Tristan da Cunha Design Ideas Competition

7.2 Design Statement

December 2015

Scott Brownrigg (URN:T7)

Contents

1.0 Design Proposal Response
No man is an Island

'No man is an island' is used as an expression of a persons connection to his or her surroundings.

Building on the past – the 'genius' of loci

The distinctive hallmarks of the island's built heritage rests on two significant factors. First in the power to unite structures with its setting and make it feel part of the landscape – second, the capacity of its inhabitants to collaborate and co-operate in the act of building and habitation in a way embodied in Heidegger's 'building dwelling'.
The proposals in this second stage of the competition are therefore reinforced and enhanced by further analysis and deeper understanding and enhancement of these traditional methods.
This can be witnessed in the response to siting, topography, climate and nature developed and practised through the tacit and deep knowledge of the unique place that the islanders have chosen as home.

Resource and resourcefulness

The Tristan da Cunha 'vernacular' is founded on a need to harness resources of the island through native wit and intelligence to create a sustainable way of life: this is often referred to as 'Genius loci:

Boat Building on Tristan

Tristan has a historically rooted and contemporary culture of fishing and boat building, both as a skill and craft but also a neccesity to life on the island. The act of building a boat brings together the community to utilise the islanders craft abilities simulateously creating a heart and hub of activity. And for us the long upturned boats along the road curving up from the harbour reiterate the language of Tristan's built forms, streamlined against a prevailing current offering protection and shelter.

Like Sverre Fehn (see image 01 pg3, image 3 pg5), for us the upturned boat metaphor assumes critical importance symbolically as well as tectonically. Fehn argued that to build on land without acknowledging the concept of the sea is to build without the limitations of the world around. Designing from a great distance these thoughts seem to us to be particularly relevant for those who have made the island their home – they are intimately approximate to the margins between earth and sea and the vessel is part of this. At a more practical level the boatbuilding technology will become a legible kit of parts for ease of construction.


Boat building on Tristan as a social and communal activity with an inherent skill set suited to working with timber

Sea, wind and light

Siting and topography

Edinburgh of the Seven Seas is more than a random collection of crofts and cottages clustered around a transit point. Whilst appropriate sites for such a settlement are narrowly limited, the form is founded on the fundamental pragmatic need for community but also for an inimitable respect for the individual within community – primary, independence and self situated in a wider congregation. This results in clusters of dwellings on individual plots all within easy reach of communal facilities (see image 3 pg3)

Design Response

We have located the complex of new government buildings at the original 'civic' heart of the settlement. They form a new centre but scale and form and siting is guided by the principles of buildings in echelon sheltered by landscape. Sited East – West, each building contains a specific function on its own plot. There is no formal public realm such as a town square as this seems inappropriate both socially and climatically but each building has a public threshold and the ensemble is clustered around a sheltered gathering space. For us, to impose Northern Hemisphere typologies of formal courts or squares, seems to imply an arrogance that the community should live like we do - rather than recognise that the pattern of historic development is one that has been "designed" by the people of Tristan Da Cunha themselves - one that fits their community and their way of life. This is a revision of the 'industrial' character of the original buildings.

This also forms a spatial relationship between the siting of these communal facilities and the longboats owned and crewed through long-standing collaboration. Each of these is now buffered by a crenelated shelterbelt just like those on other wind-beaten islands.

Climate and weather

Building form is a direct response to climate and weather. We refer to both for whilst the former can be 'read' from published data and used to inform design we are also acutely aware that people experience and 'sense' weather –

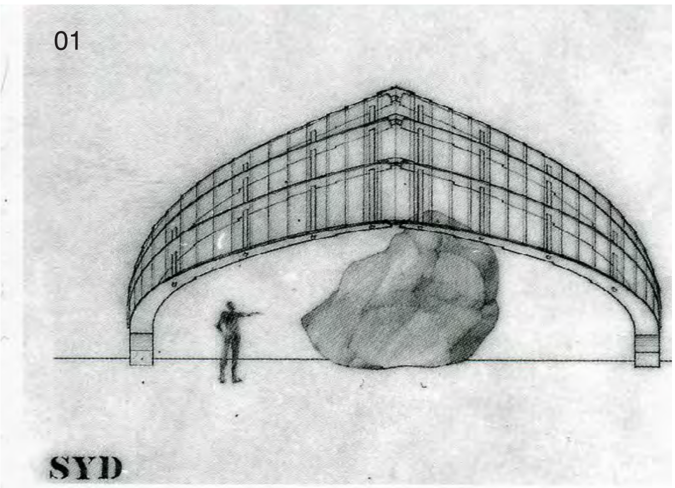
particularly in its extremes.

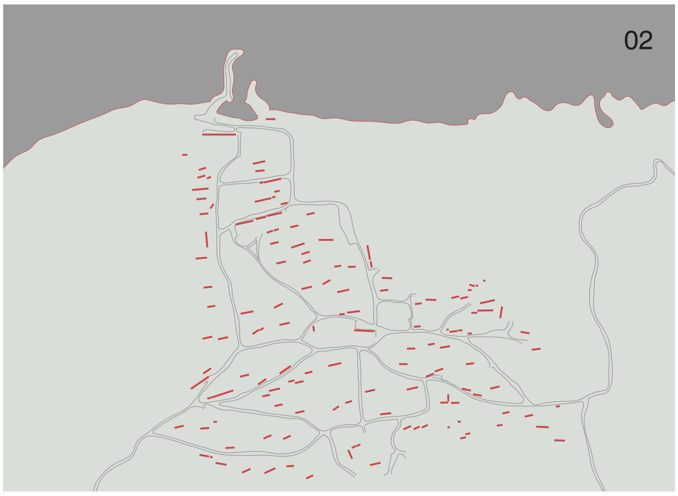
The reason that buildings are customarily sited East – West, face the sun (when present) and are gabled with cyclopean stone reminiscent in size and precision of Machu Pichu is no mystery. However, it is the combination of building form and the modification of landscape that hammers home the very real need for modification of climate through intelligent design to provide effective shelter.

New buildings are sited traditionally with long elevations East – West and short protective gables.

Building form and massing

The new Government buildings take the form of long low pavilions in echelon. They are simple skeletal structures of pre-fabricated laminated timber frames. The structural bay is generic and repeated for economy and ease of construction. Foundations are therefore minimised.





Top: Sverre Fehn's dipiction of an upturned boat
Top-left: Tristan's upturned boats re iterate this language and also reinforce the built form typology

Right: Tristans typology leads to a linear east-west language
Bottom Right: The settlement has a hierachy of spaces, both public and private

Sheltering Landscapes

The buildings and outside spaces are currently partially protected by shelterbelts. which are formed through a combination of slightly bermed bounding elements of drystone and native gorse. The proposal is to reinforce these and to introduce new ones.
Strategically placed these can afford protection from wind-driven rain and the convective cooling effects of wind on the building envelope in addition to the damaging effects on building elements. These belts are also sited to reinforce the formal structures of the settlement and provide sheltered pedestrian ways (Tunnels) running North – South (see image 07 pg 4).

These provide the basis for an encampment of sheltering roofs formed into assymetric barrel vaults. The asymmetry is not mindless form making but designed to further enhance the idea of combining design with climate and functional space use.

The longer flatter southern slope optimises the potential for daylight whilst the steeper Northern slope can enable openings that are shaded in summer and can benefit from some judicious passive solar gain in winter (see image 08 pg4).

Weather protecting elements are thin skin waterproofing materials chosen for ease of transportation, efficiency, wind tightness, low maintenance and buildability in terms of appropriate technology.

Colour coated sinusoidal steel is used for roofs and rubber EPDM is employed for walls, all on an insulated build-up to provide what has been calculated as ‘optimised’ U values to suit the climatic conditions of Tristan da Cunha. (See Energy Environment and Materials).

Those are also used for the retrofit of houses ensuring a visual coherence and continuity. Additionally the form and colour of the roofs and rainwater elements make identifiable focal points in the ‘quilted’ landscape and seem to us symbolic of identity, just as the colours of the longboats belong to the crews. In this way the roofs new and existing shelter, gather resources and provide identity. Additionally layered elements are added to further enhance and protect North facing long elevations.

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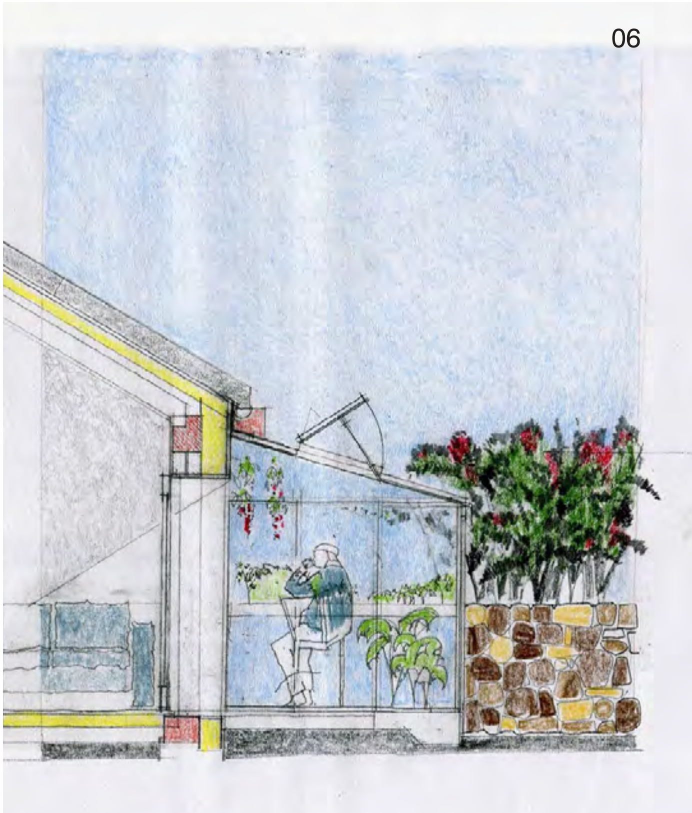

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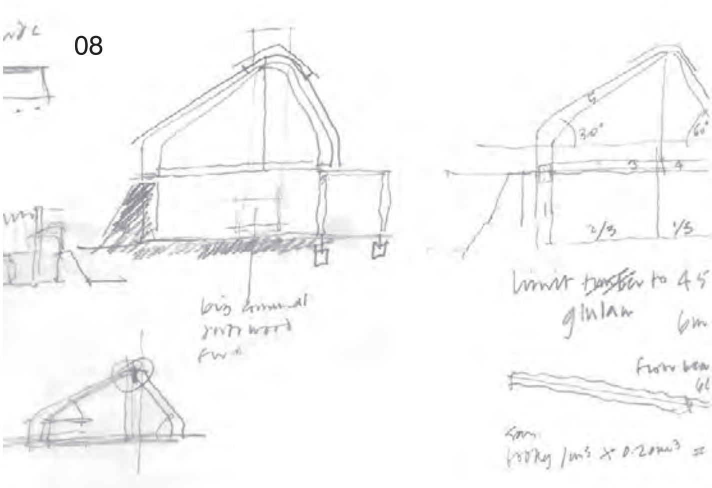

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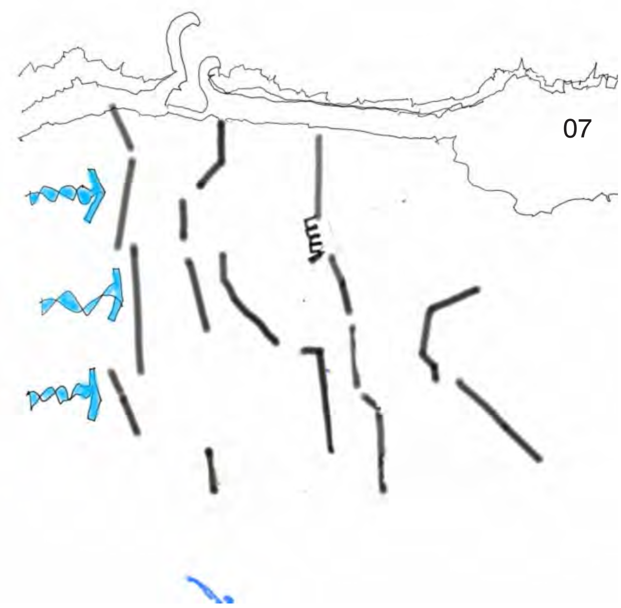
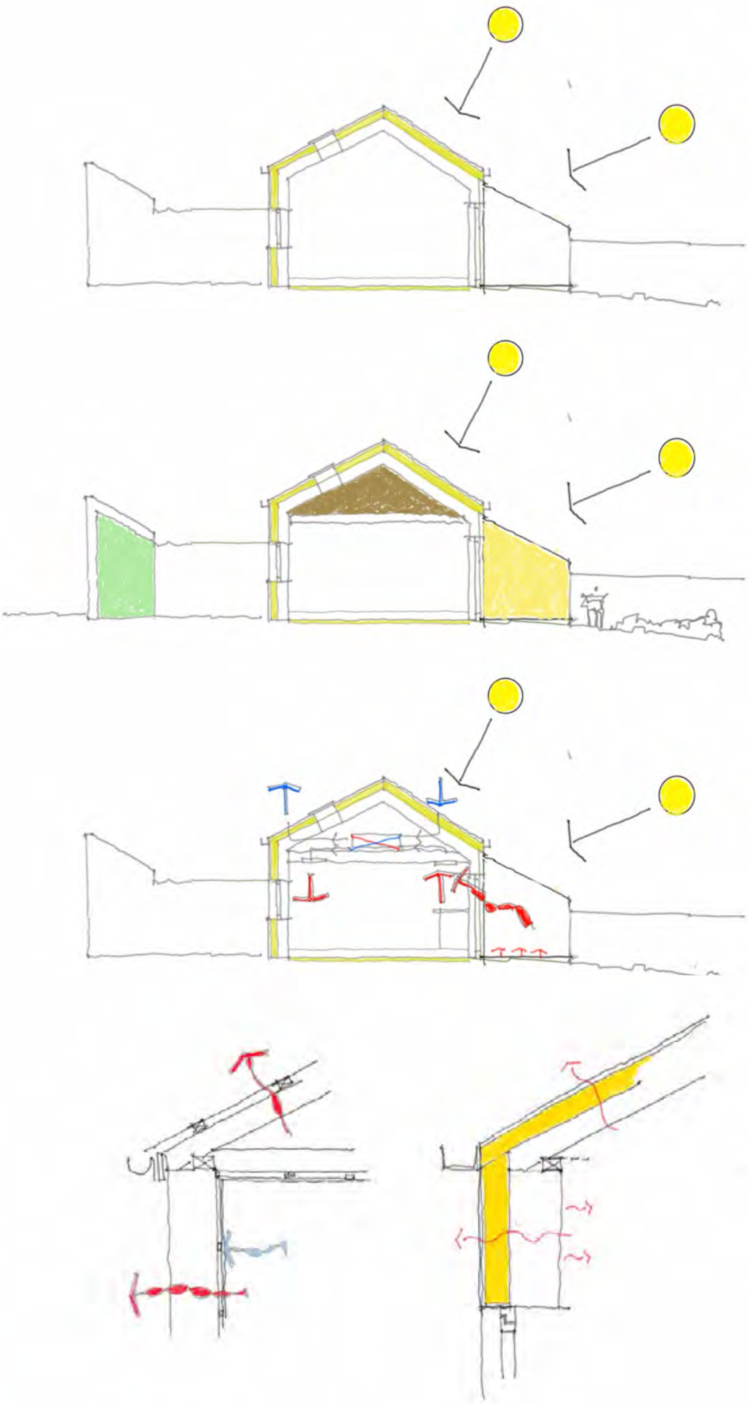


Residential Properties Environmental Analysis



01

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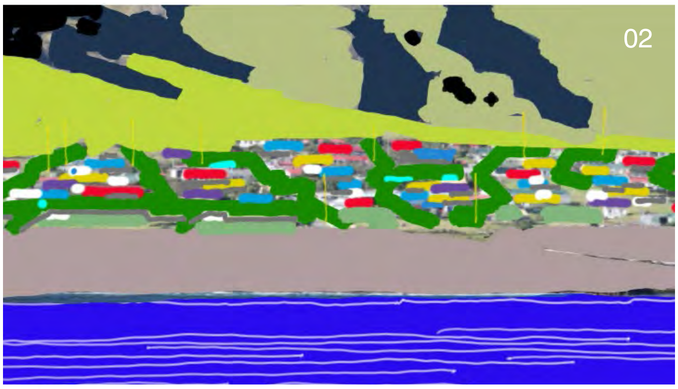


03

04

01 Tristan da Cunha postage stamp indicating indigenous vegetation, Phylica, which grows up to 4m high- as wind protection.

02 Abstract ‘Klee-style’ sketch of Edinburgh of the Seven Seas illustrating the unique and distinct pattern of settlement.

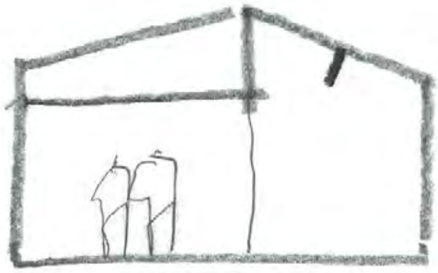
03 Low/medium technology Sverre Fehn eco-residential property with ‘upturned boat’ roof, large expanses of glazing allow light to penetrate deep into the property.

04 Battered stone facing with planting on top (west Wales) ‘provides wind shadow.’

Flexible Design: Levels of Retrofit

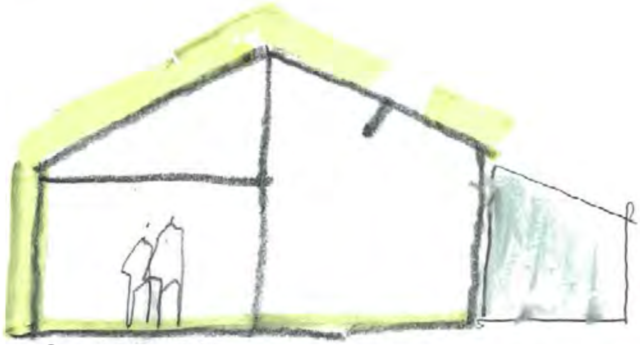
Existing Dwelling

The existing dwellings vary in both size and state of repair such that not all houses will require a full retrofit, and the cost of retrofit per dwelling will vary. For this reason the cost has been broken down per element in the order of cost and differences in level of retrofit are illustrated below.



1: Partial removal of ceiling

£1,068 per dwelling

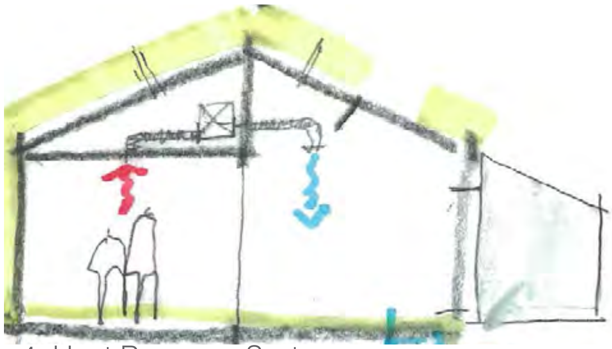


3: Green house extension

£3,135 per dwelling

2: External Insulation and rooflight

£16,224 per dwelling



4: Heat Recovery System

£2,125 per dwelling

Full Retrofit for a typical 8x12m dwelling: £23,552

See order of cost for full breakdown.
Internal decor included in cost

5: Rainwater collection systems and water recycling

£1,000 per dwelling

2.0 Technical Response

Fabric First

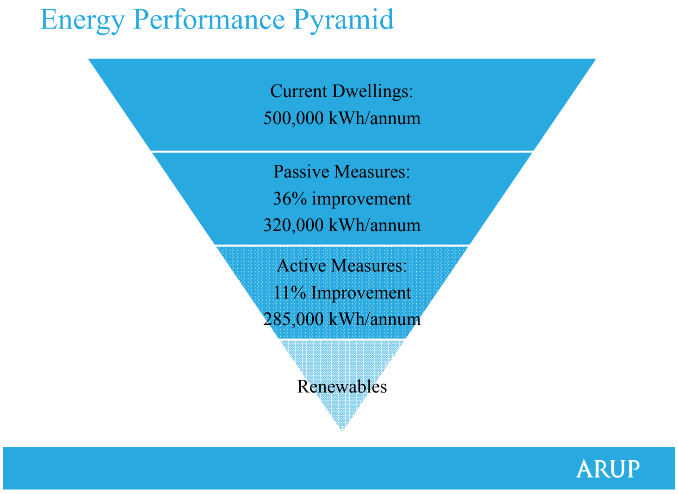
Having established that a fabric first strategy would be the most effective method, Arup undertook a series of simulations to establish some benchmark values.

The weather data supplied was compiled onto a working weather file to run through thermal modelling analysis software and from this we were able to draw a number of conclusions.

The average temperature is relatively mild compared to the typical UK climate with a peak of 23.5°C and minimum of 5.5°C. Therefore properties are likely to be heated only and not require any form of air conditioning.

A thermal model was created and the test weather file was utilized to calculate the estimated heating energy consumption for a sample property. A range of U-values were tested to seek the optimal performance which can be seen in graph 2.

From a pure engineering perspective it is clear that there is a good relationship between improved U-values compared to the annual energy consumption, see graph 2. However there is a plateau in terms of the cost performance (see Graph 3, and it appears that a U-value of 0.3 is the optimal solution in terms of reducing energy demand vs costs of the insulating material.

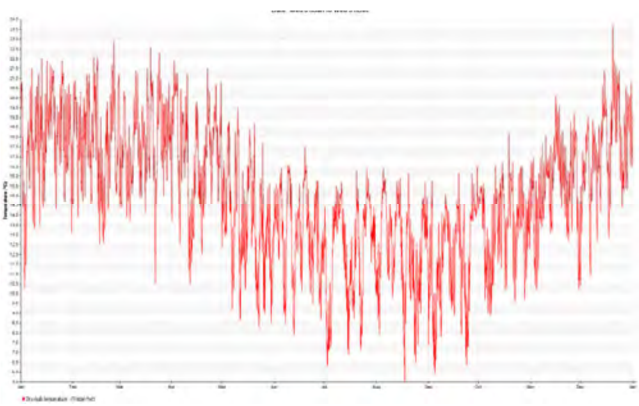


Above: Performance pyramid shows the strategy for driving down demand and meeting a reduced demand with renewable generation

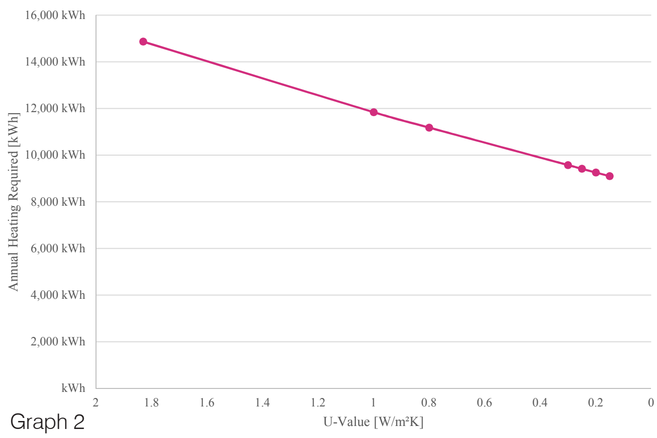
In the case of this project it would be advisable to select a compromised value of 0.3 purely on the basis of logistics as anything better would have minimal energy performance improvement, but would add significant cost to the scheme.

As can be seen the energy consumption of the dwelling reduces to a plateau. It was determined that a U-Value of 0.3 W/m².K is practical and provides a 36% reduction in annual energy consumption for heating. Using this as a guide the energy reduction of the other properties has been determined in the table 1.

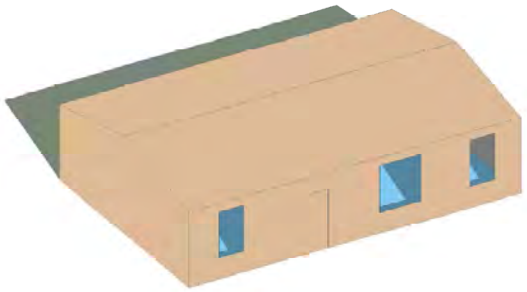
Below left: Tristan weather data for analysis
Below right: Correlation between improved U-Value and energy saving



Graph 1

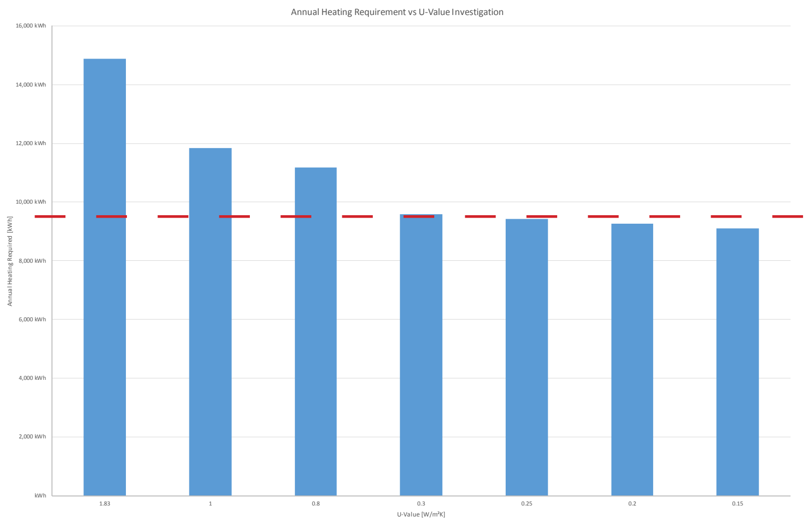


Graph 2



Above: The model was based on a typical dwelling measuring 12 x 8m.

Right: Graph 3 depicts the benfitd vs. the cost of increased U-Values and 0.3W/m²K



Graph 3

Estimates for reduced domestic and civic energy demand

Energy demand estimates for each of the dwelling types can be seen below based on the simulation of a dwelling performace with an increased U-value of 0.3. Overall a 36% saving can be made across the total domestic demand from insulating the buildings.

Table 1: Domestic energy use and reduction with increased insulation

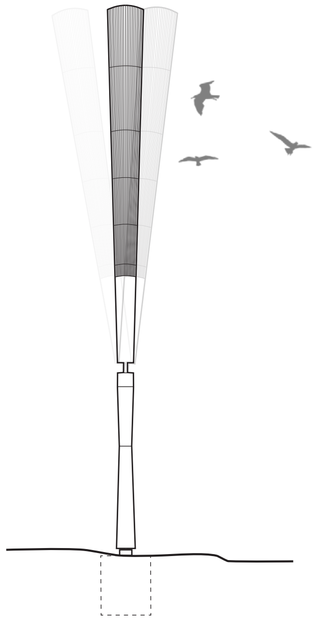
Column1	Typical Footprint [m]	Typical Electric Consumption [kWh/m²]	Reduction with improved U-Value [kWh/m²]
Traditional Croft-style property	5x10	50-70	32-45
Renovated Property	8x12	70-150	45-96
Bungalow-style new property	8x15	100-250	64-160
Private Guest Houses	8x12	100-250	64-160
Estimated Total Consumption for All Village Properties		500,000 kWh/annum	320,000 kWh/annum

Six Government buildings have been proposed for a re-design. The energy consumption of these government buildings has been estimated using data from CIBSE TM46:2008 Table 1. This data benchmarks the energy consumption of buildings based on their type, and although the data is based on UK developments it is established data that is taken to be reliable. The table below shows the energy usage of the government buildings based on their floor area and usage profile.

Table 2: Civic energy use based on high performance building specifications

.	Building Number	Total Area (m²)	Total Benchmark (kWh/m²)	Building Energy Use (kWh/annum)
Supermarket/office/stores and internet café	1	576	165	95040
Finance and Admin offices	2	288	185	53280
Public Works Dept: Mechanical and General	3&4	456	170	77520
Public Works Dept: Workshop and stores	5	384	170	65280
Agriculture, Electric, Plumbing, Sawmill and Store	6&7	384	170	65280
Telecomms: offices and stores	8	96	96	9216
Conservation and Fisheries: offices, labs and stores	9	120	120	14400
Estimated Total for All Government Buildings				380016

2.0 Technical Response
Renewables Strategy



The overall aim of the scheme is for the islanders to head towards being self-sufficient in terms of their energy needs. Currently wind energy is proposed due to the predictable and constant wind the island experiences, however we propose a dual approach in terms of considering wind alone, and wind plus an element of photovoltaic panels.

Below the calculation shows how much PV is required to meet demand for the whole settlement, how many vortex bladless turbines would be required to supply the whole settlement and then a mix scenario where PV supplies domestic demand, and vortex bladless turbines supply the civic demand.

Estimates for energy generation using Vortex Bladeless Turbines

Energy estimate from whole site once refurbishment has taken place: 700,016 kWh/Annum

$$\frac{700{,}016kWh\ per\ year\ demand}{8640kWh\ per\ year\ generation} = Approx.\ \mathbf{81\ Vortex\ Turbines}$$

Advantages of this scheme:
· Utilises the high wind potential on the island
· Deals with change in wind direction well - previous issue with last turbine
· Minimum disruption to to the environment
· Sculptural element in landscape
· Good value for money (£0.53/kWh return on first year) and low maintainance costs

Disadvantages of this scheme:
· Movement of the device could equal high wear and tear – and due to remoteness could be hard to get spare parts & train islanders in how to repair themselves
· The technology is still in an early phase and is “untried and untested”

Estimates for energy generation using Photovoltaic Panels

Total of PV (equivalent to Vortex):

$$\frac{700{,}016kWh\ per\ year\ demand}{140.6kWh\ per\ year\ generation} = Approx.\ \mathbf{4979m^2\ Photovoltaic\ Panels}$$

Advantages of this scheme:
· No moving parts
· Easy to repair and install
· Modular solutions
· Possibility of creating PV array structure with potential to hold market/shelter underneath

Disadvantages of this scheme:
· Takes large area of ground space
· Not best suited to Tristans climate due to low solar exposure
· More expensive than Vortex Bladeless (£1.43/kWh return on first year)

Suggested Scenario: Estimates for energy generation using mixed renewables

After discussion it was decided that PV should supply the domestic buildings as it has been tested and found reliable and would be easy to implement in a modular method to phase in groups of dwellings at a time. Although Vortex Bladeless is less tested it has a high power output and could be located within a reasonable proximity of the governement buildings whilst in a strategic position to harness the prevailing wind.

Supplying the domestic buildings using PV: 320,000kWh

$$\frac{320{,}000kWh\ per\ year\ demand}{140.6kWh\ per\ year\ generation} = Approx.\ \mathbf{2276m^2 Photovoltaic\ Panels}$$

Supplying the government buildings using Vortex Bladeless: 380,016kWh

$$\frac{380{,}016kWh\ per\ year\ demand}{8640kWh\ per\ year\ generation} = Approx.\ \mathbf{44\ Vortex\ Turbines}$$

As listed in the advantages of the PV, it is a modular system which could be gradually introduced based on savings made from previous investment. Each dwelling would require 19m^{2,} and the PV field could be increased in dwelling sized increments. We have suggested that PV should be installed as a centralised PV field (as done with the existing) due to the existing infrastructure which can be expanded, however if there are issues with a centralised infrastructure there is scope to install the PV locally to the dwellings on roofs.

The vortex Bladeless should try to utilise the extisting infrastructure of the PV arrays to save costs, however installation and infrastructure costs have been factored in in the order of cost estimate. Again, it is suggested that the turbines be phased in gradually, building by building, following the required number of turbines per building in the table below.

Building Number	Description	Energy Demand (kWh/annum)	Number of Turbines required per building
1	Supermarket/office/stores and internet café	95,040	11
2	Finance and Admin offices	53,280	6
3 & 4	Public Works Dept: Mechanical and General	77,520	9
5	Public Works Dept: Workshop and stores	65,280	8
6 & 7	Agriculture, Electric, Plumbing, Sawmill and Store	65,280	7
8	Telecomms: offices and stores	9,216	1
9	Conservation and Fisheries: offices, labs and stores	14,400	2
Total			44

3.0 Headline Appraisal of Cost Proposals
Renewable Strategy

Introduction

This Order of Cost Estimate is for the proposed redevelopment works in Tristan Da Cunha, to support the design ideas developed by Scott Brownrigg.
The works include the demolition and new build of existing government buildings, as well as the retrofit of 120nr residencies and sustainable energy strategy.

The level of detail shown at this feasibility stage only enables pricing to be derived on a £/residency. As the design progresses we will work with Scott Brownrigg to explore opportunities within the design to benefit from alternative construction techniques and materials. The basis of this estimate is purely for feasibility purposes. the proposed new build government building.

The estimate represents the anticipated construction cost at current prices assuming that all labour will be carried out by Tristan de Cunha residents. The costs are based on material costs only and do not account for shipping.

On the basis of the project brief and the limited design information available, we anticipate the outturn cost at current prices will be in the range of £5.75m to £6.25m. This estimate will be further refined as the design develops.

Exclusions

The following items are not included in this estimate of construction cost:
- Land acquisition
- Labour and plant.
- Shipping / transport costs
- Onerous and unexpected planning conditions
- VAT
- Inflation
- Finance costs, grants or taxation breaks
small tools / sundries required to manage and deliver the works.
-Professional Fees
- Antiquities / archaeology / UXOs
- No ecology issues
- The following information was used in the preparation of this estimate:
- Specific sustainable energy sources or other design factors relating to achieving
- End user fit out costs above those contained as part of this estimate
- No allowances have been made surveys; including SI, topographical,
ecology and noise etc.
- Ground stabilisation / remediation works; unless stated in cost plan
- External works
- New Build dwellings

Site Conditions

Tristan da Cunha has an area of 98 square kilometres. The island is generally mountainous. The only flat area is on the north-west coast, which is the location of the only settlement, Edinburgh of the Seven Seas. The highest point is a volcano called Queen Mary's Peak 2,062 metres

The remote location of the islands makes transport to the outside world difficult. Lacking an airport, the islands can be reached only by sea

There are existing government buildings (1,318m2) to be demolished to facilitate the proposed new build government building.

New energy infrastructure will be required as part of this project and we have allowed for new services to cater for capacities. These works include, but are not limited to, Photovoltaics and Vortex bladeless wind turbines.

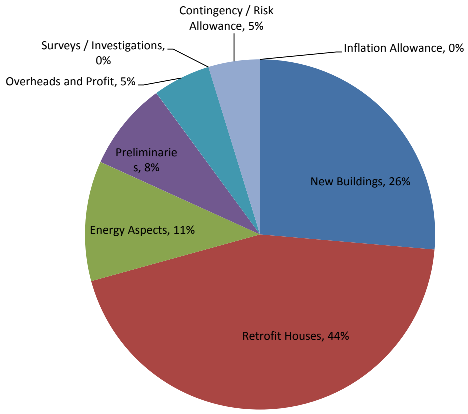
Due to the area of the site, we do not envisage any particular problems of site working requirements and restrictions.

Assumptions

- All labour will be sourced locally and not costed within the project budget.
- No Land transfers/purchases as part of the capital construction cost
- All retrofit quantities are based on a typical 12 x 8m dwelling.
- Assumed that any excavated material will be stored / piles on site.
- Professional fees for main consultants have been allowed for as a percentage of building works cost based on projects of a similar nature
- A contingency allowance to cover design/project risk has been allowed for at 5%
- Allowance has been made for management, site accommodation, services and small tools / sundries required to manage and deliver the works.

Summary

		Order of Cost	% of cost
New Buildings		1,694,100	26%
Retrofit Houses		2,848,560	44%
Energy Aspects		710,900	11%
	sub-total	5,253,560	82%
Preliminaries		522,729	8%
Overheads and Profit	6.50%	341,481	5%
	Building Works Estimate	6,117,771	95%
Professional fees	see attached fee proposal		
Surveys / Investigations	exc	-	0%
Contingency / Risk Allowance	5%	305,889	5%
Inflation Allowance	exc	-	0%
	Order of Cost Total	6,423,659	100%



The table to the above outlines the costs exclusing professional fees (please see fee proposal) with a total order of cost coming to £6,423,659.

We would expect the works within the £4.5m estimated budget to prioritise the construction of the new build Government buildings, along with the environmental updgrade of the individual dwellings in most need of improvement in a phased programme.

Breakdown of costs

		Quantity	Unit	Rate	Total, £
1	New Buildings				£1,694,100
1.1	Allowance for demolition of existing single storey government buildings (1,318m2) New build timber portal framed building including longitudinal and roof bracing and side rails; concrete pad foundations with 200mm thick ground slab; insulated walls and roof; u-value 0.3W/m2k; including mechanical and electrical installations and fit out.	1	item	75,000	£75,000
1.2	Supermarket/office/stores and internet café	576	m²	700	£403,200
1.3	New finance and admin offices building	288	m²	700	£201,600
1.4	New public works department: Mechanical and general	465	m²	700	£325,500
1.5	New PWD workshop and stores	384	m²	700	£268,800
1.6	New agriculture, electric and plumbing, sawmill and store	384	m²	700	£268,800
1.7	Telecomms offices and stores	96	m²	700	£67,200
1.8	Conservation and Fisheries	120	m²	700	£84,000

The new builds (government buildings) have been priced on a competitive but realistic £/m² method that allows for flexibility in design options with ability to downscale the proposed new builds for a limited budget.

		Quantity	Unit	Rate	Total, £
2	Retrofit Houses				£2,848,560
2.1	Remove existing ceiling to accommodate warm roof	5,760	m²	5	£28,800
2.2	New plasterboard ceiling fixed to rafters to form warm roof; taped and jointed	6,624	m²	15	£99,360
2.3	150mm thick rigid insulation overcladding external walls	14,160	m²	25	£354,000
2.4	13mm plywood to external walls	14,160	m²	10	£141,600
2.5	EPDM cladding to externa walls	14,160	m²	8	£113,280
2.6	150mm rigid insulation to existing pitched roof	13,680	m²	28	£383,040
2.7	Corrugated tin roof	13,680	m²	11	£150,480
2.8	25mm insulation to floor	11,520	m²	5	£57,600
2.9	Allowance for new floor finish	11,520	m²	20	£230,400
2.10	Remove existing windows and replace	984	m²	250	£246,000
2.11	Remove existing external doors and replacewith insulated external doors	240	nr	700	£168,000
2.12	Form opening and install Rooflights	120	nr	1000	£120,000
2.13	Form opening in external wall to create entrance to greenhouse - lintel only	120	nr	150	£18,000
2.14	Allowance for redecoration of existing properties	120	nr	1000	£120,000
2.15	Solar greenhouse extension	3,600	m²	100	£360,000
2.16	Water saving duel flush toilets and eco shower heads	120	nr	250	£30,000
2.17	MVHR system - 94% efficient or above	120	nr	1500	£180,000
2.18	Grey water collection system	120	nr	400	£48,000

The retrofit houses have been costed using an elemental breakdown to give an accurate cost estimation and to allow for partial retrofit to meet budgetary requirements. A full retrofit costs £23,738 per dwelling, however many of the dwellings may not require such extensive measures.

		Quantity	Unit	Rate	Total, £
3	Energy Aspects				£710,900
3.1	Photovoltaic Panels	2276	m²	200	£455,200
3.2	Vortex Bladeless	44	nr	5000	£220,000
3.3	Allowance for supporting infrastructure to deliver energy	1	item	35700	£35,700

The renewable generation strategies have been discussed in the technical response, however it is clear that a budget for supporting infrastructure has been allowed.

		Quantity	Unit	Rate	Total, £
5	Contractor Preliminaries				£522,729.22
5.1	Management and staff	1	item	5.00%	£262,678.00
5.2	Site Accommodation	1	item	1.00%	£52,535.60
5.3	Services and facilities	1	item	0.70%	£36,774.92
5.4	Mechanical plant and tools	1	item	0.75%	£39,401.70
5.5	Sundries	1	item	0.50%	£26,267.80
5.6	Fixed Price costs	1	item	2.00%	£105,071.20

An allowance for contractoral preliminaries has been allowed and is based on informed percentage rates.

4	External Works
4.1	Assumed carried out by on Island labour, using naturally produced materials
4.2	Allowance for Hard Landscaping
4.3	Allowance for Soft Landscaping
4.4	Allowance for External Furniture
4.5	Allowance for access road / infrastructure
4.6	Allowance for external lighting of pedestrian areas
4.7	Allowance for security lighting and CCTV

7	Surveys
7.1	Ground investigation survey
7.2	Noise impact survey
7.3	Ecology survey
7.4	Rights of light
7.5	Traffic impact assessment
7.6	Mapping of existing services
7.7	CCTV drainage survey
7.8	Archaeological Study

New Build Opportunities

In addition to the overall cost we have compiled data on the price of new builds. This has not been included as part of the order of cost total as there is not method for predicting how many will be built in the near future, however the design and construction relates to the governement buidings design and technical principles and therefore should be included.

The table below breaks down the elemental costs for the construction of an individual 3 person dwelling:

			Quantity	Unit	Rate	Total
0	**Facilitating Works**				**Total**	**420**
	Site clearance		80	m2	5	400
		Design risk				20
1	**Substructure**				**Total**	**6,350**
	Excavate to reduce levels and compact surfaces - assumed by local labour		1	item	-	
	150mm concrete ground slab		76	m2	40	3,040
	Strip foundations; 150mm concrete slab		38	m2	80	3,008
		Design risk				302
2.1	**Frame**					**7,182**
	Allowance for timber portal frame, including all connections and bracings		76	m2	90	6,840
		Design risk				342
2.2	**Upper Floors**					
		Design risk				
2.3	**Roof**					**5,775**
	Pitched roofs; Structurally insulated timber panels; including battens, counterbattens and purlins; black sinuoidal metal roof		93	m2	50	4,650
	Rooflights		1	nr	850	850
		Design risk				275
2.4	**Stairs and Ramps**					
		Design risk				
2.5	**External Walls, Windows, Doors**					**3,150**
	150mm sheeps wool insulation encased in plywoodwith EPDM external finish		91	m2		
	Insulated entrance door		1	nr	750	750
	Glazing		9	m2	250	2,250
		Design risk				150
2.6	**Internal Walls and Partitions**					**2,321**
	Timber stud internal partitions, insulation, lined with plasterboard, taped		34	m	65	2,210
		Design risk				111
2.7	**Internal Doors**					**4,095**
	Softwood internal doors - single		7	nr	450	3,150
	Softwood internal doors - double		1	nr	750	750
		Design risk				195
3	**Internal Finishes**					**4,627**
	Plasterboard the ceilings		79	m2	10	788
	Plasterboard to internal face of external wall		91	m2	10	910
	Emulsion paint to walls		159	m2	5	795
	Emulsion paint to ceilings		79	m2	5	394
	Allowance for floor finishes; inc skirtings		76	m2	20	1,520
		Design risk				220
4	**Fittings, Furnishings and Equipment**					**4,620**
	Kitchen		1	nr	3,000	3,000
	WHB		2	nr	250	500
	WC		1	nr	250	250
	Shower including tray, wastes etc		1	nr	650	650
		Design risk				220
5	**Services**					**6,379**
	Disposal installations; waste, soil and vent installation, uPVC pipework and fittings		76	m2	6	456
	Water installations; hot water		4	nr	250	1,000
	Water installations; cold water		4	nr	250	1,000
	Space heating and ventilation; electric high efficiency boiler, distribution pipework and panels		76	m2	30	2,280
	Electrical installations; mains and sub mains connection, small power distribution, cooker		76	m2	20	1,520
	Allowance for builders work in connection (10%) - assumed no cost from local labour		1	item	-	
		Design risk				123
6	**External Works**					**3,990**
	Roads, path and pavings		1	item	1,000	1,000
	Soft landscaping, planting etc.		1	item	500	500
	Fencing, railings and walls		1	item	300	300
	Drainage		1	item	500	500
	External services and connections		1	item	1,500	1,500
		Design risk				190

Summary

0	Facilitating Works	420
1	Substructure	6,350
2	Superstructure	22,523
3	Internal Finishes	4,627
4	Fittings, Furniture & Equipment	4,620
5	Services	6,379
6	External Works	3,990

4.0 Proposed Design Team

Architect: Scott Brownrigg Design Research Unit (DRU)

DRU is an ideas-led centre of expertise at the heart of Scott Brownrigg. It is simultaneously a knowledge base, think tank, school, driver for change, research and development body and ideas fulcrum. It tackles issues across the design, technological, sustainability, economical and sociological factors that impact on the built environment.

Through collaboration, both internally and with external bodies, the unit will lead the way in incubating original thought. It will develop intelligent design and innovative technical solutions to address the specific challenges presented to our industry. Its shape, role and membership shifts according to the idea that is being developed.

The Scott Brownrigg team consists of Neil MacOmish (Group Board Director), Stephen Quin (Project Director BA Hons Arch, DipArch RIBA), Stephanie Adamou (Architectural Assistant RIBA Pt2), Priit Jurimae (Architectural Assistant RIBA Pt2), Eleanor Shelley (Architectural Assistant RIBA Pt1), and Professor Wayne Forster (Scott Brownrigg Chair in Design Research and Deputy Head of the Welsh School of Architecture).

Our key project experience includes: International Sports Village, Cardiff (with Arup) £200m; Gateway to the Valleys School, South Wales (with Arup) £39m; Cardiff Pointe residential development (with Arup) £120m; while Neil MacOmish and Wayne Forster have also collaborated on Margam Park Discovery Centre and Annedd Assisted Living. Wayne is also part of the team responsible for the Solcer House, the UK's first purpose-built low-cost energy-smart house. Through Scott Brownrigg's membership, Neil and Stephen are part of the Low Carbon Research Institute investigating low carbon design solutions in residential and education sectors.

Structural & Services Engineer: Arup

The Arup team consists of Paul Webber, (Director BEng Hons) Elaine Veaudour (Senior Mechanical Engineer CEng MIMechE MIHEEM), John Payne (Electrical Engineer), Catriona Gillies (Structural Engineer CEng MIStructE- Catriona has worked on secondment to the British Antarctic Survey at Halley V Research Station), and Ewan Smith (Structural Engineer MEng Hons).

The Arup team's recent experience includes in addition to the work with SB above: Snowdon Summit Building Visitors Centre; St Helena Airport and Hotel; National Trust Stackpole Centre, Pembrokeshire. Paul leads work for the Carbon Trust, providing sustainability and low carbon advice to a wide range of clients.

Cost Consultant: Mace

The Mace team consists of Alex McCusker BSc (Hons) MSc MRICS, a Chartered Quantity Surveyor and Senior Cost Consultant. Alex has extensive expertise in delivering both pre and post contract duties as well as specific client requirements, with experience in all main building sectors. He has worked with various public sector bodies and is well educated in providing financial advice and management from initial outline business case through to project delivery and completion. He understands the importance of accurate cash flow forecasts and risk management throughout a project to assist in controlling capital investment. Having assisted in the preparation of business cases and strategic outline cases he can offer competent advice and knowledge.

Key project experience includes: Masterplan for University of the West of England (£450m), Bettws High School, South Wales (£23m), Bristol Institute of Technology (£27m).

More detailed team and project experience (CV's) can be supplied on request.

5.0 A3 Reductions of A2 Design Sheets

NO MAN IS AN ISLAND

Overall approach

1

URN T7

GENIUS LOCI : Building on the Past

'No man is an island'

A person's connections to his or her surroundings.

Heritage

First, uniting structures with their setting and make it feel part of *nature* – second, the necessary but unique capacity of its inhabitants to collaborate and co-operate in the act of *building and habitation.*

These traditional methods are further analysed and enhanced in the response to *siting, topography, climate and nature.*

The Tristan da Cunha through native wit and intelligence to create a sustainable way of life; this is often referred to as:

'**Genius loci'**

WEATHER: Tristan Vernacular

Settlement Pattern

Buildings on the island are customarily sited East – West. The way the settlement has evolved to create this linear arrangement is no coincidence. House fronts look out to the sea, making the most of the sun and the views, whilst the minimise confrontation with strong westerly winds.

Dwelling Clusters

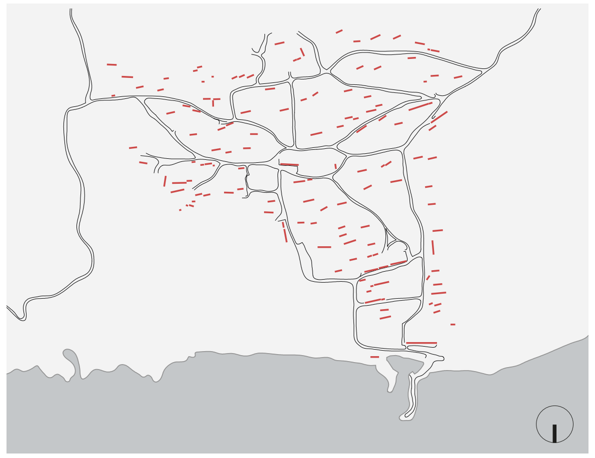
The form of the settlement is founded on the fundamental pragmatic need for community in such a remote place but also for an inimitable respect for the individual within community – primary, independence and self situated in a wider congregation. This results in clusters of dwellings on individual plots all within easy reach of communal facilities.

Sheltering Landscapes

The buildings and outside spaces are currently partially protected by shelterbelts. The proposal is to reinforce these and to introduce new ones. Strategically placed these provide protection from the elements and formulate the exterior public spaces.

Forms

Building form is a direct response to climate and weather. We refer to both for whilst the former can be 'read' from published data and used to inform design we are also acutely aware that people experience and 'sense' weather – particularly in its extremes.



'Kit of Parts'

The new proposals are all based on a modular portal frame which allows for a common construction process amongst building types. Structural components have been modularised to simplify their preparation, shipping and assembly on site. They have also been designed to be smaller than the 6mx6m offloading raft size for easier delivery to the island and better manageability during construction.

Transportation

Material choices have been made as to utilise Tristan da Cunha's resources and minimise the amount of material that has to be transported. The use of local rock in the new government buildings also reinstates the local character.

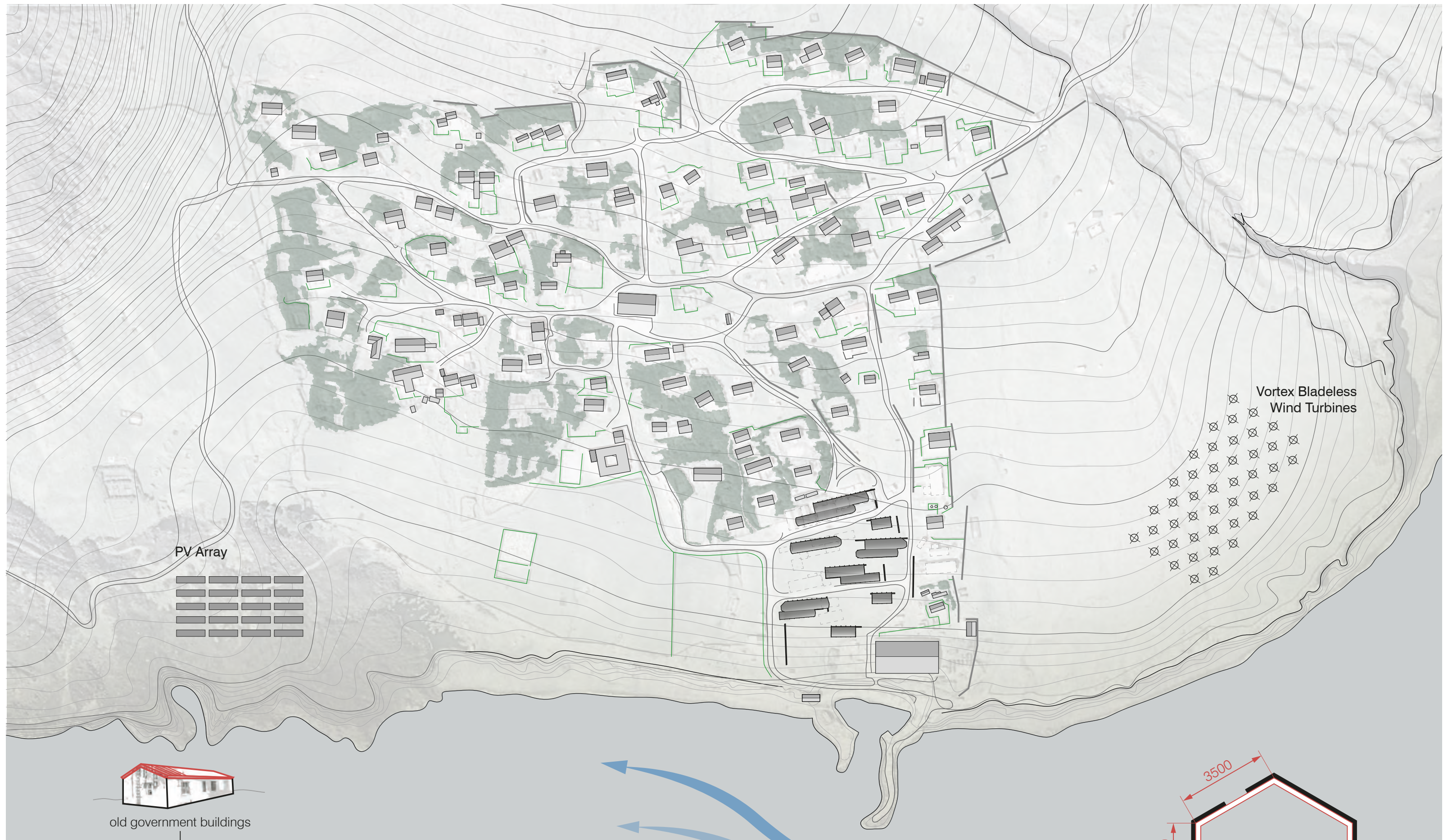
Phasing

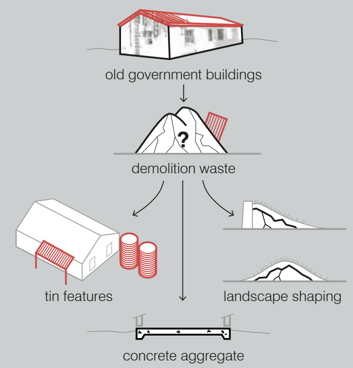
The strategies adopted minimise disruption to the residents and eliminate the need for building temporary structures for the relocation of users. The new civic centre in particular has been designed around the existing buildings in a phased manner, to facilitate relocation of use until building completion.

Government buildings phasing

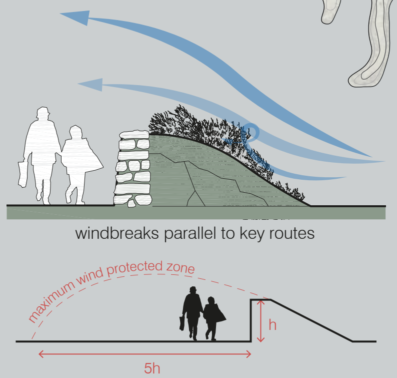
demolition

construction

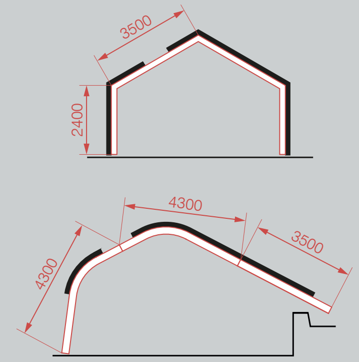




A Demolition waste management



B Wind protection



C Shared construction principles

NO MAN IS AN ISLAND
Dwellings

Harmony and contrast

Buildings on Tristan are in harmony with surrounding landscape, shaped by the climate and local circumstance. The settlement is aligned to the coast, most house fronts looking out to the sea and thus making the most of the sun and the views. On the other hand, as in the left-hand sketch, the colourful tin roofs and whitewashed walls stand out from dark volcanic rock, making a distinct statement of presence.

Thresholds, form, material

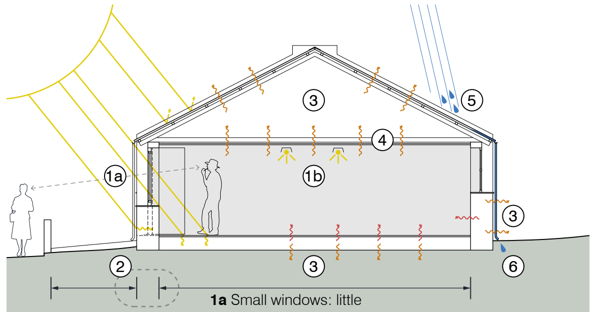
Soft forms of enclosure, like vegetation and low walls, maintain the threshold between private domestic realm, public spaces, and windswept landscapes. The buildings themselves have a distinct pitch, giving them a unique form. Their character and materiality are an expression of the island's identity – remoteness, togetherness, harmony with nature.

Tradition and innovation

Retrofitting will enhance the aspects of harmony and contrast. Improvements to the fabric of the building help reduce energy expenditure and reliance on fuel supply, as will greenhouse annexes, roof-lights and new services. The use of local resources ties the dwellings to their context. EPDM cladding is also appropriate for the harsh climate but the dark material becomes a background for features like recycled tin overhangs and colourful water butts. The dwellings become like landscape in the sketch above, with gleeful features against a muted background.

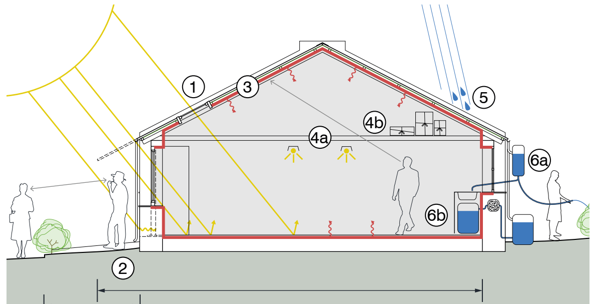
A new typology

The new dwellings are an evolution of the existing. They share a structural system and construction principles with the new build government buildings: portal frame structure and EPDM cladding. The structure is easy to assemble and modular so it can be extended when needed. Open space within can be customised, divided and rearranged as required.



Existing dwelling issues

1a Small windows: little light and solar gain
1b Low daylight: reliance on artificial light
2 Indoor and outdoor spaces do not overlap
3 No insulation: heat loss
4 Low ceilings
5 Tin/Onduline roof: noisy during rain
6 Rainwater lost

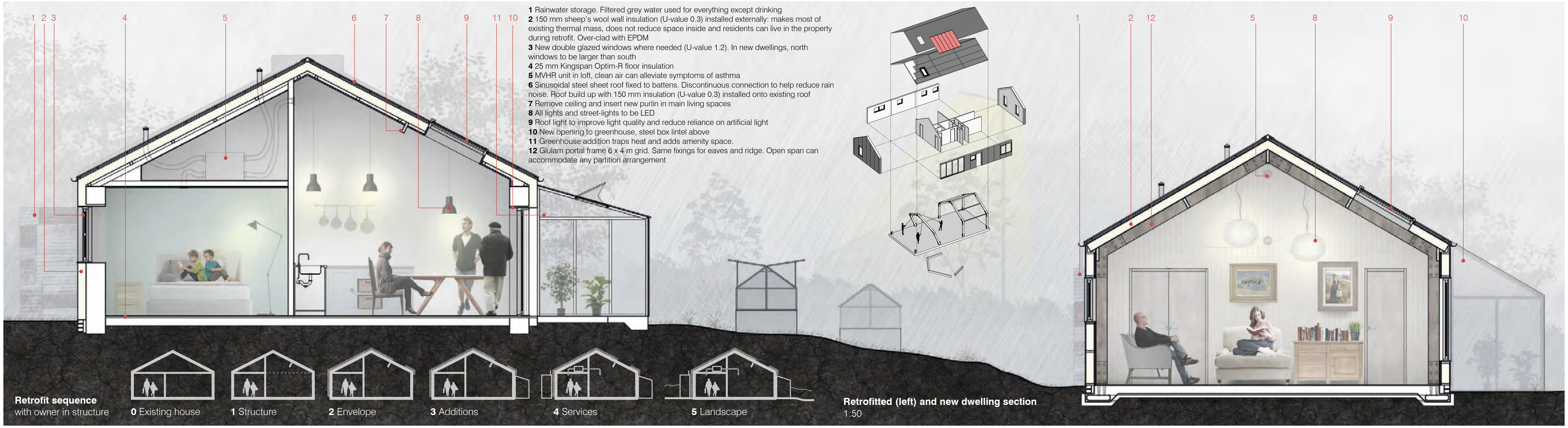


Retrofitted dwelling

1 Roof light
2 Intermediate spaces
3 Sheep's wool insulation
4a Ceiling removed
4b Easy-access storage
5 Acoustic interlay
6a Rainwater tank
6b Rainwater purified by volcanic filters

Windbreak

Basic (top) and extended new dwelling type plans
1:250



1 Rainwater storage. Filtered grey water used for everything except drinking
2 150 mm sheep's wool wall insulation (U-value 0.3) installed externally: makes most of existing thermal mass, does not reduce space inside and residents can live in the property during retrofit. Over-clad with EPDM
3 New double glazed windows where needed (U-value 1.2). In new dwellings, north windows to be larger than south
4 25 mm Kingspan Optim-R floor insulation
5 MVHR unit in loft, clean air can alleviate symptoms of asthma
6 Sinusoidal steel sheet roof fixed to battens. Discontinuous connection to help reduce rain noise. Roof build up with 150 mm insulation (U-value 0.3) installed onto existing roof
7 Remove ceiling and insert new purlin in main living spaces
8 All lights and street-lights to be LED
9 Roof light to improve light quality and reduce reliance on artificial light
10 New opening to greenhouse, steel box lintel above
11 Greenhouse addition traps heat and adds amenity space.
12 Glulam portal frame 6 x 4 m grid. Same fixings for eaves and ridge. Open span can accommodate any partition arrangement

Retrofit sequence
with owner in structure

Retrofitted (left) and new dwelling section
1:50

NO MAN IS AN ISLAND
Community buildings

3

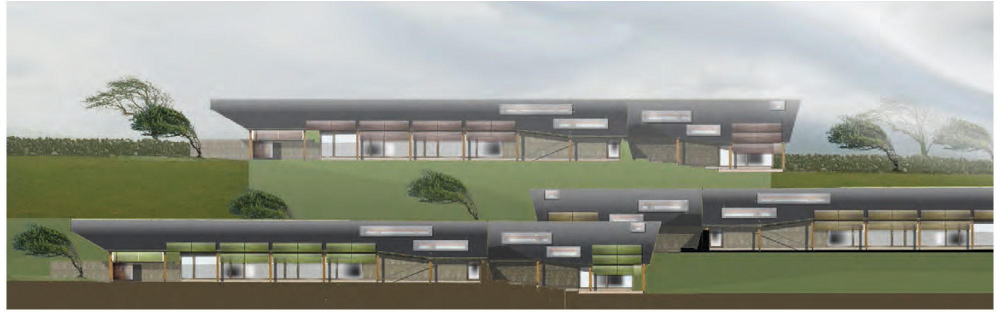
URN T7

The scheme proposes the development of a new civic centre for the local community, which will encompass the redesigned government buildings. Inspired by the upturned boats found on the island, the architecture and character evoke the idea of local residents pulling their boats up to shore.

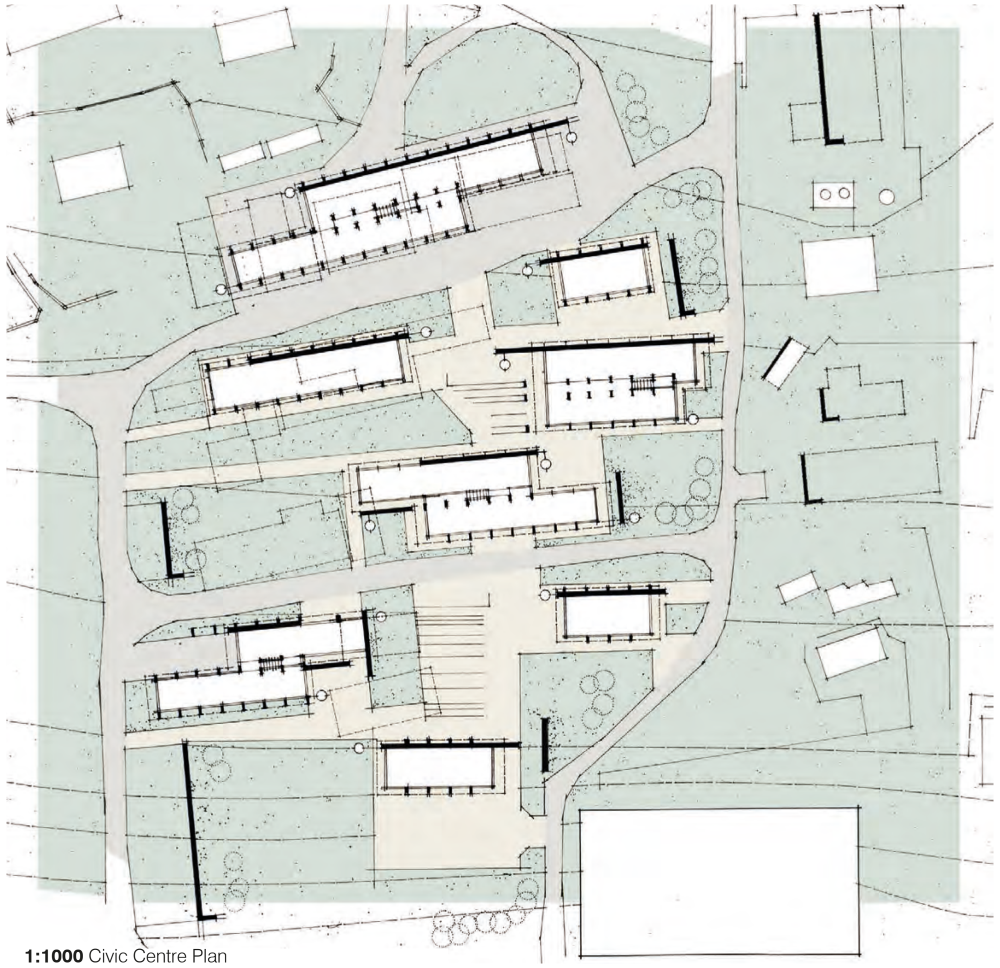
The organisation of the buildings follows on the concept of linearity that is observed in the existing settlement pattern. Arranged in harmony with the rest of the settlement, the buildings slide past eachother to frame public spaces that vary in scale and intimacy and provide shelter from the wind. The use of walls currently on the island for shelter is also articulated through the arrangement of gabion walls, which both provide shelter and frame exterior spaces.

Boating on Tristan

The new buildings use a portal frame construction system inspired by the history of boat-building on the island. Each frame is built up of standard components, which do not exceed the maximum 6mx6m dimension of the offloading rafts. The portal frame system can be repeated and combined in different ways as illustrated by the sections below to accommodate for the different building uses and sizes. The construction process using a encourages collaboration and can be repeated throughout. The roof is clad in EPDM, a durable, weatherproof and low maintenance material.

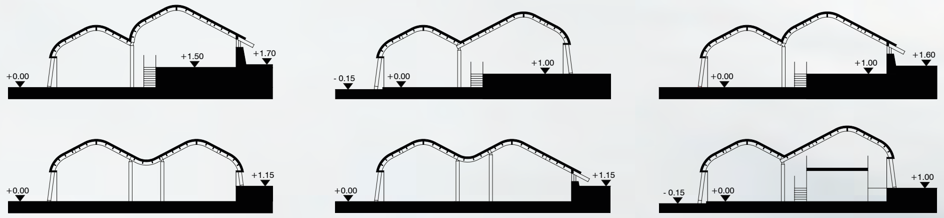


1:400 Elevation Studies

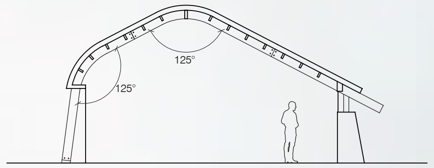


1:1000 Civic Centre Plan

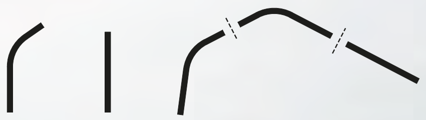
Axonometric Study

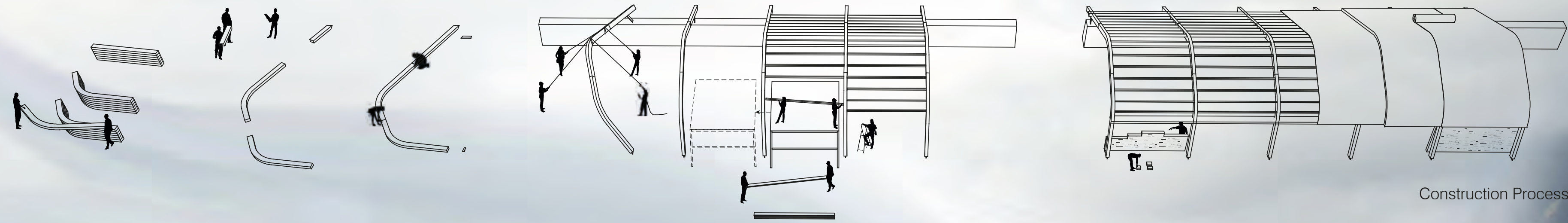


1:400 Combination Sections



Standard Cross Section





Construction Process

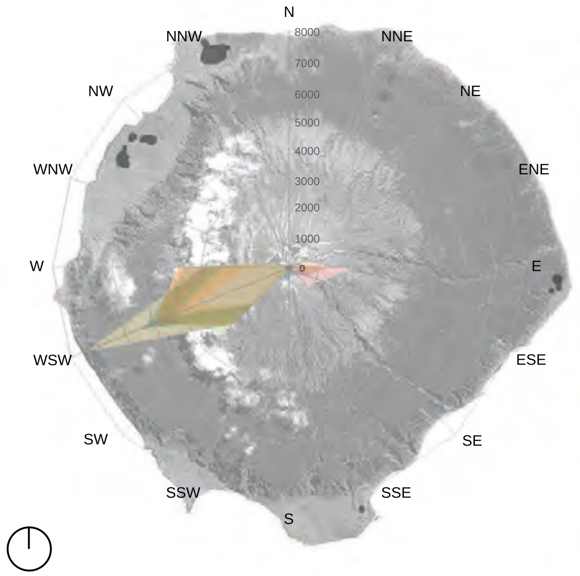
Government Buildings

The form of the building is a direct response to the island's climatic conditions. Wind is allowed to pass over the exterior shell and as this happens the building grips the ground. The north facade has higher amounts of glazing to allow for views to the see and higher solar gains. On the south facade facing the higher winds, the roof drops closer to the ground. A strip of window allows light through just over the gabion wall, which anchors the building to the ground. The exploration of the cross section and the distinct treatment of the two facades create a continuous dialogue between the building and the surrounding landscape, through the utilisation of the changing levels. This along with increased thermal comfort, better natural light and higher flexibility of space, create a better working environment for the residents of Tristan da Cunha.

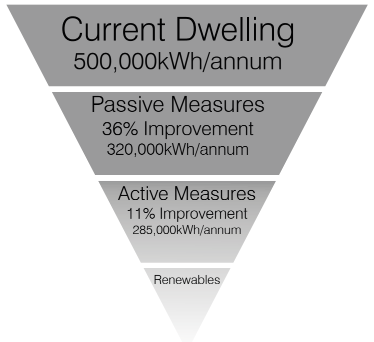
1:50 Sectional Perspective

NO MAN IS AN ISLAND
Energy systems

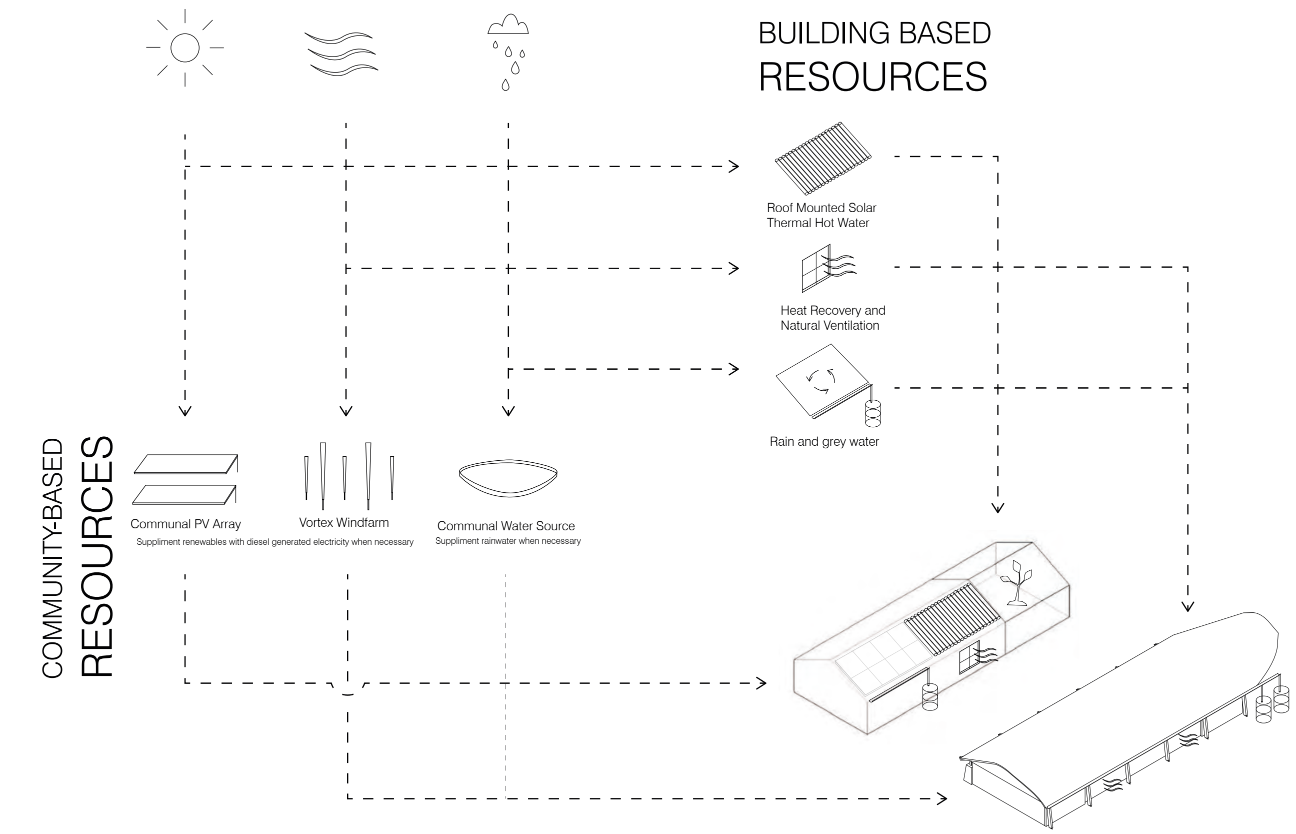
4
URN T7



The **primary energy strategy** is to **reduce demand** for generated power on the island:
Firstly through passive measures that will last as long as the building and require **minimal, inexpensive maintenance**
Secondly through active measures such as exchanging energy intensive equipment for less demanding versions



Once demand has been reduced, the new targets can be meet through generation via renewable generation.



CURRENT ENERGY USAGE AND TARGETS

Currently dwellings use between 50-250kWh/m, with an approx. U-Value of 1.83W/m²K. Based on Climatic analysis insulating dwelling to an **optimum U-Value of 0.3** could reduce heat-loss (and save energy)by 36%. Replacing inefficient equipment such as incandescent lightbulbs with energy saving LED's could save a further 11%. This analysis has lead us to a fabric first strategy, meeting the lowered demand with a range of renewables.

COMMUNITY-BASED RESOURCES

Energy:
Built-up stone walls mitigate wind chill and create shelter.
Power will be provided via **renewable generation**: primarily **Vortex Bladeless** for the Civic Centre and expand the **PV arrays** to supply the dwellings.

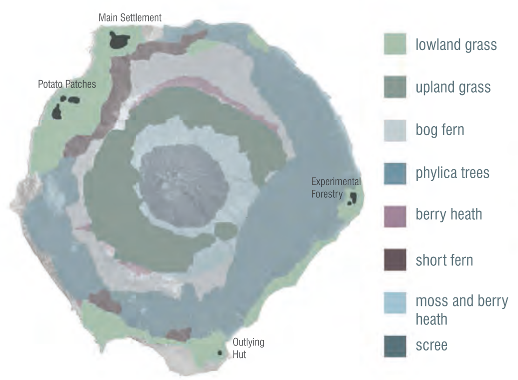
Water:
Communal water is more energy intensive with greater leakage and therefore use will gradually be phased out until only used to supply the government buildings.

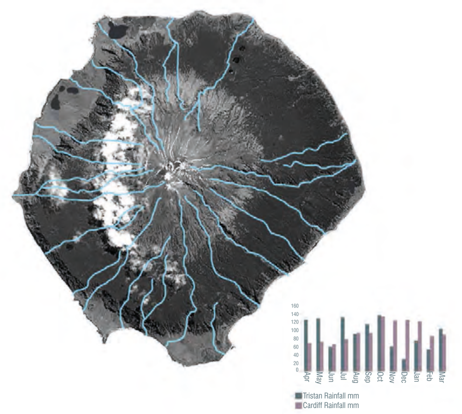
BUILDING BASED RESOURCES

Energy:
Potential to attach **solar hot water** panels to dwellings following studies on those already installed on Island. Based on our calculations a typical 3 person dwelling will require 3m² costing £3600 (allowing for installation costs).

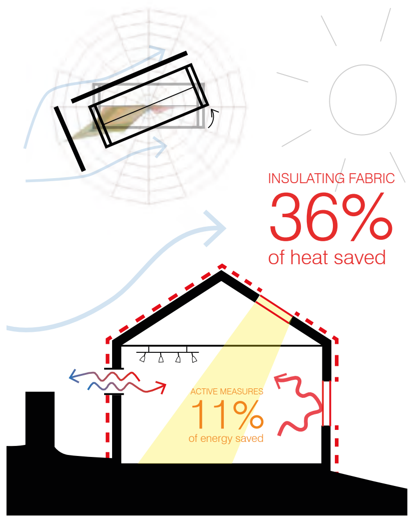
Water:
To reduce dependence on the struggling water sources water based systems will shift to each dwelling. **Rainwater will be collected** from the roof and filtered for domestic use. Maximise efficiency with smart use of water within the dwelling, recycling grey water for other uses etc.(i.e. flushing toilet)

Food:
Dwelling based micro-greenhouses that if successful can also be replicated on a communal level.





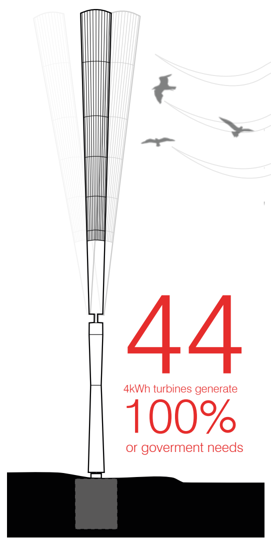
Many of the passive measures taken respond directly to Tristan's climate and build upon the measures existing on the island already. The use of dry stone walls running perpendicular to the prevailing wind provide shelter, whereas the length of the buildings generally run parallel to the wind to become aerodynamic - measures implemented in the government design. Most buildings face north to utilise the light and solar gains, a strategy that has been advanced with the introduction of north facing greenhouses and roof lights. The pitch roof typology designed to drain water has been utilised to collect water for domestic and government use. These measures are part of Tristan's existing typology but have been developed to create sustainable, low cost place oriented responses to climate.



FABRIC FIRST

By insulating the new and existing buildings to an **optimum U-Value of 0.3W/m²K**, significant energy reductions of 36% can be made. This can be achieved by applying insulation externally and replacing the window and doors with thermally sealed versions.

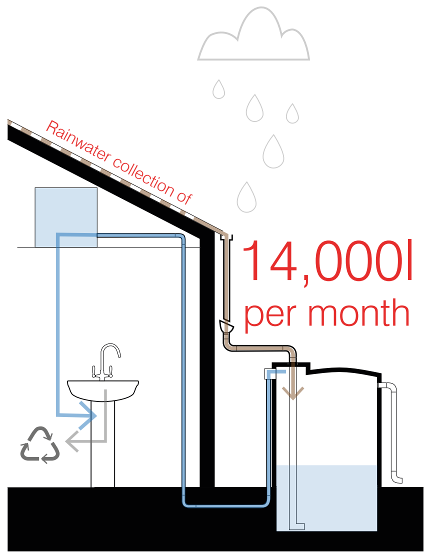
A mechanical heat recovery system can ventilate the building and maintain high indoor air quality without loosing and heat or energy. Small scale active measures such as LED lighting can **reduce energy demand by 11%** and have a long lifespan reducing future shipping demands.



ENERGY GENERATION

Vortex Bladeless turbines are well adapted to convert the high Tristionian wind speeds into a sustainable source of power utilising wobble technology.
The sculptural bladeless generators blend into the landscape with minimal impact on the indigenous wildlife. **28 Turbines supply 100% of the government buildings** energy requirements with minimal maintenance and a long lifespan. The turbines also offer excellent value for money with a cost of £0.58/kWh for the first year.

Expanding the existing, tried and tested **PV arrays by 19m² per dwelling** can meet 100% of the reduced domestic energy demand and can utilise the existing PV infrastructure.

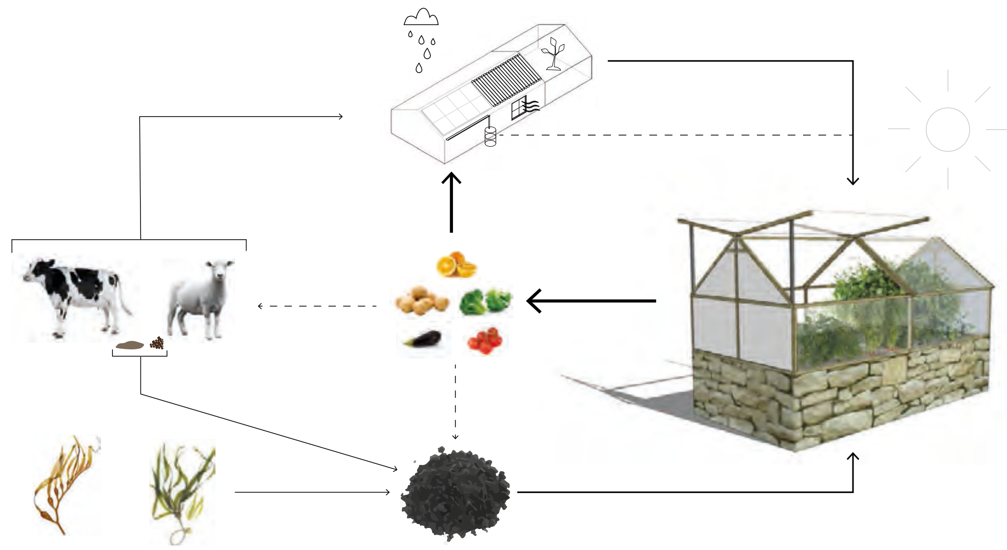


WATER COLLECTION

Tristan's roofs provide an inbuilt, low-cost method of collecting rainwater. The average roof of a 12m* 8m dwelling can supply **14,000l litres of rainwater a month** which should exceed the total use of a typical 3 person household, and reduce demand on the struggling water sources, costing about £650 per house. The system can be applied by Tristonians with the **capability for additional water storage** tank to save water for dry spells.

Specially water saving fittings and re-using grey from showers/ washing machines etc. also increases the available water for domestic use and can **provide for livestock and crops.**

FOOD CYCLE: MicroGreenhouses



Introducing micro-greenhouses offers an opportunity to trap heat, water and benefit from natural solar gains to harness the growing potential. Inexpensive raised beds creates an opportunity to line the plant bed preventing water from draining away combating a major agriculture issue on the island. Maintaining water enhances the nutritional benefits of fertiliser collected from animal waste and beach-washed seasweep and kelp. If successful can be replicated on a communal scale.