Information related to climate change related matters for climate adaptation on functioning and living.

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Climate change, Urban Heat Island, Albedo effect data are related matter. Their inter-connected issues, and our living activities and functional abilities are the driving force of this natural phenomenon which contribute to the spiralling GHG emission,
The local footprint plays a role in a global weather. The questions are:

- **What are the impacts of climate change to us and our family living condition, our living environment, our natural resources?**
- **What is the climate adaptation for resilience to drought, flood, and high level of carbon emission as a result of climate change?**

And how can we practically plan for a sustainable living with a sustainable thinking to strategic solutions.
For a concise understanding the facts of climate change impact to all facets of life, please refer to research section B, and section C. The research is a web-based platform, and provided local and global website addresses and links will give you a complete detail, and help you to plan for a sustainable living – your future vision of a sustainable culture.

SECTION A

A.1 Climate change

What is climate change?
Source: CSIRO and Bureau of Meteorology collaboration
CSIRO and Bureau of meteorology collaboration on new report - STATE OF THE CLIMATE – reference 10/28 - 10 March 2010
Website: **www.csiro.au/resources/State-of-the-Climate.html**
New link: http//www.csiro.au/news/State-of-the-Climate
Climate now: New state of the Climate Snapshot
Further information to Media Release at: **www.csiro.au/news/State-of-the-Climate.html**
There were studies in defining climate change in the last 50+ years. Scientist across all the nations including Australia have acknowledged [that] global warming and climate change are a fact, so does population and consumption growth. This phenomenon is an unmatched disaster to us, as human. It is by far, the greatest challenge to human

A.2 Energy efficiency with cool roof

Cool roof coatings reflect 70% to 85% of the sun's energy when newly installed. Without coating, conventional roofing materials have reflectivity of 5% to 25%. That means they absorb 75% to 95% of the sun's energy. Emissivity is the ability to release the absorbed heat to the internal building. Most cool roof coatings emit 85% or more.

White roof and green roof are two applications to keep a roof cool. There are safety measures and lifespan consideration in application to green roof. White reflective roof is best effectiveness to required building height of a few storeys, with large roofing area. The benefits are to energy efficiency by increasing the albedo value, and lowering the man-made heat, with savings in return during summer months. It is a solution to UHI such as smog and GHG emission on a great concern to human health issues and incurred cost on unintended consequences.

Source1: Google search for Wikipedia on Cool roof Keyword 'Cool roofs' Website:
http://en.wikipedia.org/wiki/Cool_roof

Source 2: Cool Roof Rating Council Keyword 'Cool Roof' Website: **www.coolroofs.org**
The albedo or solar reflectance of a surface is the percentage of incoming solar radiation that is reflected by a massed surface. Albedo is measured on a scale of 0 to 1, where value of 0 indicates that a surface absorbs all solar radiation. Light-coloured surfaces typically have a higher albedo value than darker surfaces. The average albedo for a white roof coating is 0.75, or 75%.

Fresh asphalt after applied is measured around 50.55°C with a reflectivity of 5%. After a period of exposure to high traffic, and extreme weather conditions, aged asphalt is measured 46.11°C with a reflectivity of 10%. With a white reflective coating, it is measured around 32.22°C with a reflectivity 50%. The difference of 14°C - 18°C in value is undoubtedly an indication to heat absorption and it is a factor of UHI. With a white reflective coating, the reflectivity is increased by 10 folds on the new asphalt surface and by 5 folds on the aged one.

A.3 Urban heat island

To download a PDF file of Urban Design please visit: http://bom.gov.au/info/leaflets/urban_design.pdf

Source 1: Bureau of Meteorology website
Keyword for search 'Urban Heat Island'

Source 2: US Lawrence Berkeley national Laboratory
Keyword: Urban HEAT Island
Website: **www.lbl.gov**

When the ambience temperature is at 12.78°C, the roof temperature is definitely higher than the air of the surroundings. The difference in heat value gained from the absorption of the warm air and hot sunrays, had shown a low albedo value to galvanised steel, black acrylic paint as shown of below chart

What is Urban Heat Island?
Urban Heat Island [UHI] is caused by many factors, which is mostly generated from surface application in building, our contribution of our daily and functional activities. In summer months, the effect of UHI raises the temperature of the urban atmosphere to an additional of 3°C - 5°C more than the surrounding land cover of the outer suburb. Majority of building material has a low albedo value, which indicates a high level of heat and cold absorption of these materials.

The heat will be transfer later on the day, to internal space, and air-conditioning, cooling and heating system are switched on for comfort during peak hour. And this consumption of energy contributes to tonnes of carbon emission, with man-made heat extracted from air-conditioning.
UHI is the result of our process in living, in designing our living environment, in planning our future living. An understanding of UHI and its impact to urban living, and how vital and important to be mindful reconsidered on energy efficiency in consumption, in avoiding the carbon cost, which is highly to be inclusive to commercial and domestic sectors on operation cost variances.

What causes Urban Heat Island [UHI]?
In cities and urban living areas, UHI is formed as we replace natural vegetation land cover with building materials for shelters, and other infrastructure. Therefore, higher urban temperatures are inevitably a result to UHI on:

- Less vegetation – trees, grass, evaporation of water content in soil and leaves
- Tall buildings and narrow streets – heat trap on configuration and reduce wind flow
- Waste heat – of air-conditioners, cars, factories

Other environmental factors to contribute to UHI

- geographical configuration
- albedo value
- weather conditions
- Winds and rain can break the murky and hot air from city centres, and windless conditions drive UHI as of result.

How does Urban Heat Island affect us?
Common sense measures can be taken on integrated strategies to reduce the negative effects of UHI within domestic and commercial communities, including:

Public health – heat stress, heat strokes, dehydration, and death amongst elderly population in all nations.
Environment – emissions of harmful pollutants, which is a public health threat to related respiratory illness and asthma.
Energy consumption - on cooling system during peak hour. This results in high energy cost to the consumers, with spiralling GHG emission, and UHI effect as of result. For every 0.6°C raised temperature in summer, the peak utility loads can increase by approximately 2% of the maximum in a medium to a large city.

Widespread implementation across a wide sector can reduce UHI on energy usage, air pollution, and heat-related health illness. UHI reduction strategies benefit to individual home and building owners directly. Cool roofs and energy efficient landscape with shade trees, can have a saving benefit in return on summertime cooling bills.

Ambient temperature 55° F (12.78C°) Roofing material Celsius C°	
Black acrylic paint	**61.11°**
Galvanized steel	**58.88°**
Clay terracotta tile	**44.44°**
Red acrylic paint	**41.11°**
White acrylic paint	**23.33°**

A.4 Albedo

Source 1: printed copy of title - Urban Heat Environment and Urban Sustainability Chapter 7 - page 149 of of f.moavenzadeh et al. (eds), Future cities: dynamics and sustainability, 149 - 172 - 2002 kluwer academics publishers, Printed in Netherlands

Source 2: Global Bio Weather Keyword ' Albedo effect'
Website: **www.globalbioweather.com/web_resources.html**
Cooler roof surfaces means less heat is transferred into the building. How much savings will depend on many factors including roof insulation, cooling system equipment and other requirement. In the right situation, a reflective roof can bring cooling savings of up to 50%, with a reduction in peak cooling demand of 10% to 15%

Source 3: US EPA on Urban Heat Island Mitigation Keyword 'Heat Island mitigation'
Website: http://www.epa.gov/hiri/
There are strategies and technologies to address UHI for mitigation such as trees and vegetation to cover the surface of unused land. And
Cool roofs can be applied to any exterior of commercial and residential buildings and shelters.
This approach is the simplest solution at a low cost to routine maintenance. Green roof is cool roof, but there are safety and structural requirements to accommodate this solution to any commercial and residential buildings. Cool pavements to appropriate location, where land cover is exposed to summer sun rays with no canopy of trees and vegetation to reflect the absorbed heat.

What is it?
Albedo is the solar reflectance of a covered surface to solar radiation [heat].The lower the albedo value, the lower the reflectivity is of the material, which mostly are of building materials in buildings and infrastructure. See Albedo values chart for urban surfaces

Albedo values for urban surfaces

Surfaces type	Albedo
Concrete	0.10 - 0.35
Grass	0.25 - 0.30
Trees	0.15 - 0.18
Brick / Stone	0.20 - 0.40
Corrugated roof	0.10 - 0.15
Tar / Gravel	0.03 - 0.18
Red Brown Tile	0.10 - 0.35
White paint	0.50 – 0.90
Coloured paint	0.15 – 0.35
High reflective roof	0.60 – 0.70

A.5 Energy efficiency landscape

Source 1: Wikipedia on energy efficient landscape Keyword: energy efficient landscape
Website: **http://en.wikipedia.org/wiki/Energy-efficient_landscaping**
Energy-efficient landscaping is designed with a long-term consideration to reduce energy consumption to a building on heating and cooling system application. There are key factors to required knowledge of embedded energy, carbon emission, energy consumption, and waste of the whole process to selected materials of construction, trees and vegetation types, and the approach of the process, from a concept of a garden to a functional garden within a life span of the building itself and the activities of the inhabitants inside the shelter, including the maintenance and the behaviour of the landscape to its surroundings.
Under water shortage condition, drought-resistant plantings are mostly appropriate to the climatic condition, in saving water and provide vegetation for evapotranspirated process. A recommendation to have a site composting to reduce construction waste in the process as well land fill cost to the total expense of the landscaping project. Outdoor lighting with integrated sensor system would be ideal to reduce the energy usage, in illuminating the beauty of a landscape after sunset.