# Domestic gas appliance review and test program

Future Fuels end-use Type A appliances test program (RP1-4-01)

**Project Summary**

Current and future plans to progressively decarbonise segments of the gas network through the blending of renewable hydrogen with natural gas are influenced by the extent to which end-user appliances can successfully utilise these fuels. At low levels of hydrogen addition, it is expected that the impact on the performance of end-user appliances will be minimal. But how much hydrogen can be safely and effectively blended into natural gas remains an open question.

Approximately 10% of natural gas in Australia is used in residential and commercial settings by regulated “Type A” gas appliances, for the purposes of cooking, space heating and water heating. These appliances are certified for use with natural gas in Australia under AS/NZS 5263.0. There are approximately 11 Million Type A gas appliances in use around Australia.

Australian natural gas typically contains no measurable hydrogen and thus certification testing required by Australian Standard AS/NZS 5263.0 is conducted primarily with natural gas as the fuel. However, some limited testing of ignition performance and flame abnormality is also conducted for these appliances when fuelled with a “limit” gas comprising 13% hydrogen and 87% methane.

The purpose of this project was to investigate the performance of Type A appliances when fuelled with blends of up to 10 vol% hydrogen in natural gas. The methodology, in part, follows the existing logic of AS/NZS 5263.0 and appliances were tested with a primary fuel of 10 vol% hydrogen in natural gas and a limit gas with an additional 13 vol% hydrogen (equating to 21.7 vol% hydrogen in natural gas).

**Tests and Research Activities**

This project also included a review of recent overseas testing of appliances and operation of those appliances in pilot trials with up to 20 vol% hydrogen in natural gas. It should be noted that new appliances in Europe and the UK are routinely tested with a test gas containing 23 vol% hydrogen. However, natural gas distribution grids typically run at a lower pressure in Australia with, in many cases, different appliance and burner designs and so further testing work in Australia was required.

Twenty-six new appliances were selected as being representative of those commonly used in the Australian market and subjected to many of the tests typically used to certify natural gas appliances. These appliances were supplied, free of charge, by members of the Gas Appliances Manufacturers Association of Australia (GAMAA). The cooking appliances included a domestic freestanding cooker with hob, grill and oven burners, barbeques, a commercial cooking range, a commercial fryer, a commercial pasta cooker and a commercial boiling table. The water heaters included external storage and external instantaneous fan forced types. Nine different heaters were tested. They included a flueless convection heater, a flueless radiant/convection heater, a decorative log effect heater, a power flued and room sealed heater, an open flued wall furnace and an open flued radiant/convection heater. The other heaters tested were a power flued ducted heater, a ducted natural draught heater and an overhead radiant tube heater.

Tests were performed on each appliance by one of two NATA accredited laboratories using natural gas blended with either 10 or 21.7 vol% hydrogen. Ignition performance, flame abnormality and emissions were assessed. Additional

tests at the University of Adelaide explored the performance of a freestanding cooker and barbeque with blends containing significantly more than 21.7 vol % hydrogen and also reviewed the performance of the cooker at lower levels of hydrogen (i.e. less than 10 vol%).

The findings of this work will be useful for informing GAMAA members about the performance of their appliances with low levels of hydrogen addition. Various companies currently planning hydrogen injection trials in distribution grids containing Natural Gas Type A appliances will also benefit from understanding the performance of these appliances operating with low levels of hydrogen under Australian conditions.

Whilst this work has focussed on new appliances, future work might explore the performance of in-service Type A appliances installed within households and businesses and investigate even higher proportions of hydrogen blended with natural gas. Future work might also inform review and revision of the relevant Australian gas specification standards and the product Standards that specify the test and compliance criteria that underpin appliance certification.

The collaboration and enthusiastic involvement of gas suppliers, appliance manufacturers, testing laboratories, regulators and university researchers, all under the auspices of the Future Fuels CRC demonstrates the shared objective of moving safely towards a low emissions future.

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- Energy Safe Victoria (ESV)
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