An brief overview of the hydrogen economy and related projects will be presented with an emphasis on the development of an organic, thermally regenerative fuel cell (TRFC) to recuperate waste heat produced by a long-haul transport truck engine. One of the major issues with such a system is the requirement of extreme chemoselectivity of the ketone hydrogenation reaction toward the desired alcohol product where undesired hydrogenolysis, dehydration and ring hydrogenation are also observed. A very high selectivity (>99.99%) is required for the reaction in both directions to ensure that the fluid has a long lifetime within the TRFC system. Careful investigation of the nature of the heterogeneous catalyst employed in this reaction has been undertaken to determine which will offer the highest rate of conversion along with almost perfect chemoselectivity. The ketone choice has also been investigated, where improved rates and chemoselectivities have been observed by adding alkyl and alkoxy substituents to the parent propiophenone and acetophenone candidates. These investigations have, first, been undertaken without a fuel cell to establish the best candidates before moving to in situ testing.