



Department of  
Primary Industries

# Water & energy productivity in irrigated agriculture

Finding effective  
solutions to the cost  
price squeeze

By Luke Jewell



# Overview of talk

- Australian and NSW primary industry energy sources and use trends
- Which industries use most energy and why
- Water use efficiency vs energy productivity – the 'nexus'
- Energy sources and emissions
- NSW DPI Climate Change and Energy program
- Addressing policy and making the grid work for industry



# Who cares about energy anyway?

## What are the main energy-related concerns for farmers?

### Cost

of energy was the number one concern



for 75% of gas users,  
66% of diesel users,  
and 59% of electricity users

### Reliability

was also a concern



for 35% of electricity users  
and 21% of diesel users

## What are the biggest barriers to decreasing on-farm energy costs?

73.5%



High up-front cost of investment

63.2%



Low return on investment

31.8%



Unsure of how to choose appropriate technologies

28.2%



Technology changes too quickly

27.7%



Unsure of how to implement appropriate technologies

10.1%



Need to see others in my industry succeed first

8.1%



Lack of interest

At a glance

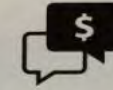
## ECONOMIC CHALLENGES FACING AUSTRALIAN BUSINESS

Directors have rated energy policy and pricing, tax reform and infrastructure development as the big issues of 2018.



Energy policy

58%



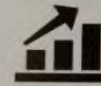
Taxation reform

47%



Infrastructure

42%



Productivity growth

35%



International competitiveness

29%

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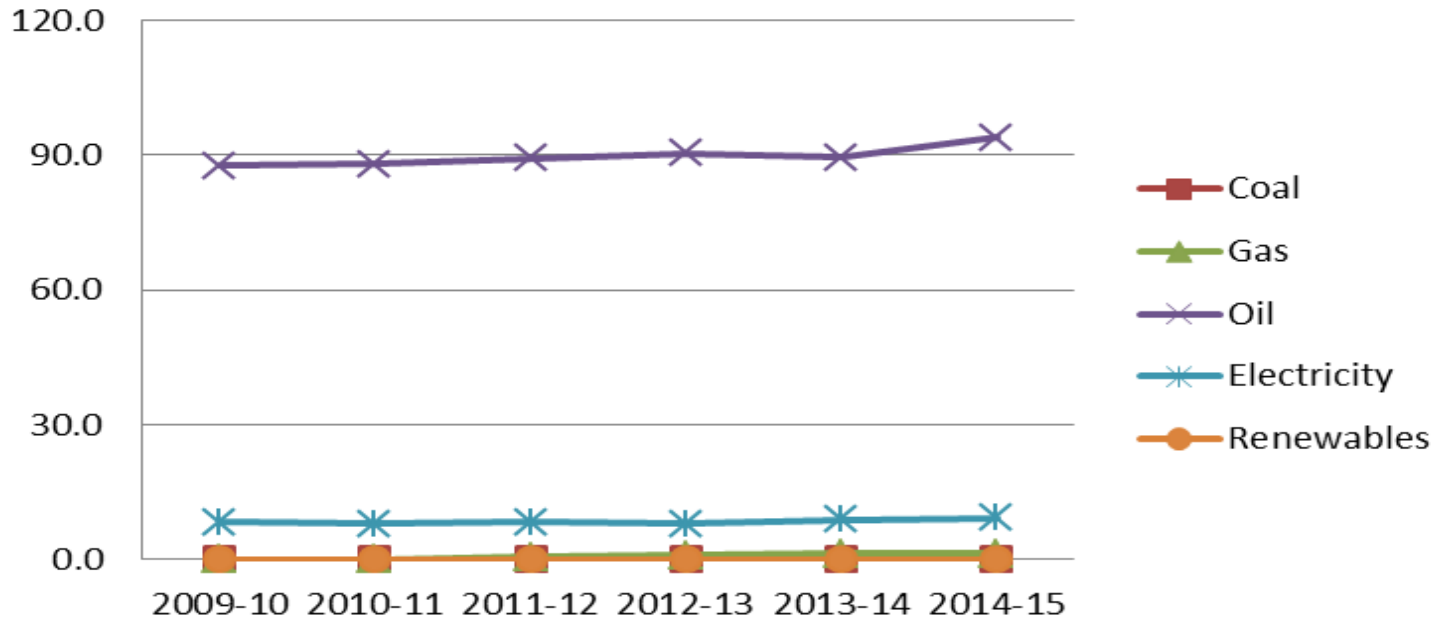
# ARENA study – renewable energy opportunities in water sector

	ALL	AGRICULTURE & IRRIGATION	URBAN WATER
High Priority (Mean Rank <4.5)	D. Storage technologies E. Small scale solar PV/wind	C. Agricultural water use F. Renewables ready infrastructure G. Water/energy/food nexus	B. Bioenergy I. Water sector collaboration
Medium Priority (4.5<Mean Rank<6)	H. Water supply & climate change	I. Water sector collaboration	F. Renewables ready infrastructure
Low Priority (Mean Rank >6)	A. Desalination	B. Bioenergy in wastewater	C. Agricultural water use G. Water/energy/food nexus

*“Economic and engineering analysis to establish an energy baseline in irrigated agriculture, and correlate the relationship between energy and water. Factor and quantify the potential savings in both energy and water” – ag stakeholder future research focus.*

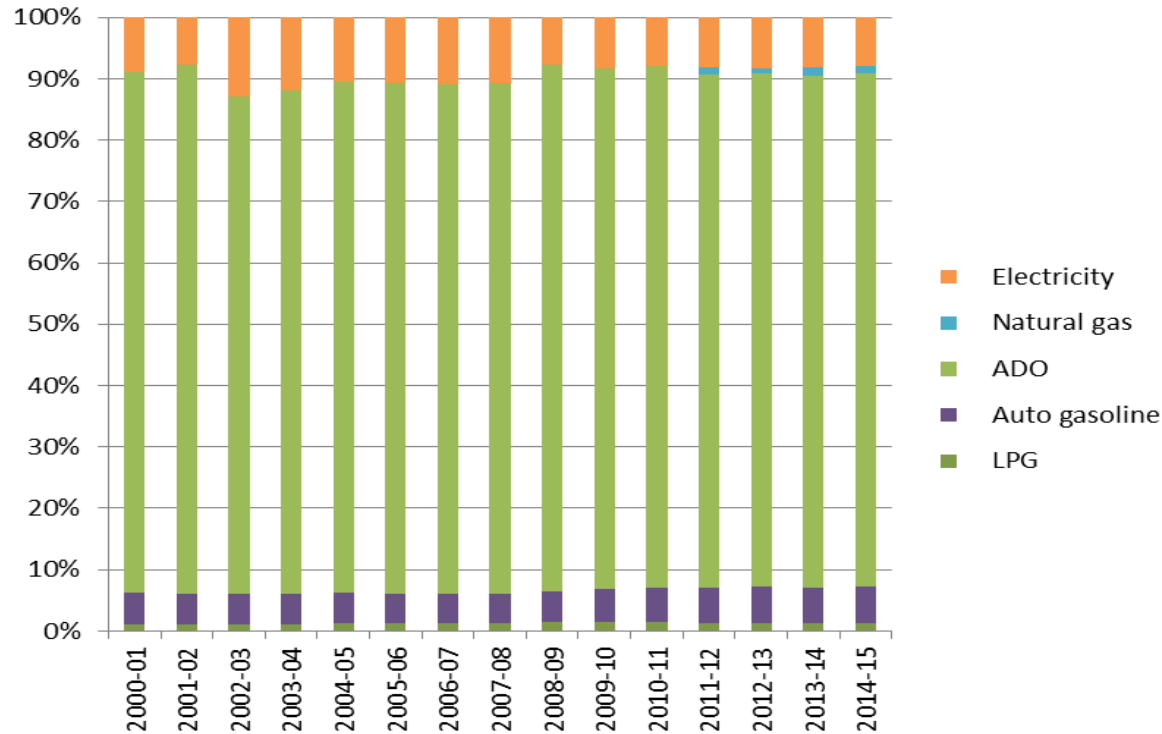
# Australian agriculture energy use trends

Final energy consumed Aust agriculture x fuel PJ/yr



- Final energy consumption is the energy consumed in end use sectors. It excludes energy consumed or lost in conversion and distribution.
- Diesel use has grown in ag.

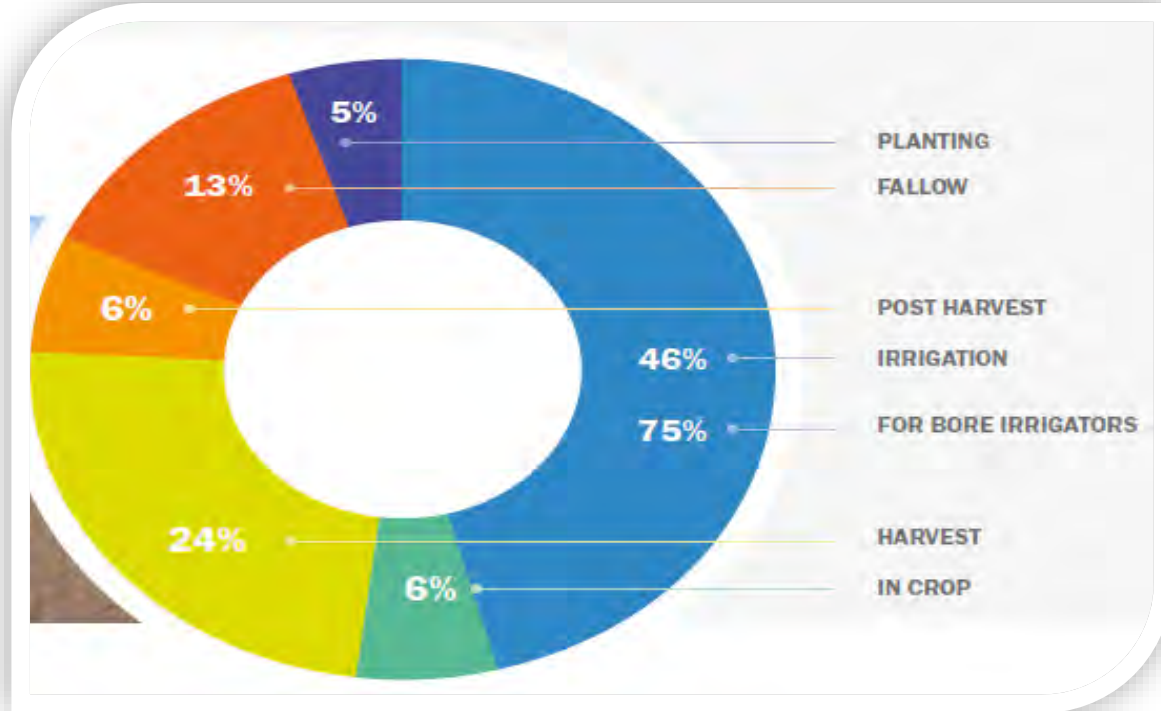
# Energy sources in NSW agriculture



- 'ADO' = Automotive Diesel Oil
- Highly dominant source of energy in NSW/Aust agriculture.



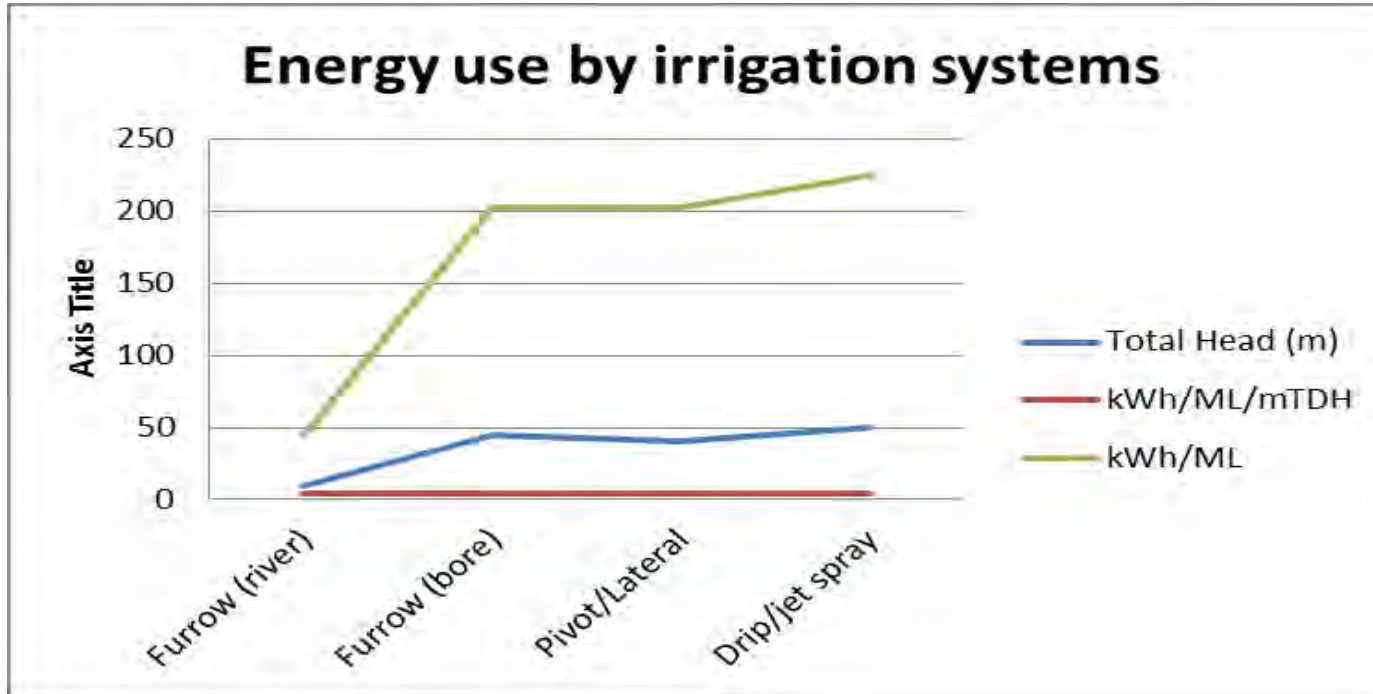
# Energy use – cotton direct on-farm



- ~%50 - 75% energy used in irrigation
- ~ 80% is diesel powered
- Benchmark is

Source: Powell & Welsh (2016)

# Water energy nexus



- Push towards WUE can result in increased energy use

Indicative 2014 irrigation grid electricity consumption for different systems and total dynamic head Source: Eyre, Alexandra et al. 2014



# Energy costs vs water use efficiency

## Irrigators switch watering systems to save power



Share on Facebook



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ABC Rural Laurissa Smith

Posted 30 July 2013 at 12:20 pm

**Rising power costs have forced some irrigators in southern NSW to revert to less efficient ways of watering crops.**

Darlington Point irrigator Matthew Stott admits drip irrigation, which uses less water but more power to run, is no longer viable.

Mr Stott, who produces winegrapes, almonds, popcorn and cotton, says growers are torn between saving money and saving water.

"There's no doubt drip is the most efficient way to irrigate in terms of water efficiency because you give the plant what you want on a daily basis.

"You're not getting the over-watering, under-watering patterns of a weekly cycle of flood irrigation.

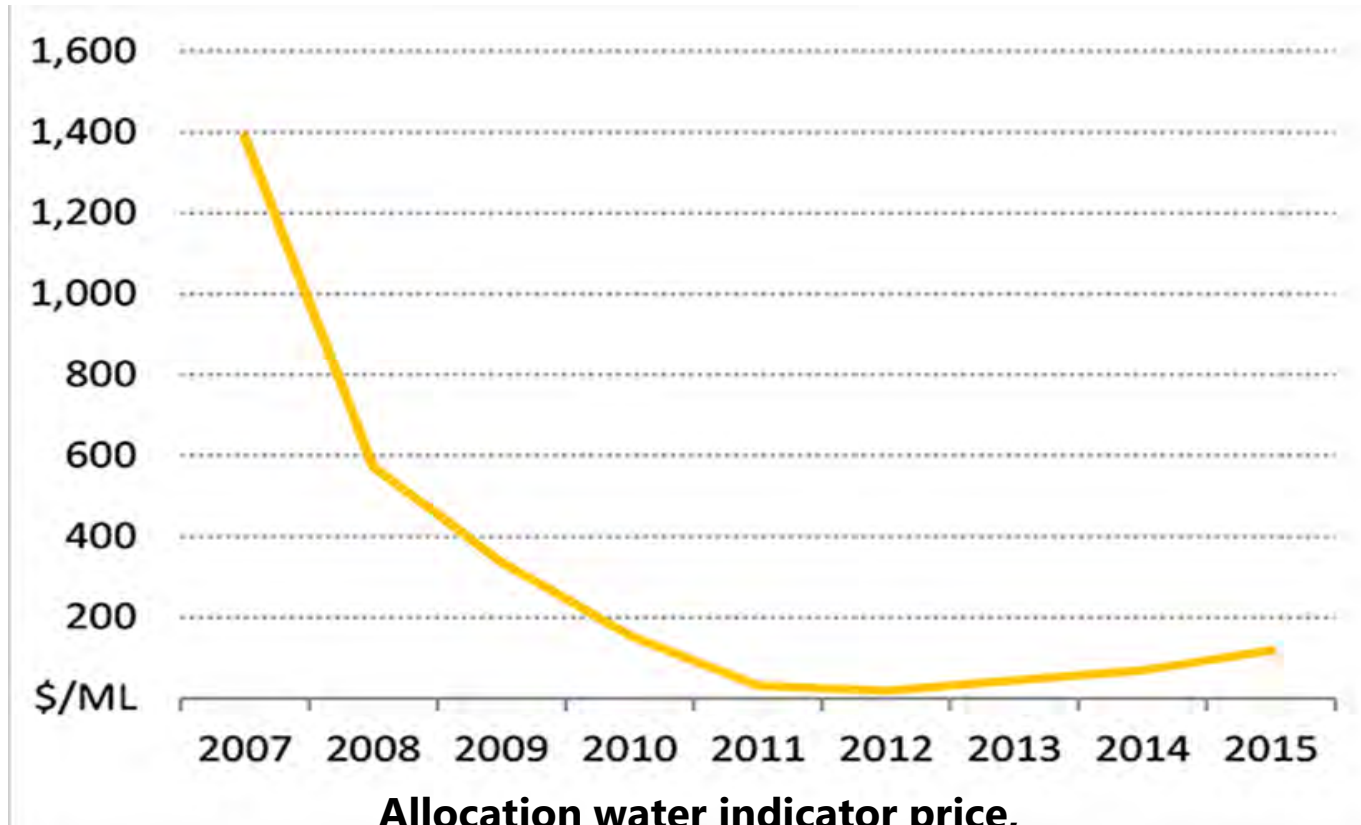
"But now the price of power, and just of energy in general, is pricing those sorts of systems right out. Now you can't afford to do it."

Mr Stott says pumping costs for bore water on his farm have jumped from \$45 per megalitre three years ago to \$70 per megalitre.



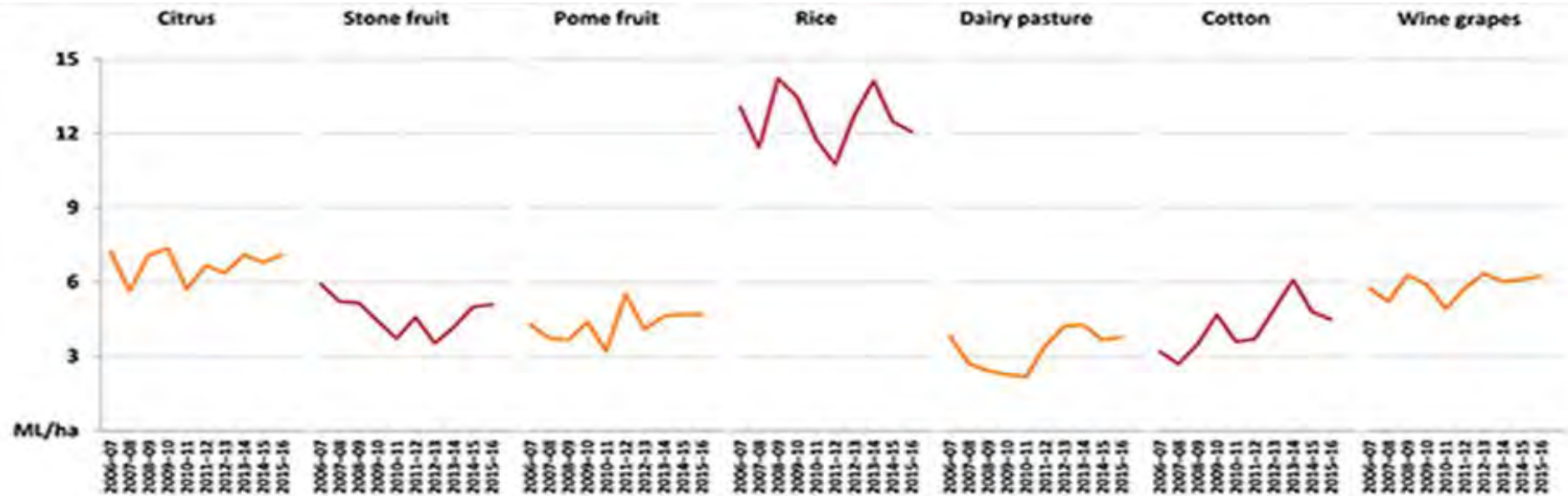
Cotton Australia says over the years growers have invested in more energy intensive equipment to reduce their water use, but that's now become cost prohibitive (Laurissa Smith)

# Water price vs energy cost



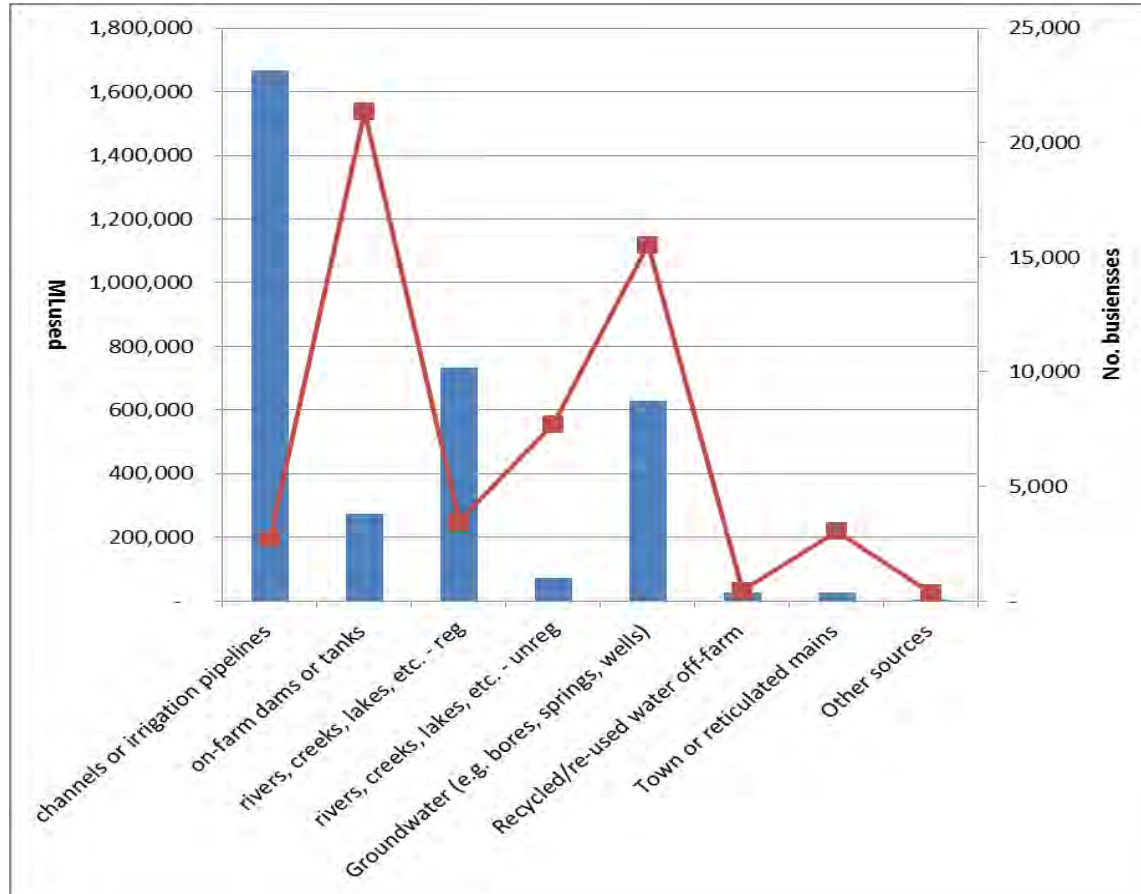
**Allocation water indicator price,  
southern Basin, 2007 to 2015**

# Water application rates vary by crop by year (2006-2016)

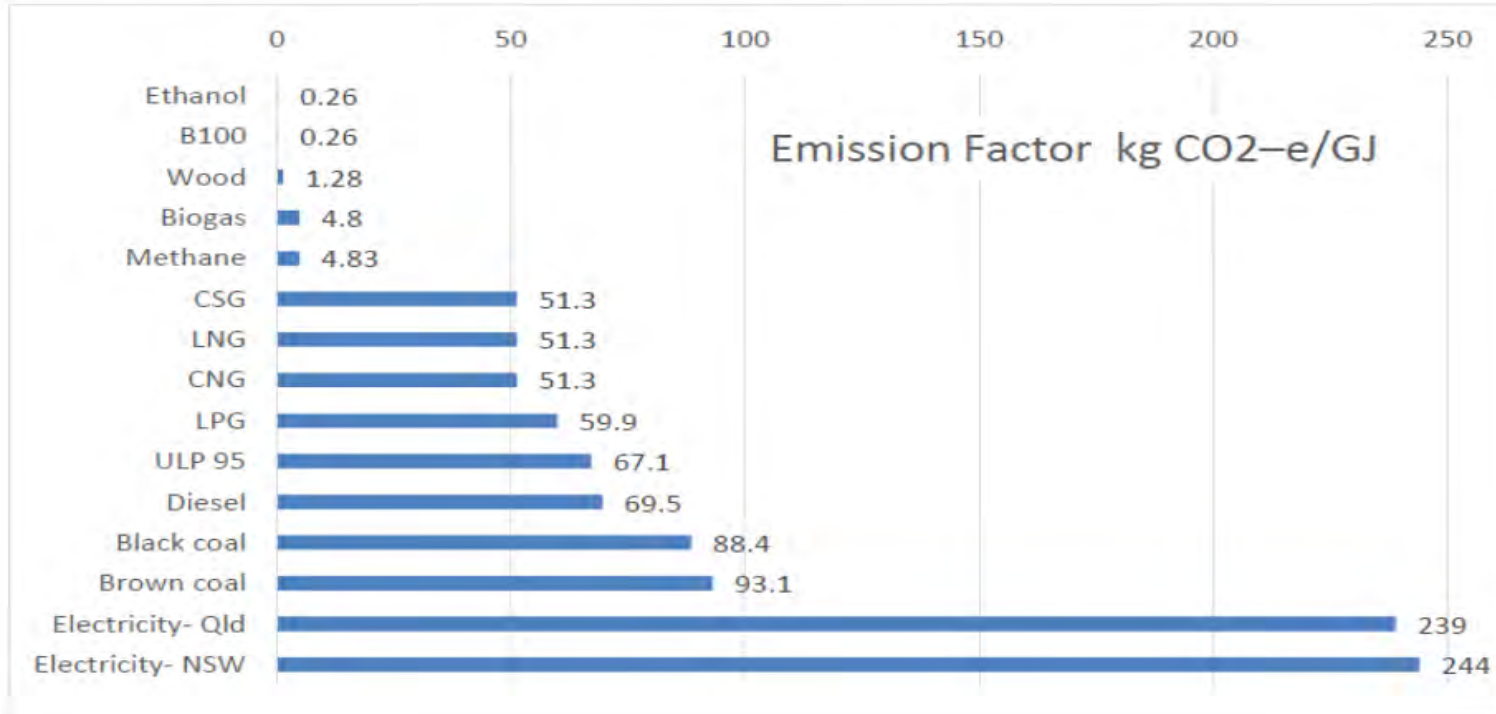


Water application rate, by commodity, Murray–Darling Basin 2006-7 to 2015-16 (ABARES Irrigation survey data)

# Water sources drive energy use



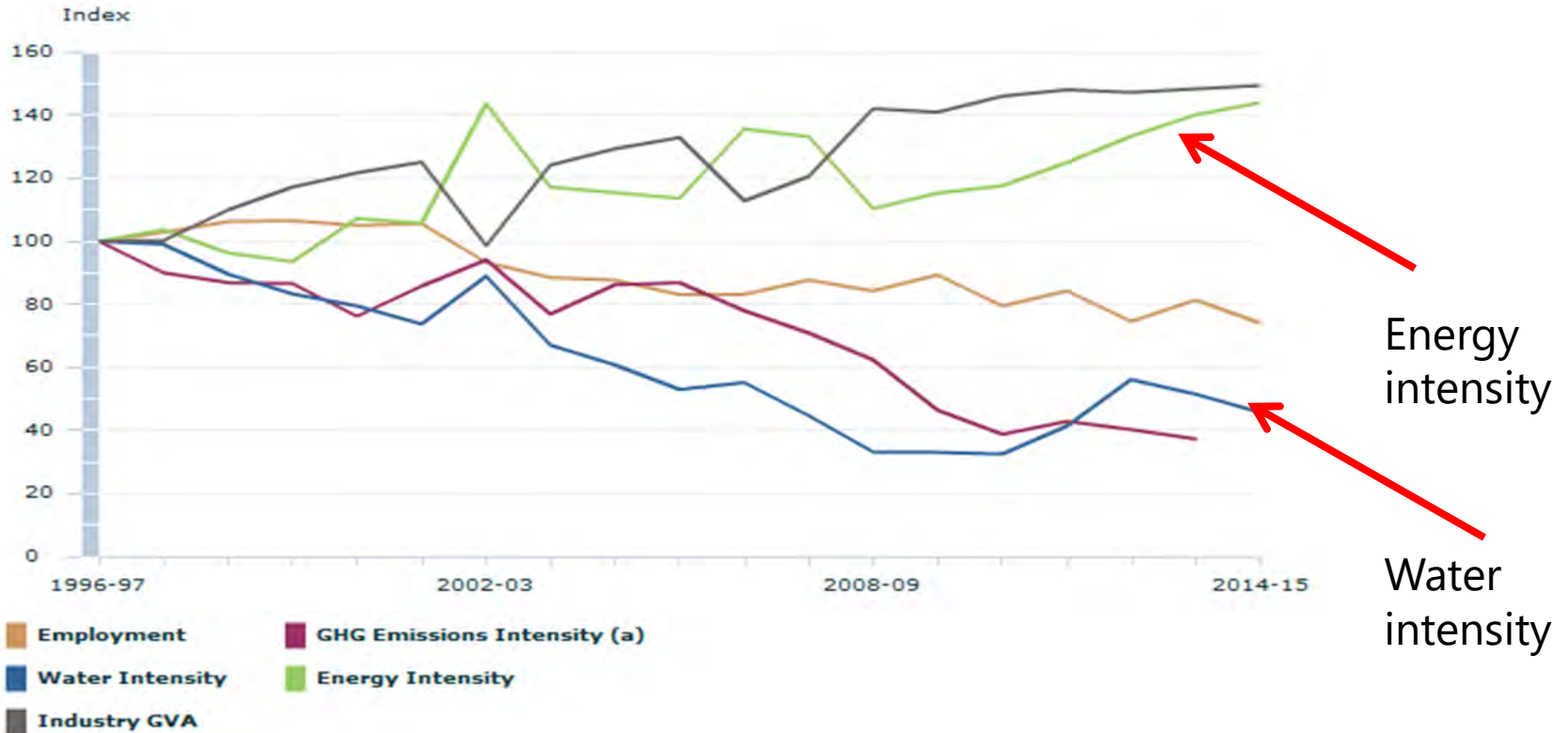
# Emissions from various energy sources



Department of Climate Change and Energy Efficiency emission factors (National Greenhouse Account Factors 2013). NB Electricity (NSW) Scope 2 and 3 emissions factors - consumption of purchased electricity by end users .



# Ag energy vs water use intensity



Save Chart Image

Australian Bureau of Statistics

© Commonwealth of Australia 2017.



# NSW Climate Change Fund

- NSW Government has been consulting with agencies and the community on the expenditure of \$500 million from the Climate Change Fund (CCF) since December 2016
- DPI has been developing a strategy and a range of projects to assist the sector respond to rising energy costs and continue to contribute to economic growth in NSW as the climate changes
- A suite of projects specifically targeted at the NSW primary industries sector has now been approved for funding in 2018.



# Primary Industries Climate Change Strategy

Growing primary industries under climate change



Department of  
Primary Industries

## DRIVERS

Higher temperatures
Increased drought frequency & intensity
Increased rainfall variability
More extreme weather events
Changes to quality of water for irrigation
Changes to ocean currents
Ocean acidification
Increased energy costs
Creation of new markets for carbon
Falling cost of renewables
Concerns about network capacity and reliability

## RISKS

Reduced productivity and profitability
Decreased yields and pasture availability
Reduced water availability
Changes to fish growth and breeding
Spread of pests and diseases into new areas
Impacts on ecosystems
Social and health impacts on regional communities

## OPPORTUNITIES

Investment in renewable energy
Increased energy efficiency
Reduced reliance on energy grid
Carbon sequestration
Emissions reduction to achieve targets

## PRIMARY INDUSTRIES CLIMATE CHANGE STRATEGY

Energy Security	Work with electricity generators and landowners to investigate and trial the use of biomass in energy generation
	Fund research projects to support clean energy for regional NSW
	Help primary industries plan for net zero emissions
	Develop a new website so farmers earn extra income by accessing carbon markets such as the Emissions Reduction Fund
Energy Efficiency	Help energy-intensive primary industry businesses identify options to improve their energy efficiency and reduce costs
Protecting Local Communities	Support farmers to pilot projects that build resilience in rural communities and primary industry sectors
	Deliver cutting-edge research and knowledge to better understand the vulnerability of our agricultural sector, and town and rural water resources

## OUTCOMES

Increased productivity and profitability (↑ \$/yr)
Improved resilience to extreme weather (↓ \$ loss/extreme weather event)
Yield reductions mitigated (↑ \$/ha)
Safeguard from energy price increases (↓ \$/kWh)
Increased energy efficiency (↓ kWh/t output)
New income streams from energy generation (↑ \$/year)
Growth of industries in new areas (↑ \$/year)
Improved protection from pests and diseases (↓ \$ loss/year)
Carbon sequestered and emissions reduced (↓ CO <sub>2</sub> /t output, ↑ t CO <sub>2</sub> /ha stored, ↑ \$/year)

# Current work to support clean energy

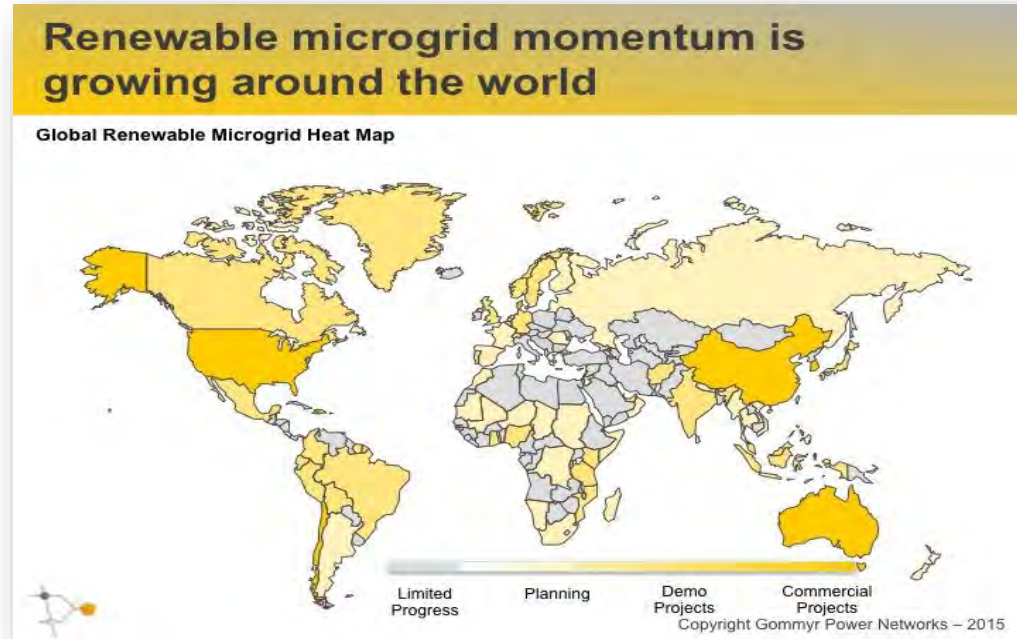
- Social research to identify the major impediments to adoption of hybrid or off-grid renewable energy;
- Investigation of energy demand profiles in regional NSW and opportunities to address gaps in the existing energy networks;



India's first 1MW canal-top solar power plant at Chandrasan village near Mehsana, 45 kms from Ahmedabad on World Earth Day, April 22, 2012. (BCCL)

# Mid to long term outcomes

- Using case studies to investigate micro-grids as a potential practicable solution to energy network 'bottle necks' in regional NSW, and rising energy costs.
- Achieving a positive outcome for the sector will also likely involve NSW developing and advocating for policy and regulatory reforms to the national energy market rules administered by Australian Energy Regulator and the Australian Energy Market Operator.





# Useful resources - checklists

## Solar Diesel Hybrid Pumping Systems

A checklist for solar irrigation quotes



## Grid Connected Solar Pumping Systems

A checklist for solar irrigation quotes



Available on NSWFA and OEH websites

# Useful resources - websites

## [NSW Farmers - Ag Innovators](#)



The AgInnovators website header includes navigation links for Projects, News, Case Studies, Events, Videos, About, and a Subscribe button. Below the header, there are two featured content blocks. The first block shows a man speaking with the text "Energy productivity: New thinking needed about regional electricity supply". The second block shows a solar battery with the text "Solar power: Solar battery calculator".

### News & Opinion

[View all](#)



#### Solar for irrigation

New checklists help farmers assess their suitability for solar



#### Biofuels

Home biogas: turning food waste into renewable energy



#### Biofuels

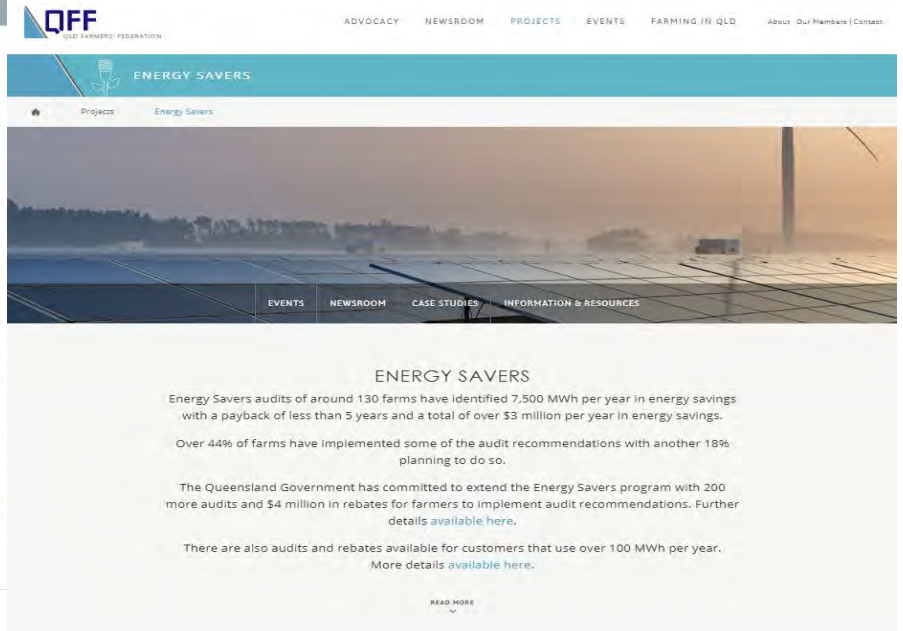
\$14m project to turn livestock waste into profitable bioproducts



#### Greenhouse technology

WA's world-first 'solar glass' set to power self-sustaining agri-oases

## [QFF - Energy savers](#)



The QFF Energy Savers website features a navigation menu with links for Advocacy, Newsroom, Projects, Events, and Farming in QLD. The main content area includes a large image of solar panels and a navigation bar with links for Events, Newsroom, Case Studies, and Information & Resources. Below this, there is a section titled "ENERGY SAVERS" with the following text:

Energy Savers audits of around 130 farms have identified 7,500 MWh per year in energy savings with a payback of less than 5 years and a total of over \$3 million per year in energy savings.

Over 44% of farms have implemented some of the audit recommendations with another 18% planning to do so.

The Queensland Government has committed to extend the Energy Savers program with 200 more audits and \$4 million in rebates for farmers to implement audit recommendations. Further details [available here](#).

There are also audits and rebates available for customers that use over 100 MWh per year. More details [available here](#).

[READ MORE](#)



# Battery storage – emerging but expensive

[Charge Works consultancy & training](#)



Alternative Energy Consultants

Thank you!

Questions?

