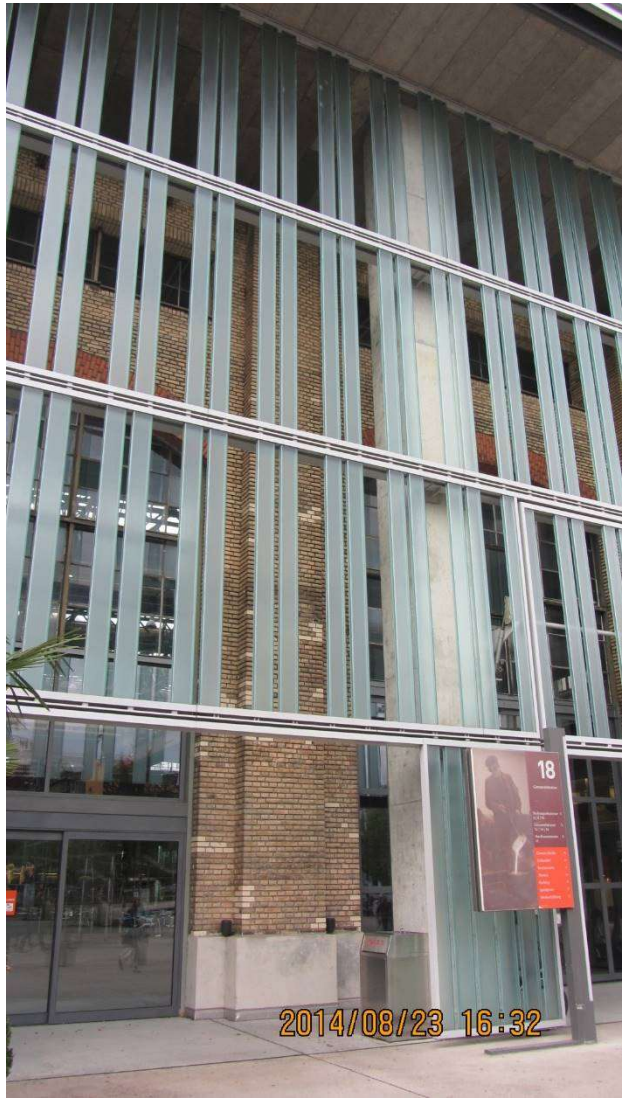
The Lloyds building

- Architect: Richard Rogers
- Year constructed: 1979-1984
- http://www.greatbuildings.com/

2014.08 Zurich

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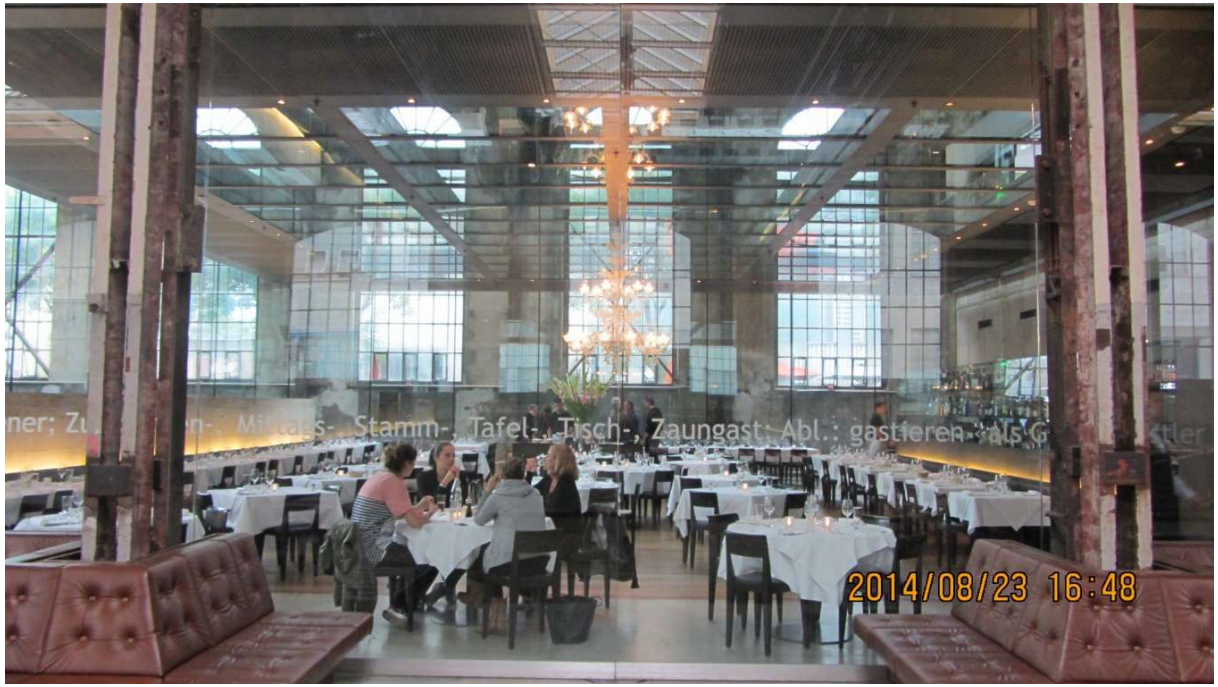
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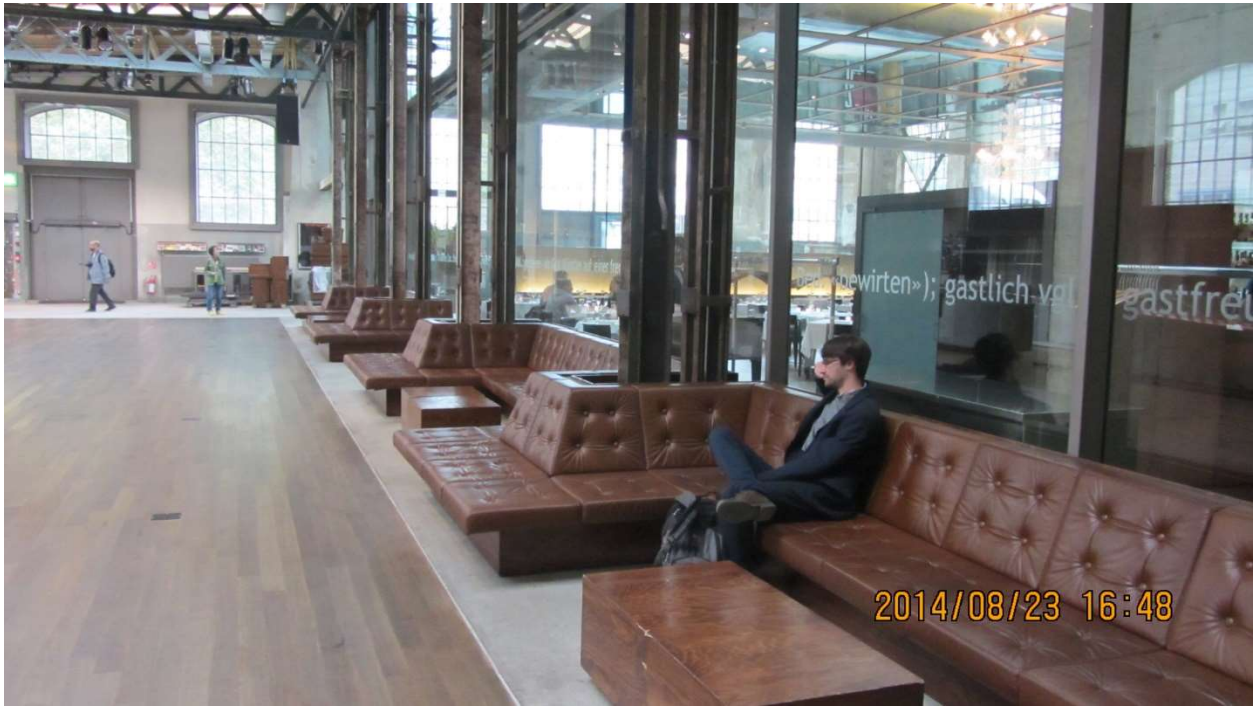
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6
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BOX
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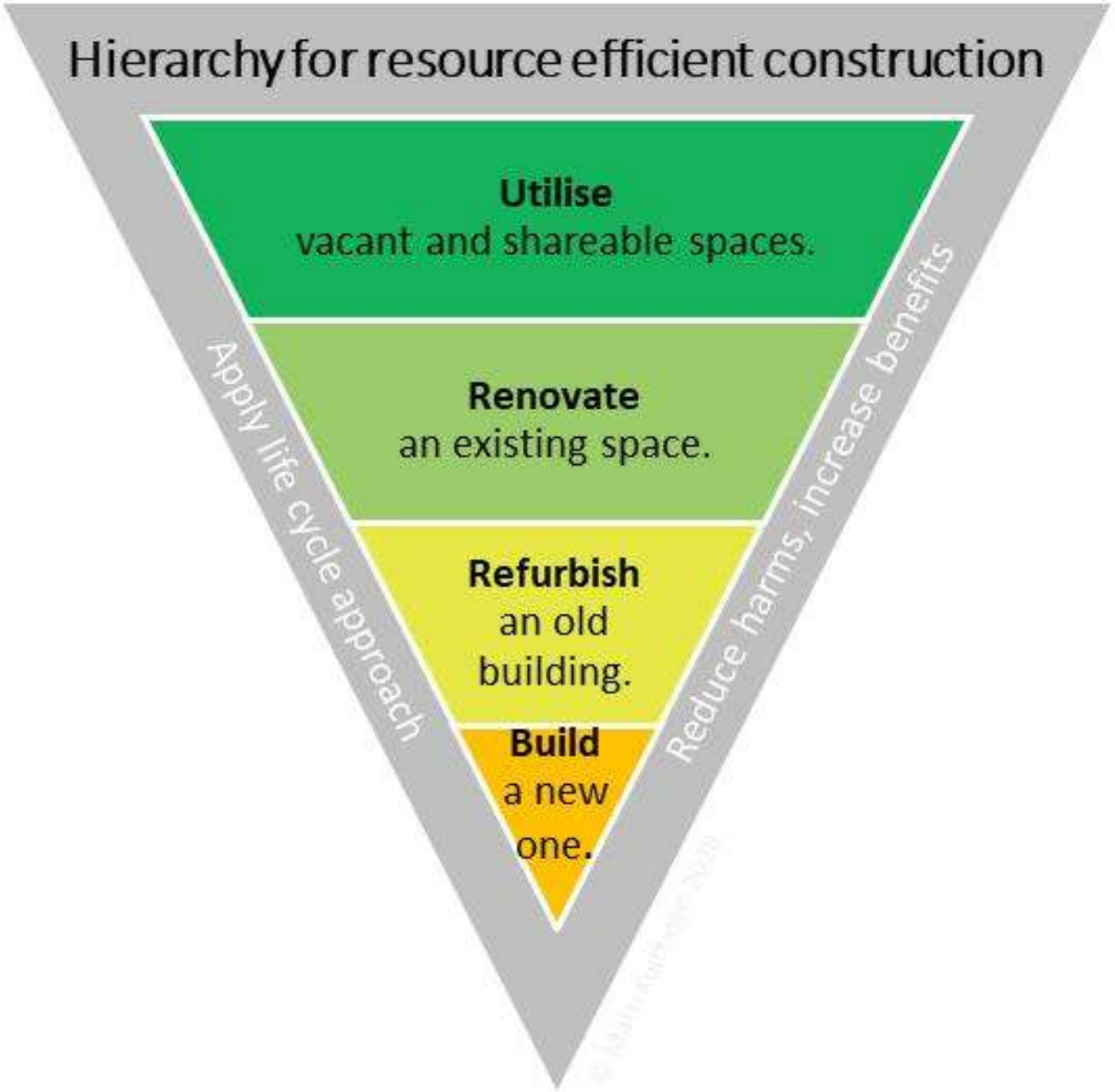

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Design for energy transition

- Two challenges to designers:
  - To design buildings so that they can be weaned away from dependence on nonrenewable fuels: photovoltaic
  - To use energy wisely: a fair share of locally available renewable resources (wind, solar)

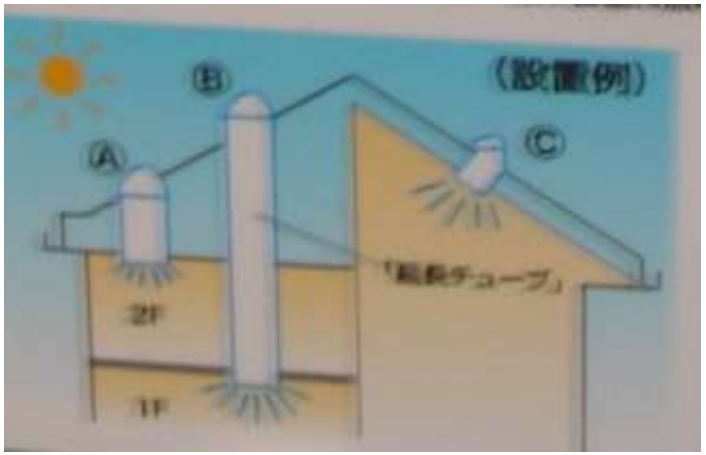
Tsinghua univ, Beijing, China

- Low energy building

Tsinghua univ, Beijing, China

- Low energy building

Light pipe (duct)

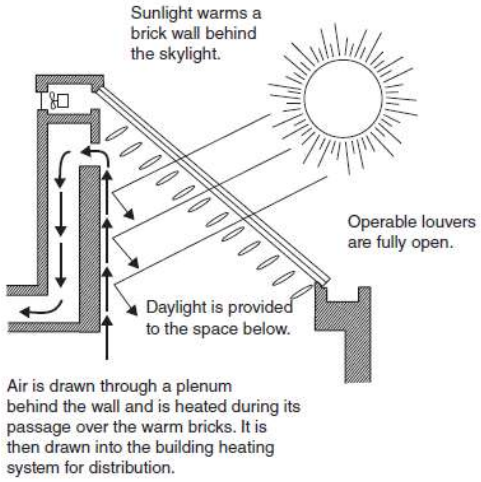

(設置例)
B
A
C
「集光チューブ」
2F
1F

Design for information age

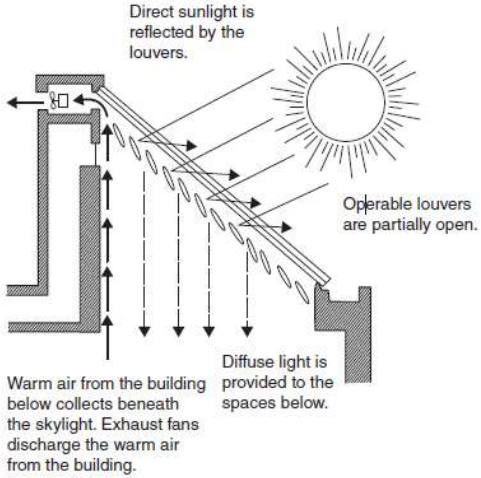
- Smart systems, smart (intelligent) buildings, smart cities
- http://www.automatedbuildings.com/

(a)

Fig. 2.7 The Albany County (New York) Airport features a central skylight (a) that provides 40% of the light and 20% of the heat for the building. (b) The insulated louvers are computer controlled to admit or block the sun and to store heat within the building on winter nights. (Courtesy of Einhorn Yaffee Prescott, Architects, Albany, NY. Redrawn by Amanda Clegg.)



Sunny Winter Day
The sun is used to provide heat and light.

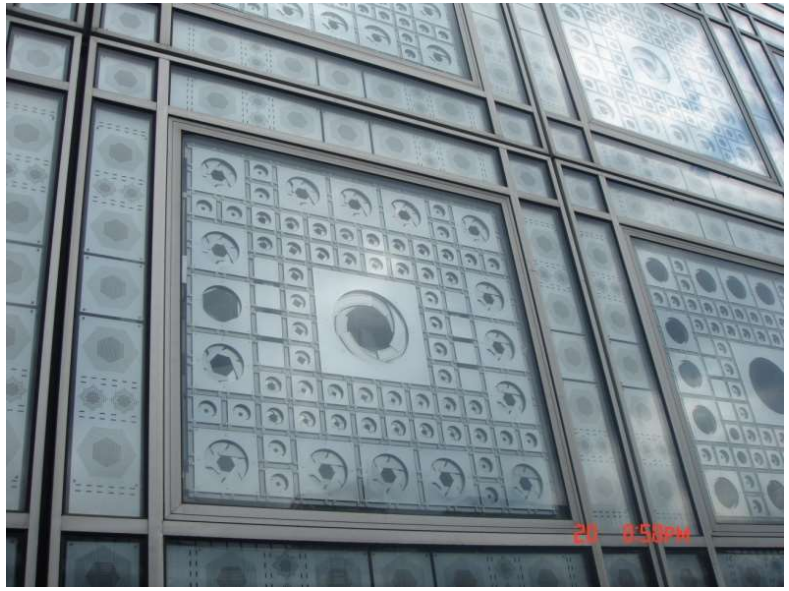


Sunny Summer Day
The sun is used to provide light, but is not allowed to penetrate the building and generate excessive heat.

The skylight provides 40% of the lighting and 20% of the heating needs.

Institute Arabe

- Jean Nouvel
- Date: 1987 to 1988



Institute Arabe

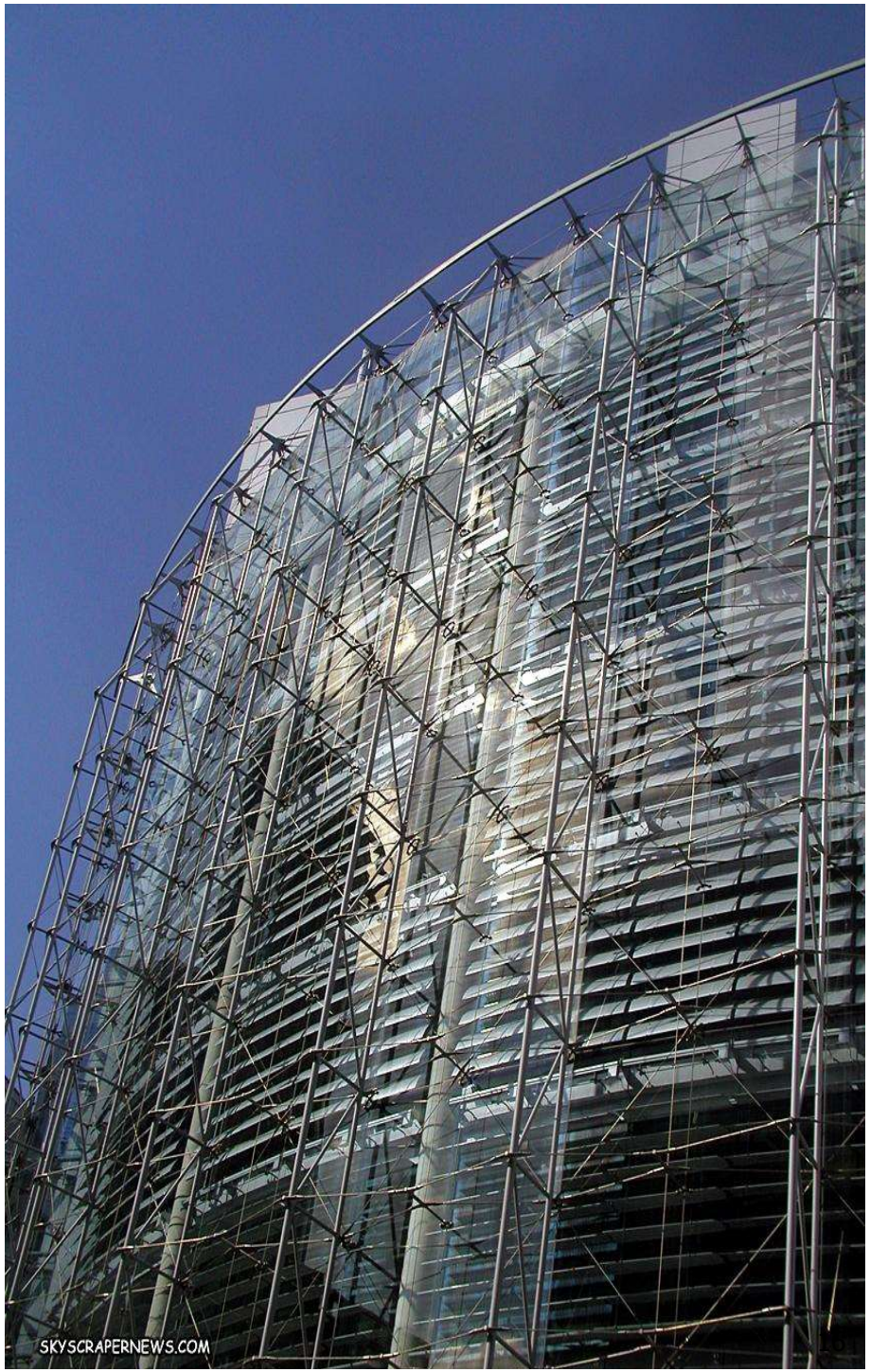
Institute Arabe

http://blog.kineticarchitecture.net/2011/01/arab-world-institute/

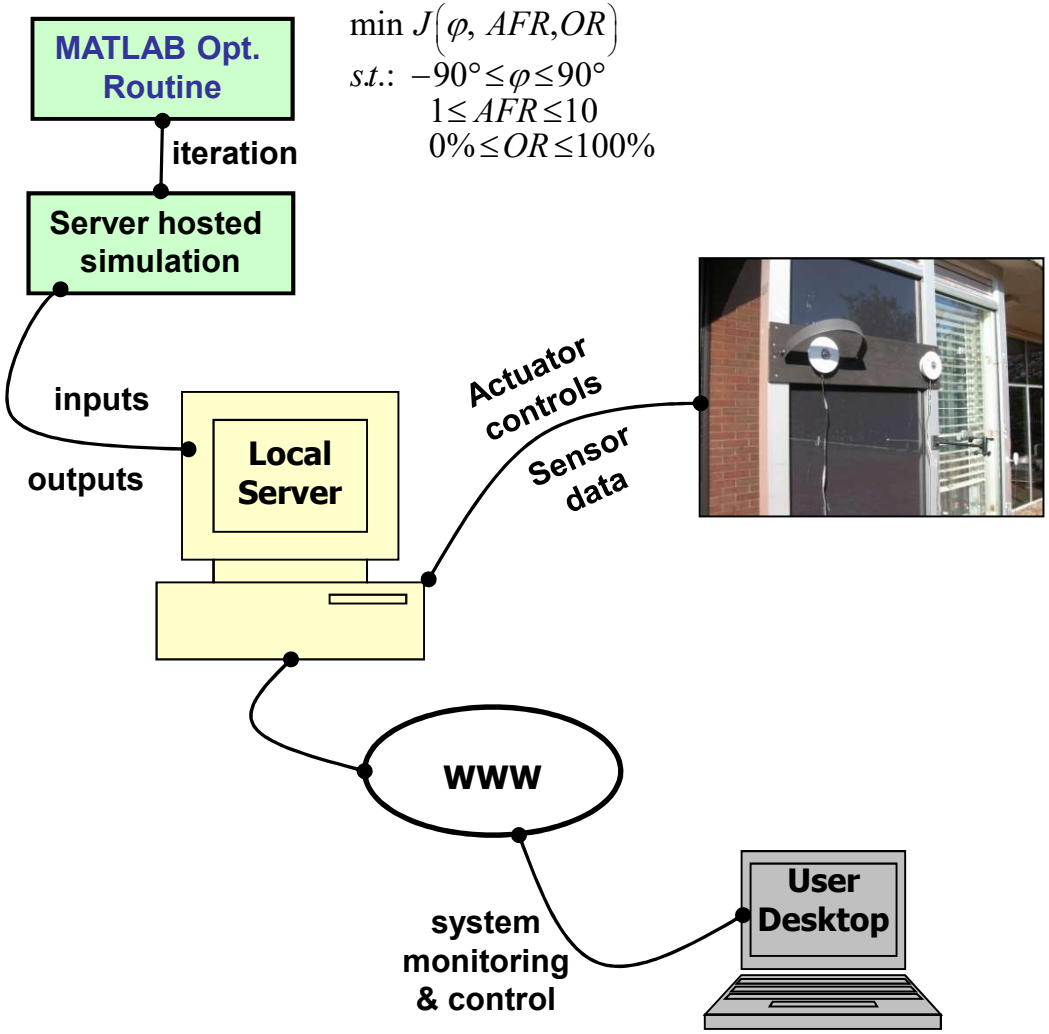
Helicon building, London

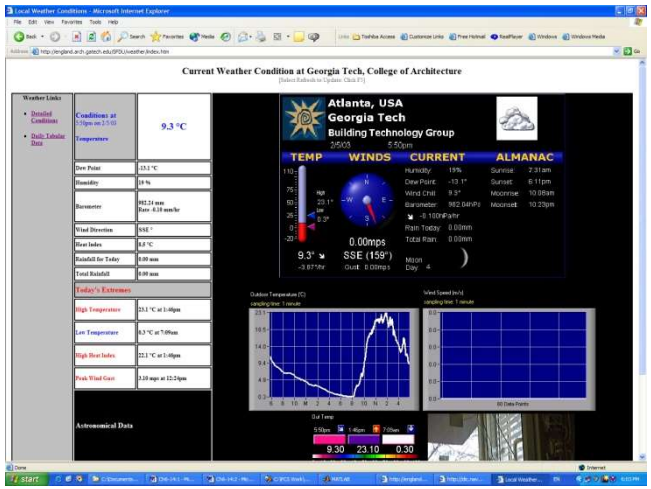
Architecture: Sheppard Robson
Engineering: Ove Arup and Partners

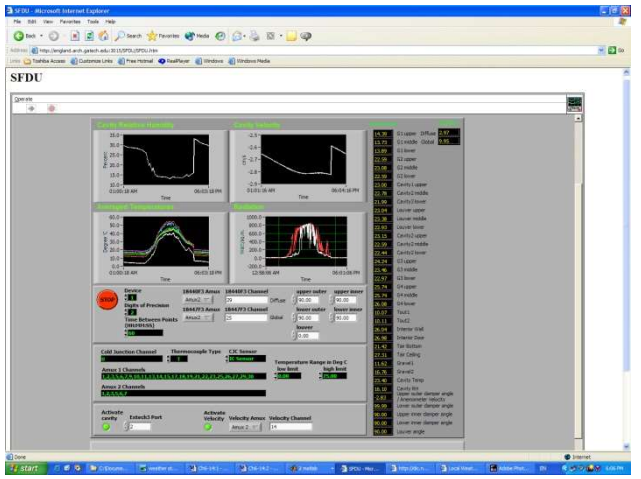
Blind slats	Air cavity
• When solar radiation incident on the façade is greater than 150W/m^2, the blind slats rotates to block solar radiation. • When solar radiation is equal to 650W/m^2, the blind slats completely closed. (90°= vertical) • Otherwise: blind slat is set to 0°(horizontal).	• In summer: if the cavity air temperature >= 28°C, external circulation mode occurs. • In winter: closed all the time.

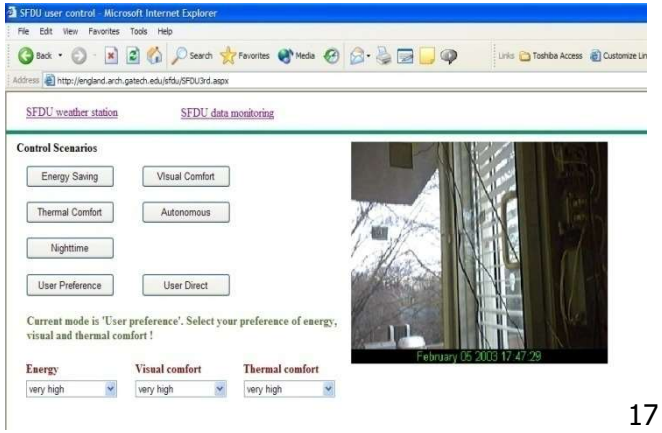


Smart double skin

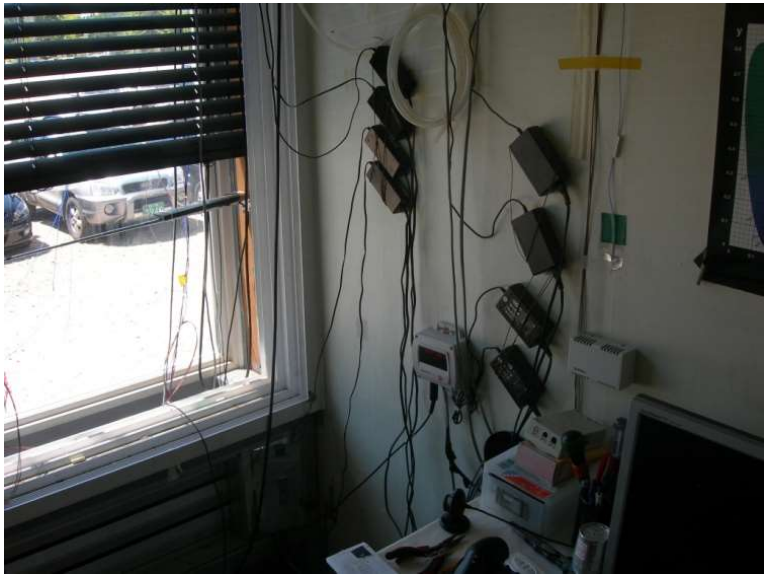








Occupant responsive optimal control of smart façade systems



http://solar.gatech.edu/

Solar Decathlon 2007

Design for transportation

- The link between transportation systems and mechanical and electrical systems in buildings should be considered.
- Photovoltaic arrays over parking areas to provide electricity for a building and recharge the parked cars (e.g., Fig.2.8)

Fig. 2.8 *"Building"-integrated photovoltaics (BIPV) provide shelter, shading, and power for a fueling station/convenience store in Eugene, Oregon. Note the green roof on the store and the biofuel pumps. (Photo by Nathan Majeski.)*

Jan 2010
AIST, Tsukuba, Japan


14 12:36PM
Jan 2010
AIST, Tsukuba, Japan

Jan 2010
AIST, Tsukuba, Japan


National Institute of Advanced Industrial Science and Technology
AIST
独立行政法人
産業技術総合研究所　太陽光発電システム
12:07
気温 057 ℃
湿度 418 %
メガ・ソーラタウンマップ
消費電力との発電比率
056 %
るいせき
中央第1
132 kW
中央第2
151 kW
中央第3
104 kW
中央第7
45 kW
ただいまの発電電力
432 kW
るいせき発電電力量
4645830 kWh
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How are we doing?

(city/state/province) that needs more environmental resources (generally equal to more land) to support itself than is available, thereby surviving through imports from other places

- 'Environmental footprint' is a concept suggested by Rees and Wackernagel (1995)
- It plots the gross resource demands of a geographical area as a footprint on the planet
- Campus green footprint: color coded map

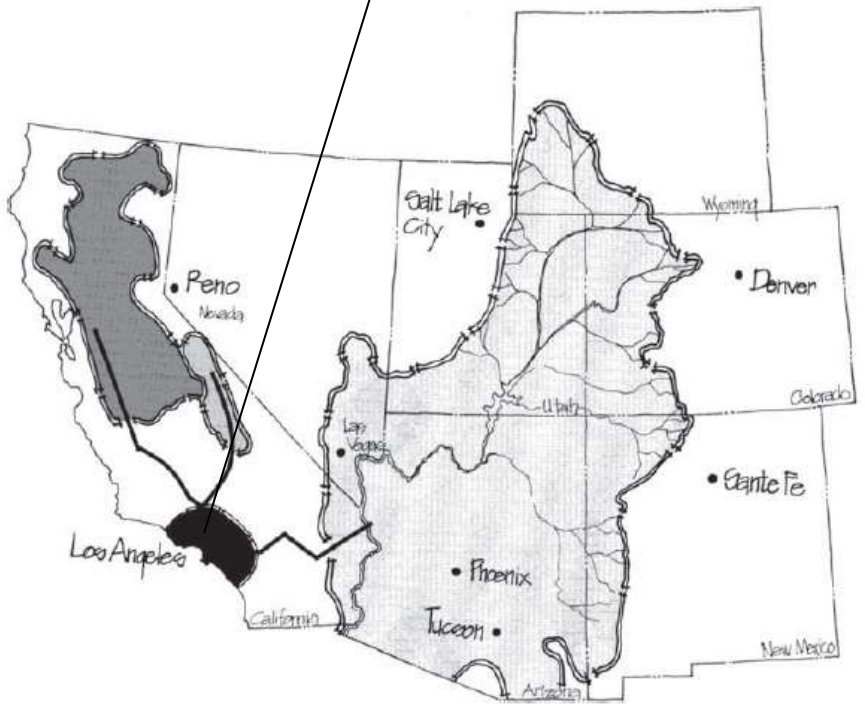

Fig. 2.9 The effective watershed of the greater Los Angeles area. The area needed to provide water to this metropolitan area (its water footprint) is vastly greater than the politically defined city limits. (From Design for Human Ecosystems by John Tillman Lyle. Copyright © 1999 by Harriet Lyle. Reproduced by permission of Island Press, Washington, DC.)

Data is given in global hectares per person (gha/person)

TABLE 2.6 Ecological Footprints for Selected Countries

Country	2013 Population millions	Footprint (gha/pers)	Biocapacity (gha/pers)	Surplus (if +) or Deficit (if –) (gha/pers)
Australia	23.3	8.8	15.7	6.9
Austria	8.5	6.1	3.0	–3.1
Bangladesh	157.2	0.7	0.4	–0.4
Brazil	204.3	3.0	8.8	5.8
Canada	35.2	8.8	16.2	7.4
China	1393.6	3.6	0.9	–2.7
Egypt	87.6	2.0	0.5	–1.5
Germany	80.6	5.5	2.2	–3.2
India	1279.5	1.1	0.4	–0.6
Nepal	27.8	0.9	0.5	–0.4
United Kingdom	64.0	5.1	1.3	–3.8
United States	317.1	8.6	3.8	–4.8
WORLD	7,181.7	2.9	1.7	–1.2

Source: © 2017 Global Footprint Network. National Footprint Accounts, 2017 Edition. Please contact Global Footprint Network at data@footprintnetwork.org for more information.

TABLE 2.7 Per Capita Energy[a] and Water[b] Use and CO_2 Emissions[c] for Selected Countries

Country	1997 Population	Energy Use[d]	Water Use[e]	CO_2 Emissions[f]
Australia	18,550,000	5975	1250	16.8
Austria	8,053,000	3790	261	7.9
Bangladesh	125,898,000	145	576	0.2
Brazil	167,046,000	1064	345	1.8
Canada	30,101,000	8000	1494	16.2
China	1,247,315,000	887	494	2.7
Egypt	65,445,000	695	1013	1.7
Germany	81,845,000	4264	572	10.2
India	970,230,000	514	635	1.0
United States	268,189,000	7921	1682	19.8
WORLD	5,892,480,000	1631	633	6.1

[a] *Source*: World Resources Institute, Earth Trends: The Environmental Information Portal; http://www.wri.org/resources.

[b] *Source*: World Resources Institute, Earth Trends: Formerly found in The Environmental Information Portal.

[c] *Source*: Nationmaster.com; http://www.nationmaster.com/; from World Resources Institute. 2003. *Carbon Emissions from Energy Use and Cement Manufacturing, 1850 to 2000*. Available online through the Climate Analysis Indicators Tool (CAIT) at http://cait.wri.org. Washington, DC: World Resources Institute.

[d] Units are thousand metric tons of oil equivalent per person per year. Data are for 2001. World per capita consumption has been stable over the past 10 years; that of the United States has increased slightly (7538 in 1990; 7921 in 2001).

[e] Units are cubic meters of water withdrawals per person per year. Data are for 2000.

[f] Units are thousand metric tons of carbon dioxide per 1000 people per year. Data appear to be for 2000.

Fig. 2.10 *Street façade view of the Bullitt Center, showing stairway, adjacent park, and cantilevering photovoltaic array. (© Miller Hull Partnership; used with permission.)*

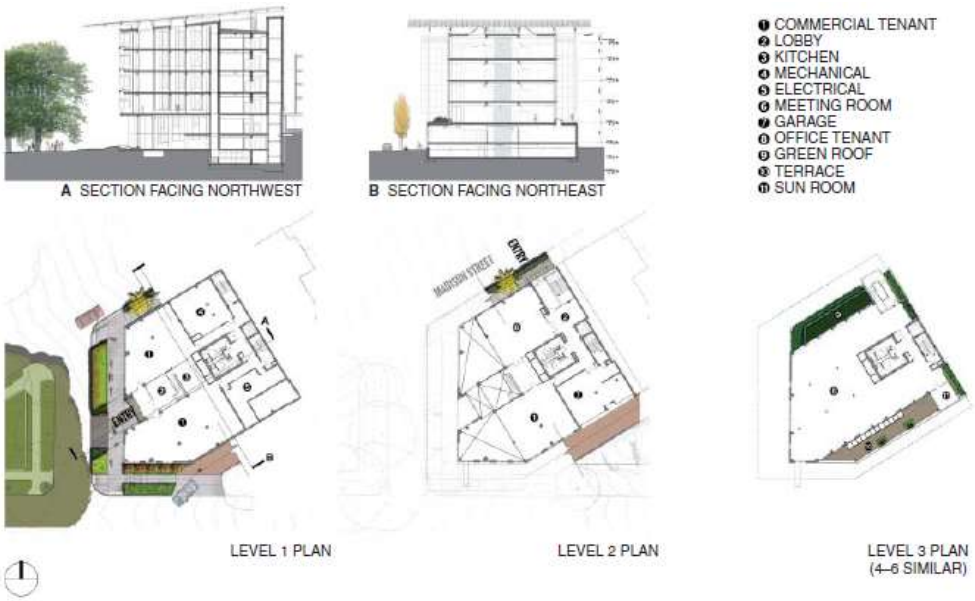

Fig. 2.11 *The Bullitt Center sits on a tight urban site, six stories above grade. (© Miller Hull Partnership; used with permission.)*

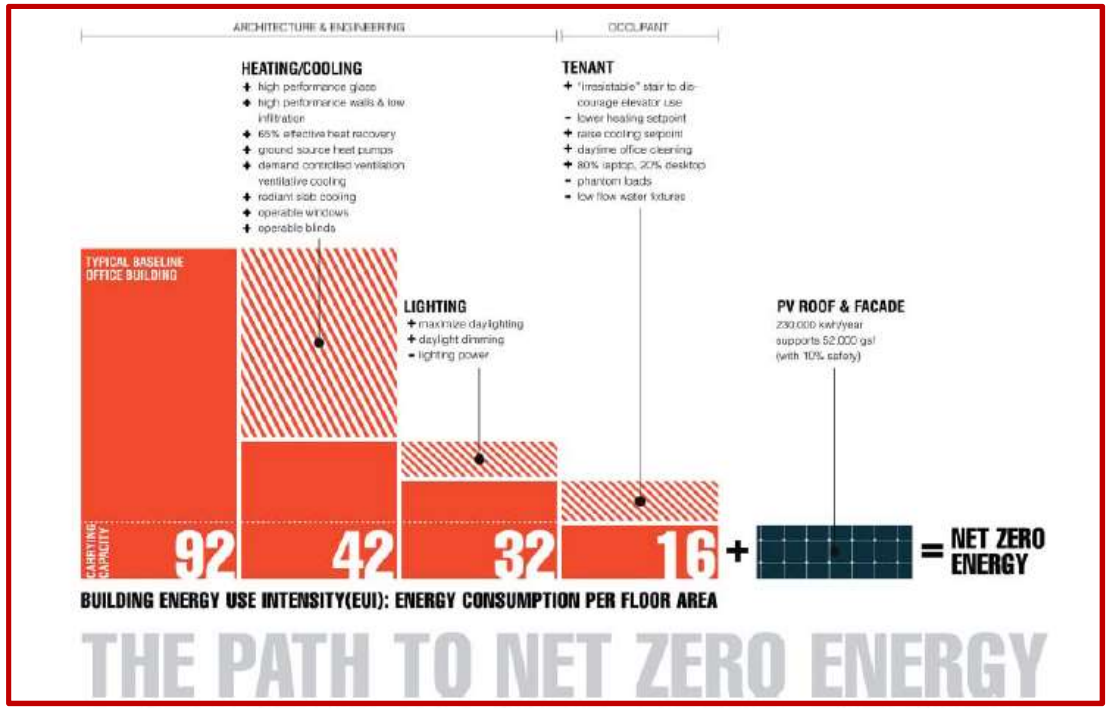

Fig. 2.12 *Path to net-zero energy from a baseline building and load reductions through heating, cooling, lighting, occupants (behavior and tenant contracts), and energy generated on site. (© Miller Hull Partnership; used with permission.)*