

# Energy and the Building Façade

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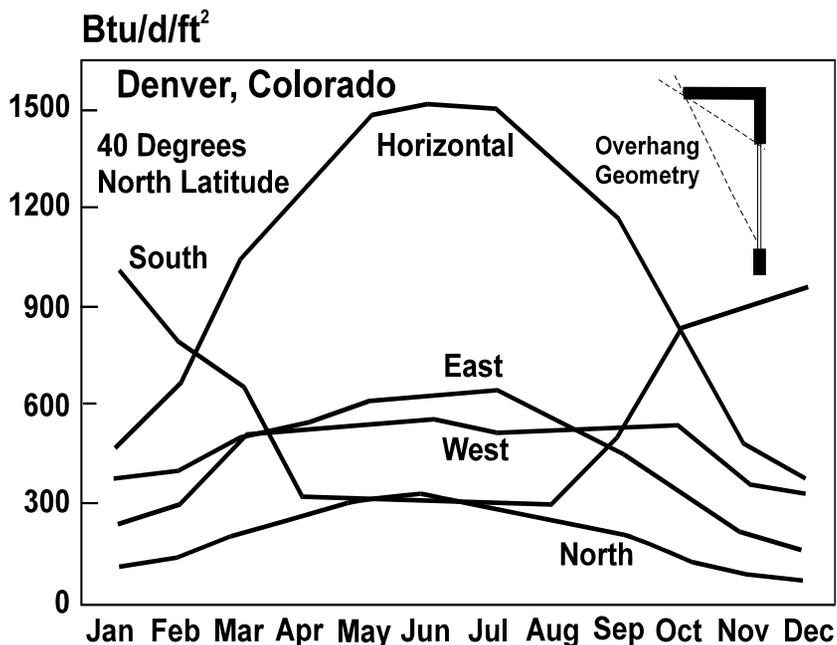
Façade: any side of a building given special architectural treatment; french façade, from Italian faccia (face)

# Façade concepts related to Energy

- Passive Solar: letting heat in
- Solar control: keeping heat out
- Daylighting façades: natural lighting
- Double skin façades; ventilation
- Active façade systems: changing properties
- Solar Ventilation Air Preheating Systems
- Photovoltaic Systems

# Treatment for a Façade depends on orientation

**Solar Radiation Transmitted Through Clear Double Glazing**

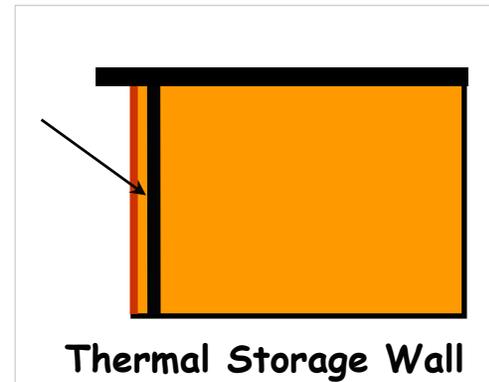
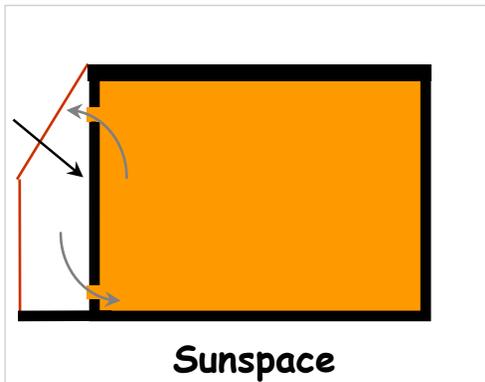
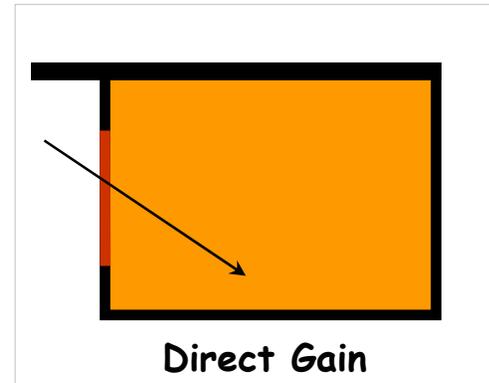
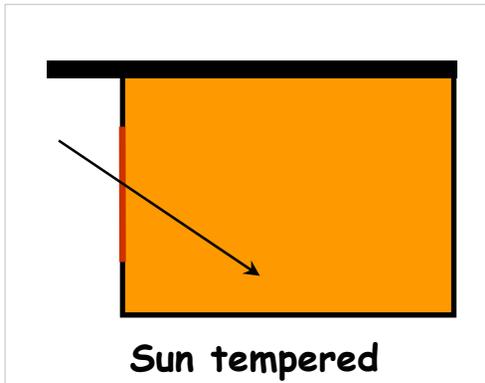
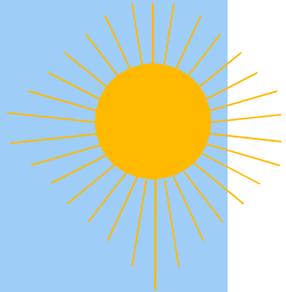


South: maximum solar gain in winter

East: maximum solar gain in summer morning

West: maximum solar gain in summer evening

North: diffuse light good for daylighting





# Direct Gain

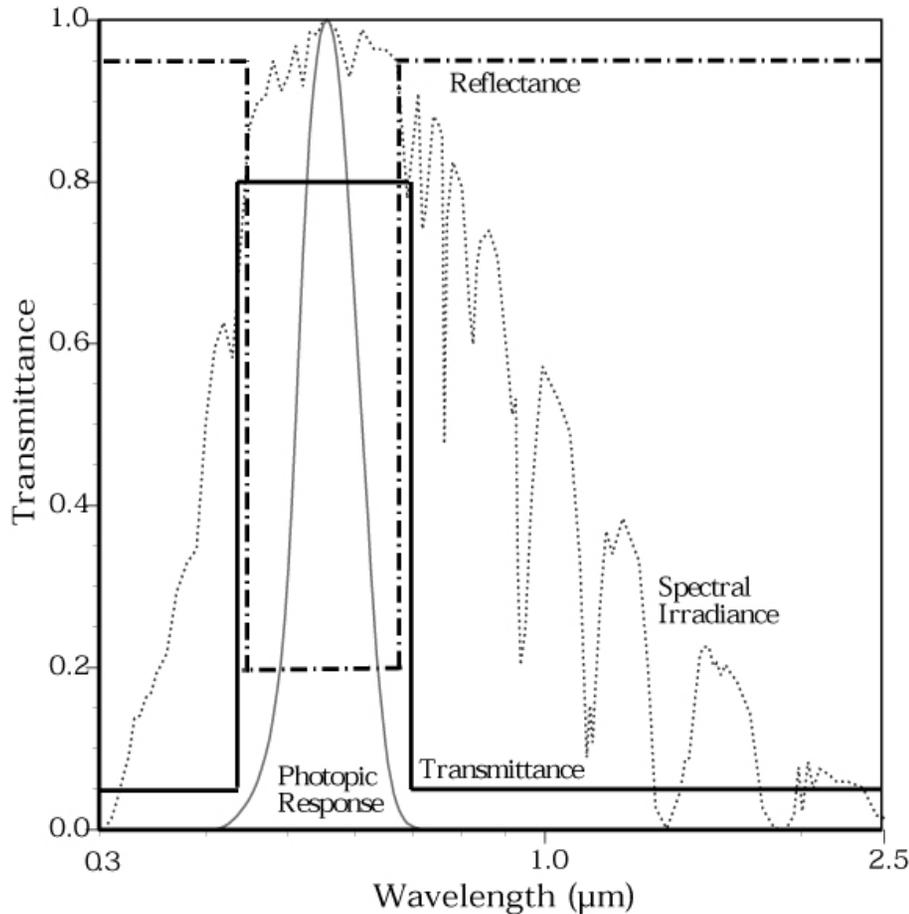


# Thermal Storage (Trombe) Wall



- Spectrally-selective glazing
- Angular selective
- Solar filters
- Exterior solar control

# Selective Glass



Ordinary glass has a visible transmittance similar to its solar heat gain coefficient. Selective glass reflects the ultraviolet and infrared, to achieve a SHGC of 0.32 while maintaining a vt of 0.70.

# Angular Selective



- Louvres
- Mini-optical light shelves
- Prismatic glazing



# Solar Filters

- Perforated metal screens
- Woven fabric screens
- Etched glass
- Translucent glass
- Fritted glass, like Ohare Airport



Overhangs work on South facade, but not on East or West  
and not needed on North

- Sunlight redirection
- Daylighting window above view window
- Light Shelves
- Overhangs



# Double skin façades

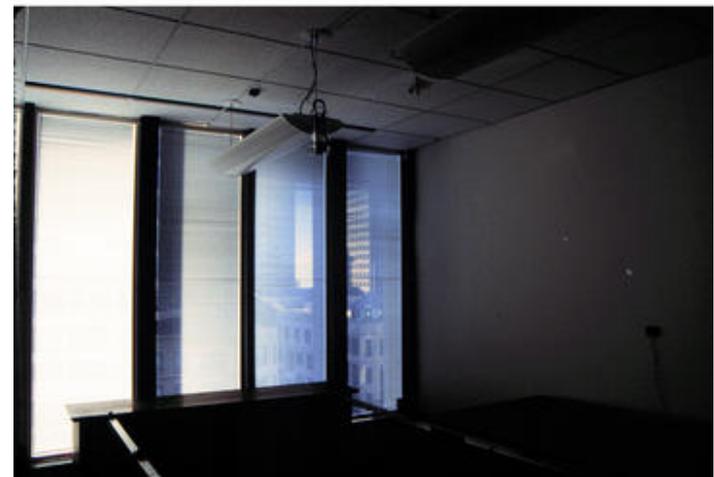


Vent heat in summer

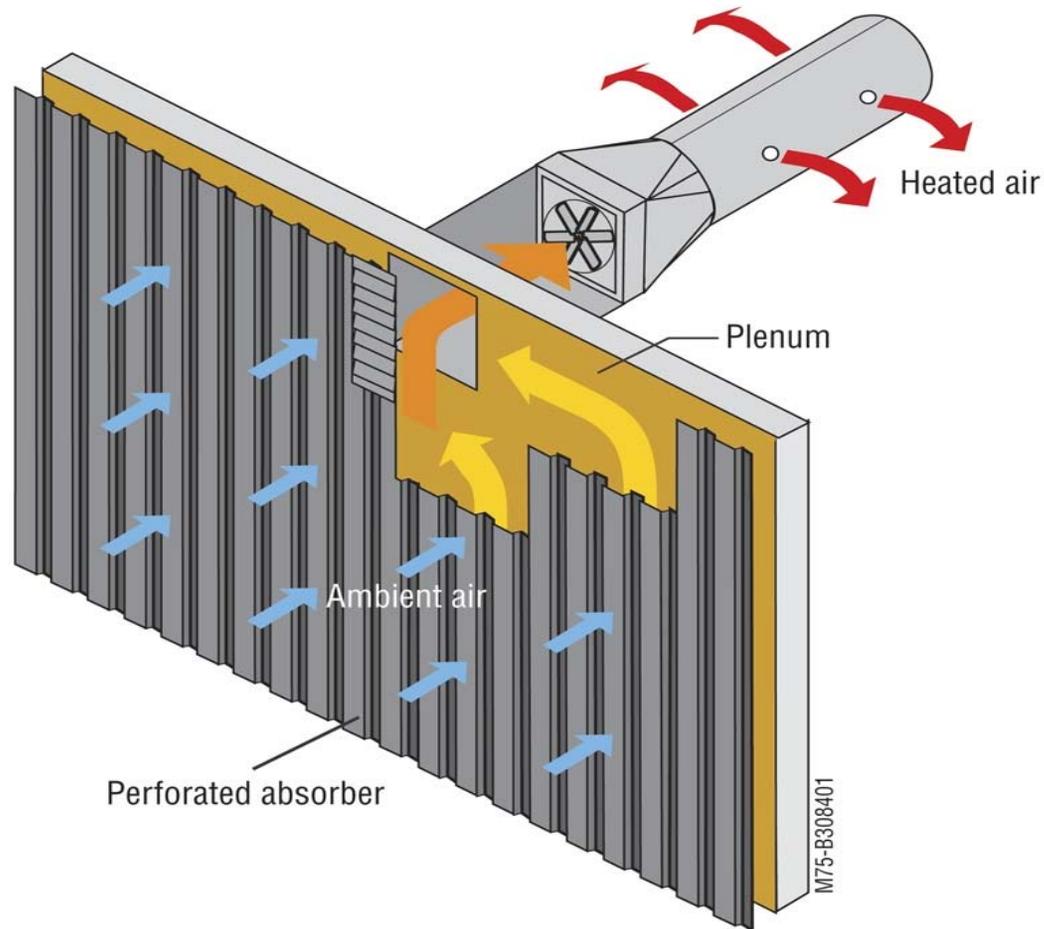
Recapture heat in winter

- Natural ventilation
- Heat extraction
- Night-time ventilation
- Mixed mode and natural ventilation

- optical and thermal properties dynamically changed in response to:
  - climate,
  - occupant preferences and
  - energy mgmt control system (EMCS)
  - Utility demand response programs
- motorized shades
- switchable windows
  - Electrochromic
  - Thermochromic
  - Photochromic



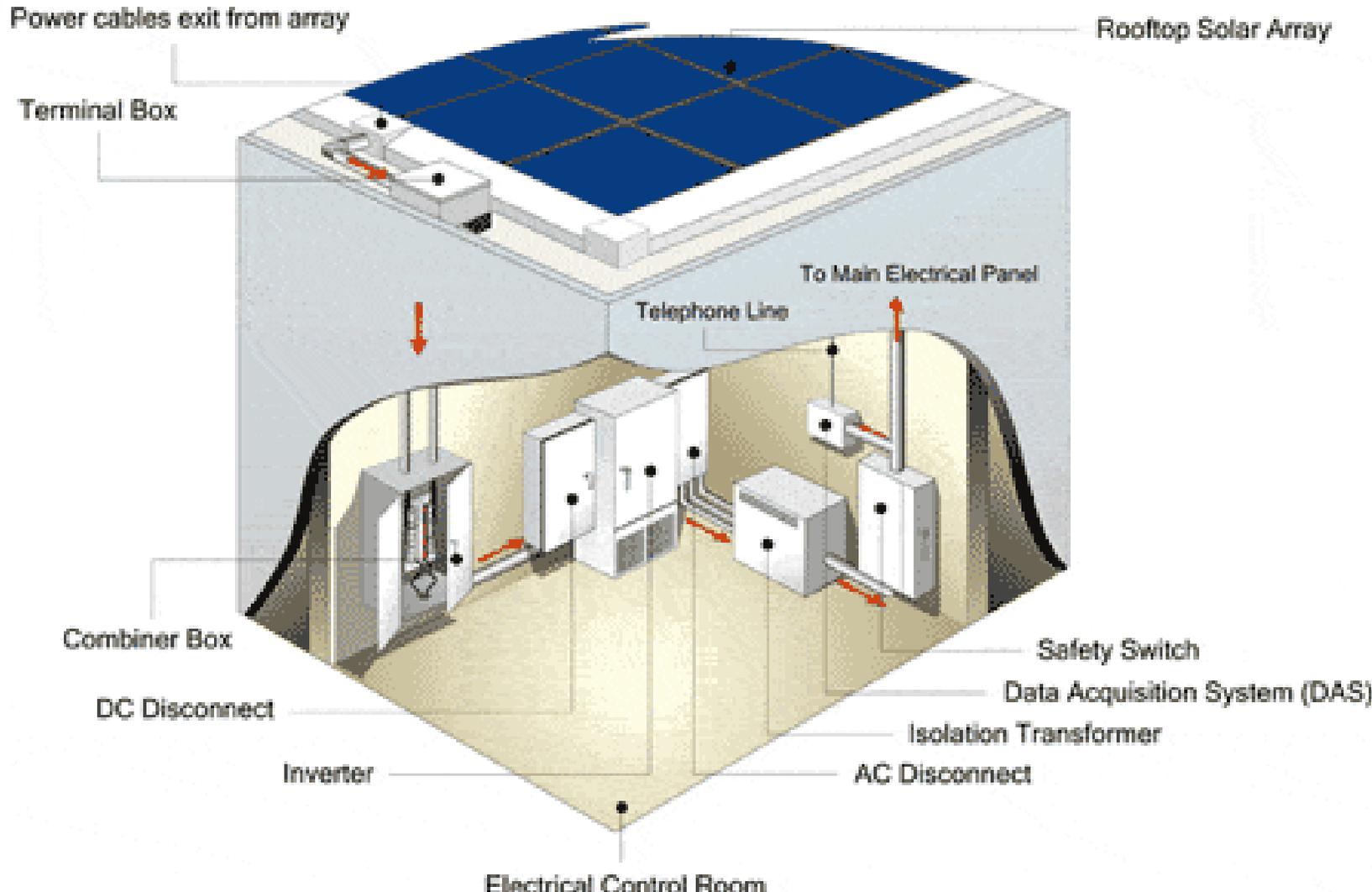
# Solar Ventilation Air Preheating





Rapid City Recreation Center – Rapid City, SD: South façade is best but east and west also work

# Photovoltaic System



# 2006 Energy PV Integrated in the Façade



# PV energy delivery on various facades

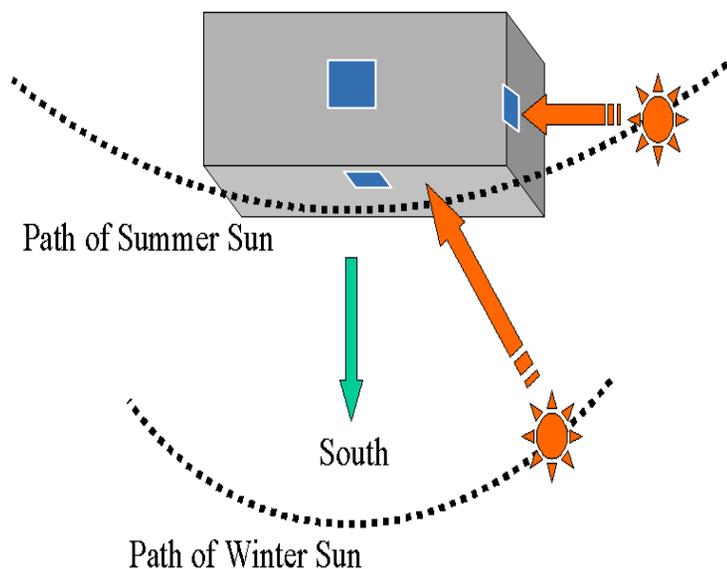
Flat roof and south wall are best...

Annual Energy Production from 1 kW of PV (84 Ft<sup>2</sup>) on each side in New York City

- North 554 kWh/yr
- East 871 kWh/yr
- South 1097 kWh/yr
- West 833 kWh/yr
- Horizontal 1393 kWh/yr

By comparison...

- Tilt=41 deg 1530 kWh/yr
- 2-axis track 1929 kWh/yr





- Thank You!