Biogenic ethanol from corn has proven effective as an oxygenate that improves gasoline engine performance. However, the US Renewable Fuel Portfolio legislation was written before shale gas became a huge technically recoverable resource in the U.S. This work investigates tapping this large methane resource as an alternative to biogenic ethanol. Recent technological advances have enabled inexpensive production of natural gas from shale that could be used for ethanol production instead of corn. This research compares these two options from several perspectives. Ethanol from corn is controversial because corn is a fundamental source for both human ingestion and as animal feed. As such, the ultimate objective has been to develop technologies for cellulosic ethanol produced from the plant residual biomass instead of the fruit or grains from the plant. However, so far these new technologies result in a much more expensive biofuel. Without cost-effective cellulosic ethanol, the amount of ethanol production is limited. The abundance of natural gas from shale could offer an alternative feedstock for ethanol production. Recent drops in natural gas price only improve the competitiveness of ethanol from natural gas over biofuels. In the current work, a comparison between two synthesis routes for fuel ethanol was conducted. The first route is the process chain using corn as the feedstock. The second is an alternative processing route using shale gas as the feedstock. The method applied is a life cycle comparison considering each of the following four environmental elements: water, atmosphere, land, and energy. While there are important impacts related to the interaction of these elements, this research will mainly focus on each element in segregation. The comparison shows that shale gas could be competitive to corn as feedstock for ethanol production. Moreover, the results provide valuable arguments and tools for political discussions and decision making that could be useful for future energy policy development.