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

Federal Research and Development Agenda for Net-Zero Energy, High-Performance Green Buildings
National Science and Technology Council
Committee on Technology
Report of the Subcommittee on Buildings Technology Research and Development
October 2008

THE FUTURE OF HIGH-PERFORMANCE GREEN BUILDINGS
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
Deutsche Post Tower in Bonn, Germany • Murphy/Jahn + Transsolar

100 kWh/m² (31.7 kBtu/ft²)
Deutsche Post Tower in Bonn, Germany  •  Murphy/Jahn  +  Transsolar

Helmut Jahn
Deutsche Post Tower in Bonn, Germany  • Murphy/Jahn  + Transsolar
Deutsche Post Tower in Bonn, Germany  •  Murphy/Jahn  + Transsolar
TOWARDS A NEW ARCHITECTURE + ENERGY

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

2003: €80M ($132/ft²)
Manitoba Hydro Place in Winnipeg, Canada  •  KPMB Architects  +  Transsolar

88 kWh/m² (27.9 kBtu/ft²)
Shoulder Seasonal
Summer Mode: air is drawn naturally in through large operable windows
South Gaining Winds
abundant in Winnipeg, shear air into south winterfronts

Winterizing
6 storey tall atria act as the building's lungs, drawing fresh air in and pressurizing it before it enters the workspace

Winter Mode
Air is drawn in through ducts, heated by geothermal field

Inner Heating and
Cooling Shunt
Further condition air as it passes into the raised floor distribution plenum

Wetwall
24 metre high wall, features either humidifiers or dehumidifiers as it enters the building

Peristyle
Limited to 203 spots to encourage employees to use public transit, and use parking spaces in city

Centrifugal System
260 compressors, 125 meters deep draw across heat or condense within the soil to condition the building

Solar Chimney
13 metre high solar chimney uses stack effect

Shoulder Seasonal/
Summer Mode
Aires used on up and exhausts it out of the building

Exposed Ceiling Hues
Uses radiant heating and cooling, warm air rises and is drawn into north atria via natural pressure differences

100% Fresh Air, 24/7
In all office spaces is drawn through the tenants access hall

Manitoba Hydro Place in Winnipeg, Canada • KPMB Architects • Transsolar
Manitoba Hydro Place in Winnipeg, Canada  •  KPMB Architects  +  Transsolar
Climate and Energy Concept: Summer
Six Story Tower Module

- Solar shade and high openings remove solar gains
- Chilled water for cooling and dehumidification
- Naturally-driven exhaust through solar chimney via north aisle
- Per floor air handling units for fresh air distribution
- Supply air 17-21°C
- Slab cooling
- 16°C - 40°C
- Per module fresh air supply unit deactivated
- Fresh air supply through facade

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

1. Louvres Closed behind South Atrium Exterior Curtainwall to Control Solar Gain in Summer
2. Fresh Air Intake through Motorized Louvres in Curtainwall Recess
3. Exhaust Air From South Atrium through Motorized Vents in Curtainwall Recess to Control Atrium Air Temperature
4. Water Feature in South Atrium for De-Humidification
5. Fan Coil Units for Subfloor Plenum Distribution and Supplementary Conditioning of Air
6. Infloor Air Distribution System
7. Displacement Ventilation of Exhaust Air into North Atrium
8. Solar Heating of Solar Chimney Providing 'Stack Effect' Condition to exhaust air from all floors
9. Solar Gain Collector at top of Solar Chimney
10. Dampers open to Engage Stack Effect Air Flow

Note: Overhead Radiant Heating From Floor Slab Above (Typ.)

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

2009: C$278M (C$400/ft²)
80 kWh/m² (25.4 kBtu/ft²)
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/ft²)
KfW Westarkade in Frankfurt, Germany  ●  Sauerbruch Hutton  +  Transsolar

76 kWh/m² (24.0 kBtu/ft²)

KfW Westarkade in Frankfurt, Germany  ●  Sauerbruch Hutton  +  Transsolar
KfW Westarkade in Frankfurt, Germany  •  Sauerbruch Hutton  +  Transsolar
Towards a new architecture + energy

KfW Westarkade in Frankfurt, Germany  •  Sauerbruch Hutton  +  Transsolar

Summer Ventilation  •  Winter Ventilation
KfW Westarkade in Frankfurt, Germany

Sauerbruch Hutton + Transsolar

2010: €95M ($320/ft²)