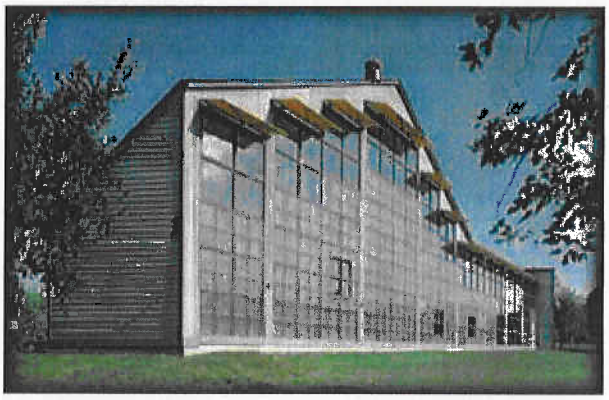
Design of Passive Solar Heated Buildings

http://www.iklimnet.com/save/passive_solar_heating.html



The following are general recommendations that should be followed in the design of passive solar heated buildings:

Passive solar heating will tend to work best, and be most economical, in climates with clear skies during the winter heating season and where alternative heating sources are relatively expensive.
Use passive solar heating strategies only when they are appropriate. Passive solar heating works better in smaller buildings where the envelope design controls the energy demand.
Careful attention should be paid to constructing a durable, energy-conserving building envelope.
Address orientation issues during site planning. To the maximum extent possible, reduce east and west glass and protect openings from prevailing winter winds.
Specify an air-tight seal around windows, doors, and electrical outlets on exterior walls. Employ entry vestibules; and keep any ductwork within the insulated envelope of the house to ensure thermal integrity. Consider requiring blower-door tests of model homes to demonstration air-tightness and minimal duct losses.
Specify windows and glazing that have low thermal transmittance values (U values) while admitting adequate levels of incoming solar radiation (higher Solar Heat Gain Coefficient). Data sources such as the National Fenestration Rating Council "Certified Products Directory" should be consulted for tested performance values. The amount of glazing will depend on building type and climate.

Ensure that the south glass in a passive solar building does not contribute to increased summer cooling. In many areas, shading in summer is just as critical as admitting solar gain in winter. Use your summer (B) and winter (A) sun angles to calculate optimum overhang design.
Avoid overheating. In hot climates, buildings with large glass areas can overheat. Be sure to minimize east- and west-facing windows and size shading devices properly. For large buildings with high internal heat gains, passive solar heat gain is a liability, because it increases cooling costs more than the amount saved in space heating.
Design for natural ventilation in summer with operable windows designed for cross ventilation. Ceiling fans or heat recovery ventilators offer additional air movement. In climates with large diurnal temperature swings, opening windows at night will release heat to the cool night air and closing the windows on hot days will keep the building cool naturally.
Provide natural light to every room. Some of the most attractive passive solar heated buildings incorporate elements of both direct and indirect gain. This can provide each space a quality of light suitable to its function.
If possible, elongate the building along the east-west axis to maximize the south-facing elevation and the number of south-facing windows that can be incorporated.
Plan active living or working areas on the south and less frequently used spaces, such as storage and bathrooms, on the north.
Keep south-facing windows to within 20° of either side of true south.
Improve building performance by employing either high-performance, low-e glazing or nighttime, moveable insulation to reduce heat loss from glass at night.
Locate obstructions, such as landscaping or fences, so that full exposure to the sun is available to south windows from 9 A.M. to 3 P.M. for maximum solar gain in winter.
Include overhangs or other devices, such as trellises or deciduous trees, for shading in summer.
Reduce air infiltration and provide adequate insulation levels in walls, roofs, and floors. As a starting point for determining appropriate insulation levels, check minimum levels in the CABO Model Energy Code.
Select an auxiliary HVAC system that complements the passive solar heating effect. Resist the urge to oversize the system by applying "rules of thumb."
Make sure there is adequate quantity of thermal mass. In passive solar heated buildings with high solar contributions, it can be difficult to provide adequate quantities of effective thermal mass.
Design to avoid sun glare. Room and furniture layouts need to be planned to avoid glare from the sun on equipment such as computers and televisions.