Urban Pathways

Factsheet

Sustainable Living unit “Tiny house”

Wuppertal Institut

UN HABITAT FOR A BETTER URBAN FUTURE

UN environment

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The Urban Pathways project helps delivering on the Paris Agreement and the NDCs in the context of the New Urban Agenda and the Sustainable Development Goals. It has established a facility in close cooperation with other organisations and networks active in this area to support national and local governments to develop action plans and concrete implementation measures to boost low-carbon urban development. This builds on UN-Habitat's role as "a focal point on sustainable urbanisation and human settlements including in the implementation and follow-up and review of the New Urban Agenda". The project develops national action plans and local implementation concepts in key emerging economies with a high mitigation potential. The local implementation concepts are being developed into bankable projects, focusing on the access to urban basic services to create a direct link between climate change mitigation and sustainable development goals.

Project concept

The project follows a structured approach to boost Low Carbon Plans for urban mobility, energy and waste management services that deliver on the Paris Agreement and the New Urban Agenda. The project works on concrete steps towards a maximum impact with regards to the contribution of urban basic services (mobility, energy and waste management) in cities to global climate change mitigation efforts and sustainable and inclusive urban development. This project makes an active contribution to achieve global climate change targets to a 1.5°C stabilisation pathway by unlocking the global emission reduction potential of urban energy, transport and resource sectors. The project will contribute to a direct emission reduction in the pilot and outreach countries, which will trigger a longer term emission reduction with the aim to replicate this regionally and globally to make a substantial contribution to the overall emission reduction potential.

Project aims

This project implements integrated urban services solutions as proposed in the New Urban Agenda providing access to jobs and public services in urban areas, contributing to equality and social coherence and deliver on the Paris Agreement and the Sustainable Development Goals. This is the first dedicated implementation action oriented project, led by UN-Habitat to deliver on inclusive, low-carbon urban services. Securing sustainability and multiplier effect, the project aims to leverage domestic and international funding for the implementation projects that will follow from this initiative.

In brief

Sustainable building optimises energy use and incorporates renewable energies, saves water and ensures its reuse/recycling, uses efficient means of transport and reduces distances, undertakes site planning and biodiversity conservation, improves indoor environmental quality and occupant's health with thermal comfort, reuses and recycles materials and manages waste effectively - aiming at the reduction of the environmental footprint of buildings (see also Urban Pathways factsheet on 'Green Buildings'). In other to demonstrate this, a prototype of sustainable living unit in the Tropics was designed and executed by the Urban Energy Unit of UN-Habitat in May 2019, partly supported by Urban Pathways project. The prototype of the sustainable living unit "Tiny house" is an affordable house provided with all basic services including: clean energy, food production, onsite waste management, natural lighting and ventilation and many more sustainable design principles (UN-Habitat, 2019). Within the floor area of 56m2, the tiny house has all the basic needs in an ecological and affordable manner.

Measures

The design features of the sustainable living unit "Tiny house" prototype are (UN-Habitat, 2019):

Building orientation and allocation of spaces within the house

<u>The long axis of the building is along East- West to minimise direct solar radiation penetration in the building and reduce heat gain</u>

- The veranda and the kitchen are located on the East and West facing walls to act as buffer zones against heat gain but benefitting from daylighting;
- Space is optimised to make it the most efficient use e.g. the staircase provides spaces for storage with a mobile bed.
- Beds provide additional storage spaces.
- The building occupies a total space of 56m^2 to minimise the foot print.

<u>Daylight, opening and natural ventilation</u>

- Window to wall ratio does not exceed 20% and are mainly placed on North and South facades;
- Sun shading are provided from the roof overhangs;
- The vegetation wall in the north (vertical farming - aquaponic) are utilised to produce food while minimising heat gain;
- Roof vents and openings are utilised to enhance natural ventilation and lighting.

Building envelope materials

- Local available building materials are used to minimise the cost and reduce carbon footprint;
- Laminboards, used as wall, are made of recyclable and re-usable materials with low toxic emissions;
- Light colour exterior reflect solar radiation and light coloured interior finishing enhance natural lighting;
- The walls and floor are made of locally available recyclable materials

Renewable energy

- A photovoltaic system is placed on the roof to generate clean energy (2 kilowatt);
- A solar hot water system provides hot water for the occupants
- A biogas digester provides the home with gas for cooking and natural fertiliser for farming.

Water conservation and efficiency

- Rainwater harvesting systems is utilised to collect and store water.
- Water efficient appliances and water- saving fixtures are included in the design

Sanitation

- on-site waste water treatment system is installed to produce biogas and natural fertiliser
- The toilet (WC) is connected to the biogas system.

Solid waste management

- Waste segregation bins are available in the house to promote waste separation at source

Food production

- Self-sufficient vertical aquaponics system provides fruits and vegetable increase food security and a balanced diet for the family

Incremental housing unit

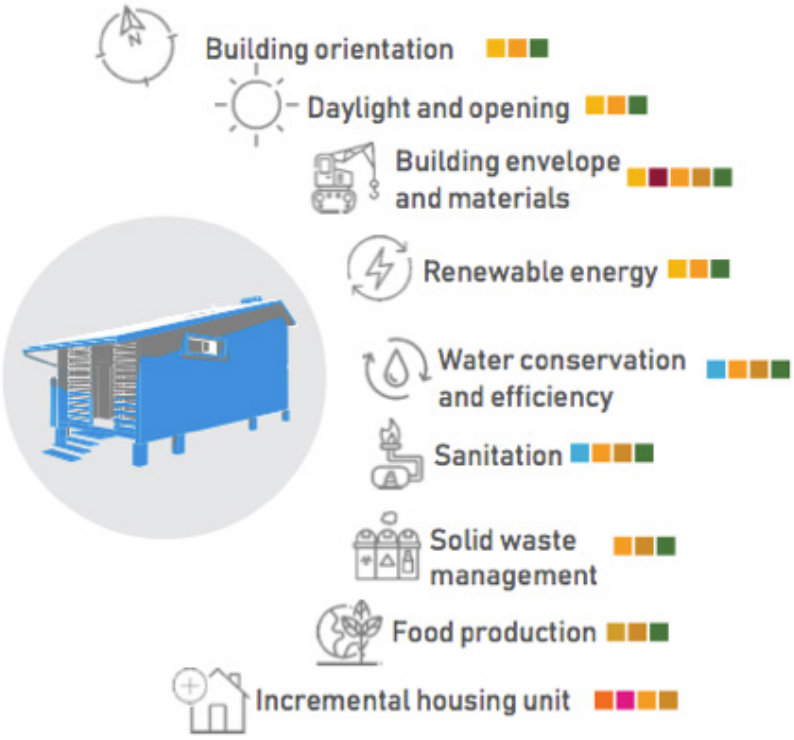
- “Incremental Housing” is a strategy to satisfy housing demand in rapidly urbanising context.
- It has been designed to stand alone or configured in a modular connected layout. This will allow its inhabitants to expand their sustainable living unit according to the spatial needs and budget of the family.

Results

The Tiny house prototype shows that an eco-house can be built efficiently and affordably. It aims to meet shelter needs through Low Carbon Pathways. Passive design features of natural daylight and ventilation reduces the need of extra appliances to cool or heat the room, which saves energy and gives pleasant thermal environment. The locally available materials or recycled materials used in the building contribute to less environmental footprint. The renewable energy use, rainwater harvesting, food production within the building makes the house self-sufficient with clean energy (for lighting and partly cooking), saved water and fresh vegetables consumption respectively. The Tiny house also minimises waste generation and separates waste at the source. With all the features, the tiny house addresses UN Sustainable development Goals 2, 6, 7, 8, 9, 10, 11,12,13.

The prototype support raise awareness on eco-housing to various stakeholders (planner, designer and citizen).

- Building Orientation: SDG 7, 11 and 13f
- Daylight and opening: SDG 7,11 and 13
- Building envelope and materials: SDG 7, 8, 11, 12 and 13
- Renewable energy: SDG 7,11 and 13
- Water conservation and efficiency: SDG 6, 11, 12 and 13
- Sanitation: SDG 6, 11, 12 and 13
- Solid waste management: SDG 11, 12 and 13
- Food production: SDG 2, 12 and 13
- Incremental housing unit: SDG 9, 10, 11 and 12



Technical and financial considerations

The Sustainable living unit is built with a careful selection of appropriate technologies for the tropics and design that provide economic, environment and social benefits.
The total cost of a unit is 18,500 Euros.

The design feature of increasing floor or built stand alone or modular connected layout provide flexibility according to the spatial need and budget availability.

Cost of UN-Habitat tiny house:	
Building materials	8,000 $
Solar system	3,000 $
Vertical farming	2,000 $
Biogas system	650 $
Solar hot water system	850 $
Labour	4,000$
Total:	18,500 USD
Car charging facility:	3,900 USD

Transferability

The design and concept of sustainable housing unit “Tiny house” is highly transferable in the cities in tropics.

References

UN-Habitat. (2019). UN-Habitat Tiny House: Sustainable Living Unit in the Tropics.

Urban Pathways

www.urban-pathways.org

More Information

Implementing Partners

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