Universität of Natural Resources and Life Sciences
Institute of Structural Engineering

Climate adaptive architecture in desert regions

World Day to Combat Desertification
17th June 2016

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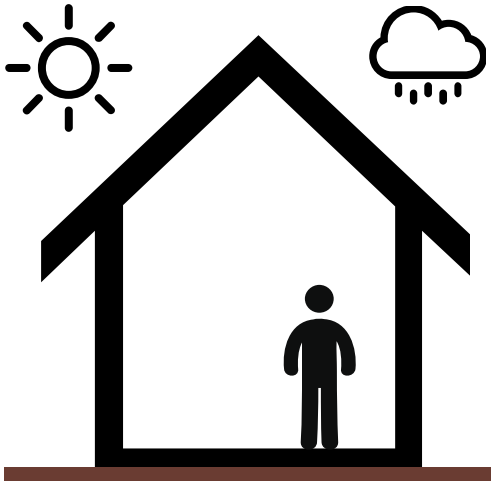
BUILDINGS + CLIMATE

World Business Council for Sustainable Development (WBCSD), Energy Efficiency in BuildingsTransforming the market, WBCSD, Geneva, 2009

WHAT WE ARE AIMING FOR…

human shelter in an economically, ecologically and socially sound way

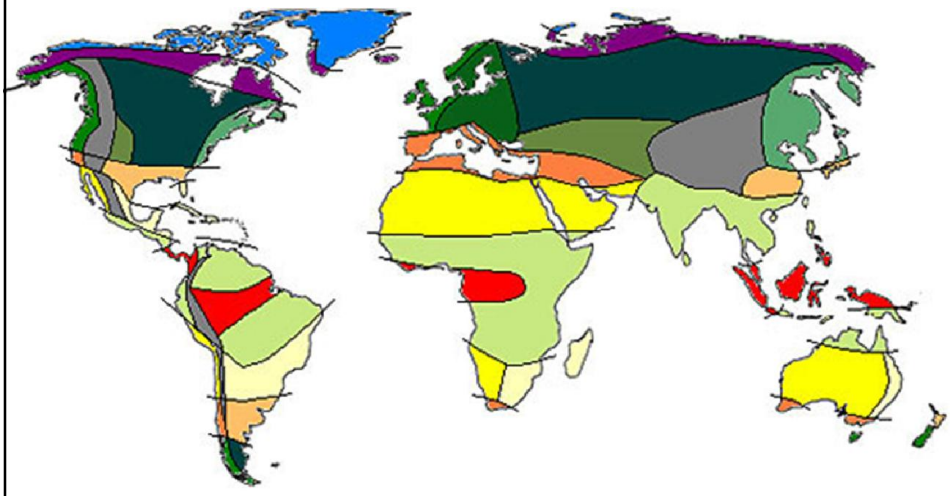


- **High internal comfort**
- **Spaces based on need and use**

but also…

- **Adequate use of (local) resources**
- **Zero CO_2 buildings**
- **Building which produce rather than consume energy**

CLIMATE ZONES



Climate regions based on Ernst Neef (1954); www.klima-der-erde.de/klimazonen.html


Addis Abeba
London
Singapore
Desert Climate
Temperate Climate
Tropical Climate


Desert Climate
Temperate Climate
Tropical Climate

CLIMATE ADAPTIVE ARCHITECTURE

Autochthonous architecture ~ from [greek] autos (self) and khthon (soil) ~ indigenous to the land and region

Vernacular architecture ~ architecture based on local resources and needs; designed by local builders rather than formally trained architects

Climate adaptive architecture ~ architecture based according to the local climate; specific to a certain (climatic) region

The local and regional CLIMATE has defined ARCHITECTURE over the centuries

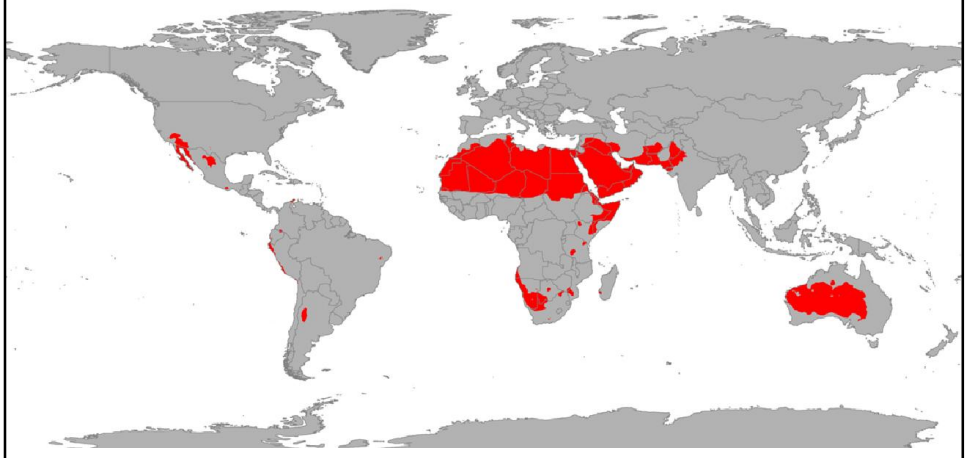
CLIMATE ADAPTIVE ARCHITECTURE

CLIMATE ADAPTIVE ARCHITECTURE

How it translates into contemporary building design…

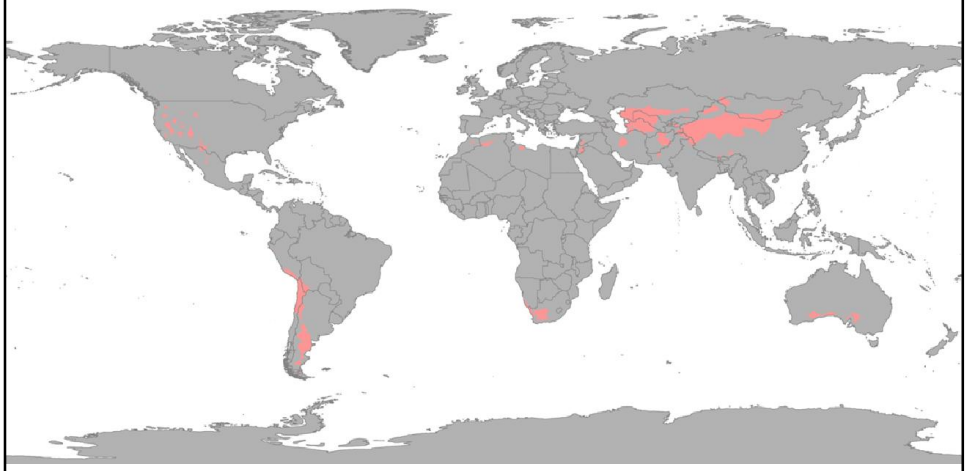
- We can learn from the craftsmanship of traditional buildings
- Climate adaptive design necessitates an understanding of the local climate
- Building design and forms vary depending on local resources and climatic conditions
- Decide for heavy weight or light weight construction depending on the climate
- Design with passive measures
- Exploit natural ventilation
- Exploit natural lighting
- Use and activate thermal mass

HOT DESERT CLIMATE



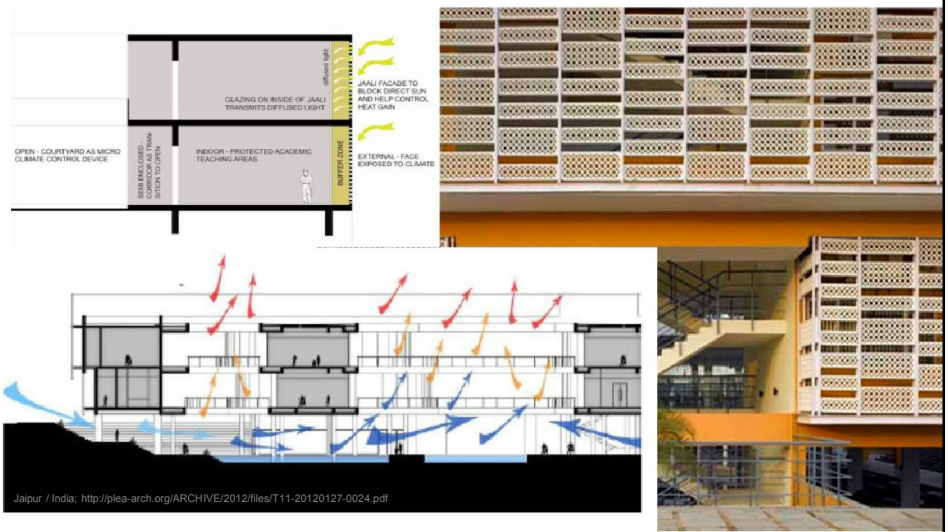
https://en.wikipedia.org/wiki/Desert_climate / M. C. Peel, B. L. Finlayson, T. A. Mcmahon. Updated world map of the K oppen-Geiger climate classi cation. Hydrology and Earth System Sciences Discussions, European Geosciences Union 2007, 4 (2), pp.439-473.

COLD DESERT CLIMATES



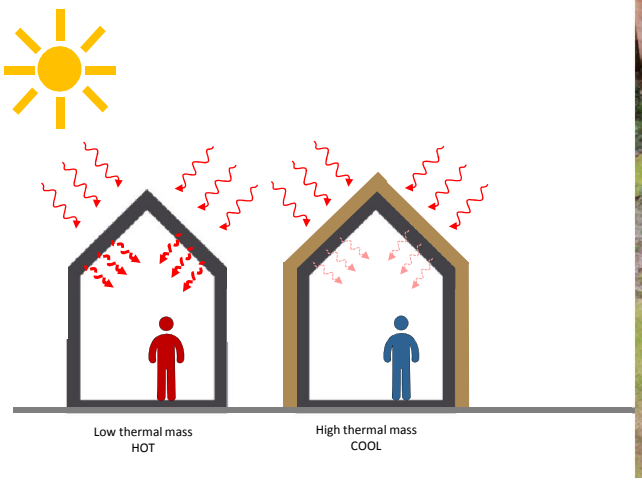
https://en.wikipedia.org/wiki/Desert_climate / M. C. Peel, B. L. Finlayson, T. A. Mcmahon. Updated world map of the K oppen-Geiger climate classi cation. Hydrology and Earth System Sciences Discussions, European Geosciences Union 2007, 4 (2), pp.439-473.

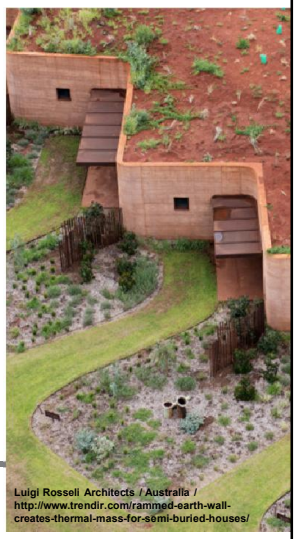
STRATEGIES FOR DESERT REGIONS # 1



 # 1: reduce cooling loads through adequate fenestration and shading

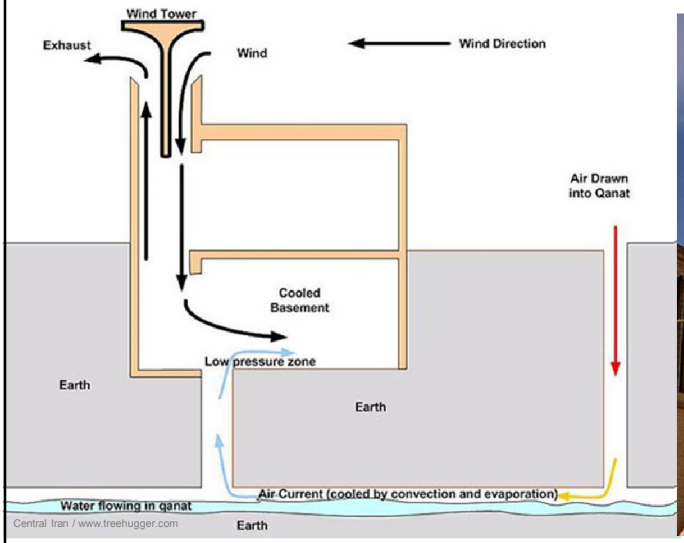
STRATEGIES FOR DESERT REGIONS # 2





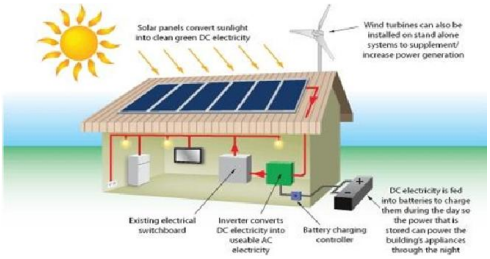
 # 2: allow for high thermal mass to reduce peak temperatures

STRATEGIES FOR DESERT REGIONS # 3



 # 3: exploit passive cooling strategies such as earth ducts and night cooling

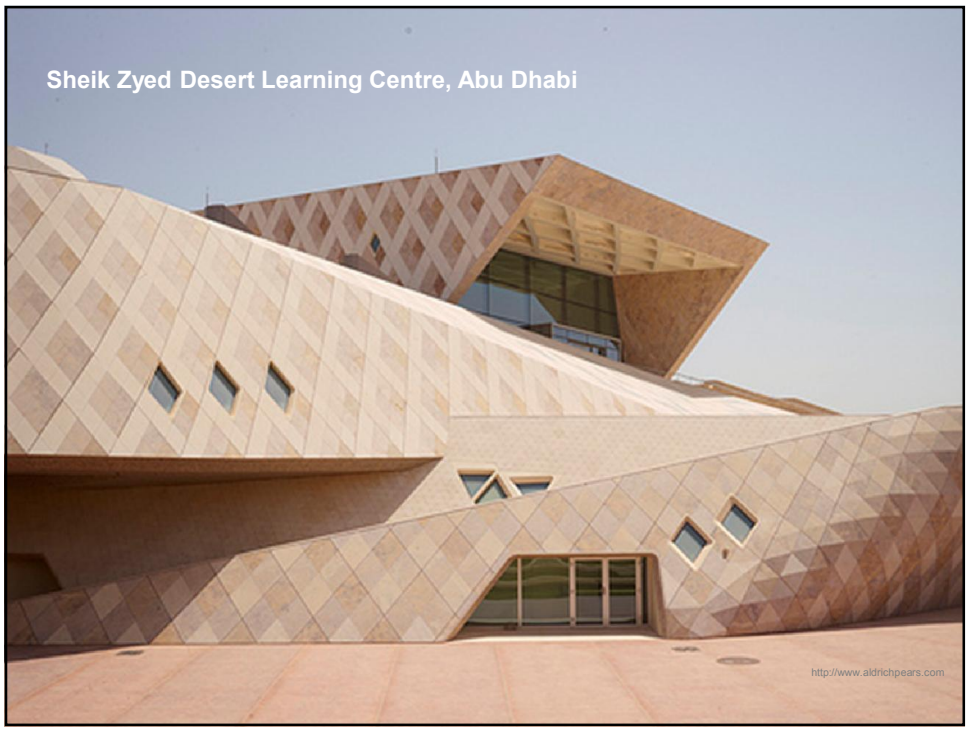
STRATEGIES FOR DESERT REGIONS # 4



http://www.versoley.com/en/products/autonomous-systems

http://www.treehugger.com/renewable-energy/teslas-gigafactory-will-produce-much-renewable-energy-it-uses-net-zero-energy.html

 # 4: utilise solar based renewable energy systems

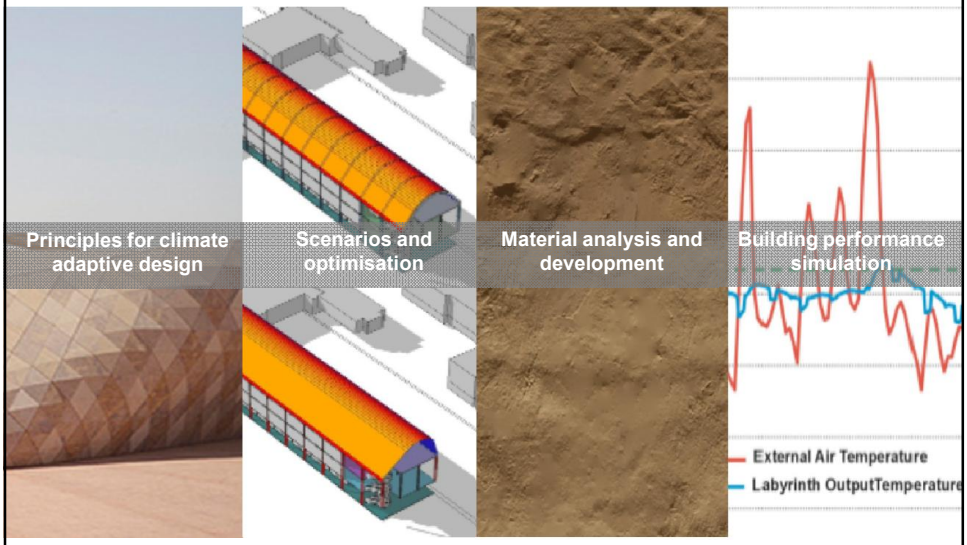

Sheik Zyed Desert Learning Centre, Abu Dhabi
http://www.aldrichpears.com


Eso Residence Paranal Observatory, Chile


Aga Khan Maternity Home, Hyderabad, Pakistan


Pioneertown, California, USA
http://www.dwell.com/green/article/operation-desert-shed

WHAT RESEARCH CAN PROVIDE…



CLIMATE ADAPTIVE DESIGN TO REDUCE CLIMATE CHANGE

In order to reduce climate change due to the energy used for buildings,

the principles of climate adaptive design can and should be applied to any type of buildings,

from residential, to offices, schools and public buildings as well as farm and other utilitarian buildings