

Each NV House built Saves 2.0 Tonnes CO₂e

A streamlined high-level carbon footprint assessment has been undertaken for AVN comparing production of four different housing types of 25m² in size and providing a comparison to the production of Nubian Vault (NV) houses.

[Environmental Resources Management \(ERM\)](#), a leading global provider of sustainability consulting and assurance services, has provided AVN with a *pro-bono* assessment of the carbon impact of the NV construction technique. Using data on village houses of 25 m² provided by AVN field staff in Boromo, Burkina Faso, the calculations suggest that each NV house built can result in **savings of approximately 2 tonnes of CO₂ equivalents (CO₂e)** as compared to the current alternatives.

The **carbon footprint** of an NV house of 25 m² is orders of magnitude lower than the alternatives, primarily due to the use of natural resources from surrounding areas in its construction and its extended lifetime. The approximate footprint of each housing type is:

- 40 kg CO₂e for an NV house (50 year lifetime)
- 4,600 kg CO₂e for a concrete wall + metal roof house (25 year lifetime)
- 2,000 kg CO₂e for an earth wall + metal roof house (10 year lifetime)
- 700 kg CO₂e for a traditional earth + timber roof house (10 year lifetime).

By the end of the 2009/10 building season, NV masons will have built the equivalent of 1,000 25 m² vaults, mainly in rural areas. This implies that the carbon savings of the VN construction method since the start of our programme can be estimated at a **total savings of at least 2,000 tonnes of CO₂e**. In fact, the figure is probably higher, as a proportion of these vaults have been built in urban and peri-urban areas, replacing a higher percentage of 'modern' metal-roofed buildings with concrete and cement mortar (rather than mud brick) walls.

Technical details....

Methodology, assumptions and data limitations

A streamlined carbon footprinting approach was employed in this study which is based upon methods outlined for undertaking life cycle assessment (LCA) studies in ISO 14040 and ISO 14044. A streamlined carbon footprint or LCA seeks to shortcut the full process by limiting the scope of the study (i.e. carbon in this case), the impacts assessed and/or by judicious use of generic data and assumptions, delivering results more quickly and using fewer resources.

The carbon footprint results and savings calculated by ERM are calculated using a high-level assessment and are useful as an indication of the carbon burden of each housing type over its lifetime.

This calculation has been based on the following assumptions:

- In rural areas, in the absence of NV construction, 60% of houses would normally have earth walls and sheet metal roofs, 15% would have concrete block walls, using cement mortar, and sheet metal roofs, and the remaining 25% are traditional earth wall and timber roof houses,
- Metal roofs and timber roofs need replacing every 7 years, that the average lifetime of a traditional house and a house with earth walls and a sheet metal roof is 10 years, and that of a house with concrete block walls and a sheet metal roof is 25 years

- The estimated lifetime of a properly maintained NV house is 50 years (the structure and solidity of the roof, combined with stronger foundations and much thicker walls, explain the longer expected lifetime as compared to the alternatives).
- The carbon footprint results and savings are based entirely upon production and lifetime data provided by AVN. Variations in this data significantly effect the results.
- All housing construction is assumed to be undertaken using entirely manual labour and is assigned a carbon footprint burden of zero.
- All locally sourced natural materials such as earth, clay, sand, gravel, stone and water are assigned zero burden.
- The maintenance on a house considers the burden of replacement materials such as sheet steel, timber and plastic lining and not that of the actual maintenance process.
- Where relevant, such as for natural resources, steel or timber, recycling or reuse has been assumed for the material when disposed and the materials disposal is assigned a burden of zero.
- Concrete is comprised mainly of cement, water, sand and gravel. All ingredients except cement are assumed to be sourced locally and have no burden. The concrete is based upon Portland cement and assumed to be imported.
- Fasoplast is estimated as having similar production burdens to PVC and is required to be transported an estimated distance of 1000 km.
- Biogenic carbon is excluded from the results.
- Transport of waste material to recycling, landfill or general disposal at end-of-life is excluded.
- Lorry transport within Africa is assumed to be using a lorry size less than 16 tonnes.
- Emission factors used to calculate the carbon footprint of each life cycle stage have been based upon the ICE database for construction materials & Defra transport emission factors, using characterisation factors according to the IPCC 2007 data for a 100 year time horizon.
- Biogenic carbon is carbon stored or released by natural non-fossil based sources. This has been excluded from the study as sequestration and release of biogenic carbon is assumed to occur in a cycle less than the 100 year time horizon considered

References

- Defra: 2009 Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting (<http://www.defra.gov.uk/environment/business/reporting/pdf/20090928-guidelines-ghg-conversion-factors.pdf>)
- ICE database: `University of Bath: Inventory of Carbon and Energy (ICE) Version 1.6a, Prof Geoff Hammond and Craig Jones, 2008 (<https://wiki.bath.ac.uk/display/ICE/Home+Page>)

Note on ERM

Environmental Resources Management (ERM) is a leading global provider of sustainability consulting and assurance services. They deliver innovative solutions for business and government clients, helping them understand and manage their impacts on the world around them. ERM has 137 offices in 39 countries and employs approximately 3,300 staff.

The ERM Foundation was established to harness the enthusiasm and expertise of ERM's consultants to provide pro-bono and fundraising support for environmental and carbon reduction initiatives around the world.