Executive Summary

This report presents an assessment of the use of landuse regulations to protect solar access for domestic solar energy systems in Canada. The research is based on the literature review and case studies covering both the U.S. and Canadian experiences. The objectives of the report are: 1) to identify the geographical and physical factors affecting solar access, 2) to examine various prescriptive models for securing solar access, 3) to assess the constraints on the applicability of solar access models in residential areas and, 4) to assess current solar access regulations and outline the common elements of a strategy for ensuring adequate solar exposure in those areas.

Three types of solar energy systems are identified. On the one hand, passive solar houses may require the greatest degree of solar access. On the other hand, active solar collectors and photovoltaic panels can be located over a wider range of locations on a lot. Since the efficiency of these technologies is improving, how much solar access is required, and where the technologies can be located on a lot, needs careful attention in a by-law.

In designing guidelines for solar access, vegetation is the only naturally occurring factor that can be controlled. Given this, latitude and topography are the main geographic and physical determinants for spacing buildings to ensure solar access. After the assessment of these constraints and given the required solar exposure, models in the form of an appropriate building envelope can be used to guide physical development for solar access. Regardless of the prescriptive technique adopted, however, other constraints such as landuse density and development costs considerations may also influence the amount of solar exposure on a lot. In some cases the duration of the exposure might be too short for practical purposes. For the purpose of addressing this issue in an ordinance, four 'levels of solar access' have been identified – rooftops, south walls, south yards and detached solar panels and accessory buildings.

It is noted that if solar access used to be the primary interest of landuse regulations then larger lots than normal would have been common. However, more compact developments are desired for many reasons. This means that for solar energy to make a greater contribution to the urban energy demand, a trade-off will have to be made between the higher densities and solar access. In general, a fiscal justification for solar access and an attempt to balance the 'sun rights' and development rights are required in all situations.

Urban design considerations are another set of constraints to solar access. The building envelope adopted in a solar access by-law will reflect a compromise for ensuring compatibility between the old and new buildings in an area. Trees and the traditional streetscape can reduce the solar access in an area but are also critical to good urban design. By and large, no single set of prescriptions could be identified to address all the constraints around solar access. Further, the by-laws should be simple to implement. As a result, successful landuse controls for solar access might be best realized through a flexible, well-defined and streamlined process that is designed around local conditions.

The case studies examined in this report suggest the form and the contents of solar access landuse controls. Ordinances from four cities and the designs of two 'solar subdivisions' are examined. The cases cover the use of the 'solar fence' and the 'solar

envelope' models, the permit and recordation strategy and conventional zoning practices for solar access protection. In the Los Angeles case, a prescriptive model in the form of a 'solar fence' was adopted as an overlay zone. Despite the simplicity of this approach, there is the limitation of using only 'one set of numbers' to protect solar access. The City of Ottawa's model by-law is an improvement over that of the Los Angeles case. This is so in that while it uses a more comprehensive 'solar envelope' as a model to guide physical development, it also opens the possibility for neighbours to intervene in protecting solar access. The most flexible ordinance examined is that of the permit and recordation strategy employed in the City of Woodburn, Oregon. In this case no prescriptive guide for physical development was specified. The by-law depends on a lot-by-lot evaluation for solar access. The evaluation, however, is only initiated when a property owner applies for solar access protection. This approach, therefore, will fail to prove as pro-active if only a small number of property owners take the initiative to apply for solar access permits. To guard against this, prescriptive models are needed to guide physical development for solar access. However, since there is a need to avoid excessive restraints against infill developments and building expansions, the objective should be to ensure that a minimum amount of useful solar access is protected.

In the cases of new developments, two studies of 'solar subdivisions' sponsored by the Ontario Ministry of Energy show that conventional planning standards do not inhibit including solar access objectives in a development plan. The arguments for specific solar access regulations, however, are that conventional by-laws do not encourage solar access objectives and that they do not provide for the protection of solar exposure over time. The City of Brampton is the first Canadian municipality to address these concerns for new residential developments. The implementation of the Brampton's solar access ordinance shows that solar access requirements only marginally affect development costs. However, the concern for the marketability of the development was a key factor in determining the design of 'solar subdivisions' and their deviation form current practices.

In the final analysis, the protection of solar access in residential areas of Canada depends heavily on the efficiency of solar energy technologies. One of the most notable influences on the requirements for solar access in new developments is the improvement in building technologies for passive solar systems. In these cases, integrated passive solar systems may realize a 66% market penetration by 2010. Of significance here, is the recognition that these passive solar initiatives add to the energy performance of buildings regardless of the lot layout, orientation and the protection of 'sun rights'.

While more emphasis can be placed on passive solar energy and south-wall access in new developments, this might not be possible in built-up areas. The existing Canadian housing stock consists of older buildings and will be relatively expensive to retrofit for passive solar energy. Given this scenario the question is: 'what are the most justifiable levels of solar access that should be protected at Canada's latitudes?' On the one hand, it is almost impossible to avoid the shadows of trees on south walls in built-up areas. On the other hand, certain levels of solar access are readily available in the suburbs. These levels of solar access are gaining more attention as recent advances in the efficiency of photovoltaic cell (PVs), rising from a mere 3% to 18%, are creating new possibilities for solar energy retrofits in developed areas. Similar improvements apply to solar collectors for domestic water and swimming pool heating.

The primary lesson from this study is that the solar access needs to be looked at holistically. *The thrust should be for energy conservation through balancing the level (or levels) of solar access with the drive for more compact development.* In keeping with this line of argument, neighbourhood solar collectors can reduce the necessity of providing larger lots. In addition to south-wall solar exposure, the potential of roof areas for solar access should be utilized.

This report concludes that solar access ordinances (for both old and new residential developments) should have two common elements for success. Firstly, to be proactive, one part of the ordinance should give appropriate prescriptive guidance for the shape and size of the maximum allowable building on a lot. This effort should be directed towards incremental changes in conventional specifications; ensuring consistency in the size, shape and scale of the buildings in an area. Secondly, a set of less prescriptive guidelines is necessary for solar access protection. This is needed to provide clear directions for addressing public concerns such as aesthetics, and a process to balance 'sun rights' with the development rights. The most important aspect of landuse regulations for solar access lies in recognizing them as a legitimate objective in development and in contributing to the policy framework for supporting related technological innovations. Some of the recommendations from this report are:

1) *In formulating solar access ordinances for existing areas, the building envelope adopted should not result in turning most of the buildings into non-conforming uses.*

2) *Private vegetation and landscaping - being easier to remove and/or trimmed, should be temporarily exempted from having to conform to a solar access by-law.*

3) *Any solar access ordinance should ensure that a property owner would achieve a minimum standard in terms of solar energy gain before neighbours are asked to compromise their landscaping rights.*

4) *There should be the option for property owners to contribute towards small locally centralized solar energy systems.*

5) *The landuse ordinances should allow for negotiated arrangements for solar access among neighbours.*