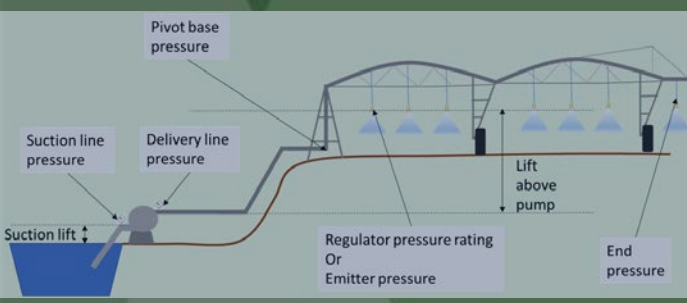
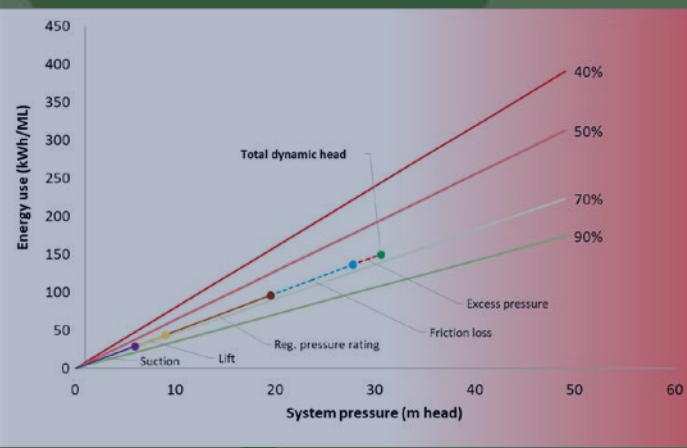




# Energy Decision Support Tool: a tool to improve energy efficiency of irrigation systems

APEN  
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# Focus of the presentation

- Need for the tool
- Development of the tool
- Learnings from the use of the tool
- Where to from here

# The Goulburn-Murray Irrigation District

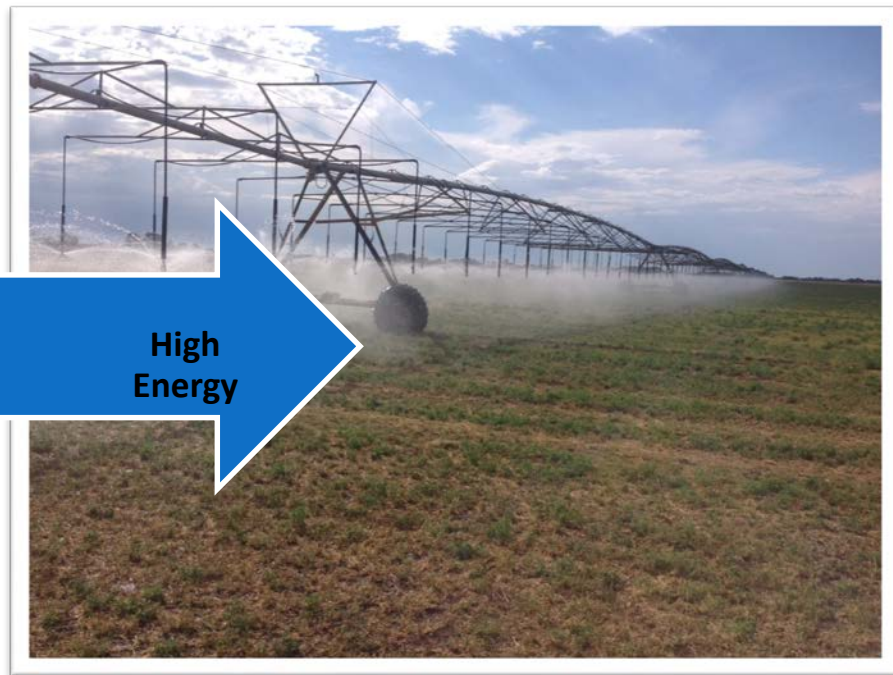
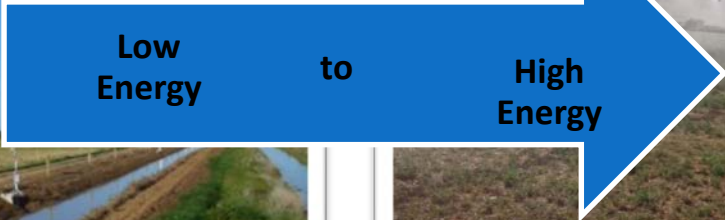
- The Goulburn-Murray Irrigation District (GMID) is in Northern Victoria, Australia and has ~15,000 farms
- The District is a flat, intensively irrigated floodplain with a gravity-fed irrigation supply network.  
650,000 ha irrigated land (and changing)



# Irrigation Methods Changing

Over 220 CPLM irrigators in the SIR in 2018 up from <20 2008

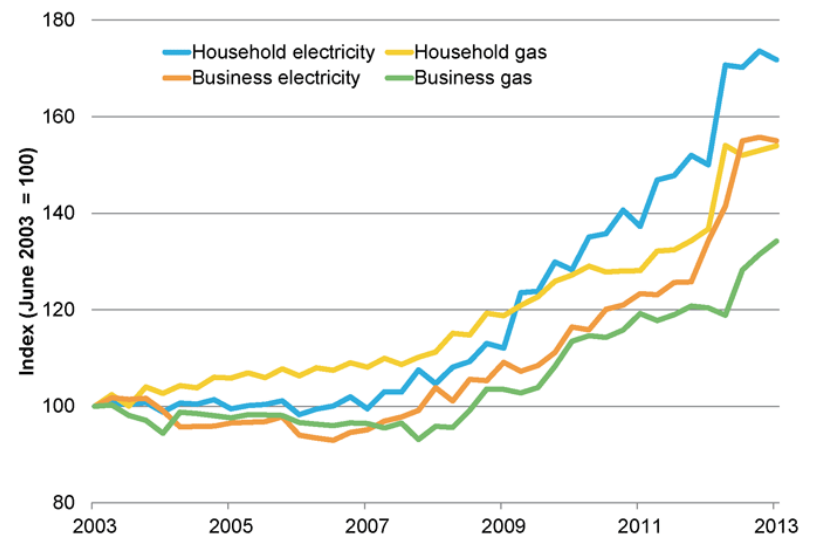
Farmers invest for better water-use efficiency, higher productivity and labour savings



# What is the problem or need

- System changes **need more energy** in pursuit of water savings
- “**Energy cost** has been increasing
- **Farmers don’t know** if their energy use is appropriate (i.e. do I have a problem)
- **Tools exist, but complicated**
- A simple tool is developed

60% real electricity price increase for business since 2003



Source: Australian Bureau of Statistics.

# Development of the 'Energy Calculator'

The Energy Calculator was developed to allow an Irrigation Extension Officer to assist an irrigator to answer the following questions:

- Is my irrigation system functioning efficiently?
- What is the likely cost : benefit of improving the energy efficiency of my system?
- What parts of my system can be improved to operate more efficiently?

# Development of the 'Energy Calculator'

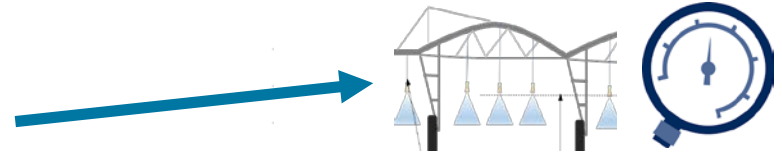
The Energy Calculator has two parts:

- Part 1 – Energy Cost Assessment
  - Part 2 – System Energy Diagnostics
- 
- Testing of the tool - what did we do
    - 2 case studies
      - Methodology undertook system performance check (uniformity and application efficiency, operating pressure) on conjunction with energy assessment
      - One had a lot of information about their system, the other less understanding

# Case study 1 – Part 1

## Irrigation energy cost assessment

Irrigation system **Your system**  
Specify TDH  
25.6 meter



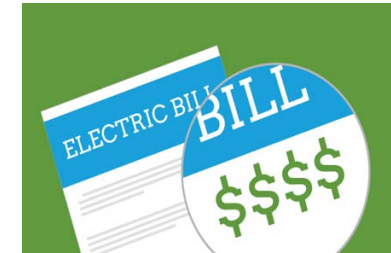
Area under pressurised system 25 ha

Crop grown lucerne

Amount of water applied 187 ML 7.5 ML/ha



Power cost  
Electricity \$/kWh 0.2  
Diesel \$/litre 1



	Specify TDH		My figure
	Electricity	Diesel	
<b>Energy cost</b>			
per ha	\$174 ha	\$210 ha	
per ML	\$23.3 ML	\$28.0 ML	\$30.0 ML
<b>Total energy cost</b>			
This season	\$4,359	\$5,244.8	\$5,610
Over 15 years	\$87,869	\$105,720	\$113,080
<b>Energy consumption</b>			
per ha	872 kWh/ha	210 L diesel/ha	
per ML	117 kWh/ML	28 L diesel/ML	

**Potential saving:**  
\$1250/year  
\$25,200 over 15 years

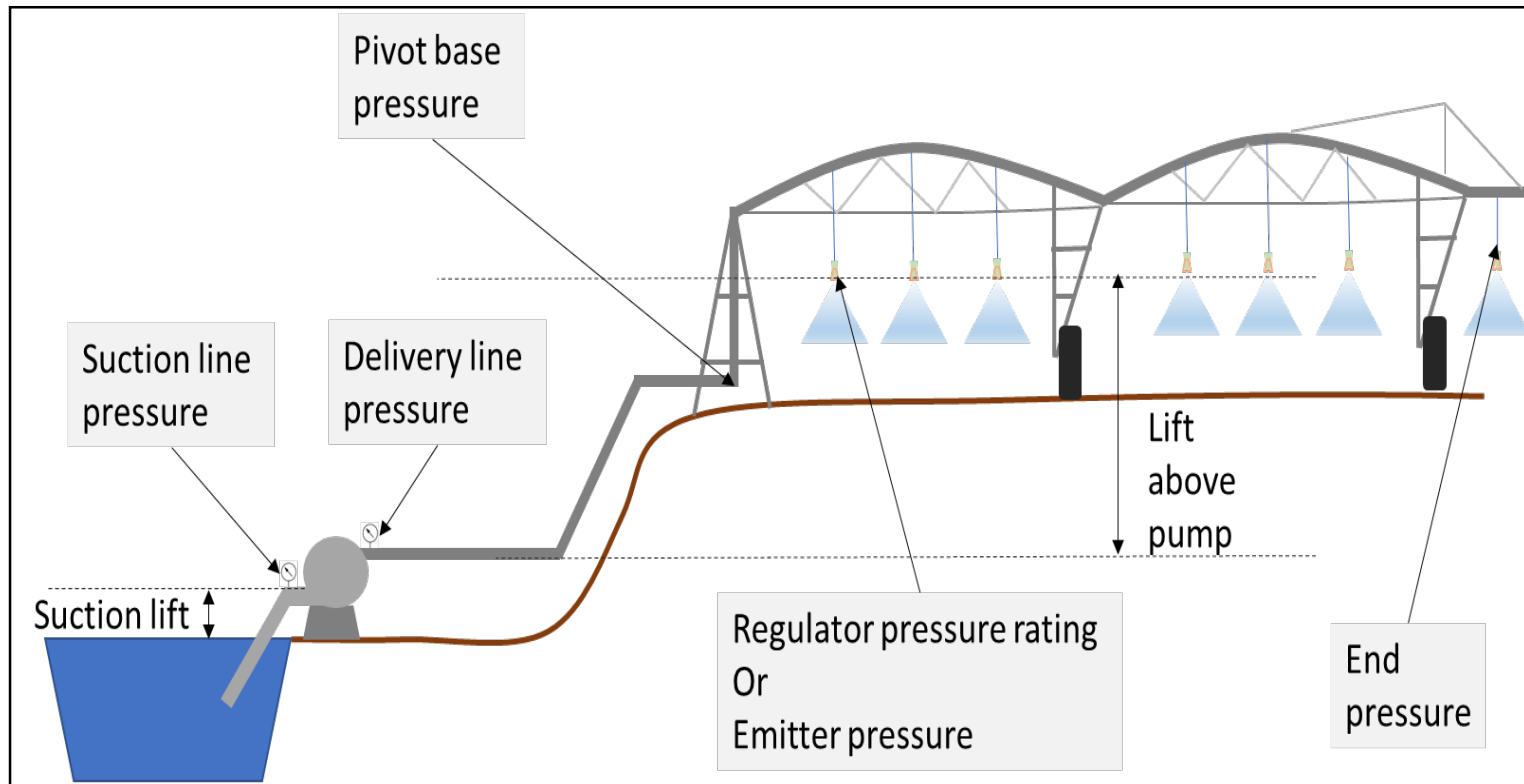


# List of irrigation system included in the Energy Calculator and typical operating pressures

System type	System Total dynamic Head (m)
Reuse system	4
Pipe and riser system	20
CPLM (low head)	21
CPLM (medium head)	30
CPLM (high head)	50
Sub Surface Drip	25
Specify TDH	User defined

# Part 2 – System energy diagnostics

Diagram showing the locations where system pressure is measured to determine system efficiency and diagnose energy losses



# Case study 1– Part 2

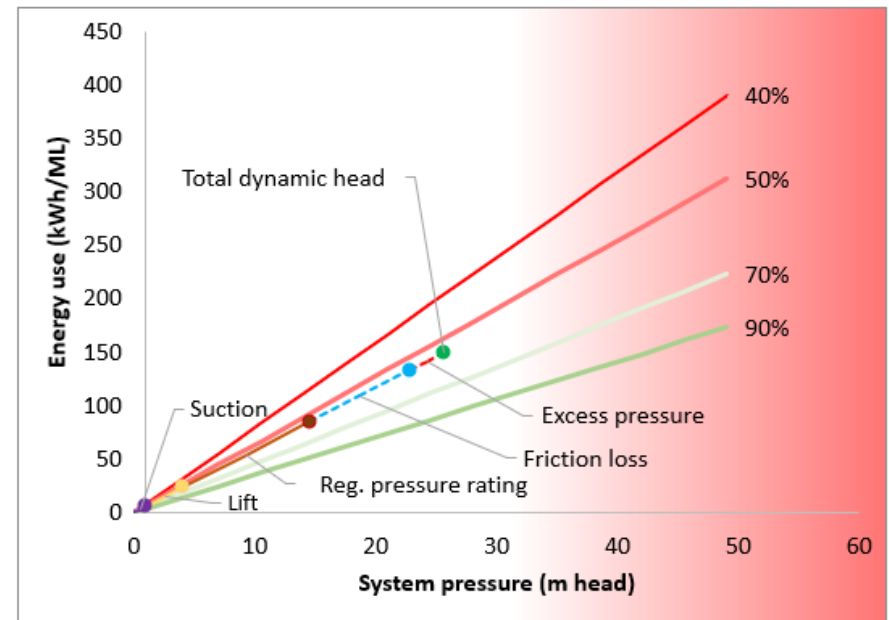
## System energy diagnostics

Energy source	Electricity	
Energy unit cost (default: 0.25 )	0.2 \$/kWh	
Energy use	150 kWh/ML	82
<b>System pressure</b>		
Suction line pressure	1 m head	1.0 m
Delivery line pressure	35 PSI	24.6 m
<b>Total dynamic head</b>		<b>25.6 m</b>

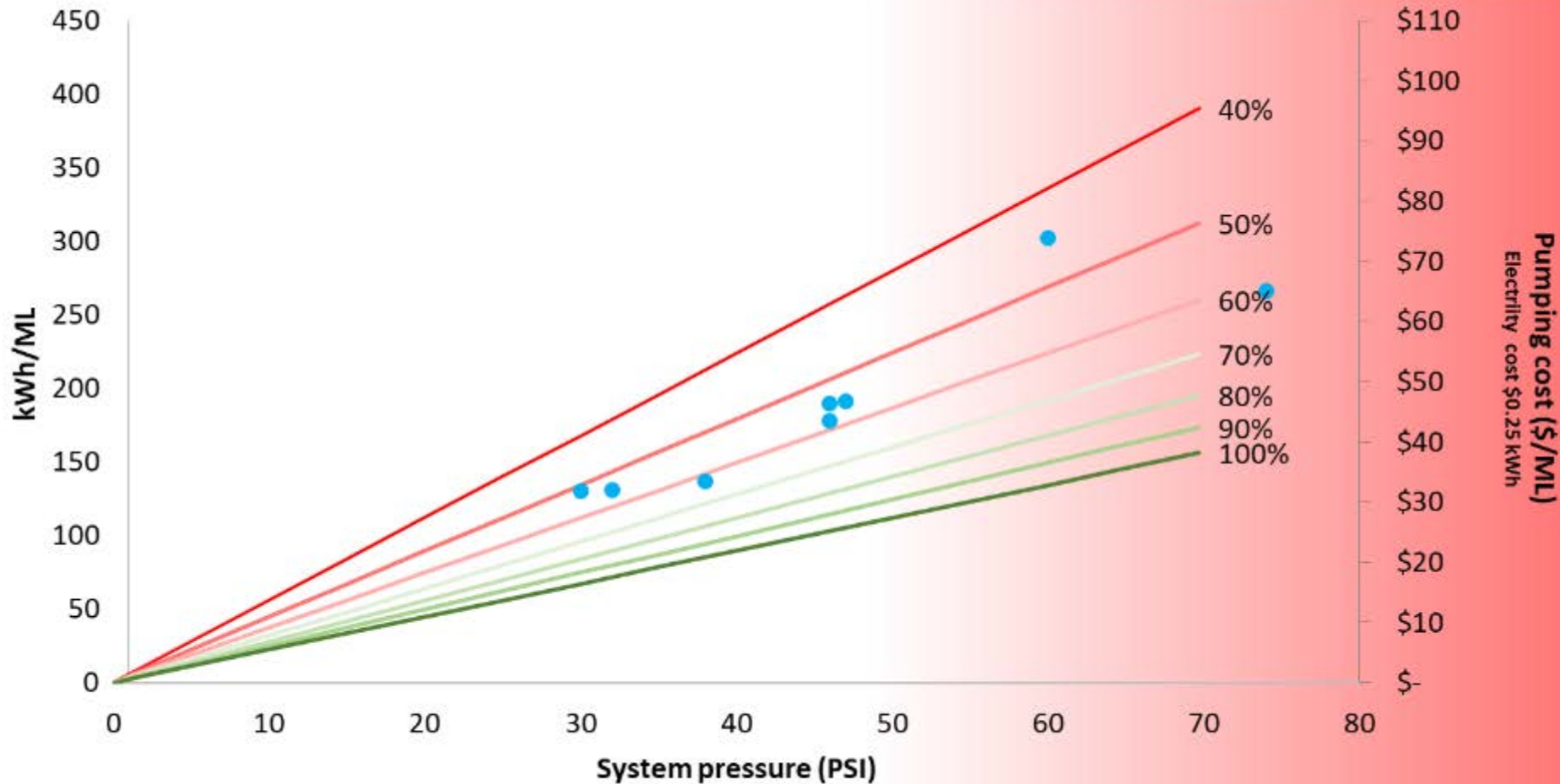
**Estimated pump efficiency**                      **54 %**  
**Pumping costs**                                      **30.00 \$/ML**

- Over size motor on pump leading to poor efficiency
- Potential solution to increase nozzle size to increase flow rate and take advantage of oversize pump
- Or change pump or install VSD

Lift above pump	3 m head	3.0 m
Regulator pressure rating	15 PSI	10.5 m
End pressure	24 PSI	16.9 m
<b>Excess pressure</b>	<b>4.0 PSI</b>	<b>2.8 m</b>
<b>Friction loss</b>		<b>8.2 m</b>



# Energy efficiency of systems in the SIR



# Findings

We successfully created a simple Energy Calculator that enables farmers to:

- Estimate the energy efficiency of their irrigation system
- Estimate the cost : benefit of improving the energy efficiency
- Identify what parts of the system can be altered to improve energy efficiency

The case studies have highlighted:

- The need to consider system performance (uniformity) when assessing energy efficiency
- The need for the assistance from an Extension Officer to input the correct data, interpret outputs and help identify solutions
- Need to educate farmers about importance of knowing and values of paying for service to improve system

# Where to from here

- Learnings
  - Either we need to demonstrate/educate the importance of system and energy check so that farmers will value them (and pay in future)
  - Or we (government) provide service for farmers
  - Courses, education and Ag notes – so landowner better understand their system and what to look for when purchasing a new system (capital vs operating costs)
  - Include the tool in ‘extensionAus’
- Add solar
- Roll out to landowners

