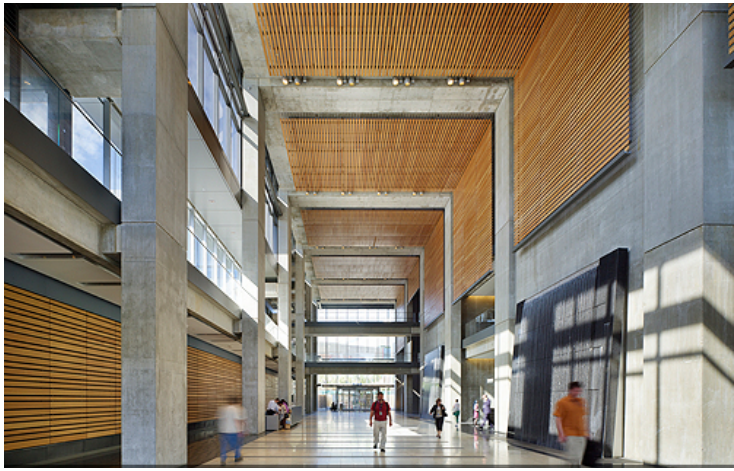
www.architectscience.com

TOWARDS A NEW ARCHITECTURE + ENERGY



Buildings Technology R&D Vision

Enable designs of new buildings and retrofits of existing buildings that over the life cycle:

- Produce as much energy as they consume (NZEB).
- Double the service life of building materials, products, and systems and minimize life cycle impacts.
- Reduce domestic water use by 50% (to 50 gal/day per person), maximize water recycling and rainwater harvesting, and minimize stormwater runoff.
- Achieve breakthrough improvements in indoor occupant health, productivity, and comfort.

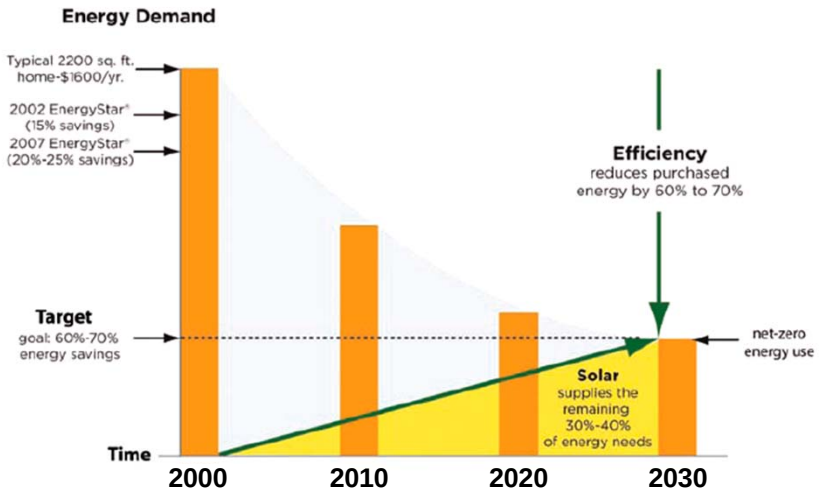
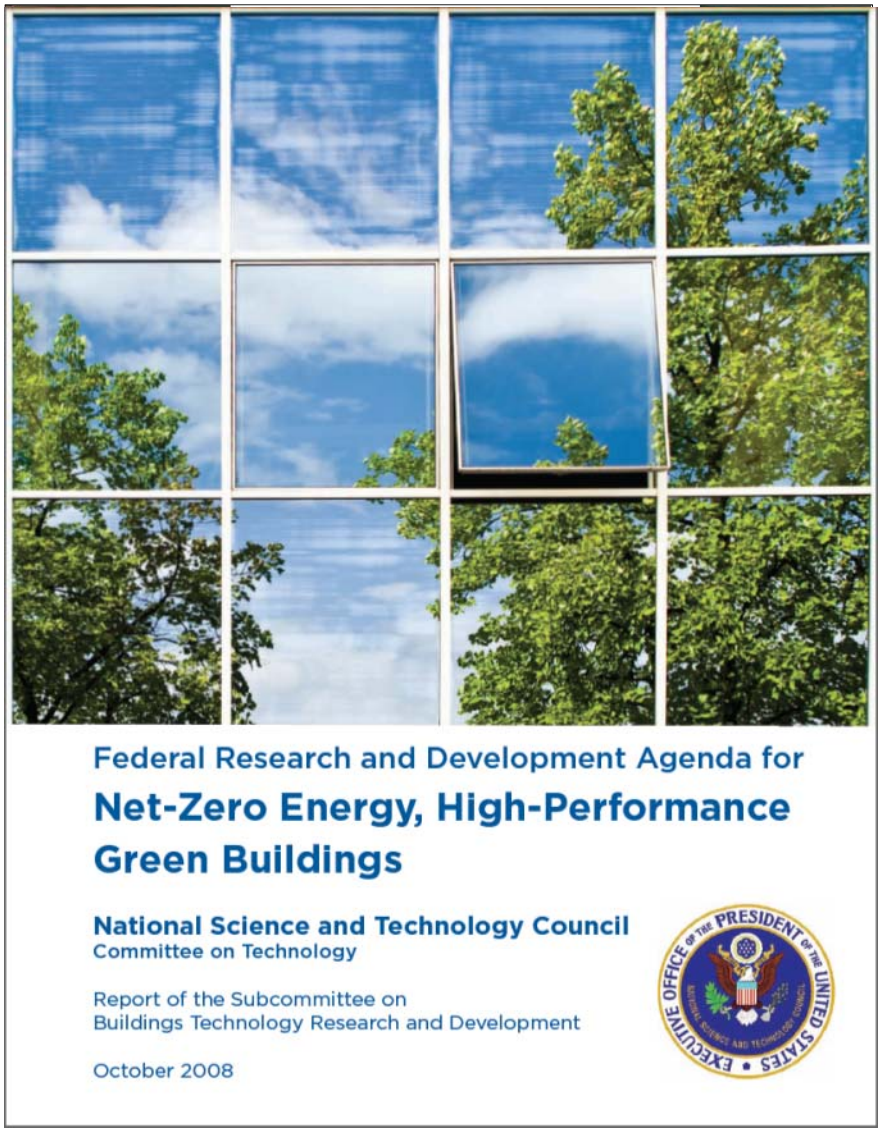


Figure 3. Approach for Achieving Net-Zero Energy Buildings




Greenland
Iceland
Finland
Russia
Canada
United States
México
Ukraine
Kazakhstan
Mongolia
China
South Korea
Turkey
Iraq
Iran
Afghanistan
Pakistan
Algeria
Libya
Egypt
Saudi Arabia
India
Thailand
Mauritania
Mali
Niger
Chad
Sudan
Nigeria
Ethiopia
Kenya
DR Congo
Tanzania
Angola
Namibia
Botswana
South Africa
Madagascar
Indonesia
Papua New Guinea
Australia
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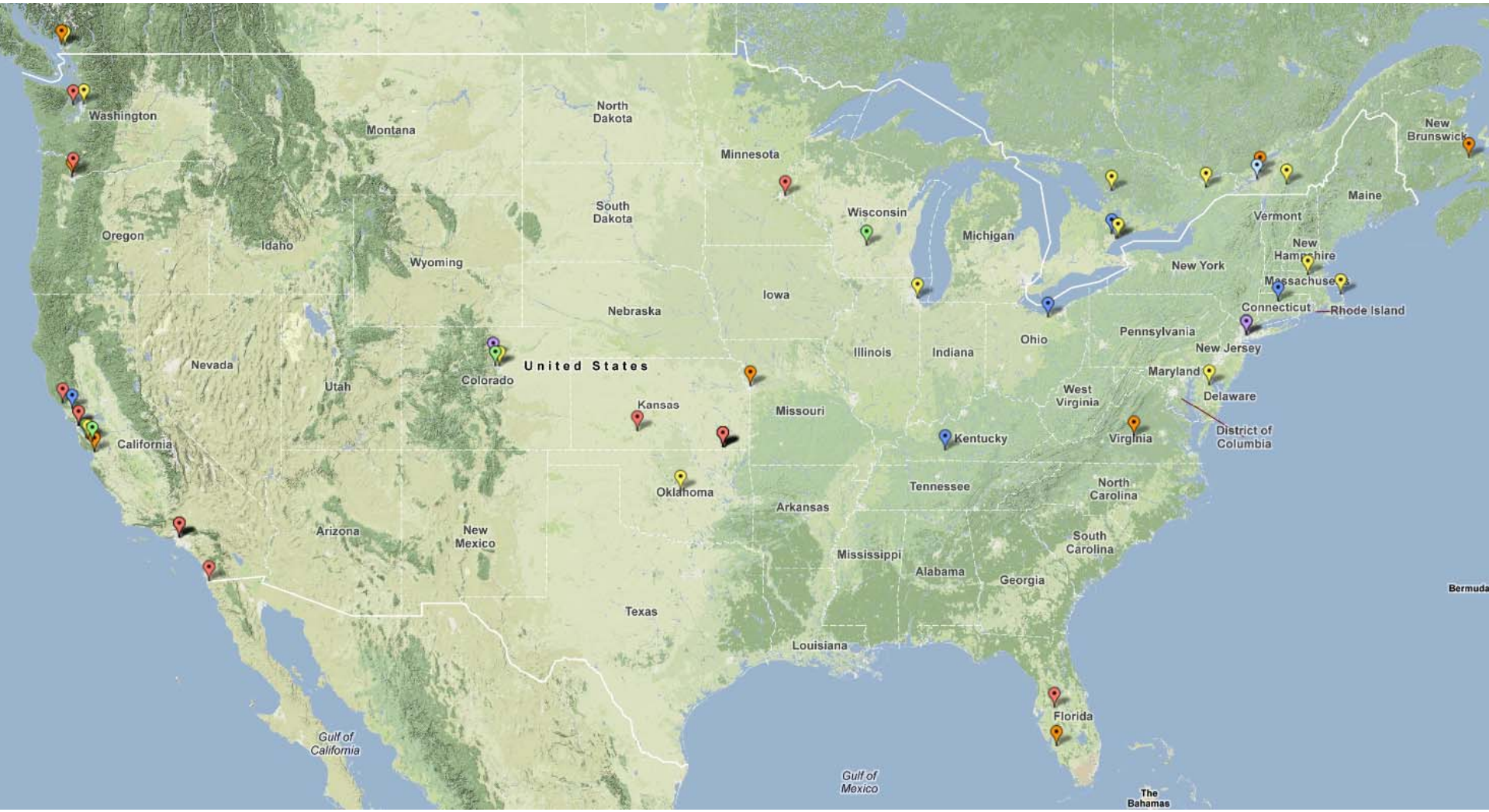
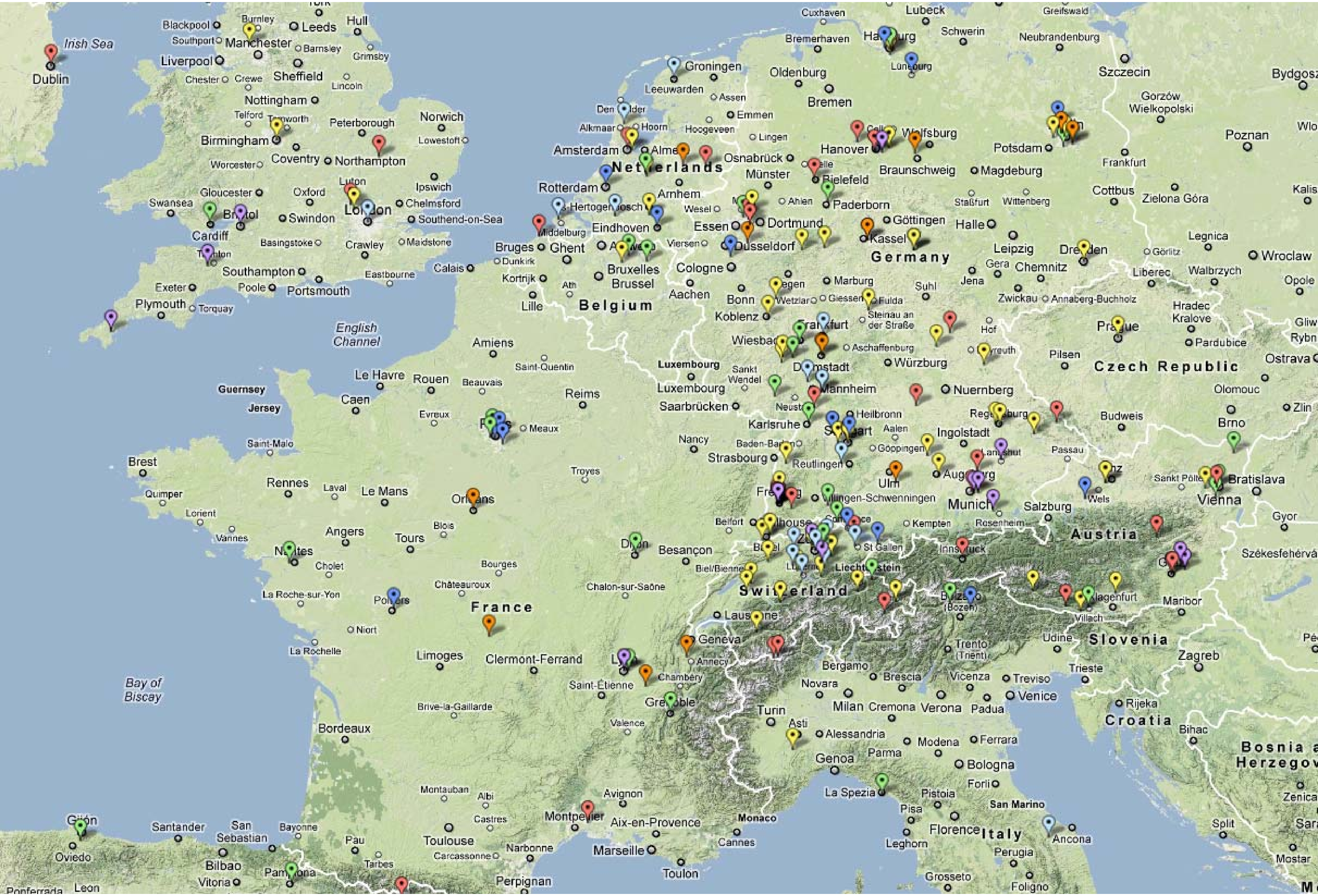
North Atlantic Ocean
South Pacific Ocean
South Atlantic Ocean
Indian Ocean
Southern Ocean



Zero Energy Buildings: A Critical Look at the Definition
www.nrel.gov/docs/fy06osti/39833.pdf

Zero Energy Buildings: A Critical Look at the Definition
www.nrel.gov/docs/fy06osti/39833.pdf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Burnley
Leeds
Hull
Southport
Manchester
Barnsley
Grimsby
Liverpool
Sheffield
Chester
Crewe
Lincoln
Nottingham
Telford
Tamworth
Peterborough
Norwich
Birmingham
Lowestoft
Worcester
Coventry
Northampton
Luton
Ipswich
Gloucester
Oxford
Chelmsford
Swansea
Bristol
Swindon
London
Southend-on-Sea
Cardiff
Basingstoke
Crawley
Maidstone
Taunton
Southampton
Eastbourne
Exeter
Poole
Portsmouth
Plymouth
Torquay
English Channel
Calais
Guernsey
Jersey
Saint-Malo
Brest
Quimper
Lorient
Vannes
Rennes
Laval
Le Mans
Nantes
Angers
Tours
Cholet
La Roche-sur-Yon
Poitiers
Niort
La Rochelle
Bay of Biscay
Bordeaux
Le Havre
Rouen
Caen
Evreux
Beauvais
Amiens
Saint-Quentin
Paris
Meaux
Reims
Troyes
Orléans
Blois
Bourges
Châteauroux
France
Limoges
Clermont-Ferrand
Brive-la-Gaillarde
Montauban
Albi
Castres
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Carcassonne
Narbonne
Perpignan
Montpellier
Avignon
Aix-en-Provence
Marseille
Toulon
Cannes
Monaco
Lyon
Saint-Étienne
Valence
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Chambéry
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Geneva
Dijon
Besançon
Chalon-sur-Saône
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Dunkirk
Kortrijk
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Ghent
Antwerp
Bruxelles
Brussel
Belgium
Luxembourg
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Amsterdam
Rotterdam
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Leeuwarden
Den Helder
Alkmaar
Hoorn
Almere
Arnhem
Eindhoven
Middelburg
Emmen
Hoogeveen
Assen
Lingen
Osnabrück
Münster
Bielefeld
Paderborn
Dortmund
Essen
Düsseldorf
Cologne
Aachen
Bonn
Koblenz
Siegen
Marburg
Giessen
Fulda
Wiesbaden
Frankfurt
Darmstadt
Mannheim
Karlsruhe
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Würzburg
Bayreuth
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Jena
Gera
Leipzig
Chemnitz
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Zwickau
Halle
Magdeburg
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Wolfsburg
Hanover
Celle
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Kassel
Germany
Bremen
Oldenburg
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Cuxhaven
Hamburg
Lüneburg
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Schwerin
Neubrandenburg
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Berlin
Potsdam
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Cottbus
Zielona Góra
Gorzów Wielkopolski
Poznan
Legnica
Wroclaw
Walbrzych
Liberec
Opole
Hradec Kralove
Pardubice
Prague
Pilsen
Czech Republic
Ostrava
Olomouc
Brno
Zlin
Budweis
Linz
Wels
Salzburg
Austria
Sankt Pölten
Vienna
Bratislava
Gyor
Graz
Maribor
Klagenfurt
Villach
Innsbruck
Rosenheim
Kempten
St Gallen
Liechtenstein
Switzerland
Zurich
Basel
Lucerne
Bern
Lausanne
Slovenia
Zagreb
Croatia
Rijeka
Trieste
Udine
Trento
Bolzano
Bergamo
Brescia
Vicenza
Treviso
Venice
Padua
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Milan
Novara
Turin
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Mostar
Zenica
Gijón
Oviedo
Santander
San Sebastian
Bilbao
Vitoria
Pamplona
Bayonne
Pau
Tarbes
Leon
Ponferrada

Climate Consultant 5.2 (Build 2, Oct 25, 2011)

File Criteria Charts Help

MONTHLY DIURNAL AVERAGES

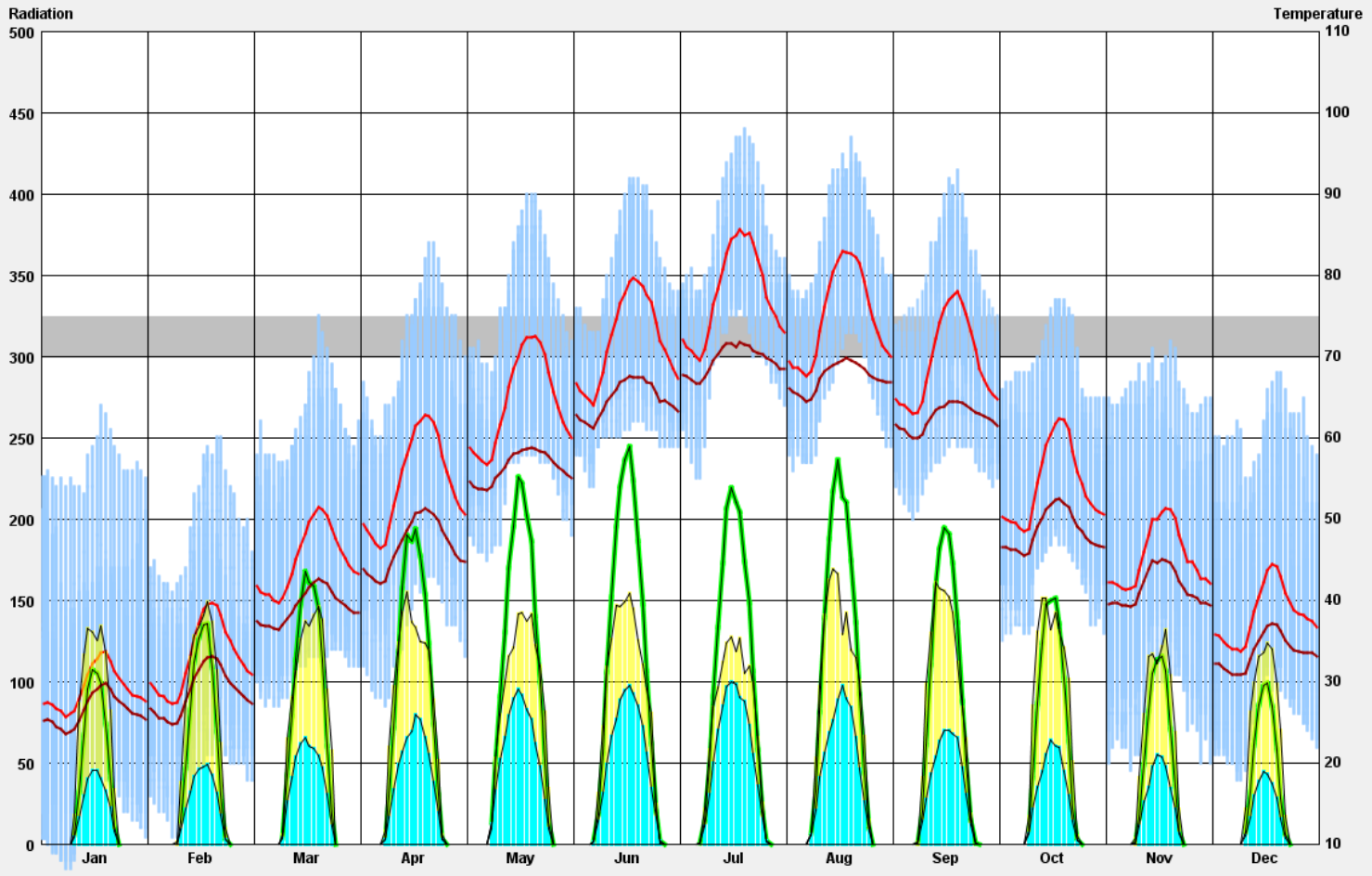
LOCATION: Philadelphia International Ap, PA, USA
Latitude/Longitude: 39.87° North, 75.23° West, **Time Zone from Greenwich** -5
Data Source: TMY3 724080 WMO Station Number, **Elevation** 6 ft

LEGEND

HOURLY AVERAGES

TEMPERATURE: (degrees F)
- DRY BULB MEAN
- WET BULB MEAN
- DRY BULB (hourly)
- COMFORT ZONE

RADIATION: (Btu/sq.ft)
- GLOBAL HORIZ
- DIRECT NORMAL
- DIFFUSE



Display Hourly Dry Bulb Temp

TEMPERATURE RANGE:
- 10 to 110 °F
- Fit to Data

Back Next

Climate Consultant 5.2 (Build 2, Oct 25, 2011)

File Criteria Charts Help

MONTHLY DIURNAL AVERAGES

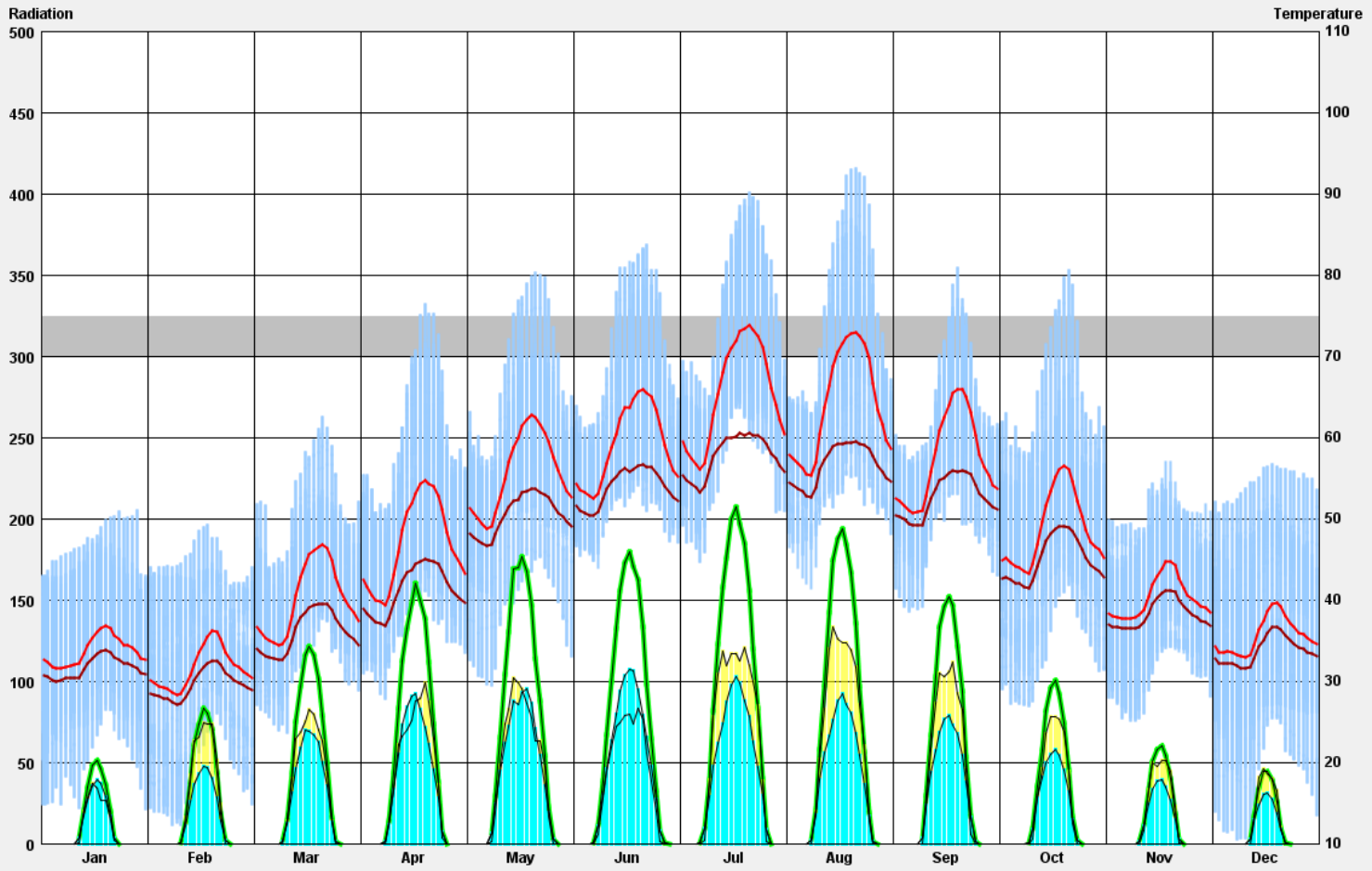
LOCATION: STUTTGART, -, DEU
Latitude/Longitude: 48.68° North, 9.22° East, **Time Zone from Greenwich** 1
Data Source: IWEC Data 107380 WMO Station Number, **Elevation** 1374 ft

LEGEND

HOURLY AVERAGES

TEMPERATURE: (degrees F)
- DRY BULB MEAN
- WET BULB MEAN
- DRY BULB (hourly)
- COMFORT ZONE

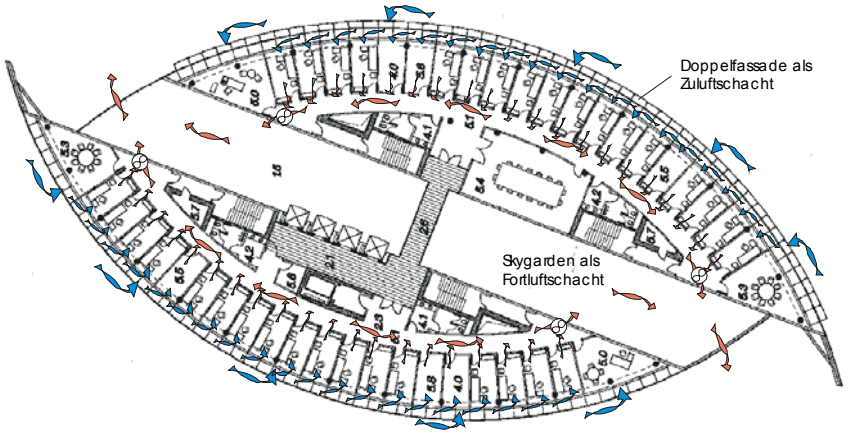
RADIATION: (Btu/sq.ft)
- GLOBAL HORIZ
- DIRECT NORMAL
- DIFFUSE



Display Hourly Dry Bulb Temp

TEMPERATURE RANGE:
- 10 to 110 °F
- Fit to Data

Back Next



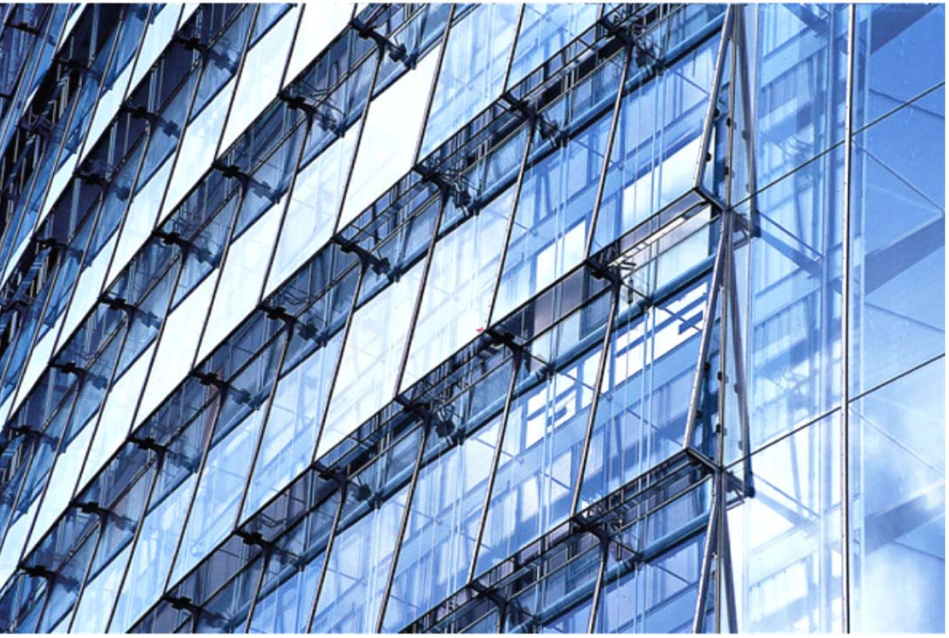
► Deutsche Post Tower in Bonn, Germany ● Murphy/Jahn + Transsolar

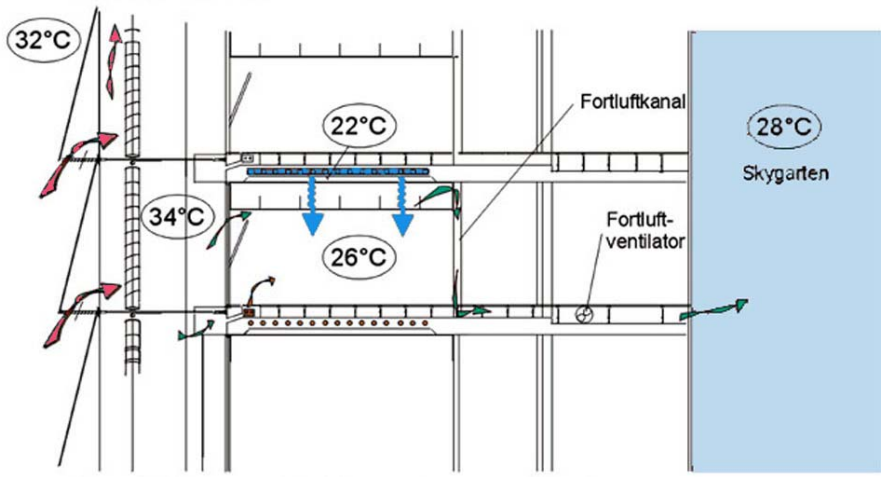
100 kWh/m^2 (31.7 kBtu/ft^2)

Helmut Jahn

► Deutsche Post Tower in Bonn, Germany ● Murphy/Jahn + Transsolar

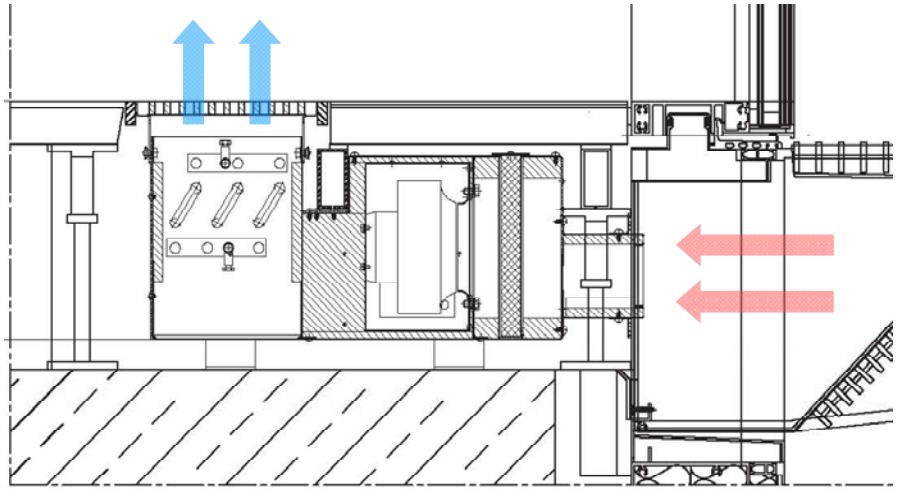
► Deutsche Post Tower in Bonn, Germany ● Murphy/Jahn + Transsolar





Das Klima- und Lüftungskonzept im Sommer

► Deutsche Post Tower in Bonn, Germany ● Murphy/Jahn + Transsolar



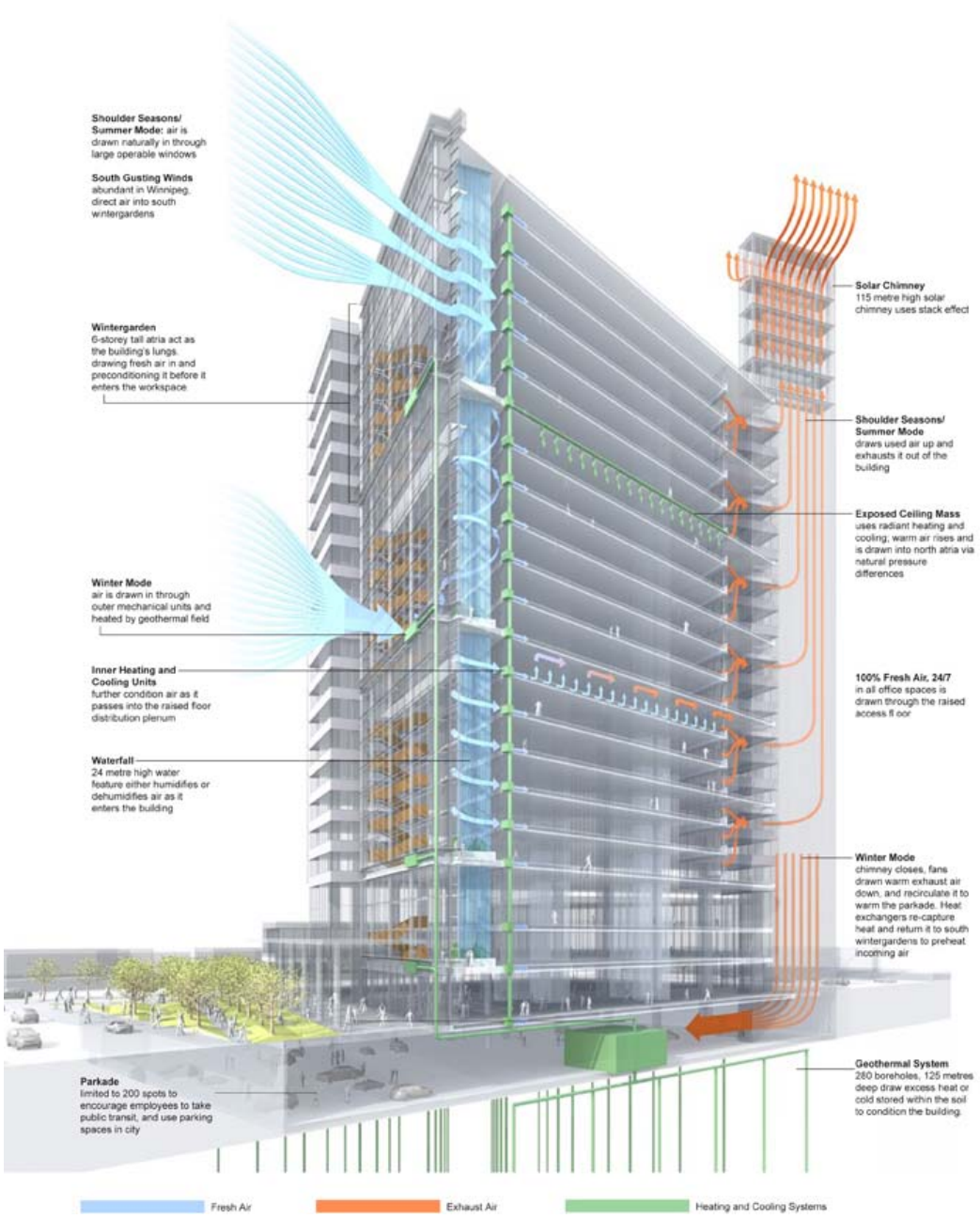
Trox FSL Under Floor Façade Ventilation Unit

► Deutsche Post Tower in Bonn, Germany ● Murphy/Jahn + Transsolar

► Deutsche Post Tower in Bonn, Germany ● Murphy/Jahn + Transsolar

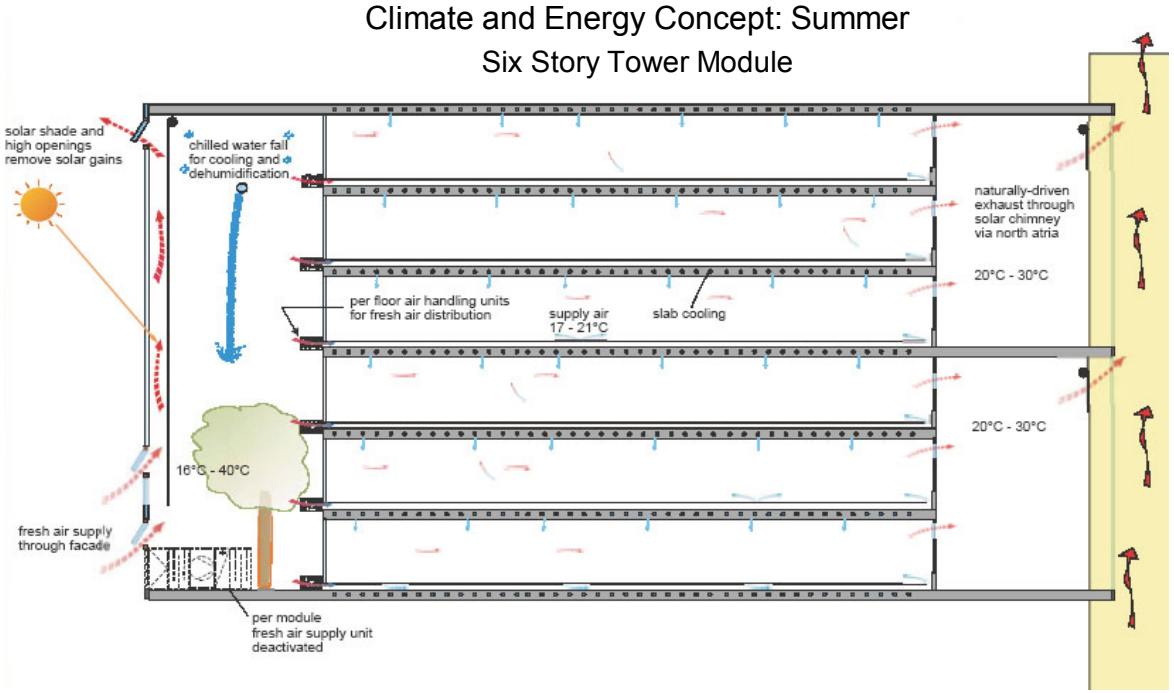
2003: €80M ($132/ft^2)

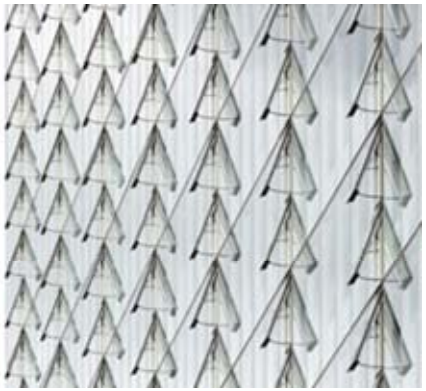
► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar 88 kWh/m^2 (27.9 kBtu/ft^2)



► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar

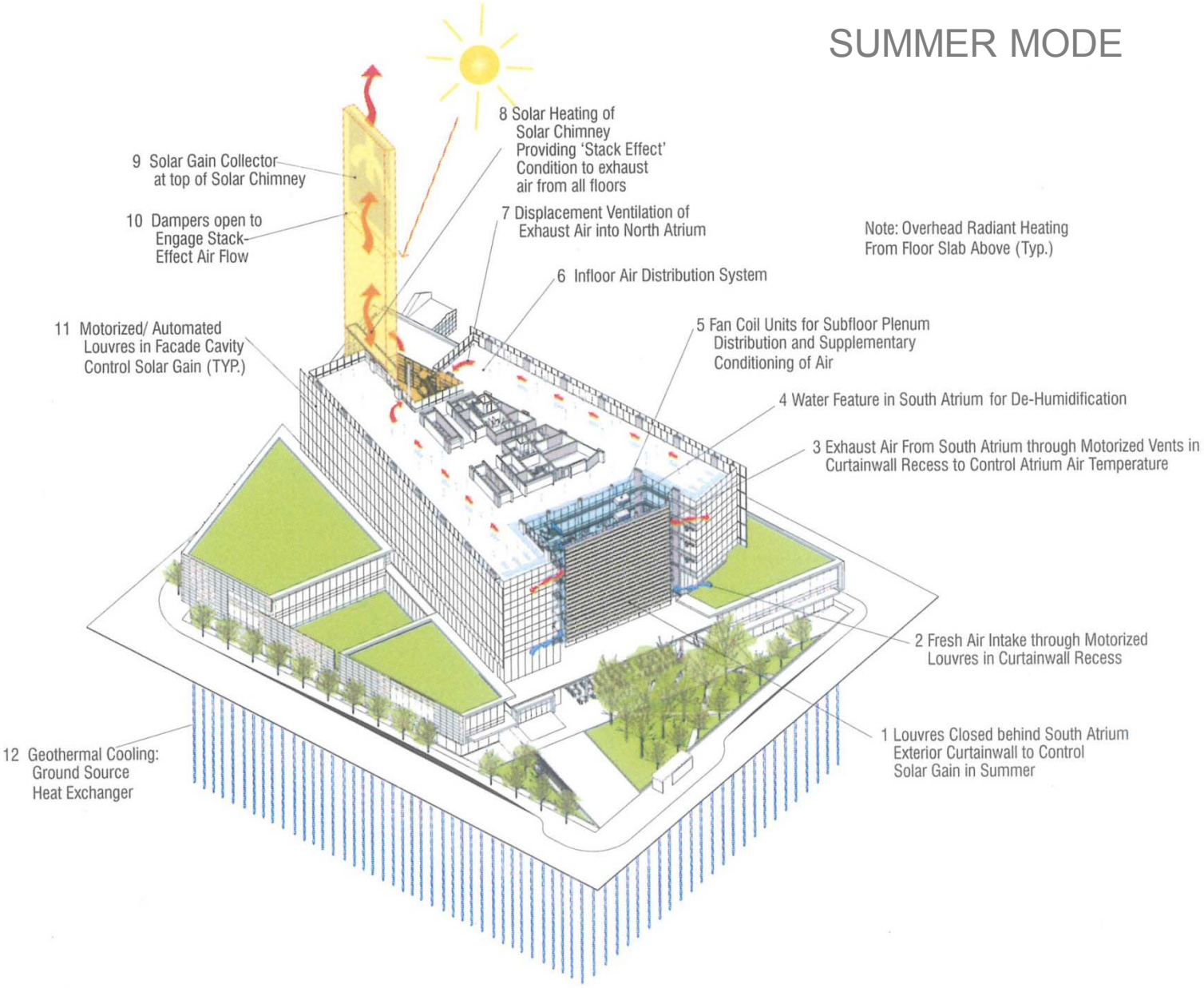
► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar





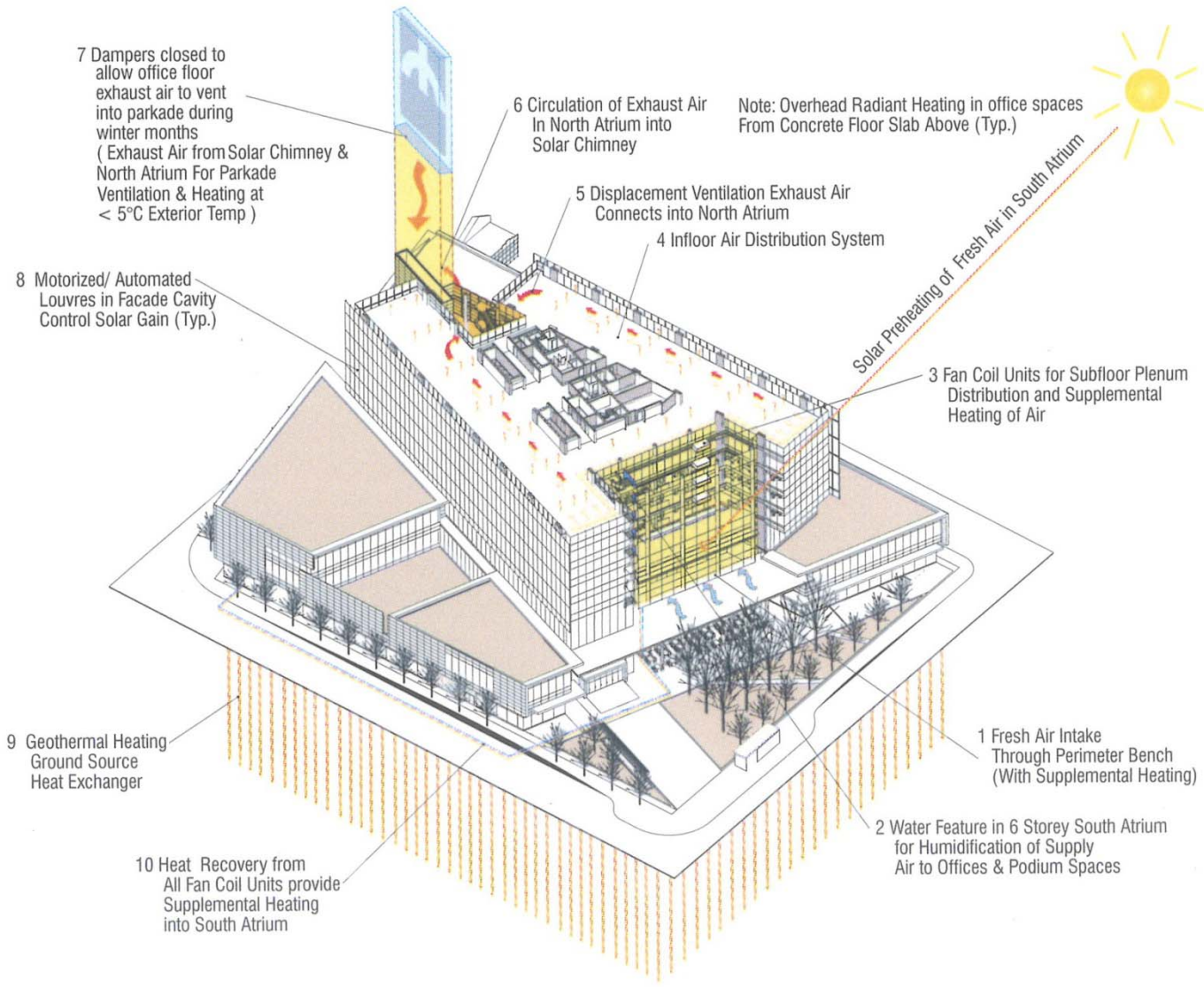
► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar

SUMMER MODE

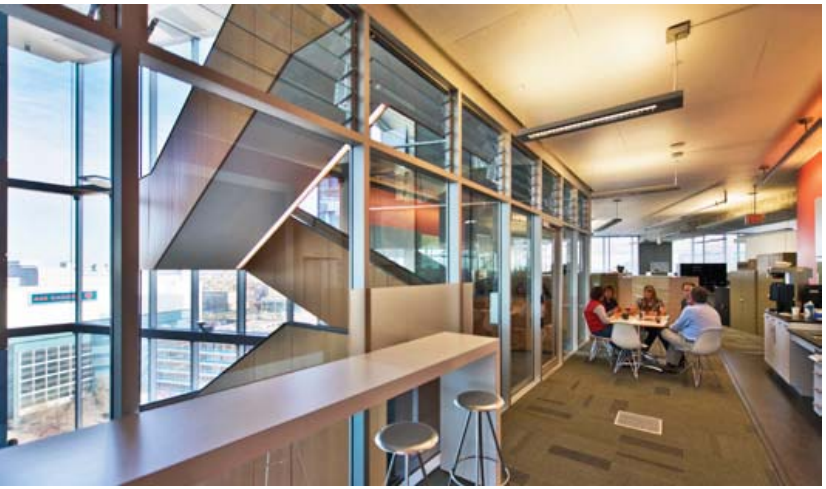


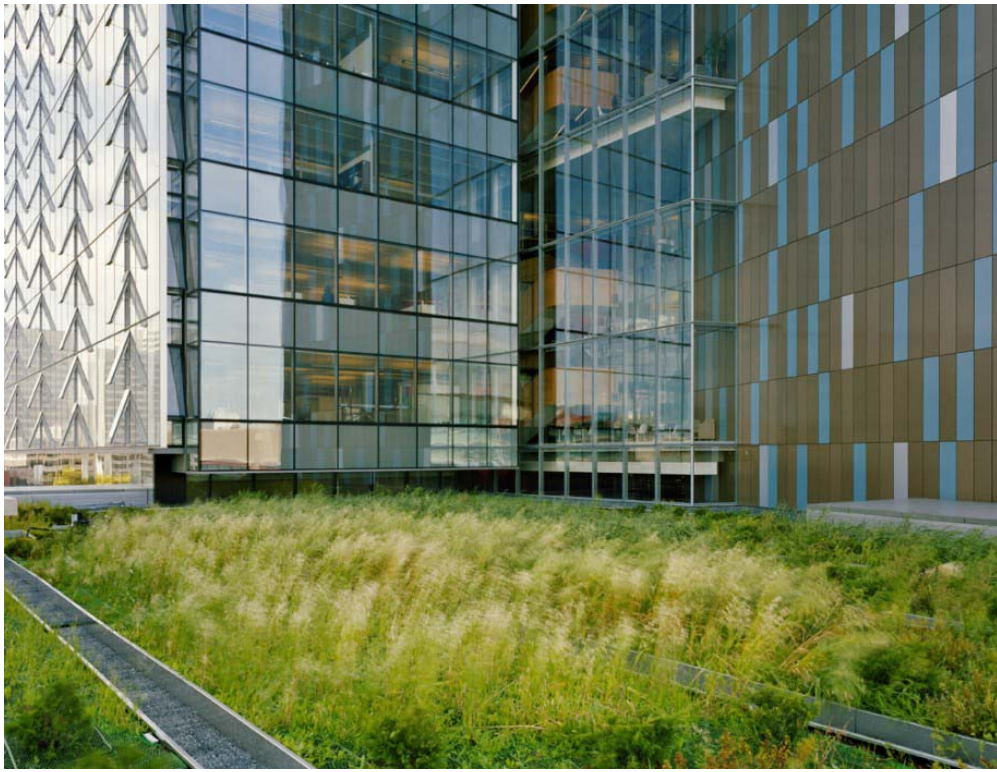
► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar

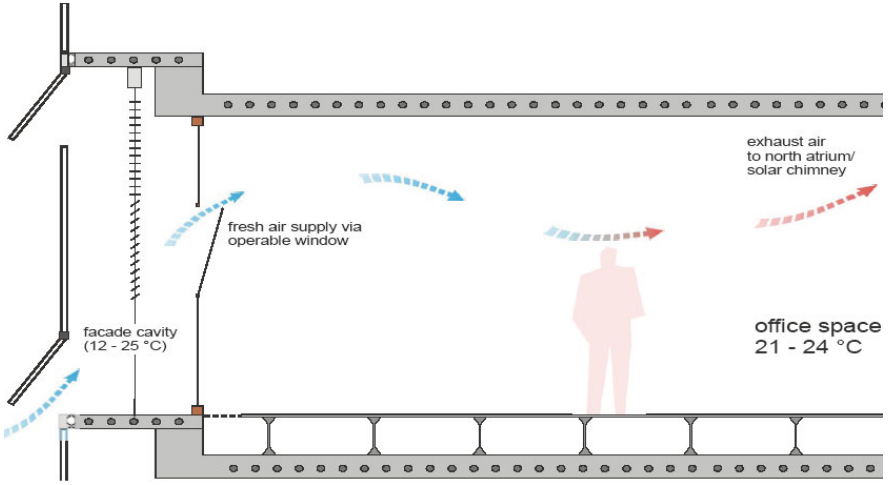
WINTER MODE



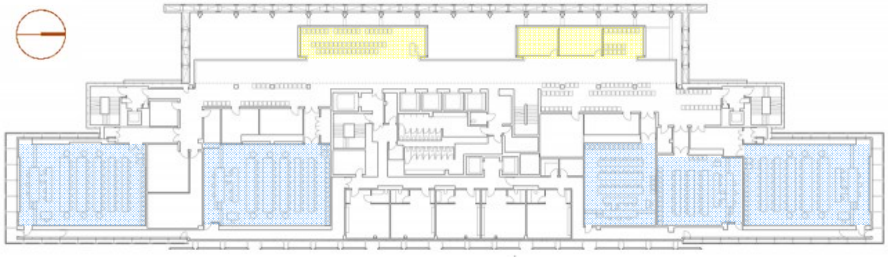
► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar





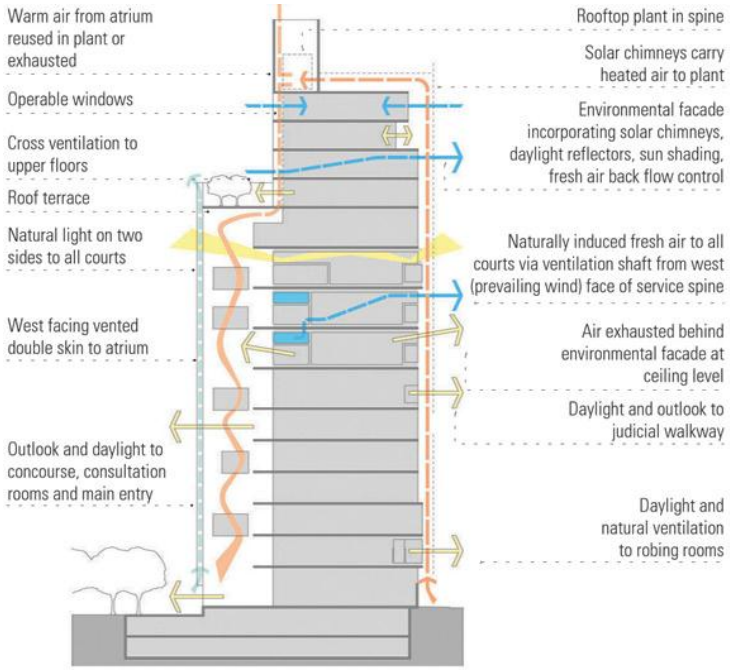


► Manitoba Hydro Place in Winnipeg, Canada ● KPMB Architects + Transsolar 2009: C$278M (C$400/ft^2)

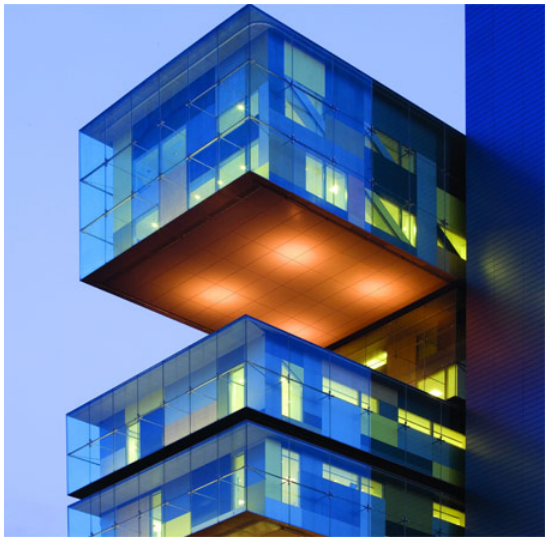


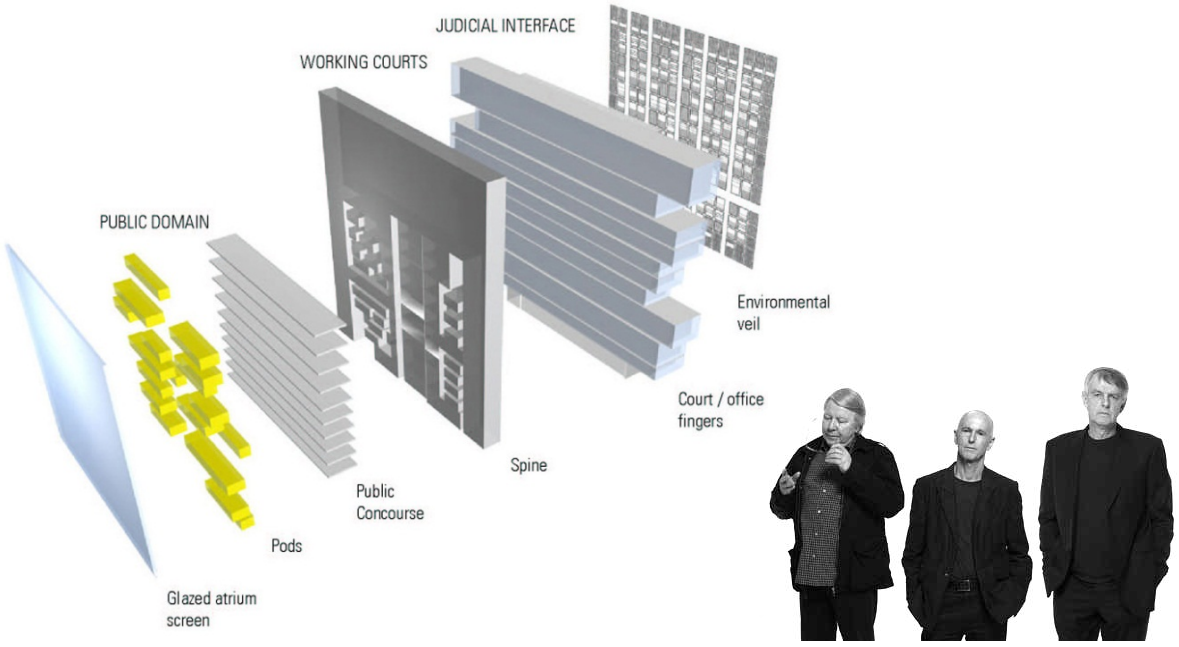
http://issuu.com/tonyrichardson/docs/cjc_book_final_lr

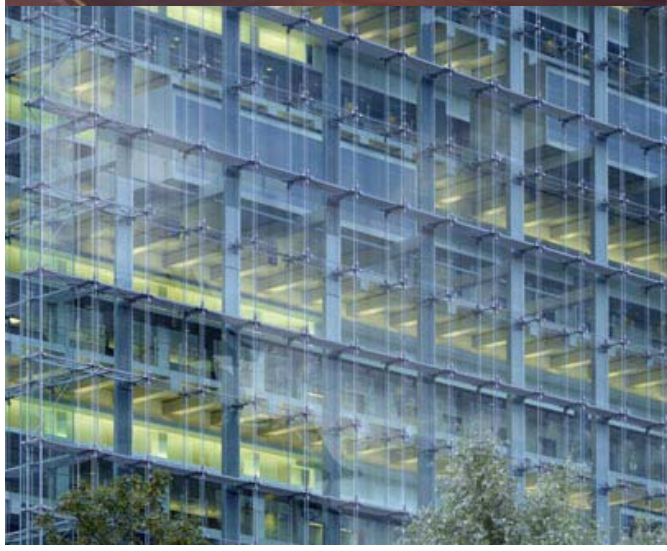
► Manchester Civil Justice Centre in Manchester, UK ● Denton Corker Marshall 80 kWh/m^2 (25.4 kBtu/ft^2)



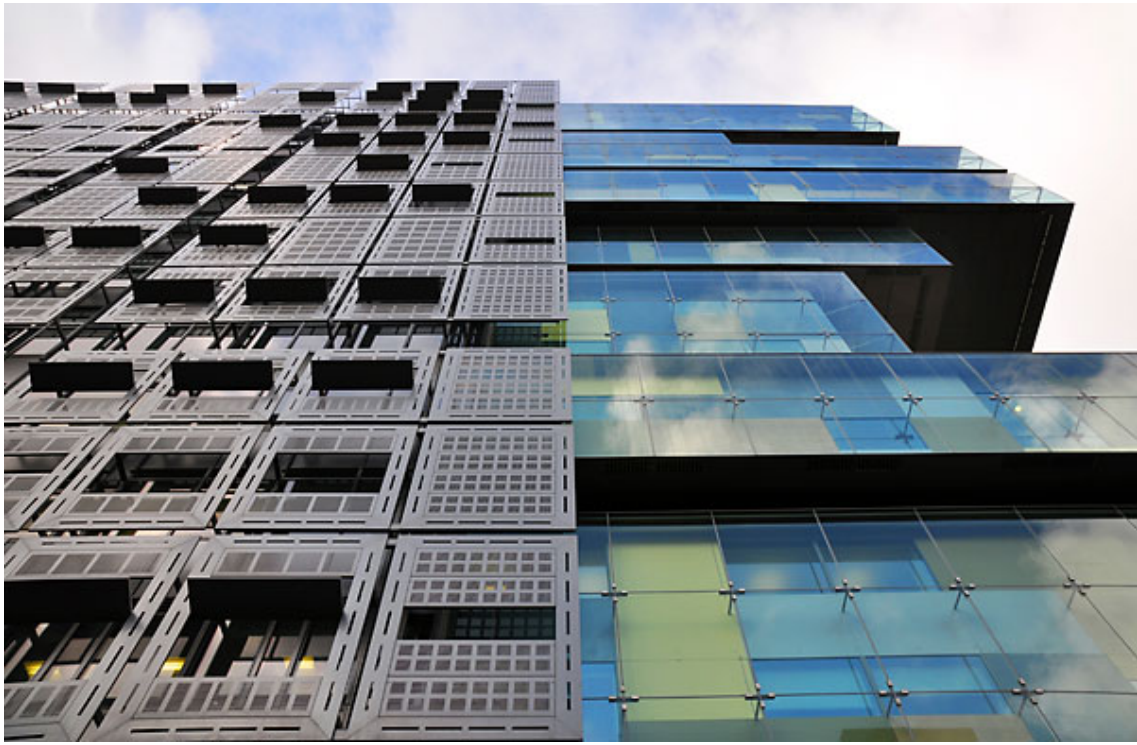
► Manchester Civil Justice Centre in Manchester, UK ● Denton Corker Marshall

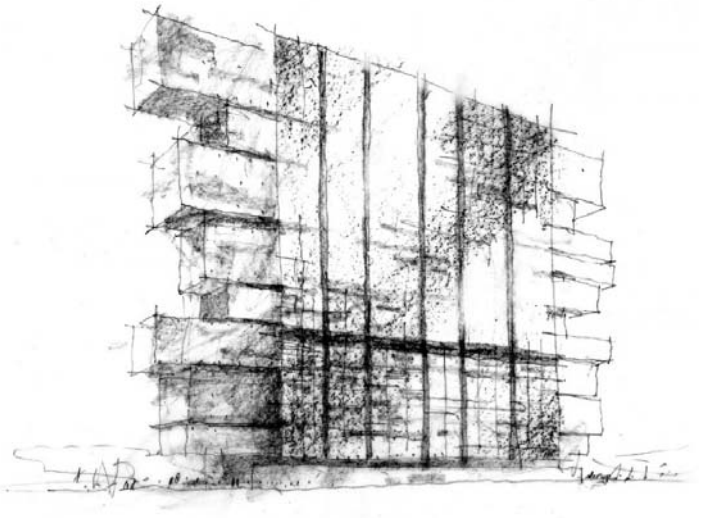




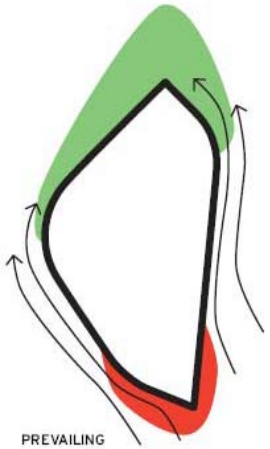


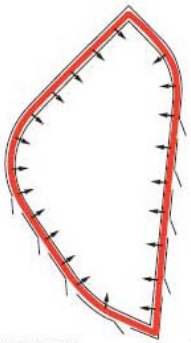
► Manchester Civil Justice Centre in Manchester, UK ● Denton Corker Marshall

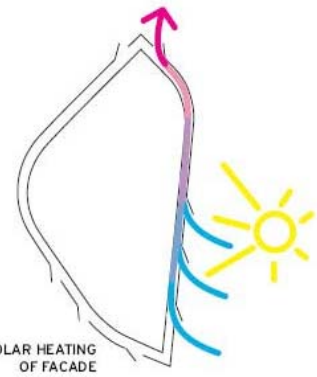




► Manchester Civil Justice Centre in Manchester, UK ● Denton Corker Marshall 2007: £160M ($676/ft^2)



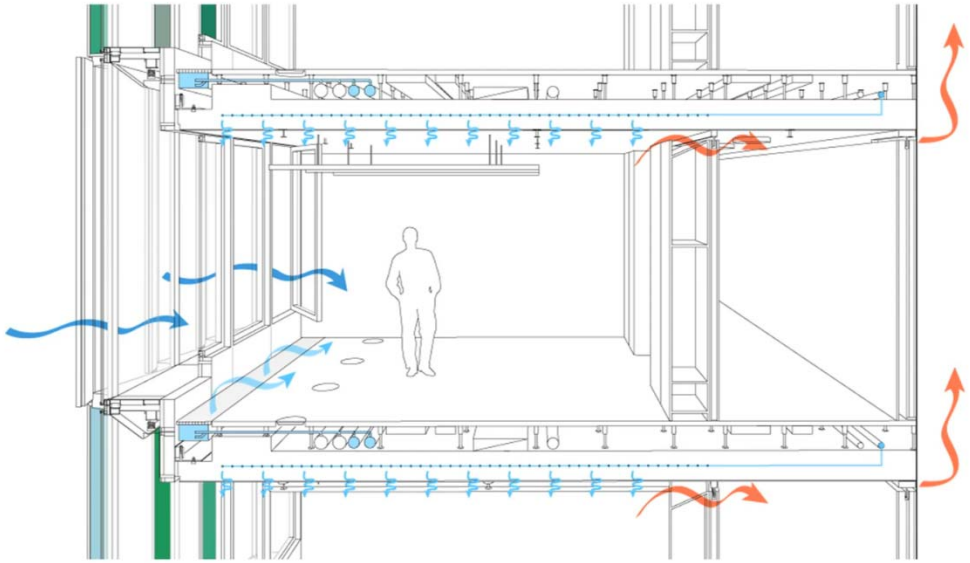




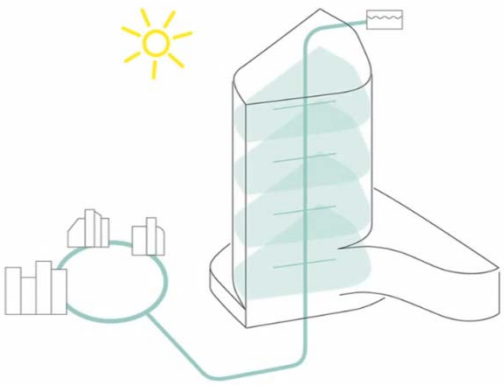
http://www.artecercano.com/videos/shutton/westarkade.php

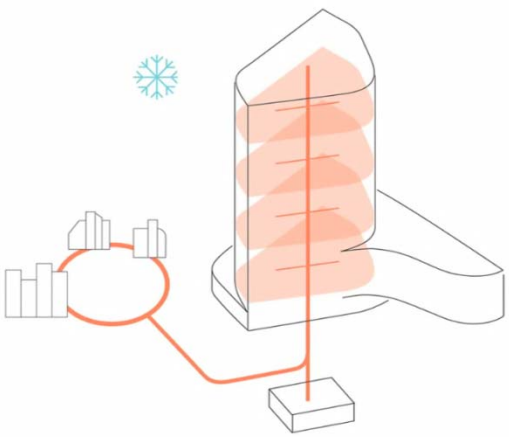
► KfW Westarkade in Frankfurt, Germany ● Sauerbruch Hutton + Transsolar

76 kWh/m^2 (24.0 kBtu/ft^2)



► KfW Westarkade in Frankfurt, Germany ● Sauerbruch Hutton + Transsolar

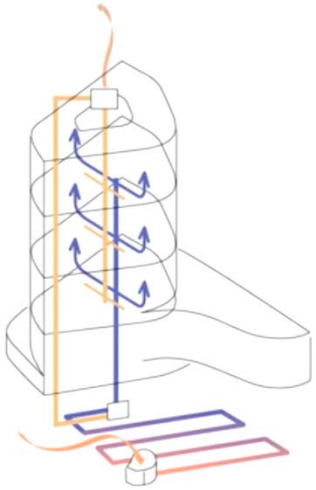




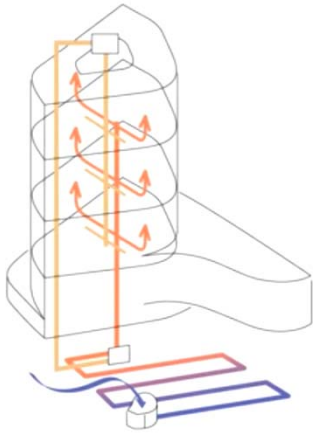
Summer Cooling

Winter Heating

► KfW Westarkade in Frankfurt, Germany ● Sauerbruch Hutton + Transsolar



Summer Ventilation



Winter Ventilation

► KfW Westarkade in Frankfurt, Germany ● Sauerbruch Hutton + Transsolar

► KfW Westarkade in Frankfurt, Germany ● Sauerbruch Hutton + Transsolar 2010: €95M ($320/ft^2)