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A major challenge of integrating renewable energy sources into the existing energy grid is presented by the variability of renewable power. One method to reduce such variability for solar power and to provide 24/7 baseline power is to use solar updraft towers, where solar energy heats the ground and the air underneath a large-area transparent collector roof and drives the updraft flow through a massive vertical chimney (solar tower). The large thermal mass of the facility makes it possible to power the turbine installed in the tower around the clock. However, a traditional rigid design of the tower of desirable height (750–1500 m) makes the cost of the facility nearly prohibitive. We present a flexible inflatable tower design that could radically reduce the costs and complexity of the construction, as well as improve the survivability of the facility in case of extreme weather. Stability of the flexible tower under wind loading and control of its movement present an interesting problem, for which we developed analytical treatment. Experimental results confirm the premises of our theory. (Received September 13, 2016)