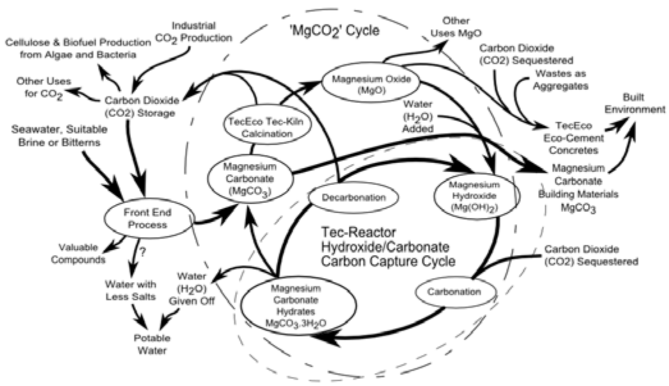
ARCH 5550 • LA 5405
Optimizing the Building/Landscape Interface
Envisioning the Sustainable Campus
Integrating carbon, energy, and water management strategies toward zero- and net-positive design



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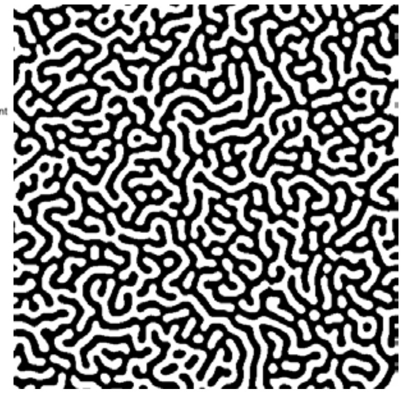
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"…academic architecture is a kind of crystallized pedagogy and that buildings have their own hidden curriculum that teaches as effectively as any course taught in them."
- David Orr, *Earth in Mind*, p 113

Exercise Two: Optimizing the Performance Baseline
Due: June 6, 2011, Informal Review, Studio @3:00 PM
Grade weighting: 30% total grade (30 points); team grade

OBJECTIVES
- Optimize site and systems boundaries for your project.
- Develop methods to achieve the Zero+ goals for performance and eco-effective design.
- Refine the parameters that influence the performance metrics, tools and related design targets for your project.
- Refine the description of the existing context, project characteristics, manifesto, and performance to be used as a baseline for measurement of the expected improvements of the final proposed solution.
- Apply strategies gleaned about integration of energy, water, runoff and waste optimization from the case studies and precedents identified for exercise 1.
- Refine the holistic approach to integrated buildings, landscapes and eco-technical systems to achieve net-zero and zero+ performance goals.

INTRODUCTION
In our charge to create the instruction book for Spaceship Earth, aka the U of MN Campus, you should now have a firm grasp of the baseline performance of your selected systems and how the systems have typically been deployed (or not). Now we are going to try to improve the performance of the eco-technical systems to achieve the Zero+ goals.

Herbert Giradet defines '**eco-technical systems**' in *Cities People Planet* (2008) as:

> *Cities are 'fossilized' structures superimposed on living landscapes, however their existence is not just based on local ecosystems, but also on land surfaces elsewhere and on a great variety of technical systems… Because modern cities are multi-layered biological and technical systems, they might be most usefully described as* eco-technical systems.

Please read Giradet pp108-130 (available on moodle under week 2's readings) for Wednesday

Cities (and campuses) can be understood as **super-organisms**, with a complex array of complementary supporting eco-technical systems. Yes, the appendix can be removed, but then there are long term health impacts that may not be obvious. As a super-organism, the sum of the whole is greater than the parts. The campus (and city) does exceed the sum of the individual parts, as a system of systems. So how can a specific (sub) system provide a larger contribution to the whole without causing massive disruption? (Witness the chaos created by the Central Corridor project on circulation around the campus.)

Let's consider the laws of thermodynamic, which remind us that we have a finite amount of energy available, and that entropy has potential to be poetic. Most architecture resists entropy via brute force and lots of energy, while the landscape embraces the generative quality of entropy. So how can a hybrid building/landscape system find a balance between entropy and providing services?

Optimization is an iterative process when dealing with the complex systems found in the intersection of landscape and buildings. The best trade-off between conflicting parameters is known as the **Pareto Frontier**[1], a term used in economics and engineering. In the built environment, there are too many variables that can interact in unpredictable ways, plus there is the intangible poetics of place to deal with.

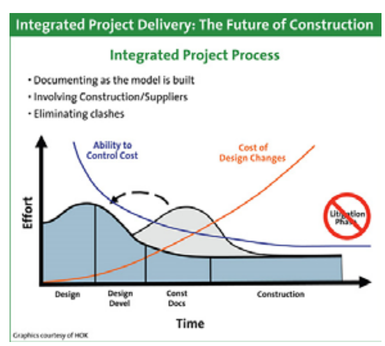
Optimization can be manifested in multiple ways:

- As a 'tune up' of the system (e.g., commissioning), so that the parts of the system are reset to performing as originally intended.. Minor tweaks, calibration, cleaning, and replacement of broken parts are the strategy to achieve the baseline. Here the sum of the parts equals the whole and there is no attempt at making significant improvements

- Eliminating excess and redundancy – creating a 'lean' system - so that the simplest system with the least number of parts and subsystems are delivering the needed services. The risk is the creation of a fracture in a critical system that can be disabled by failure in just one location.

- Creating a resilient system that is robust enough to deliver the needed services even when there is a major disturbance event.

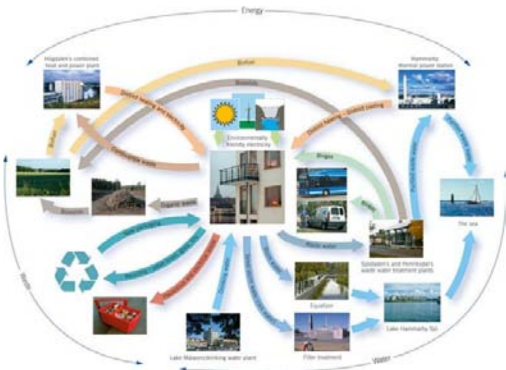
Beyond the simulation tools that have been shared in class, there is an entire discipline devoted to developing optimization tools and algorithms used by economics and engineers[2] worth considering for future exploration from: cellular automata, stochastic programming, to metaheuristics. In the design disciplines, there is the recent emergence of **integrated design practices** to optimize the design process for either sustainable design objectives or project delivery. This integrated multi-disciplinary approach allows for negotiations over system parameters, mostly for buildings and aircraft.



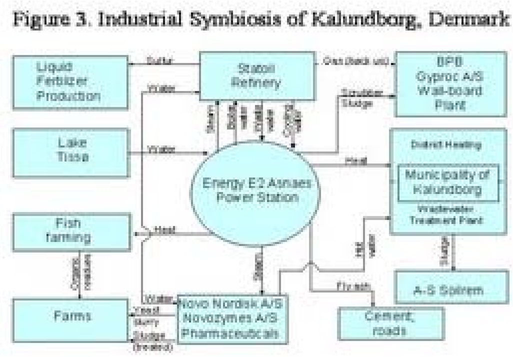
Source: construction.com

[1] http://en.wikipedia.org/wiki/Pareto_frontier#Pareto_frontier
[2] For more info, see: www.calresco.org/lucas/pmo.htm

At the urban scale, **industrial ecology** is one of the few examples where there attempts for inter-system optimization, by using the waste produced by one process as the feed-stock and energy source for another process. Kalunborg, Denmark is an example of applied industrial ecology.



Hammarby Sjöstad's "eco-cycle", www.hammarbysjostad.se/



www.eoearth.org/article/Industrial_symbiosis

The final concept about optimization worth invoking is **Mutualism**, which describes how two or more species (or systems interact). **Symbiosis** is the mutual cooperation of two species that provide benefits for both. Conversely, **parasitism** has positive impacts for one species at the expense of the other. **Commensalism** describes a relationship where one species benefits and the other isn't significantly harmed or helped. **Amensalism** is a relationship where one species inhibits or destroys another while not gaining any significant benefits (beyond lack of competition). It's worth noting that not all mutuality conditions happen synchronously, but may be asynchronously- over longer periods the relationships may change from benign to malignant. When you design a regenerative/Zero+ system aim, for symbiosis over the long haul.

Most performance criteria need to be analyzed within a system of linkages, feedbacks, benefits and impacts. Improving the performance of one criteria may have a negative impact on other equally important metrics. Increasing the amount of glazing in a building can improve the daylighting of the interior, but also increases the heat loss in winter. Identifying such reciprocal benefits and impacts takes practice, and having a holistic understanding of the built environment which this course will help you develop.

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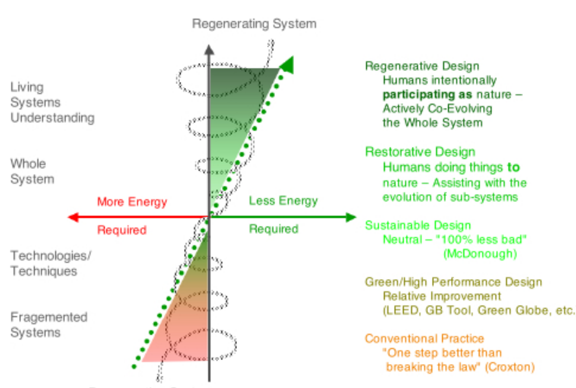


integrativedesign.net

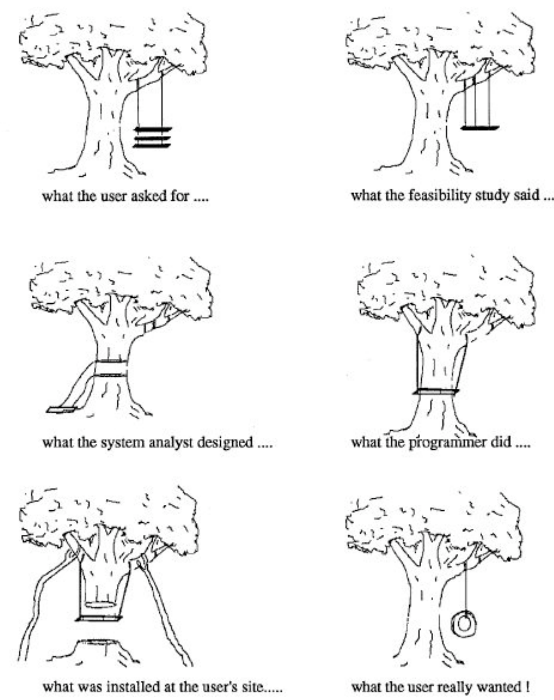
METHODOLOGY

Each system has its own process for optimizing – you therefore have the freedom to pursue any means and methods to improve (and prove) the increase over the baseline performance. You are encouraged to try several modeling tools and calculators, such as those introduced earlier in Week One. Your approach should employ an iterative process and this should be apparent in your graphic and written presentation. The teaching team will discuss appropriate methodologies with each team in class.

DELIVERABLES DUE: TUESDAY 6/6

The full description of deliverables for Exercise Two will be distributed on Thursday, June 2nd with the instructions for Charrette Two. As a minimum, your team needs to anticipate providing:

- A kit of parts/strategies to improve system performance (don't forget the poetics)
- Test the validity of your strategies by applying them to the Church Street corridor with a context specific design – provide several alternative schemes
- Graphic interpretations of all performance data that back up your strategies
- Refined versions of all previously developed materials and graphics that integrate/adapt to the optimization of the building/landscape/infrastructure
- Executive summary of optimization process with brief discussion of costs, benefits, impacts related to the system.
- Polished results from Charrette Two (Thursday 6/2)



cx.lbl.gov/

All exercises will result in a written report that is to be formatted using the Zero+ Campus Project report ***Adobe InDesign*** template. Your team will be asked to present your findings as PDFs to the entire class and selected guests on the due dates. You are asked to use a consistent graphic format for all project boards and reports, please see the "Report and Board Templates" provided on the Moodle website. Please include the following information in your report:

GRADING CRITERIA - Exercise 2: *30% total of grade (30 pts)*

- Innovation and synthesis leading to optimization (you won't be graded on the level of performance, but on the rigor of your process as you attempt to optimize the system)
- Clarity and accuracy of quantitative analysis charts, graphs and annotated drawings
- Clarity and accuracy of conclusions drawn