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Siting =/= Protection: A Note on Solar Access

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Articles

SITING ≠ PROTECTION: A NOTE ON SOLAR ACCESS

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In assuring solar access, it is necessary to distinguish between siting collectors and protecting their access to sunshine once they have been placed. Siting requires the flexibility to balance potentially competing uses of land; it is best accomplished by zoning and land use planning. Once a collector is sited, however, flexibility must give way to certainty. The necessary certainty cannot be provided by zoning, which conveys no legally enforceable right. It is best accomplished by the recognition of a solar right through a priority-based permit system.

> Diogenes . . . , when Alexander asked him if he wanted anything: "Just at present," said he, "I wish that you would stand a little out of the line between me and the sun," for Alexander was interfering with his basking in the heat.[1]

I
INTRODUCTION

The problem that Diogenes raised more than 2,300 years ago has taken on a new urgency. As a result, the legal literature on the problem of

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1. M. Tullius Cicero, *Tusculan Disputations*, V. xxxii. 92: "At vero Diogenes liberius, ut Cynicus, Alexandro roganti, ut diceret, si quid opus esset: *Nunc quidem paullulum*, inquit, *a sole*. Offecerat videlicet apricanti."

access to direct sunlight is voluminous.[2] Commentators have suggested easements,[3] restrictive covenants,[4] public and private nuisance law,[5] zoning,[6] transferable development rights,[7] the prior appropriation doctrine,[8] and Japanese sunshine laws[9] as potential models or solutions.

The purpose of this article is neither to add to this list nor to critique any of the options exhaustively. Instead, the focus is conceptual rather than mechanical. The goal is to demonstrate that the participants in this debate have largely overlooked a fundamental distinction between siting collectors[10] and protecting them from obstruction once they have been legally sited.[11]

A method of assuring solar access that embodies this distinction involves two discrete steps. The first is to establish the legal standards for siting collectors. Because the problems and possibilities differ significantly between developed neighborhoods and proposed developments, both the type of siting regulations and their focus should also differ. The second step requires the creation of a procedure to allow individuals to obtain a protected right to direct sunlight for a legally sited collector.

2. The *Index to Legal Periodicals* lists at least 27 articles on the issue under "Energy"; the *Solar Energy Legal Bibliography* lists 21 articles under "Solar Access Rights" and several more on the issue under "Land Use." Dwight Seeley, Barbara Euser, *et al.*, *Solar Energy Legal Bibliography*, Golden, CO: SERI, March 1979; SERI/TR-62-069 (avail.: NTIS), at 83-92, 52-66, reprinted in 1 SOLAR L. REP. 705, 519 (1979). For an overview, *see* Goble, *Solar Rights: Guaranteeing a Place in the Sun*, 57 ORE. L. REV. 94 (1977).
3. *See* Williams, *Solar Access and Property Rights: A Maverick Analysis*, 11 CONN. L. REV. 430 (1979).
4. *See* Myers, *Solar Access Rights in Residential Developments*, 24 PRAC. LAW. 13, (March 1, 1978).
5. *See* Gevurtz, *Obstruction of Sunlight as a Private Nuisance*, 65 CALIF. L. REV. 94 (1977); Sandy F. Kraemer, James G. Felt, "Solar Shade Control: New Law For A New Technology," *Energy Communications*, vol. 3 no. 3, 1977, at 213.
6. *See* Bersohn, *Securing Solar Access Rights: Easements, Nuisance, or Zoning?*, 3 COLUM. J. ENVT'L L. 112 (1976).
7. *See* Matuson, *Legislative Approach to Solar Access: Transferable Development Rights*, 13 N. ENGLAND L. REV. 835 (1978).
8. *See Allocation of Sunlight: Solar Rights and the Prior Appropriation Doctrine*, 47 U. COLO. L. REV. 421 (1976).
9. *See* Miller, *Let the Sunshine in: A Comparison of Japanese and American Solar Rights*, 1 HARV. ENVT'L L. REV. 578 (1976).
10. Throughout this article, the term "collector" is used to include both active and passive solar energy systems, as well as photovoltaic arrays.
11. Sandy Kraemer initially noted the distinction, Sandy F. Kraemer, SOLAR LAW, Colorado Springs, CO: Shepard's Inc., 1978, at 123, but did not develop it. *See also* Gail Boyer Hayes, SOLAR ACCESS LAW, Cambridge, MA: Ballinger Publishing Co. (Environmental Law Institute), 1979, at 46-47. The distinction is implicit in the California Shade Control Act, Pub. Res. Code §§ 25980-25986 (West Supp. 1979). *See* text following note 64 *infra*.

By treating these two aspects of the access issue separately, many of the problems inherent in any unitary approach can be avoided. For example, desired increases in density can be accommodated by varying the siting requirements; some areas might have no permissible locations. No method of assuring access, however, avoids all problems. The proposed bifurcated approach, for example, may ultimately preclude some density increases. While the planning necessary to establish the siting standards provides a way of evaluating explicitly such trade-offs, some conflict is inherent in any attempt to assure access within a land use framework that has traditionally ignored the sun.

In addition, the access issue has both legal and political aspects. While this article is concerned primarily with the legal issues, the importance of the political and policy issues should not be ignored. Unfortunately, the questions of political acceptability are less clear cut. In fact, they are often a mixture of contradictory parts. For example, while solar energy has wide popular appeal, people are torn by the belief that it will involve removing trees.[12] Similarly, although the most exclusive and sought-after residential developments often have the most restrictions on land uses, many people object to at least some types of restrictions. Thus, the political aspects of the access problem have a significant educational component:

> The application of solar energy will mean that property owners will lose some freedoms while gaining others that are more appropriate to this new technology. It may be, for example, that we will have to give up the right to plant trees wherever we like on our property. In exchange, we may acquire the right to have more sunshine pass over our neighbor's lot unimpeded.[13]

This article focuses on the more tractable legal problems. Specifically, it analyzes the potential advantages and difficulties that result from breaking the access issue into its two components.

II
SITING DISPERSED SOLAR ENERGY SYSTEMS

Building patterns can be divided into two broad classes: comparatively stable, developed areas on the one hand and new developments or large redevelopments on the other. The line between these two

12. George Washington University, *Solar Energy Incentives Analysis: Psycho-Economic Factors Affecting the Decision Making of Consumers and the Technology Delivery System*, Washington, DC: George Washington University (for DOE), January 1978; HCP/M-2534-01 (avail. NTIS), at 23.
13. Environmental Law Institute, *Legal Barriers to Solar Heating and Cooling of Buildings*, Washington, DC: DOE, December 1978; HCP/M2 528/01 (UC-59a) (avail. NTIS), at v.

classes is obviously imprecise, particularly in redevelopment projects. The fundamental criterion for distinguishing between them is, however, simple: an area is a "new development" if the part being developed is large enough in relation to existing building heights and densities to allow new buildings to be laid out and oriented to assure solar exposure. Thus, an area where existing singlefamily residences were being replaced piecemeal with multifamily units would be a "developed area."

While there is an unavoidable gray area, the distinction is nevertheless both possible and helpful. The distinction, however, is only analytical: no irreversible result need flow from a particular label. Only the focus of the planning approach changes.

A. SITING ISSUES IN STABLE, DEVELOPED AREAS

Developed areas are highly diverse in both uses and densities. They range from rural and semirural through residential and mixed-use areas to high-density urban districts. Despite the apparent diversity, however, developed areas share several common characteristics.

First, they are at or near existing density limitations, or at least no planning proposals call for major density increases in the near future. While there may be ongoing, gradual change, it is generally limited to the development of unused parcels or the redevelopment of under-used lots. Such changes involve small areas and blend into the general character of the neighborhood.

More important, existing land uses have arisen within a framework of land ownership that ignores the sun. The source of this framework is the Jeffersonian grid system.[14] This geometric system has been very successful in achieving its goal of stimulating a rapid and orderly settlement of the public domain. It has done so, however, by disregarding not only the sun but also local topographic and climatic conditions. The basic grid structure is thus the same in Des Moines, Seattle, and Minneapolis.

This standardized grid has fostered a similarly standardized pattern of development: Structures are generally oriented toward streets that have been laid out on geometric rather than solar principles. Two results are particularly significant. First, many structures are oriented so that their roofs run north and south. Because of their limited southern exposure, they may be poor candidates for solar retrofit. Second, the cookie-cutter

14. *See* Marshall Harris, *Origin of the Land Tenure System in the United States,* Ames, IA: Iowa State College Press, 1953, at 384-93.

uniformity engenders significant off-lot shading problems. In rectangular-grid developments, most lots are shaded at some point during the day by obstructions on five adjoining lots.

Both problems are also likely to arise when the grid pattern has been violated: the curvilinear streets common in many post-war subdivisions have continued the tradition of ignoring the sun. In fact, shading and orientation may be even more significant impediments to retrofitting in such developments than where the rectangular grid prevails.

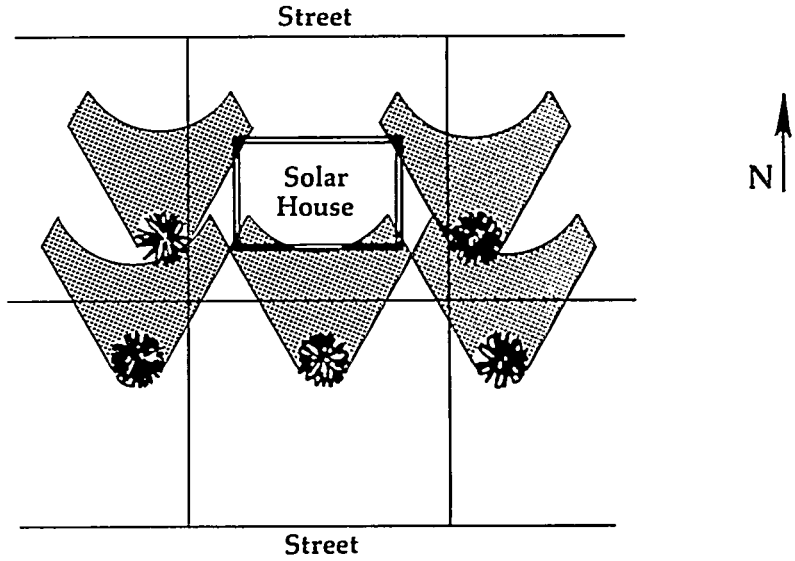


Figure 1. Objects such as trees on five lots may shade the solar owner's lot at some point during the day.

Finally, shading by vegetation and structures on adjacent lots is a constraint on the solar exposure potential in existing developments. Such obstructions cannot simply be removed. While the political limitations on mandatory vegetation removal and controls are likely to decrease as the number of people owning solar energy systems increases, the potential constitutional problem — the 14th Amendment prohibition against taking private property without due process of law — remains, particularly in any attempt to require structures to be razed.[15] Thus, the goal of siting collectors in existing developments is to maximize the potential that remains.

15. *See, e.g.*, United States v. Causby, 328 U.S. 256 (1946); *but see* Miller v. Schoene, 276 U.S. 272 (1928). *See generally* notes 85-98 *infra* and accompanying text.

This goal, however, does not exist in a vacuum; it is necessary to avoid unduly disrupting the expectations of adjacent landowners. The need to balance these potentially competing interests makes the siting issue complex. Flexibility is the dominant characteristic of any satisfactory solution.

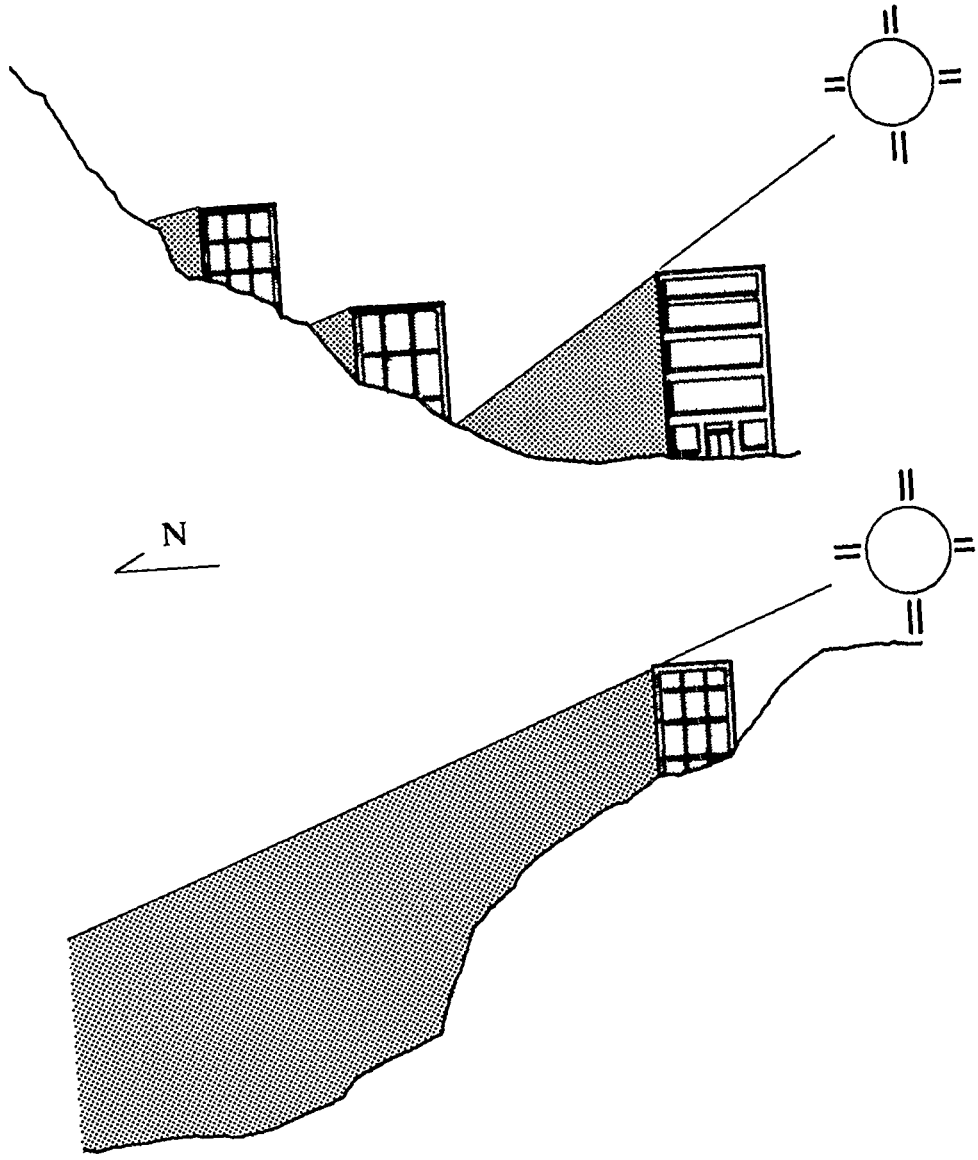


Figure 2. The effect of land slope on the amount of area shaded by a building.

1. *The Advantages of Zoning and Planning*

The most effective method of achieving the needed flexibility is the planning and zoning process. This approach offers other valuable benefits. For example, while easements provide a method of tailoring exposure requirements to the idiosyncracies of individual parcels, their usefulness is limited by both their consensual nature and their cost. Similarly, although restrictive covenants can be applied to larger areas than easements can, the practical problems of securing the necessary unanimity among all affected landowners in such large areas will generally limit the use of covenants to new developments.

Zoning largely avoids these difficulties. Not only is it far less expensive than securing easements to cover the same area, but it spreads the cost among all taxpayers, thus improving the economics of solar energy use. Zoning can be applied to large areas without encountering the potential holdout problems that plague both easements and restrictive covenants.

Planning and zoning, as inherently multivariable processes, provide the logical place to consider siting issues because the existing height, density, and setback requirements of zoning regulation are the framework in which access must be achieved. At the planning and zoning stage, the effect of proposed construction or other land use changes on solar exposure can be most easily determined and rectified. Since most planning and zoning occurs locally, solar exposure needs can be adapted to local use and density requirements as well as to local topography and climate. Finally, zoning encourages public involvement, fulfilling an important educational function. The planning and zoning process thus offers a number of real advantages, both in its own right and in comparison with other alternatives.

2. *A Collector Envelope*

Zoning is the most frequently suggested method of assuring access, but most of its proponents have ignored the distinction between siting and protecting solar energy systems. The focus of much of the literature, therefore, differs from the more limited role for zoning suggested here.

Traditional zoning tools such as height and setback requirements, nevertheless, can be applied within the constraints imposed by existing land uses. Since the legal[16] and technical[17] limitations of zoning have been examined elsewhere, the following is only an overview of the possibilities.

16. *See* Kraemer, *supra* note 11, at 73-94; Eisenstadt & Utton, *Solar Rights and their Effect on Solar Heating and Cooling*, 16 NAT. RESOURCES J. 363, 379-88 (1976).
17. Martin Jaffe, Duncan Erley, *Protecting Solar Access for Residential Development: A Guidebook for Planning Officials*, Washington, DC: HUD (American Planning

A three-dimensional volume within which a collector must be sited—a "collector envelope"—can be specified by height and setback requirements. These can be determined in relation to the existing requirements within each zone and the daily period when the collection of solar radiation is to be protected.[18] For example, in a zone with a 25-foot height limitation, a collector placed 25 feet above ground level in a flat area will not be shaded by structures on the adjacent lot. The actual figures will vary in relation to roof types, land slope, and the latitude of the site.[19] In most cases, however, the collector can be located lower than the existing height limitation without being shaded because the sun's altitude is always at some angle above the horizon. Finally, the further the collector is located from the southern property line, the lower the height at which it can be sited without being shaded by buildings on adjacent parcels.[20] In fact, the few studies indicate that most roofs in residential settings are shadow-free under existing height and setback requirements.[21]

Specifying the location and dimensions of the collector envelope does not, however, assure that the collector will be unobstructed at all points within the envelope. It guarantees only that it will not be shaded by legally constructed buildings on adjoining lots. Some of the envelope may be shaded by vegetation. Nevertheless, by establishing the largest possible envelope, it should be possible to site the collector at some permissible location that is not shaded.

Description of the collector envelope through height and setback requirements also minimizes adverse effects on adjoining landowners. By incorporating the existing limitations, the envelope procedure will allow the owner of the adjacent lot to develop or redevelop the land in conformity with the existing standards.

This restricted collector envelope approach reflects the more limited solar potential of many older structures. A major restructuring of existing buildings to make full use of solar energy is unlikely to be economical in the near future. The description of a collector envelope through height and

Ass'n) May 1979; HUD-PDR-445 (avail: GPO), at 46-81; Eisenstadt & Utton, *supra* note 16, at 388-413.

18. *See* text accompanying notes 49-51 *infra.*
19. *See* Jaffe, Erley, *supra* note 17, at 34-37, 126-28. *See generally* Hayes, *supra* note 11, at 77-79.
20. For an examination of some of the issues that should be considered in defining a collector envelope, *see* Hayes, *supra* note 11, at 79-84.
21. *See, e.g.*, Dubin-Mindell-Bloome Associates, P.C., *A Study of Existing Energy Usage on Long Island and the Impact of Energy Conservation, Solar Energy, Total Energy and Wind Systems on Future Requirements*, New York: Dubin-Mindell Bloome Associates, P.C. (for Suffolk County Dept. of Environmental Control), October 1975, at 44; California Energy Commission, *Solar Energy in California: Residential Thermal Applications - Draft*, Sacramento: CEC, ch. VII at 2.

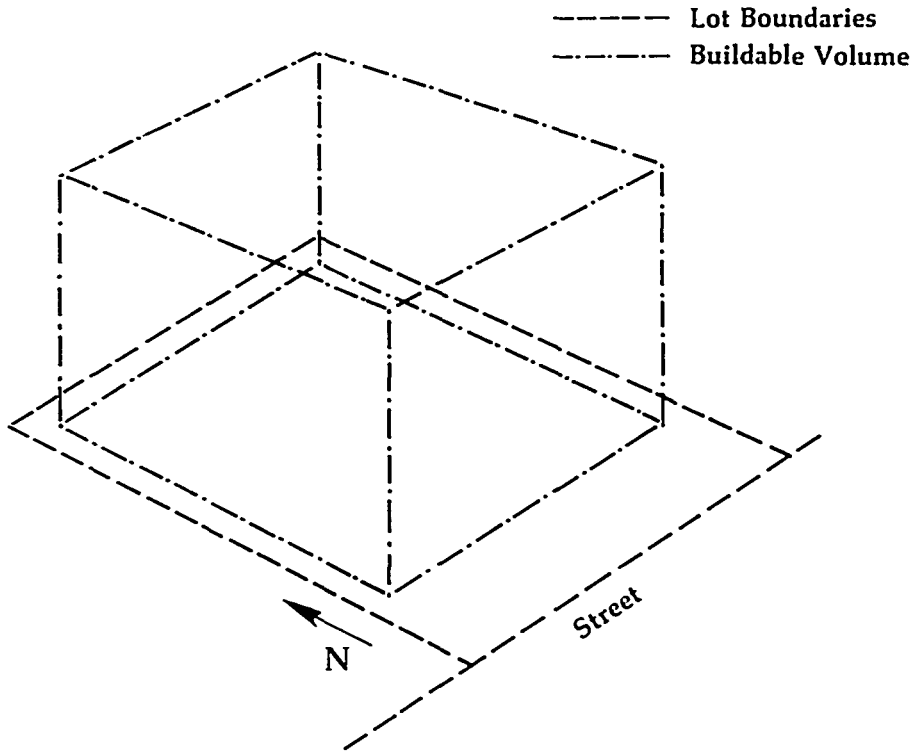


Figure 3-A. Collector Envelope:
Height limitations and setback requirements create a "buildable volume" within which any structure can be located. The buildable volumes of adjacent lots potentially cast determinable shadows on the solar lot. The area within the buildable volume of the solar lot that is not shaded by the buildable volumes on adjacent lots is the "collector envelope" within which a collector can be legally sited without being shaded by structures or potential structures on adjacent lots.

setback requirements will generally provide sufficient solar radiation for such cost-effective retrofits as active, domestic hot water systems. Thus, as a transitional step, the collector envelope concept is a workable compromise for the problems of siting collectors in existing developments.

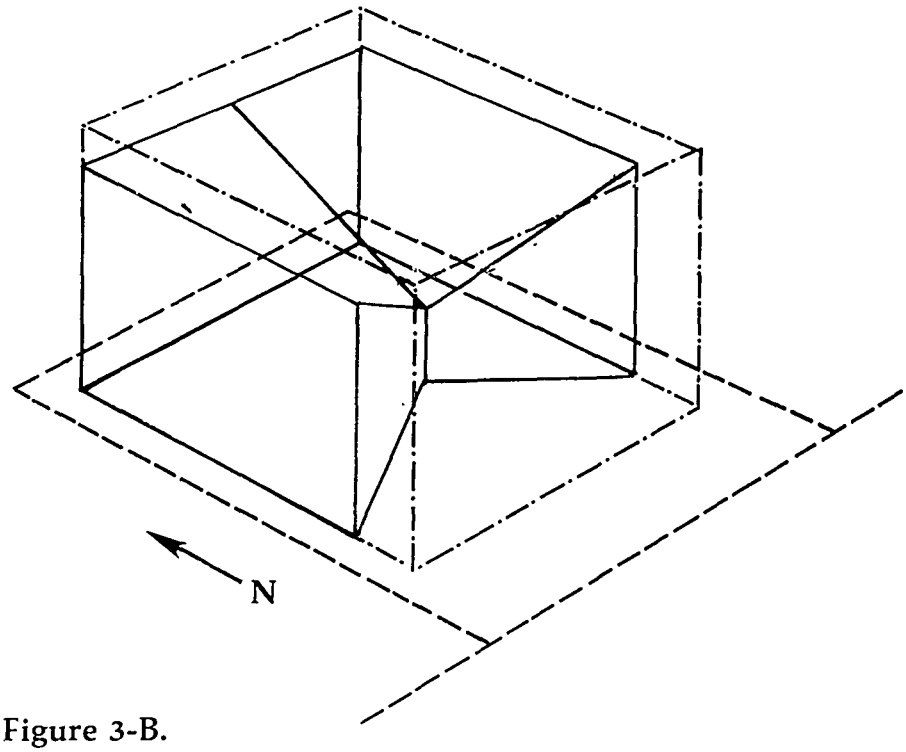


Figure 3-B.

The area of the buildable volume (—·—·—) that remains after shadows from adjacent lots intersect the buildable volume (———) is the collector envelope: that is, the collector envelope is the area between —·—·— lines and ——— lines.

B. SITING ISSUES IN NEW DEVELOPMENTS AND LARGE REDEVELOPMENTS

As with existing uses, new developments are diverse; they range from new residential subdivisions and industrial parks to urban redevelopment projects. All share significant common factors, however. Most important, they involve major changes in density through development or redevelopment of a comparatively large tract, frequently under single ownership.

In such new developments, solar exposure considerations can be integrated into the initial site planning. Local climatic conditions can be exploited; streets can reflect topography; structures and vegetation can be sited and oriented both to maximize solar exposure and to avoid or minimize the shading of other lots. Thus, in new developments both

aspects of the siting issue can be addressed without the constraints that restrict the potential in developed areas. That is, structures that are not initially solar-equipped can be oriented to make retrofitting possible; all structures and vegetation can be sited to avoid shading other buildings.

1. *Integrating Solar Considerations*

Solar exposure need not be the sole or even the dominant concern in the planning process. Other energy conservation considerations,[22] as well as surrounding uses, aesthetics, and other factors should also be considered. Although protecting exposure without siting controls might "result in leapfrog development, which would, in turn, result in the use of more fossil fuel for transportation,"[23] reasonable solar access is compatible with other conservation goals. Solar access can be integrated into the planning process; it need not lead to monotonous, low-density developments or treeless neighborhoods.

First, there are different degrees of solar exposure. The American Planning Association, for example, has distinguished four levels of access:

- *Detached collector exposure,* the least restrictive option for adjoining landowners, would provide solar access only for active, fluid-cooled collectors located near the structures they serve.
- *Roof-top exposure* would allow for roof-mounted active systems as well as passive systems with skylights or clerestories.
- *South wall exposure* would provide access for wall-level passive and active systems.
- *South lot exposure,* the least restrictive for the solar owner, would allow solaria, greenhouses, or reflectors to be used.[24]

Different density zones can be planned to provide different amounts of solar radiation. Residential zones, for example, can be laid out to allow for extensive passive applications.

22. *See generally* Corbin C. Harwood, *Using Land to Save Energy,* Cambridge, MA: Ballinger Publishing Co., 1977; Ralph L. Knowles, *Energy and Form: An Ecological Approach to Urban Growth,* Cambridge, MA: MIT Press, 1974.
23. Environmental Law Institute, *supra* note 13, at 22. *See also* Hayes, *supra* note 11, at 52; David Engel, "Testimony," *A Forum on Solar Access* (Proceedings), New York, NY, July 28, 1977, Rockville, MD: NSHCIC (undated), at 3; Steven K. Rivkin, "Regulatory Analysis and Consumer Rights and Powers," *Early Use of Solar Energy in Buildings: A Study of Barriers and Incentives to the Widespread Use of Solar Heating and Cooling Systems,* New York, NY: AIA Rsearch Corp. (for NSF), August 1976; NSF/RA-760578 (avail: NTIS: PB-267 832), at 6.
24. Jaffe, Erley, *supra* note 17, at 23-24.

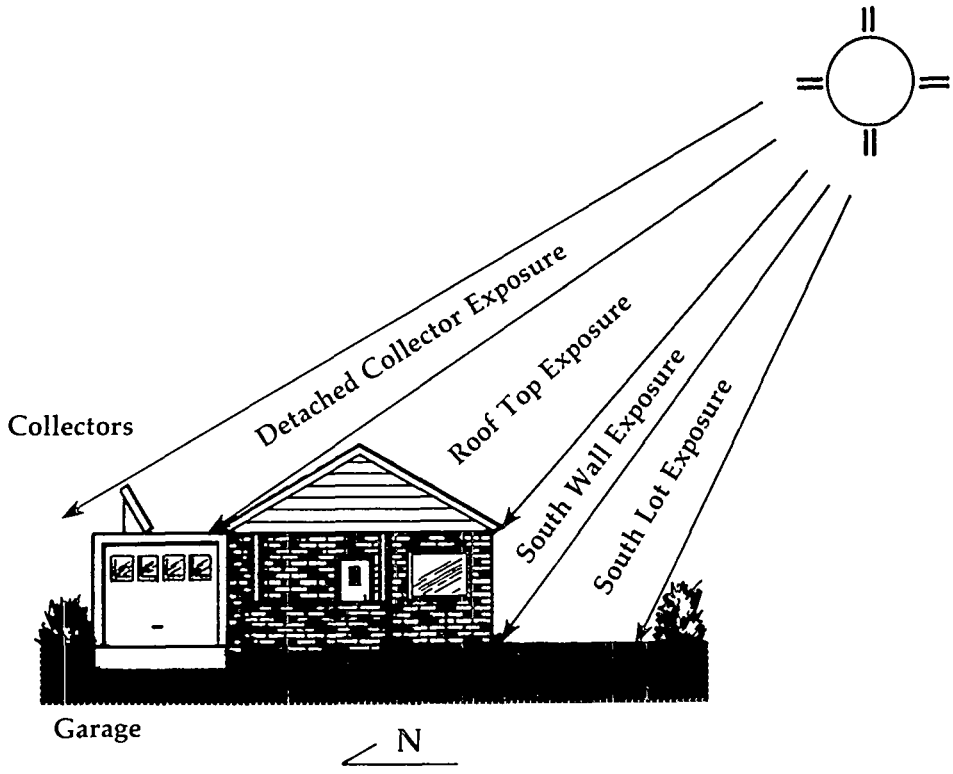


Figure 4. There are at least four levels of solar exposure.

This approach would allow some areas to be zoned for no solar uses. Unlike traditional zoning, however, such a designation would not mean that solar energy systems were prohibited; it would merely prevent the owner of a system in such an area from obtaining a right to sunshine. A solar owner in a no-solar zone thus would need to obtain private assurances by buying easements or run the risk of being deprived of exposure for her collectors. Such zoning designations are perhaps appropriate in core commercial areas where building heights vary widely. In many such high-density districts, the ratio of roof area to building volume already severely limits the potential of solar energy.[25] Another candidate for no-solar zoning classification would be steep north-facing slopes, where

25. *See generally Renewable Energy and the City: Joint Hearings Before the House Subcomm. on the City of the Comm. on Banking, Finance & Urban Affairs and the House Subcomm. on Oversight & Investigations of the Comm. on Interstate & Foreign Commerce*, 96th Cong., 1st Sess., October 16-17, 1979, at 42 (statement of Dr. John H. Gibbons); *id.* at 133 (statement of Barry Commoner). *But see id.* at 75 (statement of Travis L. Price).

any construction higher on the hill would block what little sunshine reaches the downhill solar system.

Some solar exposure is, however, compatible with most densities. Historical examples of high-density solar applications are being recognized. For example, the city of Olynthus, an urban center of classical Greece with a population of from 12,000 to 15,000, was planned to provide each building with sufficient sunshine to allow solar heating.[26] In ancient Rome, *solaria* to capture the sun's heat were built onto the tenements of the poor. [27] Recent studies have demonstrated that such examples are not anomalous. For example, it is possible to site up to 8.4 detached, single family residences and 9.8 attached row houses per acre.[28] In comparison, the traditional rectangular grid generally produces densities of only 4.8 detached residences per acre.

Solar exposure can also be built into higher density development. For example, Professors Ralph Knowles and Richard Berry of the University of Southern California have recently completed a study of solar access in the urban environment. They concluded that nearly 50 condominiums per acre could be designed to assure each unit unobstructed solar access. Similarly, the project produced designs for a commercial area that assured both economical densities and solar access.[29] In both the residential and commercial zones, the solar design led to medium density development that reduced the energy costs not only of the structures, but of the transportation system as well. In short, although solar exposure will affect other planning objectives, it is not necessarily incompatible with them.

Introducing solar considerations during the initial site planning should minimize the detrimental effects on development and on adjacent uses, while allowing higher levels of sunshine to reach each structure. Finally, because most constraints that limit the solar potential of existing developments are not present in new developments, it is possible to shift the focus of the siting regulations. Rather than specify the permissible locations for collectors, regulation can focus on shadows by establishing shading limits.

26. Jordan & Perlin, *Solar Energy Use and Litigation in Ancient Times*, 1 SOLAR L. REP 583, 585-86 (1979). For an examination of similar developments in the American Southwest, *see* Knowles, *supra* note 22, at 17-46; Donald W. Aitken, "Natural Energy Design by Intuitive Wisdom," *Proceedings Supplement, Solar 79 Northwest*, Seattle, August 10-12, 1979, Seattle: Bonneville Power Administration, August 1979, at 5.
27. *See* Jordan & Perlin, *supra* note 26, at 588 n. 23 and accompanying text.
28. Richard Stein, "Testimony," *A Forum on Solar Access* (Proceedings), New York, NY, July 28, 1977, Rockville, MD: NSHCIC (undated), at 19-20.
29. Ralph L. Knowles, Richard D. Berry, *Solar Envelope Concepts: Moderate Density Building Applications*, Golden, CO: SERI, March 1980; SERI/SP-98155-1, at iii, 3, 88-94, 120-26. *See* 1 SOLAR L. REP 727 (1979).

2. *Three Approaches*

There are at least three methods of controlling shadow-casting objects, each with different applications. Since none of the methods is instrinsically superior, a community might select one or more approaches after reviewing local requirements. Regardless of the method selected, however, the first step is to determine the degree of solar exposure that will be mandated for the area. Then site planners can select the most appropriate method.

The first way of limiting off-lot shading is to use traditional zoning tools to specify the location, volume, and shape of buildings—a "structural envelope."[30] Once the desired degree of exposure has been determined, off-lot obstructions can be controlled by specifying setbacks, maximum heights, and inclined planes to define a space in which any structure must be located. For example, because of the angle at which sunshine strikes the earth's surface, potentially obstructing buildings can be taller the further they are located from the northern property line of the parcel on which they are sited (the neighbor's southern property line). In addition to reducing off-lot shading, this method would assure that buildings constructed within such an envelope embody sound passive solar principles by reducing their northern exposure and increasing their southern exposure. The major drawback of this approach is its potential complexity and rigidity; such problems with traditional light-and-air controls are frequently cited by zoning commentators.[31]

A second option relies upon establishing "hypothetical walls," imaginary obstructions running along the appropriate property lines.[32] Shading in excess of what would be produced by the obstruction is prohibited. The desired level of sunshine is obtained by adjusting the height of the hypothetical wall. This method is comparatively simple to enforce; it is only necessary to place a pole of the specified height on the property line to determine the length of permissible shadows. To determine the appropriate height of the hypothetical walls, however, the zoning board would have to make many of the same computations as under approach. In addition, builders and their architects would have to define the buildable area by computing the dimensions of the structural envelope.

30. This approach has been more fully examined by Ralph Knowles. Knowles, Berry, *supra* note 29, at v-vi, 5-14. *See* 1 SOLAR L. REP. 727 (1979).
31. *See, e.g.*, 3 N. Williams, AMERICAN LAND PLANNING LAW § 67.01, Chicago, IL: Callaghan & Co., 1975. *See also* Jaffe, Erley, *supra* note 17, at 21.
32. This method was initially suggested in Eisenstadt, Long, & Utton, *Proposed Solar Zoning Ordinance*, 15 URB. L. ANN. 211, 214 (1978). It has been more fully developed by Sandy Kraemer. See Kraemer, *supra* note 11, at 209-25.

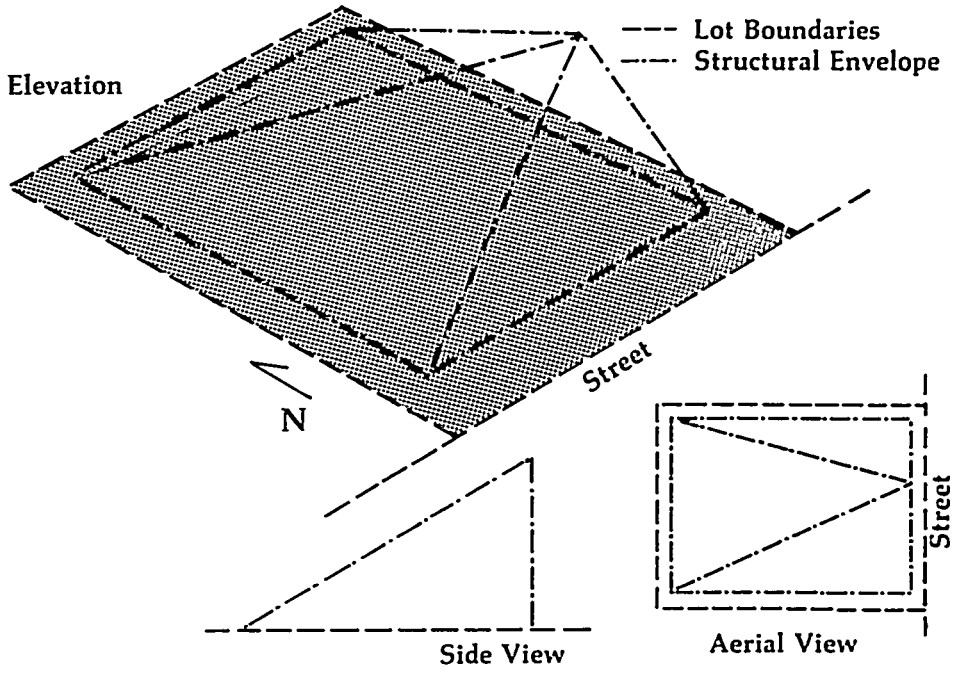
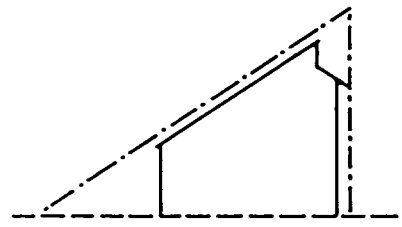


Figure 5-A. Structural Envelope:

Since the shadows cast by any object can be determined, it is possible to specify a volume (the structural envelope) on any lot within which structures or vegetation will produce only a predetermined amount of shading of adjacent lots. By varying the dimensions of the volume, the desired amount of off-lot shading can be achieved.

Figure 5-B. The building shape would be controlled by the envelope.



The third approach is to prescribe general standards, allowing the developer to plan the area in compliance with them.[33] This approach offers the greatest flexibility, but it shifts the responsibility to the local officials who authorize building permits or development plans. This may create problems in areas lacking either staff or knowledge of the options.

3. *Trees and the Limitations of Zoning*

The focus thus far has been on the problems created by structures; vegetation has been noted only as a constraint on the solar radiation potential in existing developments. The detrimental effects of vegetation should not, however, be underestimated. Many commentators, for example, conclude far too readily that deciduous trees do not block sunshine in the winter, when heating demand is greatest.[34] Even granting this conclusion, any obstructive vegetation can preclude such continuous uses of solar energy as for heating potable water and such developing solar technologies as seasonal storage. Upon closer inspection, however, this conclusion is revealed as a piece of common knowledge that is incorrect: Leafless trees may obstruct from 20 to 80% of the available energy, depending on species, according to recent readings taken on the streets of Davis, California.[35] The presence of any obstructive vegetation thus can be a serious problem.

Any vegetation controls must be flexible.[36] Trees are important for reducing summer cooling requirements. Since most electric utilities in this country experience their highest demands for electricity in the summer,[37] reducing air-conditioning loads should be a major goal of any energy conservation plan. The placement of trees in locations where they will provide summer shade for buildings need not, however, produce significant off-lot shading. To be effective for summer cooling, most vegetation will necessarily be located south of the structure to be cooled. Thus, unless the trees are very tall at maturity, they will not often shade adjacent lots.

33. This approach has been adopted by two states. See CAL. GOV'T CODE § 66473.1 (West Supp. Pamp. 1979); MINN. STAT. ANN. § 462.358(2) (West Supp. 1979).
34. *See, e.g.*, Eisenstadt & Utton, *supra* note 16, at 406-07.
35. These figures, reported in Jaffe, Erley, *supra* note 17, Figure 90, at 137, are the average of readings taken by Living Systems, Inc. Telephone conversation, Martin Jaffe, senior research associate, American Planning Association, March 6, 1980. *See also* Hayes, *supra* note 11, at 30.
36. *See generally* Martin Jaffe, "Protecting Solar Access," *Environmental Comment*, May 1978, at 12.
37. *See, e.g.*, Stephen L. Feldman, Bruce Anderson, *Utility Pricing and Solar Energy Design*, Worcester, MA: Clark University (for NSF), 1976; NSF/RA-760406 (avail: NTIS, PB-263 798), at 12.

Vegetation can be helpful in reducing winter energy demand by serving as windbreaks, but relatively low, compact shrubs and hedges can satisfy this function without also shading a collector located on the adjacent parcel. Finally, since trees vary widely in both mature heights and the amount of leafless shading they produce, municipalities should consider enacting into law lists of approved species for different areas and uses.

Despite such possibilities, however, planning and zoning are generally ill-equipped for regulating vegetation. They were developed for controlling static elements, the built components of the environment, not dynamic, growing elements. The utility of traditional land use tools to control vegetation is further limited by the idiosyncratic nature of the problem. It is the relationship between a particular collector site and the location of distinct plants on adjacent parcels that creates the problem. Attempting to restrict these relationships for all possible combinations is likely to produce complex overregulation. Vegetation-produced shading thus reveals the more basic limitations of general siting regulations.

III
PROTECTING SYSTEMS FROM SHADOWS

It is requiring too much of a single mechanism for it both to prescribe permissible sites for collectors and to provide adequate assurances of continuing solar radiation for legally sited collectors. These two goals have requirements that differ too radically: siting requires flexibility, protection requires certainty.

Certainty is the dominant criterion for evaluating protection proposals because uncertainty and risk reduce investment for all but the inveterate gambler.[38] Thus, if the use of solar energy is to be increased, individuals considering the installation of solar energy systems must be assured of continuing solar radiation, or at least of compensation for its obstruction.

A. THE LIMITATIONS OF ZONING: A REPRISE

Planning and zoning do not provide certainty. The fundamental axiom of both processes is that, as legislative acts, "zoning regulations are

38. A recent study, for example, concluded that risk is "a major psycho-economic factor." George Washington University, *supra* note 12, at s-2.

not contracts by government and may be modified."[39] Thus, zoning ordinances can be readily amended or repealed. Although it is not clear how many involved developed areas, between 1960 and 1967, two-thirds of American cities enacted new or extensively revised zoning schemes.[40] Furthermore, less substantial changes such as variances are even more routinely granted.

In view of the discretionary authority of zoning boards and the ease of rezoning, it is difficult to agree with some solar zoning advocates that zoning can be used to create a solar "right." These conclusions either reflect a fundamental misapprehension of zoning[41] or implicitly assume major changes in its current legal basis.[42] Since an individual lacks a vested interest in a particular zoning classification, the value of any zoning right is at best extremely limited.

A further problem with planning and zoning is their bluntness: they are well suited for controlling only static and general elements. Extending them to regulate the dynamic aspects of land uses will lead to massive and detailed controls, which are likely to be politically unacceptable and to create a negative public perception of solar energy.

B. SOLAR ENTITLEMENTS AND THEIR CRITICS

The simplest method of providing the necessary certainty is to recognize an explicit entitlement to direct sunlight.[43] Despite the simplicity and

39. Reichelderfer v. Quinn, 287 U.S. 315, 323 (1932). *See also* Robinson v. City of Los Angeles, 146 Cal. App. 2d 810, 304 P.2d 814 (1968); Eggebeen v. Sonnenberg, 239 Wis. 213, 1 N.W.2d 84 (1941).
40. Allen D. Manvel, *Local Land and Building Regulation: How Many Agencies? What Practices? How Much Personnel?*, Washington, DC: GPO (for the National Commission on Urban Problems), 1968; Research Report No. 6, at 31. *See also* Hayes, *supra* note 11, at 221.
41. *See, e.g.*, Eisenstadt & Utton, *supra* note 16, at 395-96 (arguing that a variance or zoning change resulting in the obstruction of a collector's sunshine would result in compensation for the solar owner).
42. Hayes, *supra* note 11, at 85-86 (suggesting that variance procedures be changed to require government compensation for shading of a collector). *See also* Reitze, *A Solar Rights Zoning Guarantee: Seeking New Law in Old Concepts*, 1976 Wash. U.L.Q. 375, 399. It is sometimes suggested that solar energy use in reliance on zoning which prevents shading might be protected as a nonconforming use in the event of a zoning change. This theory, which would keep neighboring land from taking advantage of its current zoning, seems uncertain at best. *See* Hayes, *supra* note 11, at 141.
43. *See* William R. Harris, *Is the Right to Light a California Necessity? Prepared Statement Submitted Before the California State Assembly Committee on the Judiciary*, Santa Monica, CA: Rand Corp., December 11, 1975; AD-Ao26660; Goble, *supra* note 2, at 99-105.

efficacy of this approach, several analysts have questioned it because of their fear that it will unduly restrict the development of adjacent parcels.[44] The magnitude of this fear, however, is far out of proportion to the potential effects of a solar entitlement.

First, several studies have demonstrated that solar exposure is compatible with most, if not all, density levels.[45] Furthermore, in extreme situations, an area could simply be zoned so that there were no legal collector sites, thus preventing possible conflicts. The adverse impact of the necessary right thus should be minimal.

Second, the critics of a solar right have ignored the important distinction between siting and protecting collectors. The recognition of a right arising regardless of the collector's site could preclude development. This problem is ameliorated, however, by restricting the entitlement to legally sited collectors. Such a restriction would be legally permissible; it is within a state's plenary authority not only to create property rights but also to specify their content. As the Supreme Court has held, property interests "are created and their dimensions defined by existing rules or understandings that stem from an independent source such as state law—rules or understandings that secure certain benefits and support claims of entitlement to those benefits."[46] Tailoring the right in this manner is a major advantage of enacting a solar entitlement explicitly.

Nevertheless, there are likely to be situations in which even a carefully restricted solar entitlement will preclude some development of adjacent parcels. This is most likely to occur when the character of the area has changed significantly after a collector has been properly sited. Since the entitlement is a constitutionally protected property right that attaches to the collector once it has been legally sited, subsequent changes in the siting requirements will not divest the collector's owner of the right.[47]

There are, however, methods available to reduce the conflict between development and solar access. Assuring that the solar right is freely alienable, for example, would allow it to be transferred in response to economic conditions.[48] A more fundamental potential limitation would be

44. *See, e.g.*, Environmental Law Institute, *supra* note 13, at 22; Engel, *supra* note 23, at 3; Arnold W. Reitze, Jr., Glenn L. Reitze, "Protecting a Place in the Sun: Part Two," *Environment*, vol. 18 no. 6, July/August 1976, at 4; Hayes, *supra* note 11, at 181-82, 187.
45. *See* notes 28 and 29 *supra* and accompanying text.
46. Board of Regents v. Roth, 408 U.S. 564, 577 (1972). *See also* Sperry & Hutchinson Co. v. Rhodes, 220 U.S. 502, 505 (1911); Reich, *The New Property*, 73 YALE L. J. 733 (1964).
47. U.S. CONST. amends. V, XIV; Chicago, Burlington & Quincy R.R. v. Chicago, 166 U.S. 266 (1896).
48. *See* Williams, *supra* note 3; *but see* Goble, *Solar Access and Property Rights: Reply to a 'Maverick' Analysis*, 12 CONN. L. REV. ___ (1979) (forthcoming).

a restriction of the right to a specified time period. At a minimum, the period should correspond to the expected life of the solar installation, say 20 years. In addition, permits should be renewable unless the zoning classification had changed in the interim and an adjacent landowner objected to the renewal. Although a time limit might make creation of an access right more acceptable during the initial stages of the solar transition, limits designed for active systems would be too short for most passive systems. Being integral parts of the building, they should last the life of the building. The important point, however, is that, in creating an explicit right to sunshine, such issues can be examined and resolved.

Two other limitations should be built into any solar right. First, because of the rotation of the earth (the apparent motion of the sun), the quality of solar energy varies during the day. The energy intensity of sunlight is changing continuously in relation to the atmospheric volume through which it must pass. For example, 5% of the total daily energy can be collected in 17 minutes at solar noon, but it takes 83 minutes to collect the same amount of energy just after sunrise or just before sunset. As a result, almost 90% of the total available energy strikes the collector between 9:30 a.m. and 2:30 p.m., only 56% of the daylight period.[49] Similarly, shadows are far longer in the early morning and late afternoon hours. Thus, while a foot-high object casts a shadow more than 4 feet long at 8:00 a.m. (or 4:00 p.m.), at noon the same object casts a shadow only 1.6 feet long.[50] This suggests a useful compromise. Since radiation intensity is low during the maximum shadow periods, any nonconsensual protection measure should restrict the solar entitlement to a period around solar noon, such as the commonly used 9 a.m. to 3 p.m. or 10 a.m. to 2 p.m. period.[51] Restricting access in this way has the additional advantage of reducing potential summer heat gain. The parcel could receive only 58% as much of the total daily available energy during the summer as during the winter.

Second, since the recognition of a solar right will restrict the uses of adjacent parcels, there is concern that some individuals will use solar energy as a pretext for prohibiting land use changes, for reasons unrelated to solar energy use. Although this problem is ameliorated by employing a two-step, siting/protection procedure, it remains a valid concern. Fortunately the solution is straightforward: minimum energy collection capabilities can be included in the statutory definition of "solar energy

49. All figures in this paragraph are for 35° N. latitude (Albuquerque, N.M.) on January 4. *See* Kraemer, *supra* note 11, at 207.
50. *Id.* at 223.
51. *See, e.g.*, CAL. PUB. RES CODE § 25982 (West Supp. 1979).

system" that is included in the act establishing the protective mechanism.[52]

Despite the care with which a solar right is structured, however, some redevelopment is likely to be blocked. The choice is, then, clear: Is business-as-usual development to be favored over more intensive and widespread use of solar energy? In such comparatively rare cases, the preferable answer is to foster "an economic purpose for urban growth that stresses the long-term costs of maintaining equilibrium in the built environment over the short-term costs of development"[53] through the recognition of a solar entitlement.

Several legal mechanisms have been suggested that could be adapted to provide the requisite property right. Easements and covenants, for example, are interests in real property. Reliance upon such consensual methods, however, will impede a transition to solar energy by increasing its costs and granting neighbors a veto power over the installation of solar energy systems on adjacent parcels.

Although the recognition of a prescriptive easement for sunlight[54] would avoid these shortcomings, prescriptive periods are generally far too long. A solar owner would be forced to gamble that nothing would obstruct her access for 10 to 20 years, the period required for the easement to mature.[55] Since certainty is the dominant criterion for protective mechanisms, prescriptive acquisition of solar easements is not a meaningful option.

Finally, the recognition of a private nuisance action for obstruction of sunlight is a method that would circumvent both the cost and time problems.[56] Unfortunately, however, litigation would be required in most

52. *See, e.g.*, N.M. STAT. § 47-3-3(A) (1978) (requiring a system to collect 25,000 Btu per day); ORE. REV. STAT. § 469.160(1) (1977) (system must supply 10% of structure's total annual energy requirements). The standard in both statutes is nearly the same: collection of the amount of energy required for domestic water consumption. Eisenstadt, Long, & Utton, *supra* note 32, at 219 n. 32. *See also* William A. Thomas, Alan S. Miller, Richard L. Robbins, *Overcoming Legal Uncertainties About Use of Solar Energy Systems*, Chicago, IL: American Bar Foundation 1978, at 31. *But see* Kerr, *New Mexico's Solar Rights Act: The Meaning of the Statute*, 1 SOLAR L. REP. 737, 743 (1979) (noting that additional statuatory language "may vitiate the 25,000 Btu standard"); Hillhouse & Hillhouse, *New Mexico's Solar Rights Act: Cloud over Solar Rights*, 1 SOLAR L. REP 751, 756 (1979).
53. Knowles, *supra* note 22, at 1.
54. Prescription is a method of acquiring an easement simply by long, continued use, rather than agreement. *See, e.g.*, Clawson v. Primrose, 4 Del. Ch. 643 (1873).
55. *See, e.g.*, CAL. CIV. PROC. CODE § 749 (West 1955) (20 years); *Id.* § 749.1 (10 years); N.Y. REAL PROP. ACTS § 501 (McKinney 1979) (10 years); ORE REV STAT § 12.050 (1977) (10 years).
56. *See* generally Gevurtz, *supra* note 5.

cases before the solar owner was certain of unobstructed solar radiation because of the balancing of interests that is implicit in nuisance theories. In addition, because of the rejection of the doctrine of ancient lights,[57] American courts are unlikely to take the required initiative.[58] Thus, the most promising approaches are those that have been enacted by California (public nuisance) and New Mexico (prior appropriation).

C. SHADING OF SOLAR COLLECTORS AS A PUBLIC NUISANCE

Public nuisance law is an ill-sorted collection of tort and criminal law concepts for which concise definition is impossible. As one commentator noted, it is a "wide term which came to include obstructed highways, lotteries, unlicensed stage-plays, common scolds, and a host of other rag ends of the law."[59]

Definition may be elusive, but application of this theory to the protection of solar access is not.[60] As an expression of the state's plenary power—or, as it is more often ill-phrased, its "police powers"—an activity or condition becomes a public nuisance when a legislative body declares it to be one.[61] The state's authority to declare a nuisance is limited only by constitutional restrictions.[62]

California has adopted this approach, enacting a statute declaring that

> no person owning or in control of a property shall allow a tree or shrub to be placed, or, if placed, to grow on such property, subsequent to the installation of a solar collector on the property of another so as to cast a shadow greater than ten percent of the collector absorption area . . . at any one time between the hours of 10 a.m. and 2 p.m. . . . [T]he location of a solar collector is required to comply with the local building and setback regulations, and to be set back not less than five feet from the property line, and no less than 10 feet above the ground. A

57. *See* Goble, *supra* note 2, at 108-15.
58. *See, e.g.*, Keiper v. Klein, 51 Ind. 316 (1875); Parker v. Foote, 19 Wend. 309 (N.Y. Sup. Ct. 1838); Musumeci v. Leonardo, 77 R.I. 225, 75 A.2d 175 (1950). *See also* Siu v. McCully-Citron Co., Civil No. 56405 (Cir. Ct., Hawaii), noted at 1 SOLAR L. REP. 542 (1979).
59. Newark, *Boundaries of Nuisance*, 65 L.Q. REV. 480, 482 (1949). *See generally* Reynolds, *Public Nuisance: A Crime in Tort Law*, 31 OKLA. L. REV. 318 (1978).
60. *See generally* Kraemer, *supra* note 11, at 117-28; Kraemer, Felt, *supra* note 5.
61. Courts can, although only infrequently do, declare a public nuisance in the absence of legislation. *See, e.g.*, City of Chicago v. Geraci, 30 Ill. App. 3d 699, 332 N.E.2d 487 (1975).
62. *See* Linde, *Without "Due Process,"* 49 ORE. L. REV. 125 (1970).

> collector may be less than 10 feet in height, only if in addition to the five feet setback, the collector is set back three times the amount lowered.[63]

Any person violating these provisions "is guilty of a public nuisance" and can be punished by a fine of up to $500 per day.[64]

The California statute is a useful first step, but it is a flawed model. Although the statute implicitly recognizes the siting-protection dichotomy, it vitiates the potential advantages of local flexibility by prescribing statewide standards. Furthermore, it will probably increase the cost of solar energy by allowing up to 10% of the collector's surface to be shaded.

The most serious shortcoming, however, is the statute's failure to allow collector owners to bring private suits to protect their systems from shadows. Although generally an individual who can demonstrate a particular injury not shared by the general public may maintain a private action to abate a public nuisance,[65] the issue often turns on a detailed construction of the statute by the courts, and such a private right of action should not be presumed to arise automatically.[66] The act emphasizes that it is the duty of the local prosecutor "to prosecute all persons guilty of violating this section by continuous prosecutions until the violation is corrected."[67] Unfortunately, this approach introduces the uncertain element of politics; local prosecutors are elected officials. Although the language would probably support a mandamus action against the prosecutor by the aggrieved solar owner to compel enforcement, this is an unnecessarily circuitous approach, since the legislature has the power to authorize individual actions.[68] While the apparent justification for these limitations was the desire to produce a politically palatable piece of legislation, they result in a very restricted solar right.

Beyond the problems presented by this particular act, public nuisance is an intrinsically limited model. It is not clear, for example, that public nuisance doctrines can be used to prevent shading caused by a structure erected in compliance with a building permit. The general rule is that an

63. CAL. PUB. RES. CODE § 25982 (West Supp. 1979).
64. *Id.* § 25983.
65. *See, e.g.*, Biber v. O'Brien, 138 Cal. App. 353, 32 P.2d 425 (1934); Gibbons v. Hoffman, 203 Misc. 26, 115 N.Y.S.2d 632 (Sup. Ct. 1952). *See generally* Prosser, *Private Action for a Public Nuisance*, 52 VA. L. REV. 997 (1966).
66. *See, e.g.*, Venuto v. Owens-Corning Fiberglas Corp., 22 Cal. App. 3d 116, 99 Cal. Rptr. 350 (1971). *But compare* Transamerica Mortgage Advisors, Inc. v. Lewis, 100 Sup. Ct. 242, 244-47 (1979) *and* Cannon v. University of Chicago, 99 Sup. Ct. 1946, 1953-61 (1979) *with* Touche Ross & Co. v. Redington, 99 Sup. Ct. 2479, 2485-91 (1979), Cannon v. University of Chicago, 99 Sup. Ct. at 1974 (Powell, J., dissenting), *and* Cort v. Ash, 422 U.S. 66, 79-85 (1975).
67. CAL. PUB. RES. CODE § 25983 (West Supp. 1979).
68. *See, e.g.*, FLA. STAT. ANN. § 60.05 (West 1969); WIS. STAT. ANN. § 280.02 (West 1958).

act authorized by the government, if performed without negligence, cannot be a public nuisance since "that which is authorized by the state is necessarily not an offense against it,"[69] despite cases that reach the opposite result.[70] Such uncertainty is a significant drawback.

D. APPROPRIATING SUNLIGHT: THE PERMIT APPROACH

An alternative model for a solar entitlement that avoids the difficulties and limitations of public nuisance law is the prior appropriation doctrine.[71] It is based on the long standing recognition by both courts and commentators of the similarity of water and sunlight.[72]

1. Objections to a Priority System

Despite the similarity of these two resources, however, some analysts of the solar access issue have argued that the analogy is fatally flawed and that application of the doctrine to sunshine would create significant problems. At the heart of the criticism seems to be the fear that the advocates of the prior appropriation approach would "adopt an entire body of law simply to benefit from some of its features."[73] To use the analogy, however, it is not necessary to adopt the whole body of Western water law. Despite its objection to the water law analogy, for example, the Environmental Law Institute has proposed a model law embodying major elements of the permit system that typifies modern Western water codes.[74] Many of the objections to the water rights analogy appear to result

69. 1 F. Harper & F. James, THE LAW OF TORTS § 1.29, Boston, MA: Little, Brown & Co., 1956. *See also* Delaware, L. & W. R.R. v. Chiara, 95 F.2d 663 (3d Cir. 1937), *cert. denied*, 305 U.S. 609 (1938); Katcher v. Home Sav. & Loan Ass'n, 245 Cal. App. 2d 425, 53 Cal. Rptr. 923 (1966); CAL. CIV. CODE § 3482 (West 1970).
70. *See* Eaton v. Klimm, 217 Cal. 362, 18 P. 678 (1933) (no privilege despite compliance with zoning ordinances); Garrett v. State, 49 N.J.L. 94, 7 A. 29 (1886) (no privilege under county license authorized by statute). *See generally* 52 COLUM. L. REV. 781 (1952).
71. *See Allocation of Sunlight: Solar Rights and the Prior Appropriation Doctrine*, 47 U. COLO. L. REV. 421 (1976) (unsigned student piece by Mary White).
72. *See, e.g.*, Ingraham v. Hutchinson, 2 Conn. 584, 598-99 (1818) (Gould, J., dissenting); Parker v. Foote, 19 Wend. 618, 620 (N.Y. Sup. Ct. 1838); Barger v. Barringer, 151 N.C. 433, 66 S.E. 439 (1909); 2 Blackstone, COMMENTARIES *14.
73. Hayes, *supra* note 11, at 192.
74. *Compare* "An Ordinance Concerning Solar Energy, Providing for Recordation of Solar Collectors, and Affording Solar Access Protection for Recorded Collectors" §§ 6-8, in Hayes, *supra* note 11, at 156-62, and Environmental Law Institute, "Prototype Solar Access Legislation, Preliminary Draft," in ELI, Conference materials, "Solar Policy for the 80's," Washington, DC, September 11-12, 1978; Washington, DC: ELI, with ALASKA STAT. §§ 46.15.010-.270 (1978).

from a focus on the common law approach by both proponents and critics. The critics have raised five types of objections.

a. Issues of Fact and Definition

First, they have argued that the analogy is factually inaccurate: "Sunshine falls everywhere; usable water is found only in particular places."[75] The immense quantity of sunlight that strikes the earth's surface is irrelevant to any given piece of land. Once a collector has been sited, usable sunlight flows only in a narrow channel; and, unlike water, sunlight cannot be diverted to distant land. If this were not the case, there would be no access issue. The essential similarity of the two resources arises from the fact that, at any point, there is only a finite usable amount of either element.

The critics seem to demand identity rather than similarity.[76] The second type of objection demonstrates the narrow nature of this criticism. The critics have urged that there are significant definitional problems in attempting to apply water law to sunlight. For example, they have focused on the prior appropriation doctrine's common law requirement that water be diverted before any private rights to its use are created. It has been argued that, because "divert" means to "turn aside or deflect," sunlight is not often diverted.[77] This argument, however, ignores the purpose of the requirement — to provide evidence of the intent to appropriate water:

> "[The] open, physical demonstration of the intent to take" . . . is most often evidenced by a diversion . . . but it can also be evidenced in other ways, for example, as in this case, by watering livestock directly from the source . . . or . . . by placing water wheels into a stream in order to use the flowage as power to operate a mill located on the bank.[78]

Although some courts continue to require a physical diversion, the more modern approach has dispensed with this requirement, recognizing that its evidentiary function is now fulfilled by the application for a water use permit.[79]

75. Environmental Law Institute, *supra* note 13, at 28. *See also* Kraemer, *supra* note 11, at 156; Eisenstadt, Long & Utton, *supra* note 32, at 214.
76. *See* Goble, *supra* note 48, at note 87.
77. Environmental Law Institute, *supra* note 13, at 28.
78. Hunter v. United States, 388 F.2d 148, 153 (9th Cir. 1967) (citations omitted).
79. McClellan v. Jantzen, 26 Ariz. App. 223, 547 P.2d 494 (1976); Colorado River Water Conservation District v. Colorado Water Conservation Board, 594 P.2d 570 (Colo. 1979); State Dept. of Parks v. Idaho Dept. of Water Adm'n, 96 Idaho 440, 530 P. 2d 924 (1974).

The objection that the appropriation doctrine's concept of beneficial use is by definition inapplicable to solar radiation is similarly misplaced. One report argued that a comparison cannot be made of "the value of a solar air conditioning system to one building, for example, versus the value of a five-story addition to an adjacent structure."[80] This problem, however, is not limited to sunlight. Courts have been presented with cases requiring them to evaluate a water use and a conflicting use of land that obstructs the flow of water.[81] The issue may also be directly addressed in the act creating the solar entitlement, either by defining the term or by including energy collection requirements in the definition of "solar energy system."[82]

b. Administrative Issues and the Rush to Develop

The third and perhaps most telling objection is that a permit system will require an administrative agency to operate it.[83] Although this is a potential drawback to any permit system, the approach may not require a large bureaucracy. Despite the large number of potential permittees, a small agency could probably handle a gradual transition to solar energy. Ultimately, the advantages seem worth the additional cost. Any effective protective mechanism will necessarily impose costs, but these will be more than offset by assuring owners of solar systems that they will have continuing access to direct sunlight.

Critics also fear that the doctrine would force premature development as property owners rush to install solar systems merely to forestall neighboring development or rush to develop their properties before a neighbor installs a solar energy system. This race, they argue, would create inequities and inefficiencies: "[I]f a solar doghouse with a collector on its south wall were placed on a southern lot line, it might prevent nearly all further development on the lot to the south."[84] The restriction of the

80. Environmental Law Institute, *supra* note 13, at 28. *See also* Hayes, *supra* note 11, at 190-92; Kraemer, *supra* note 11, at 151.
81. *See, e.g.*, O'Leary v. Herbert, 5 Cal. 2d 416, 55 P.2d 834 (1936) (ground water flow obstructed by mining); Labruzzo v. Atlantic Dredging & Const. Co., 54 So. 2d 673 (Fla. 1951) (obstruction of spring's flow by dredging). *See also* RESTATEMENT OF TORTS § 849 (1939).
82. Such a definition is offered in the proposed solar zoning ordinance in Eisenstadt, Long & Utton, *supra* note 32, at 220. *See* note 52 *supra* and accompanying text.
83. *See* Environmental Law Institute, *supra* note 13, at 29. *But see* Hayes, *supra* note 11, at 149.
84. Hayes, *supra* note 2, at 186. *Accord*, Warren, *Common Problems in Drafting State Solar Legislation*, 1 SOLAR L. REP. 157, 186 (1979). *See also* Kraemer, *supra* note 11, at 156; Environmental Law Institute, *supra* note 13, 28; Hayes, *supra* note 11, at 187; Williams, *supra* note 3, at 449-50.

right to legally sited collectors, however, reduces the problem because foreseeable land use changes would be built into the siting regulations. Some uneconomical solar systems might be installed, but one goal of assuring access is, after all, to speed the transition to solar energy. Moreover, the inclusion of energy collection requirements would assure that system installed was at least effective.

c. Constitutional Issues

Finally, critics of a priority-based permit system have argued that it might be unconstitutional.[85] The objection is that, because the surface owner has a limited property interest in the airspace above his land,[86] a permit system that recognized other rights in part of that airspace would result in an unconstitutional taking of private property without due process of law in violation of the 14th Amendment. Two lines of judicial authority indicate, however, that such fears are overstated.

First, the decisional law on the taking issue is confused; the Supreme Court's opinions have been called a "crazy-quilt pattern."[87] Certainty on the issue is, therefore, impossible. The difficulty hinges on the distinction between "regulation" and "taking"; it is muddled by the Court's conclusion that if "regulation goes too far it will be recognized as a taking."[88] How far is "too far" continues to plague courts and commentators.

Nevertheless, analysis of the most recent Supreme Court case suggests that a priority-based permit system of solar entitlements would be constitutional. In *Penn Central Transportation Co. v. City of New York*,[89] the Court upheld the application of New York City's Landmarks Preservation Law, preventing construction in the airspace above Grand Central Station. Content that the preservation of historic buildings was a valid state objective and the law a reasonable means of achieving this goal,[90] the Court concluded that the statute was valid on its face.

Turning to the application of the law to the Grand Central parcel, the Court noted two instances in which regulation would result in a taking: when it destroys "distinct, investment-backed expectations"[91] and when

85. Environmental Law Institute, *supra* note 13, at 27; Hayes, *supra* note 11, at 187; Kraemer, *supra* note 11, at 154-55; Grout, *Access to Sunlight: New Mexico's Solar Rights Act*, 19 NAT. RESOURCES J. 957, 959 (1979). *But see* Hayes, *supra* note 11, at 145-46 (arguing that a recordation procedure creating rights in the airspace of adjoining landowners would be constitutional).
86. *See, e.g.*, United States v. Causby, 328 U.S. 256 (1946).
87. Dunham, *Griggs v. Allegheny County in Perspective: Thirty Years of Supreme Court Expropriation Law*, 1962 SUP. CT. REV. 63, 63.
88. Pennsylvania Coal Co. v. Mahon, 260 U.S. 393, 415 (1922).
89. 438 U.S. 104 (1978).
90. *Id.* at 129.
91. *Id.* at 127.

it precludes the possibility of "earning a reasonable return" on the property.[92] The Court, in concluding that there had been no taking, focused not on the loss due to the regulation, but on what was left after regulation.

This two-part analysis supports a conclusion that a solar permit system would be constitutional. First, statutes that promote the health, safety, or general welfare have been upheld under various due process standards.[94] A transition to solar energy would enhance both the general welfare (by reducing dependence on imported energy) and health (by reducing pollution). The method of promoting solar energy use is reasonably related to these goals; the use of solar energy requires access to direct sunlight. The method thus would be valid on its face.

Second, much of the Court's language in the Grand Central case applies directly to solar entitlements. The Court dismissed the contention that "full use of air rights is so bound up with investment-backed expectations . . . that Governmental deprivation of these rights invariably . . . constitutes a taking."[95] Similarly, the Court rejected the argument that "a 'taking' must be found to have occurred whenever the land use restriction may be characterized as imposing a 'servitude' " on the parcel.[96] Though restricting placement of buildings and vegetation, a permit system adopted in conjunction with siting requirements would not preclude either existing uses or new, consistent uses. Thus, except in the most unusual circumstances, the statute would be constitutional.[97]

The second line of judicial authority for finding a solar permit system constitutional is the unanimous conclusion that the adoption of water permit systems by formerly riparian jurisdictions did not result in takings. For example, when Oregon adopted a permit system in 1909, the legislature abrogated "unused" riparian rights. Since the riparian doctrine does not require actual use as a condition for a valid water right, riparians attacked the statute as a taking of their property. The Ninth Circuit Court of Appeals, in denying their claims, noted that "common-law rights to the relative use of certain natural resources may be modified in the interest of securing a fairer distribution thereof as well as preventing physical or economic waste."[98] This conclusion has been approved by the Supreme

92. *Id.* at 129.
93. *Id.* at 131.
94. *See, e.g.*, Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 394 (1926); Berman v. Parker, 348 U.S. 26, 33 (1954).
95. 438 U.S. at 130 n.27.
96. *Id.*
97. *See generally Supreme Court, 1977 Term*, 92 HARV. L. REV. 57, 222-32 (1978).
98. California-Oregon Power Co. v. Beaver Portland Cement Co., 73 F.2d 555, 568 (9th Cir. 1934), *aff'd*, 295 U.S. 142 (1935). *See generally* Hutchins, *The Common-Law Riparian Doctrine In Oregon: Legislative and Judicial Modification*, 36 ORE.L. REV 193, 204-12 (1957).

Court: "[E]very state is free to change its laws governing riparian ownership and to permit appropriation of flowing waters for such purposes as it may deem wise."[99] The enactment of a permit system for solar entitlements should likewise be permissible, for existing uses would not be impaired; only future inconsistent uses would be restricted.

Objections to the prior appropriation method for a solar permit system thus are largely specious. In addition, many are undercut if the permit system applies only to legally sited collectors. The remaining problems seem insignificant in relation to the potential benefits that would result from assuring the owners of solar energy systems of continuing, protected access to sunlight.

2. *A Permit System for Sunshine*

The modern water codes in effect throughout the West offer an analogy for a permit system of solar entitlements. These statutory permit procedures present a more useful model than the appropriation doctrine's common law basis. Although varying somewhat in details, these permit systems conform to a general pattern.[100] The person who wants a water right applies to a designated agency. The agency makes an initial determination of whether the proposed use is in the public interest; if the agency concludes that it is, a permit is issued. The permittee must then construct the necessary water-control works and apply the water to the beneficial use within a specified time. Afterward, the user files a statement with the agency that the construction has been completed in compliance with any limitations in the permit and that the use has begun. If the proof is satisfactory, a final certificate of appropriation is issued evidencing a right to the use of the quantity of water covered by the permit.

Some elements of this approach should be highlighted. First, the essential nature of a water right—or an insolation entitlement—is usufructuary rather than proprietary. That is, an individual obtains a property interest in the use of the resource rather than in the *corpus* of the individual particles comprising it. Thus, "beneficial use" defines and limits the entitlement; the utility of this standard has been acknowledged by some advocates of solar zoning.[101]

Second, the priority system allocates rights to use by temporal ranking: First in time, first in right. There is a rough moral justification for this

99. Connecticut v. Massachusetts, 282 U.S. 660, 670 (1931).
100. *See generally* 1 W. Hutchins, Water Rights Laws in the Nineteen Western States (Washington, DC: Department of Agriculture, 1971), at 312-43; 5 Waters and Water Rights §§ 442-.4 (R. Clark ed., 1972).
101. *See* Eisenstadt, Long & Utton, *supra* note 32, at 212, 220.

approach: An individual who makes the substantial capital investment to use the previously unused resource should be able to continue the use. There is also a more practical rationale: A ranking by any other ordering principle requires agreement on the procedure or ranking method. Even if this were possible in a society of competing users, it would significantly undercut the certainty of an entitlement because the solar user might be preempted at any time by a higher ranked use.[102]

New Mexico has taken the first step toward creation of a prior appropriation permit system for sunshine by enacting its Solar Rights Act.[103] The act declares that "the right to use the natural resource of solar energy is a property right."[104] In regulating disputes involving the use of solar energy, the act applies the water law concepts of beneficial use and prior appropriation.[105] In addition, it provides a role for city and county zoning boards.[106] Unfortunately, it is an ambiguous and simplistic response that has stimulated substantial criticism and debate.[107] The statute does not limit protection to collectors meeting either local or state siting standards; the role of permits, if any, is unclear;[108] and the act does not limit the daily period for which a right may be obtained.[109]

A priority-based permit system with local siting requirements[110] offers a workable solution to the problem of assuring the owners of solar energy systems of continuing solar radiation. It would give adjacent landowners clear notice of the restrictions to be applied to their property. In many situations, the limitations resulting from the issuance of a solar permit would be less severe than those required under a solar zoning ordinance designed both to guarantee solar access and to determine siting of collectors. Since the placement of a legally sited collector would define the scope of the restrictions, adjacent landowners would have more flexibility in planting vegetation than under the uniform limitations of a zoning scheme for both structures and vegetation. Both injunctive and compensatory remedies could be provided.

102. *See generally* Kerr, *supra* note 52, at 740.
103. N.M. STAT. §§ 47-3-1 to 5 (1978).
104. *Id.* § 47-3-4A.
105. *Id.* § B. *See also* Kerr, *supra* note 52, at 739.
106. N.M. STAT. § 47-3-4C (1978).
107. *See, e.g.*, Gail Boyer Hayes, "Testimony," *A Forum on Solar Access*, (Proceedings), New York, NY, July 28, 1977, Rockville, MD: NSHCIC (undated), at 24-25; Grout, *supra* note 85, Hillhouse & Hillhouse, *supra* note 52; Kerr, *supra* note 52.
108. *Compare* Kerr, *supra* note 52, at 746-47, with Grout, *supra* note 85, at 960-61, and Hillhouse & Hillhouse, *supra* note 52, at 752-53.
109. *See* text accompanying notes 49-51 *supra*.
110. For a model statute, see Dale D. Goble, "Solar Access: Evaluation of Present Statutes and Proposed Legislation," *Proceedings of Solar 79 Northwest*, Sally King, Sue Killen, eds., Seattle, August 10-12, 1979; Seattle: Bonneville Power Administration, DOE, August 1979, at 173-5.

Vegetation might still create problems. The remaining issues, however, are technical and policy questions rather than legal problems and will affect any solar access scheme. For example, allocation of the cost of pruning[111] and procedures for preserving evidence of the height and location of vegetation at the time the collector was installed[112] would need to be determined in the law establishing the permit scheme.

In short, a priority-based permit system would provide the certainty required to encourage the use of solar energy while minimizing the restrictions on adjacent landowners.

IV
CONCLUSION

The legal discussion of the problem of assuring access to direct sunlight for solar energy systems has largely focused on particular solutions. This is unfortunate because it has served to obscure the distinction between specifying permissible sites for collectors and guaranteeing continuing access to sunshine for legally sited collectors. The requirements of these two differ fundamentally; it is requiring too much of any method to resolve both problems.

Specifying permissible locations for collectors requires a flexible balancing of the potentially competing interests of the solar owner, adjacent landowners, and the public. This balance can be accomplished most readily through zoning and planning, the primary source of existing land use restrictions. While the options differ between new and existing developments, the goal remains the same: to provide the maximum solar access consistent with other requirements and desires.

Once the legal siting requirements have been established, the need for continuing flexibility must give way to the solar owner's need for certainty. If the use of solar energy is to increase substantially, owners of solar energy systems must have an enforceable right to continuing sunshine. Certainty can best be provided through the adoption of a priority-based permit system. The solar entitlement would attach only to legally sited collectors, and siting requirements would be established in conjunction with existing and proposed use and density needs. Therefore, the right should not become an impediment to change. To the extent that it might, however, the advantages seem to outweigh the risk. Nevertheless, even this potential detrimental impact can be lessened by limiting the permit to the life of the system.

The combination of locally determined siting requirements and statewide solar entitlements thus can provide a balance between the need for flexibility in land use planning and the need for certainty of continuing sunshine.

111. *Compare* Kraemer, *supra* note 11, at 123, with Hayes, *supra* note 11, at 149.
112. *See, e.g.*, Hayes, *supra* note 11, at 31.

Active domestic water heating panels on some of 105 homes in the Time for Living in University City development by Time for Living, Inc. in San Diego, California