Large Eddy Simulations (LES) of turbulent flows have proven to be valuable to better understand complex turbulent flows. Here we deploy this technique to better understand and develop engineering models for flow in large wind farms. As wind energy is characterized by low power density, in order for wind energy to make a significant contribution to our overall energy supply, very large wind farms (on or off-shore) need to be envisioned. For very large wind farms, interesting couplings with atmospheric boundary layer become important. This presentation will first summarize results that were already presented during a 2012 visit to Iowa State. These results focus on understanding how wind turbines, when deployed in large arrays, extract kinetic energy from the atmospheric boundary layer. A suite of LES, in which wind turbines are modeled using the classical `actuator disk' concept, are performed for various wind turbine arrangements, turbine loading factors, and surface roughness values. We use the results also to develop a new wake superposition model, the coupled wake boundary layer (CWBL) approach as an update to the classic Jensen/Park model. It enables to capture the interactions of the turbine wakes with the atmosphere. Further more, we describe the notion of generalized transport tubes as a new tool for flow visualization that is particularly useful to analyze the spatial transport of physical quantities (e.g. kinetic energy arriving at a particular wind turbine). This work is a collaboration with colleagues, postdocs and students involved in the WINDINSPIRE project and is supported by the US National Science Foundation.