4

Energy on farms

4.1 Energy in agriculture is becoming an increasingly important issue on farms for economic and environmental reasons. Savings in electricity and fuel costs are another incentive to improve energy efficiency. Improving the efficiency of energy use on farms can also help to reduce greenhouse gas emissions associated with burning fossil fuels. The uptake of farming practices that already promote resilience in the face of weather and climate variability, such as those in Chapter 3, may also offer the additional benefits of reducing energy usage.

4.2 The Rural Industries Research and Development Corporation (RIRDC), guided by the National and Rural Research Priorities of the Australian Government notes that:

> Demand for alternative feedstocks for fuels, electricity, chemicals and a range of commercial products has grown dramatically throughout the world in the early years of the 21st century…
>
> Australia faces a complex set of challenges and opportunities with respect to future energy supplies, policy and technology. An unprecedented interest in bioenergy in the international arena, as well as Federal and State governments who are keen to promote new industries, and investors and engineers keen to promote new biofuel and bioenergy technologies, means that bioenergy is becoming a tangible option for the future. A move to bioenergy will have major implications for farms and regions.
>
> High oil prices are already having an impact on agriculture as input costs increase, not just for fuel, but for other products reliant on oil such as fertiliser. Farming systems have been partly buffered from increasing oil prices due to changes in the way systems run (for example legumes reducing dependence on nitrogen-based fertilisers, minimum tillage etc) but are reaching

> limits and are increasingly 'energy exposed'. The challenge is to become more energy efficient and self-sufficient at farm and regional level.[1]

Energy efficiency

4.3 Energy is a significant portion of the running costs incurred in modern agriculture. If the cost of energy is to increase as predicted, savings in electricity and fuel costs are one incentive to improve energy efficiency. Many of the farming practices detailed in the Chapter 3 that promote the increase of soil carbon, also make credible claims to reduce energy usage and greenhouse gas emissions on-farm.

4.4 Controlled Traffic Farming (CTF) for example, uses less energy than conventional farming. In its submission to the Committee, the TIAR points to some of the broader environmental benefits of CTF:

> Reduced greenhouse gas emissions due to:
>
> - reduced on-farm energy consumption due to less tillage, lighter draft loads and more efficient use of tractor power, and
> - reduced carbon losses as a result of less tillage, reduced energy consumption in the manufacturing and transport sectors due to lighter equipment and less fertiliser manufactured and transported.[2]

4.5 In evidence to the Committee, Dr Jeff Tullberg of the ACTF Association demonstrated the many advantages of CTF, pointing to some of the less obvious energy saving benefits:

> It is well known that, by reducing tillage, you reduce the amount of fuel you use, so you reduce the amount of carbon dioxide that gets produced as a result of burning diesel fuel…When you are no longer tilling the soil, you are disturbing it very little, and most of your fuel is actually used to carry this weight around the paddock. If you are going on permanent wheel tracks which are hard you use a lot less fuel—about half the fuel. Those are the emissions related to diesel fuel use—and, as I say, that is commonly known.
>
> People often do not consider the energy that goes into producing herbicides, which is one of the issues of zero tillage. In controlled

1 http://www.rirdc.gov.au/programs/new-rural-industries/bioenergy- bioproducts-and-energy/program-overview/program-overview_home.cfm, accessed 12 January 2010.

2 Tasmanian Institute of Agricultural Research, Submission no. 15, p. 5.

> traffic, because you grow more crops and because you can get onto ground quicker, you can deal with weeds when they are smaller, you can use less active ingredients and you get reduced herbicide use. But the big one in terms of energy going into modern cropping systems … is nitrogen fertiliser. These figures are worked out on the basis of perhaps 50 kilograms of nitrogen per hectare, which might be a reasonable Australian broadacre situation. There is very little difference between conventional mulch tillage and zero till. This is a significant improvement in controlled traffic again because of course you do not put fertiliser on permanent wheel tracks and because you do not get the inefficient fertiliser use associated with compacted soil.[3]

4.6 The Murray Irrigators Support Group gave evidence to the Committee about the energy saving potential of Fast Watering technology used in conjunction with Padman Stops[4]:

> Gravity or surface irrigation, as we said, is 80 per cent of our irrigation and has little or no energy cost. There has been a bit of emphasis for irrigators to convert to a pressurised system, such as centre pivot, drip or spray, but what will happen is that their energy costs will increase, as will the amount of carbon they put out. One thing we are trying to do is retain our gravity irrigation system and make it efficient. We know that it can be just as efficient as the other systems, but the great thing is that there is not much cost there. Most of it is already there and it is low carbon.[5]
>
> That leaves us with the question of pumping water for irrigation. Pumping water has significant implications for carbon pollution, and I am sure that is of interest to this committee. The energy costs that come from putting water into a pipe, be it centre pivot, sprinkler system or drip, are significant. Work done by Guangnan Chen and Craig Baillie[6] shows that a pressurised irrigation farm can use three times the energy overall that a gravity fed farm might use. Currently a large amount of irrigation in Australia,

3 Dr Jeff Tullberg, Executive Committee Member, Australian Controlled Traffic Farming Association, *Transcript of Evidence*, 14 July 2009, p. 45.

4 A Padman Stop is a watertight rubber flap set in a concrete structure that makes it easy to automate gravity flow water, thus reducing the loss of water from leaking bay outlets.

5 Mr John Padman, Murray Irrigators Support Group, *Transcript of Evidence*, 3 September 2009, p. 42

6 National Centre for Engineering in Agriculture, University of Queensland.

> prior to Water for the Future, is under gravity fed systems or has a component that is fed by gravity.[7]

4.7 The 2005 document, *Landcare Australia: Meeting the Greenhouse Challenge* has some more general advice from farmers, to farmers, for improving on-farm energy efficiency:

> The type of fuel used in vehicles and machinery will influence the amount of greenhouse gases they emit when operating. Purchasing a new vehicle that uses an alternative fuel, such as liquid petroleum gas (LPG), or converting existing vehicles to make them compatible with alternative fuels, can reduce greenhouse gas emissions, improve air quality, and reduce running costs.
>
> Landcare Greenhouse Challenge participants identified the following ways to increase energy efficiency on their farms:
>
> - Select energy efficient machinery, appliances and vehicles when making purchases, and replace old, inefficient equipment.
> - Conduct regular maintenance on existing equipment to improve efficiency.
> - Adopt minimum till practices to reduce fuel consumption.
> - Use alternative fuels where possible (e.g. LPG).
> - Install renewable or alternative energy sources, such as solar panels, to supply electricity.[8]

4.8 There are also numerous smaller ways to reduce and conserve energy usage on farms. A Canadian study, 'Energy and the Canadian Food System,'[9] suggests that by taking a holistic approach, major savings in energy on farms may be made. Many of the examples in the study have a corresponding practice for which submissions were received by the Committee. For example:

- Tillage systems and physical manipulation of the soil
- Irrigation and soil moisture control
- Renewable energy production
- Plant species selection

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7 Mr John Padman, Murray Irrigators Support Group, *Transcript of Evidence*, 3 September 2009, p.45.

8 *Landcare Australia: Meeting the Greenhouse Challenge*, Department of the Environment and Heritage, 2005, p. 20.

9 *Energy and the Canadian Food System with particular reference to New Brunswick*, Stuart B. Hill & Jennifer A. Ramsey, McGill University, Quebec, 1977.

Other practices in the study may only be relevant in the context of Canadian agriculture or climate but remain as examples of what might be achieved through a focus on energy efficiency.

Energy efficiency in agricultural industries

4.9 A review prepared by the CSIRO in 2008 for Land & Water Australia offered advice for government on the location of agricultural industries for improved energy efficiency:

> Clustering of compatible industries with intensive livestock production, in order to tighten or close the resource loop, is another option. Agricultural industrial parks that co-locate industries involved in waste processing, energy generation, water capture and recycling, feedstock and foodstuff manufacture etc with livestock production have the option to reduce energy demand from fossil fuels and increase value in the value chain. The siting of these agricultural industrial parks should be determined after considering the potential for increased exposure of the site to climate change.[10]

4.10 The National Agriculture and Climate Change Action Plan 2006-2009 offers a series of strategies to reduce energy demand in agriculture as well as along the agricultural industry supply chain. While no real action is suggested, it is evidence that the issue has been acknowledged.[11]

Alternative energy

4.11 It is clear from the evidence presented to the Committee that there is significant interest in developing alternative energy sources for on-farm use and as a supplementary income stream. Initiatives within the bioenergy industry offer opportunities for creating energy from waste or by-products from agriculture and forestry.

4.12 In its submission to the Committee, the Grain Growers Association made a case for alternative energy sources on-farm as a supplementary income

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10 "An overview of climate change adaptation in the Australian agricultural sector – impacts, options and priorities." CSIRO, 2008, p. 262.

11 http://www.daff.gov.au/__data/assets/pdf_file/0006/33981/ nat_ag_ clim_ chang_action _plan2006.pdf, accessed 11 January 2010.

stream, and as an important contribution that farmers can make towards a low carbon economy:

> We should also look for other new revenue streams for farmers and regional Australia such as the harvesting of solar and wind energy and the production of renewable fuels. These new potential enterprises can be implemented on Australian farms right now if the correct incentives are put in place. New enterprise opportunities will assist to provide greater resilience to rural and regional communities, improved employment and investment opportunities and place Australia in a strong position for a changed climate and a low carbon economy.[12]

4.13 In particular, the submission from the Grain Growers Association called for:

- Continued development of, and support for, renewable fuel sources such as biofuels as part of a wider strategy of energy security. Australia should encourage the use of biofuels and if necessary continue to mandate these into the fuel system. Farmers should be encouraged to use biodiesel on farm, which can be locally produced as an alternative to petrochemical diesel from the oil industry. The government should reconsider its approach to fuel excise to facilitate such developments.
- Diffuse energy generation opportunities across Australia, should be encouraged, particularly on farms, including solar and wind power generation and small scale biofuels production. That is, as well as large scale investments, that individuals be encouraged to have household or small business generation sets to cover the immediate site power requirements and may be able to contribute back into the power grid. Such a strategy would relieve the need for new coal powered systems and make greater use of the natural resources of wind and sun available to Australia. [13]

4.14 In evidence to the Committee, Mr Hansard of the National Association of Forest Industries also identified alternative energy options as potential opportunity:

> Another key market signal is the full recognition of wood biomass for the generation of bioenergy. The current regulations under the National Renewable Energy Target Scheme only partially recognise wood biomass for the creation of renewable energy credits. The result is a significant lost opportunity to rural and

12 The Grain Growers Association, Submission no. 46, p. 3.

13 The Grain Growers Association, Submission no. 46, p. 9.

> regional Australia, in terms of jobs and investment, and a continued heavy reliance of Australia's economy on fossil-based energy.[14]

4.15 Another approach to optimising alternative energy opportunities is the conversion of diesel engines to run on alternative fuels. Bennett Clayton Pty Ltd is an engine technology company that specialises in converting diesel engines into alternative fuels including LPG, LNG and bio-alcohols (methanol and ethanol). In its submission to the Committee, Bennett Clayton outlined a current project and some of the benefits:

> Bennett Clayton is currently working with farmers in the Riverina to develop alternatives to diesel engines used by rice farmers to pump water from deep bores. Bennett Clayton has invested significant R&D in developing a conversion for a commonly used engine (John Deere 6068) from diesel to LPG.
>
> In the first instance LPG was chosen as a locally available fuel, and the technology has been structured for easy local manufacture. The converted engines are essentially ready to operate on renewable fuels (methanol or ethanol) that could in future be produced locally from local farm products (lignocellulose).[15]
>
> The converted engines have been very successful, reducing the cost of operating the pumps from $51 per megalitre of water pumped to $38 per megalitre of water pumped (on current fuel prices). The engines have also shown emissions reductions of up to 94% (particulates and NOx).[16]
>
> These changes can have a very significant impact in the farm irrigation sector, both by offering farmers greater efficiency, and by reducing emissions. As the engines are essentially ready for renewable bio-alcohols, farmers could transition to an on-farm produced bio-alcohol (e.g. methanol) fuel as soon as production technology, currently in development, becomes available…
>
> These alternative fuel engines have demonstrated reliability, having operated in the field for thousands of hours. They exhibit extremely low emissions, and reduced CO_2 production. They are more economical than diesels, both in fuel cost, and in maintenance…

14 Mr Allan Hansard, Chief Executive Officer, National Association of Forest Industries, *Transcript of Evidence*, 24 June 2009, p. 2.

15 Bennett Clayton Pty Ltd, Submission no. 72, p. 1.

16 Bennett Clayton Pty Ltd, Submission no. 72, p. 2.

> However, the take up of these engines in the market is hampered by the distortion created by the Commonwealth diesel fuel rebate. Farmers enjoy a Commonwealth Government rebate of about 38c per litre for diesel fuel used on the farm.[17]

Bioenergy on farms

4.16 Bioenergy is renewable energy made available from materials derived from biological sources. Bioenergy is also the term used to describe the many varied ways of utilising biomass to create fuel for energy.

4.17 The bioenergy industry in Australia is starting to offer viable alternatives for farmers to produce on-farm energy, sequester carbon, and profit from selling biomass. In its submission to the Committee, CSIRO categorise the different technological pathways for the production of bioenergy:

> There are many different technological pathways to producing biofuels, bioelectricity and other bioproducts. The various production pathways can be broadly grouped into:
>
> - First generation technology - which means that it is already used by commercial enterprises.
> - Second generation technology - this represents a step change in technology - it has been physically demonstrated but is not yet commercial due to scale-up issues, or it is not commercially viable due to very high conversion costs.
> - Third generation technology - this means that the process is at the conceptual planning stage, 'on drawing board' or at bench top demonstration stage, but has a long way to go before it can be deployed.
>
> Each of these different technologies has close links to the types of biomass that can be used to feed the process (known as biomass feedstocks). In addition to the types of technologies and feedstocks, assessments must be made in relation to the current production base for biomass (i.e. what is already being produced in Australia) as well as future production base (which may include new and novel plant species, or changes in land use to produce energy crops or forests etc).[18]

4.18 The submission continued:

> Different parts of the plant can be used with different technologies. For example with a cereal crop, ethanol is currently

17 Bennett Clayton Pty Ltd, Submission no. 72, p. 3.

18 CSIRO, Submission no. 19, p. 15.

produced only from grain using first generation technology. By moving production to use second generation technologies however, the fate of the stalks or stubble from the grain could be diverted away from the current system of being retained in a minimum tillage system (or in some areas being burnt), to being

- co-fired in the a coal fired power station to produce bioelectricity
- converted into ethanol via enzymatic technologies
- converted directly into syndiesel using thermochemical processes
- converted by pyrolysis into biochar and syngas (which could be used to produce syndiesel or run a turbine for bioelectricity)
- in future, being fed into a biorefinery to make a range of bioproducts (e.g. bioplastics, adhesives) as well as energy or fuel as a co-product.[19]

Working bioenergy plants

4.19 There are plants producing bioenergy in operation in a number of industries that use readily available biomass that would otherwise be a waste product. The Australian Pork Limited submission to the Committee described an early bioenergy project still in operation:

> …Australia's first on farm anaerobic digester in 1989 at Berrybank Piggery… is still generating heat and power for use on site and exporting electricity back into the grid. (Unfortunately, biogas capture and use is yet to be widely adopted across the industry due to the poor return on investment faced by pig producers, which has been exacerbated by low cost of coal fired electricity).[20]

4.20 Sugar mills in Australia have a readily available source of feedstock in the form of bagasse, the fibrous residue remaining after sugarcane is crushed to extract the juice:

> Australia's sugar industry is now using a "waste" by-product - bagasse - to co-generate over 1000 GWh of electricity per annum plus a similar amount of heat. The heat is used to crystallise the sugar, while most of the electricity is exported to the grid.[21]

19 CSIRO, Submission no. 19, p. 16.

20 Australian Pork Limited, Submission no. 16, p. 12.

21 CCRSPS Network, Submission no. 10, p. 9.

4.21 The Committee is also aware of a macadamia nut factory in southern Queensland that produces power from nut shells to run its operations (20%) and feeds the rest back into the grid (80%).[22]

4.22 Extensive research and development has been carried out in Western Australia, where Verve Energy operated a pilot Integrated Wood Processing (IWP) plant for several years, using advanced pyrolysis technology developed by the CSIRO to process oil mallee biomass:

> Combined with eucalyptus oil extraction, the IWP offers the potential to commercialise charcoaling, carbon activation technology and renewable electricity generation. The technology was developed in Australia by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), which Verve Energy adapted to electricity generation. Production from mallee tree feedstock of three marketable products - activated carbon, renewable electricity and eucalyptus oil - allows the mallee chain to be viable for farmers and developers alike.[23]

4.23 Up to 10 potential sites around the state were identified for future IWP plants to be built:

> Basically, wherever there are substantial plantings, and access to the Transmission System on to the grid, there is an opportunity to build an IWP plant.[24]

4.24 The Western Australian energy minister Francis Logan issued a media statement just prior to the end of plant operation discussing the improved commercial attractiveness of the technology:

> I have asked Verve Energy to seek expressions of interest from within the private sector about the commercial application of this technology. There is still a long way to go but I believe this technology represents a terrific opportunity for investment, at the cutting-edge of renewable energy production. With the right kind of investment, five to 10 mallee-tree generators could be built for the Wheatbelt and generate up to 50MW of electricity. Not only will this improve electricity reliability issues in the South-West,

22 http://www.agl.com.au/sustainability/Pages/energy-from-macadamia-nut-shells.aspx, accessed 14 December 2009.

23 http://www.verveenergy.com.au/mainContent/sustainableEnergy/OurPortfolio/iwp.html, accessed 14 December 2009.

24 http://www.oilmallee.org.au/wood_processing.html, accessed 11 January 2010.

> but also provide farmers with an additional income source, particularly on land affected by salt.[25]

4.25 The plant received $20 million of funding from numerous government agencies. Despite the cited commercial potential the plant closed down in 2006 at the end of its demonstration period.

Biochar

4.26 Renewable energy is one of the by-products of biochar production (see Chapter 2). The biofuel produced in the biochar process is often syngas, which is a mixture of mainly hydrogen and carbon monoxide, with a little carbon dioxide. The proportions of the three gases vary according to the processes used to create the syngas. However, the important point is that syngas is combustible and so can be used as a fuel source. Depending on the process, the biofuel from the kiln could also be bio-oil, which can be used as a substitute for diesel in some engines.[26]

4.27 As discussed in Chapter 3 the biochar itself may be used as a soil conditioner. A 2009 CSIRO report explains the potential, and slightly competing, outcomes of different biochar processes:

> Biomass ('feedstock') for biochar production can comprise most urban, agricultural and forestry biomass such as wood chips, saw dust, tree bark, corn stover, rice or peanut hulls, paper mill sludge, animal manure and biosolids. Under controlled conditions (i.e. in a pyrolysis plant), about 50% of the carbon in biomass is converted to biochar while the remainder is used for the pyrolysis process and bioenergy (heat, stream, electricity) production, the exact ratios depending on the type of production (e.g. fast vs. slow pyrolysis), biomass source and set conditions of pyrolysis…
>
> Sustainable production of biochar occurs as part of bioenergy production from pyrolysis of sustainably-produced biomass, which may be in the form of thermal energy, synthesis gas ('syngas'; e.g. hydrogen, methane, carbon monoxide) or bio-oil. Yields of biochar are reduced when yield of energy obtained from the system is increased. However, as calculated by Gaunt and Lehmann (2008), while the energy gain decreases if biochar is added to soil instead of being burnt for further heat production

25 http://www.oilmallee.org.au/pdfs/Fran Logan_Milestones at Mallee Plant.pdf, accessed 11 January 2010.

26 *The basics of biochar*, Background Note, Parliamentary Library, 10 September 2009, http://www.aph.gov.au/library/pubs/bn/sci/Biochar.htm, accessed 14 December 2009.

> and energy gain, the emission reductions by adding biochar to soil are much greater than the fossil fuel offsets when using the biochar as energy. In other words, if energy maximisation is the key goal, then biochar should be used for further energy generation (mainly heat); however, if emission reductions and climate change mitigation through C sequestration is the aim, then biochar should be captured and added to soil. Additional analysis is required to assess the relative merit (in terms of CO_2-e benefit) of these two pathways and will be largely driven by the CO_2-e intensity of electricity production (i.e. coal versus green power production).[27]

4.28 In evidence to the Committee, Mr Dale Park of the Western Australian Farmers Federation suggested that the utilisation of a pyrolysis plant could be an alternative income stream for farmers and offer benefits to the local communities:

> Another avenue of agricultural income would be to produce biomass to burn one way or the other. I would prefer to put it into pyrolysis, and you generate energy with that as well. Giving farmers another option is quite important. Things like bioenergy mean that we will keep people in those rural areas, whereas forestry traditionally has taken people out of those areas and reduced our populations. Maybe some of these new green industries can help keep that population in those country areas.[28]

4.29 Mr David Thompson, of the Northern Inland Forestry Investment Group, in evidence to the Committee, saw a potential source of savings and income for farmers who had lots of trees on their farms. Forestry residues from thinning trees can be used to produce syngas for electricity and subsequently feeding into the grid:

> [The syngas produced] can be used to generate electricity. My understanding from the local expert on pyrolysis is that for that to fly the feed-in tariff for the electricity coming from the pyrolysis plant needs to be around 80 per cent of the current green energy retail price, which I think is 24c, so it needs to be around about 16c.[29]

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27 An Analysis of Greenhouse Gas Mitigation and Carbon Biosequestration Opportunities from Rural Land Use, CSIRO, August 2009, p. 144.

28 Mr Dale Park, Land Management and Climate Change Executive Portfolio Holder, Western Australian Farmers Federation Inc., *Transcript of Evidence*, 24 September 2009, p.12.

29 Mr David Thompson, Project Manager, Northern Inland Forestry Investment Group, *Transcript of Evidence,* 19 August 2009, p. 5.

4.30 Under the Climate Change Research Program, the federal government has provided funding for a research project into biochar, which will target gaps in our understanding of this emerging technology and address uncertainties about its use:

> This project will draw together leading researchers in Australia in the areas of biochar, bioenergy, soil science, emissions management and life-cycle assessment into a national effort, aimed to address key aspects of biochar generation and application in Australian agriculture.[30]
>
> Key activities under the project will include:
>
> - a life cycle assessment of biochar from feedstock source to production to sink, including costs, risks, benefits and implications for farmers
> - categorisation of biochars according to their properties and suggested usage
> - economic assessment of biochar for both net greenhouse gas emissions and potential profitability to land owners
> - analysis of risk factors in terms of rates of applications as well as the potential production of toxic by-products during pyrolysis.[31]

Sources of biomass

4.31 Biomass is material derived from recently living organisms, which includes plants, animals and their by-products. Biomass is the raw material, or feedstock, that is processed to create bioenergy, biochar and other bio products.

4.32 One source of biomass for energy producers and one that could potentially provide supplementary farm income is mallee eucalypts. Oil mallees are already used in integrated cropping and grazing systems, and to assist in salinity control in some areas.[32] The submission to the Committee from Future Farm Industries CRC (FFI CRC) points to current research and future developments for the use of oil mallee as biomass:

> … FFI CRC is developing short rotation woody crops (starting with oil mallees) that will diversify farm income into bioenergy

30 http://www.daff.gov.au/about/obligations/grants_reporting_requirements/november_2009 accessed 14 December 2009.

31 http://www.daff.gov.au/climatechange/australias-farming-future/climate-change-and-productivity-research/emissions_reduction2?SQ_DESIGN_NAME=spaced&SQ_ACTION=set_design_name, accessed 14 December 2009.

32 Future Farm Industries CRC, Submission 67, Attachment B.

> and bio-sequestration enterprises, and add to the resilience of mixed crop-livestock farming and wheatbelt communities.[33]
>
> Specialist cropping, livestock or mixed farmers will have an additional, new enterprise based on woody crops located in harmony with the still dominant crop or grazing enterprises. The current constraint to a viable oil mallee industry - a cost efficient biomass harvester, is now being tackled by FFI CRC. With its commercialisation in 2010-11, farmers will be able to choose between harvesting biomass for energy related products and bio-sequestration of carbon, according to price and farm priorities.[34]

4.33 In evidence to the Committee Mr Hansard, of the National Association of Forest Industries, suggested the forestry industry as a reliable source of biomass:

> I would like the committee to note a complementary activity to the use of wood biomass for energy—that is, the use of wood biomass for the production of biochar. The forest industries welcome the recognition by both sides of parliament about the potential benefits of biochar in storing carbon and improving the productivity of our agricultural soils... The forest industry is the largest source of biomass for the potential production of biochar. The win-win in this is that, while producing biochar, you can also generate heat for energy generation. But, as previously mentioned, we need the correct market signals.[35]

4.34 The National Association of Forest Industries submission to the Committee made a more detailed case for the use of forest industry by-products for biomass:

> Wood waste for renewable energy - There is enough wood waste available from existing forest industry activities in Australia to produce 3 million megawatt hours of electricity per annum. The net benefit of using this wood waste would be a permanent reduction in Australia's greenhouse gas emissions of up to 3 million tonnes of CO_2e per year. Renewable energy from wood waste reduces CO_2e emissions by 95-99% for each MWh of

33 Future Farm Industries CRC, Submission 67, p. 2.

34 Future Farm Industries CRC, Submission 67, p. 3.

35 Mr Allan Hansard, Chief Executive Officer, National Association of Forest Industries, *Transcript of Evidence*, 24 June 2009, p 3.

> electricity generated when compared to coal-fired electricity generation.[36]

Potential negative impacts associated with bioenergy

4.35 A number of submissions brought to the attention of the Committee some of the potentially negative impacts of collection and transportation of biomass required to produce bioenergy. Evidence was also received by the Committee expressing concern about the potential pressures on food production in favour of fuel production.

4.36 The CSIRO submission to the Committee notes that one of the challenging issues with the use of biomass to create biochar or bioenergy is the sourcing of material, and costs of collection and transportation of the biomass to the processing plant:

> Climate change will present a new and developing opportunity for biofuels in Australia. The use of biofuels is one mitigation strategy that can reduce greenhouse gases. However, the production of biofuels may be affected by the impacts of climate change and careful thought needs to go into the location of feedstocks for biofuel production and its relationship with land used for food production. As biofuels is an emerging industry and is not yet locked in to particular locations, it is in a position to take advantage of early planning and to address climate change adaptation issues associated with its supply chain. For example, there is likely to be less reliance on moving production facilities if crop locations could be anticipated in advance…
>
> Production of biofuels is dependent on the quantity and geographic location of the biomass. As such, the production of biofuels will be affected by the adaptation undertaken by the suppliers of these crops to maintain crop quality and quantity.[37]

4.37 One Queensland firm has overcome collection and transportation issues of biomass by offering on-site biomass charcoal production with a fully mobile pyrolysis plant. Claims are also made that some of the off-gases from the processor are used to run the mobile plant.[38]

4.38 A number of submissions also concern expressed about the potential to divert grain or sugar away from human food and animal feed value chains

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36 National Association of Forest Industries, Submission no. 51, p. 4.

37 CSIRO, Submission no. 19, p. 15.

38 http://www.bigchar.com.au/index.htm, accessed 14 December 2009.

for the production of energy. This concern was shared by Australian Pork Limited. In its submission to the Committee, one of the key recommendations for government to maintain a sustainable pork industry was the removal of government assistance for biofuels:

> Mandating ethanol content in fuel and encouraging grain-based biofuel production diverts grain from human food production, creates a food versus fuel relationship and eventually increases food prices for consumers. Incentives must be redirected into second-generation biofuels that are economically viable.[39]

> [F]rom an intensive livestock industry perspective, additional demand for grain distorts local markets and artificially inflates feed grain prices. Coupled with this is the increasing demand for food and international policy support for biofuels, causing world grain prices to trend upward. [There] is a significant threat for the viability of highly grain dependant intensive livestock industries such as the Australian pork industry.[40]

4.39 The submission to the Committee from the Victorian Government also expressed concern about the impacts of grain production diverted away from food to fuel:

> Other policies may affect Victorian farming businesses through impacts on market prices and market access. For example, the decision of the US Government to promote biofuels is an example of a policy risk for Australian farm businesses originating in another country. The policy diverted grain production away from food to fuel leading to upward pressure on grain prices. This benefited Australian wheat growers, but adversely affected dairy farm businesses, feed lotters and piggeries that purchase grains to finish cattle for market.[41]

4.40 In its submission to the Committee the Australian Academy of Science pointed to a global trend of increasing pressure on food agriculture to supply biomass:

> A further pressure is now emerging with the world's attention turning to renewable sources of energy. Most countries are converting, to a greater or lesser extent, to ethanol and biodiesel to deliver part of their energy needs. It is a sobering thought that Australia does not have enough arable land to satisfy its current

39 Australian Pork Limited, Submission no. 16, p. 5.

40 Australian Pork Limited, Submission no. 16, p. 16.

41 State Government of Victoria, Submission no. 73, p. 8.

> fuel needs as biofuels, even if no food crops were grown. In the US for example, already there are concerns about impact on food supply as the total corn crop in some States has been redirected to the biofuels industry which is likely to consume up to 80% of the total US corn crop in the next few years. It is now clear that whilst arable land resources are static there will be competition for that land between the food industry and the biofuels industry. The demand for agricultural produce is likely to intensify.[42]

Research and development

4.41 Several submissions to the Committee called for increased government support for alternative energy options as well as research and development opportunities.

4.42 While significant research has already been undertaken by government bodies, industry, and individuals to improve and develop energy on farms, there is still much work to be done.

4.43 In evidence to the Committee, Mr Hansard, of the National Association of Forest Industries, stressed the emerging nature of bioenergy in Australia:

> …these opportunities for our industry and for agriculture are just evolving now. We do not have all the answers as to the commercial side of this, and this is where we really need help from the government in order to put some good research into this sort of thing and look at the economic viability of these sorts of systems. We know that it can be done, because it is done overseas. In relation to the recognition and use of wood biomass, we are behind a lot of the other Western countries. We know it can be done; what we need is some good research into how it fits in to Australia and how we can actually do it so that it is commercially viable.[43]

4.44 Ms Narelle Martin, in her submission to the Committee, raised the question of how prepared Australian farming may be for very high oil prices. She advocated accelerating the pace of research to assist farmers exploit the potential opportunities in bioenergy:

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42 The Australian Academy of Science, Submission no. 48b, p. 8.

43 Mr Allan Hansard, Chief Executive Officer, National Association of Forest Industries, *Transcript of Evidence*, 24 June 2009, p. 7.

> Not only is equipment used by farmers run on diesel fuel, but many fertilisers and pesticides are derived from oil based products. Climate change and the increasing costs of fuel pose a major challenge for farming and rural communities. A useful question to ask is what happens with farming when oil hits a price of US$300 a barrel? How will price rises in these farm inputs, an outcome of a confluence of costs that will arise from climate change and issues associated with Peak Oil, be managed and mitigated?
>
> There is an urgent need for research to be undertaken and accelerated on alternative fuel stocks, and adapting current technologies so that they can more easily use other fuel stocks. At the moment, we transform petroleum based energy into food and fibre, a situation that is unsustainable.
>
> There are also significant opportunities for farmers and farming communities to take advantage of climate change. Traditionally, farmers and farm lobby groups identify themselves as providing food and fibre for the world. There should be two more planks for the farming mantra: as generators of power, and harvesters of carbon. In both cases, there are significant potential opportunities for farmers to be able to increase the range of income streams…
>
> There is considerable potential for rural research and development to assist farmers to identify and adapt to such innovation. Identifying policy roadblocks and regulations that act as constraints on the development of innovative power generation is one area. Assisting in developing models so that ideas and applications can be trialled on a small pilot scale would be of considerable assistance.[44]

4.45 Australian Pork Limited (APL) funds research into on-site bioenergy and greenhouse gas mitigation. Pork production is heavily energy and fuel dependant and APL funds a number of projects for alternative energy production with pig waste and other initiatives that aim to save energy. The covered anaerobic pond and the anaerobic digester are two waste management systems that can be successfully used to collect methane for generating electricity. The submission to the Committee from Australian Pork Ltd., identified some of the research needs for bioenergy in the Australian pork industry:

44 Ms Narelle Martin, Submission no. 14, pp. 1-2.

> … key information gaps remain around bioenergy including performance of lagoons as well as production systems in differing climates and the lack of experience among technology providers to build, commission and operate biogas capture systems.
>
> Significant progress has been made towards commercialisation of on-farm methane capture and use via the Federal Government's Methane to Markets in Agriculture Program, to which APL is the largest financial co-contributor. However, further R & D work is required to make these technologies truly commercial, for example: a wider demonstration of the technology, particularly of the proposed sludge management techniques, developing lower cost digesters for smaller sites, and technologies better able to digest deep-litter bedding. Additionally, a critical mass needs to be developed to reduce construction and operating costs. Equally important is the extension work to make information available to pork producers, their consultants and technology providers.[45]

4.46 Some of the current APL funded projects related to alternative fuels include:

- Using piggery waste to generate electricity
- Anaerobic digestion of livestock wastes
- Assessing the performance of lagoons and covered anaerobic lagoon digesters
- Since 2007 APL and pork industry partners have been the leading financial co-contributors to DAFF's *Methane to Market (M2M) in Agriculture* program, which has led to the following projects being jointly funded:
  - ⇒ Retro-fitting floating covers with biogas flaring at a 700 sow piggeries
  - ⇒ Use of biogas for shed heating.[46]

Committee conclusions

4.47 The Committee is of the view that promoting energy efficiency on farm and promoting the use of alternative fuel sources are an integral part of adaptation to climate variability and climate change. This is a complex issue, involving concerns about commercial viability and competing

45 Australian Pork Limited, Submission no. 16, p. 13.

46 Australian Pork Limited, Submission no. 16, p. 12.

demands for resources. Finding practical alternatives to current energy sources, and practical alternative uses for agricultural waste have clear benefits.

4.48 The Committee is encouraged by the range of practices already available for farmers that have the multiple benefits of reducing energy usage and increasing enterprise resilience. It is also encouraging to note that the potential impacts of increased energy costs on agricultural industries are being acknowledged. The Committee supports existing research into energy efficiency for agricultural industries.

4.49 The Committee believes that increased incentives for use of alternative energy on farms are needed. The potential benefits, both economic and environmental, mean that some priority should be given to such research as part of the overall research strategy for agriculture and climate change. The Committee concludes that there needs to be continued investment in research into bioenergy and its applications for agriculture and its associated industries. It is the Committee's view that the funding and support for research and development into alternative energy sources be continued and increased.

Recommendation 6

4.50 **The Committee recommends that the Australian Government, as part of its overall response to issues affecting agriculture and climate change, increase its investment and support for research into energy efficiency in the agriculture sector and the development of alternative energy and alternative fuels on-farm, particularly in regard to:**

- **Biofuels;**
- **Biomass from agricultural waste; and**
- **Biochar.**