For an integer $k \geq 2$, let $(L_n^{(k)})_n$ be the $k$-generalized Lucas sequence that starts with 0, . . . , 0, 2, 1 ($k$ terms) and each term afterwards is the sum of the $k$ preceding terms. In this paper, we find all powers of two that appear in $k$-generalized Lucas sequences; i.e., we study the Diophantine equation $L_n^{(k)} = 2^m$ in positive integers $n, k, m$ with $k \geq 2$. 