

# *Tax Law, Policy and Energy Justice: Re-thinking biofuels investment and research in Australia*

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## **Abstract**

*Tax law and policy can encourage investment in innovative research into biofuels as part of a just transition to a low carbon economy. This multi-disciplinary paper aims to re-think those fiscal levers. Biofuels such as ethanol can be categorised by the type of feedstock used for processing into the final product. Triggered by the rise in oil prices, many biofuel studies were conducted in Australia over the period 2007 to 2014. We ask whether there is a contemporary tax policy narrative to elicit from previous Australian studies on biofuel innovation, and take a qualitative research approach in our investigation. We next consider the type of fiscal support that might encourage further biofuels research. The framework of energy justice is used for analysis. Findings suggest that stability in contemporary government tax law, policy and national energy co-ordination is required for biofuel innovation. Australia needs to use a greater diversity of energy resources: the gap that this paper addresses. Globally, tax law and policy drive investment towards a sustainable energy mix.*

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## 1 Introduction

Tax law and policy can encourage investment in innovative research into biofuels as part of a just transition to a low carbon economy. Policy stability is part of the solution as it enables long-term research and investment planning. Current fiscal policies for biofuels, such as grant schemes, are problematic because they vary considerably between the state, territory and national governments. Australia has concerns about its energy reserves, and although biofuels are but a small element in the mix, we raise the point as to whether the reserve shortfall could be better addressed by a tax policy that encompasses biofuels.

In 2016 Australia was placed in the bottom third of OECD countries for bioenergy, having produced less than 10 gigajoules (GJ) of bioenergy per capita. Finland and Sweden, by comparison, produced 50-70 GJ per capita.<sup>2</sup> Part of the difference is due to an abundance of cheap coal that Australia uses for electricity production; with reserves of 14 million terajoules (TJ) in 2016. Also, gas is a primary energy source for domestic heating; with Australian reserves in 2016 of three million TJ.<sup>3</sup>

Australia's increased carbon emissions over the past years are linked to gas production for export.<sup>4</sup> Given the impact of fossil fuels on climate change, there is a need for government policies to encourage investment to promote all types of renewable energy, including biofuels: a realistic option in the transition towards a sustainable future.<sup>5</sup> The definition of sustainable or ecologically sustainable development (ESD) was stated in 1992 in Australia's National Strategy on Ecologically Sustainable Development, and still applies today:

Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.<sup>6</sup>

Typical biofuels are bioethanol and biodiesel. Biofuels can be categorised by the type of feedstock used for processing into the final product. Generation one feedstocks include food crops and crop waste (e.g. grains and sugar cane) that are processed into bioethanol via a variety of methods, such as fermentation. Feedstock from non-petroleum oils,

1 Max Koslowski, 'Scott Morrison will push Trump for fuel security deal in White House talks,' *Sydney Morning Herald*, 20 September 2019 <<https://www.smh.com.au/politics/federal/scott-morrison-will-push-trump-for-fuel-security-deal-in-white-house-talks-20190917-p52s6i.html>>.

2 KPMG, "Bioenergy State of the Nation Report: A report on Australia's bioenergy performance", (Bioenergy Australia, 2018).

3 For gas and coal statistics, see Energy International Administration (EIA) Energy Statistics 2018, <<https://www.eia.gov/beta/international/data/browser/#/?c=004&ct=0&vo=0&v=H&end=2016&showdm=y>>.

4 Department of Environment and Energy, "Quarterly Update of Australia's National Greenhouse Gas Inventory for March 2019", (Canberra: Australian Government, 2019), 25.

5 E.g. Mikael Hook and Xu Tang, 'Depletion of Fossil Fuels and Anthropogenic Climate change: A review' (2013) 52(1) *Energy Policy* 797.

6 Ecological Sustainable Development Steering Committee, "National Strategy for Ecologically Sustainable Development" (Canberra: Department of the Environment and Water Resources, 1992).

such as waste vegetable oils and animal fats are processed into biodiesel using transesterification, an organic chemistry process.<sup>7</sup> The widescale adoption of generation one feedstocks for ethanol production has been questioned from several angles including setting up a 'food versus fuel' situation, whereby food crops and animal feed are diverted for conversion into transport fuel, and claims to rises in food prices as a consequence.<sup>8</sup> The price-rise spikes for food commodities during 2008 were blamed, in part, on the significant production of corn and other food grain ethanol and this brought the 'food versus fuel' debate into sharp public focus. This association was questioned by World Bank and OECD studies (REFS).<sup>9</sup>

Some US studies have found that production of generation one biofuels, specifically corn-based ethanol, require more energy usage than is yielded by the resultant fuel, and with high GHG emissions. However, the central principle of these studies, their analytical approaches and incorporation of outmoded data were criticised heavily in later studies, which found corn ethanol to have a positive energy balance and significantly lower GHG emissions compared with gasoline, the most appropriate comparator.<sup>10</sup>

The need to increase the scale of biofuels production to improve the GHG reductions from transport fuels addresses the shortfalls of generation one biofuels and led to the next generation of biofuel production. Second generation ethanol production is limited as the technology is still undergoing development and currently it requires more costly technical processes.<sup>11</sup> The technology for conversion of generation two production relies on non-food plant feedstock, such as lignocellulosics (plant matter), to produce ethanol; and inedible oilseeds for biodiesel; for example, oil-rich seeds from the pongamia tree, native to Asia and northern Australia. While generation two feedstocks avoid direct 'food for fuel' issues, there can still be indirect competition with food via land, water and biodiversity reduction issues.<sup>12</sup>

Since 2011, biofuels research has focused on generation three, or advanced, biofuels, such as algae, as a low cost, low impact renewable feedstock.<sup>13</sup> Algae is considered a feedstock that can be produced in areas not suited to agriculture such as warm, flat lands with consistent light and access to brackish or saltwater. Generation four biofuels use a biomass carbon capture and sequestration process that is claimed to lock away more carbon that it produces.<sup>14</sup> With the exception of Brazil, no country is producing large volumes of biofuel without the financial support of subsidies as current costs of grain feedstocks

7 Tim Johnson et al., "A Bio-energy Roadmap for South Australia. 'The Jacobs Report'", (Adelaide: Renewables SA, 2015); KPMG, "Bioenergy State of the Nation Report: A report on Australia's bioenergy performance," 2018, above.

8 E.g. Attila H Rezaie, 'Upholding the Human Right to Food in the Face of Agro-Biofuel Technology' (2017) 6(1) *Canadian Journal of Human Rights* 155.

9 John Baffes and Tassos Haniotis, *Placing the 2006/08 Commodity Price Boom into Perspective* (World Bank, 2010); OECD, *Economic Assessment of Biofuel Support Policies* (OECD, 2008).

10 Bruce E Dale, 'Thinking Clearly about Biofuels: ending the irrelevant 'net energy' debate and developing better performance metrics for alternative fuels' (2007) 1(1) *Biofuels, Bioproducts and Biorefineries* 14; Andrew Warden and Victoria Haritos, *Future Biofuels for Australia: Issues and opportunities for conversion of second generation of lignocellulosics* (Rural Industries Research and Development Corporation (RIRDC), 2008).

11 Ian O'Hara, Karen Robins, and Bas Bas Melssen, *Biofuels to Bioproducts: A growth industry for Australia* (Queensland University of Technology, 2018); Lena Partzsch, 'Biofuel Research: Perceptions of power and transition' (2017) 7 *Energy, Sustainability and Society*.

12 Alex Baumber, *Bioenergy Crops for Ecosystem Health and Sustainability* (Routledge, 2016).

13 Amar Doshi et al., 'Economic and Policy Issues in the Production of Algae-Based Biofuels: A review' (2016) 64 *Renewable and sustainable energy reviews* 329.

14 Stephen A Rackley, *Carbon Capture and Storage* (Butterworth-Heinemann, 2017).

(in the case of first generation biofuels) or the costs of production or conversion (in the case of advanced biofuels) is high. Clearly, further research and development is needed to progress second generation and advanced biofuels which offer improved GHG emissions reductions and potential for larger scale production toward economic competitiveness.

Given that recent Australian governments have been perceived as lacking a long-term fiscal approach for renewable energy policy,<sup>15</sup> the selection of Australia as the case study for this research makes sense as an attempt to understand the policy levers, and specifically tax law barriers, to prioritising diversity in the energy mix.

Bioenergy, which includes biofuels, has not been prioritised by the Morrison government.<sup>16</sup> Federal grant programs for renewables are small in number and found to preference solar, wind and battery storage at the expense of bioenergy research. Bioenergy is currently only 4% of Australia's energy consumption. Bioenergy Australia (the industry association) in its latest strategic plan identifies the main obstacles being limited financially viable commercial projects in operation, and poor domestic capacity to deliver large-scale projects.<sup>17</sup> Innovations in the science and commercialisation of biofuels could help grow the share of bioenergy within Australia's energy mix. In Prime Minister Scott Morrison's September 2019 state visit to the United States, Australia's low fuel stockpiles was an agenda item. At that date, Australia had 58 days of net fuel stocks, well below the 90 days required by the International Energy Agency.<sup>18</sup> This is why diverse sources of energy, known as the 'energy mix', is important, and the issue typically discussed in the context of fuel shortage crisis aversion, and security in case of global conflicts. Rather than Australia request access to US fuel stockpiles, policy should require the nation to draw on a variety of its own fuel sources.

Our qualitative research aims to re-think Australian tax law and policy to encourage investment in innovative research into biofuels towards economic and environmentally sustainable outcomes.

The authors are undertaking a larger biofuels project that combines inter-disciplinary research to address a holistic range of bio-product issues. It includes enquiring into whether further scientific and technological breakthroughs in biofuels are needed to lower economic costs. It also asks whether Australia might utilise lessons from the European Union, where biofuel regulation and environmental consciousness have been important for nearly two decades.<sup>19</sup> European Union regulations on biofuels could, arguably, inform policy in Australia.

The research for this paper limits its scope to Australian government tax law and policy relevant to progressing biofuel research and innovation. Looking back at biofuel research

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- 15 Grace Cheung and Peter J Davies, 'In the Transformation of Energy Systems: What is holding Australia back?' (2017) 109(1) *Energy Policy* 96; Mark Diesendorf, "Renewable Electricity Policy for Australia", (Canberra 2018); Tony Wood and Guy Dundas, "State governments can transform Australia's energy policy from major fail to reliable success", in *The Conversation* (2018).
- 16 Prime Minister Scott Morrison, "Meeting our climate commitments without wrecking the economy", (Media release, 25 February, 2019).
- 17 Bioenergy Australia, "Strategic Plan 2017-2020", (Canberra 2017), p. 3; see also Ian O'Hara, Karen Robins, and Bas Bas Melssen, 2018, above n 11.
- 18 Max Koslowski, "Scott Morrison will push Trump for fuel security deal in White House talks," 2019, above n 1; KPMG, "Bioenergy State of the Nation Report: A report on Australia's bioenergy performance," 2018, above n. 1.
- 19 E.g. Hazariah Noh, Arturo Benito, and Gustavo Alonso, 'Study of the Current Incentive Rules and Mechanisms to Promote Biofuel Use in the EU and their Possible Application to the Civil Aviation Sector' (2016) 46 *Transportation Research Part D*.

activity in Australia between 2007 and 2014, there was an unprecedented intensity of research interest and associated publications. This focus on biofuels grew out of concern about rising oil prices which, by mid-2014, peaked at around US\$110 per barrel.<sup>20</sup> Oil prices then fell. The economic imperative for the use of biofuels foundered in the wake of the rapid fall in oil prices and research interest flagged.

## Questions

This phenomenon of casting aside cutting-edge biofuels research, on the basis of economics alone, raised our research question on whether the early 2000s Australian studies on biofuel innovation might help inform contemporary tax law and policy relevant to biofuels. Further, the Australian community has been subject to many variations in energy policy since the early 2000s,<sup>21</sup> which led to the next research question about the type of fiscal support that might encourage more consistent biofuels innovation.

Our research is original and significant for its timely questioning of the adequacy of government taxation and policy support for innovation around biofuels when further diversification of Australia's energy mix would be to the national benefit.

This paper narrows its focus to biofuels for transport (aviation, marine and road) where petroleum is the dominant source of fuel. The authors are motivated by the need to arrest petroleum's adverse environmental impact, which could be partially alleviated by a managed growth in biofuels.

The findings from this research, based on this Australian case study, contribute to the formulation of contemporary policy, laws and regulations to progress biofuel innovation. Globally, tax law and policy are important drivers of investment towards a sustainable energy mix.

## Energy Justice

We use the emerging framework of energy justice, which provides a decision-support tool for policy makers to bring into balance the energy trilemma of competing aims: economics (such as energy pricing), politics (such as energy security) and the environment (sustainability, specifically here, of biofuels).<sup>22</sup> The energy justice concept is depicted in Figure 1.

Energy policy formulation for resources such as biofuels, is seen as 'dominated by economists and industry — where economic costing is the prime tool for decision-making'.<sup>23</sup> Energy justice emerged from, *inter alia*, the principle of distributive justice, which for this research, might concern the fair allocation of land and water resources for generation two biofuel production.<sup>24</sup>

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20 Diane Kraal, 'Review of the Petroleum Resource Rent Tax: Implications from a case study of the Gorgon gas project' (2017) 45(2) *Federal Law Review* 315.

21 The Rudd government 2007 Carbon Pollution Reduction Scheme; the Gillard government 2012 Carbon Pricing Mechanism; the Abbott government 2014 Direct Action Plan; the Turnbull government 2017 Climate Policy Review; and the Morrison government 2018 Fair Dinkum Power policy.

22 As applied by Diane Kraal, 'Petroleum Industry Tax Incentives and Energy Policy Implications: A comparison between Australia, Malaysia, Indonesia and Papua New Guinea' (2019) 126 (March) *Energy Policy* 212.

23 Raphael J Heffron and Darren McCauley, 'The Concept of Energy Justice Across the Disciplines' (2017) 105(1) *Energy Policy* 658, p. 664.

24 Raphael J Heffron and Darren McCauley, 'Resolving society's energy trilemma through the Energy Justice Metric' (2015) 87(1) *Energy Policy* 168.

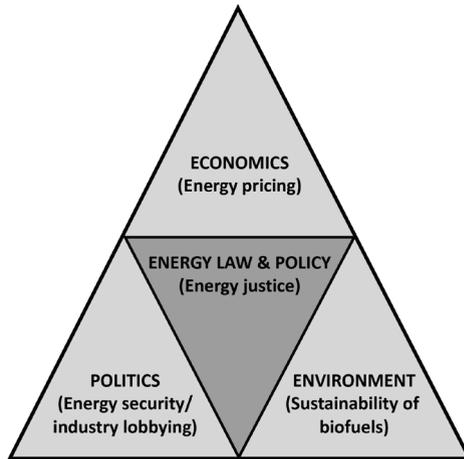


Figure 1. Energy justice: The triangle of energy law and policy

Source: adapted from Heffron and McCauley (2017).

Energy justice can be defined as a world-wide energy system that equitably disseminates both the costs and benefits of energy, and includes due process in decision-making.<sup>25</sup> The energy justice framework is operationalised through eight core principles: due process, transparency and accountability, availability, affordability, sustainability, intra- and inter-generational equity, and responsibility.<sup>26</sup> Energy justice is a ‘conceptual framework, that seeks to identify when and where injustices in the energy sector occur and how best law and policy can respond to them’.<sup>27</sup> It requires academics and other practitioners to consider the implications of energy policies and their critical evaluation.<sup>28</sup>

In this article the energy justice framework and some of its core principles are used to evaluate the costs and benefits of biofuels in an Australian case study, along with the implications of the provision of tax incentives to the biofuels sector.

25 Simon Marsden, ‘The ‘Triangle’ of Australian Energy Law and Policy: Omissions, connections and evaluating environmental effects’ (2017) 29(3) *Journal of Environmental Law* 475; T. Van de Graaf et al., eds., *The Palgrave Handbook of the International Political Economy of Energy* (Palgrave Macmillan, 2016); Donald Zillman et al., ‘Introduction: How Technological and Legal Innovation Are Transforming Energy Law,’ in *Innovation in Energy Law and Technology: Dynamic Solutions for Energy Transitions*, ed. Donald Zillman, et al. (Oxford University Press, 2018), 1-19.

26 Benjamin Sovacool et al., ‘Energy Decisions Reframed as Justice and Ethical Concerns’ (2016) 1(May) *Nature Energy* 1.

27 Raphael J Heffron and Darren McCauley, 2015, above n 24, 169.

28 Ibid.; Raphael J Heffron, Darren McCauley, and Gerardo Zarazua de Rubens, ‘Balancing the energy trilemma through the Energy Justice Metric’ (2018) 229 *Applied Energy* 1911; Andrew Lawrence, ‘How can climate justice and energy justice be reconciled?’, in *Handbook of the International Political Economy of Energy and Natural Resources*, ed. Andreas Goldthau, Michael Keating, and Caroline Kuzemko (Edward Elgar, 2018), 227-37.

## 2 Research Frame

We aim to re-think Australian government tax law and policy to encourage investment in innovative research into biofuels as part of a just transition to a low carbon economy. A qualitative research approach will generate results from two questions:

(1) Policy narrative: Is there a contemporary tax policy narrative to elicit from previous Australian studies on biofuel innovation?

(2) Fiscal support: What type of fiscal support could encourage biofuels research, innovation and investment in Australia?

The results from the first question will be drawn upon for the discussion of the second question.

### ***Tax Policy narrative***

For question one, about the value of older biofuel studies to frame a tax policy narrative, a scientific and technical database search is conducted to select academic Australian studies from the early 2000s that primarily consider biofuels for the Australian situation and have been subsequently well cited. The text of the selected biofuel studies is then scanned into a database,<sup>29</sup> on which a content analysis is performed to show the frequency of words and to generate word cloud diagrams. Content analysis is a research technique for making replicable and valid inferences from data to their context.<sup>30</sup>

The biofuel studies are drawn from the 'golden era' of Australian biofuels research over the period from 2007 to around 2011. Our premise was that these past publications focus on the technical and economic attributes of biofuels alone. This prompted us to re-read the selected publications and consider any citations of them. To widen the analysis of the benefits of past biofuel research studies with objectivity, we interrogate the findings through the lens of the 'energy justice' framework. This framework underpins the belief that not only economic, but also political and environmental, pressures are considerations needed to progress Australia's contemporary biofuel policy and laws; and to resuscitate investment in innovation for the sector.

Previous studies on biofuel production have noted its chequered history, including the dark spectre of the agricultural land issue of 'food versus fuel'.<sup>31</sup> For example in the United States, government subsidies provided to farmers to grow corn for processing to biofuel result in price rises of corn used for stockfeed.<sup>32</sup> In Malaysia, rainforests are cleared for palm oil plantations.<sup>33</sup> While in Australia, a handful of biofuel producers have benefited from past government grants, and from mandates for bioethanol for transport fuel.<sup>34</sup>

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29 The database is interrogated by NVivo, software designed for qualitative data analysis. It is applied to rich text-based and/or multimedia information, a where deep level of analysis on large volumes of data is required.

30 Klaus Krippendorff, *Content Analysis: An introduction to its methodology* (Sage, 1980).

31 Luc Pelkmans et al., "The Role of Sustainability Requirements in International Bioenergy Markets," in *International Bioenergy Trade: History, status and outlook on securing sustainable bioenergy supply, demand and markets*, ed. Martin Junginger, Chun Sheng Goh, and Andre Faaij (Springer, 2014), 125-49.

32 David Pimentel, 'Ethanol Fuels: Energy balance, economics, and environmental impacts are negative' (2003) 12(2) *Natural Resources Research* 127.

33 Johannes Pirker et al., 'What are the Limits to Oil Palm Expansion?' (2016) 40 *Global Environmental Change* 73.

34 Australian National Audit Office, *The Ethanol Production Grants Program* (Australian Government, 2015).

## *Fiscal support*

For question two, about the government fiscal support required for biofuel innovation in Australia, a database search is conducted for tax incentive literature, taxation legislation, and policy and schemes that are relevant to biofuels. For institutional data, the search covers relevant government and non-government organisation (NGO) websites.

Various studies have described tax incentives as preferential tax treatments provided to selected taxpayer groups and usually result in those taxpayers deferring or paying less tax than they otherwise would.<sup>35</sup> Governments traditionally justify using tax incentives to address market failure associated with external pressures, such as regional competition for inward investment.<sup>36</sup> Tax incentives (also known as tax holidays, tax concessions, tax breaks and tax exemptions,) can take many forms, including double deductions, fiscal stability clauses, accelerated depreciation of capital expenditure and infrastructure tax credits. Some tax incentives are legislated, while others are determined under confidential contracts.<sup>37</sup>

Kraal writes of those that argue that tax incentives for investment – in particular for foreign direct investment – are bad policy, both in theory and in practice. Examined were ways in which tax incentives could be made more effective and more efficient.<sup>38</sup> An Asia-Pacific government paper on tax incentives acknowledges the shortcomings of tax incentives as tools to achieve policy goals, making reference to the country's costly and ill-targeted research and development (R&D) concessions.<sup>39</sup> It suggests there are more effective approaches to fixing investment problems, such as direct grants and low-interest loans. For the infrastructure-intensive fossil fuel sector, there is the contention that best practice is 'lower levels of legislated and discretionary tax incentives'.<sup>40</sup> Eminent economist, Joseph Stiglitz, calls for limiting industry tax breaks to rare exceptions.<sup>41</sup>

For research question two, consideration is given to Australian fiscal incentives available for energy, and specifically for transport, whether for the local but nascent biofuels industry, or the more dominant fossil fuels industry.

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35 D Holland and R J Vann, "Income Tax Incentives for Investment," in *Tax Law Design and Drafting*, ed. V Thuronyi (Washington, D.C., 1998), 1-32; Sebastian James, *Tax and Non-Tax Incentives and Investments: Evidence and Policy Implications* (World Bank, 2013); Diane Kraal, 2019, above n 22.

36 E M Zolt, "Tax Incentives: Protecting the tax base " in *United Nations Handbook on Selected Issues in Protecting the Tax Base of Developing Countries*, ed. H. Tonino A. Trepelkov, & D. Halka (United Nations, 2015), 451-95.

37 Craig Emerson and Diane Kraal, "Taxation of the Mining, Petroleum and Gas Sectors," in *Special Report: Proceedings of the 2014 Papua New Guinea Tax Review and Symposium, 29-30 May, no. 70* ed. Francis Odhuno (National Research Institute of Papua New Guinea, 2016), pp. 39-70; IMF, *Papua New Guinea: Staff Report for 2016, Article IV Consultation* (International Monetary Fund, 2017).

38 Diane Kraal, 2019, above n 22, 213 cites Alex Easson and Eric M Zolt, *Tax Incentives* (World Bank Institute, 2002).

39 Papua New Guinea Taxation Review Committee, *Issues Paper No.1: Mining and Petroleum Taxation* (PNG Government, released March 2014, 2014).

40 Diane Kraal, 2019, above n 22, 212.

41 Joseph E Stiglitz, *Globalization and its Discontents Revisited: Anti globalization in the era of Trump*, 3rd ed. (W. W. Norton, 2017).

### 3 Question One: results and discussion

#### **Results: Major Australian biofuel studies, 2007-2011**

For research question one, our database search resulted in studies that met the criteria, as defined in the method section, to six major Australian biofuel studies as per Table 1 below.<sup>42</sup>

**Table 1. Results: selected major Australian biofuel studies, 2007-2011**

Report No	Publication Date	Authors	Study Title
1.	2007 May	O'Connell, D., Batten, D., O'Connor, M., et al.	<i>Biofuels in Australia: Issues and Prospects</i> . A Report for the Rural Industries Research and Development Corporation (RIRDC). Canberra: RIRDC.
2.	2007 November	Batten, D., & O'Connell, D.	<i>Biofuels in Australia: Some Economic and Policy Considerations</i> . A Report for the Rural Industries Research and Development Corporation (RIRDC). Canberra: RIRDC.
3.	2008	Australian Academy of Technological Sciences and Engineering (ATSE)	<i>Biofuels for Transport: A Roadmap for Development in Australia</i> . Melbourne: ATSE.
4.	2008	CSIRO, & Future Fuels Forum	<i>Fuel for Thought: The future of transport fuels: challenges and opportunities</i> . Canberra: CSIRO.
5.	2008	Warden, A., & Haritos, V.	<i>Future Biofuels for Australia: Issues and opportunities for conversion of second generation of lignocellulosics</i> . Canberra: RIRDC.
6.	2011	L.E.K. Consulting	<i>Advanced Biofuels Study: Strategic Directions for Australia</i> , Summary Report and Appendix. Sydney: Australian Centre for Renewable Energy (ACRE).

The O'Connell et al. 2007 study (Report 1) about the prospects for conventional biofuels in Australia,<sup>43</sup> has more than seven major citations.<sup>44</sup> For instance, Doshi et al. extended the O'Connell et al. study by discussing the economic costs and benefits of generation one

42 See Appendix 1 for brief summaries of the six selected biofuel studies.

43 Deborah O'Connell et al., *Biofuels in Australia: Issues and Prospects. A Report for the Rural Industries Research and Development Corporation* (RIRDC) (RIRDC, 2007).

44 Thomas Brinsmead, Alexander Herr, and Deborah O'Connell, 'Quantifying Spatial Dependencies, Trade-offs and Uncertainty in Bioenergy Costs: An Australian case study, (1) – least cost production scale' (2015) 9 *Biofuels, Bioproducts and Biorefining* 21; Amar Doshi et al., 2016, above n 13; Damien Farine, Deborah O'Connell, and et al, 'An Assessment of Biomass for Bioelectricity and Biofuel, and for Greenhouse Gas Emission Reduction in Australia' (2012) 4 *GCB (Global Change Biology) Bioenergy*; Alexander Herr and Michael Dunlop, 'Bioenergy in Australia: An improved approach for estimating spatial availability of biomass resources in the agricultural production zones' (2011) 35(5) *Biomass and Bioenergy*; Deborah O'Connell and Victoria Haritos, 'Conceptual Investment Framework for Biofuels and Biorefineries Research and Development' (2010) 1(1) *Biofuels*; Mervyn Shepherd et al., 'Eucalypts as a Biofuel Feedstock' (2011) 2(6) *Biofuels* 639; Joanne Tingey-Holyoak and John Pisanelli, 'Implications of Biomass Production and Accountability for "Water Grabbing"' (2012) 3(2) *Sustainability Accounting, Management and Policy Journal* 262.

and two biofuels and suggested that algae needed further development as a generation three feedstock.<sup>45</sup>

The Batten and O'Connell 2007 study (Report 2) can be described as a biofuel industry position statement,<sup>46</sup> compiling knowledge in 2007 and pointing out critical gaps. It has since been positively cited.<sup>47</sup>

The ATSE 2008 study (Report 3) centres on biofuels for transport,<sup>48</sup> and has since had five major citations.<sup>49</sup> For instance, Malik et al. through their work that evaluates the energy consumption economic stimulus, employment, and GHG impacts in the biofuel supply chain, widened the ATSE claim about the potential of biofuels for transport and carbon mitigation.<sup>50</sup>

The CSIRO 2008 study (Report 4) about future transport needs,<sup>51</sup> has also been cited widely.<sup>52</sup> For instance, the Senate Select Committee on Fuel and Energy report concerns the impact of higher petroleum, diesel and gas prices and drew on the CSIRO submission for its study on biofuels for transport.<sup>53</sup>

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45 Amar Doshi et al., 2016, above n 13.

46 David Batten and Deborah O'Connell, *Biofuels in Australia: Some Economic and Policy Considerations. A Report for the Rural Industries Research and Development Corporation* (RIRDC) (RIRDC, 2007).

47 Gabriele Bammer et al., *Disciplining Interdisciplinarity: Integration and Implementation Sciences for Researching Complex Real-World Problems* (Australian National University E Press, 2011).

48 Australian Academy of Technological Sciences and Engineering (ATSE), *Biofuels for Transport: A Roadmap for Development in Australia* (ATSE, 2008).

49 Mariam Al Hattab and Abdel Ghaly, 'Production of Biodiesel from Marine and Freshwater Microalgae: A review' (2015) 3(2) *Advances in Research*; Andrew Chapman, Benjamin McLellan, and Tetsuo Tezuka, 'Proposing an Evaluation Framework for Energy Policy Making Incorporating Equity: Applications in Australia' (2016) 21 *Energy Research and Social Science*; Anna Dalla Marta et al., "Water and biofuels," in *Climate, Energy and Water: Managing trade-offs, seizing opportunities*, ed. Jamie Pittcock, Karen Hussey, and Stephen Dovers (Cambridge University Press, 2015), 108-22; Arunima Malik, Manfred Lenzen, and Arne Geschke, 'Triple Bottom Line Study of a Lignocellulosic Biofuel Industry' (2016) 8 *GCB (Global Change Biology) Bioenergy*; Greg Tegart, 'Energy and Nanotechnologies: Priority areas for Australia's future (technical note)' (2009) 76(9) *Technological Forecasting and Social Change* 1240.

50 Arunima Malik, Manfred Lenzen, and Arne Geschke, 2016, above n 49.

51 CSIRO and Future Fuels Forum, *Fuel for Thought: The future of transport fuels: challenges and opportunities* (CSIRO, 2008).

52 ABC News, "Petrol report a wake-up call: environmentalists", (2008); Mark A Andrich, Jörg Imberger, and E R Oxburgh, 'Inequality as an Obstacle to Sustainable Electricity and Transport Energy Use' (2013) 17(4) *Energy for Sustainable Development* 315; Tom Beer, 'CSIRO: Alternative transport fuels' (2009) 19(4) *Australasian BioTechnology*; Elliot Fishman and Tim Brennan, "Oil Vulnerability in Melbourne", in 33rd Australasian Transport Research Form (2010); Matthew L. James, "The (Green) Car of the Future", in *Background Notes* (Canberra: Parliament of Australia, 2009); Senate Select Committee on Fuel and Energy, *Final Report: Inquiry into Impact of Higher Petroleum, Diesel and Gas Prices and Several Related Matters* (Australian Government, 2010); Vertical News.com, 'Global Warming Focus: 'Fuel for Thought' on Transport Sector Challenges,' Verticalnews.com 11 August 2008.

53 Senate Select Committee on Fuel and Energy, 2010, above n 52.

Report 5, the Warden and Haritos 2008 study on generation two biofuel feedstock (lignocellulosics),<sup>54</sup> has been cited more than six times.<sup>55</sup> An example on how this Australian study has had international impact is demonstrated through the German study by Jansen, which targeted investors, scientists and decision-makers with an interest in generation two biofuels.<sup>56</sup>

The LEK 2011 study (Report 6) on advanced biofuel strategies to transition to renewable energy,<sup>57</sup> has been cited a number of times.<sup>58</sup> For instance, the LEK fuel cost data was updated by Dunn et al. for their own strategies towards renewable energy.<sup>59</sup>

### ***Discussion: Major Australian biofuel studies, 2007-2011***

The results from question one provided six selected studies, which are discussed in terms of the competing aims of energy justice (economic, political and environmental). For brevity, we now substitute the terms, Report 1, Report 2 and so on for each of the reports from Table 1.

*Economics.* Reports 1 and 2 deal predominantly with the economics of biofuels, while Report 4 extends its biofuels transport discussion with economic modelling. Reports 3 and 5 are more concerned with the technical or scientific aspects of biofuels, while Report 6 covers both technical pathways and economics.

The word cloud in Figure 2 is generated from the text in Report 1,<sup>60</sup> which focuses on prospects for conventional biofuels in Australia. The word cloud depicts (by size of font) the most often used words. It shows the high frequency of the word 'production' that indicates the dominance of economics in the report discussion on generation one and two biofuels.<sup>61</sup>

From the energy justice perspective, the dominance of economics in this type of report reduces its value considerably compared to an energy report that includes the energy justice elements of economics as well as politics and environmental considerations.

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54 Andrew Warden and Victoria Haritos, 2008, above n 10.

55 Bandana Biswas, Paul Scott, and Peter Gresshoff, 'Tree Legumes as Feedstock for Sustainable Biofuel Production: Opportunities and challenges' (2011) 168(16) *Journal of Plant Physiology*; Julie Glover et al., 'Australia's Crops and Pastures in a Changing Climate: Can biotechnology help?', (Canberra: Bureau of Rural Sciences 2008); Roland Jansen, *Second Generation Biofuels and Biomass: Essential Guide for Investors, Scientists and Decision Makers* (Wiley-VCH Verlag, 2012); Christopher Mitchell, Richard Harper, and Rodney Keenan, 'Current Status and Future Prospects for Carbon Forestry in Australia' (2012) 75(3) *Australian Forestry*; Ling Peng et al., 'Potential for Bioenergy Production from Sugarcane in China' (2014) 7(3) *Bioenergy Research*; Joely Taylor, 'Growing a green fuel industry in Australia' (2011) *Ecos Magazine* at <<http://www.ecomagazine.com/?paper=EC10107>>(last accessed 30 June 2019).

56 Roland Jansen, 2012, above n 55.

57 L.E.K. Consulting, *Advanced Biofuels Study: Strategic Directions for Australia, Summary Report* (Australian Centre for Renewable Energy (ACRE), 2011).

58 Alan Dunn et al., "Why EVs? A Comparison of Alternative Fuels to Help Australia Regain Energy Security," in *Transition Towards 100% Renewable Energy: Selected Papers from the World Renewable Energy Congress WREC 2017*, ed. Ali Sayigh (Springer International, 2018), 103-14; Jennifer Hayward et al., 'The Economics of Producing Sustainable Aviation Fuel: A regional case study in Queensland, Australia' (2015) 7(1) *Global Change Biology: Bioenergy* 497; Daniel Tan, "Growing the grunt: developing green biofuels for Australia," *The Conversation*, 14 May 2012 2012.

59 Alan Dunn et al., 2018, above n 58.

60 Deborah O'Connell et al., 2007, above n 43.

61 The Figure 2 words: 'production', 'biofuels', 'ethanol' and 'biodiesel' had count frequencies of between 200 to 300 out of the top 100 most frequently used words in this publication. The lowest frequency in this group was 30.

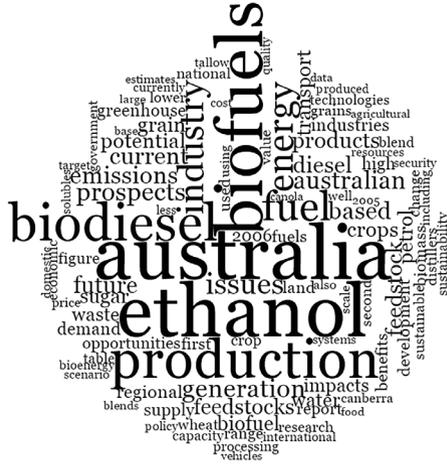


Figure 2. Word cloud generated from O’Connell et al. (2007)

*Environment.* Report 1 points to the contribution of biofuels to the mitigation of GHG emissions and climate change. It also discusses the negatives of generation one biofuels on sustainability issues, including the effect on biodiversity of the removal of crop and forest residues. The little emphasis that Report 2 has on GHG and the environment, reflects its reliance on the then carbon pollution reduction system (CPRS) Bill that was to go before Parliament.<sup>62</sup> Report 4 is also confident that ‘Australia will be forced to manage its response to reducing greenhouse gas emissions’ through the then proposed CPRS legislation.<sup>63</sup> Other reports of that time anticipate that the Rudd government’s CPRS would be passed by the Parliament and serve to incentivise GHG emission reduction. We note that Rudd’s CPRS Bill eventually failed to be passed by the Australian Senate.<sup>64</sup>

Report 3 refers to ‘huge tracts of level poor-quality land, magnificent sunlight, abundant saline water’ in Australia for its evaluation of the components necessary for generation one biofuels.<sup>65</sup> It raises ‘food versus fuel’ issues as a generation one biofuel limitation. Report 5 ignores environmental issues in its discussion of generation two lignocellulosic biofuels.

Report 6 recommends 20 specific actions (short-, medium- and long-term) that could be taken by government to assist business establish a sustainable, market-led, advanced biofuels industry. Actions identified to reduce GHG emissions included fuel efficiency improvements through engine technology, and a reduction of vehicle weight via the use of lighter materials. The recommended strategies are still valid for 2019.<sup>66</sup>

62 Carbon Pollution Reduction Scheme Bill 2009 [No. 2] (Cth). A Bill to reduce pollution caused by emissions of carbon dioxide.

63 CSIRO and Future Fuels Forum, 2008, above n 51, 11.

64 Ian Bailey et al., ‘The Fall (and Rise) of Carbon Pricing in Australia: A political strategy analysis of the carbon pollution reduction scheme’ (2012) 21(5) *Environmental Politics* 691.

65 Australian Academy of Technological Sciences and Engineering (ATSE), 2008, above n 48, 45.

66 E.g. KPMG, ‘Bioenergy State of the Nation Report: A report on Australia’s bioenergy performance,’ 2018, above n, 2; Ian O’Hara, Karen Robins, and Bas Bas Melssen, 2018, above n 11.



Most reports call for continuing federal support for research; we note that the energy industry still calls for research and development (R&D) tax incentive support.<sup>70</sup> In 2007, the then research and development tax concession allowed companies to claim a deduction of more than 100% for eligible expenditure on R&D activities.<sup>71</sup>

Report 3 finds that on a world scale, Australia's R&D efforts have been minor, although some of the nation's technology breakthroughs are world-class. It calls for more substantial R&D support from government. Report 4 claims that government support for R&D expenditure influences research on transport fuels. Report 5 ignores government policy, although it does identify innovation research gaps in areas, such as the science needed to address technology and feedstock. Report 6 calls for a general increase in government R&D funding. Findings from all six of the selected reports indicate a consistent call from both researchers and industry for government fiscal support for innovative biofuel research and development.

The Figure 4 word cloud is generated from the text in Report 2,<sup>72</sup> which focuses on the federal government policy position towards the biofuel industry in 2007. The word cloud shows the most often used words, depicting their frequency of appearance by size of font. It depicts a high frequency of the economic term 'production' and less use of the word 'policy' (indicated by the arrow in Figure 4) in its discussion about the future for biofuel in Australia.<sup>73</sup>

Our view is that the energy justice element of the politics of energy diversity would be addressed in this publication if an equal consideration had been given to achieving transparency and responsibility.

In summary, and in terms of informing contemporary tax policy, the findings of the selected reports suggest that, in the period around 2007, stability in government policy was the norm. The reports had expected that a carbon trading system would be introduced and remain, and thus reports on biofuel science were not particularly concerned with GHG emissions: it was an issue to be addressed by government policy and legislation. In 2007 Australia had voted in a Labor government (under Kevin Rudd) after 11 years of conservative coalition leadership. The electorate was yet to endure the policy instability that came with government leadership changes from the Rudd-Gillard-Rudd era of 2010-2013 and the Abbott-Turnbull-Morrison era from 2013 onwards.

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70 E.g. AusBiotech, "Submission. Treasury Laws Amendment (Making Sure Multinationals Pay Their Fair Share of Tax In Australia and other Measures) Bill 2018. Response to the Inquiry by the Senate Economics Legislation Committee. November 2018", (2018).

71 Repealed R&D Tax Concession, formerly sections 73B to 73Z of the *Income Tax Assessment Act 1936* (Cth).

72 David Batten and Deborah O'Connell, 2007, above n 46.

73 The Figure 4 word 'policy' had a count frequency of 81, compared to 'production' with a count frequency of 139 out of the top 100 most frequently used words in this publication.



support for business in Australia is the research and development tax incentive that costs just under 34% of budgetary assistance (\$2.8 billion).<sup>74</sup>

In mid-2011 the research and development (R&D) tax concession provisions were changed to the R&D tax incentive (RDTI).<sup>75</sup> In 2015, as part of the National Innovation and Science Agenda, the Australian government announced an RDTI review that involved public submissions and industry meetings. The resultant Ferris report in 2016 made a range of recommendations to address the cost and effectiveness of the RDTI, but follow up action was slow.<sup>76</sup>

The process of the RDTI reforms seems to have met the principle of transparency, as there were 69 public submissions by November 2018 to the review and they covered a range of views. For example, AustBiotech's submission of 2018, a biotechnology association with a small but diverse membership, stated that the corporate tax link to the RDTI 'will see start-up biotechs with turnover under \$20 million and in tax loss, lose a much-needed portion of their cash refund'.<sup>77</sup> The Price Waterhouse Coopers submission claimed the proposed changes might have a potentially negative impact that includes the discouragement of R&D investment, and influencing of business decisions toward conducting research activities offshore. PWC was of the view that the 'Bill has a high level of complexity and creates inequality between different industries'.<sup>78</sup>

Finally, in 2018 a Bill covering the RDTI was tabled for debate in Parliament.<sup>79</sup> Schedules 1-3 of the Bill deal with the changes to the RDTI that Ferris proposed. In particular Schedule 1 seeks to reform the RDTI to better target innovative research, and improve its effectiveness, integrity and fiscal affordability. For example, increasing the R&D expenditure tax threshold prescribes a rise from \$100 million to \$150 million and links the RDTI to a claimants' corporate tax rate, plus a 13.5% premium.<sup>80</sup>

The Senate Legislation Committee released its own review in February 2019, which covered the RDTI and multinationals and their taxation. The Senate recommendations on the RDTI

74 International Energy Agency (IEA), "Bioenergy: Roadmap development and implementation", (Amsterdam: International Energy Agency, 2017). For RDTI data, see Productivity Commission, 'Trade and Assistance Review 2017-18', Canberra, <<https://www.pc.gov.au/research/ongoing/trade-assistance/2017-18>>.

75 R&D Tax Concession, repealed sections 73B to 73Z of the *Income Tax Assessment Act 1936* (Cth). The replacement RDTI provisions are in Div. 355, *Income Tax Assessment Act 1997* (Cth).

76 Bill Ferris, Alan Finkel, and John Fraser, "Review of the R&D Tax Incentive", (Released 4 April, Canberra: Department of Industry Innovation and Science, 2016).

77 AusBiotech, "Submission, Treasury Laws Amendment (Making Sure Multinationals Pay Their Fair Share of Tax In Australia and other Measures) Bill 2018. Response to the Inquiry by the Senate Economics Legislation Committee. November 2018," 2018, above n, 70, 1.

78 Price Waterhouse Coopers, "Submission, Treasury Laws Amendment (Making Sure Multinationals Pay Their Fair Share of Tax In Australia and other Measures) Bill 2018. Response to the Inquiry by the Senate Economics Legislation Committee. November 2018", (2018), p. 2.

79 Treasury Laws Amendment (Making Sure Multinationals Pay their Fair Share of Tax in Australia and Other Measures) Bill 2018 (Cth).

80 Other proposed changes include capping the refundable RDTI to \$4 million for small entities and changing the RDTI calculation of large entities, referred to as the 'intensity premium', such that the higher the R&D expenditure, the higher the tax offset. Schedule 2 concerns enhancing the integrity of the RDTI and Schedule 3 is about improving the RDTI administrative framework.

were deferred until after the May 2019 federal election.<sup>81</sup> Post-election, the aforementioned Bill cannot simply be re-introduced in the same format, since government needs to properly address the recommendations of the Senate 2019 review. From an energy justice perspective, political imperatives are now seen to have held sway as the final form of the Bill will depend on negotiations with Senate crossbenchers.

*Early stage investor tax incentive.* Through the National Innovation and Science Agenda (NISA), launched in December 2015, the federal government seeks to encourage early stage innovation by companies via specific tax incentives.<sup>82</sup> Thus in 2016 tax legislation was amended to include tax incentives for investments made in qualifying early stage innovation companies (ESICs). The policy aim is to encourage innovation by aligning the tax system and business laws with a culture of risk-taking in positive entrepreneurship. The two early stage tax incentives provide eligible investors with:

- a 20 per cent non-refundable carry-forward tax offset on amounts invested in qualifying ESICs; and
- a 10-year exemption on capital gains tax for investments held as shares in an ESIC.<sup>83</sup>

It is too early to assess the efficacy of this tax incentive, but in terms of energy justice it would seem to be transparent and available, although not particularly targeted to biofuel companies.

### ***Tax subsidies***

*Fuel tax credits: heavy industry.* Petroleum fuels, such as petrol and diesel and biofuel blends, are excisable goods if they are produced or manufactured in Australia under the Excise Tariff Act 1921 (Cth). The excise is passed onto consumers at the retail petrol pump. However, a fuel tax credit that offsets fuel excise (and customs duty) is also available for businesses involved in manufacturing, quarrying and construction. Other major beneficiaries include commercial power generation, primary production and mining.<sup>84</sup>

This credit can be classified as a form of tax subsidy, and given it is specifically available to fossil fuels, in terms of energy justice, it transgresses the principle of inter-generational equity.

*GST relief.* Australia's goods and services tax (GST) is a further tax paid on purchases of fuel products. However the GST legislation allows registered businesses to claim back

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81 Senate Economics Legislation Committee, "Report: Treasury Laws Amendment (Making Sure Multinationals Pay Their Fair Share of Tax in Australia and Other Measures) Bill 2018 [Provisions]", (Released 11 February, Canberra 2019). The main recommendations included: the need for a refined approach to the proposed cap on the refundable tax offset within the context of investment decisions that have already been taken; a refinement of any proposed R&D intensity measure, which should reflect the inherent differences in R&D intensity across industries and potential negative impacts on businesses with large operating costs; the need for a collaboration premium that was recommended by the 2016 review; and the need for the substantial mooted savings to be reinvested in R&D-focused activities, possibly by increased direct funding grants. At public hearings it was demonstrated how difficult the intensity threshold would be to implement.

82 National Innovation and Science Agenda (NISA), see Tax Incentives for Early Stage Investors, < <https://treasury.gov.au/national-innovation-and-science-agenda/tax-incentives-for-early-stage-investors/> >.

83 *Income Tax Assessment Act 1997* (Cth), Division 360: Early stage investors in innovation companies. The tax incentive is currently capped at \$200,000 per investor per year.

84 *Fuel Tax Act 2006* (Cth), Fuel Tax Credits, Division 41.

a GST credit from fuel, whether petroleum or biofuels.<sup>85</sup> The GST credit for fossil fuels diminishes the effect of credit afforded to biofuels.

The GST credit can be classified as a form of tax subsidy and, given it is specifically available to fossil fuels, it transgresses the energy justice principle of inter-generational equity.

## **Tax Concessions**

*Fuel excise concession: aviation.* A concessional rate of excise is levied on aviation fuel. Gasoline and aviation turbine fuel cost \$1,280 million in tax revenue forgone in 2017-18.<sup>86</sup> Aviation has the highest relative energy expenditure, which excludes electricity.<sup>87</sup> While there are voluntary offsets available for purchase by aviation passengers, questions are being asked about the efficacy of carbon offset schemes designed for the aviation industry.<sup>88</sup>

Our view is that given the concession is specifically available to aviation fossil fuels, it transgresses the energy justice principle of inter-generational equity.

*Fuel excise concession: alternative fuels.* Alternative fuels include biodiesel, bioethanol, liquefied petroleum gas (LPG), liquefied natural gas (LNG) and compressed natural gas (CNG). These alternative fuels are all currently subject to the advantage of concessional fuel excise rates compared to petrol and diesel. The Australian Tax Expenditure Statement 2017 forecasts the fuel excise concession for alternative fuels will cost \$200 million per annum from 2018-19 to 2020-21.<sup>89</sup> However, the heavy industry 'fuel tax credit' serves to reduce the benefit of concessionary excise treatment provided to alternative fuels.

The fuel excise rates for domestically manufactured bioethanol and biodiesel were set to zero on 1 July 2015 and from that date increase on 1 July of each year until 1 July 2020 and 1 July 2030 respectively.<sup>90</sup> The final excise rates for biodiesel (a high energy fuel) and bioethanol (a medium energy fuel) will be 50 per cent of fossil fuels (petrol and diesel). We note that prior to June 2015 alternative fuels were subject to the same fuel excise rates as fossil fuels, but at the same time received offset grants.<sup>91</sup>

An Australian National Audit Office inquiry in 2015 recommended that the alternative fuel offset grants be abandoned because the cost was high and greenhouse gas abatement benefits had been too low.<sup>92</sup> Further, the health benefits were modest; the benefits to motorists were minor; and the inquiry found no evidence that support for the Australian bioethanol industry exerted downward pressure on petrol prices.

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85 *A New Tax System (Goods and Services Tax) Act 1999* (Cth), Division 11.

86 Australian Treasury, "Tax Expenditures Statement 2017", (Canberra 2018).

87 L.E.K. Consulting, 2011, above n 57.

88 Susanne Becken and Brendan Mackey, 'What Role for offsetting Aviation Greenhouse Gas Emissions in a Deep-Cut Carbon World?' (2017) 63(1) *Journal of Air Transport Management* 71.

89 Australian Treasury, "Tax Expenditures Statement 2017," 2018, above n, 86.

90 As per the *Excise Tariff Amendment (Taxation of Alternative Fuels) Act 2011* (Cth) as amended by the *Excise Tariff Amendment (Ethanol and Diesel) Act 2015* (Cth).

91 The Ethanol Production Grants Program, see <<https://www.anao.gov.au/work/performance-audit/ethanol-production-grants-program>>.

92 Australian National Audit Office, 2015, above n 34.

## Grants & loan funding

Results and discussion of federal and state policies and schemes for energy are in the next sections.

### *Federal policy and schemes*

The Australian Labor Party (Labor) government period of the 2007-2013 saw the institution of the carbon pollution reduction system (CPRS) policy. Labor's 2009 Commercialisation Australia scheme still grants funds of up to \$1 million to commercialise innovative intellectual property.<sup>93</sup> The Commercialisation Australia grants can be seen as a form of subsidy as they lower fixed costs and investment risks.

In 2011 the Labor government set up AgriFutures Australia and funded its Bioenergy, Bioproducts and Energy Program, which is still available for projects by rural industries to enable activity in the bioenergy supply chain.<sup>94</sup>

In 2012 the Labor government also established the Australian Renewable Energy Agency (ARENA) to provide funding to projects that advance energy technologies and innovative systems to increase renewable energy, including biofuels, in Australia's energy mix.<sup>95</sup> To complement ARENA, it also set up the Clean Energy Finance Corporation (CEFC) in 2012. ARENA is currently developing a national database of biomass resources for bioenergy.

However it has only \$521 million of funds left until 2022.<sup>96</sup>

Grant schemes during the Labor government period, but now discontinued, include the \$800m Clean Technology Investment Program and the \$200m Clean Technology Innovation Program.

In late 2013 the Labor government was replaced by the Abbott government, a conservative coalition, which repealed the carbon tax. In 2014 the Abbott government announced its Direct Action Policy, an emissions offsets scheme funded by the Emissions Reduction Fund and administered by the Climate Change Authority.<sup>97</sup> The scheme combined government purchasing of emission reductions from voluntary schemes, such as early burning of savannah grasses for fire management. Bioenergy projects were not targeted.

In 2015 the Turnbull coalition government tried to invigorate renewable energy projects, including biofuels. The Australian Bioenergy Fund (ABF) was set up in 2015 to provide investor funds through equity investment in bioenergy. Eligible ABF projects can include those producing clean energy from agricultural, council, forestry and mining waste. Capital investment in the ABF fund has been secured from the CEFC and the fund is managed by a UK private equity group.<sup>98</sup>

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93 The Labor government introduced carbon tax legislation in 2012. It was repealed in 2014 by the incoming conservative government, *Clean Energy Legislation (Carbon Tax Repeal) Act 2014* (Cth).

94 See < <https://www.agrifutures.com.au/partnerships/biomass-bioenergy/> >. AgriFutures Australia was formerly the Rural Industries Research and Development Corporation.

95 The core grant funding is legislated, *ARENA Act 2011* (Cth).

96 Australian Renewable Energy Agency (ARENA), "General Funding Strategy 2018-21", (Canberra: ARENA, 2018).

97 See Department of Energy and Environment, < <http://www.environment.gov.au/climate-change/government/emissions-reduction-fund/about> >.

98 Dianne Glenn, 'The Long View: Policy directions in Australia to support the industrial biotechnology sector' (2017) 13(2) *Industrial Biotechnology* 72. See also The Australian Bioenergy Fund (ABF), < <https://www.foresightgroup.eu/institutional/our-business/infrastructure/australian-bioenergy-fund-abf/> >.

In 2016 through the \$1 billion Clean Energy Innovation Fund (CEIF) renewable projects are funded through debt and equity finance. The fund is administered by both ARENA and the CEFC. The CEIF provides funds for investor loans and equity financial products;<sup>99</sup> which is a policy move away from providing grants, and perhaps reflective of Turnbull's merchant banker background.

In 2019 the Morrison government, a conservative coalition, announced a \$2 billion Climate Solutions Fund to supersede the Abbott government's Emissions Reduction Fund, but the new fund has essentially the same aims.<sup>100</sup> The fund is administered by the Department of Environment and Energy.

In summary, the carbon tax, funding bodies and funds established by the federal Labor government (2007-2013) have since been curtailed or removed by successive conservative coalition governments. From the energy justice perspective, we see little inter- and intra-generational equity in the stalling and stopping of so many funding bodies, schemes and funds, as summarised in Table 3.

**Table 3. Federal Energy Schemes**

Government	Date	Administrator	Scheme
Australian Labor Party	2009	RIRDC/AgriFutures Australia	Commercialisation Australia
	2011	AgriFutures Australia	Bioenergy, Bioproducts and Energy Program
	2012	ARENA	Funding legislated
	2012	Clean Energy Finance Corporation	Clean Technology Investment Program. Clean Technology Innovation Program
Liberal Party & National Party (conservative coalition)	2014	Climate Change Authority	Direct Action policy and Emissions Reduction Fund
	2015	Clean Energy Finance Corporation	Australian Bioenergy Fund
	2016	ARENA	Clean Energy Innovation Fund
	2019	Dept. of Environment and Energy	Climate Solutions Fund

### *States' policy and schemes*

*New South Wales and Queensland.* In 2016 Queensland launched its Biofutures 10-Year Roadmap and Action Plan, with \$20m into its Industry Development Fund for the

99 Fact Sheet – Clean Energy Innovation Fund, < <https://www.environment.gov.au/minister/hunt/2016/pubs/mr20160323-factsheet.pdf> >.

100 Prime Minister Scott Morrison, "Meeting our climate commitments without wrecking the economy," 2019, above n, 16.

Commercialisation Program and Acceleration Program.<sup>101</sup> In early 2019 Queensland committed \$100m over three years to its Resource Recovery Industry Development Program to attract new infrastructure investment. These capital grants are policy levers that provide a means to reduce the initial investment required for a qualifying project.

The New South Wales (NSW) government set up its Climate Change Fund in 2007 under the *Energy and Utilities Administration Act 1987* (NSW). The fund can cover bioenergy activities. The NSW government and ARENA have co-funded a pilot project in ethanol technology.<sup>102</sup>

According to the IEA a biofuel mandate is a policy lever that provides the market with a firm level of demand.<sup>103</sup> Since 2007 NSW has mandated that volume fuel retailers sell 6% ethanol in petrol and 2% biodiesel in diesel. Queensland legislation mandates for 4% ethanol in petrol and 0.5% biodiesel in diesel for retail fuel.<sup>104</sup>

While these mandates might be helpful for alternative energy sources in the transport sector in Queensland and New South Wales, our view is that the energy justice principle of availability is transgressed as the biofuel mandates have not been legislated elsewhere in Australia.

*Victoria.* Pre-dating the 2007 federal Labor government's renewable initiatives, in 2004 the Victorian Labor government established its Sustainability Fund which still receives funds from landfill levies that are redistributed as grants to support programs and initiatives that facilitate recycling, resource efficiency and climate change programs. The fund is guided by the Victorian Waste and Resource Recovery Policy under the Environment Protection Act 1970 (Vic).<sup>105</sup> Over the years the fund has committed over \$1 billion to projects. It currently funds a waste-to-biomass project.<sup>106</sup> The New Energy Technology Sector Strategy covers potential bioenergy projects.<sup>107</sup>

Our view is that while the Sustainability Fund does not directly target biofuels, it demonstrates energy justice principles of accountability, sustainability and intra- and inter-generational equity.

*South Australia.* The RenewablesSA initiative aims to promote the growth of the state's renewable energy industry. South Australia already has large-scale renewable energy generation via solar, and wind. It has hydrogen and bioenergy strategies.<sup>108</sup> The Renewable Technology Fund of 2017 can provide loans or grants support biomass projects, while

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101 Dianne Glenn, 2017, above n 98; KPMG, "Bioenergy State of the Nation Report: A report on Australia's bioenergy performance," 2018, above n, 2.

102 See NSW Department of Planning and Environment < <https://energy.nsw.gov.au/renewables/renewable-generation/bioenergy> >.

103 International Energy Agency (IEA), "Bioenergy: Roadmap development and implementation," 2017, above n, 74.

104 The Australian Competition and Consumer Commission (ACCC) has a bulletin on fuel mandates < <https://www.accc.gov.au/consumers/petrol-diesel-lpg/biofuels>>. See *Liquid Fuel Supply Act 1984* (Qld) and *Biofuels Act 2007* (NSW).

105 See Environment Protection Authority Victoria, < <https://www.epa.vic.gov.au/> >.

106 The Victorian Government, Sustainability Fund, < [https://www.environment.vic.gov.au/\\_\\_data/assets/pdf\\_file/0031/392935/SustainabilityFund20171819.pdf](https://www.environment.vic.gov.au/__data/assets/pdf_file/0031/392935/SustainabilityFund20171819.pdf) >.

107 Department of Economic Development Jobs Transport & Resources, "New Energy Technologies. Second Strategy", (Melbourne: Victorian Government, 2016).

108 Tim Johnson et al., "A Bio-energy Roadmap for South Australia. 'The Jacobs Report'," 2015, above n, 7. See also South Australia Renewables: < <http://www.renewablesa.sa.gov.au/about> >.

its 2018 Regional Growth Fund grants can apply to sustainability projects.<sup>109</sup> Typically government loans are a policy lever, providing an alternative means to reduce the cost of project capital through access to low interest rates.<sup>110</sup>

Our view is that South Australia has a focus on wind and solar energy with its initiatives driven by a change to extremely dry climatic conditions across the state. This preference has been led by a grassroots interest in renewables.<sup>111</sup> While the various fund initiatives do not specifically target biofuels, they demonstrate the energy justice principles of intra- and inter- generational equity and sustainability for renewables.

*Other states and territories.* The Northern Territory has the federal Northern Australia Infrastructure Facility (NAIF) established in 2016 to provide up to \$5 billion in low-interest loans to encourage private sector investment in economic infrastructure.<sup>112</sup> The NAIF applies to projects across northern Australia, generally above the Tropic of Capricorn. There is no specific funding for bioenergy initiatives.

The Tasmanian government encourages bioenergy investment. In July 2016, the government set up the Wood and Fibre Processing Innovation Program, with funds of \$1.25 million. The Australian Capital Territory (ACT) has no specific funding for bioenergy initiatives, although since 2014 the three ACT bioenergy plants together generate 4.4MW of energy, and it is exploring net zero precincts. In Western Australia there are no government grants or incentives that offer support to the development of the bioenergy sector, although there are bioenergy plants that generate around 1MW of energy.<sup>113</sup>

Through access to federal funds, northern Australia and the ACT are progressing towards lower emissions, however in terms of energy justice, Tasmania and Western Australia show poor accountability to their constituents in relation to carbon reduction and climate change, much less for biofuels. The schemes are summarised in Table 4.

**Table 4. States and Territories: Energy schemes**

State	Date	Scheme
Queensland	2016	Biofutures 10-Year Roadmap and Action Plan
	2017	Biofuels Mandate
	2019	Resource Recovery Industry Development Program
New South Wales	2007	Biofuels Mandate
Victoria	2004	Sustainability Fund
South Australia	2009	RenewablesSA
	2017	Renewable Technology Fund
	2018	Regional Growth Fund

109 See Renewable Technology Fund, <https://virtualpowerplant.sa.gov.au/sites/default/files/public/attachments/energy-investment-guidelines.pdf> >; and Regional Growth Fund, < <https://www.regional.gov.au/regional/programs/regional-growth-fund.aspx> >.

110 International Energy Agency (IEA), "Bioenergy: Roadmap development and implementation," 2017, above n, 74.

111 Cole Latimer, 'Renewable boom despite lack of policy, banker says,' *The Age* (Melbourne), 5 March 2019.

112 Dianne Glenn, 2017, above n 98. See also Northern Australia Infrastructure Facility (NAIF), < <https://naif.gov.au/about-naif-finance/naif-key-facts/> >.

113 *Ibid.*

Australian Capital Territory	2014	Bioenergy plants
Northern Australia	2016	Northern Australia Infrastructure Facility
Tasmania	2016	Wood and Fibre Processing Innovation Program
Western Australia		NIL

We have explored government fiscal support, such as the federal taxation system or federal and state direct grants and loans, which might encourage biofuels research, innovation and investment around Australia. In the first instance, our findings suggest that recent federal tax changes indicate a negative effect on biofuel innovation investment. These changes include the 2014 repeal of the carbon tax;<sup>114</sup> the long delay from the 2016 RDTI tax concession inquiry to the 2018 Bill; and the 2015 introduction of fuel excise on biofuels and removal of the alternative fuel offset grant. In perusing the website that covers the RDTI tax concession inquiry,<sup>115</sup> there is a dearth of bioenergy organisations among the 69 submissions, and little lobbying for biofuel mandates from the southern states of Australia.

Also there is the limited introduction of biofuel mandates, i.e. in only two states. Further, the current fiscal policy situation lacks coordination between state and national governments, including the many and varied renewable energy grant schemes.

## 5 Conclusions and future research

This paper has aimed to re-think Australian government tax law and policy to encourage investment in innovative research into biofuels towards economic and environmentally sustainable outcomes. We have discussed the Australian case study findings gathered from selected biofuel reports from 2007 to 2011, a period of time when the expectation of stability in government policy for research and investment was the norm. Thus policy stability, which enables long-term research and investment planning, is the salutary point for contemporary policy makers. Also discussed was the consistent call over the 2007 to 2011 period for government fiscal support for innovative biofuels research and development, which was followed by years of a slow degradation in support.

In attempting to determine the type of fiscal support that might encourage biofuels research, innovation and investment in Australia, we instead found that recent taxation changes suggest a negative effect on biofuel innovation. Changes have included the repeal of the carbon tax; the long delay from the 2016 RDTI tax concession inquiry to the present. The negative impact is further compounded by the 2015 introduction of excise for biofuels; and the lack of a national mandate for biofuels. Also, current fiscal policies reveal a lack of coordination between the state, territory and national governments that provide the scarce, albeit varied, renewable energy grant schemes.

We recommend that the RDTI tax incentive impasse be settled promptly, and that a national co-ordination of grant schemes needs vital attention and reconsideration of a carbon tax.

We note the shift in research focus to wind and solar as sources of renewable energy, which is now at a scale not envisaged in 2007 (the ‘golden’ era of biofuels research). Wind and solar have emerged as the dominant sources of renewable energy in South Australia

114 *Clean Energy Legislation (Carbon Tax Repeal) Act 2014* (Cth).

115 Submissions: Making Sure Multinationals Pay Their Fair Share of Tax in Australia, < [https://www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Economics/TLABMultinationalsTax/Submissions](https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Economics/TLABMultinationalsTax/Submissions) >.

driven by grassroots interest. However, such a grassroots movement may not be as likely to facilitate biofuel innovation.

The Morrison government, through its Fair Dinkum Power policy, promotes hydrogen as the preferred future source of renewable energy. However, it has not dismissed coal as the energy to be utilised to separate hydrogen from water. This is of concern to those who advocate a reduction in GHG emissions.

A greater diversity of resources is needed in the energy mix. Biofuels are currently a minor component and we believe this shortfall needs to be redressed by tax law and government policy as part of a just transition to a low carbon economy. This paper contributes to that debate.

The authors seek to significantly impact the success of Australia's bio economy and will be engaging further with decision makers. In future research into bioenergy production we plan to empirically apply the energy justice framework through the use of metrics. Data will be gathered about selected countries to derive costs to compare bioenergy infrastructure projects.

**Appendix 1. 'Energy Justice' elements found in Australian biofuel studies, 2007-2011**

i. O'Connell, D., Batten, D., O'Connor, M. et al. (2007). Biofuels in Australia: Issues and Prospects A Report for the Rural Industries Research and Development Corporation (RIRDC). Canberra: RIRDC. 84pp.

Economic	Political	Environmental	
<p>Economic opportunities for regional Australia from bioproducts.</p> <p>Aim is for economic production of biofuels to a target to 10-20% of transport market.</p>	<p>Lists national and state policies for biofuels. But policy discussion is limited.</p>	<p>Discusses GHG and climate change as drivers for biofuels industry.</p> <p>Land and water impacts of biofuels ie. use of crop and forest residues for feedstock and implications on ecosystem and sustainability.</p> <p>Energy security as an emerging issue.</p> <p>Health outcomes from biofuels may be positive. eg. reduction in diesel particulate emissions if change is made to biodiesel.</p> <p>Transition to a sustainable future</p>	

ii. Batten, D., & O'Connell, D. (2007). Biofuels in Australia: Some Economic and Policy Considerations. A Report for the Rural Industries Research and Development Corporation (RIRDC). Canberra: RIRDC. 56pp.

Economic	Political	Environmental	
<p>Economic and policy issues raised about the production of liquid biofuels in Australia and overseas.</p>	<p>Bioenergy security policy concerns. Partly resolved by biofuels.</p>	<p>Refers to the Rudd government's proposed emissions trading system of 2007-2010 to reduce greenhouse gases (GHG). But this report overall has a minor environmental emphasis.</p>	

iii. Australian Academy of Technological Sciences and Engineering (ATSE). (2008). Biofuels for Transport: A Roadmap for Development in Australia. Melbourne: ATSE. 111pp.

Economic	Political	Environmental
<p>Technical rather than economic report.</p> <p>Aims to explore future biofuel feedstock and processing options</p> <p>Purpose to underpin next phase of government policy for start-up and scale-up of the biofuels industry.</p>	<p>Concerns over energy security.</p> <p>GHG abatement.</p> <p>Land and water use.</p> <p>Taxation: R&amp;D tax incentive should be extended to bioethanol &amp; lignocellulosic feedstocks.</p> <p>Biofuels research needs to be better funded.</p> <p>Australia needs to develop clear-cut long term policies for biofuels.</p> <p>Policy Issues include:</p> <ul style="list-style-type: none"> <li>• Biofuels must be seen as a component of an overall policy for security and sustainability.</li> <li>• In the short to medium term the need will be for supplementation of fossil fuels for transport.</li> <li>• The potential for increased production of Generation 1 biofuels from current resources is limited. Without significant changes, bioethanol and biodiesel will remain a small fraction of transport fuels.</li> <li>• Future focus must be on Generation 2 biofuels based on bioethanol from lignocellulosic materials and on biodiesel from algae.</li> </ul>	<p>Raises issues of 'food versus fuel'. The positives for Generation 1 biofuels are 'huge tracts of level poor-quality land, magnificent sunlight, abundant saline water.'</p> <p>International sustainability criteria are still evolving.</p> <p>Biofuels sustainability includes:</p> <ul style="list-style-type: none"> <li>• the production chain GHG balance is favourable;</li> <li>• biomass production is not at the expense of existing carbon sinks, both vegetation and soil;</li> <li>• biomass production does not endanger food supply and existing business activities such as local supply of energy, medicines or building materials;</li> <li>• biomass production has no negative impact on biodiversity (protected or vulnerable biodiversity is unaffected or strengthened);</li> <li>• soil and soil quality are retained or improved;</li> <li>• ground water and surface water are not depleted and water quality is maintained or improved;</li> <li>air quality is maintained or improved</li> </ul>

Five main citations, 2009-2015; more minor citations

iv. CSIRO, & Future Fuels Forum. (2008). Fuel for Thought:

The future of transport fuels: challenges and opportunities. Canberra: CSIRO. 44pp.

Economic	Political	Environmental
<p>Economic modelling based on assumption of high oil prices and peak oil.</p> <p>Report based on quantitative data.</p> <p>Assumed retention of emissions trading scheme and high oil prices.</p> <p>Use of algae as a new feedstock for biofuels was promoted.</p> <p>Advocates:</p> <ul style="list-style-type: none"> <li>• Accelerated scrapping of road vehicles 15 years or older</li> <li>• Increasing the rate of fuel excise by a factor of 5 over 40 years</li> <li>• Mandatory improvements in vehicle fuel efficiency</li> <li>• A \$2000 subsidy for low emission and alternative fuel vehicles.</li> </ul>	<p>The government energy policy of 2008 concerns active reduction of GHG through emissions trading scheme (ETS).</p> <p>Energy security concern over reliance on oil-based fuels.</p> <p>One policy idea was to increase fuel excise in order to reduce GHG.</p> <p>Risks attached to both market-based policies, and government interventionist policies.-</p> <p>Issues over public versus private passenger transport. Government reluctance to improve public transport.</p> <p>Provides examples of areas of co-intervention impacting upon transport across at least two levels of government whether federal and state and/or local:</p> <ul style="list-style-type: none"> <li>• Road funding</li> <li>• Vehicle registration</li> <li>• City infrastructure</li> <li>• Fuel excise rates</li> <li>• Rail, sea and aviation infrastructure</li> <li>• Industry development fuel research expenditure.</li> </ul>	<p>Environmental impact low due to confidence in the federal Rudd government's proposed carbon pollution reduction scheme (CPRS).</p> <p>Expectation of success with research on carbon capture and storage to deal with GHG emissions from coal.</p>

8 main citations, 2008-2013; more minor citations

v. Warden, A., & Haritos, V. (2008). Future Biofuels for Australia: Issues and opportunities for conversion of second

Generation of lignocellulosics. Canberra: Rural Industries Research and Development Corporation (RIRDC). 53pp.

Economic	Political	Environmental
A technical report. However some economic issues raised concern a move to feedstock of lignocellulosic biomass, such as native grasses and non-food plants.	Policies and politics not discussed, although research gaps identified.	nil

Six main citations, 2008-2014; more minor citations

vi. L.E.K. Consulting. (2011). Advanced Biofuels Study: Strategic Directions for Australia: Summary Report and appendix. Sydney: L.E.K. Consulting. 104pp.

Economic	Political	Environmental
<p>-A technical report on pathways and likely non-food feedstock for advanced biofuels (ABF), with large emphasis on economics.</p> <p>Optimism about scalability of algae as a feedstock for ABF.</p> <p>ABF needs to become cost competitive.</p>	<p>Insufficient investment in infrastructure, such as via R &amp; D funding.</p> <p>Government needs to support industry-led action.</p> <p>Government should provide a platform for gaining investor and stakeholder investment confidence. -</p> <p>Undertake a legislative and regulatory audit to identify and address non-complementary legislation and revise accordingly.</p> <p>Claims Australia's biofuels policy sits at the intersection of energy, environmental and regional development policies.</p>	<p>ABF can provide a more sustainable alternative to Generation 1 biofuels as they are based on non-food feedstock. -</p> <p>ABF biomass sources include waste streams (agriculture, forestry, household and industrial).</p> <p>Some consideration of GHG effect on the environment.</p> <p>The report refers to an economically sustainable industry. For example one that fosters a feedstock conversion industry and refining capacity.</p>

Three main citations, 2011-2018; more minor citations

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