The aim of this article is twofold. First, an existing trailing edge noise model is validated by comparing with airfoil surface pressure fluctuations and far field sound pressure levels measured in three different experiments. The agreement is satisfactory in one case but poor in two other cases. Nevertheless, the model reproduces the main tendencies observed in the measurements with respect to varying flow conditions. Second, the model is implemented into an airfoil design code that is originally used for aerodynamic optimization. An existing wind turbine airfoil is optimized in order to reduce its noise emission, trying at the same time to preserve some of its aerodynamic and geometric characteristics. The new designs are characterized by less cambered airfoils and flatter suction sides. The resulting noise reductions seem to be mainly achieved by a reduction in the turbulent kinetic energy across the boundary layer near the trailing edge and to a lesser extent by a smaller boundary layer displacement thickness. ©2010 American Society of Mechanical Engineers