to measure real-time voltage (Phase & Line) and current across TP&N, with readouts on power factor, graphs showing current, voltage and energy over time (basic power quality measurements). We suggest that we do not need to measure harmonics, K Factor, crest factor and advanced analytics (full power quality measurements).

If there are more complex issues with the electricity supply or system, then an electrical engineer will be required on site with more advanced electricity measuring equipment in order to recommend changes in design or additional equipment to resolve these issues.

To design a power supply such as a Solar PV system, these parameters are sufficient to provide us with maximum and minimum loads and usage patterns. These parameters are also adequate to implement energy efficiency measures, including behavioural change in use of appliances.

For larger installations, full power quality measurement is recommended to enable remote monitoring and troubleshooting. One such system would cost less than one visit to the site by a flying technician. Additionally, as situations change, operations expand, and new devices and/or new buildings are installed, electrical installations will also change. We must therefore continue to monitor the main supply for sites and building buildings to enable normal operation and safety verification, in addition to continuous energy consumption monitoring.

If we can procure an energy monitor which also provides information on power quality for a similar price, this would be ideal, since it is most likely that these monitors will be permanently installed for continued measurement.

Recommendations for power quality:

- Energy monitoring devices must be capable of measuring at least the separate currents on three phases and neutral (4CTs), in addition to voltage measurement on all phases for the main distribution board (CT on live only with voltage measurement for single phase). This will provide adequate indication of power quality to determine if there are issues with the electricity system which need to be addressed.

- Installation of full power quality monitoring systems on sites/premises where the main switch is rated at 200A (TP&N) or higher.

5.5. Installation

Although most monitors are relatively simple to install, the process involves working on live electrical boards; therefore, there is a serious risk of electrical shock.

Qualified personnel experienced with electrical installations should be locally available, as most operations will have a contract for generator maintenance and general electrical work. On-site staff (preferably someone responsible for electrical and maintenance tasks) should be trained in maintenance and operation of the devices to support troubleshooting. One element of this pilot phase is to determine the level of expertise required to install the hardware and operate the software in each system, in addition to remote access reliability, data quality and overall ease of use.

Recommendations for installation:

- Installation is only to be carried out by those qualified in / very familiar with working on electrical installations.

5.6. Non-Intrusive Load Monitoring (NILM)

Ideally, we would measure the consumption of all devices connected to electricity; however, although this is technically possible with modern technology, it would be very expensive. Non-intrusive Load Monitoring (NILM) has been developed to attempt to detect loads connected to a circuit, learning consumption patterns to identify specific appliances. This can be up to 70% accurate for easy-to-identify loads; however, difficulties arise with smaller (<50W) and variable loads, and distinction between devices with similar electrical signatures is very challenging.

Energy measurement devices are becoming cheaper and smaller, creating a possible future scenario in which all devices are fitted with them and data is collected and analysed by specially-designed energy monitoring systems, similar to the 'Internet of Things' which connects everything online. Another possible future scenario involves investing more in NILM technology, which would require fewer measurement points and would avoid integration issues with multiple measuring device manufacturers. The demand for more prolific energy monitoring is certainly increasing, however it is not clear which method will be most appropriate in the future.

NILM is not yet sufficiently developed for 3-phase systems and is not sufficiently accurate for device monitoring in single phase.

Recommendations for NILM:

- NILM is not considered an important parameter in device selection. If it is included as part of appropriate devices, this feature could be used in addition to measurement of the primary parameters.

5.7. Software to Display Measured Data

A highly important feature of energy monitoring is the aggregation, analysis and presentation of information for effective audience engagement. While it is important to measure in units of power, energy, voltage and current, these may not be readily understood or of interest to many. In developing effective behavioural change, it will be important to comprehend the motivations of individuals and to present information in a way that is appealing and interesting. We can translate units of power and energy to represent costs or CO_2 emissions, or other visualisation methods which correlate to lower consumption in words, pictures, graphs, etc.

Software systems accept data from several different energy monitoring devices, so it is not necessary to source all devices from the same manufacturer. This software would be required to collate and combine data from all sources and to automatically present it in easy-to-read dashboards to inform decision making.

Some energy monitoring systems are quite basic in this regard, and are particularly limited in effectively displaying, comparing, collating and combining high numbers of data points into global readouts. Specialist software has been developed to provide improved presentation and data management which can collect, analyse and present data from multiple products and manufacturers in one platform for all devices.

At present, companies are offering free access to the cloud and their software; however, this is limited to usually two or five years depending on the company. Companies may elect to charge for continued software use and access to the cloud in future.

Recommendations for Software Systems:

- Additional software systems would not form part of the piloting phase, as the higher levels of investment are excessive for small systems. Product-linked software should be used.

- If the organisation adopts one type of energy monitor only for global use, then the software from that manufacturer may be satisfactory. If several devices are to be procured, then an additional software package will be required.

- Further research is required comparing capabilities of independent and product-linked software systems with regard to ability to present data in multiple, customisable formats, report generation, length of storage of data, compatibility with multiple systems, ease of use, and cost.

5.8. Costs

The assessed criteria for each system are outlined in the following table:

Table 3: Energy Monitoring Systems Costs and Specs across Different Manufacturers

Manufacturer	Ease of Use	Ease of Installation	Power Quality	Data Storage and Transmission	Cost	Range of Options for Multiple Scenarios
Eyedro	★★★	★★★	★	★	$	★
Smappee	★★★	★★★	★	★★	$	★★
Schneider	★★	★	★★★	★★★	$$$$	★★★
Accuenergy	★★	★	★★★	★★★	$$$	★
ABB	★★	★	★★★	★★★	$$$$	★★★
eGauge	★★	★	★★	★★★	$$	★
Dent	★★	★	★★★	N/A	$$$	★

Please note: *This table is an initial assessment of different solutions and is not an official endorsement by MSF or ICRC of any particular technology.*

The costs at each location will be dependent on the layout of the site, the way in which it is wired, and the type and number of monitoring devices required.

Recommendations on specific products and manufacturers:

- Trial multiple products, as actual installation and use of systems will provide much greater understanding of ease of use, installation, and suitability –including direct feedback from the field– than desk review can.

- Where device monitors are to be installed, trial Smappee, which allows remote switching of devices. It also appears to have better power quality features than Eyedro at present.

- In locations with large distribution boards where up to 10 circuits are to be measured, eGauge presents a good option as it has higher power quality measurements.

- In locations where power is stable and installations are satisfactory quality, trial Eyedro.

- Continue investigation into products and feedback from known users, obtaining data from actual installations.

6. Overview of Behaviour Change Techniques and Interventions

According to the IPCC, behavioural change and lifestyle change are the key mitigatory measures for reducing energy service demand. Key barriers include imperfect information, fear of low RoI, cognitive and behavioural patterns, and lack of awareness. The key policies to initiate behavioural change and to address the common barriers are awareness raising, education, and energy audits, which in conjunction with other methods have potential to reduce energy use by 20-40% compared to business as usual.[1]

Most research and behaviour-based interventions thus far focus on household and residential energy use where large-scale population programs have achieved relatively modest long-term savings. By simply providing basic feedback and education (energy literacy) materials in the form of mailed reports, a saving of between 1-3%,[2] was achieved. When combined with technological efficiency measures such as weatherization of buildings or the replacement of devices with more energy efficient options, savings of 20% were possible. In work settings, energy savings of up to 75% have been achieved when behavioural interventions are combined with technologies.[3] Motivation and cues for behavioural change can be better maintained when and where other energy saving interventions are being implemented simultaneously, thus these should always accompany one another. In particular, behaviour change measures can multiply the impact of technological and managerial interventions.

Phase 2 will focus on identifying specific opportunities for behavioural change interventions and on finding common barriers that may be targeted at scale across the organisations. Behaviour-based intervention can be designed using the existing best practices outlined in this document. In absence of detailed information about the energy consumption in the operational context, the global overview presented by the IPCC assessment report on behavioural change provides a very high-level overview on the areas where the largest gains can be made. The following table shows achievable levels of energy consumption reduction for various end uses. The next steps outlined in this document include a roadmap to identify the most important areas of intervention based on ICRC and MSF operations. Pilot tests will determine which consumption reductions can realistically be achieved, and the time and means required to do so.

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[1] United Nations, IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 2014 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland. Available at: https://www.ipcc.ch/report/ar5/syr/ [Accessed 12/01/2020].

[2] UK Government Department of Energy and Climate Change, RAND Europe, *What works in changing energy-using behaviours in the home? A rapid evidence assessment.* 2012. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69797/6921-what-works-in-changing-energyusing-behaviours-in-.pdf [Accessed 12/01/2020].

[3] Bin, Shui (2012). 'Greening Work Styles: An analysis of energy behavior programs in the workplace'. ACEEE.

TABLE 4: THEORETICALLY ACHIEVABLE LEVELS OF ENERGY CONSUMPTION REDUCTION THROUGH BEHAVIOUR CHANGE (IPCC[4])

END USE	PERCENTAGE CHANGE	NOTES
Heating	10 % - 30 %	Typical value.
Hot water	50 %	Shorter showers, switch from bathing to showering and other conserving behaviours.
Cooling	50 % - 67 %	Includes the use of fans during tolerable brief periods of heat, eliminating the use of cooling equipment in moderately hot climates.
Lighting	70 %	Turning off unnecessary lights.
Refrigerators	30 %, 50 %	Using smaller fridges and elimination of extra fridges.
Dishwashers	75 %	Fully loaded operation as opposed to part loaded operation.
Clothes washers	60 % - 85 %	Cold compared to hot water washing, fully loaded operations.
Clothes dryers	10 % - 15 %, 100 %	Operation at full load rather than at one-third to half-load, air drying inside or outside.

Please note: *The table shows best possible scenarios, some of which are tied to specific contexts that may not correspond to realities in ICRC and MSF operations.*

Individual energy consumption in a work environment has several characteristics that set it apart from household energy consumption, and that in some ways make identifying suitable behaviour interventions more complex. Clear financial incentives such as reduced energy bills are offered to individuals at a household-level, but clearly are not possible in office environments. In addition, as office environments do not present the same opportunities for individualized feedback and monitoring, information about energy saving is usually communicated at a group level, which reduces the sense of individual responsibility and impact. Importantly, merely informing employees of the benefits of saving energy and requesting that they reduce their use of light, heat and cooling does not appear to necessarily lead to changed behaviours.[5] Effecting change towards more environmentally sustainable behaviour needs to consider barriers, as well as motivations, opportunity, and capacity of the individuals from whom change is expected. Performance of the right behaviours should be made as easy as possible, be it through structural changes in the environment, prompts, social support, or other nudges. It is very important that comfort remain as little-affected as possible, and that staff are involved from the beginning. Group ownership of the strategies increases the odds for success.

The most important lessons from this desk research are that an intervention should:

1. Seek to understand in detail what behaviours have the greatest achievable impact on energy performance and whose behaviours need to change, and

2. Design interventions to reduce or eliminate barriers and address motivation, capabilities and opportunities for staff to reduce their consumption.

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[4] United Nations, IPCC, *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, 2014 [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland. Available at: https://www.ipcc.ch/report/ar5/syr/ [Accessed 12/01/2020]. p. 687.

[5] Kollmuss, A. & Agyeman, J. 'Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?' *Environmental Education Research* 8 (2012): 239–260.

6.1. Behaviour Change Techniques for Reducing Service Demand

All interventions must be prefaced by a systematic tracking of energy consumption, which is critical for setting a baseline and subsequently determining which intervention will be most appropriate and effective. The data collected can also be used to encourage energy-saving behaviours through motivating actions, for example by providing evidence of successful reductions in energy consumption due to a change in habits. In some cases, simply presenting energy use data has successfully led to a reduction in personal energy consumption in residential units.[6]

It is, however, important to emphasise that behaviour change measures must occur as part of a wider system change. Without strong monitoring, and technical and organisational change, these techniques will have little significant effect.

6.2. Nudging

Within the design of choice architecture, 'nudging' is a tool that employs human impulse behaviour to influence choices – but, importantly, without forcing them. Rather, nudges make use of positive reinforcements and indirect suggestions. When possible, any interventions chosen should rely on nudging rather than coercion or imposition.

Key nudging techniques and strategies that are commonly deployed in the workplace include social norms, changing default options on machines and appliances, feedback, benign peer pressure, and rewards. In particular, the employing the influence of upper management and peers to address social norms by setting the tone and modelling good behaviour has proven to be critical to the success of behaviour-based intervention programs in professional environments. The majority of cases require more than one behaviour intervention to effect lasting change, and sometimes the appropriate intervention is not immediately obvious.

Some examples of specific interventions applicable within office and professional settings are outlined below; these are not exhaustive, and serve as a sample of some proven effective strategies. It would be a mistake to design an intervention without having conducted in advance the prerequisite data collection, analysis and contextualisation.

6.2.1. Goals and Planning

Commitment-making: the institution (at mission/ office / coordination level) and individual staff pledge to achieve a specific goal and track progress; goal framing needs to consider environmental values of the individuals involved and can be based on symbolic or monetary benchmarks.

[6] Bruelisauer, Marcel; Goette, Lorenz; Jiang, Zhengyi; Schmitz, Jan; Schubert, Renate. 'Appliance Specific Feedback and Social Comparisons: Evidence From a Field Experiment on Electricity Saving' (November 28, 2018). Available at SSRN: https://ssrn.com/abstract=3299500 or http://dx.doi.org/10.2139/ssrn.3299500 [Both accessed 12/01/2020].

Action Examples:

- Include a pledge to be environmentally conscious and mindful into the onboarding materials for new staff, and ask current staff to sign a symbolic pledge.
- Collect baseline data (using the monitoring devices, the relevant parts of the TIC tool (MSF) or Environmental Monitoring System (ICRC), field analysis and specifically designed surveys, and then set realistic goals to reduce energy consumption in kW-h per person or per m^2 of facility space while tracking the process and highlighting achievements.

6.2.2. Feedback and Monitoring

Feedback mechanisms can provide users with a normative frame of reference on their energy consumption compared to an average or compared to other users. Both direct and indirect feedback is useful. Direct feedback involves displaying real-time electricity consumption directly at workstations or mobile phones, or via screen displays in the residence, office floor or common area, and usually showcases in terms of comparative percentage relative to either a target level or an average consumption. Indirect feedback can also be provided in the form of an energy audit to inform consumers of whether there is abnormally high consumption behaviour compared to the average or norm.

Action Examples:

- Where meters and submeters are installed, provide a screen in a common area that displays live energy consumption; this can be facilitated during the installed metering set-up.
- Conduct energy audit by a trusted authority to highlight areas of overconsumption and red flags.

6.2.3. Shaping Knowledge

Improve energy literacy and share information on how to perform certain actions –and on the positive or negative consequences of certain actions– through newsletters, podcasts, webinars, in-person meetings, posters, emails, videos, etc. Templates and a framework for educational material can be provided centrally by the coordination or headquarters, but must be distributed, adjusted and implemented by the taskforce locally. It is important to find a messaging approach that appeals to emotions – in particular, positive emotions such as the senses of pride and accomplishment have led to positive decision making by individuals (see Table 5: Toolkit of Behaviour Change Strategies (p27) for more details).

Action Examples:

- Provide staff with tips and tools on how to use high-impact energy consuming assets such as dryers and AC more efficiently.
- Distribute general energy literacy materials to staff.
- Organize workshops, talks and online training materials.

6.2.4. Social Support

One way of providing important social incentives to induce behaviour change is for the leadership and other 'role model' positions to broadcast an organisational commitment to improve environmental impact footprints. Leaders within the organisation can be key in delivering crucial environmental messaging. Staff 'champions' can also play a vital role in getting more colleagues on board by modelling good behaviour (switching off lights and appliances, fully loading dryers etc.) or by otherwise encouraging others to contribute to energy saving activities. People tend to follow the behavioural lead of those with whom they share a sense of similarity or those whom they admire or care about, as demonstrated by UNICEF in a comedic promotional video.[7]

Action Example:

- Identify key messaging to be delivered by organisational leaders at all staff meetings in projects and missions

6.2.5. Comparison of Behaviour

Launch a competition to reduce energy consumption between floors, rooms or buildings, or compete over other such norms. Proceed with caution, however, as competitions run the risk of only providing temporary improvements, or even generating a rebound effect. Comparisons of behaviour –for example comparing present consumption to average or past patterns– is a less risky option; generally, highlighting how behaviour departs from an average tends to nudge individuals to adjust their behaviour towards the norm, and can be effective in reducing the footprint of high-consumption users in the longer term.

Action Example:

- Create a benign competition or challenge where projects compete for three months to reduce their energy footprint based on KPIs identified.

6.2.6. Reward and Threat

Actively acknowledge or recognise positive behaviour. The reward can be either material and specific, or immaterial through generating positive emotions by highlighting and recognizing achievements. Rewarding and congratulatory feedback in simple forms –such as displaying a smiley face when targets are met– can help avoid rebound effects. Economic rewards are very appealing in general. Threats can be used, but should be avoided in favour of rewards, and motivational and positive messaging.

Action Example:

- Assign a 'Green Award' to projects based on exemplary behaviour.

6.2.7. Associations, Prompts, Reminders and Designing 'Choice Architecture'

Frequently remind staff to take certain actions, or remind them of their target commitments. Change default choices, such as default thermostat settings or AC unit automatic switch-off times. The user will have to make a conscious choice to change the thermostat setting or turn on the AC. Remove barriers and 'frictions' that act as deterrents from making the most beneficial and positive choice. Intentionally designing 'choice architecture' will simplify what people are asked to do by reducing the apparent choices available, or by framing decisions in a way that automatically guides people towards the most beneficial behaviour.

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[7] UNICEF, 'Stuff UNICEF cares about: Saving the Planet', 2019. Available at: https://www.youtube.com/watch?v=4u98H3JoAgM [Accessed 12/01/2020].

Action Example:

- Install (timer) switches on all ACs, set default temperature to 24° and equip desks with individual fans that can be controlled locally for additional cooling according to individuals' thermal comfort.

6.3. Target Intervention Areas for Energy Consumption Reduction

Potential intervention areas are listed below and have been identified through interviews and literature research. Only one category relies solely on 'staff curtailment behaviour', referring to staff adapting their behaviours to consume less energy. The remainder will require a change in managerial and/or procurement practices, which implies behavioural change at different levels of the organisations.

6.3.1. Staff Service Demand Reduction Behaviours

These include frequent, low-cost behaviours which require little or no skill and that can be performed and observed by all users of the office; these are essentially curtailment behaviours. In office and residence settings, they mostly relate to thermal comfort, workspace, and eating, each of which can take place in multiple locations around the work building. Specific behaviours include turning off lights, appliances and devices when not in use, air-drying, lowering / increasing thermostat settings in cold / warm climates, closing refrigerator doors properly, closing windows and doors when HVAC is in use, wear clothing appropriate to the climate and season, putting laptops and printers in sleep mode when not in use, turning off printing machines at night, etc.

6.3.2. Facility Management Measures

These aim at decreasing energy demand involve targeting and encouraging organisational behaviours with a monthly or seasonal recurrence, and should be restricted to low-cost and low-skill requirements. Such behaviours evade categorisation as either 'curtailment' or 'efficiency' measures, and include:

- Cleaning and replacing filters around the office;
- Programming thermostats and timed switches;
- Setting appropriate refrigerator, freezer and water heater temperatures;
- Removing redundant water coolers / heaters, fridges, coffee makers, or other appliances;
- Creating shared canteen facilities and moving away from personal or numerous low-capacity fridges;
- Installing switches with default automatic switch-off times to equipment and appliances;
- Repairing doors and windows, installing automatic door closers, installing viewing windows in doors;
- Installing meters on the main DB and key locations, repairing poor electrical installations, monitoring and maintain systems;
- Encouraging security and cleaners to also adopt these behaviours.

6.3.3. Institutional-Level Intervention

This applies to the implementation of changes at management, human resources, procurement, policy, and budgeting levels. These include:

- Procuring high efficiency appliances as standard;
    - this should be informed by life-cycle cost analyses performed during procurement evaluations; investment in systems with higher up-front costs can lead to significant long-term savings;
- Encouraging the use of fans in favour of cooling equipment during periods of tolerably high temperatures;
- Ensuring high-quality electrical installations by consulting experts;
- Mentioning 'energy efficiency' in recruitment materials and processes, including in ToRs and contracts;
- Appointing 'energy champions', or location-specific 'responsible individuals' across the work environment;
- Training staff in energy efficiency as part of onboarding;
- Globally reporting, target-setting, and comparing energy consumption per staff member / m^2 / location and subsequently taking appropriate mitigation actions;
- Incentivizing reduced consumption –either on a personal or locational-basis– by introducing competitions and other motivations;
- Demonstrating the negative health impacts of improper AC use;
- Relaxing dress codes to allow for lower thermostat settings in colder climates or lower AC settings in hotter climates;
- Creating an organisational culture that normalizes these and other positive behaviours.

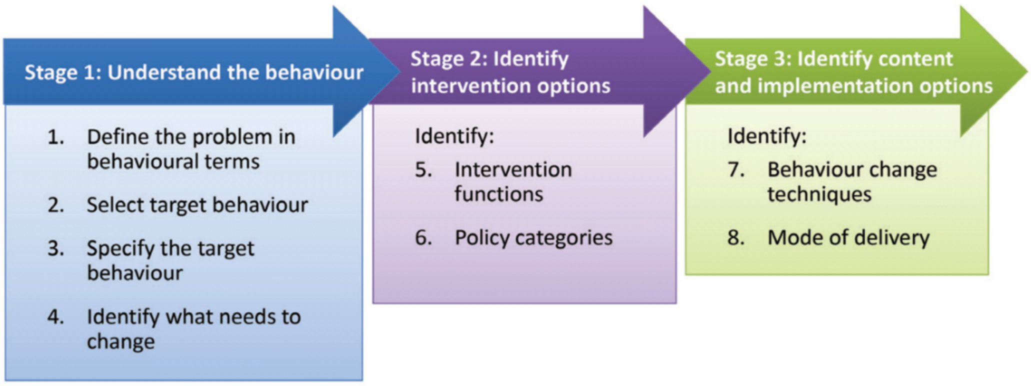

Figure 3: Behaviour Intervention Flowchart[8]

The above examples are not exhaustive, and several interventions could fit into multiple categories. Barriers and opportunities for behavioural change vary considerably by location, building type, culture,

[8] Michie, S.; Atkins, L.; West, R. (2014) *The Behaviour Change Wheel: A Guide to Designing Interventions.*

and stakeholder groups – as do the options to overcome these. The Behaviour Change Wheel[9] outlines a process for identifying which techniques will be most effective in implementing a desired behaviour change, and it could be suitably put to effective use in ICRC and MSF contexts. It is also advisable to incorporate learnings from other organisations' behavioural interventions. Regardless, the process must begin with identifying the specific problems to be solved, and then matching these with suitable behaviour change techniques.

General guides on designing behaviour interventions have been compiled by Rare[10] and The Behavioural Insights Team.[11] Key points from the toolkit are summarized below in Table 5.

TABLE 5: TOOLKIT OF BEHAVIOUR CHANGE STRATEGIES

Toolkit of Strategies
MOTIVATE THE CHANGE
1. Leverage positive emotions
2. Frame messaging to personal values, identities, or interests
3. Personalize and humanize messages
4. Harness cognitive biases
5. Design behaviourally-informed incentives
SOCIALISE THE CHANGE
6. Promote the desirable norm
7. Harness reciprocity
8. Increase behavioural observability and accountability
9. Encourage public and peer-to-peer commitments
10. Choose the right messenger
EASE THE CHANGE
11. Make it easy by removing frictions and promoting substitutes
12. Provide support with planning and implementation of intentions
13. Simplify messages and decisions
14. Alter the choice setting
15. Use timely moments, prompts and reminders

[9] Michie, S.; Atkins, L.; West, R. (2014) *The Behaviour Change Wheel: A Guide to Designing Interventions.* London: Silverback Publishing. Available at: http://www.behaviourchangewheel.com/ [Accessed 12/01/2020].

[10] *Rare*, https://rare.org/ [Accessed 12/01/2020].

[11] 'Publications', *The Behavioural Insights Team*, https://www.bi.team/our-work/publications/ [Accessed 12/01/2020].

7. Considerations for ICRC and MSF Contexts

In light of these general wider findings, it is important to consider interventions that are most suitable and practical for humanitarian operations and contexts. ICRC and MSF both operate in a wide range of contexts, across which operational priorities can greatly differ. As such, the steps proposed in the following sections have been designed to ensure relevance within humanitarian operations. Implementations should be driven and owned by staff in field operations with due consideration for local priorities. The role of HQ / coordination should be to support these by providing a framework, tools, materials, and guidance on implementing these activities.

Demands are likely to vary based on operational contexts. ICRC and MSF's operations cover a large portion of the world's regions and climatic conditions: the energy demands of projects in Ukraine will differ greatly from those in Central African Republic; likewise, even within a single country, a project in a rural setting will have very different demands to an urban coordination unit. Furthermore, energy requirements are significantly dictated by the type of project being delivered; a health structure offering inpatient care will have more energy-dependent equipment and staff than a small outpatient facility.

Beyond geographic location, a project's energy demands will be greatly shaped by the background of staff, and behaviour change interventions must take this and related factors into account. For example, varied social backgrounds may be a causal factor behind differing levels of interest and engagement, or disinterest and apathy, towards energy reduction. It is therefore logical, advisable and appropriate to factor in these differences, and to tailor calculations and audits to each context.

ICRC and MSF share a consistently high-staff turnover. This fact can negatively influence attempts to integrate sustained organisational change. Additionally, the commitment to keeping costs as low as possible in the short-term (on order to reach the greatest number of beneficiaries) can mean that investments that pay out in the long-term can be difficult to justify.

With these differences in mind, it is then essential to consider **how to implement**. In the humanitarian sector, implementation opportunities for behaviour change can be divided between Operations, Offices, and Residences: operational staff comfort should not be compromised; however, Offices and Residences provide a good interventional entry point. Residences should be considered a prime opportunity for behaviour change, as they 1) are usually empty during the day, and 2) usually represent the lowest organisational priority in terms of service delivery.

As has been mentioned, behaviour change measures must be based on data from monitoring present consumption if they are to succeed. In ICRC and MSF operations specifically, this requires being able to break down energy use by context, operations, offices, and dwellings. As such, it is recommended to conduct an ongoing monitoring program for baseline data before implementing reduction and efficiency measures.

Additionally, the identified behavioural change measures have not yet been tested in such contexts, and any intervention thus carries any number of unknowns.

7.1. Next Steps

In order to capitalise on this phase of the project, it is important to consider how the work completed here, fits within the wider ecosystem of measures that can be taken. The below table outlines a possible approach to improving the energy efficiency of field projects. The table is divided into understanding current consumption, reducing consumption, and implementing renewable solutions.

Table 6: Proposed Steps to Plan, Study and Implement over the Course of a Three-Phase Project

General objectives	Actions	Phase	Expected benefits	Tasks
1. Understanding energy consumption in field sites	1.1 Monitoring energy sites	1	Data required to design renewable energy systems and energy-efficiency program are collected	• Design an energy monitoring plan • Install sensors • Manage energy data
	1.2 Energy audits	2	Energy audits are used in field premises to understand how energy is consumed and to find opportunities for improvement and energy efficiency	• Design energy audits applicable to field sites and users • Train staff to carry out audits • Implement energy audits
2. Reducing energy consumption in field premises	2.1 Behaviour change	1	Energy consumption in field sites is reduced by changing staff habits	• Design, test and validate behaviour-based energy strategies • Implement strategies
	2.2 Energy-efficient equipment	2	Energy efficiency criteria are systematically considered in the purchase of equipment for field premises	• Develop procurement guidelines and tools for purchases • Purchase energy-efficient equipment
	2.3 Passive design approach for buildings	2	New building rentals, acquisitions or renovations consider architecture that minimizes energy consumption	• Develop criteria applicable to field conditions • Assess building energy efficiency • Consider energy efficiency criteria in the rent, purchase or refurbishment of buildings

	2.4 Roll-out of electrical rehabilitation, including safety	2	Electrical installations are carried out with energy efficiency in mind	• Define energy efficiency measures to be implemented (create guidance and sensitisation for implementers) • Implement energy-efficient electrical installations (create guidance and sensitisation for implementers)
3. Implementing renewable energy solutions	3.1 Business case	3	Sites are provided with business case showing the potential for renewal energy use	• Develop an assessment form usable by admin staff • Carry out field assessments • Draft business case
	3.2 Finance mechanisms	3	Funding mechanism found to implement renewable energy system	• Explore the use of investment funds • Explore the use of new financing model
	3.3 Implementation	3	The installation of renewable energy system is funded	• Define portfolio of implementation models and draft contracts accordingly • Manage bidding and contracts • Supervise implementation work

ANNEXES

ANNEX 1: DOCUMENTS REVIEWED – BEHAVIOUR CHANGE

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Annex 2: List of Individuals Consulted as Part of the Project Phase

Last Name	First Name	Organisation
Rowe	Daniel	MSF OCG
Guevara Dr.	Maria S	MSF OCG
Delfosse	François	MSF OCG
Lanneau	Benjamin	MSF OCG
Castella	Grégoire	MSF OCG
de Ribaucourt	Hervé	MSF OCG
Palomares	Maria Ten	MSF OCB
Lopez	Agusti	MSF OCBa
Van Dyke	Jason	MSF OCA
Gonzalez	Alfredo	MSF OCP
Mandin	Dimitri	ICRC
Ryf	Andreas	ICRC
Kistler	Deborah	ETHZ
Schmitz	Jan	ETHZ
Terry	Fiona	ICRC
Kiehl	Melissa	ICRC
Blundell	Art	Natural Capital Advisers
Vad	Kathrine	ICRC
Njuki Njururi	Cyprian	ICRC
Devine	Carol	MSF Canada
Rohrbach	Werner	ICRC
Sheth	Vyoma	Consultant External
Berthet	Corentine	MSF OCG
Miller, Dr	Clayton	National University of Singapore
Chirol	Philippe	MSF Contractor Electrician
Drury	Duncan	Nethope
Odriozola	Veronica	Formerly Healthcare Without Harm
Demeules	Gerald	UNDP
Armel	Carrie	Stanford University Energy Efficiency Center
Abi Abdallah	William	UNICEF

Annex 3: Rules for Working with Nudge Theory

Below are simple rules for working with Nudge Theory. They are numbered, but do not necessarily represent a linear process or sequence. Adapted from *BusinessBalls*.[12]

1. Understand and validate the required change**:** Clearly understand the change you seek to encourage or enable, and confirm that it is both ethical and in people's best interests; consult as necessary. Be objective and fair. Use proper measures, not assumptions or guesswork. Quantify and define situations, changes, and outcomes. Clarify terminology. Avoid vague or technical terms which cannot be easily understood, or which could mean different things to different people. Avoid being influenced by your own heuristic tendencies, and by those of your organisational leadership.

2. Check for obstacles: Consider what might be preventing people from naturally shifting towards the identified / required change. If necessary, consult a sample group. This often highlights obstacles which can be removed, and/or supporting arrangements that can be introduced which enable a natural change, without need for further intervention.

3. Check for unhelpful existing nudges: Often, nudges which unhelpfully influence or obstruct people's thinking already exist. Use the Nudge Toolkit for clues as to possible heuristic effects which are already acting on people's thinking. These may have developed completely accidentally, or may have been established negligently or cynically by authorities, leaders, corporations, etc.

4. Remove obstacles and establish support: Even if further interventions are warranted, remove obstacles and introduce support as far as possible to make it easier for people to shift towards the desired change.

5. Create a 'map' of the environmental / influential system around people: If no obvious obstacles exist, or additional interventions are warranted, create a 'map' or analysis of environmental / circumstantial factors, and/or of people's engagement (or non-engagement) with the issue to which change is desired. Look for hidden influential factors. Refer to the Nudge Toolkit[13] for pointers.

6. Explore which environmental/circumstantial factors can be altered/introduced: Assess and test the effects of altering / introducing these factors ('nudges'). Refine your ideas so that you can offer people new choices that can help their shifting – through free will – towards beneficial change. Refer to the Nudge Toolkit[14] for ideas as to the types of heuristic influences which might be altered / introduced.

7. Teach / train leaders at all levels in the group / organisation about Nudge Theory and its potential uses and comparative advantages over conventional enforcement or direct instructions, threats, etc.

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[12] 'Nudge Theory: A Complete Overview,' BusinessBalls. Available at: https://www.businessballs.com/improving-workplace-performance/nudge-theory/#nudge-toolkit. [Accessed: 12/01/2020].

[13] *Ibid.*

[14] *Ibid.*

Annex 4: Audit Tools To Be Adapted[15]

Audit Tool 1: General Questions

While the following tool is not specifically energy-focused, it contains some questions that might aid understanding and estimation of a building's energy consumption (quantity of employees, working days, median temperature, etc.) and can be adapted as needed.

Question	Answer	Notes
General		
Date		
Place / Name of the facility		
Location (Latitude/Longitude)		
Property block/parcel No./Address		
Name and position of the person answering this checklist		
Contact information		
Years covered by the report:		
Working days extension: Number of days/week		
Working days extension: Hours/day		
Working days extension: Are there seasonal variations? Y/N		
Is there a person in charge of environmental issues at the facility? Y/N		
How does the facility get / purchase the supplies for daily work? Are decisions on what supplies to buy made at the local level or in a centralised manner?		
How are maintenance activities performed in the building? Is there a specific person in charge of this and a plan?		
What are the criteria used for food procurement?		
Minimum Annual Temperature		
Maximum Annual Temperature		
Relative Humidity in Winter		
Relative Humidity in Summer		

[15] These tools were developed during the MSF Environmental Impact Toolkit TIC project and should be used or adapted further as needed.

Precipitation (mm per year)		
Insolation levels (kW-h/m^2/year)		
Windspeed Monthly mean (@ 10 m)		
Climate: cold/warm		
Is medical care provided in the facility? Y/N		
Level of complexity of medical care		
Typology: A/B/C/D		
Activities: OPD / IPD / Maternity / Paediatrics / HIV / Malaria / Surgery / X-ray / ER		
Project duration in years		
Environment: Rural/Urban/Camp		
BUDGET		
Annual budget (indicate currency)		
Annual log budget (indicate currency)		
Project Volume (calculated based on Log Cell inputs)		
Energy expenses (both fuel and city power and mobility)		
BUILDING / PROPERTY COMPONENTS		
Size of property		
Facility size (medical)		
Pharmacy Y-N		
Building orientation		
Building floor area per floor		
No. of stories/floors		
No. of parking spaces for Workers		
No. of parking spaces for Visitors		
Building capacity - No. of beds		
Building capacity - %average occupancy/year:		
No. of employees - Full-time		
No. of employees - Part-time		
Year constructed		
Type of building construction		

Type of roof construction		
Note any past damage to the facility		
No. of buildings on plot		
Is there any available space for parking bicycles? Y/N		
Are there showers available for employees? Y/N		
Is there any space for solar equipment (terraces, patios, gardens)? Consider areas where sun exposure is not heavily affected by shade.		
Is there any open space that could facilitate composting and/or small vegetable gardens?		
WATER		
Sewage Treatment		
Annual water consumption per reporting year		
Fresh water		
Annual bottled water consumption		
Do you use hot water? Y/N		
Annual hot water consumption per reporting year		
Number of fountains?		
Use in landscape?		

Audit Tool 2: Energy

This tool comprises three sections (General Energy Questions, Energy Card, and Energy self-assessment), and characterizes the energy context of the facilities (sources, total consumption, level of maintenance, quality, etc.).

General Energy Questions

Question	Answer	Notes
Who is responsible for receiving and paying the bills?		
Is there any energy efficiency policy or plan in place? Y/N		
Are you connected to the electricity grid? Y/N		
Does the city/village have a natural gas network? Are you connected to it? Y/N; Y/N		
Do you have your own vehicles? Y/N		

Energy Card

Parameter	Notes	Selection	Choices	Rationale	How to collect data	Request needed
Critical power breakdowns			count	To get an indication of the quality of energy system/maintenance	From LRS	
Last visit of Electrician			date	Based on field visit from HQ; MIO or referent.	field visiting report	
Electrical system details		OR	rehabilitation/ new construction; temporary/long-term	To determine type of energy system installation	From energy and construction teams	
Schematics available				Is there a line diagram of the electrical installations, and when was it last updated?	field visiting report / NRG team	
Night use			kVA installed generator capacity used during night.	To determine energy use in night time vs day time	From energy team	yes
Grid access		OR	yes/no. If yes, how many kW-h/month are being used	To determine if city power is available	From field data; otherwise from Log Cells	
Installed capacity of generator			kVA	To determine power need of project	Calculated by totalling all generator individual capacities	

Alternative Energy (pv, biomass)			yes/no		field	
Oldest generator			run-time	The runtime of the oldest generator gives a general indication of the status of all generators, and might also indicate the need for investments.	LRS	
Space Heating			yes/no	Specific need for projects in areas that temperatures go low in periods. Added complexity and increased energy needs.	Field	
Centralized system				Centralized systems add complexity.	Field	
Fuel use/m^2	L/(month*m^2)		Energy intensive medical operations or poor performance of system	If this value go high, there might be reason to investigate reasons and solutions to reduce energy consumption.	calculated output	
Fuel use/patients	L/(month*consultation)		Energy intensive medical operations or poor performance of system			
Energy expense vs log budget	%		Energy intensive medical operations or poor performance of system			
Energy expense vs project volume	Euro/unit		Energy intensive medical operations or poor performance of system			

Energy self-assessment

CONTINUOUS USE ELECTRICITY GENERATED		JAN	FEB	MA	APR	MA	JUN	JUL	AUG	SEP	OCT	NOV	DEC	REFERENCE
Electricity Grid	Energy Consumed (kW-h)													
From Gas 1 Natural Gas	Energy Consumed (m3 or kW-h)													
From Gas 2 Bottled Gas/LPG	Energy Consumed (m3, litres, kg or kW-h)													
From Liquid Fuel 1 Naphtha/Gasoline	Energy Consumed (litres or kW-h)													
From Liquid Fuel 2 Diesel	Energy Consumed (litres or kW-h)													
From Liquid Fuel 3 Biodiesel	Energy Consumed (litres or kW-h)													
From Renewable Sources Photovoltaic	Energy Consumed (kW-h)													

RESERVE/EMERGENCY ELECTRICITY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	REFERENCE
From Gas 1 Natural Gas	Energy Consumed (m3 or kW-h)													
From Gas 2 Bottled Gas/LPG	Energy Consumed (m3, litres, kg or kW-h)													
From Liquid Fuel 1 Naphtha/Gasoline	Energy Consumed (litres or kW-h)													
From Liquid Fuel 2 Diesel	Energy Consumed (litres or kW-h)													
From Liquid Fuel 3 Biodiesel	Energy Consumed (litres or kW-h)													
From Renewable Sources	Energy Consumed (kW-h)													

Thermal Energy		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Reference
From Gas 1 Natural Gas	Energy Consumed (m3 or kW-h)													
From Gas 2 Bottled Gas/LPG	Energy Consumed (m3, litres, kg or kW-h)													
From Liquid Fuel 1 Naphtha/Gasoline	Energy Consumed (litres or kW-h)													
From Liquid Fuel 2 Diesel	Energy Consumed (litres or kW-h)													
From Liquid Fuel 3 Kerosene	Energy Consumed (litres or kW-h)													
From Solid Fuel Wood	Energy Consumed (kg or m3)													
Solar Thermal Energy 1	Energy Consumed (Flat plate m^2 or tubes m^2)													
Solar Thermal Energy 2 Water	Energy Consumed (litres)													

Fuel for Transportation for own vehicles		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Reference
Fuel 1 Naphta / Gasoline	Energy Consumed (litres or kW-h)													
Fuel 2 Diesel	Energy Consumed (litres or kW-h)													
Fuel 3 Biodiesel	Energy Consumed (litres or kW-h)													

Audit Tool 3: List of Appliances

This tool is for compiling a list of appliances so as to keep a facility inventory and describe their general consumption levels. For this purpose, the power, quantity and time of use of each appliance should be noted.

Name	Power (W)	Quantity	Hours per day	Days per week	Energy consumption (kW-h/year)	Comments (include here if the appliance has an energy efficiency label)
Air Conditioning (cooling/heating)						
Autoclave						
Water pump						
Cooker						
Computers						
Heater						
Freezer						
Refrigerator						
Electric oven						
Lighting						
Compact fluorescent lamps (CFL)						
Halogen lamps						
Incandescent bulbs						
LED lamps						
LED tubes						
Fluorescent tubes						
Other						
Washing machine						
Microwave oven						
Electric kettle						
Centralized HVAC (heating, ventilation, air conditioning) system						
Water Heater						
Medical equipment 1:						
Medical equipment 2:						
Medical equipment 3:						
Other equipment?						

Dryers						
Dishwasher						