



Technology assessment

Introduction

Over the last few years, a considerable amount of experience in water recycling has been gained throughout Australia. This was primarily due to the need to secure water supplies during the Millennium Drought, but also due to production expansion and rising water and trade-waste costs. With the overall aim of enabling water recycling activities within the agri-food sector in Australia, effort in this project was put toward reviewing technological progress across all industry sectors, including municipal wastewater. This enabled leading-edge technology and best practice to be identified and shared between the agri-food industry sectors such that innovative efficiencies could be demonstrated and implemented for wider national benefit.

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Objectives

Technological assessment within the project had two key objectives:

- Develop a framework for selecting appropriate water treatment technologies to produce recycled water of a quality that is 'fit for the purpose'; and
- Demonstrate increased water recycling in agri-food sectors through targeted water recycling technology trials.

Methodology

The project team undertook an extensive review of best practices in Australia, which included site visits and discussions with personnel at a dairy manufacturing case study site, Kellogg's, Bega Cheese, City West Water (Altona, Victoria), Melbourne Water Eastern Treatment Plant, Melbourne Cricket Ground sewer mining facility, Active Research, SA Water Bolivar, Southern Rural Water, Ingham's Sydney and Carlton United Brewery Brisbane. Discussions were also held with researchers and consultants delivering to individual sectors. These included attendance at MINTRAC (National Meat Industry Training Advisory Council) workshops and meetings with Mike Johns, Richard Ford and The University of Queensland representatives on activities for Meat and Livestock Australia (MLA)/Australian Meat Processor Corporation (AMPC), with Victoria University researchers on recent work into ceramic membranes and Anammox, and with Dairy Innovation Australia Ltd.

An appraisal of stakeholder wastewater streams supported the categorisation of four key types/streams. This was based on the concentration of carbon (C), nitrogen (N) phosphorus (P) and salts as well as the likely flow rates.

The wastewater streams groups are:

- A. low [C, N, P]
- B. high [C, N, P]
- C. high [C], low [N, P]
- D. low [C, N, P], high [salt].

A framework for technology assessment was developed (Figure 1) to encourage the uptake of new technologies and enable cross-industry learning. It therefore considered a broad number of options that were already implemented in individual sectors, as well as technologies not yet proven in Australia. The framework incorporates issues of broader concern that can influence decisions on the uptake of specific technologies, including regulatory, water quality, impacts on production/reuse, local industry/community. Importantly, the framework enabled a technology decision tree to integrate with a regulatory assessment and value proposition tool. This integration provided guidance on the value of technology selections to the business.

The technology assessment framework was applied in consultation with three industry partners: the dairy factory, Bega Cheese and Kellogg's. It was also used in the development of reviews and fact sheets for MLA/AMPC. Each of the applications to the dairy factory, Bega Cheese and Kellogg's involved a combined application of the framework, with value proposition and regulatory assessment. At the dairy factory, outcomes from the technology selection application informed the corporate decision to conduct a pilot trial to treat dairy wastewater to potable water standard.

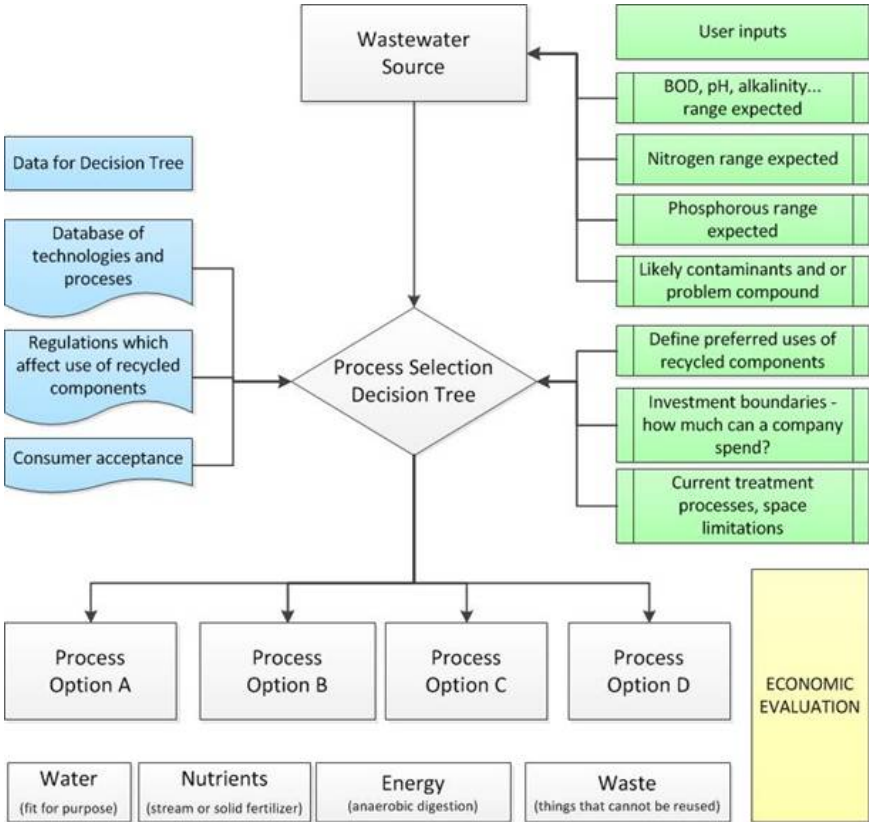


Figure 1. Technology assessment framework

Key outputs and outcomes

The application of the technology decision tree informed which options presented to collaborating partners would likely provide benefit to the business.

- Kellogg's was presented with five technology options
- Bega Cheese was presented with three technology options
- The dairy factory was presented with two technology options

For each business, the data collection process was carried out with consideration of existing processes, uses for water, water quality data and site constraints (as guided by the framework in Figure 1). The benefits to individual businesses were then assessed using the value proposition tool.

A key outcome of the integrated decision support framework (Figure 2) was its ability to provide a means and structure to empower a business to get from ‘thinking about water recycling option’ to ‘taking a sound proposal to the board’.

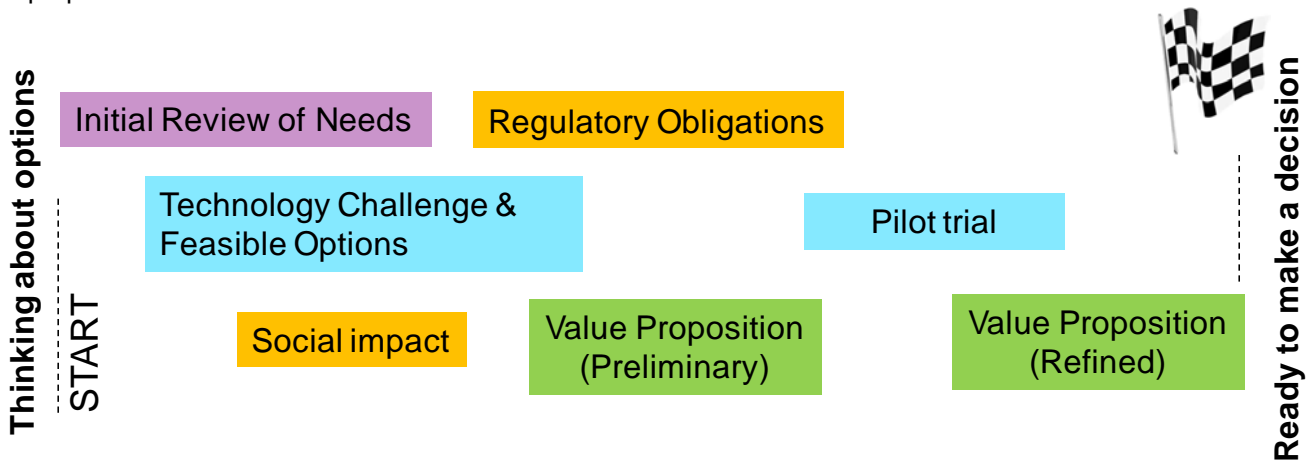


Figure 2. Schematic of integrated framework for technology assessment

The pilot trial with the dairy factory was a collaborative effort between the dairy factory, CSIRO and ADI Systems. It sought to demonstrate the ability of a combined P removal and recovery, membrane bioreactor (MBR) and reverse osmosis (RO) system to generate potable water that would enable production expansion at the dairy factory site (Figure 3). Responsibilities for inputs to the trial were mutually agreed prior to the start of work:

- Dairy factory personnel – trial host, sample collection and analysis, maintenance, RO system coordination
- ADI Systems – supplier of MBR, technical knowledge of treatment train at Allansford
- CSIRO – design and supply of P-removal and recovery system, disinfection, analysis, P removal and recovery.

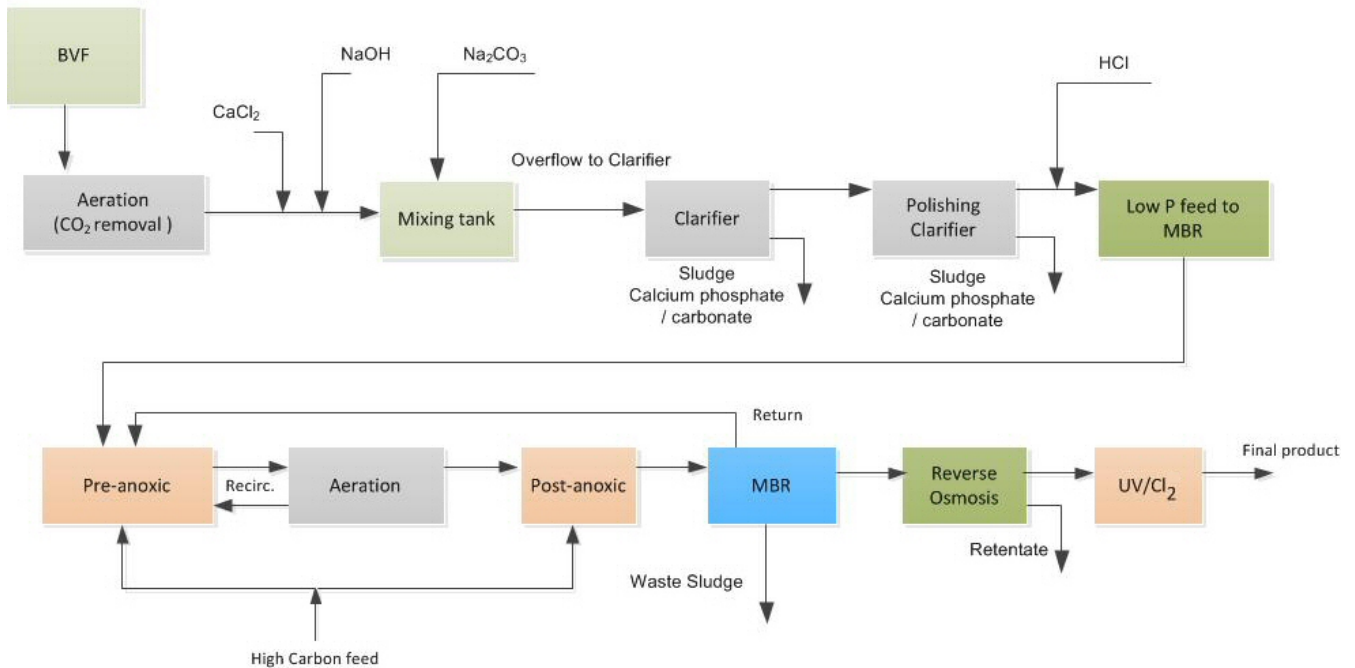


Figure 3. Flow diagram of pilot trial system

The pilot trial was assembled during early 2014, and fully operative from May to July 2014 to process 1.8 L/min of anaerobic digester effluent to potable water. Challenges arose due to equipment availability and maintenance issues. Importantly, these complications were minimised through pro-active

communication and sharing resources between each of the collaborators. The pilot enabled the demonstration of a new P removal and recovery process, and showed the technical feasibility of the MBR-RO process.

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Conclusions and recommendations

An integrated framework was generated to empower industry to take ownership of 'start-to-finish' when developing a means to recycle water. Future work will be considered to make this knowledge available for broad dissemination across industry. Limitations with this approach are that:

- the framework requires a good understanding of wastewater treatment if 'newer' technologies are to be considered; and
- technologies within the decision tree are viewed as 'generic', meaning that performance may vary with proprietary technologies.

Application of the technology assessment framework has enabled direct impact with specific Industry partners in developing options for future returns to the business:

- Bega Cheese/the dairy factory case study/Dairy Innovation Australia Ltd
- Kellogg's/Australian Food and Grocery Council
- Meat MLA/AMPC.

There are potential opportunities to make the technology decision tree into a standalone spreadsheet 'tool'. At present, it is a loosely connected database with performance data and comparative costs. A barrier to a spreadsheet-based guidance tool may be its ability to cope with specific wastewater characteristics that may inhibit the viability of some technologies. A positive view on this is that the tool could offer guidance on the exemplar pilot trials that could benefit the wider industry.

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The pilot trial at the dairy manufacturing case study site proved to be a valuable inclusion in the business strategy. It enabled new technologies to be explored, built capacity through transfer of knowledge to further support the industry, consolidated business plans and lowered risk.