**Minnesota's Energy Situation:**

Minnesota is almost totally dependent on outside sources for its energy supplies, producing only 0.2% fuel used in the state. Minnesota pays more for fuels than some other states and is more vulnerable to possible supply disruptions. The former Minnesota Energy Agency had developed forecasts of the supply/demand relationship in the year 1995. Its baseline forecast assumed that energy users would respond to higher energy prices by 1) reducing their consumption or switching to lower priced fuels, b) that there would be some energy conservation, and c) that economic growth would continue.

There are three basic strategies that may eliminate or postpone the forecasted gap between energy supply and demand:

- Increase supplies of traditional fuels;
- Increase conservation efforts;
- Develop additional supplies of energy from non-traditional sources.

These strategies will undoubtedly all be pursued to some extent. Shakopee can play a role in energy conservation and encourage use of non-traditional methods. In the last few years, Shakopee's City Council has expressed its own commitment to energy conservation through its budgeting for conservation and new, green technologies for city buildings as well as exploring regulations that facilitate their use in private construction.

**Residential Sector:**

The residential sector accounted for 16% of all primary fuel used and 38.2% of all electricity consumed in 1975, for a total of 26% of all primary energy used. In the breakdown of energy use in Minnesota homes, it can be seen that space heating and hot water heating account for over 80% of the energy use. Energy conservation in these areas can be an extremely important factor in reducing residential energy consumption.

## Energy Use in a Minnesota Home

| Energy Use | Percentage |
|---|---|
| Space Heating | 70 |
| Hot Water Heating | 14 |
| Lighting/Appliances, etc. | 8 |
| Cooking | 4 |
| Clothes Drying | 4 |
| TOTAL | 100 |

(Source: MN State Energy Agency)

Since the age of a structure is a big factor in how much energy loss is present, the degree of conservation methods required will vary from structure to structure.

**Landscaping for Energy Efficiency:**

Trees, shrubs, turf and other ground covers are among the best exterior solar and wind control devices. During summer months vegetation controls reflection/absorption of heat radiation, provides shade for walls and ground surfaces, and creates insulating dead air spaces. Plants can insulate buildings from intense heat and protect cooling equipment from the effects premature wear that can be the result of rapid exterior temperature changes. Plants serve double duty by absorbing day heat and then releasing it slowly at night, thereby cooling daytime temperatures and warming and moderating evening temperatures. Overstore deciduous trees can provide cooling effects during warm months while allowing maximum solar penetration during cooler seasons.

Vegetation can be effectively used for intercepting, diverting or lessening the impact of wind. Thus, the climate around structures can be greatly modified by the control of air movement. Depending upon the desired control, plants can provide obstruct, guide, deflect, or allow the infiltration of air. Landscaping can, thus, be a significant factor in microclimate control in and around buildings. Landscaping is given a very practical role while at the same time increasing adding beauty and overall quality to developments in the City.

**Solar Access:**

The Metropolitan Land Planning Act requires municipalities to address solar access in their Comprehensive Plans and regulations. As an alternative energy resource, direct solar radiation using simple flat-plate collectors has the potential to supply one-half of Minnesota's space heating, cooling, water heating and low-temperature industrial process heat requirements, according to the MNEA.

It is important to begin planning now for solar access. The City should consider not only the existing available technology for solar access, but also regulatory devices for protecting solar access which may need to be enacted in the future.

In the use of any solar energy system, the most important factor involved is the assurance of direct access to sunlight. The required level of access to sunlight varies according to the type of solar heating system used.

- *Rooftop Protection*. Protects the sunlight falling on south-facing rooftops of structures and favors the use of active solar energy systems for both space and domestic water heating. It is also useable by some types of passive space heating systems, such as skylights or clerestory systems with internal heat collectors and storage media.

- *South Wall Protection*. Protects the rooftops and south walls of structures and is suitable for passive solar energy systems.

- *South Lot Protection*. Protects the rooftops, south wall and south lot adjacent to

the south wall and offers everything south wall protection offers with the additional possibility of using solar greenhouses, solaria, and reflective surfaces to increase the efficiency of both active and passive heating systems. Snow or light colored patios are examples of reflective surfaces.

- *Detached Collector Protection*. Protects only part of a lot for use by detached collector systems. It almost always favors active solar systems, especially those using a fluid to transfer heat from the collector to the dwelling. Detached location could be a site for a free standing collector or a garage or accessory building roof.

As solar access protection moves from the rooftops down to ground locations on the lot, the restrictions on adjacent land to the south become more severe. As a collector moves closer to the ground, it becomes more susceptible to shadows from adjacent vegetation and buildings.

In the northern states the problems of solar access are more severe because of the lower winter solar altitude (the height of the sun above the horizon). It may not be possible in many cases to protect 100% of a structure's solar access for the full 12 months of the year, and compromises must then be made.

At low solar altitudes, the atmosphere itself absorbs considerable sunlight. Solar altitudes below 12% are essentially useless for solar energy collection. Approximately 88% of the sun's energy reaching the surface in the Twin Cities area on December 21 falls between 9:00 a.m. and 3:00 p.m.

The guidebook, *Protecting Solar Access for Residential Development*, recommends that cities consider south wall access as an objective for local solar access policies. The passive solar energy systems which south wall access make possible are often less expensive to install and operate than active systems. Also, the option is open to use the roof or south wall for active collectors. In high-density districts with varied building heights, south wall and sometime even rooftop solar access may be difficult to protect. High rise buildings can be buffered from lower buildings by greenbelts, highways, or other land uses that do not require a high level of solar access.

The guidebook also states that good solar access does not justify sprawl - producing large lot zoning because reasonably high housing densities can be achieved in many areas without sacrificing solar access, provided the housing is carefully sited and oriented. Shakopee's zoning standards permit relatively high single-family (up to 5 DU/A) and medium-density residential development (up to 8 DU/A) without sacrificing opportunities for solar access.

**Trees and Access to Direct Sunlight:**

If solar access is to be assured, then trees must be of a suitable type and be placed correctly on the property. There are situations where the energy savings of tree shade during the summer months exceed the energy savings by allowing the maximum solar

access to a solar heating system. The amount of sunlight that can be blocked by a leafless deciduous tree can vary from 20 to 80% of available radiation, depending on the species of tree. When trees are planted, the mature height of the tree, its location, its shape, its leaf-out and leaf-drop characteristics and its winter bare-branched shading should all be taken into consideration.

**Tools Available to Protect Solar Access:**

The private and public sectors both have options available to them for the development of solar access.

Private Action:

Lot size, orientation of existing homes to the sun, tree masses on or adjacent to the site, and size and type of collector to be installed all play a role for the private sector. Lots with two or more acres normally allow a variety of operations for the individual to control solar accessibility. Pitched roofs oriented to the south or south-facing walls provide the greatest solar access. Private developers can orient multiple-family structures to the extent that placement of buildings or design of structure maximizes southern exposures. Maximizing the amount of windows on the south side and minimizing openings on the north and northwest sides of buildings maximize energy efficiency.

Public Action:

Since subdivision and zoning regulations are the basic tools for protecting solar access at the local level, maximum effort should be used to identify and minimize potential obstacles to providing solar access by changing those regulations. The City of Shakopee's zoning regulations already accommodate the use of solar energy equipment, especially in residential developments. Future advances in solar technology may suggest additional changes, and the City will be open to making those changes as necessary.

Traditional orientation of gridiron or curvilinear street patterns may not optimize the potentials for solar access. Conventionally speaking, east-west streets will provide housing with southern exposure. Since subdivision regulations for street design cannot be restrictively applied in every case, density credits or other incentives will be necessary to encourage the private sector to present development proposals with potentials for solar access. Other considerations include:

- Flexibility to follow topography;
- Flexibility to preserve natural features;
- Flexibility of other design techniques such as cluster housing; and,
- Flexibility when circumstances prevent solar access (i.e., shading of higher buildings).

Generally speaking, however, is that when a street system is designed to permit sufficient solar access, few problems result in the installation of solar collectors on existing structures.

If east-west street systems are not always possible, for environmental or other reasons, the siting of buildings may have to be adjusted.

**Commercial/Industrial Concepts:**

Many of the techniques described above can also be applied to the commercial/industrial sector. However, there are significant problems and challenges, and different solutions may be necessary because these types of land uses contain greater building massing.

The needs of various industries and location imperatives for buildings can make it difficult to guarantee low profile buildings in an industrial setting. Careful site selection and sensitive orientation of buildings will still be necessary.

Vast expanses of roofs and parking lots and heat losses from certain manufacturing processes create microclimates in a heavily developed industrial park. These elements increase the problems of cooling the buildings in the summer and protecting them from the cold winter winds.

Co-generation:

Basically this means that heat or steam produced as a by-product in an industrial process is harnessed and forced into an on-site turbine, which runs a generator; this escaping steam is put to use. Electricity produced can supplement conventional sources or can be shared by other nearby users. Peak demands are reduced while cost savings can also be realized.

District Heating:

This concept is not new but is making reappearance. Steam or hot air by-products are recycled into the originating building or surrounding buildings as a source of heat. 3M Chemolite currently heats specific buildings in this manner.

**Goals, Policies and Objectives**

| | |
|---|---|
| **Goal 1.** | **The City will support, plan for and encourage the use of solar energy as an alternative energy source.** |

**Objectives:**

1.1. Review and modify the zoning ordinance and other relevant city regulations as necessary to remove barriers to the use of solar energy systems and to ensure access to solar energy. Specific items that should be reviewed include; building heights, building setbacks, performance standards for solar access, site plan review, vegetation controls and incentives.

**1.2.** Review and modify zoning and subdivision regulations as necessary to ensure that as many new lots in the city as possible offer proper solar orientation.