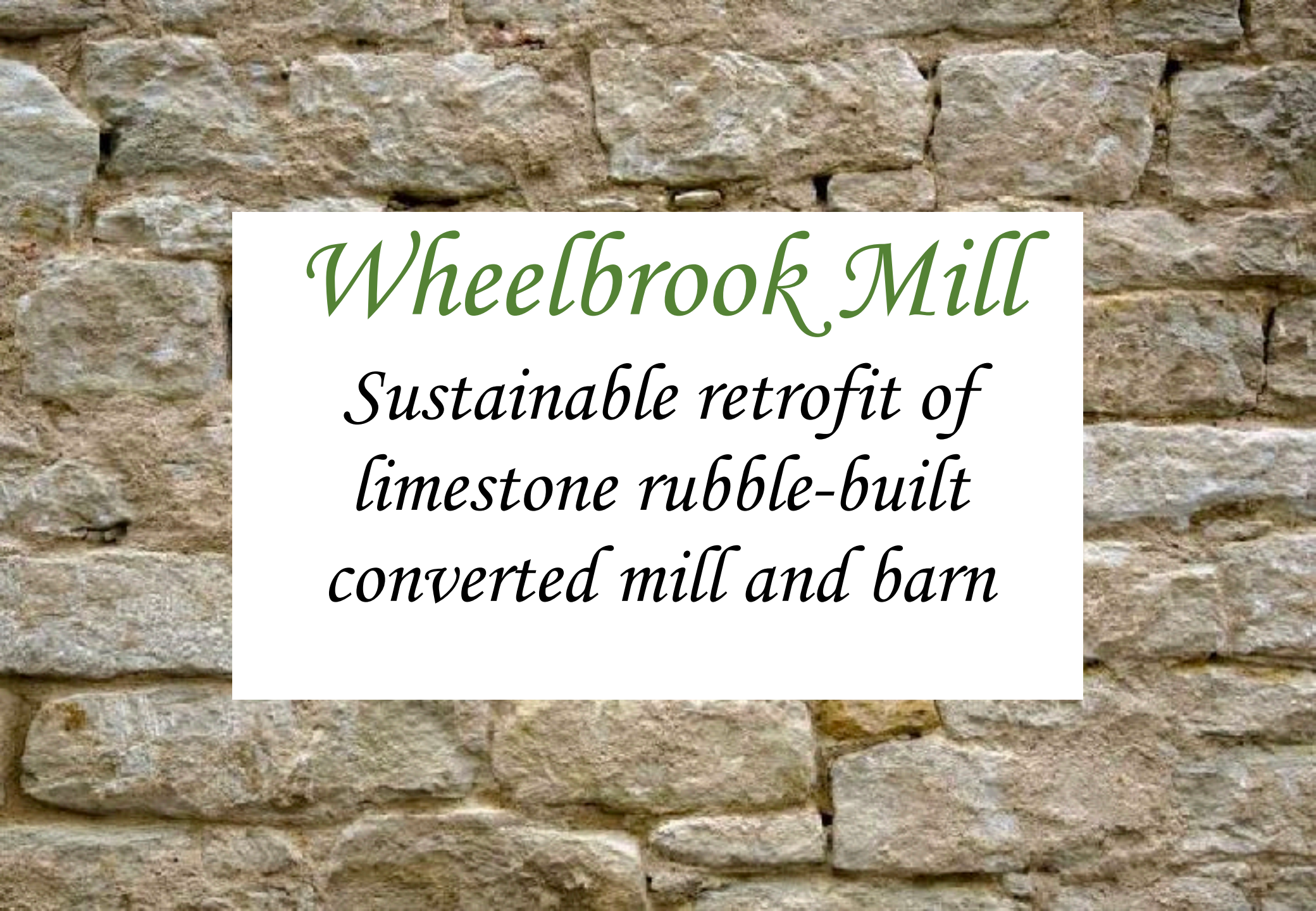

Wheelbrook Mill

Sustainable retrofit of limestone rubble-built converted mill and barn

Issues

- Agricultural building - not built to be a dwelling
- Lots of roof area, high ceilings in most rooms
- Very expensive to heat (using gas)
- South-facing walls absorbent, permanently damp
- Damp causing mould and staining of wall paint
- Draughty
- Conversion to dwelling used 1980s technology

Before the Plan

H-E-E-E-E-L-P!

- Greengauge Building Physicists
- Put all the house data into Wufi Pro
- Recommended breathable materials, thicknesses to optimise the insulation U-values vs breathability
- Heating loads per room, ASHP output required
- Greengauge recommended mechanical ventilation

The Plan

- Sustainable materials throughout
- New roof over main part of property
- Breathable internal wall insulation
- 31 PV panels (11kWp) & 13.5kWh Tesla battery
- 2 Mitsubishi Ecodan Air Source Heat Pumps
- Mechanical Ventilation & Heat Recovery
- Fix draughts and bring in much more natural light

External walls

All external walls in the two-storey area insulated internally to 90mm:

- Existing plaster hacked back to stone, made good
- 40mm breathable, insulating lime plaster
- 40mm breathable wood fibre panels
- 10mm breathable lime plaster finish
- Breathable paint

Sustainable Materials (walls)

- Seciltek Isovit e-cork – sustainable, breathable hydraulic lime plaster + cork + other natural stuff
- SteicoTherm wood fibre panels
- Solo OneCoat breathable lime plaster finish
- Breathable paint


F3
F4
F5
F6
E4
E5
E6
D3
D4
C2
C3

Roof

- 1980s impermeable black plastic membrane = rot!
- Bring lofts into the 'warm envelope'
- Create airtight layer inside the existing roof timbers
- Insert wood-fibre between existing 80mm rafters
- Add 140mm counter-rafters and 140mm wood-fibre
- 35mm sarking board, then permeable membrane
- Batten, then counter-batten (for air gap), then tiles

Sustainable Materials (roof)

- Airtightness layer (12mm plywood or plasterboard sealed with Passive Purple)
- PavaFlex flexible wood-fibre batts
- PavaTextil recycled cotton batts (better for acoustic)
- Steico Universal wood-fibre sarking board
- PavaTex ADB permeable membrane
- Clay tiles (second-hand where possible)

MVHR

- Mechanical Ventilation & Heat Recovery
- Blows filtered external air into all living spaces, after it's been warmed by heat recovery from exhaust air
- Exhaust air drawn from kitchen, bathrooms & WC, expelled to outside after extracting 96% of heat
- We used radial layout – all rooms served by 1 (or 2) ducts from central supply and extract manifolds
- Program all systems to sync with Octopus Flux


zehnder

Sustainable Suppliers

- Buy (and sell) surplus materials on eBay
- Intelligent Membranes Ltd (Passive Purple)
- Mike Wye – Beaworthy, Devon (also offer training)
- Unity Lime – Oakly, Buckinghamshire
- EcoMerchant Natural Building Systems - Swindon
- SolarSense (PV and ASHP) – Clevedon, Bristol