



switchasia  
PROGRAMME

# Live Comfortably

Lower heating costs,  
cleaner indoor air

Technical Catalogue  
of Energy Saving Solutions for Kabul Households  
April 2018



Kabul Green Homes project

# Kabul Green Homes Project

Catalogue of technologies adapted to residential houses  
to promote sustainable solutions  
for reducing domestic energy consumption  
and improving health.



# Kabul Green Homes Project

Kabul Green Homes Project (KGHP) is being implemented by GERES, Rural Movement Organization (RMO) and Afghanistan Microfinance Association (AMA) in collaboration and coordination with Kabul Municipality (KM) in 15 districts of Kabul city. The overall objective of this project is large scale, market-driven production of approved energy saving solutions (ESS) and their sustainable consumption by private households in Kabul and beyond to contribute to economic growth, poverty reduction and climate change mitigation. The KGH project started in 2016 and will continue until 2020. The project is funded by the European Union through Switch Asia-2 program and co-funded by the French Agency for Development (AFD). The KGH project offers validated ESSs such as solar verandas, roof thermal insulation, double glazed windows, tandoor cap for local kitchens and biogas digesters through subsidy policies, market mechanism, creation and support of green loan packages for Kabul populations. Furthermore, the KGH project is supporting relations between trained SMEs/craftsmen and retailers of construction and thermal insulation materials. The technical team of the KGH project has been locally selected and has trained a significant number of Micro Small Medium Enterprises (MSME) and craftsmen, including carpenters, welders, tinsmiths and masons, to be in relation with local communities and implement ESS packages. These craftsmen will continue the project activities in the frame of the Solar House Technicians Association (SHTA), even after the project ends.

By the end of this project, more than 4550 houses will be equipped with ESS technics. More than 100 SMEs will be trained. The green loans will be created and available for most MFIs in the country. Solar House Technician Association (SHTA) will be well developed to run the value chain of ESS dissemination after the project ends.

ESSs applied through KGH project will save more than 9,000 cubic meters of heating fuel. Consequently, a minimum of 13,000 tons of carbon dioxide are projected to be avoided per year.

This catalogue introduces the technical packages and its specifications offered by the project. For more information, please refer to technical guidelines or implementing NGOs.



## By 2060, one of out two Afghans will live in a city

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Kabul's population has grown from less than a million to over 4 millions in the last 15 years (15% of the overall population), making it the fifth fastest growing city in the world.

**In most residential areas, construction patterns have low insulation and energy intensive heating devices.** Many households face challenges to meet their energy needs and spend a major part of their budget purchasing fuels. Preliminary survey and mapping shows that more than 30,000 house of Kabul city are eligible for the energy saving solutions developed by GERES. This amount will increase with the new design and technology.

**Afghanistan is following the path of countries that depend on biomass energy, fossil fuel and energy poverty and that also experienced these technics.** Wood and coal are still the main source of energy for Kabul inhabitants but they lead to terrible air pollution. The indoor smoke mainly affects women and children, and still this is the main cause for premature deaths in Afghanistan. Thus, reducing fuel consumption with energy saving solutions technics could improve family livelihoods, improve health and reduce the amount of money spent on fuel consumption.



In 2015, the main forests occupied only 2% of the country's land ([rainforests.mongabay.com](http://rainforests.mongabay.com)). Forests have not been enough to provide fuel for cooking, heating of houses and construction work. Despite limited contributions to the global CO<sub>2</sub> output, demands for energy and transport are growing as lifestyles are changing.

Urbanization is an opportunity to drive economic growth and innovative change in sustainable energy consumption patterns, to pave the road for a progressive shift towards a low emission development.

# Improving living conditions for poverty alleviation, ecology and sustainability

Afghanistan is the 14th most vulnerable country in the world in terms of climate change. It is characterized by a semi-arid weather, continental climate, with harsh winters, hot summers, scarce rainfalls and rainsquall. The benefits of energy efficiency on living conditions, reduction of fuel consumption, and on the environment can be clearly linked to the Afghanistan situation.

The renewal of natural resources is slow and fuel prices for heating considered exorbitant by most households. After 30 years of GERES involvement in central Asia, this catalogue covers a wide range of prices and a mix of technologies, allowing 30 to 60% of fuel saving. Perfectly adapted to the Afghan traditional households, they allow the reduction of fuel consumption and the preservation of the natural environment.

The efficiency of technologies have been proved: more than 6,000 households have been already equipped with energy saving solutions in Kabul homes. In the next year, a minimum of 1,500 more homes will directly benefit from energy-saving solutions technologies through subsidy mechanisms, while a large number of houses will be technically supported .

You can also give it a try!

## Renovate your house to reduce significantly your fuel consumption for heating

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The technologies in this catalogue provide an opportunity to improve energy efficiency solutions for both houses that are already built and for newly constructed houses. The package could help you save from 30 to 60% of fuel used for heating, lowering energy bills and reducing CO<sup>2</sup> output.

### Comfort is a priority

Passive solar technologies (verandas), insulation techniques and efficient heating systems improve winter and summer comfort within houses. Less heating fuel for warmer winters and fresher summers, just by using these technics.

### Clean indoor air for a better health

Indoor air quality is crucial, as smoke is the first reason for premature deaths of women and children in the country, especially in big cities. Indoor smoke can be reduced with improved heating systems and better insulation.



### Easy and fast installation

GERES, RMO and AMA are committed to introducing innovations and systems which can be easily handed over to local artisans. These technics have been steadily adapted to local skills and materials can be easily accessible and implemented. The techniques that have been introduced in this catalogues can be easily installed by local trained craftsmen in traditional Afghan houses and new buildings.

*“Energy Saving Solutions developed by the Kabul Green Home Project and energy efficiency in the construction of houses are not very well known techniques and devices for most of the Kabul population. In many areas, they had never heard about it before. Therefore, the designers of the KGH Project considered awareness-raising as an important component of the project. The awareness team has designed a city-wide awareness campaign to inform as much as possible the Kabul population. This campaign has included direct meetings with the community (small, medium and big meetings) and local authorities, organizing or participating in workshops and seminars, designing and distributing awareness raising tools, designing and installing large banners in the city, television interviews and other related activities. Thanks to the awareness campaign, the demand has significantly increased for ESS packages. The awareness teams of GERES and RMO closely work with communities, craftsmen and stakeholders in order to support dissemination of ESSs and strengthen the link between communities, local authorities and trained SMEs/Craftsmen. The awareness team has reached more than 45,000 people directly and has indirectly informed about 650,000 people about the KGH project and its activities.”*



**Razma Hamdil**

**Senior Awareness Officer, GERES**

## A vision and a strategy: we can all contribute to a better future!

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All artisans and Small Medium Enterprises (SMEs) are locally selected and trained, and all materials are available in targeted areas.

We simplify the technologies and adapt them to the SMEs capacities, to make sure they are able to produce, maintain and follow them. The technologies are perfectly adapted to the needs of local communities, and they are accessible and affordable for all categories of people.

At the moment, we are offering and disseminating 6 main technical packages, including:

- verandas made with wood or metal, covered by glass and polycarbonate
- Verandas made with wood or metal, covered by plastic
- Roof thermal insulation
- Windows over or double glaze
- Biogas units for dairy farms
- Tandoor cap for local kitchens

And one technique that has been newly introduced, which is biogas.



**Najibullah Eman**  
**Technical Team Leader, RMO**

Be in touch with qualified artisans in Kabul for the best price and quality!



# Research for better and more adapted technologies

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**R&D** (Research and Development) refers to the practice of improving existing technologies or creating new ones.

Kabul Green Homes Project aims to improve the existing energy saving solutions and develop new technical packages. The focus of R&D is to create adaptability and development of accessible and affordable solutions in terms of price, effectiveness, design and acceptance. The ESS validation process starts with the collection of innovative ideas or information from pre-applied technologies, and ends with their validation.

The main R&D steps for validation of Energy Saving Solutions are:

**Prototype:** a new ESS technique supposed to be built in a controlled area (a lab, an office, a staff member's house).

**Lab Tests:** series of tests are conducted on prototypes at laboratory level.

**Pilots:** pilots are built in order to ease in-situ tests and receive user feedback. The pilot has to be built in the targeted project area with the same range of eligibility.

**In-Situ Test:** a series of tests are conducted on pilots that are constructed at users' home to validate their impact.

**Demonstration:** a demonstration unit intends to show the ESS technique and its use, efficiency and advantage to the people. The demos are already validated technologies, though some modifications may happen based on users' feedback.



**Mohammad Jawad Asadi,  
Senior R&D Officer**

## Find your technology!

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The Passive Solar house will offer you an additional warm and bright room and will reduce the fuel consumption of rooms connected to it!

You can choose from any range of Passive Solar Veranda models, for all tastes and prices you can refer to the following pages:

<b>Glass verandas:</b>	<b>page 13</b>
<b>Wood or metal frame veranda:</b>	<b>page 17</b>

**Tips to personalize the use of your veranda: page 19**

Technologies for increased comfort, reducing fuel consumption in your home and facilitating cooking in winter. Thermal insulation is the first step in improving the thermal comfort of developed techniques!

<b>Roof thermal insulation:</b>	<b>page 21</b>
<b>Windows double-glazing:</b>	<b>page 24</b>
<b>Improved cooking stove:</b>	<b>page 26</b>
<b>Tandoor cap</b>	<b>page 27</b>
<b>Biogas digesters:</b>	<b>page 29</b>

How to combine a veranda and insulation to get the best use of them?

<b>Packages of technologies:</b>	<b>page 27</b>
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# How to Select your ESS techniques?

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## Saving per year (fuel consumption reduction):



: Less than 4000 AFN

: From 4000 to 6000 AFN

: From 6000 to 8000 AFN

: More than 8000 AFN

## Financial investment:



: Less than 10000 AFN

: From 10000 to 15000 AFN

: From 15000 to 25000 AFN

: More than 25000 AFN

## Duration of return on investment:



: Less than 3 years

: From 3 to 5 years

: From 5 to 7 years

: More than 7 years

## Obtaining solar energy: Passive Solar house, rural and urban designs

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**Veranda Frame with wood and wire**



Decrease your fuel consumption at least by **30-44%**.

An additional **warm room** all day long.

**10%** temperature increase inside your house.

No need to install plastic in the windows for winter



Frame covered with a plastic sheet in winter, to gain heat

## The Passive Solar house makes a significant difference in your life

An additional warm room in winter can be used for domestic tasks, social life or as a study room for the children. The veranda gains sun energy and transfers the heat through the openings of windows from the veranda into the rooms alongside during daytime. During the summer season, the plastic is removed and the structure can be covered with plants, herbs and reeds to be in the shade and cool down the house. The cool air passes through adjoining rooms.

# House for glass and polycarbonate veranda, urban design

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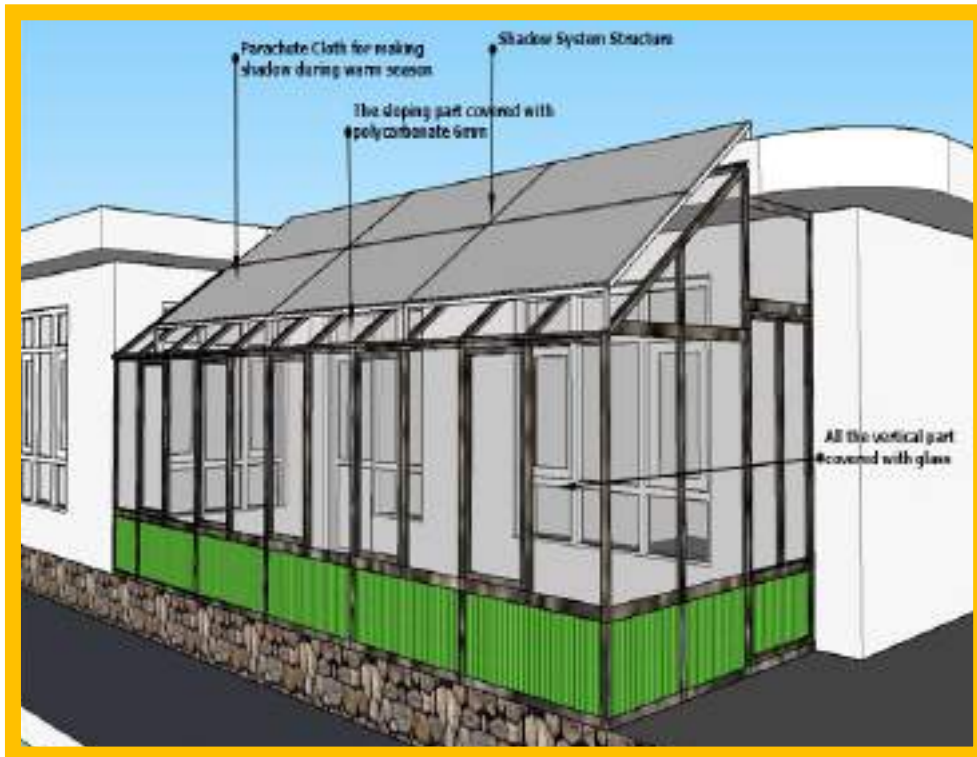
## Requirements:

- The position of the house should be southward.
- No obstacle creating shadow like high building, trees, etc.
- Enough space for the veranda structure
- Roofs edges have to be strong enough to support the frame.
- Attached rooms should have windows large enough to allow the heat transfer from the veranda.



**Solar Veranda , here**

# Obtaining Solar energy : Passive Solar Veranda, urban designs



Protect your home from summer overheat with a simple structure: Install the canopy during the summer seasons (May to August), use a mosquito net to prevent insects from entering inside. In the summer season, try to open all veranda's windows and openings for better ventilation.

## Passive Solar Veranda with metal frame, covered by glass and polycarbonate



- Proper ventilation to reduce summer overheat
- Extra warm room in winter, affordable cost to heat adjacent rooms
- Warm water without fuel consumption;
- Improve hygiene and health of the family;
- Protection from the dust and mist

### Tips

Thermal insulation of the living room, especially windows and roofs, can significantly improve the energy efficiency of the rooms that are adjacent to the veranda!



# Passive Solar Veranda with metal frame covered by glass and polycarbonate

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Example of summer veranda





A world of comfort, in winter and in summer!

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**Passive Solar Veranda with metal frame, covered by plastic**



**Passive Solar Veranda, with wood frame, covered by plastic**



# Passive Solar Veranda with metal frame, covered by plastic



Colored Metal structure with  
long - lasting protection.



# Passive Solar Veranda with wood and metal frame covered by plastic

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## Tips

Thermal insulation of the living room can significantly improve the efficiency of the veranda!

Paint the frame in different colors and cover it in the summer with reeds or plants to turn it into a cool place to relax with family and friends!

# Tips for personal use of Passive Solar Verandas

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**In summer, turn the veranda into a cool place!**



- During the summer, use reeds, plants and even mosquito nets to create a nice and cool place for the whole family!
- For regular ventilation during the day, open the door and windows of the PSH.



**In winter, refurbish the PSH to make it warmer and more comfortable!**

# Heat Retention: Inside Roof Insulation

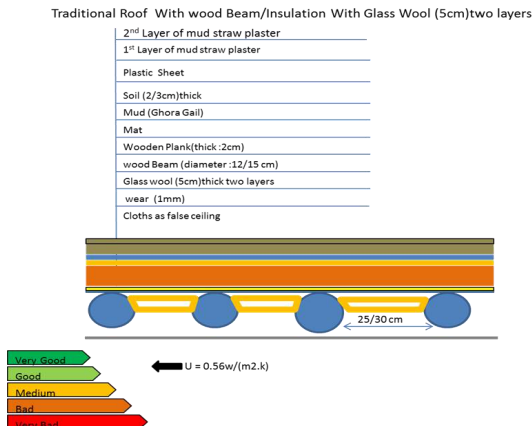
Roof insulation reduces the fuel consumption by at least 10%. Several kinds of materials can be used as insulators. Two main types: external and internal roof thermal insulation.

Implementation requirements:

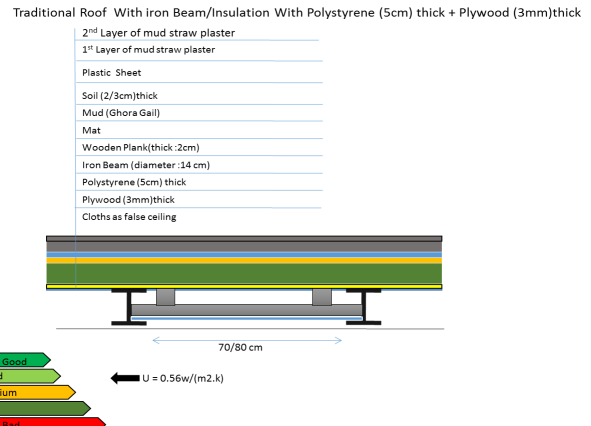
- Traditional roof with wood or metal beams
- The targeted ceiling must be at the top of the house because it is the most in contact with outside air
  - ◆ The roof should be in good condition, with no leakage
  - ◆ The targeted room should be the most used in winter.



## 1. Example of glass wool insulation (5 cm) with two layers



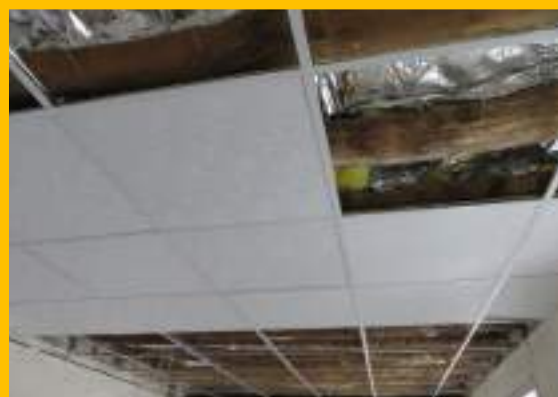
## 2. Example of insulation with 5-cm thick polystyrene sheets





Around  
850 Afn/m<sup>2</sup>

Insulation of roofs constructed  
with glass wool



### Application requirements for roofs with glass wool and polystyrene insulation :

- Traditional wooden or iron beam roofs
- No leakage from roofs during snow and rainy season
- Sufficient space between stove chimney and false ceiling
- The height of the rooms should not be less than 2.3 meters
- Rooms that have the least access to sunshine are more eligible.

At least **10%** fuel saving!



Around  
950 AFN/ m<sup>2</sup>

Insulation of roofs  
constructed by  
polystyrene

Insulation of the roof using polystyrene



### **Basic steps for roof thermal insulation with glass wool and polystyrene sheets :**

- If a false ceiling is pre-existing, it should be removed and if possible re-installed after the insulation work
- Glass wool or EPS should be prepared according to roof criteria and sizes
- Glass wool should be covered with tissue or fabric (sheath)
- Glass wool or EPS should be tightened with 1mm wire
- False ceilings installation
- In case of EPS, a wooden board should be placed above the stove chimney on the false ceiling.

# Long-term investment: Double Glass Window



## Essential construction steps:

1. Remove the existing glass from the windows temporarily.
2. Clean all the glasses (broken glasses should be replaced).
3. Create squared or rectangular aluminum channels to fit the size of the glass.
4. Remove the sealed sheet from the aluminum frame.
5. Put the adhesive pre-prepared aluminum frame on the glass.
6. Remove the sealed sheet from the other site of aluminum frame.
7. Put the second glass on the aluminum frame.
8. Apply silicone seal on the gap between the two glasses and the aluminum frame.
9. Let the prefabricated double glazed dry up for a while (minimum 60 minutes).
10. Clean the window frame and install the double glaze with silicone and/or a wood stick.



### The basic conditions for implementation

- The window frame should have the correct size and be strong enough to support 2nd glass.
- The windows should not be too old with too many gaps.
- The glass sizes should not be more than 1.2 m<sup>2</sup>.





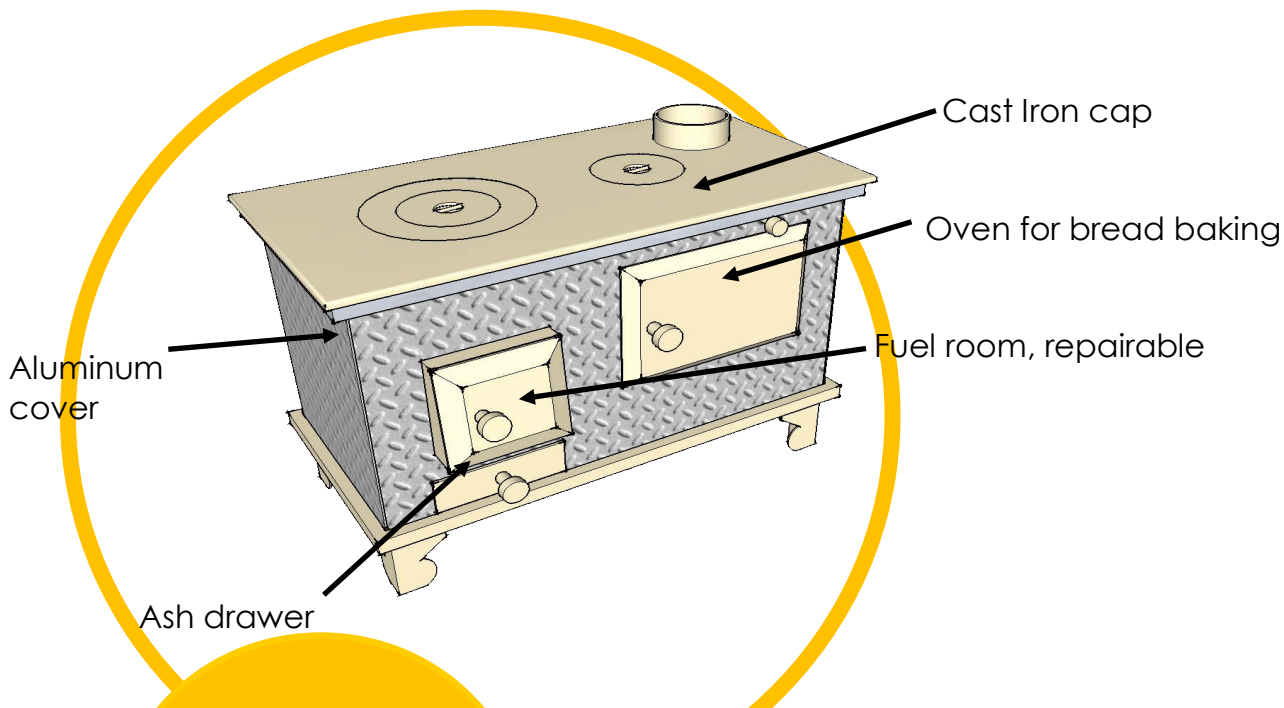
Around  
**1000 AFN/m<sup>2</sup>,**  
at least **10%** fuel  
saving in winter.



- Prefabricated double glazed installation on traditional wood frame windows
- Already-tested technology on PVC and aluminium frame

Traditionally, most people build houses with large windows due to that single glass and poor windows frame, lots of heat being wasted through the windows. With double-glazing windows, you can significantly improve the comfort inside the room and save fuel consumption for heating. Ventilation is very important for the room, especially with double glass windows: you will need to regularly open the windows, particularly while cooking or boiling water so that the atmosphere of the rooms can ventilate.

## Cook with less fuel consumption: Improved Heating Stove



Around  
**7000 AFN/Unit,**  
at least **10%** of fuel  
saved in the winter.



Note: This heating stove model has not reached the dissemination step yet

## Small innovation, big change Clean kitchen: Tandoor cap



Tandoor cap is a proper and convenient structure, that can be put on tandoors during usage. It is designed for traditional kitchens to decrease inside smoke.

**10% of fuel savings,**  
less than **1500 AFN**  
**per unit**

Easy to build



Using tandoor cap, there will be no smoke inside the kitchen. Health of women and children can be significantly improved.

The best option for your house?  
Discover our combined solutions package!

Roof Insulation

Up to **60%**  
Fuel Saving!



Passive Solar Veranda

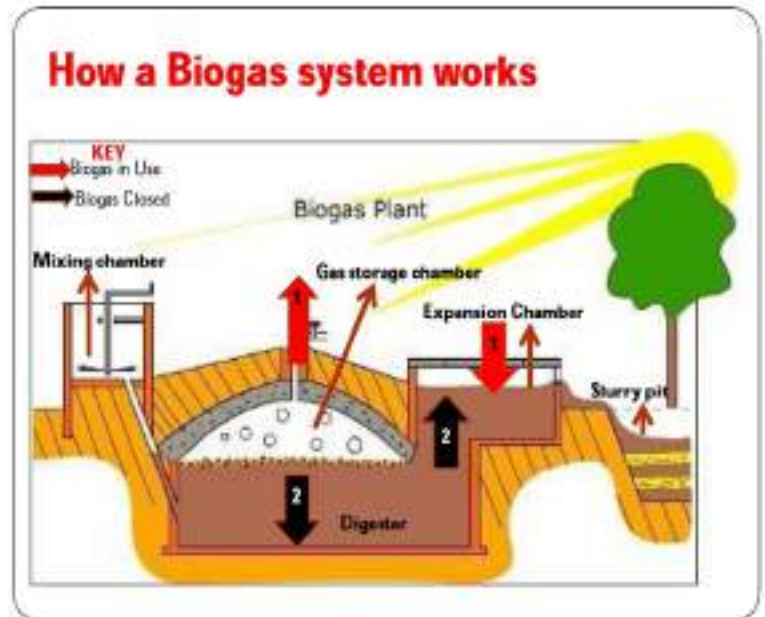
Double-Glazing

## Renewable Energy: Biogas

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste, biogas is a renewable energy source.

Biogas can be produced by anaerobic digestion with anaerobic organisms, which digests the material inside a closed system, or fermentation of biodegradable materials. Biogas is the first mixture of **methane (CH<sub>4</sub>)** and **carbon dioxide (CO<sub>2</sub>)** and may have small amounts of **hydrogen sulfide (H<sub>2</sub>S)**, **moisture** and **siloxanes**.

The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel: it can be used for any heating purpose, it can also be used in a gas engine to convert the energy in the gas into electricity and heat.



# Interested? Find your closest technician!



## SHTA

Solar House Technicians Association

Association of qualified artisans in Kabul districts 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 16, 17 and 22.



## Contacts:

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# PASSIVE SOLAR TECHNOLOGIES

A SUSTAINABLE WORLD,  
FOR ALL OF US



# Many Thanks To

## **Kabul Green Homes Implementing Partners**

Group for the Environment, Renewable Energy and Solidarity (GERES)

Rural Movement Organization (RMO)

Afghanistan Microfinance Association (AMA)

## **Kabul Green Homes Project team, especially**

Project Management team

Technical and Operation Department

Awareness Department

Monitoring and Evaluation Department

Research and Development Department

Administrative and Finance Department

Logistic, security and IT Department

The drivers, cooks, guards and cleaners

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District Authorities of 15 Districts

Solar House Technician Association (SHTA)

Ministry of Energy and Water

Wakils Shurhas and local authorities

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External consultants

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