Project Title:	'The production of hydrogen from methane using non-thermal plasma: a feasibility study.'
Principle Investigator:	Professor C Whitehead (University of Manchester)
Project duration:	01/10/07 – 30/09/08
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There is a growing necessity to find alternative ways to produce energy with lower emissions of pollutants and higher efficiencies compared to combustion. One such option is the use of Polymer Electrolyte Membrane (PEM) fuel cell system, PEM fuel cells convert hydrogen gas into useful electric power with an efficiency that is not limited by thermodynamics and the only by product is water. However due to current infrastructure, storage technology and safety concerns, hydrogen gas cannot be stored on-board in adequate amounts for mobile applications. One way of getting round this problem is producing the hydrogen on board and on demand, this can be done by using hydrocarbons. Hydrocarbons are any chemical compound made up of hydrogen and carbon and they can also easily be used to produce other clean fuels such as methanol.

The objective of this project was to investigate the feasibility of non-thermal, atmospheric pressure plasma processing being used for the conversion of hydrocarbons such as methane into cleaner fuels, including hydrogen and methanol, in an energy efficient and sustainable way. Plasma can be described as an electrically charged gas mixture which responds strongly to electromagnetic fields. Current techniques of reforming waste greenhouse gasses are much less energy efficient than this proposed solution. One of these is steam reforming which is conducted at high temperatures and has problems with corrosion and catalyst poisoning.

This project particularly focused on the simultaneous combination of a plasma discharge with a catalyst, catalysts are substances that cause or accelerate chemical reactions without being affected themselves. The aim of focusing on the combination of these substances was to improve the overall conversion of the hydrocarbon and to optimise the efficiency of the production of hydrogen or methanol.

In this project, a system has been developed for detecting the end products of the plasma processing using a process called gas chromatography. This process breaks the final substance down into its component parts so the efficiency of the conversion can be measured. It was found that by combining the plasma discharge with a catalyst, the degree of conversion of the methane can be increased and the efficiency for the production of certain products (hydrogen, methanol) improved.

In terms of benefits to the North West region, the University of Manchester has enhanced its reputation and expertise in the area of plasma methods for methane reforming and hydrogen production. This has lead to the award of a new grant to the University (totaling £317,000) giving it the opportunity to participate as a partner in the UK's SUPERGEN Hydrogen Delivery consortium. One of the Universities' spin out companies, Plasma Clean Ltd, is expected to play a central role in the exploitation and commercialisation of any novel technology resulting from this project.