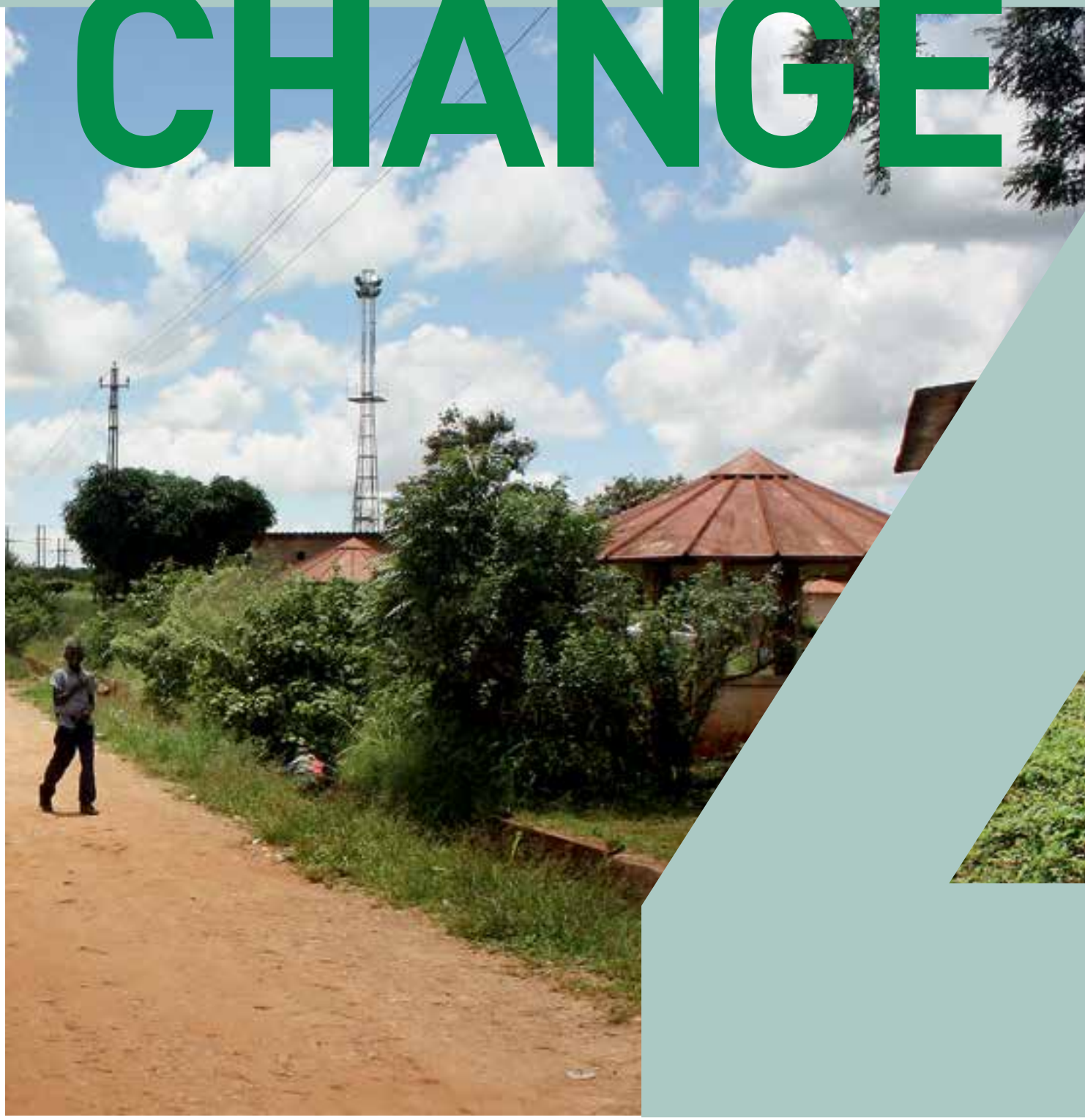
PILOTS FOR CHANGE



Developing Zambia's Sustainable Housing Guidelines meant eight houses were built to test and demonstrate ways of incorporating sustainable principles in the construction of homes. These "pilot houses" prove that comfortable and affordable homes can be built while prioritising locally sourced, unconventional building materials and boosting the local construction sector.

WORDS MARY ANNE CONSTABLE **IMAGES** SUPPLIED

Despite marked economic growth, high levels of unemployment in Zambia remain. To address this, the Zambia Green Jobs Programme (ZGJP) was formulated in 2013 as a joint United Nations (UN) programme led by the International Labour Organization (ILO), and four other participating agencies, namely United Nations Environment Programme (UNEP), International Trade Centre (ITC), United Nations Conference on Trade and Industry (UNCTAD) and the Food and Agriculture Organisation (FAO), with funding from the government of Finland through its Ministry of Foreign affairs. The ZGJP recognises the potential of the building construction sector to drive green growth and create jobs by supporting local micro, small and medium enterprises (MSMEs) through construction of affordable, decent and sustainable low-cost houses. In particular, construction of houses in the residential sector requires relatively low skill levels and is labour intensive. Zambia's formal employment rate is 16%, with the informal employment sector – MSMEs – making up the 84% shortfall (2014, CSO labour force survey). Therefore, supporting MSMEs has huge potential to combat existing unemployment.

Growth in the residential building sector also provides an opportunity to address Zambia's significant housing shortage. A 2012 study by the ILO revealed Zambia needs 1.3million new dwellings to achieve its Vision 2030, by which time the country aspires to become a middle-income nation. According to ZGJP, this equates to building one house every two minutes of each working day for the next 19 years – a significant ask.

DEMONSTRATING SUSTAINABILITY

As part of the ZGJP's focus on the residential housing sector, UNEP partnered with the then Ministry of Local Government and Housing - now Ministry of Local Government - to facilitate the development of Sustainable Housing Guidelines, which guide the process for building future low-cost housing in Zambia. Musoli Kashinga from UNEP emphasises: "More needs to be done to ensure that sustainable construction principles are entrenched not only at policy level, but also at implementation level, ranging from the national, provincial, district and household levels."

Jeremy Gibberd from South African-based consultancy Gauge, was involved in training municipal officials and assisting with the development of the written standards and guidelines. As part of the implementation process of the ZGJP, several pilot houses were built to demonstrate ways of addressing the housing shortage on a larger scale, while also supporting MSMEs in the residential construction sector. Gibberd also used the existing Sustainable Building Assessment Tool (SBAT) to evaluate the efficacy of each pilot house. "The assessment process provided valuable feedback on designs, including ways to improve local content, indoor environmental quality, energy, and water efficiency, which will be used in future housing," says Gibberd. One consideration was designing the house plans for adequate cross ventilation. "It never gets very cold in Zambia but it does get hot," he says. Other passive design features include correct orientation, opening windows, overhangs and shaded verandas. Some of the houses also use solar panels and solar heated geysers, as well as rainwater harvesting.

As the implementing agent for the project, ILO engaged several private sector partners, including LafargeHolcim and non-governmental organisation the People's Process on Housing and Poverty in Zambia (PPHPZ). The VTT Technical Research Centre of Finland (VTT) was appointed to manage the project and to provide technical expertise.

LOCAL CONTENT, LOCAL LABOUR

Gibberd encouraged the use of local materials for the construction of the pilot houses as part of the sustainability agenda. "The current approach in Zambia is that you avoid local because it's seen as crude – not of quality," he says, and therefore it is typical to use cheap imported materials and fittings. Conventional low-cost houses use concrete block walls, cheap timber trusses and steel windows. The corrugated iron roofs often have no ceilings, leading to fiercely hot internal temperatures. The designs are generally very basic with little consideration for orientation or passive design features. Most of the imported fittings are of low quality and once broken may be difficult to replace. Gibberd says a plastic veneered chipboard kitchen unit typically wouldn't last much longer than two years.

The attraction with imported goods is that they are immediately and ubiquitously available from local stores and local contractors in Zambia, Gibberd explains. On the other hand, a timber door made by a local craftsman will take longer to manufacture, although it will last much longer. It requires a mind

shift and lots of support for small businesses to be able to produce the right quality of components on a larger scale, and in a reasonable time frame, but this is an essential part of creating local green jobs. Support also needs to extend to local industries such as the timber industry, which Gibberd explains is good, but does not always meet quality standards for building.

Farai Shumba from PPHPZ reiterates that government authorities also hold an aversion to local materials. "There is a dire need to have robust marketing of [unconventional materials and technology] so that there is a wider buy-in from the stakeholders and beneficiaries," he says.

PPHPZ is particularly experimental with its exploration of unconventional building materials, which helps develop its vision to provide an evidence base for pro-poor housing typologies using community driven initiatives. Its pilot houses focus on the use of soil stabilised blocks (SSBs) as a replacement for the more typical concrete blocks. Shumba adds: "Our approach of mobilising and engaging local community artisans from the slums, who mostly do not have formal training and certification, provides a value chain linkage for informal communities to have a 'piece of the cake' in the construction market."

PILOT DEMONSTRATION HOUSES

Competition by Zambia Institute of Architects

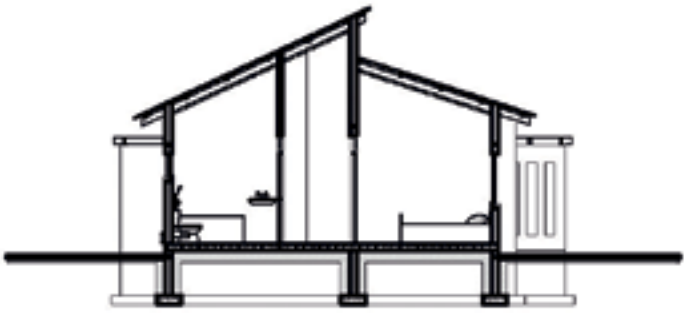
Architect Mutinta Sichali, who won an open competition run by the Zambia Institute of Architects (ZIA), designed three pilot houses. The competition called for a design for low- to medium-cost housing that uses local building materials. Sichali sought out simple, unconventional, local building materials that could be made by the surrounding community. This made her approach unique, compared to the other entries. Her considered designs incorporate plenty of cross ventilation through the open plan living areas, as well as staggered double-pitched roofs that allow for high-level north-facing clerestory windows. Large windows allow in ample daylight and all of the electrical fittings are energy efficient, while verandas on either side create shading from the sun.

At Kalumbila, the vision is to create a new mining town for some 50 000 people that work at the local Sentinel Copper Mine. Sichali's houses will be used as a model for the houses in the town. Lumwana is also a mining town located to the east of Kalumbila.

DEMO HOUSE 1: SOIL STABILISED BLOCKS

Location	Lumwana
Dates	2015-2016
Construction time	About one year
Footprint size	102m² three-bedroom house
Local materials	60 - 79%
Labour skill level	Medium-high
Cost	$550/m²
Client	ILO/VTT
Designer	Mutinta Sichali Architects
Contractor	Soweco General Dealers, Thorn Park Construction Training Centre (electrical & roofing)

A three-bedroom house with concrete slab base, interlocking soil stabilised block (SSB) walls, corrugated iron roof with a low emissivity coated membrane as underlay on timber trusses, and locally-made timber framed windows. The SSBs can be made with any type of soil (free from vegetable matter) and are stabilised with 8-10% cement. They are compressed either manually or mechanically using a hydraform machine and then dried in the shade or covered. The blocks were made by the local community – who were already familiar with the technology – using material found on site. The house is off-grid – being far away from a city and existing infrastructure. Therefore, solar PV panels and rainwater storage tanks were installed. The construction of the house was particularly beneficial to the women in the local area who, through learning to make the SSBs, are now skilled enough to work in the construction industry and generate income.



Cross section through pilot house shows high level clerestory windows and adequate cross ventilation through the house.

DEMO HOUSE 2 &3: BURNT BRICKS

Location	Kalumbila
Dates	2015-2016
Construction time	About one year
Footprint size	Demo house 2: 102m² three-bedroom house Demo house 3: 68m² two-bedroom house
Local materials	60 - 79%
Labour skill level	Medium-high
Cost	Demo house 2: $600/m² Demo house 3: $480/m²
Client	ILO/VTT
Designer	Mutinta Sichali Architects
Contractor	Demo house 2: Rads Engineering & General Supply, Thorn Park Construction Training Centre (electrical and roofing) Demo house 3: Lapinta Road Network, Thorn Park Construction Training Centre (electrical & roofing)

Two houses using different MSME contractors. Both have concrete slab bases, red face brick walls (locally made), corrugated iron roofs with a low emissivity coated membrane as underlay on timber trusses, and locally-made timber framed windows. Due to the location in a town, there was an existing electricity grid, water and sewage systems to connect to, organised waste management and good road infrastructure. However, this meant there was no incentive to install PV solar systems or rainwater collection. Limitations in local rules and recommendations for material selections meant it was not possible to use unconventional SSBs.

Mutinta Sichali, who won a competition by the Zambia Institute of Architects, took a unique approach to the design of the pilot houses, seeking out simple unconventional and local building materials that could be made by the surrounding community.

Sitchali's house designs feature staggered double-pitched roofs that allow for high-level north-facing clerestory windows.

LafargeHolcim's first house was built in 2015 as "proof-of-concept" for sustainable and affordable housing solutions, at its Zambia head office, using the Ikhaya Futurehouse building system.

LafargeHolcim concrete houses (with PPHPZ)

LafargeHolcim has two large factories in Zambia, in Chilanga and Ndola. The company offers solutions for the construction, renovation and extension of affordable houses, tailored to local challenges and the needs of individuals, NGOs, and public organisations responsible for housing. A total of 440 000 people were positively impacted in 2015 and the aim is to increase this number to 25million by 2030. LafargeHolcim's demonstration houses were built as an extension of this vision, to contribute to social impact in the housing sector.

The first house was built in 2015 at the Zambia head office as "proof-of-concept" for sustainable and affordable housing solutions using a structural insulated concrete panel system. Thereafter, another two were built in Chilanga using interlocking mortarless blocks and SSB construction. A fourth house in Ndola, also of SSBs, improves on the use of local content. The houses are fairly conventional in design, yet they incorporate good passive design principles. There is natural cross ventilation through the living areas, and there are covered verandas for shading, and large windows for ample daylight. Conventional electrical and water fittings are used. Lafarge will be taking forward the interlocking concrete block (Habiterra) houses for urban areas and the SSB houses for rural areas.

DEMO HOUSE 1: STRUCTURAL INSULATED CONCRETE PANELS

Location	Lafarge Zambia head office, Chilanga
Date	2015
Construction time	6 weeks
Footprint size	91m² four-bedroom house
Local materials	20 - 30% (polystyrene imported from South Africa)
Labour skill level	Medium
Cost	$587.83/m²
Client and designer	Lafarge
Contractor	Ikhaya Futurehouse, Prosecon (slab)

A four-bedroom house using the Ikhaya Futurehouse building system. It consists of factory-produced 2.4m high and 1.2m wide wall panels with an 80mm thick expanded polystyrene (EPS) core. Galvanised wire mesh is applied to both sides and the panels are finished with a 35mm thick gunnite spray. The foundation is a concrete slab and the conventional timber roof truss is covered by concrete tiles. Windows are steel framed. Advantages are that the walls are durable, long-life and low maintenance. Construction is fast and economical due to the lightweight and prefabricated panels. The insulated walls provide a thermally well-controlled environment and their air-tightness creates a water and vapour barrier. Importing the mesh and polystyrene from South Africa means a lower local content. Gibberd says future developments will find a cellulose replacement for the polystyrene so that the prefabricated panels can be manufactured locally.

A two-bedroom house using Habiterra mortarless interlocking concrete blocks which can be laid 15 times faster than conventional concrete blocks.

The Habiterra house has a flat concrete slab roof which can be used as an insulated roof garden.

DEMO HOUSE 2: HABITERRA INTERLOCKING CONCRETE BLOCKS

Location	Chilanga
Dates	2015
Construction time	Four weeks
Footprint size	60m² two-bedroom house
Local materials	60 - 79%
Labour skill level	Low-medium
Cost	$416.66/m²
Client	Lafarge
Designer	The Design Workshop
Contractor	Habiterra, Pro Sup (slab)

A two-bedroom house using Habiterra mortarless interlocking concrete block walls. The foundation is a concrete slab, with a flat concrete slab roof and steel framed windows. Local content is high, and due to the lack of mortar and interlocking nature, the blocks can be laid 15 times faster than conventional concrete blocks, in any weather conditions. They are also lightweight and durable and the skill level required is low. A crew of three unskilled workers can assemble 2500 blocks on prepared foundations in a few days. The high thermal mass of the walls makes the house thermally efficient. There is, however, a high concrete content. What is unique about this house is that its flat roof can be used for activities such as sleeping outside at night (as relief from the hot Zambian climate), or as an insulated roof garden.

DEMO HOUSE 3: SOIL STABILISED BLOCKS

Location	Chilanga
Dates	2015
Construction time	Four weeks
Footprint size	60m² two-bedroom house
Local materials	90% +
Labour skill level	Low
Cost	$366.66/m²
Client & Designer	Lafarge
Contractor	PPHPZ, Pro Sup (slab)

A two-bedroom house using SSB walls. The foundation is a concrete slab, with a corrugated iron roof on timber trusses, and steel framed windows. Building a simple house with SSBs, in comparison to conventional burnt brick, saves on average 14 trees per house (used to fire the bricks), reducing CO_2 emissions tenfold and mitigating the rate of deforestation. They reduce the cost of wall construction by 20% compared to a burnt brick wall as less mortar is required (due to the size of the blocks) and plastering is not necessary. SSBs can be made on site using local materials and requires a very low level of skill. Walls also have high thermal insulation properties.

These two semi-detached units will be replicated in PPHPZ's new 100-unit low-cost housing development in 10 Miles, near Lusaka.

DEMO HOUSE 4: SOIL STABILISED BLOCKS (IMPROVED LOCAL CONTENT)

Location	Ndola
Dates	2015
Construction time	6 months
Footprint size	120m² three-bedroom house
Local materials	90% +
Labour skill level	Low-medium
Cost	$366.66/m²
Client & Designer	Lafarge
Contractor	PPHPZ

A three-bedroom house using SSBs. An evolution of Demo house 3, Demo house 4 uses locally produced concrete tiles on the roof, and timber framed windows and doors crafted by local MSMEs. Thus the house features almost 100% local content.

People's Process on Housing and Poverty in Zambia (PPHPZ)

PPHPZ were involved in the construction of two of the Lafarge demo houses built from SSBs as well as a third house (two semi-detached units), which is intended to be replicated in a new 100-unit low-cost housing development in 10 Miles near Lusaka.

PPHPZ is particularly innovative with its use of buildings materials and took advantage of the existing ant hills, which were earmarked for clearance, using this rich soil to make the blocks.

PPHPZ DEMO HOUSE: SOIL STABILISED BLOCKS

Location	10 Miles, near Lusaka
Dates	2015-2016
Construction time	3 months
Footprint size	60m² two-bedroom semi-detached house
Local materials	90% +
Labour skill level	Low
Cost	$327.27/m²
Client & Contractor	PPHPZ

A two-bedroom semi-detached house using SSBs. The foundation is a concrete slab, with a corrugated iron roof on timber truss, and steel framed windows. Good passive design features.

SOURCEBOOK

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