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Industrial Large Scale Applications of Superconductivity – Current and Future Trends

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Since the initial development of NbTi and Nb₃Sn superconducting wires in the early 1960's, superconductivity has developed a broad range of industrial applications in research, medicine and energy. Superconductivity has been used extensively in NMR low field and high field spectrometers and MRI systems, and has been demonstrated in many power applications, including power cables, transformers, fault current limiters, and motors and generators. To date, the most commercially successful application for superconductivity has been the high field magnets required for magnetic resonance imaging (MRI), with a global market well in excess of \$4 billion excluding the service industry. The unique ability of superconductors to carry large currents with no losses enabled high field MRI and its unique clinical capabilities in imaging soft tissue. The rapid adoption of high field MRI with superconducting magnets was because superconductivity was a key enabler for high field magnets with their high field uniformity and image quality. With over 30 years of developing MRI systems and applications, MRI has become a robust clinical tool that is ever expanding into new and developing markets. Continued innovation in system design is continuing to address these market needs. One of the key questions that innovators in industrial superconducting magnet design must consider today is what application of superconductivity may lead to a market on the scale of MRI? What are the key considerations for where superconductivity can provide a unique solution as it did in the case of MRI? Many companies in the superconducting industry today are investigating possible technologies that may be the next large market like MRI.