1. What is NOₙ? 
Nitric oxides are highly reactive gases; primarily NO (>90%) and NO₂, involved in many pollutant processes e.g. the formation of acid rain. They are produced as a result of high temperatures during the combustion of fuels, and legislation is in place to control emissions i.e. the Industrial Emissions Directive (IED) regulates activities that involve burning or gasification of waste (Figure 1). Technologies have been developed which react a reductant with NOₓ emissions, forming harmless N₂ and H₂O. Development of a material and process to treat NOₓ emissions using H₂ is the aim of this project.

2. H₂ for deNOₓ
Measurements made on an operational gasification plant (Figure 2), identified the gaseous fuel produced as having a 10-17% H₂ content depending on the conditions in the gasifier. Utilising H₂ already present in the system (Figure 1) could provide a reductant which does not have to be specially manufactured (e.g. NH₃, urea), and hence would be a cleaner approach. H₂ can also be used in NOₓ storage and reduction (NSR) processes where NOₓ species are ‘trapped’ and subsequently reduced through alternate lean and rich-burn cycles (Figure 4).

3. Catalysts
Catalysts prepared using impregnation techniques (Table 1)
Supported on honeycomb monoliths (Figure 3)
Channel size = 1 mm x 1 mm (~80 channels per monolith)

Table 1. Summary of prepared H₂-deNOₓ catalysts and associated processes

<table>
<thead>
<tr>
<th>H₂-SCR</th>
<th>H₂-NSR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt/Al₂O₃</td>
<td>Pt/Ba/Al₂O₃</td>
</tr>
<tr>
<td>Ag/Al₂O₃</td>
<td>Pt/K/Al₂O₃</td>
</tr>
<tr>
<td>Ag/Ba/Al₂O₃</td>
<td>Ag/K/Al₂O₃</td>
</tr>
</tbody>
</table>

4. Experimental Results

5. Initial Conclusions and Future work
Initial results (Figure 4) suggest that catalysts demonstrate some deNOₓ activity and there is some competition between desired NOₓ storage and the formation of NO₂. Further work will investigate the performance of the prepared catalysts in their relevant processes (SCR/NSR) and identify optimum conditions/limitations. The catalysts will be characterized through temperature-programmed studies (TPD and TPSR).