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Australian Renewable
Energy Agency

ARENA

17 January 2019

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ARENA submission to the Inquiry into Innovative Solutions in Australia's Waste Management and Recycling Industries

This submission provides background information and insights from projects funded by the Australian Renewable Energy Agency (ARENA) as relevant to the House Standing Committee on Industry, Innovation, Science and Resources Inquiry into Innovative Solutions in Australia's Waste Management and Recycling Industries (the Inquiry).

In summary -

- ARENA continues to observe substantial interest by industry and local government in energy from waste (EfW) technologies and this is reflected in ARENA's project portfolio and forward funding pipeline.
- A range of commercial readiness and regulatory factors impede the uptake of EfW technologies in Australia. These include the relative inexperience of local supply chain stakeholders with these technologies compared to international markets, challenges in securing bankable supply arrangements for suitable waste feedstocks and the relatively low cost of landfill in Australia.
- Overall, we consider that EfW could provide an important, but volume-limited, role in the Australian stationary energy and transportation sectors. Ideally, and consistent with the waste management hierarchy, the relative volume of waste feedstock available for energy production will decline over time as strategies for the reduction, re-use and recycling of organic waste streams become more effective.
- ARENA will commission a Bioenergy Roadmap in 2020 to identify the role bioenergy can play in Australia's future energy mix.
- ARENA is focussing its remaining funding on its existing funding priorities which includes the grid integration of renewables and supporting industry to reduce emissions, which may include EfW technologies.

About ARENA

The Australian Renewable Energy Agency (ARENA) was established in 2012 by the Australian Government. ARENA's function and objectives are set out in the *Australian Renewable Energy Agency Act 2011*.

ARENA provides financial assistance to support innovation and the commercialisation of renewable energy and enabling technologies by helping to overcome technical and commercial barriers. A key part of ARENA's role is to collect, store and disseminate knowledge gained from the projects and activities it supports for use by the wider industry and Australia's energy market institutions.

ARENA's approach to Energy from Waste (EfW)

ARENA has a role in advancing EfW technologies through:

- funding demonstration and deployment projects to advance commercial readiness,
- building increased industry capacity and public acceptance of new technologies, and
- developing case studies and collecting data to support policy and regulatory design.

The waste management hierarchy (e.g. reduce, reuse, recycle, recover, dispose) is an important foundation for waste management policy and strategy. In the absence of specific regulatory controls, waste will tend to flow to the point in the hierarchy where it can realise the highest value (or lowest cost). In some cases this means many *potentially* valuable waste streams will go to landfill because of high costs or risks associated with other pathways. ARENA's energy from EfW portfolio of projects seeks to demonstrate new technologies and business models that create viable pathways for renewable wastes into bioenergy production.

Because ARENA's mandate is focussed on increasing renewable energy supply, we generally consider waste reduction, re-use and recycling approaches only to the extent that they may impact feedstock volumes and pricing, and therefore the viability of an energy recovery project.

Also, consistent with ARENA's mandate, ARENA support is limited to renewable waste streams. These are typically an organic waste stream (e.g. from agriculture) or the organic fraction of a mixed waste stream (e.g. municipal solid waste). ARENA relies on the Clean Energy Regulator's guidelines for determining the renewable component of EfW electricity generation, under which;

- solid waste incinerators, pyrolysis and gasification are eligible technologies,
- organics, paper/cardboard materials, nappies and wood products are the materials considered renewable,
- the amount of large-scale generation certificates (LGCs) can be calculated.

Recipients of ARENA funding for bioenergy projects are required to submit two life cycle analyses to demonstrate their environmental benefits, the first based on modeled data and the second based on actual process data.

Responding to Australia's waste management challenge

The Committee would be aware that in July 2017, China announced that they would be restricting the amount of imported recyclable waste (effective from January 2018), including some 619,000 tonnes sent annually from Australia.

On 26 April 2018, the ARENA Board received correspondence from the former Minister for the Environment and Energy requesting that ARENA consider further prioritising waste to energy projects, particularly those involving the avoidance of landfill. A similar request was made to the Clean Energy Finance Corporation.

ARENA's Chair wrote to the Minister stating that ARENA would continue to work with the sector to develop high quality projects and concepts that both align with ARENA's mandate and look to address the diversion of waste from Australian landfill operations.

In November 2019, the Minister for Energy and Emissions Reduction announced that ARENA would lead the development of a bioenergy roadmap to identify the role bioenergy can play in Australia's future energy mix. Leading bioenergy industry stakeholders will be consulted on the development of the roadmap, with broader industry consultations to be held in early 2020 before provision of a final product in mid 2020.

The roadmap will consider:

- the potential for biofuels to decarbonise the industrial and transport sectors,
- the role biofuels can play in contributing to Australia's liquid fuel security,
- opportunities to use biogas in the gas network,
- bioenergy's capacity to generate heat, steam and power, and
- the economic opportunities for Australia, including a focus on regional Australia.

ARENA's EfW project portfolio

As of December 2019, ARENA had invested approximately \$98 million in 25 projects EfW projects. [Attachment A](#) provides a summary of EfW projects funded by ARENA to date.

These projects cover a range of waste streams, conversion approaches and energy products. A major focus for funding has been the development and demonstration of innovative approaches to biofuel production (e.g. ethanol and biodiesel) from agricultural waste and the biomass component of wastewater. ARENA has also funded a range of projects which seek to divert municipal solid waste from landfill. We have not contributed funding to landfill gas projects as these are considered already commercially mature in Australia.

Overall, incineration, anaerobic digestion and gasification can be considered the most mature energy conversion technologies, however their application in Australia remains limited by a range of commercial, regulatory and social factors. These include the relative inexperience of local supply chain stakeholders with these technologies compared to international markets, challenges in securing long-term bankable supply arrangements for suitable waste feedstocks and the relatively low cost of landfill in Australia. Landfill and other disposal options are a competitive threat to the long term supply of EfW feedstocks.

ARENA is funding projects that use various waste streams (e.g. municipal solid waste (MSW), wastewater, wood waste and agricultural waste) for electricity production. Overall, we consider that due to its high cost and limits on feed-stock availability, EfW could play an important, but volume-limited, role in power generation in Australia. In the long term, biofuels are likely to be most successful in transport applications that are not readily electrifiable (e.g. heavy freight, shipping and aviation).

ARENA has funded projects at various scales, from early stage studies to large capital projects. For example the Kwinana and East Rockingham EfW facilities will be the largest facilities of their type in Australia. Both of these facilities convert MSW to electricity using a high-efficiency incineration process.

The waste hierarchy prioritises the avoidance, re-use and recycling of waste before considering recovering energy from waste. A commonly reported concern in relation to EfW processes is that, once established, they can create a demand for feedstock which puts them in competition with higher value uses, such as using organics for composting or recycling of plastics. We note that the “waste-arising” contractual structure employed in the East Rockingham project allows the local council (as waste provider) to maintain or increase recycling rates for wastes to higher value purposes without financial penalty. The commercial innovation displayed in this project illustrates how EfW can be integrated into broader waste management strategies for councils.

Ideally, and consistent with the waste hierarchy, the volume of waste feedstock available for energy production will decline over time as strategies for the reduction, re-use and recycling of organic waste stream have greater effect. Such a shift would acknowledge the value of nutrient and carbon recovery from waste streams for use in forestry and agriculture. ARENA’s experience is that the commercial readiness of hybrid power generation and carbon recovery technology (e.g. pyrolysis) remains low at this stage.

Please contact Jon Sibley, Principal Policy Advisor ([REDACTED]) if you would like to discuss any aspect of ARENA’s submission.

Yours sincerely

Darren Miller
Chief Executive Officer

Attachment A - Summary of ARENA-funded EfW projects

Summary of projects by waste source

Primary waste stream	Number of projects	ARENA grant (\$M)	Total project value (\$M)
Agricultural waste	10	\$32.94	\$86.55
Biomass	2	\$0.58	\$1.22
Biosolids from waste water	4	\$14.11	\$37.62
Municipal Solid Waste	5	\$42.82	\$1,213.95
Various	2	\$4.75	\$10.16
Wood waste	2	\$2.50	\$6.70
	25	\$97.70	\$1,356.21

Summary of projects by primary output (energy output or capacity building)

Primary output	Number of projects	ARENA grant (\$M)	Total project value (\$M)
Biofuel	11	\$36.69	\$97.11
Biogas	4	\$5.18	\$12.16
Capacity building	2	\$4.75	\$10.16
Electricity	8	\$51.08	\$1,236.78
	25	\$97.70	\$1,356.21

Summary of projects by energy conversion technology

Conversion technology	Number of projects	ARENA grant (\$M)	Total project value (\$M)
Anaerobic digestion	3	\$2.94	\$7.83
Fermentation	4	\$21.53	\$59.31
Gasification	2	\$6.25	\$17.33
Hydrogenation	2	\$7.19	\$19.24
Incineration	5	\$44.40	\$1,216.92
Mechanical catalytic conversion	1	\$0.50	\$1.20
Pyrolysis	1	\$5.47	\$13.49
Torrefaction	1	\$0.43	\$0.88
Various	6	\$8.99	\$20.02
	25	\$97.70	\$1,356.21

List of projects

Project	ARENA grant (\$M)	Project value (\$M)	EfW conversion
East Rockingham Resource Recovery Facility	18.0	511.0	MSW to electricity
Macquarie Capital - Kwinana Waste to energy (NB same project in CEFC table referred to as Phoenix Energy above)	23.0	696.0	MSW to electricity
Southern Oil Refining - Biosolids to renewable crude oil.	4.0	12.3	Biosolids to renewable fuels
Southern Oil Refining - Biocrude and biofuel laboratory, to support the development of a commercial-scale renewable diesel and jet fuel refinery.	3.2	6.9	Biomass to renewable fuels
Boral Timber - Hardwood Residue Bio-refinery Feasibility Study	0.5	1.2	Wood waste to renewable fuels
Logan City Council - Logan City Biosolids Gasification Project	6.2	17.3	Biosolids to energy
CSIRO - Feasibility study into dispatchable, cost effective power from forest and mill waste using the direct injection carbon engine (bioDICE)	0.4	0.9	Biomass to renewable fuel
RE Group - Feasibility study to generate hybrid energy, co-firing waste at Mt. Piper coal power station.	1.0	3.5	MSW to electricity
MSM Milling - Canola mill using forestry residue to replace LPG in a biomass boiler.	2.0	5.5	Wood waste to energy
ReNu Energy - Biogas plant at a sheep abattoir to anaerobically digest waste for use as on-site energy, using a novel Build Own Operate and Maintain business model.	2.1	6.4	Agricultural waste to biogas
UnityWater - Feasibility study for an energy facility to generate biogas and electricity at a sewage treatment facility.	0.7	1.1	Wastewater to biogas
Mount Alexander Waste to Energy - Feasibility study for a facility to turn sewage, green waste and food residue from local businesses into bioenergy for Coliban Water.	0.1	0.3	Organic waste to biogas
Queensland University of Technology - R&D project to develop technologies to integrate biogas from sugarcane residues into the sugar	2.2	4.3	Sugarcane waste to biogas

production process.			
AgriFutures - National database for biomass resources, displayed on the Australian Renewable Energy Mapping Infrastructure.	3.2	6.6	Includes agricultural waste data, forestry waste data and MSW data.
Bioenergy Australia - Participation in International Energy Agency bioenergy Technology Collaboration Program.	1.6	3.6	Specific tasks include energy from biogas, biorefinery and biofuels.
Microbiogen - Optimisation of a yeast strain to more efficiently convert non-food waste to ethanol and a 'green coal' bio product.	4.0	8.1	Sugarcane waste to bioethanol
Ethtec - Development and construction of a fermentation process to efficiently generate ethanol from agricultural waste.	12.0	32.0	Agricultural waste to bioethanol
Renergi - A low emission biofuel technology	5.5	13.5	Agricultural waste to renewable fuels
Regional Developments Australia - Feasibility Study for Stage 1 of the Pentland Bioenergy Project - a new, fully integrated renewable biofuel facility producing 300 million litres of fuel grade ethanol.	3.0	13.1	Sugarcane waste to bioethanol
Almond Board of Australia Incorporated - Renewable Energy Production from Almond Waste	0.0	0.0	Almond waste to renewable energy
Bureau of Sugar Experiment Stations - Cane2Fuel: a biomass input system for producing second generation biofuels	1.3	2.0	Biomass to biofuel
Microbiogen - Production of Generation 2 ethanol from sugarcane waste	2.5	6.2	Sugarcane waste to bioethanol
University of the Sunshine Coast - Control and manage the moisture content of woody biomass to create certainty in the quality and supply for bioenergy	0.3	1.0	Wood waste to energy
Re.Group Pty Ltd - Feasibility Study into Mt Piper Hybrid W2E Project	0.4	0.9	MSW to electricity
Visy Industries Australia - Visy Clean Energy Project	0.4	2.5	MSW to electricity