



BUSINESS RESEARCH AND INNOVATION INITIATIVE  
**Turning farm crops into a  
renewable hydrogen source**

## Fact sheet

### Challenge summary

The Grains Research and Development Corporation (GRDC) is seeking an environmentally-friendly way to produce fertilisers that are critical to the success of Australia's grains industry. The production of such fertilisers will rely less on fossil fuels and the world's most energy-intensive processes. This BRII challenge requires an innovative solution that will enable Australia to recycle biomass (plant and animal matter), to generate hydrogen for renewable fertiliser production.

### Potential themes

Agricultural advancement, farming, energy, environment, renewables, gasification.

### Overview of challenge

Australia's agriculture industry depends on 4.9 million tonnes of fertiliser per annum. Ammonia is the building block of most of these fertilisers, utilising approximately 1.5 million tonnes of pure ammonia per annum.

Efforts are underway to produce renewable ammonia to reduce greenhouse gas emissions as part of the agriculture industry's contribution towards action to reduce global warming. A more comprehensive solution for obtaining renewable ammonia is low-pressure (less energy-intensive) ammonia production technologies that utilise renewable hydrogen as a feedstock. Finding a way to source the renewable hydrogen needed to feed low-pressure ammonia production technologies is one of the challenges that needs to be addressed.

The set of circumstances surrounding ammonia production, and the aim to improve sustainability presents us with a challenge that requires an innovative solution. The solution will simultaneously address two of the world's greatest challenges: ensuring we have enough food to feed the world's growing population, while creating solutions that help address climate change.

### Solution requirements

Producing renewable ammonia at low-pressure (less energy-intensive processing conditions) requires a source of renewable hydrogen as a feedstock. The GRDC's investigation into renewable hydrogen sources suggests that hydrogen can be obtained from the electrolysis of water using energy obtained from photo voltaic cells and/or wind turbines.

The production of hydrogen from gasification is rarely associated with renewable ammonia production. In cases where the two are associated, it is only theoretical. That is, no prototypes or physical trials involving a combination of the technologies appear to exist.

Scope exists to assess the feasibility of developing innovative solutions to achieve the combination of the gasification of excess biomass from farms to produce hydrogen, followed by the low-pressure production of ammonia for fertilisers for agriculture.

A key aspect of the innovative nature of any solution to this challenge will lie in the ability to combine processing of hydrogen production with ammonia production. While technology for the gasification of biomass exists, innovation is required to enable the hydrogen produced from the biomass to feed low-pressure ammonia production technology. There is an opportunity for hydrogen production via the gasification of biomass to be integrated with other processes and potentially be modularised into all-encompassing processing units. Similarly, the way in which the ammonia is used as a fertiliser provides additional scope for innovation. Ideally, the solution would be suitable for deployment at the farm level or small regional clusters for the disseminated generation of ammonia.

A solution should also have scope for commercialisation on a national or global scale.

## *Benefits of the solution*

A solution to the challenge will have several positive social impacts. A distributed network of combined hydrogen and ammonia processing units brings employment opportunities to remote communities. At the same time, it allows residents to sense and demonstrate the importance of their community, and to connect more deeply with similar communities as part of a fertiliser production network. Communities can also feel satisfied knowing that their production network is based on the epitome of recycling; excess biomass from the farm being returned to the farm as a necessary and beneficial input.

Producing fertilisers with lower energy requirements and obtaining hydrogen by recycling excess biomass from farms has positive impacts beyond environmental and social impacts. For example, it is expected that of grain growers' profits will increase as a result of reduced fertiliser costs.

The market opportunities for a solution to this challenge are strong. If every grain-growing farm in Australia had a combined hydrogen and ammonia processing unit, it would equate to approximately 20,000 units. This number increases sharply when other biomass-producing farms are added to the market, including sheep, livestock and horticultural farms.

Hydrogen is also valuable in and of itself. This means that the manufacture of only hydrogen is an option. It can be used on farms to power vehicles, pumps and irrigation systems, and can also be stored as an energy source and can be sold into the electricity grid.

The use of the solution will not be limited to Australia. The gasification of biomass to produce hydrogen for use in ammonia production, or for direct use, can occur in agricultural areas on a global scale. The solution is expected to be transferable.

### **How to apply**

For information on how to apply, visit [business.gov.au/BR11](https://business.gov.au/BR11)