The electrostatic deflection of elastic membranes plays a key role in the design of micro- and nanoelectromechanical systems (MEMS and NEMS). Many components of MEMS and NEMS devices make use of electric fields to cause deformations in elastic membranes. In many sensors, these deflections are used as a reference by which measurements and readings are taken. In other devices, this deflection is utilized in closing a valve or in completing a circuit as part of a switch. These deflections have also been used to create pumps. In all of the above applications, it is important to understand the behavior of the membrane as the electric field is varied. In particular, it is important to understand the steady state configuration, as well as, the point where the membrane becomes unstable and no stable state exists, a situation well know in the MEMS community as the “pull-in” instability. In this manuscript, we examine different scenarios for an electrostatic-elastic system where alterations have been made to affect how the membrane behaves in the presence of the electric field. In particular, we consider the tailoring of the dielectric property of the elastic membrane, the addition of an external pressure on the membrane, and the introduction of a volume constraint to affect the behavior of the membrane. In these problems, we use a number of mathematical techniques, including symmetry analysis, phase plane analysis, perturbation theory, and numerical methods, to explore the mathematical models and make conclusions about behavior. It is shown that each of these modifications has a profound effect on the behavior of the membrane deflection and could be utilized in future design of MEMS and NEMS devices.