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We define the generalized Newton complementary dual of a monomial ideal in a polynomial ring over a field. We show good properties of such duals including linear quotients and isomorphisms between the special fiber rings. This generalizes the Newton complementary dual that was first introduced by Costa and Simis. We construct the cellular free resolutions of duals of strongly stable ideals generated in the same degree. When the base ideal is generated in degree two, we provide an explicit description of cellular free resolution of the dual of a compatible generalized stable ideal. (Received January 22, 2018)