ON-LINE ZONING ORDINANCE DISCLAIMER

The Web version of the City of Cambridge, Massachusetts Zoning Ordinance is provided for reference and the convenience of having the Ordinance in a computer-readable format. The print version of the Zoning Ordinance, together with any amendments adopted by the City Council subsequent to the most recent update to the print version, remains the official version of the Ordinance. If any discrepancies exist between the print and web versions of the Zoning Ordinance, the print version, together with any City Council amendments, shall be considered correct. Recent amendments to the Zoning Ordinance may appear on the Web prior to being incorporated into the print version of the Ordinance.

ARTICLE 22.000 SUSTAINABLE DESIGN AND DEVELOPMENT

Text current through Ordinance #1363 of January 5, 2015.

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22.10 INTENT AND PURPOSE

It is the intent of this Article 22.000 to promote environmentally sustainable and energy-efficient design and development practices in new construction and renovation of buildings in the city. Some of the regulations in this Article include design standards that shall be applied to new construction and renovation projects of a significant size. Other regulations in this Article modify regulations found elsewhere in this Zoning Ordinance in order to encourage the incorporation of specific design features that will improve the sustainability and energy-efficiency of buildings.

22.20 GREEN BUILDING REQUIREMENTS

22.21 Statement of Purpose. This Section 22.20 is adopted to ensure that major new projects and substantially rehabilitated buildings in the City of Cambridge are planned, designed and constructed in a sustainable way so as to minimize adverse environmental impacts as they are initially constructed and as they are occupied and operated over the course of their useful lives. It is the purpose of this Section 22.20 to encourage the reuse of existing buildings and materials; to encourage the conservation of natural resources and reduction of toxins in new construction and substantial rehabilitation of existing buildings through selection of recycled and otherwise environmentally appropriate building materials and methods; to ensure a reduction in the use of energy in both the initial construction of the project and in its daily operation; and to encourage an arrangement of buildings and mix of uses, on individual lots and within the city as a whole, that will foster pedestrian, bicycle, and public transit use in the city. While the provisions of this section apply to projects of 25,000 square feet or larger, developments of all sizes are encouraged to incorporate sustainable design principles. Notwithstanding the provisions of this Article 22.00, the requirements of all local, state and/or federal regulations applicable to a project must be met, particularly the State Building Code, including its energy components.

22.22 Applicability. Any new construction, or any substantial rehabilitation of an existing building for an existing or new use, that totals 25,000 square feet of Gross Floor Area or more and that (1) requires the issuance of a special permit under any provision of this Zoning Ordinance (including but not limited to special permits required in Article 13.000 – Planned Unit Development Districts, Section 19.20 – Project Review Special Permit, and Section 5.28.2 – Conversion of Non-Residential Structures to Residential Use) or (2) is subject to the provisions of Section 19.50 – Building and Site Plan Requirements, shall be subject to the requirements of this Section 22.20.

22.23 **Requirement.** LEED, when used in this Section 22.20, refers to the Leadership in Energy and Environmental Design Green Building Rating System as developed and revised from time to time by the United States Green Building Council (USGBC).

1. *For construction of at least 25,000 square feet of gross floor area but less than 50,000 square feet.*

Such projects shall be required to meet the requirements of the most current applicable LEED building rating system at the level 'Certified' or better.

2. *For construction of 50,000 square feet or more of gross floor area.*

Such projects, shall be required to meet the requirements of the most current applicable LEED building rating system at the level 'Silver' or better.

There shall be a period of twelve months from the time of adoption of a new version of LEED, during which projects shall have the option to file under either the old or newly-adopted version.

22.24 **Procedures.** Any project subject to this Section 22.20 shall comply with the following procedural requirements.

1. *Special Permit Application or Section 19.50 Compliance Documentation.*
   As an element of the application or documentation, the applicant shall submit a completed LEED Project Checklist for the appropriate LEED building standard to demonstrate how the project is anticipated to meet the requirement of Section 22.23 above. The Checklist shall be accompanied by a brief narrative indicating the mechanisms proposed to achieve each of the credits and prerequisites and demonstrating the anticipated methods by which compliance with the requirements of this Section will be achieved at the time of construction of the authorized project. The checklist and narrative shall be accompanied by an affidavit by a LEED-Accredited Professional (LEED-AP) Project Manager or by appropriate consultants stating that to the best of their knowledge, the project has been designed to achieve the requirements of Section 22.23 above.

2. *The following requirements shall apply to all development subject to this Section 22.20:*

   a. Prior to the issuance of the first Building Permit for each authorized building.

      (1) Submittal of an updated LEED checklist and narrative description outlining compliance with the certification level required by Section 22.23 above to the Inspectional Services Department (ISD) and the Community Development Department (CDD). The narrative shall highlight any design changes made subsequent to the Development Consultation or granting of the Special Permit.

      (2) The checklist and narrative shall be accompanied by an affidavit by a LEED-AP Project Manager or appropriate consultants stating that to the best of their knowledge, the project has been designed to achieve the stated credit requirements.

   b. Prior to issuance of the first Certificate of Occupancy for each authorized building.

(1) Submittal of a final LEED checklist and narrative description indicating in detail how the requirements of this Section 22.20 have been met to the Inspectional Services Department (ISD) and the Community Development Department (CDD).

(2) The checklist and narrative shall be accompanied by an affidavit by a LEED-AP Project Manager or appropriate consultants stating that to the best of their knowledge, the project has been designed and constructed to achieve the requirements of Section 22.23 above.

22.30 GREEN ROOFS

22.31 *Purpose.* The purpose of this Section is to remove potential impediments to the development of green roof systems on new and existing buildings by clarifying that such systems should not count against a building's Gross Floor Area, and by providing for limited access and enjoyment of green roofs by occupants of a building.

22.32 ***Functional Green Roof Area*** shall be defined as area atop a roof surface on a building, open to the sky and air, which is surfaced with soil and living plant materials for the purpose of retaining rainwater and absorbing heat from sunlight. The depth of soil and planted material shall be at least two (2) inches to be considered Functional Green Roof Area. For the purposes of maintaining the plant material, Functional Green Roof Area may be accessible by means of a roof entrance.

22.33 *Floor Area Exemptions for Functional Green Roof Area.*

22.33.1 Spaces meeting the definition of Functional Green Roof Area as defined in Subsection 22.32 above, which are to be accessed only for maintenance purposes and are not intended to be used by building occupants or others, shall be exempt from the calculation of Gross Floor Area of a building.

22.33.2 Spaces meeting the definition of Functional Green Roof Area as defined in Subsection 22.32 above, which are intended to be accessed for use by occupants of the building or others, and which are located above the third floor of the building, may be exempted from the calculation of Gross Floor Area of a building only after the granting of a special permit by the Planning Board. The proponent seeking such a special permit must demonstrate that the Functional Green Roof Area is designed such that the vegetation will withstand the foot traffic associated with its anticipated use. The Planning Board shall also consider the potential visual, noise and privacy impacts of the anticipated use on neighbors. Unless such a special permit is granted, any Functional Green Roof Area located above the third floor of a building that is intended to be accessed for use by building occupants or others shall be counted as Gross Floor Area.

22.34 *Floor Area Exemptions for Patios or Decks Adjacent to Functional Green Roof Area*

22.34.1 In non-residential zoning districts and in Residence C-1A, C-2, C-2A, C-2B, C-3, C-3A, and C-3B zoning districts, where a rooftop surface above the third floor includes Functional Green Roof Area as defined in Section 22.32 above, adjacent open-air outdoor space intended for use by building occupants or other persons that does not meet the definition of Functional Green Roof Area, such as a patio or deck, shall be exempted from the calculation of Gross Floor Area of the building, provided that the total space exempted in such a manner shall not exceed fifteen

percent (15%) of the amount of Functional Green Roof Area on the building and that all such usable outdoor space shall be set back at least ten (10) feet from all outer roof edges.

22.34.2 In residential zoning districts not listed in Section 22.34.1 above, where a rooftop surface above the third floor includes Functional Green Roof Area as defined in Section 22.32 above, adjacent open-air outdoor space intended for use by building occupants or other persons that does not meet the definition of Functional Green Roof Area, such as a patio or deck, may be exempted from the calculation of Gross Floor Area of the building only after the granting of a special permit by the Planning Board. The total space exempted in such a manner shall not exceed fifteen percent (15%) of the amount of Functional Green Roof Area on the building and all such usable outdoor space shall be set back at least ten (10) feet from all outer roof edges. In granting the special permit, the Planning Board shall consider the location and orientation of the patio or deck in relation to adjacent properties and potential visual, noise and privacy impacts of the anticipated use on abutters.

22.40 EXTERIOR WALLS AND INSULATION

22.41 *Purpose.* The purpose of this Section is to remove potential impediments to the construction of exterior walls with additional insulation or wall-based mechanical systems that can improve the energy-efficiency of a building, by exempting the additional gross floor area created by such features from the calculation of a building's total Gross Floor Area.

22.42 *Double-Skin Facades*

22.42.1 A ***Double-Skin Façade*** shall be defined as a multilayer exterior wall system comprising a solid outer wall, a solid inner wall, and a ventilated intermediate air space, intended to improve insulation and manage solar heat gain as an element of a building-wide mechanical system for heating and cooling a building.

22.42.2 *Floor Area Exemption for Double-Skin Façades.* Within an exterior wall system that meets the definition of a Double-Skin Façade as defined in Section 22.42.1 above, the area occupied by the intermediate air space shall be excluded from the calculation of Gross Floor Area on a lot, up to a depth of one (1) foot, provided the space is not to be accessed except for maintenance purposes.

22.43 *Exterior Insulation*

22.43.1 *Floor Area Exemption for Added Exterior Insulation.* Where the thickness of a solid, non-removable exterior wall of a building is greater than six (6) inches, such wall being comprised entirely of structural material, insulating material and interior and exterior finishes, any Gross Floor Area that is further than six (6) inches from the innermost solid plane of the exterior wall may be excluded from the calculation of Gross Floor Area of a building.

22.43.2 *Yard Exceptions for Added Exterior Insulation.* Existing conforming or pre-existing non-conforming buildings or buildings that received a building permit prior to August 2, 2010 that cannot add insulation exterior to the exterior structural wall of the building without intruding into a required setback may encroach or further encroach into the required yard setback through the addition of insulation external to the exterior structural wall of the building, provided that the additional insulation does not increase the thickness of the exterior wall by more than four (4)

inches and that the resulting outermost plane of each exterior wall is no closer than seven feet, two inches (7'-2") to the nearest property line.

22.50 OVERHANGS AND SUN-SHADING DEVICES

22.51 *Purpose.* The purpose of this section is to remove potential impediments to the addition of passive solar shading devices intended to reduce the impact of solar heat gain on a building or lot, by exempting areas underneath such devices from the calculation of Gross Floor Area under certain circumstances.

22.52 *Floor Area Exemption for Sun-Shading Devices.* Areas directly underneath a building overhang, eave, awning or other sun-shading device shall be excluded from the calculation of Gross Floor Area for a lot, provided that the overhang, eave, awning or other sun-shading device extends no more than three (3) feet from the exterior wall plane of the section of the building beneath it, and provided that the ground surface directly beneath the overhang, eave, awning or other sun-shading device meets the definition of Permeable Open Space as defined in Article 2 of this Zoning Ordinance.

22.53 *Floor Area Exemption for Pergolas, Arbors and Trellises.* Ground space directly underneath an outdoor pergola, arbor or trellis structure shall be excluded from the calculation of Gross Floor Area of a lot, provided that the structure is at least 80% open to the air across all horizontal or vertical surfaces, and that any parallel structural support members with a cross-section of greater than one (1) inch by two (2) inches are separated from each other by at least three (3) feet on center. These features may be freestanding or attached to a building.

22.60 SOLAR ENERGY SYSTEMS

22.61 *Purpose.* The purpose of this Section is to define solar energy systems within the zoning ordinance, to provide a mechanism for publicly registering such systems so that nearby developers can be aware of their existence, and to provide limited zoning protections for such systems in some instances where developers of neighboring properties are seeking a special permit or variance.

22.62.1 Solar energy systems are viewed as potentially valuable contributors to meeting the City's objective of encouraging sustainable development and energy conservation. However, the complex nature of urban development in the city limits the extent to which the city's zoning regulations can be employed to guarantee long-term access to sunlight on a wide geographic basis. Therefore, the following provisions are intended to provide limited support for such systems and to raise awareness of their contribution to the objectives of this Article 22.000 on the part of the general public and property owners.

22.62 A ***Solar Energy System*** shall be defined as a device or combination of equipment that converts radiant energy from the sun into heat or electricity that can be used for the purpose of heating indoor spaces, producing hot water, or powering electrical devices.

22.63 A ***Registered Solar Energy System*** shall be defined as a Solar Energy System for which a building permit has been issued, provided that at least one year has passed since the issuance of such permit, and whose sun-exposed elements are at a height no lower than five (5) feet below the maximum height allowed within the base zoning district in which it is located. Such systems

shall be recorded on a public registry of Solar Energy Systems that shall be maintained by the City's Inspectional Services Department and made available to property owners by request.

22.64 *Protection of Registered Solar Energy Systems*. The impacts of a proposed development seeking a special permit or variance on a Registered Solar Energy System shall be considered by the Board of Zoning Appeal or the Planning Board, whichever is applicable, in making its determination, as described in Article 10, Subsection 10.32 and Article 19, Subsection 19.33 of this Zoning Ordinance. No protection shall be provided by this Zoning Ordinance to a Solar Energy System that does not meet the definition of a Registered Solar Energy System.

22.70 WIND TURBINE SYSTEMS

22.71 *Purpose*. It is the intent of this Section 22.70 to permit the limited use of wind turbines throughout the city (a) for the purpose of small scale generation of electricity for on-site consumption as an accessory use to other activities located on the same lot, (b) for the purpose of researching, testing, evaluating, or demonstration of the efficacy in an urban setting of such instruments as a means by which renewable sources of energy might be employed to generate electricity at a larger scale for both a domestic and commercial purposes, and (c) in appropriate locations in non residential districts for the generation of electricity for commercial sale as a principal use. These provisions are intended to ensure that such facilities are well designed, carefully sited, and operated in a manner that will not pose a nuisance or hazard to the general public or nearby neighbors.

22.72 *Wind Turbine Systems Permitted by Special Permit.*

A Wind Turbine System may generally be permitted anywhere in the city after the granting of a special permit from the Planning Board, subject to the conditions and limitations described in this Subsection 22.72. In special cases, there is a limited provision for the permitting of Wind Turbine Systems as-of-right, without the granting of a special permit, as described in Subsection 22.73 below.

22.72.1 Dimensional Limitations.

1. Height. There shall be no maximum height limit for a Wind Turbine, but the permitted height of a Wind Turbine shall be specifically approved by the Planning Board.

2. Setbacks. There shall be no required minimum yard setbacks for a Wind Turbine, but the permitted placement of a Wind Turbine with respect to public street lines and adjacent lot lines shall be specifically approved by the Planning Board. All equipment and structures accessory to the Wind Turbine shall be subject to the yard requirements of the applicable zoning district unless waived by the Planning Board.

22.72.2 Application Material.

At a minimum the special permit application shall contain the following material:

1. Plans of the site showing the location of the Wind Turbine System and its relationship to other uses and buildings on the site, including elevations of Wind Turbines and other features on the site; plans, descriptions, illustrations and/or photographs describing the surrounding uses and physical context in sufficient detail to allow an assessment of the proposal on those

surrounding activities; illustration of the laydown options for maintenance of the equipment; any proposed screening and landscaping.

2. A detailed description of the Wind Turbine System including number, size, materials, noise rating, operational plan, maintenance schedule.

3. A narrative discussion of the extent to which the operation of the proposed Wind Turbine System will generate continuous shadows, intermittent shadows (a.k.a. flicker), and/or noise that may be detected from adjacent properties and from the public street.

4. Photo simulations or other representations, from at least two vantage points (one of which should be from a public street), illustrating the proposal in its physical context.

5. A detailed estimate of the cost of removal of the Wind Turbine System.

22.72.3 Standards for Granting of the Special Permit.

In addition to the limitations requirements described in Section 22.74 below and the criteria established in Section 10.43 of the Zoning Ordinance for the granting of a special permit, the Planning Board shall consider the following specific criteria.

1. The visual impact of the Wind Turbine System on the abutting properties and the neighborhood. In recognition of the fact that a Wind Turbine of any significant size will introduce a physical structure and form not typical of most residential and commercial neighborhoods in the city, the Planning Board shall consider the following when assessing whether a proposal has any unreasonable negative impacts on neighborhood character or adjacent uses:

    a. the size, scale and bulk of the proposed Wind Turbine System in relationship to the scale of typical buildings and other elements in the neighborhood;
    b. the visibility and impact of the proposed Wind Turbine System from important view corridors and viewsheds, with the understanding that reasonable efforts should be made to make the system visually unobtrusive, although in many cases a system may not be reasonably expected to be screened from public view;
    c. the nature of adjacent uses, including the historical and architectural quality of surrounding buildings, the consistency of that architectural character over an extended area, and the extent to which the proposed Wind Turbine System is visually integrated with that character and with the larger urban landscape; and
    d. in the case of building-mounted Wind Turbine Systems, the visual relationship between the system and the architecture of the building upon which it is installed.

2. The extent, frequency and duration of continuous and intermittent shadows and their relationship to interior spaces and places people will regularly occupy. Such impacts should be minimized and directed away from sensitive spaces in residential environments. It shall be the burden of the applicant to demonstrate that there shall be no significant adverse impact on adjacent properties.

3. The extent of detectable noise and vibration impact on neighboring uses.

4. Where a Wind Turbine System is proposed in an Open Space District or near an open space facility, particularly one with a significant natural aspect, the system's impact on any conservation, historic, or recreational value should be carefully analyzed.

5. Other factors with regard to the operational and visual impacts of the Wind Turbine System that may suggest that a time limitation should be imposed on the special permit.

22.73 *Wind Turbine Systems Permitted As-of-right*.

A Wind Turbine System shall be permitted as-of-right, without the granting of a special permit, only if the conditions and limitations of this Subsection 22.73 and the requirements of Subsection 22.74 below are met. Any proposed Wind Turbine System not meeting all of the conditions and limitations of this Subsection 22.73 may be permitted only after the granting of a special permit by the Planning Board, as described in Subsection 22.72 above.

22.73.1 District Limitations.

The Wind Turbine System and all associated monitoring and testing equipment must be located in a Residence C-3, C-3A, C-3B or Special District 6 zoning district.

22.73.2 Use Limitations.

1. The Wind Turbine System must be accessory to an educational use, Section 4.56 c, Paragraphs 4-6, dormitory use accessory to such educational use, Section 4.56 c, Paragraph 8, or museum use, Section 4.56 i, Paragraph 2 where such museum has as its core mission the display, exploration and dissemination of knowledge, scientific principles, and natural phenomena to the general public.
2. The Wind Turbine System shall only be installed for the purpose of advancing the educational and instructional purposes of the institution to which it is accessory and shall not be installed for the specific and principal purpose of generating electricity for sale. However, energy generated by the Wind Turbine System may be used in the operation of the physical plant of the institution to which it is accessory.

22.73.3 Dimensional Limitations.

1. The Wind Turbine must be installed on a building and may not be a freestanding structure.

2. *Height*: The Wind Turbine Height may not extend more than forty (40) feet above the existing height of the portion of the building upon which it is mounted. Such limitation shall apply even if the height of the building is non-conforming and already exceeds the height of structures permitted in the zoning district. The height shall be measured to the highest point of the turbine, including the height of blades when in the vertical position.

3. *Setbacks*. The Wind Turbine shall be subject to the following minimum setbacks, which shall apply regardless of the location of the building upon which the turbine is installed.

    a. No portion of the Wind Turbine may be located nearer than two hundred (200) feet to any structure containing a residential use (exclusive of transient residential uses, Section 4.31 i) that is neither owned nor under the control of the institution erecting the turbine.

    b. The minimum setback of the Wind Turbine from any public street line or from a lot line of a lot not in the ownership of the institution to which the Wind Turbine is accessory shall be a distance equal to the Wind Turbine Height. However, a Wind Turbine with a height of ten (10) feet or less shall have no required minimum setback.

22.73.4 *Time Limitations*

A building permit authorizing the installation of a Wind Turbine System under the provisions of this Subsection 22.73 shall limit said use to a period not to exceed two years unless, prior to expiration of said two years, a request in writing is submitted to the Inspectional Services Department for an extension of the permit for an additional two years. Such extension shall not be unreasonably withheld and may be granted if the conditions and requirements of this Subsection 22.73 and Subsection 22.74 below continue to be met by the Wind Turbine System and no nuisance or hazard has been identified during the previous two years of operation. Such building permit may be extended for additional two year intervals in the same manner.

22.74 *General Limitations and Requirements for Wind Turbine Systems*

22.74.1 In all cases, a Wind Turbine System shall be subject to the following limitations and requirements:

1. The Wind Turbine System shall be free from any appurtenances with the exception of equipment necessary to monitor, regulate, secure, and maintain the system and the electricity it may produce. No sign may be attached to the system with the exception of unobtrusive manufacturer identification and operational guidance informational signs. No cellular or mobile phone equipment may be attached to the system.

2. The Wind Turbine System shall not be independently lighted except as may be required by any local, state or federal regulation.

3. The Wind Turbine System shall be painted in subdued tones of white, black, silver, grey, dark green, brown, blue or similarly subdued, non-reflective color unless otherwise required by local, state and/or federal regulations or allowed by the Planning Board.

4. In operation the Wind Turbine System shall meet the requirements of the Cambridge Noise Ordinance, cumulatively for all equipment installed at a single location. All equipment shall be rated for noise generation so that it can be evaluated prior to installation.

5. The site shall be capable of accommodating the laydown of the Wind Turbine without trespass onto city streets or adjacent lots held in a different ownership.

6. The Wind Turbine System shall be designed and located so as to prevent unauthorized access and otherwise be maintained in a safe operating condition.

7. *Abandonment*. Given the unique safety considerations associated with Wind Turbines, the owner shall be obligated to remove the Wind Turbine System if any one of the following occurs:

    a. abandonment of the Wind Turbine System through disuse for a period of one year;

    b. non-functioning of the Wind Turbine System for more than 100 days, where substantial steps have not been initiated to make necessary repairs; or

c. failure to request an extension of a building permit as required in Subsection 22.73.4 above, or a special permit authorized under Subsection 22.72 above, where that special permit may have been time-limited by the Planning Board.

Upon failure to remove the Wind Turbine System 150 days after any one of these threshold events occurs, the City of Cambridge shall have the authority to enter the property and remove the system at the expense of the owner/operator where it finds that the equipment constitutes a hazard to the general public. At or before issuance of a building permit for the system, the Permittee shall post a bond or other surety in a form and in an amount acceptable to the City that shall cover the cost of removal of the system by the City should that be necessary, such bond amount to be consistent with estimates for removal prepared at the Permittee's expense by a qualified engineer. The surety mechanism shall account for cost of living adjustments over the expected life of the system.

8. A Wind Turbine System principally used for the express purpose of the commercial selling of the energy generated shall be permitted only in non-residential zoning districts. In residential districts, such commercial use ~~is~~ shall not be permitted. However, it is understood that in those residential districts a portion of the energy generated by the system that is not immediately consumed on-site may at times be sold back or credited to the local-serving power utility, consistent with any applicable state or federal law or regulation. Furthermore, a cooperative system serving multiple adjacent properties shall be permitted in residential districts and may share the output of the system without being considered a commercial use.

22.74.2 Waiver of Requirements
When granting a special permit for a Wind Turbine System, the Planning Board may grant a waiver from the general requirement to accommodate laydown of a Wind Turbine without trespass onto city streets or adjacent lots as described in Subsection 22.74.1, Paragraph 5 above. The Planning Board may also grant a waiver of the requirement to post a bond or other surety that shall cover the cost of removal of the Wind Turbine System by the City, as described in Subsection 22.74.1, Paragraph 7 above. The Planning Board may grant such a waiver if the Board finds the requirement to be unnecessary in a given case.

22.75 *Definitions*

22.75.1 *Wind Turbine*. A device that converts wind energy to rotational energy that then drives an electrical generator. A conventional turbine generally consists of a tower or pole, a nacelle body, and a rotor with multiple blades. Variations may include vertical axis turbines and structural elements housing and encapsulating the rotating elements of the turbine. It is anticipated that as testing and experimentation continues the physical form of turbines may become much more varied.

22.75.2 *Wind Turbine System*. A combination of equipment designed to be permanently mounted on a building or freestanding, including Wind Turbines and associated and accessory equipment and structures, necessary to convert wind energy to electricity.

22.75.3 *Wind Turbine Height.* The vertical dimension of a Wind Turbine as measured from ground level in the case of a freestanding turbine, or from the height of the portion of the building upon which it is mounted in the case of a building-mounted turbine, to the highest point of the Wind Turbine, including the height of blades when in the vertical position.