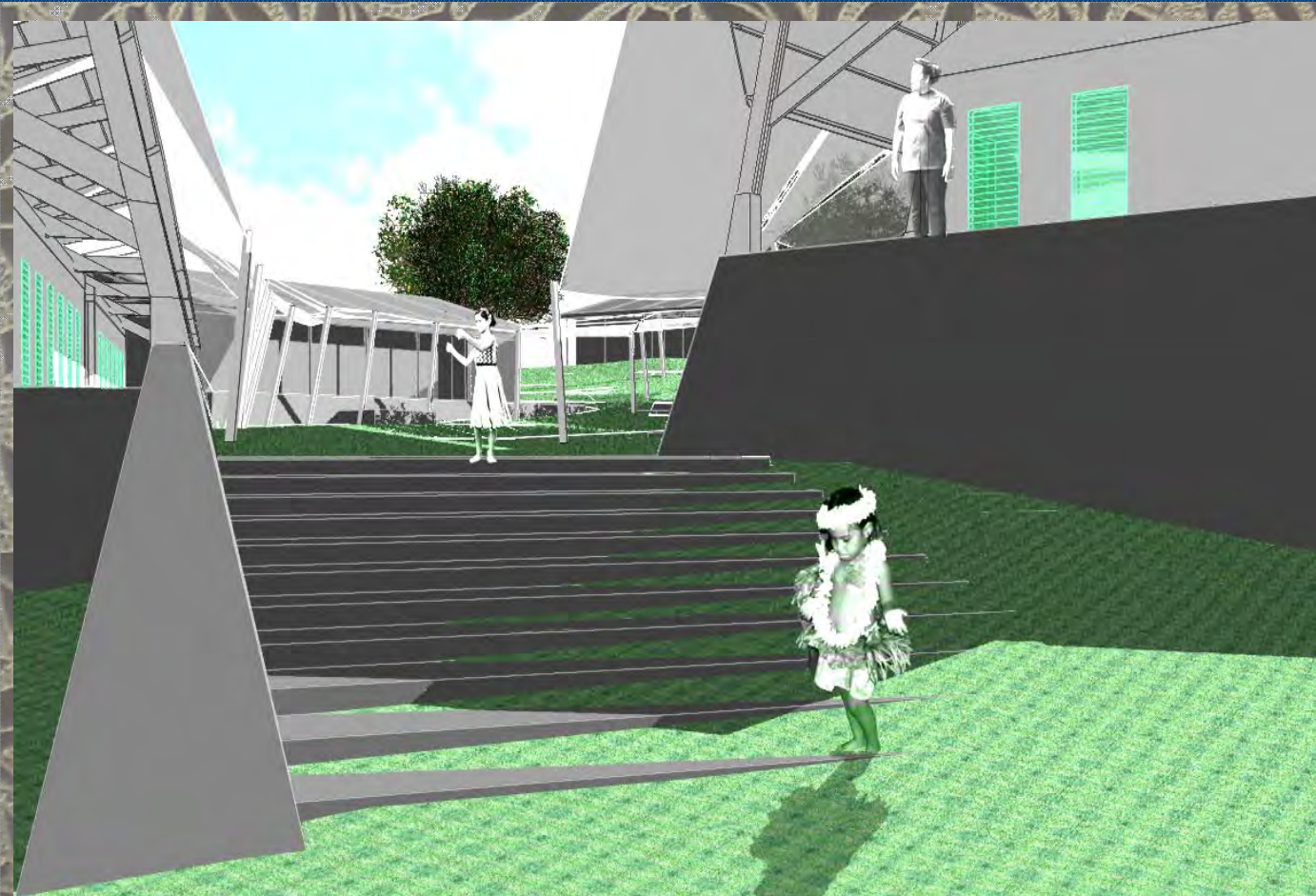
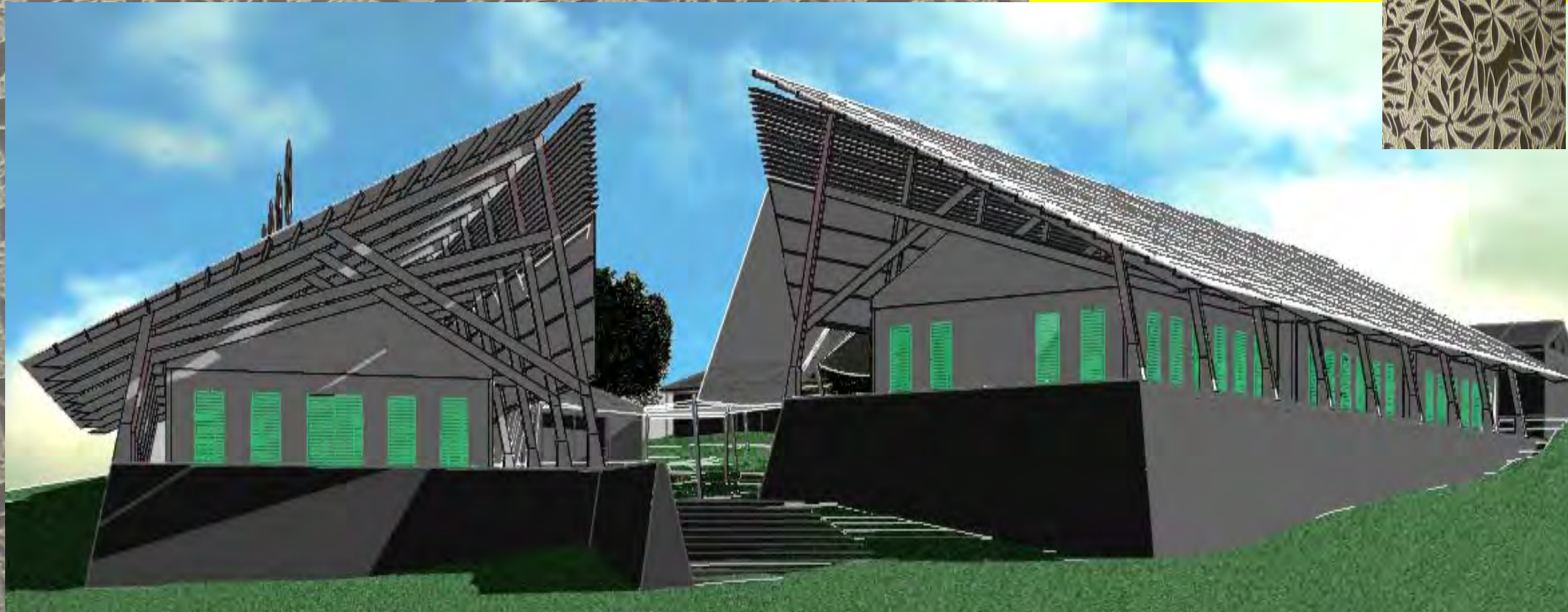


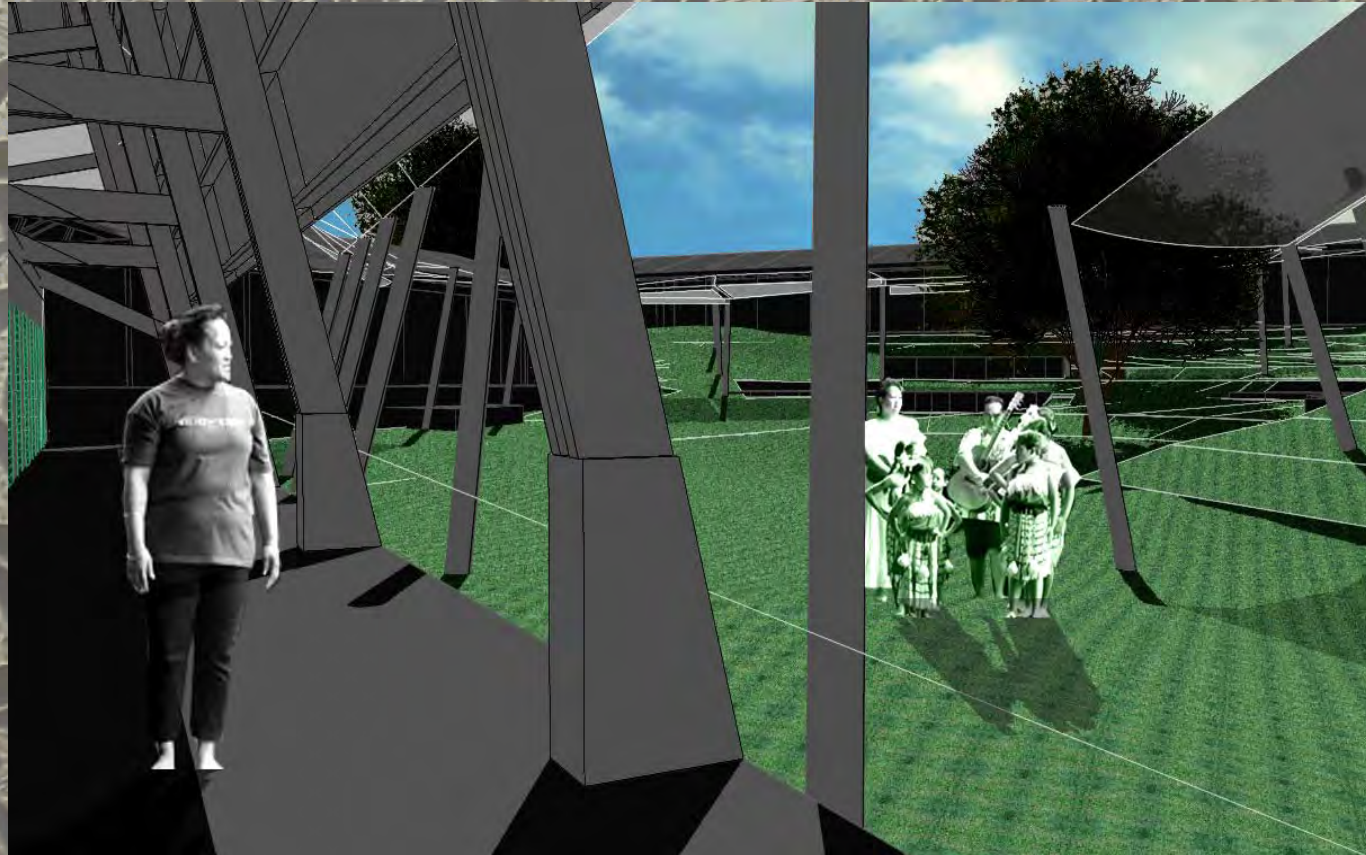
# COOK ISLANDS



## FIELD RESEARCH JOURNAL

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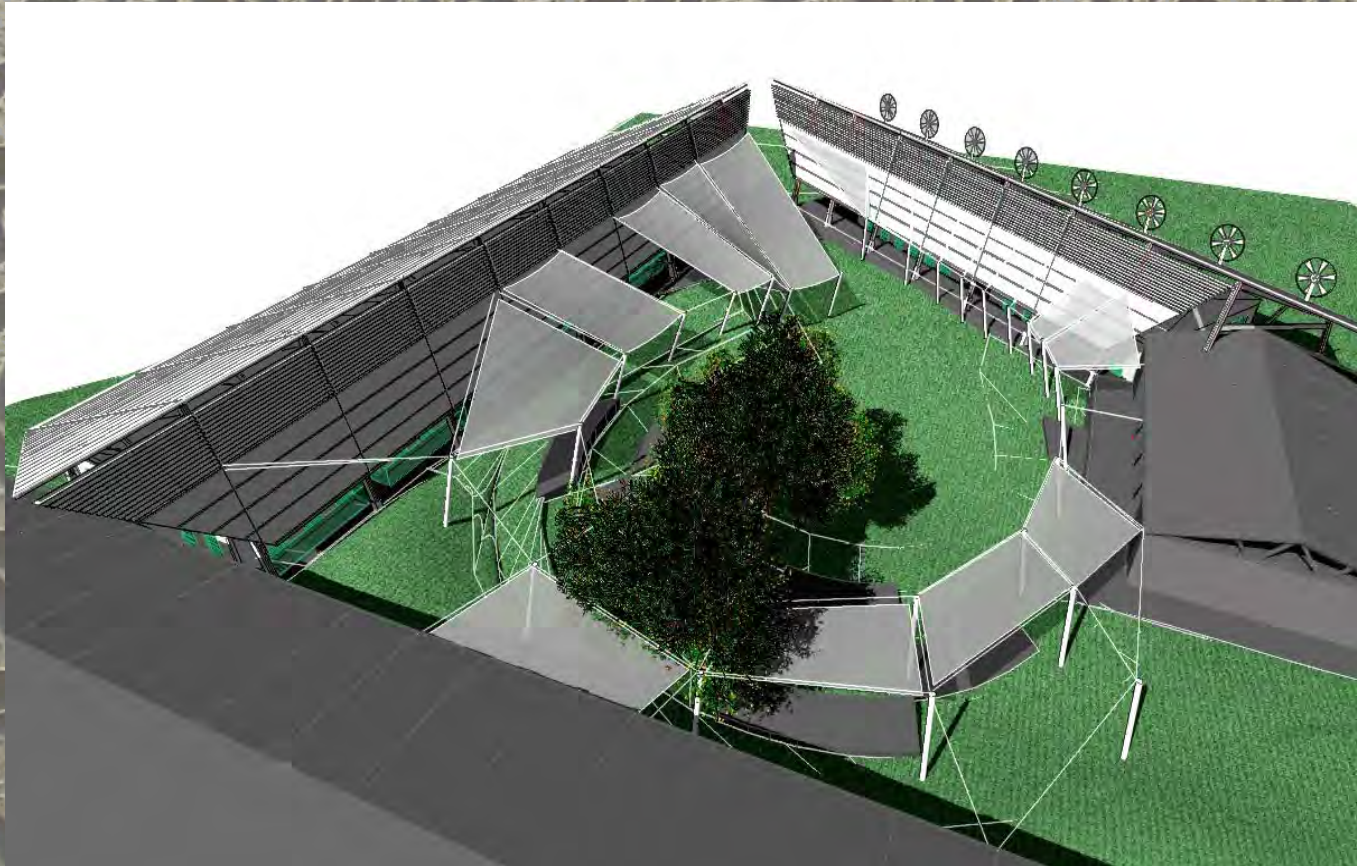


## FIELD RESEARCH

The new Cook Islands Ministry of Education building venture was developed as collaboration between the University of Melbourne's UNESCO Observatory and the Cook Islands Ministry of Education. The Ministry identified a need for a new administration building on Rarotonga, the nation's main island. The project was offered as a research/design subject for undergraduate and postgraduate students in the University's Faculty of Architecture, Building and Planning. This is a real-life design endeavour and was intended to encourage students to contend with complex cultural representation and environmental awareness while remaining conscious of a budget funded by foreign aid.

The Research and Design Trip occurred in September 2006.

Upon arriving on the Island and receiving the brief, we immersed ourselves in research. We developed a visual diary of existing buildings on Rarotonga and an inventory of traditional building styles throughout the other islands. Various activities highlighted the lifestyle of the Cook Islands and the traditional occupation of space and relationship to the landscape. A series of lectures and tutorials with local conservationists and representatives of the Ministry refined our knowledge of the local culture and environment to a point where we could begin to make informed design decisions.



The Building Solution maximizes the opportunity to protect the sensitive ecology of the island through the judicious use of technology and careful design. The scheme attempts dialogue with elements of traditional Polynesian culture and local identification with the landscape. The design addresses the high cost of energy, construction and materials on the island while balancing that with the need to employ local builders and suppliers.

A chance meeting with some local builders gave us a wealth of information on the local construction industry. With the National Library and campus of the University of the South Pacific at our disposal it was quite easy accessing other information ad hoc. The majority of the design documentation was undertaken on the Island with only the technology we brought with us.

Our designs and research were presented to the Prime Minister, local community, representatives of the Ministry and New Zealand Aid.

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# CULTURAL CONSIDERATIONS

The new Ministry of Education building addresses the possibilities of broader education within the island community without resorting to paternalistic interpretation. Issues such as climate solar design, energy reduction, water-sensitive sanitation, and construction techniques are inherent in the scheme and can inform other building projects in the Cook Islands. The proposal provides space and resources for auxiliary community uses. The adjacent sports ground has direct access to the canteen and lavatories for weekend games. The amphitheatre serves the local population by providing a secure and intimate partly covered outdoor space with associated facilities. The secure car park and boardroom in the lower ground floor are partly underground making an excellent cyclone shelter for the village of Nikao, where the building is located.



Large areas of open and covered outdoor space reflect traditional Polynesian outdoor living. The spaces are open and comfortable to make allowance for the tropical climate and the informal working arrangements of the Ministry staff. A range of shared facilities and informal circulation maximizes interaction between occupants. Circulation spaces are located outside the buildings and are connected to a lightly covered walkway that encircles the amphitheatre. Wide steps, corridors and lots of covered open space provide many outdoor working and recreation areas. A traditional food garden near the canteen makes a connection to the cultural landscape of the islands and provides an interactive, scented open, outdoor area.

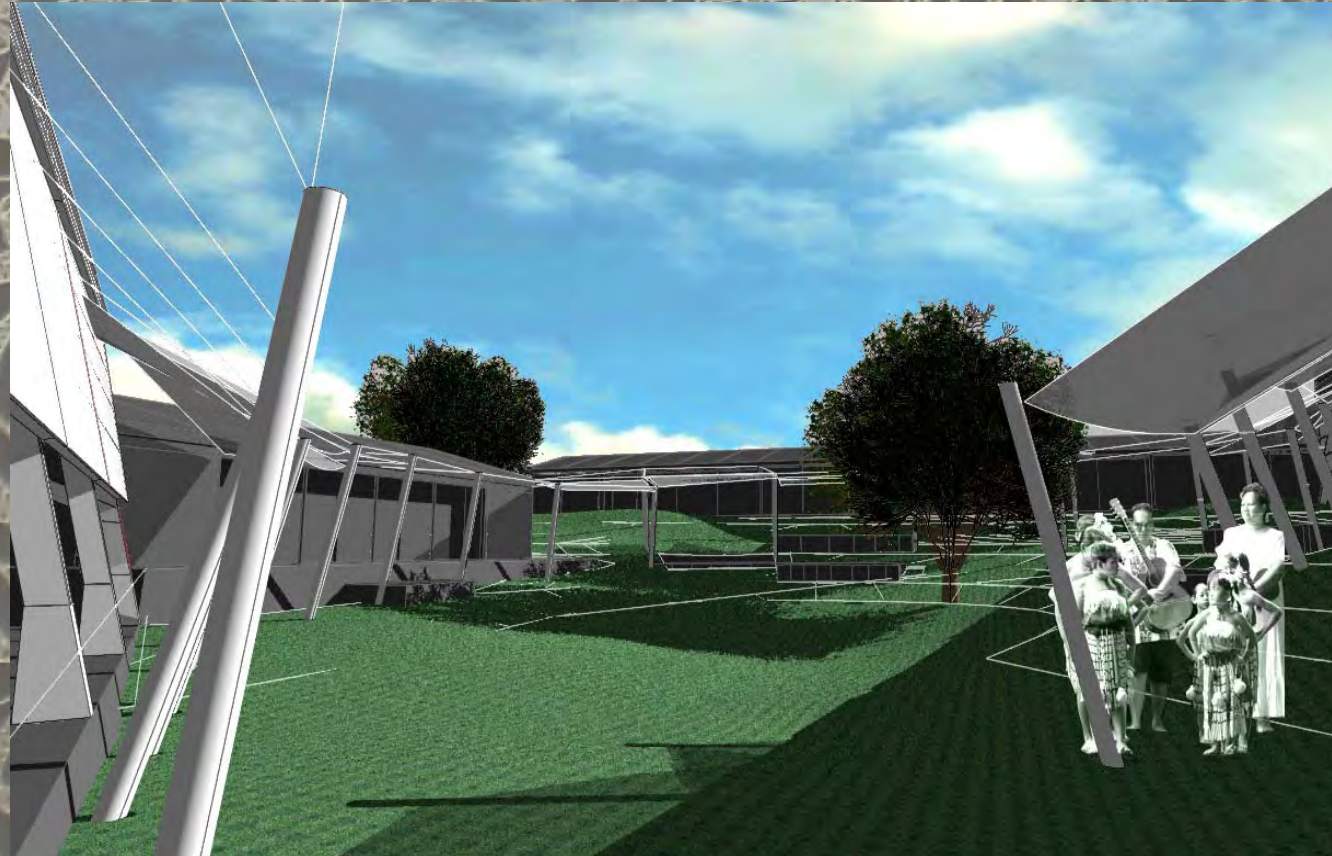
The amphitheatre in the middle, enclosed by the buildings, makes allusions to the marae or sacred space found in Polynesian landscapes. The marae is the customary place for important events in the clan including the award of honors and the teaching of lore; consistent with the modern Ministry's function. The formal part of a marae is the platform known as the paepae. The generous concrete base of the new buildings reflects the paepae in this scheme. Large, open spaces on the platform allow for a range of more formal activities as well as outdoor working space. The vast fly-roof that protects the building is a reflection of the ubiquitous large roof typology found throughout the South Pacific.

Projecting gables and expressed scissor beams bestow a uniquely Polynesian sentiment to the scheme.

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## ECONOMIC CONSIDERATIONS

The proposed buildings have been designed to maximize the use of local resources and skills with imported material where appropriate. The scheme employs sprayed concrete which is the cheapest masonry construction available on the island and has the added benefit of embedded insulation and minimal material use. Prefabrication of some elements, notably the engineered timber trusses, will reduce costs further.

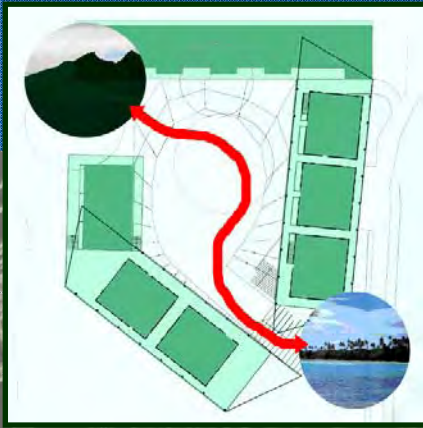


The quality of construction needs to make allowance for a near total lack of scheduled maintenance and the severe deterioration caused by the tropical climate. The roof is clad in aluminum, which, despite the initial expense, has a significantly longer life span and recyclability compared to other materials. The masonry construction and aluminum louvers represent the need to ensure durability against the potential of a highly destructive cyclone.

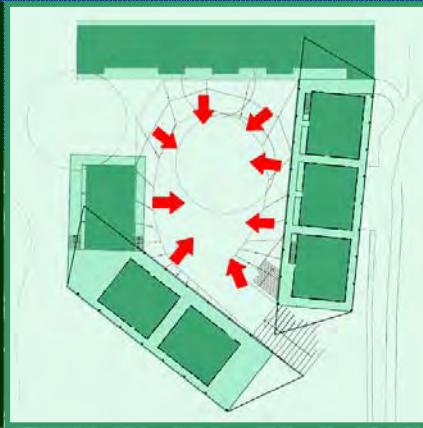
The cost of diesel-generated electricity on Rarotonga is a massive 70¢NZ/kWh. The wind turbines and PV system will reduce electricity cost significantly and potentially allow a net surplus of greenhouse friendly electricity to be fed back into the grid. The savings on electricity alone will allow the building to pay for itself in about 20 years. Also, the modular design, natural lighting and passive climate control allows flexible energy use.

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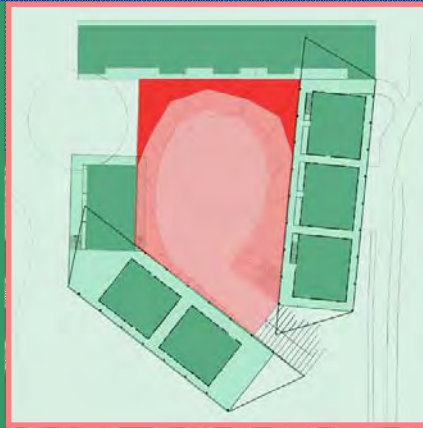
# SITE REACTIONS



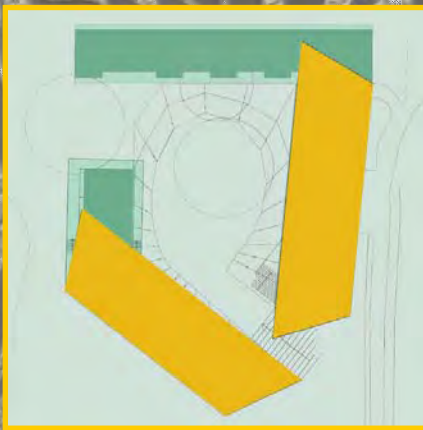
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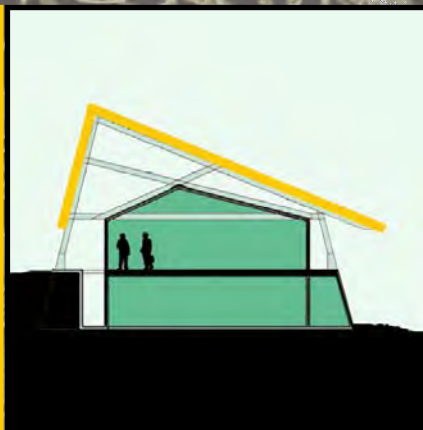
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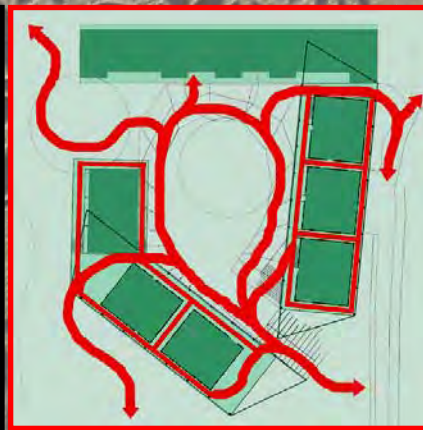
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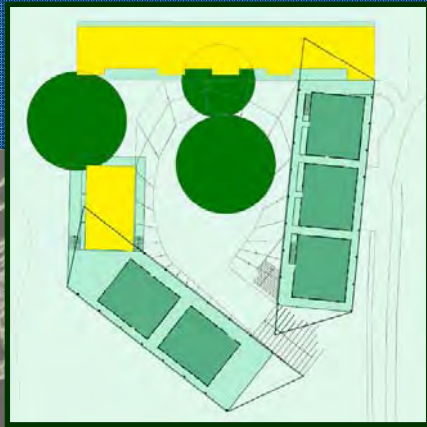
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- 1. Context Connections
- 2. Enclosed space
- 3. Sacred space
- 4. Roof Area
- 5. Large 'fly' roof
- 6. Circulation

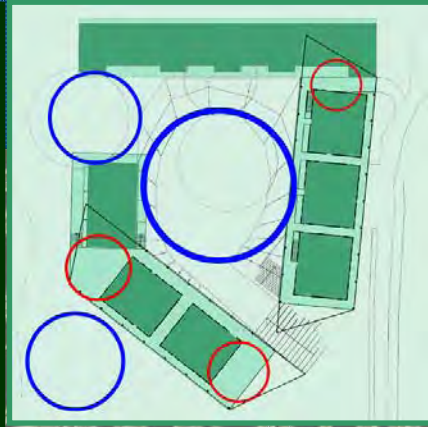


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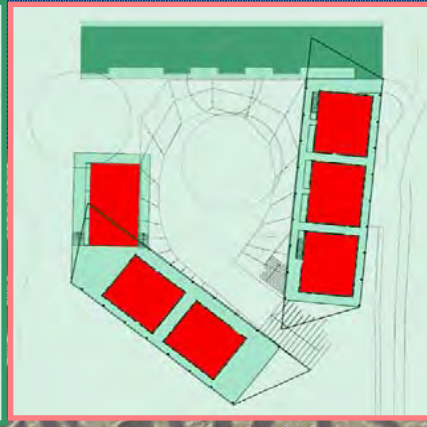
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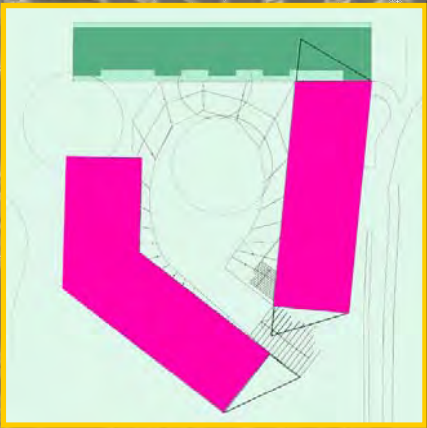
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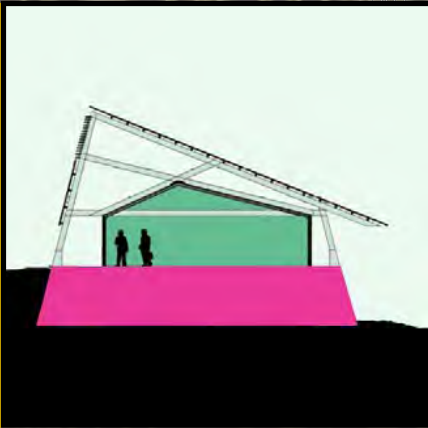
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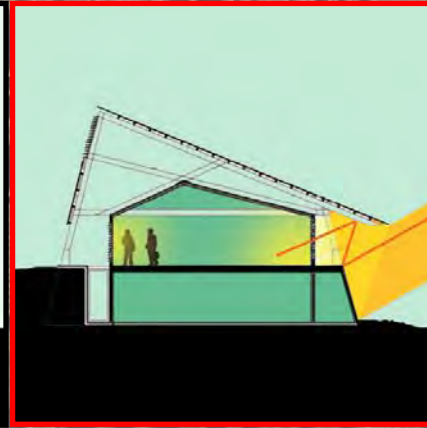
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7. Immediate Landscape

8. Covered and Uncovered space

9. Modular design

10. Platform base (Marae)

11. Platform base (Marae)

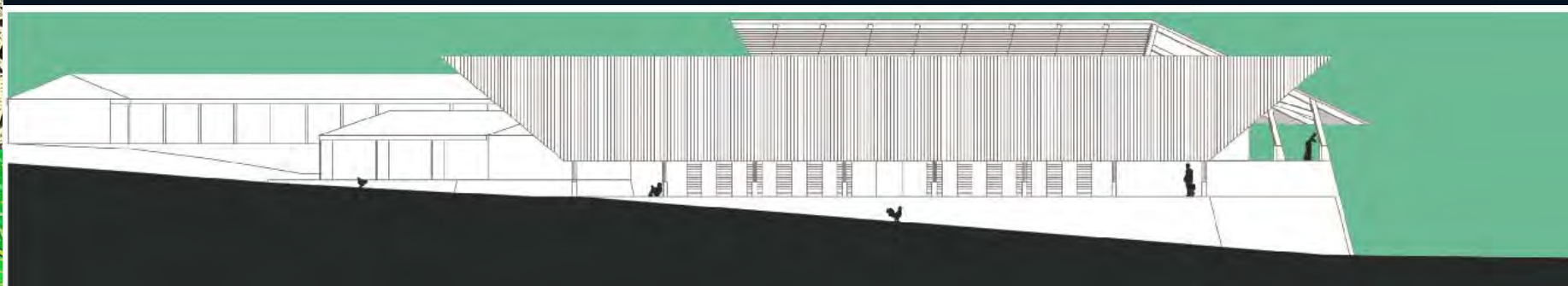
12. Sun and shade solutions



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# ENVIRONMENTAL CONSIDERATIONS

The approach to the site takes place from the main road that encircles the Island. The building dominates the flat, clear spaces of the adjacent sports ground and presents a legible new entrance. An irregular circulation route connects this entrance, the new building and spaces to the existing buildings, reflecting the connection between the two main elements of the broader landscape; the sea and the mountain. The proposal is sensitively sited within the immediate site and attempts to reconcile itself with the tropical ecology by encouraging the engulfing landscape to occupy the site and conquer redundant areas. Rather than wasteful demolition, the proposal reuses existing buildings with the option of refurbishment at a later date.



East Elevation



East Elevation

New buildings maintain a dialogue of function, scale and materiality with the existing buildings and provide a sense of enclosure to create a visual refuge and foster interaction between Ministry staff. Most existing trees have been maintained with an existing mango tree creating a new focus. From within the new spaces and buildings, the essentially horizontal outlook is maintained between the platform and the roof; framing views of the sea and the hinterland. The same feature controls natural light by reflecting sunlight off the concrete base, onto the underside of the roof and diffusing the stark tropical light.



West Elevation (Internal)



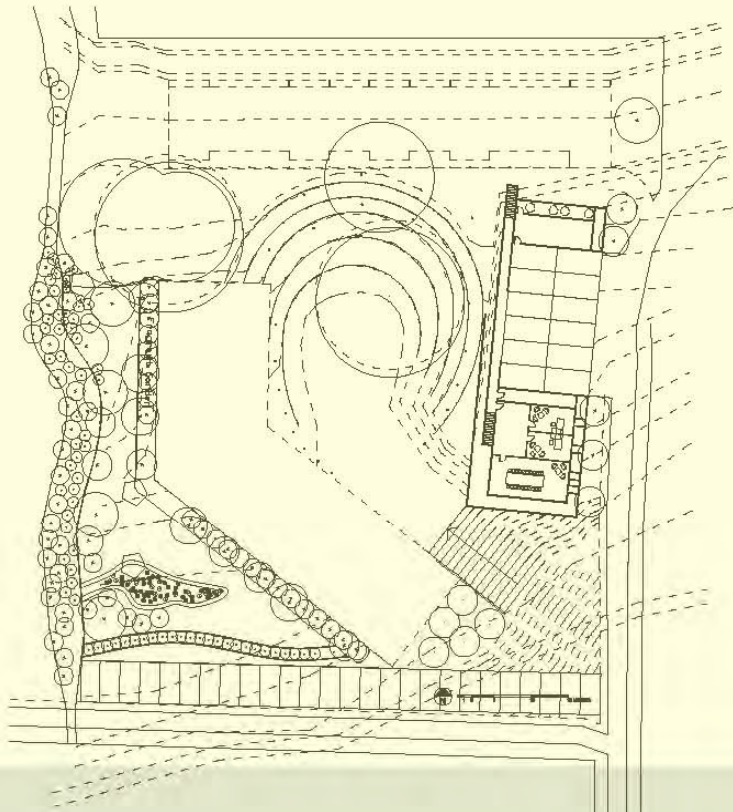
Section through East wing (proposed building)

Section through West Wing (retained building)

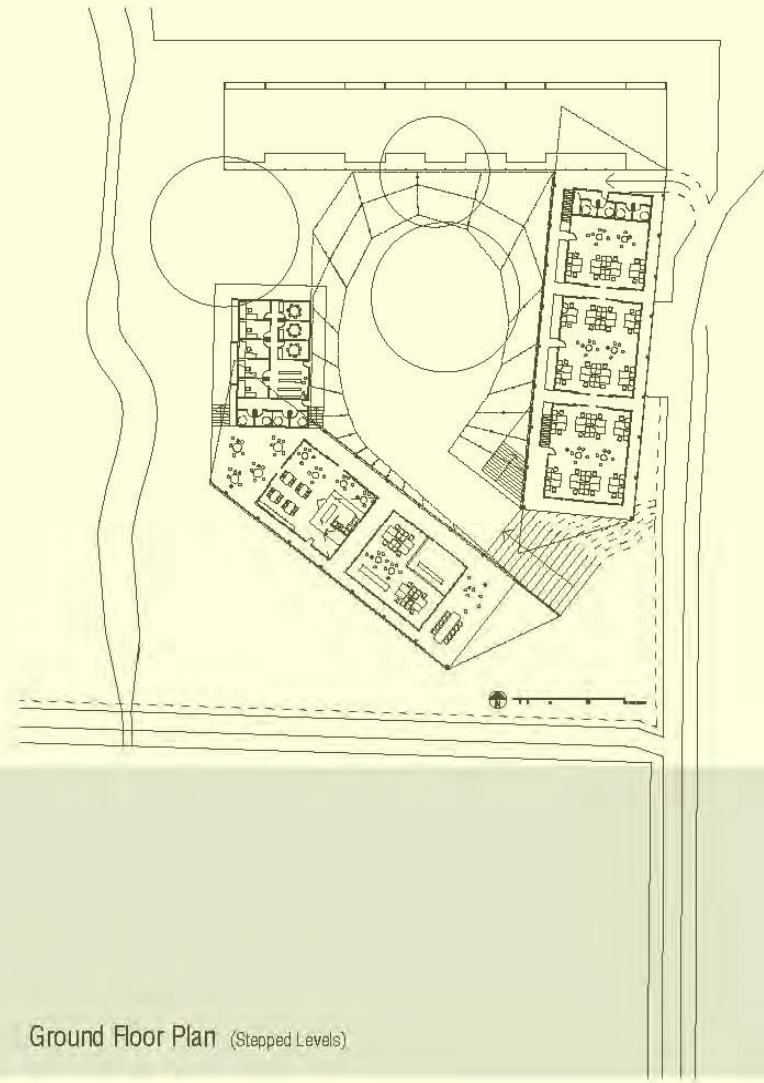


The large fly roof shades formal outdoor areas and the buildings beneath. The outdoor circulation spaces and the substantial dimension between the fly roof and the buildings are designed to maximize natural ventilation through the site and to disperse the hot air that accumulates under the roof. The building will incorporate a double-louver window system to maximize airflow, reduce thermal transfer and provide a better seal when air-conditioning is necessary.

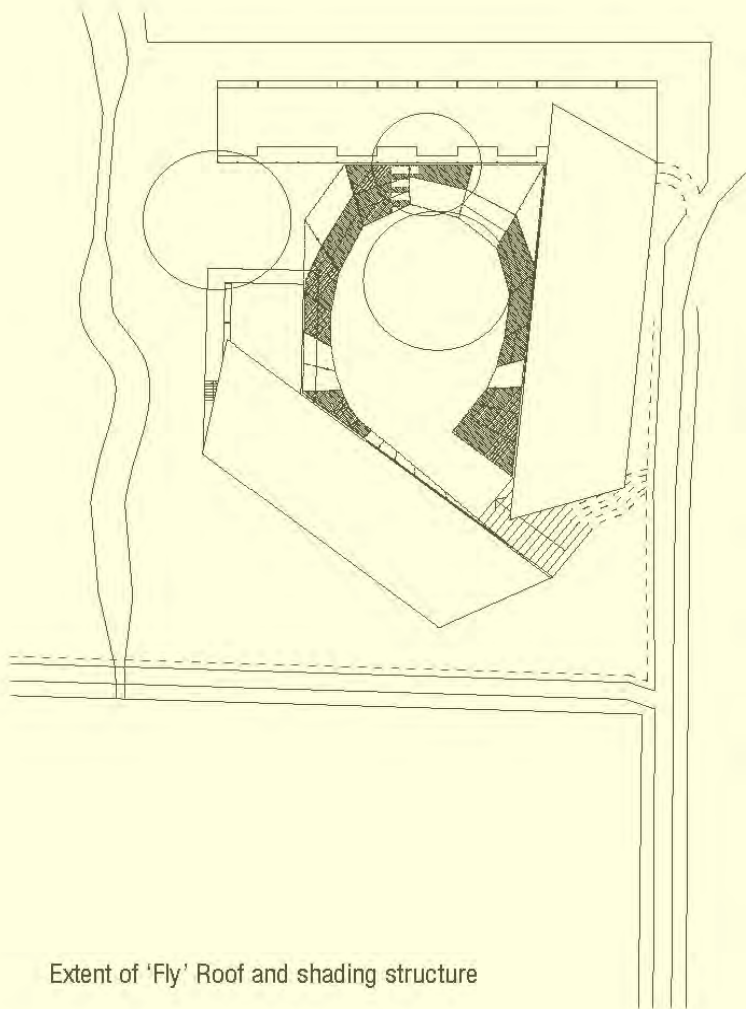
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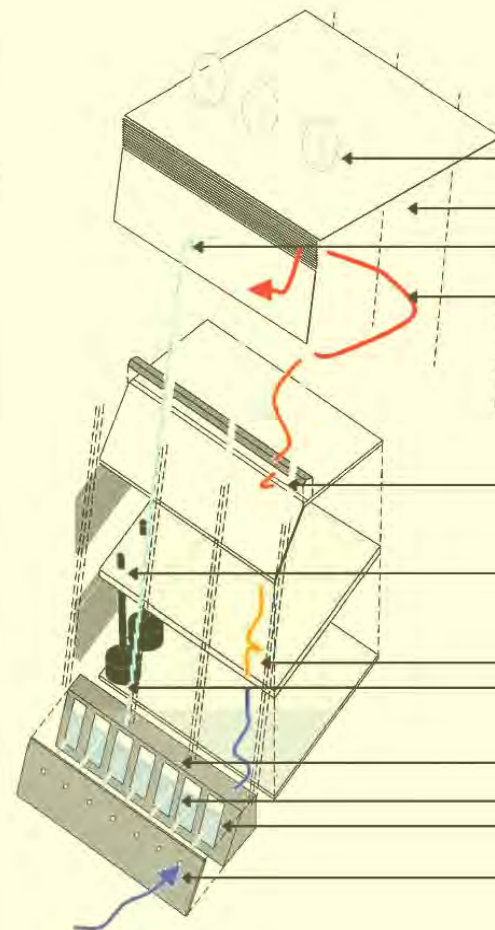
Landscape and Basement Plan



Ground Floor Plan (Stepped Levels)



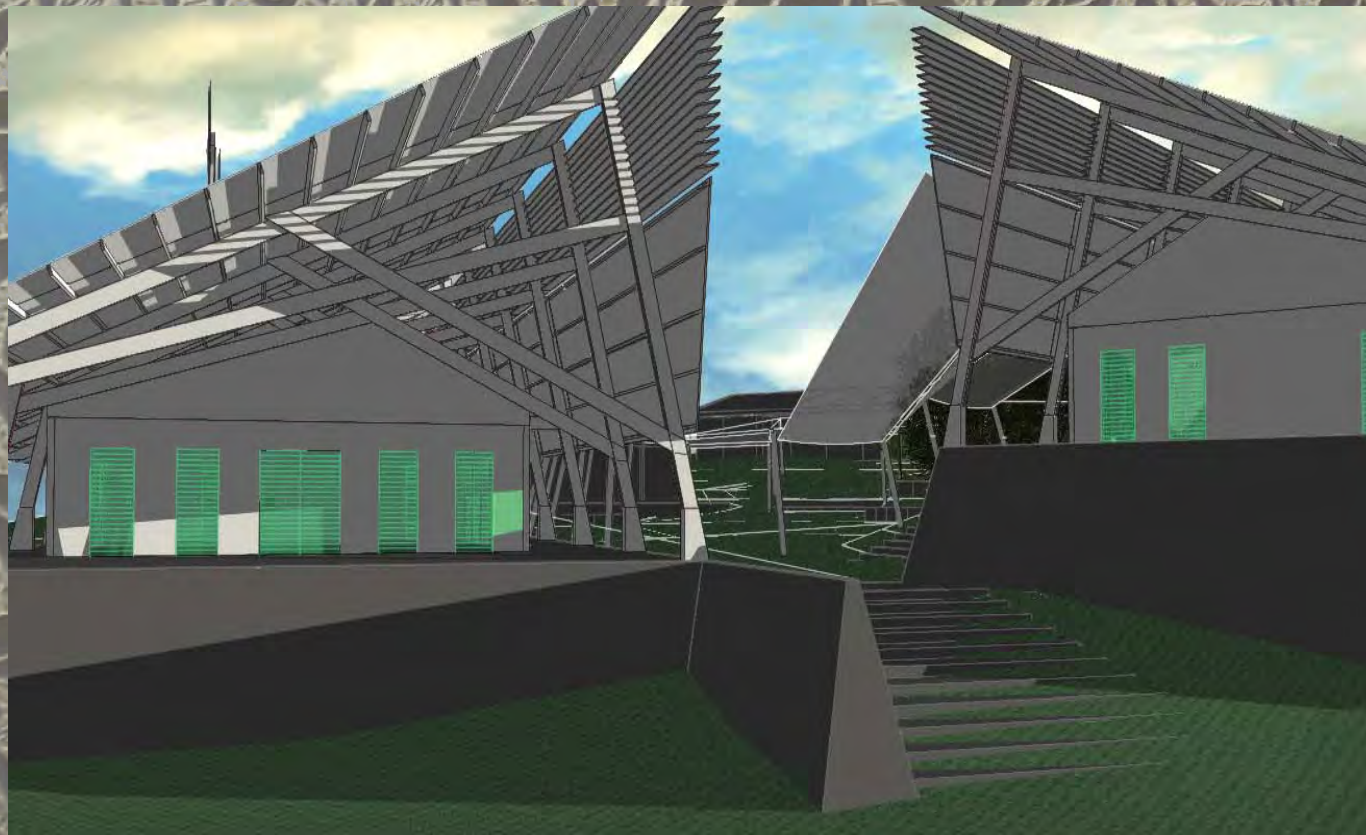
Extent of 'Fly' Roof and shading structure



Axonometric section

- Swift wind turbine
- Amorphous solar roof
- Rain Water collection
- Air under roof reaches up to 80 degrees, which in turn draws cool air up through the buildings occupied spaces
- Rising warm air moves through vent in ridge capping
- Lavatory pedestal
- Cool air is drawn through vent in floors
- Composting toilet chamber. Waste decomposes on large contained units
- First flush system used for collection of water
- Water storage tanks
- Air circulates through pipes within water tanks
- Air is drawn into the building through holes in the base





The stack effect ensures Passive ventilation of interior spaces. Air is drawn from outside through pipes in the basement water tanks, is subsequently cooled, and directed up through floor and roof vents by the heat of the fly roof and the action of wind. When air-conditioning is required, a small domestic scale air conditioner in each building module removes the necessity for a large and unsustainable air-conditioning plant.

The building will function independently of the diesel-generated electricity grid by incorporating a large area of amorphous photovoltaic roofing. An array of small, roof-mounted wind turbines facing the prevailing nor-easterlies will supplement the PV system.



## COST OF TECHNOLOGIES

With a building area of approx. 1000m<sup>2</sup> we can assume energy load of buildings (partially air-conditioned) is 75kWh/m<sup>2</sup>/year.

Energy consumption could be 75,000kWh/year.

Cost of power on Island is 70¢kWh.

Total annual cost of powering the building would be \$52,000/year.

Taking into account PV roofing costs \$1,000/m<sup>2</sup> or \$300,000 in total and Turbines cost \$3000 each or \$24,000 in total.

Total cost is \$324,000. The technology would pay for itself within 7 years and the lifespan of items exceeds 20 years.

The site's substrate is composed of porous basaltic soils and coral sand and the issue of water, especially groundwater contamination, is a major problem on the island. For this reason, the scheme will employ an autonomous approach to water. Rainwater will be collected from the roof filtered and stored as a potable supply in large concrete tanks in the base of the building. Human waste will be received and processed by composting lavatories with grey water being diverted to a native food garden and gully on the northeastern corner of the site.

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