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Designer Responsibility; 2.4.6 Summary; 2.5 Conclusion; 3 Radiant Energy Indoors; 3.1 Introduction; 3.2 Physics of Buildings; 3.2.1 Radiant Energy; 3.2.2 Radiant Energy Spectra; 3.2.3 Basic Optical Parameters; 3.3 Photometric Characterisation; 3.3.1 Characterisation Methodology Issues; 3.3.2 Daylight Factor; 3.3.3 Nearby Obstacle Aspect Ratio; 3.3.4 Glazing/Floor Ratio; 3.3.5 Lighting Recommendations; 3.4 Radiometric Characterisations; 3.4.1 Obstacles; 3.4.2 Window Transmission; 3.4.3 IPV Location; 3.4.4 IPV Cell Orientation; 3.4.5 Further Profiles: Buildings, Users and Applications; 3.5 Computer Simulation; 3.6 Discussion; 3.6.1 Summary of Parameters; 3.6.2 IPV Designer Recommendations; 3.7 Conclusion; 3.8 Future Work; 3.9 Further Reading; 4 Fundamentals of Solar Cells; 4.1 Introduction; 4.2 Brief History of Solar Collectors and PV; 4.2.1 The 'Selenium Years'; 4.2.2 The 'Silicon Years'; 4.2.3 History of IPV; 4.2.4 IPV Today; 4.3 Photonic Semiconductors; 4.3.1 What is a Semiconductor?; 4.3.2 Photonic Semiconductor Properties; 4.3.3 Solar Cell Categories; 4.4 Photovoltaic Technology; 4.4.1 Electrical Efficiency Calculation; 4.4.2 Fill Factor; 4.4.3 Short-circuit Current; 4.4.4 Open-circuit Voltage; 4.4.5 Power Curve; 4.5 Suboptimal Solar Cell Efficiency; 4.5.1 Optical Issues; 4.5.2 Material Quality Issues; 4.5.3 Parasitic Resistance; 4.5.4 Efficiency Losses Summary; 4.6 IPV Material Technologies; 4.6.1 Spectral Response; 4.6.2 Amorphous Silicon Thin Film; 4.6.3 Polycrystalline Thin Film; 4.6.4 Conventional Silicon Cell; 4.6.5 Other PV Technologies; 4.6.6 Thin-film Modules; 4.7 Efficiency Improvements; 4.7.1 Current and $I(SC)$; 4.7.2 Voltage and $V(OC)$; 4.7.3 Fill Factor; 4.7.4 Concentration; 4.8 Conclusion; 4.9 Further Reading; 5 Solar Cells for Indoor Use; 5.1 Introduction; 5.2 Technology Performance at Indoor Light Levels; 5.2.1 Experimental Procedure; 5.2.2 Results; 5.2.3 Efficiency with Intensity; 5.2.4 Spectral Response; 5.3 Indoor Light Level Model Presentation; 5.3.1 Phenomenological Model; 5.3.2 Heuristic Model; 5.3.3 Technology-specific Models; 5.4 Discussion; 5.5 Designing PV Modules for Indoor Use; 5.5.1 Transparent Conductive Oxide

Sommario/riassunto

Photovoltaic technology - or the direct conversion of light into electricity - is the fastest growing means of electricity generation today, however it is generally used outdoors. Relatively little attention has been focused on the many obstacles to overcome when designing efficient indoor products. As a result, indoor products are more often than not limited to low power. Designing Indoor Solar Products bridges this gap by showing where AES (Ambient Energy Systems) based on photovoltaic cells may be used for higher power devices. Motivated by both financial and ecological arguments,