Designing the Fifth Facade
Colin Rohlfing, Sustainable Design Leader
THE FIFTH FACADE

Urban roof conditions

Heat Island, Air Quality, Biodiversity, Insulation, Cultural interaction
Diana Balmori - Fluid interface between landscape and structure in the development of urban public spaces

Epidermis of the city: Architecture, Urbanism, Landscape, Infrastructure, the Inhabitants and their Behavior

Administrative Town: Sejong, South Korea
Campo de los Igleses: Bilbao, Spain
THE ENERGY OF THE METROPOLIS

Efficiency of Existing Conditions

CHICAGO GREENHOUSE GAS EMISSIONS AND REDUCTION GOALS

Chicago’s goal is to reach an 80 percent reduction in greenhouse gas emissions from 1990 levels by 2050, with the sharpest reductions occurring over the next 12 years. By 2020 (the use of 1990 levels follows the Kyoto Protocol). Achieving this goal will also help reduce other forms of harmful gases, such as nitrous oxide, which will improve overall air quality. Achieving this goal will require the commitment and collective action of individuals, businesses, government and other institutions.
Biomimicry is a new way of viewing and valuing nature, based not on what we can extract from the natural world, but on what we can learn from it and apply as principles.

~ Janine Benyus
ENVIROMENTAL PERFORMANCE INDICATORS

- Water collection and storage
  - # gallons/storm

- Solar gain and reflectance
  - % albedo

- Carbon sequestration
  - # tons/acre

- Water filtration
  - % pollutants captured

- Evapo-transpiration
  - % rainfall returned

- Nitrogen and phosphorous cycling
  - # tons/acre

- Biodiversity
  - % diversity of native species

- Soil building
  - mm of soil created
phase-1 land use plan
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Preservation of Topography, Habitat, Biodiversity, Streams, Riparian Corridors
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MANIKARA Transport water vertically, Beavers dam

The Moist Deciduous Forest
The performance of water in an ecosystem is critical to understand.

please hover over arrows
for more information

mechanism
Lateral roots absorb excess moisture from surface layer soil and the tap root sends the collected moisture downward to recharge groundwater. During the dry season, the reverse happens.

nature's design
series of upstream barriers slow water

design principle
series of upstream barriers slow water
THE EPIDERMIS OF THE METROPOLIS

Distributed and gravitational water cycle

roof to garden: rainwater catchment and greywater systems recycle and reduce water use at the individual building scale.

street to field: bioswale networks guide stormwater to wetlands at the city scale; wetlands filter and hold stormwater; water is pumped into fields to irrigate crops.

city to farm: stormwater becomes an integrated part of urban agriculture; wetlands serve as a natural cistern for the dry season.

Living Building Neighborhood competition entry
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Location of Solar and Wind Corridors
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Location of Solar and Wind Corridors

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Production, Consumption, Dissipation, Exchange

*EUI can be an ineffective metric for residential performance - also misleading as uses GSF, not TFA.
THE ENERGY OF THE METROPOLIS
“Where Energy Meets Form”

Defined by natural beauty and rich cultural history, Khed SEZ is designed to become a treasured community for families and a vital center for business.

In true partnership with nature...
~ the mind can relax and grow
~ the body can heal and regenerate
~ the spirit can expand and flourish.
DISTRICT ORIENTATION FOR OPTIMIZATION

King Abdullah University of Science and Technology
Nature as Mentor: What would nature do here?

Let the landscape direct WHERE to build
Let the Genius of Place and architecture patterns direct HOW to build
Life’s Principles and Ecological Performance Standards describe WHY it matters

Genius of Place

The primary factors driving the face of the landscape on the Conoco-Philips site can be grouped by their presence:

- Plenty: Wind and Sun
- Precious: Water
- Predictable: Temperature Extremes and Fire

As a result of brutal wind and sun, scarce water, and predictable fire occurrences and temperature extremes, all the organisms that live in that habitat have adopted various strategies to accommodate those environmental pressures with grace. The congruence of these survival strategies across taxa suggests their mandatory inclusion in any design implemented in this area. The major strategies, with their design implications, are below:
ENERGY MEETS FORM – GENIUS OF THE PLACE
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Advanced Building Physics of the 5th facade

http://netzerocourt.com/
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Advanced Building Physics creates the Design

With the exception of summer days, the temperature is below a comfortable level; the temperature reaches 70-75°F during 15% of operational hours. Consider an optimized orientation which will absorb less thermal energy in under-heated periods and less in overheated periods. Due to the extreme temperatures, high conductive loss is expected, consider thermal mass, wall insulated walls, roofs, an optimized window to wall ratio (min. heat loss in winter, max. sunlight), and low U values. Saving by insulation is expected to be much higher than using an optimized floor aspect.

With the exception of summer days, the humidity throughout the year is well above comfortable levels. There is the possibility to use evaporative cooling during warmer months (June and July) due to the 7-8°F differences between the dry and wet bulb temperature. 58% of operational hours have an optimal amount of relative humidity during this period. Active dehumidification is suggested to control humidity as well. If there are possible strategies to decrease wind speed, summer passive ventilation should be seriously considered since during the summer months, humidity is less than 40% and there should not be any risk.
On-site Food Source
USER PERCEPTION AND BEHAVIOR

Data collection and display to drive behavior in the 5th facade
“Readiness to act will allow cities and communities to invest boldly in growing resilience and building up the local capacity for innovation, adaptation and rapid cultural change.

There comes a point where lack of action means further incremental change can no longer keep up with exponential problems.

Personally, I’d rather live in a city that’s moving fast to meet the future, than one that started father ahead, but is stuck and complacent, or simply unwilling to go beyond mere incremental change.“

Alex Steffen
Futurist and Design Optimist