SUSTAINABILITY BASE

Window to the Future on Earth

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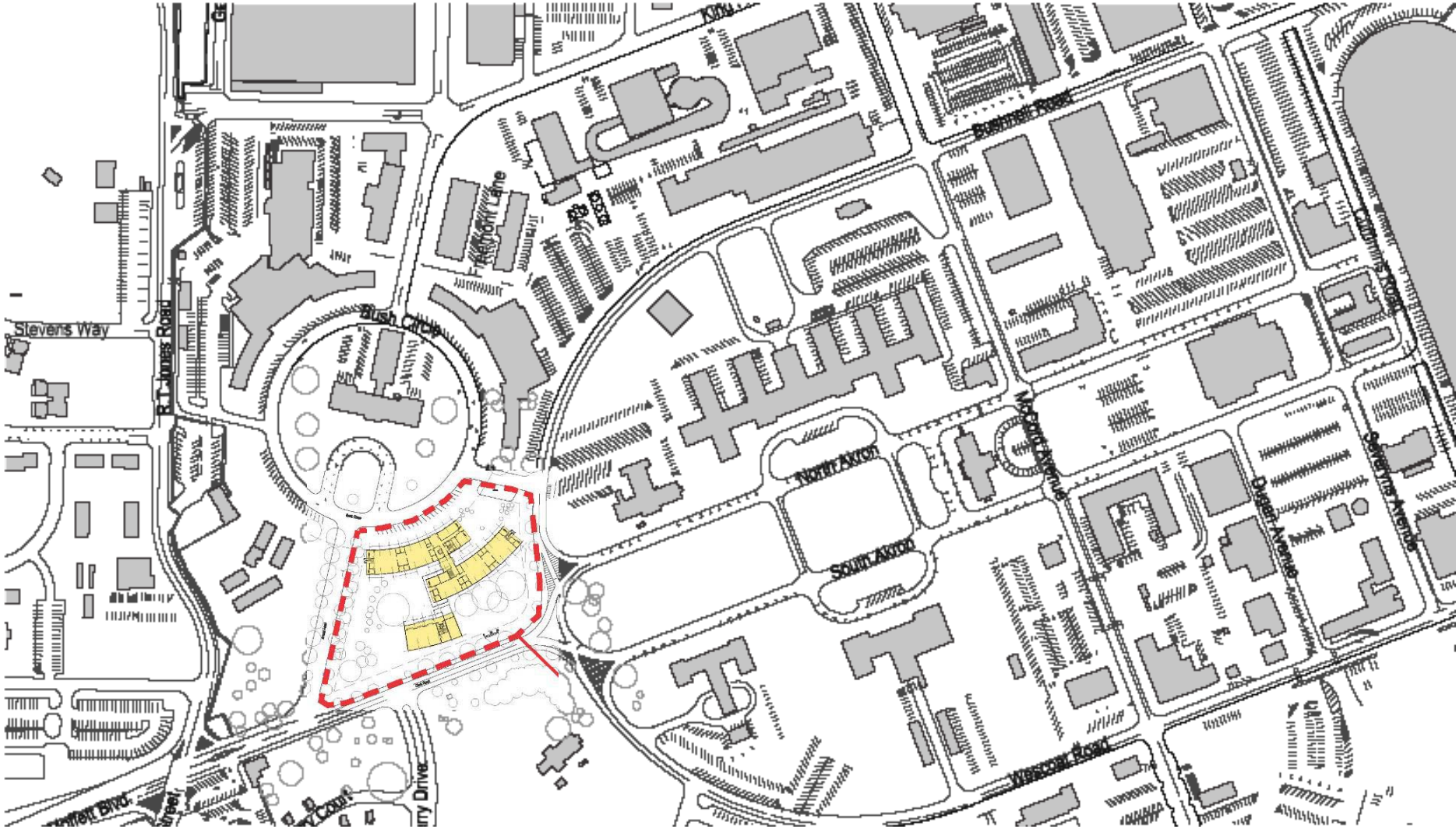
HISTORY OF PROJECT

- ✓ Business as usual – “Renovation by Replacement”
- ✓ Mid-level managers – enthusiastic but lacked vision
- ✓ Senior management provided inspiration (“First Lunar Outpost on Earth”), broke down barriers
- ✓ Informed by enlightened visionaries – William McDonough

GOALS AND INTENTIONS

- ✓ GREENEST BUILDING IN THE FEDERAL GOVERNMENT
- ✓ ZERO NET ENERGY CONSUMING
- ✓ LEED PLATINUM PLUS
- ✓ LIVING TEST BED FOR NEW TECHNOLOGIES
- ✓ “NASA INSIDE”

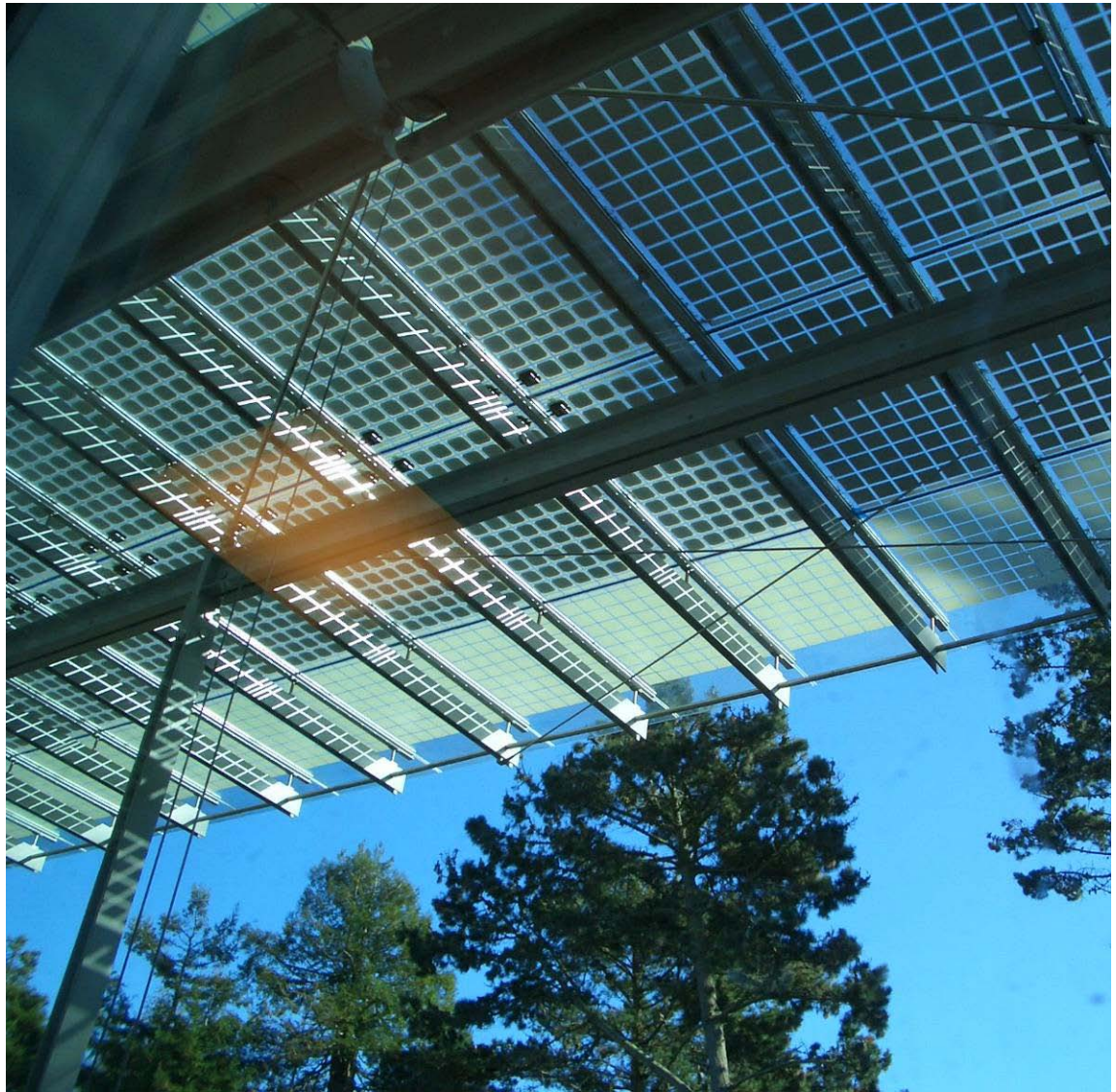
BUILDING LOCATION ON AMES CAMPUS


Stevens Way
R.T. Jones Road
Bush Circle
Bush Lane
Bldg
Bldg
Bldg

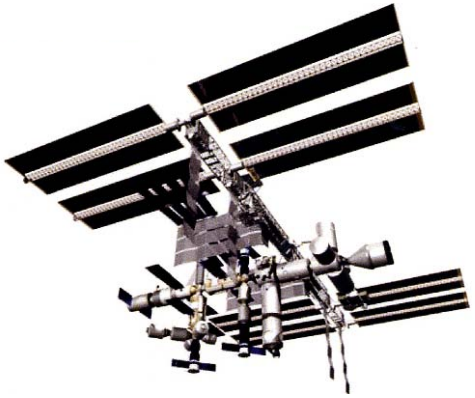
BUILDING DESIGN

BUILDING DESIGN

BUILDING DESIGN INSPIRATION



A canopy that shades the building, supports day lighting, generates oxygen, produces energy, and provides a strong image of NASA for occupants.



"BRIGHT" GREEN BUILDING

- ✓Dynamic living system – intelligent building + intelligent occupants
- ✓Real-time feedback key to optimizing building performance
- ✓Ethnographic analysis of work habits to optimize work performance while minimizing energy use

WORKPLACE EFFECTIVENESS

Goal: Create a highly flexible, collaborative and supportive work environment. Action areas include:

- ✓ Community and Collaboration
- ✓ Operational Flexibility
- ✓ Daylight + Views
- ✓ Fresh Air
- ✓ User Control
- ✓ Healthy Materials

WORKPLACE EFFECTIVENESS: FLEXIBILITY

A column-free interior, mindful window wall design, and raised floors allow space plan reconfigurations based on changing needs—more open office space, more enclosed offices, larger conference areas, etc.

REF: DS-309

WORKPLACE EFFECTIVENESS | COMMUNITY

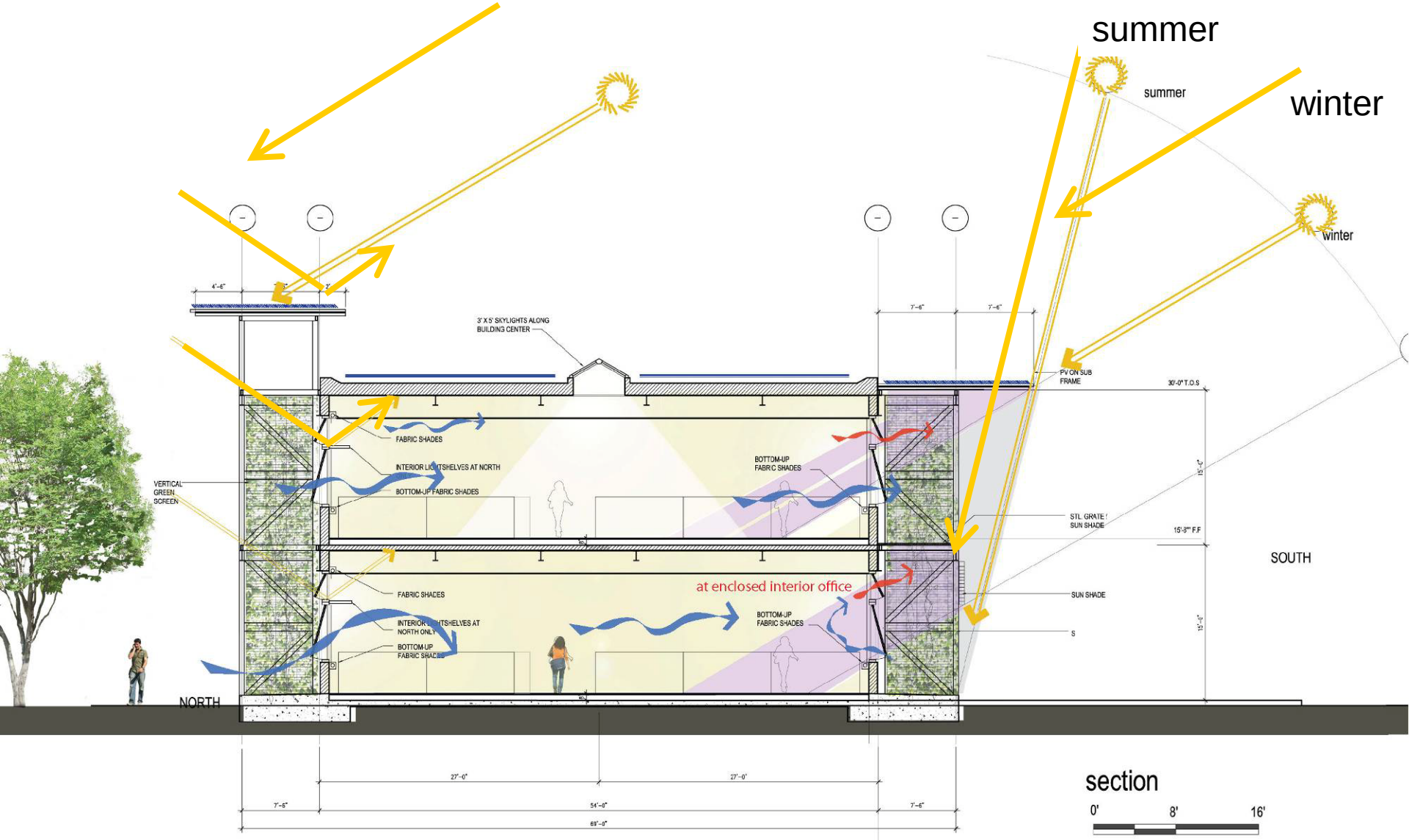
Interior streets connect neighborhoods to exterior gathering spaces, offering a wide range of work environments and providing a connection to the outdoors.

WORKPLACE EFFECTIVENESS: DAYLIGHT + VIEWS

Strategies:

- ✓ Provide adequate light levels year-round to eliminate need for ambient electrical lighting
- ✓ Design electrical lighting to respond to daylight levels; provide task lighting.
- ✓ Glare
  - Keep contrast ratios below 1:10
  - Avoid direct sunlight onto work surfaces
- ✓ Views
  - Provide multiple views from workstations to relieve eye strain and provide connections to outdoors (biophilia)

BUILDING METABOLISMS | ENERGY: Passive Solar



BUILDING METABOLISMS: ENERGY

- ✓ Reduce energy demand through:
  - Natural ventilation, supplemented by 200 geothermal wells
  - Day lighting supplemented by LED electrical lighting
  - High performance building envelope/windows that both reduce heat loss/ gain and support natural ventilation and day lighting strategies
  - Intelligent adaptive controls systems connected to the building monitoring system
  - Solar-thermal for all heated water

BUILDING METABOLISMS: WATER

Strategies:

- ✓ High performance fixtures
- ✓ Gray water capture systems
- ✓ Rainwater capture systems
- ✓ On-site black water treatment (?)
- ✓ Connections to local non-potable sources
- ✓ Intelligent landscape design

90% reduction

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Energy Efficiency
Appliances
Computers
Displays
Floor Coverings
Insulation
Lighting
Telecommunications
Windows

Water
Low flow devices
Smart Water Metering
Rainwater Collection
Storm water Quality Control
Storm water Quantity Control
Water Efficient Landscaping
Water Quality Control
Water Use Reduction
Wastewater Technologies

Renewable Energy
Geothermal Heating/Cooling
Green Power Purchase
Onsite Renewable Energy
- Fuel Cell (biofuel)
- Rooftop Photovoltaic
- Solar Thermal
- Sterling Engine
- Wind Turbines
- Outdoor PV Charging Stations
- Vehicle Charging Stations

Pollution and Waste
Air Quality
Carbon Reduction
Composting
Cradle-to-Cradle Products
Disposal Diversion
eWaste Reduction
Green Cleaning Program
Paper Reduction
Regenerative Waste
Storage/Collection of Recyclables
Ventilation
Water Quality

Intelligent Technology
Intelligent/Adaptive Learning
Analytic Tools
Automation
Carbon Management
Data Processing/Storage
Digital Controls
Energy Management
Energy Simulation
Green IT
Grid Interface
Interactive Models
Lifecycle Analysis
Sensors
Smart Energy Metering
Supercomputer Modeling
System Optimization

Materials
Drywall
Glass
Materials Simulation
Metals
Nanotechnology
Paint
Plastics/Polymers
Rapidly Renewable
Recycled/Reused
Regional
Structural

Human Factors
Acoustics
Auto vs. Manual Controls
Collaborative Working
Dashboard Interface
Human Comfort
Human/Machine Interface
Human/Building Interaction
Sustainable Education
Wearable/Mobile Devices

CURRENT STATUS

- ✓Construction began September
- ✓Building to be completed and occupied March 2011
- ✓On track for a LEED Platinum + certification from the U.S. Green Building Council

SUMMARY

- ✓A model for both NASA and entire Federal sector
- ✓The built environment need not consume 40% of total US energy consumption
- ✓No sacrifice and minimal cost differential
- ✓NASA a good steward of tax payer funds

Backup slides

OBSTACLES OVERCOME:

- ✓NASA HQ concern over schedule and budget risk
- ✓Federal Acquisition Regulations (FAR)
- ✓Pride of ownership and financial concerns for design team
- ✓Schedule, budget, schedule, budget, schedule, budget…

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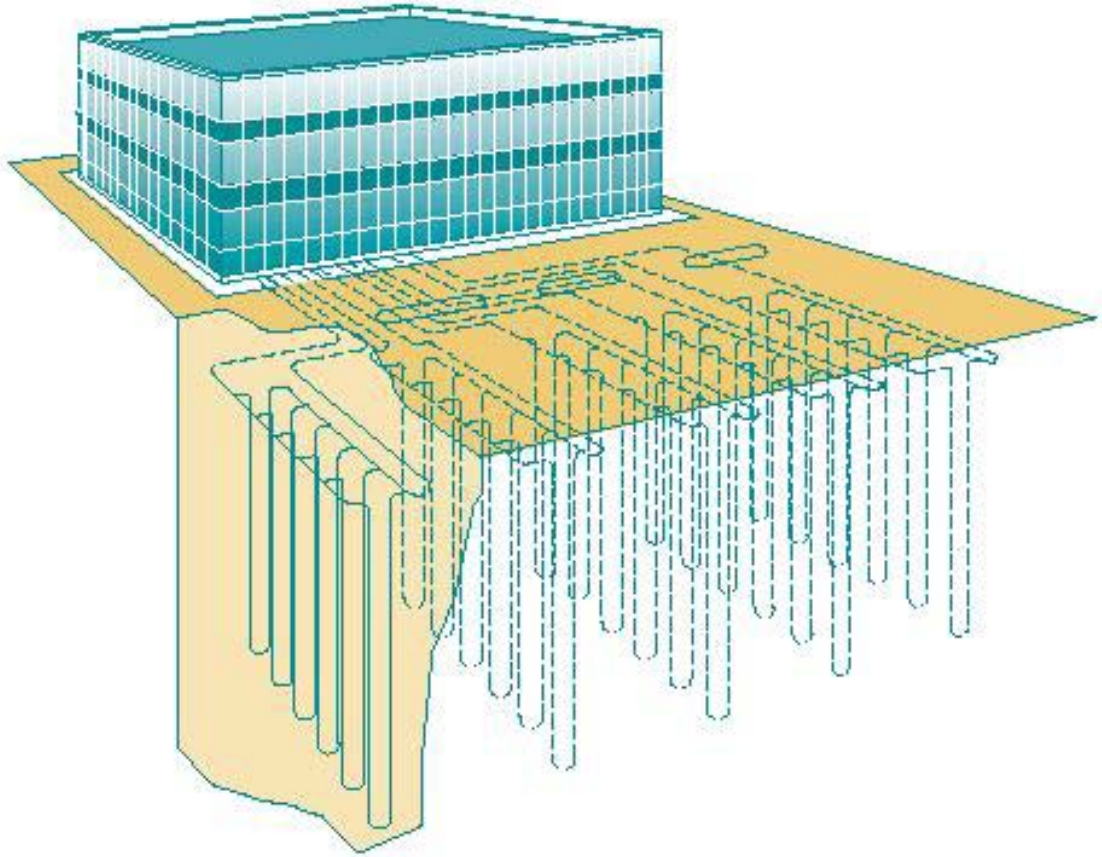
BUILDING METABOLISMS | ENERGY: Geothermal



- When natural ventilation cannot meet comfort criteria, a radiant heating/cooling system is employed.
- Separating thermal comfort from air delivery allows for wider comfort zones and promotes mixed mode operation with reduced energy losses.
- Connecting a radiant system to a geothermal system further improves overall energy performance

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