

Enhancing Energy Efficiency in the Humanitarian Infrastructure: Guidelines

Webinar

Presenter Davide Mazzoni – Trama Tecnoambiental (TTA)

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giz Deutsche Gesellschaft
für Internationale
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Agenda

What is energy efficiency (EE)?

Why is EE important?

The five areas of intervention

1 - Power Generation

2 - Power Distribution

3 - Appliances

4 - Buildings

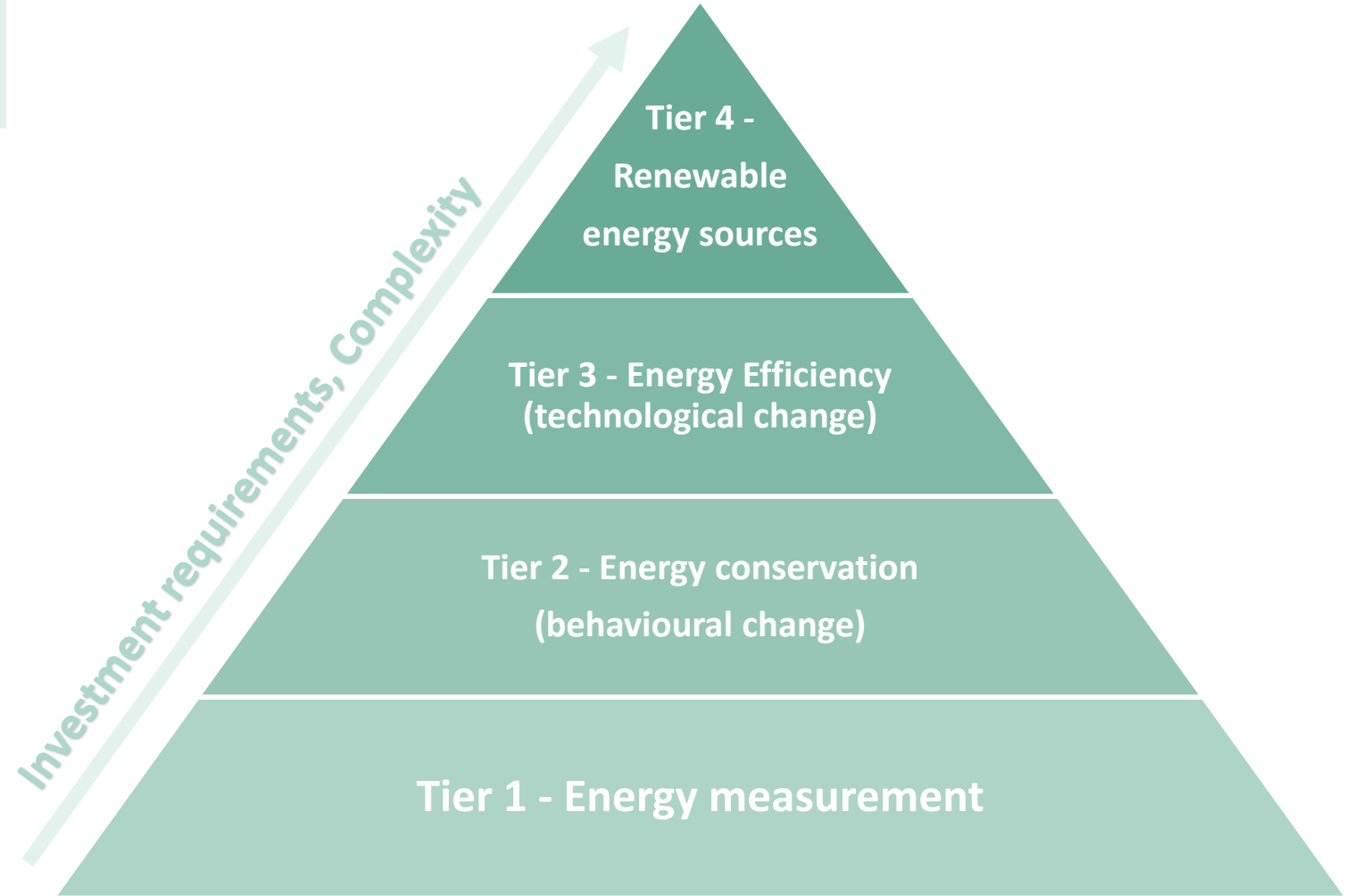
5 - Behavioural Change

What is energy efficiency (EE)?

Energy efficiency means using less energy to perform the same task - in other words, eliminating energy waste.

Energy savings are achieved by improving energy efficiency. This is the cheapest and often fastest way to reduce fossil fuel use and lower energy bills.

*What cannot be measured
cannot be improved*



Why is EE important?

Energy efficiency

Cost savings

Increased **resources** for People of Concern

Less dependence on fuel

Increased **autonomy** and **reactivity** of operational responses

Reduced GHG emissions

More **sustainable operations**



The five areas of intervention

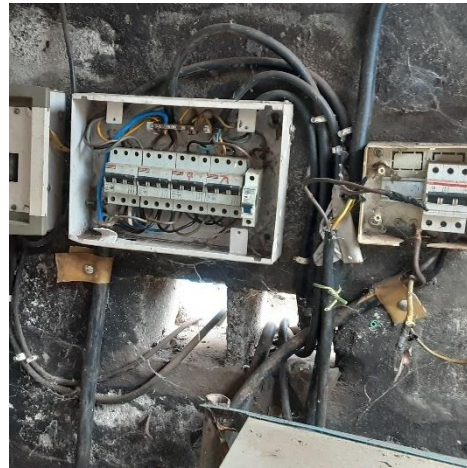
Power
Generation

Power
Distribution

Appliances

Buildings

Behavioural
Change

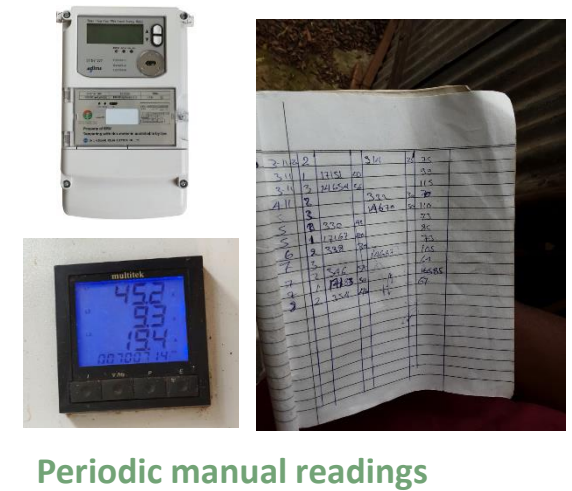
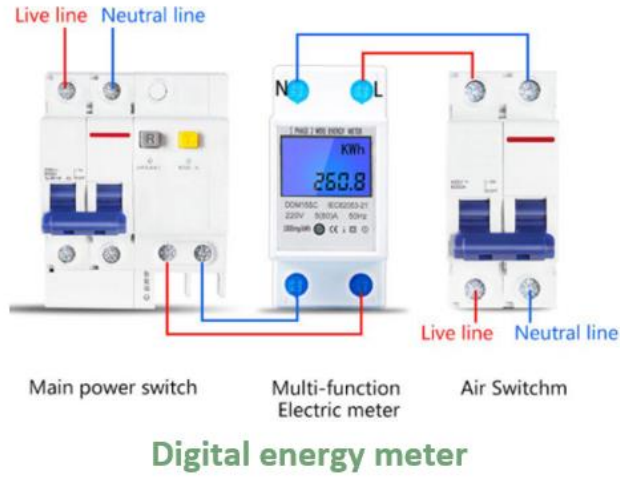
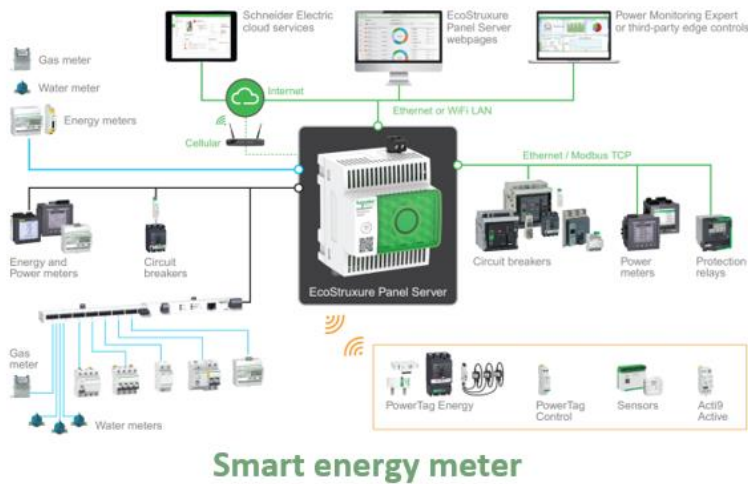


Power Generation

- ✓ Energy Monitoring
- ✓ Efficient use of diesel generators
- ✓ Grid connection
- ✓ Improve local technical capacity



Power Generation – Energy Monitoring



Cost and complexity decrease

Energy monitoring is a prerequisite for all interventions.
Indicators: Daily, monthly and annual energy readings, peak load, phase balance

Energy performance Indicators (EnPI):

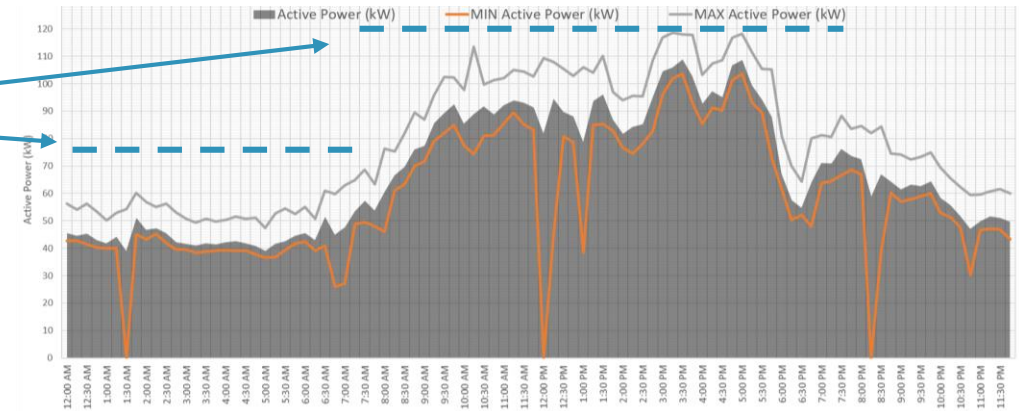
- ✓ Electricity consumption per worker (kWh/staff)
- ✓ Electricity consumption per m2 area (kWh/m2)

Humanitarian organisations are encouraged to **develop a road map for establishing a centralised energy monitoring system** (at HQ, Regional or Country Offices) that tracks energy consumption in their facilities.

UNHCR “Green Boxes” is a UNCHR initiative to install IoT energy meters.

Power Generation – Efficient use of diesel generators

- Avoiding the use of diesel generators is not always possible (emergency response or backup power)
- **Proper sizing** of diesel generators is important to avoid energy losses, increased emissions and accelerated wearing
- Use **multiple generators of different sizes in shifts**, so that the smaller generator works at night, and the bigger one at peak time.
- Do not purchase generators in bulk and in fixed sizes, but rather **choose the right size on an individual basis**
- Use **single-phase generators** in small compounds (< 25 kVA)

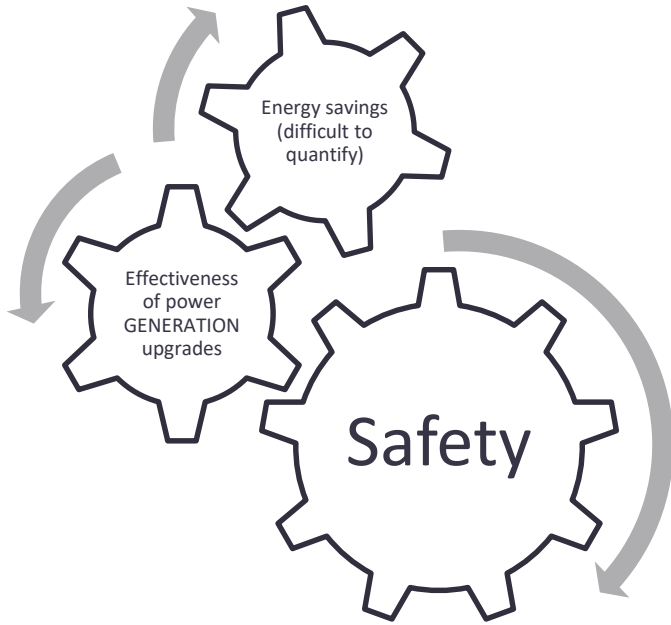


Power Distribution

- ✓ Common problems
- ✓ Guidelines

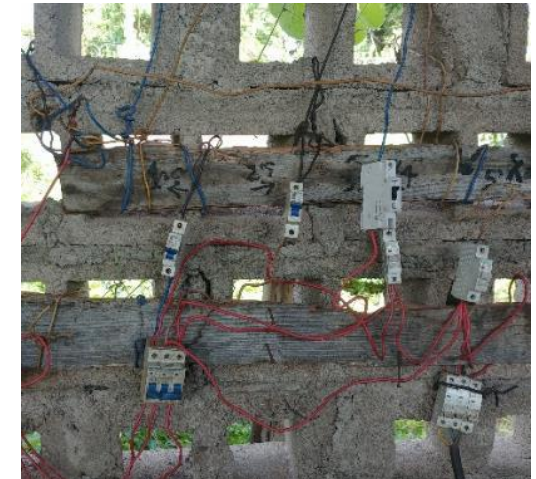
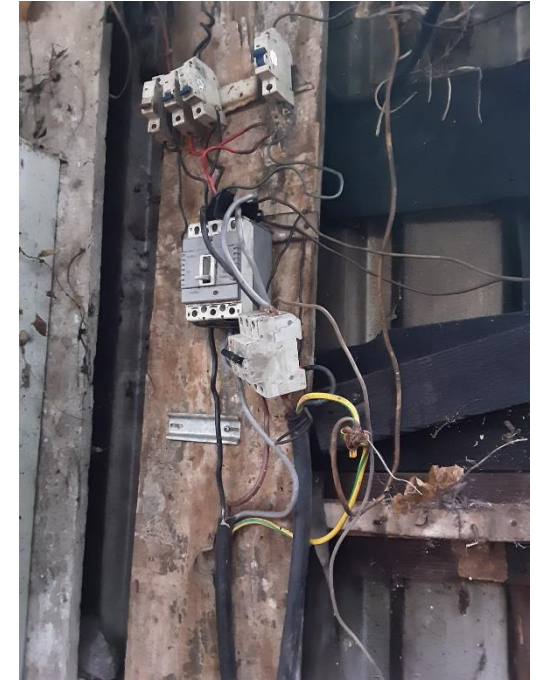


Power distribution – Common problems



Common problems







- ✓ Electrical installations are done by **non-qualified personnel** and not up to international and national standards.
- ✓ Risk of **fire**: Undersized cables, lack of suitable protections, and improper connections.
- ✓ Risk of **electrocution**:
 - ✓ Dangerous live wires exposed and reachable by children.
 - ✓ Missing electrical protections such as Residual Current Devices (RCDs) or earthing systems.
 - ✓ Circuit breakers hang on tense wires and are not placed inside distribution boards.



Power distribution – Guidelines

Guidelines

- Electrical installations shall be upgraded to **international standards** (IEC 60364) or national wiring rules, by **qualified electricians** and following a **technical design**
- Use **cables of the right size** to reduce voltage drops and the risk of fire
- Use distribution boards equipped with the **right protections** and an earthing system
- Make sure that the right **tools** are available locally.
- Use **labels and wiring diagrams** in the distribution boards
- Make sure that **metal power poles** are insulated
- Prefer **underground cabling**
- Make sure **phases are balanced**. If not, shift loads among phases

Function	Label	IEC Code
Protective earth	PE	
Neutral	N	
Line, single phase	L	
	L1	
Line, 3-phase	L2	
	L3	

Appliances

- Air conditioning
- Cooking / Water Heating / Water Pumping
- Other appliances



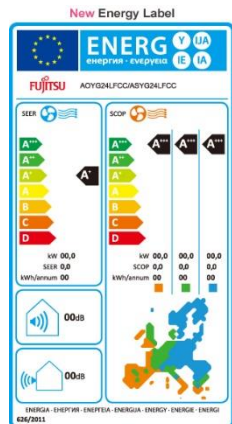
Appliances: Air Conditioning (A/C)

1. Find out what are the main energy consumption drivers and focus on these appliances (low-hanging fruits)

- **Air Conditioning** accounts for up to 90% of the energy consumption in hot climates (data from Ethiopia)
- Water heating
- Cooking
- Water pumping

2. Guidelines on procurement of A/Cs

- Use international competitive tenders
- Set minimum EE requirements (e.g. Energy Efficiency Ratio (EER) > 3.5 W/W (equal to 12 BTU/W))
- Purchase equipment with energy efficiency certifications like “Energy Star”, “Blue Angel”
- Give priority to those containing gases with the lowest possible Global Warming Potential (GWP)
- Use inverter-based A/C units



Appliances: Air Conditioning (A/C)

3. Guidelines on design and installation of A/Cs

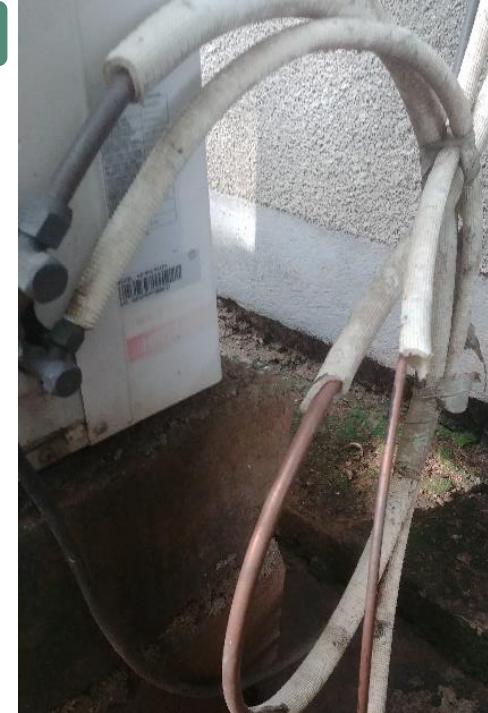
- **Sizing:** make sure it is done according to the room volume, insulation, airtightness and external temperature
- **Short pipelines.** Keep the gas pipelines as short as possible to avoid energy losses
- **Shading.** Install A/C external units on shaded walls / raise them to the gutter level / plant trees in front of them / build a pitched roof to protect if from sunlight and rain
- **Engage qualified designers and installers** with proven experience.



Appliances: Air Conditioning (A/C)

4. Guidelines on O&M of A/Cs

- Establish a **maintenance plan**, assigning roles and responsibilities
- Keep **service logs**
- Keep **operation manuals** always available on site
- **Replace pipe insulation** when they start wearing out
- **Monthly ordinary maintenance** (refer to operation manuals):
 - Cleaning **filters and fins** with a soft brush
- **Annual ordinary maintenance:**
 - Check the **pressure** and refill the gas if necessary. Keep the refills operation recorded on a maintenance activity log.
 - Check for **gas leaks**: mix 50% dish soap and 50% water in a spray bottle and spray it over gas pipes and connections. Look for the forming of bubbles to find gas leaks.
 - Replace **pipe insulation**



5. Guidelines on End-of-Life Management of A/Cs

- The impact of unintentional gas leaks from air conditioners on global warming is about 2000 times greater than that of CO₂.
- They shall be decommissioned, by authorised firms that are able to properly dispose of refrigerant gases through the use of using vacuum pumps.

Appliances: Cooking / Water Heating / Water Pumping

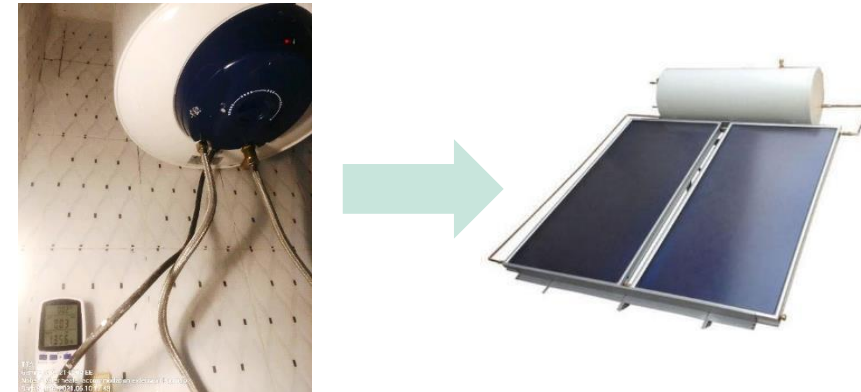
6. Guidelines on efficient cooking

- Prefer **induction** cooking hobs (in canteens) or **ceramic** over solid plate electric stoves
- **Communal cooking facilities** are more efficient than individual kitchens



7. Guidelines on efficient water heating

- **Switch off electric boilers when idle:** they waste the energy equivalent of 1.5 hot showers in thermal losses in 24h. Potential savings for a UNHCR compound: **5% of the yearly energy bills.**
- Do not install **oversized** electric heaters (30L per person is more than enough)
- **Solar thermal panels** shall always be preferred over electric boilers in new facilities. Retrofitting: they can be used to feed hot water into the already-installed electric water boilers (converted to simple storage).



8. Guidelines on efficient water pumping

- **Float switch level sensors** automatically shut down the pumps when tanks are full, preventing overflowing.



Appliances: Other appliances

9. Other appliances

- **Efficient lighting.** Replace fluorescent tubes with LED lamps to halve the consumption
- **Fans.** Encourage the installation of fans over air conditioners in locations with tolerable temperatures
- **Solar direct-drive (SDD) refrigerators** are an efficient and robust solution in sites with unreliable power supply
- **Power factor correction (PFC)** is a low-cost intervention to improve the energy efficiency of reactive or capacitive loads such as fluorescent lamps, electric motors, transformers, etc.

Buildings

- Main inefficiencies
- Guidelines



UNHCR
The UN Refugee Agency
UNHCR Gambella Sub-Office
Officially opened by
His Excellency the President of Gambella, H.E. Omed Ojulu
and
UNHCR Country Representative, Ms. Ann Encombe
on
19 November 2019

Buildings – Main inefficiencies



Main inefficiencies

Poor roof insulation

Poor airtightness

Insufficient shading

Poor wall and window insulation



Buildings – Guidelines

Roof insulation

Use insulated roofing solutions for future installations, such as **insulated metal or composite sheets**

Use natural and locally available materials such as **straw/clay** to insulate metal roof

Airtightness

Install door sweeps

Fine-tune doors for a perfect closure

Shading

Increase the number of fast-growing trees

Paint the walls white

Wall and window insulation

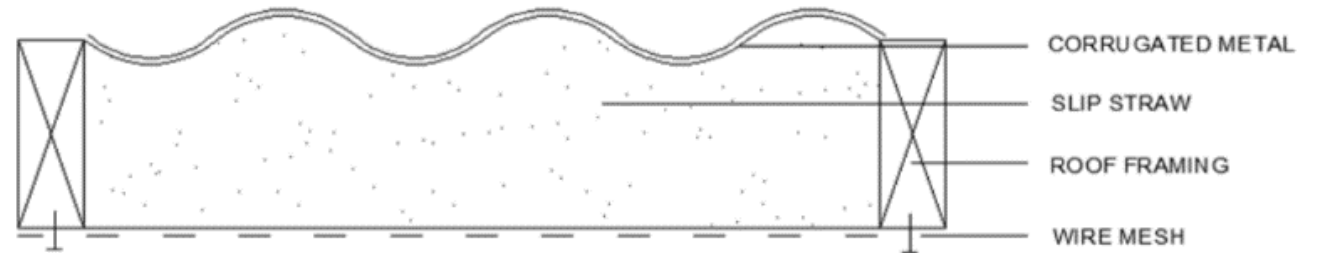
Use low-cost thermal insulation techniques such as cavity walls

Prefer uPVC doors and windows over aluminum

Procurement

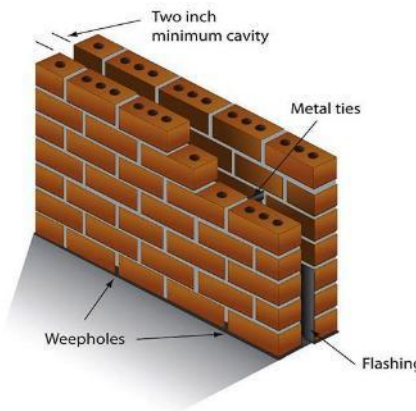
Chose competent and energy-efficiency aware contractors through a competitive bidding process

Include EE requirements as part of the bidding requirements



Straw/clay roof insulation technique is an example of low-cost and sustainable roof insulation.

CAVITY WALL



Behavioural change

- Main bad habits
- Guidelines



Behavioural Change – Main bad habits

An annual saving of **16%** in energy terms or the equivalent of **6,320 USD/year** could be saved if only **ten (10) people** decided to **turn off their A/C units when they are at work (case study from Ethiopia)**



Two
common
bad
habits

Causes

Doors and windows are kept open in air-conditioned spaces

Simple oversight

Cultural: belief that air circulation is necessary to cleanse and purify the environment

A/C is left on in staff residences during the day when people are away

Simple oversight

A/C are poorly maintained and need several hours to cool down the rooms

Behavioural Change – Guidelines

Monitor

Set up an **energy monitoring framework** to provide the necessary energy consumption baseline.

Quantify

Quantify the potential savings for a certain behavioural change. Ask staff to adopt energy conservation measures for a week. Record energy consumption and compare with baseline.

Identify

Identify intervention options and behaviour change techniques

Implement

Training and **awareness-raising** sessions, making people aware of the habits leading to a waste of energy and the potential positive impacts of changing a specific behaviour.

- ✓ Encourage to turn off electric boilers when staff is at work
- ✓ Encourage to keep doors and windows closed with A/Cs on
- ✓ Encourage to turn off A/Cs in accommodations during the day
- ✓ Include energy efficiency as a theme in new employee orientation
- ✓ Use emails, informative flyers

Define targets

Set energy conservation targets and motivate employees to reach them (through **recognition and rewards**)

Remove barriers

Remove any potential barriers and **deterrents** (e.g. A/C do not cool down quickly because of poor maintenance). Install **automatic switches**.

Thank you

Contact

davide.mazzoni@tta.com.es