BBIFMAC EEGAI Definitions & Fundamentals – Burdekin April ’15

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BBIFMAC
A Research Centre of the University of Southern Queensland

UNIVERSITY OF SOUTHERN QUEENSLAND

NCEA
National Centre for Engineering in Agriculture

ENERGY EFFICIENCY GAINS FOR AUSTRALIAN IRRIGATORS
EEGAI

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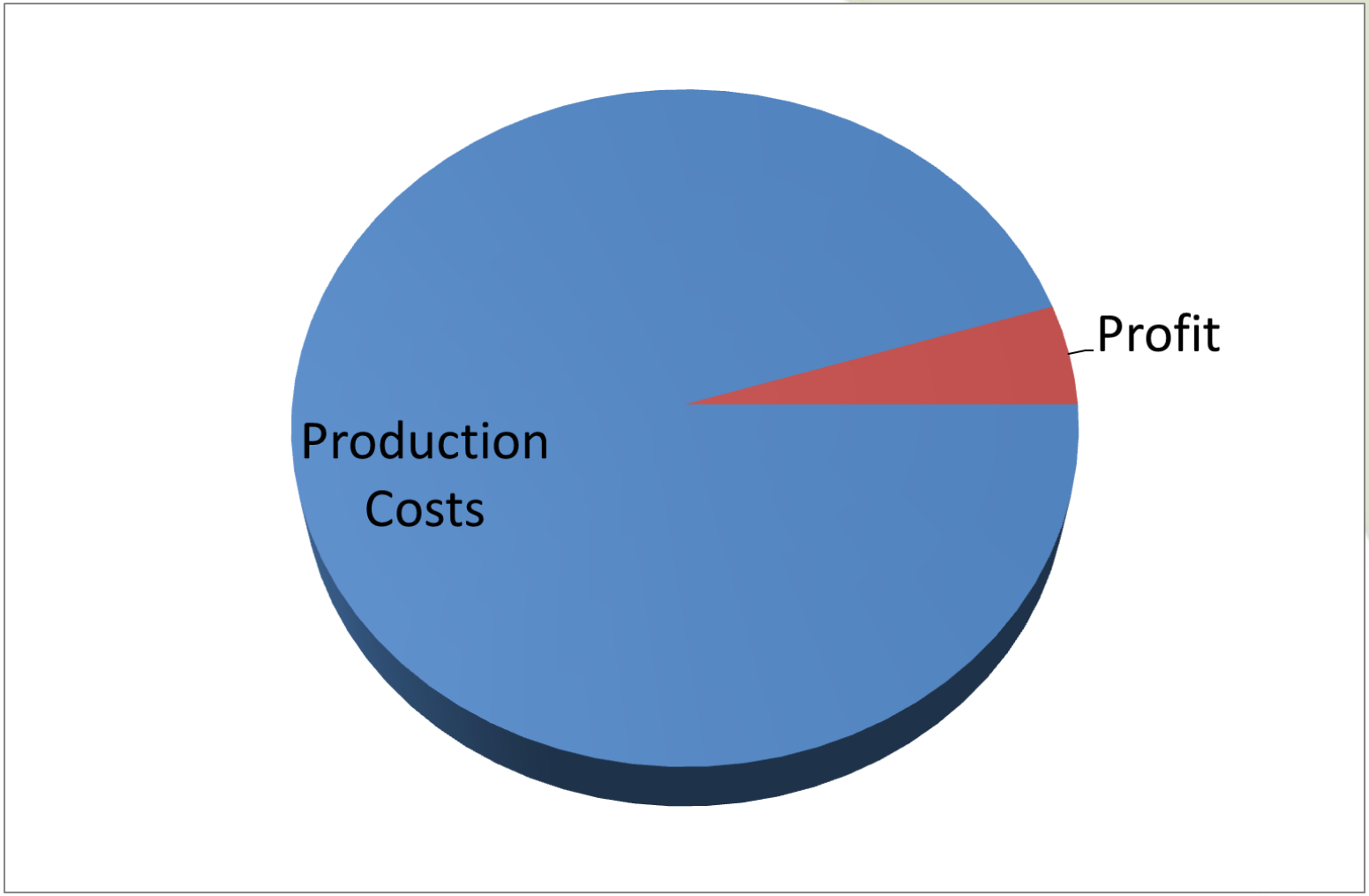
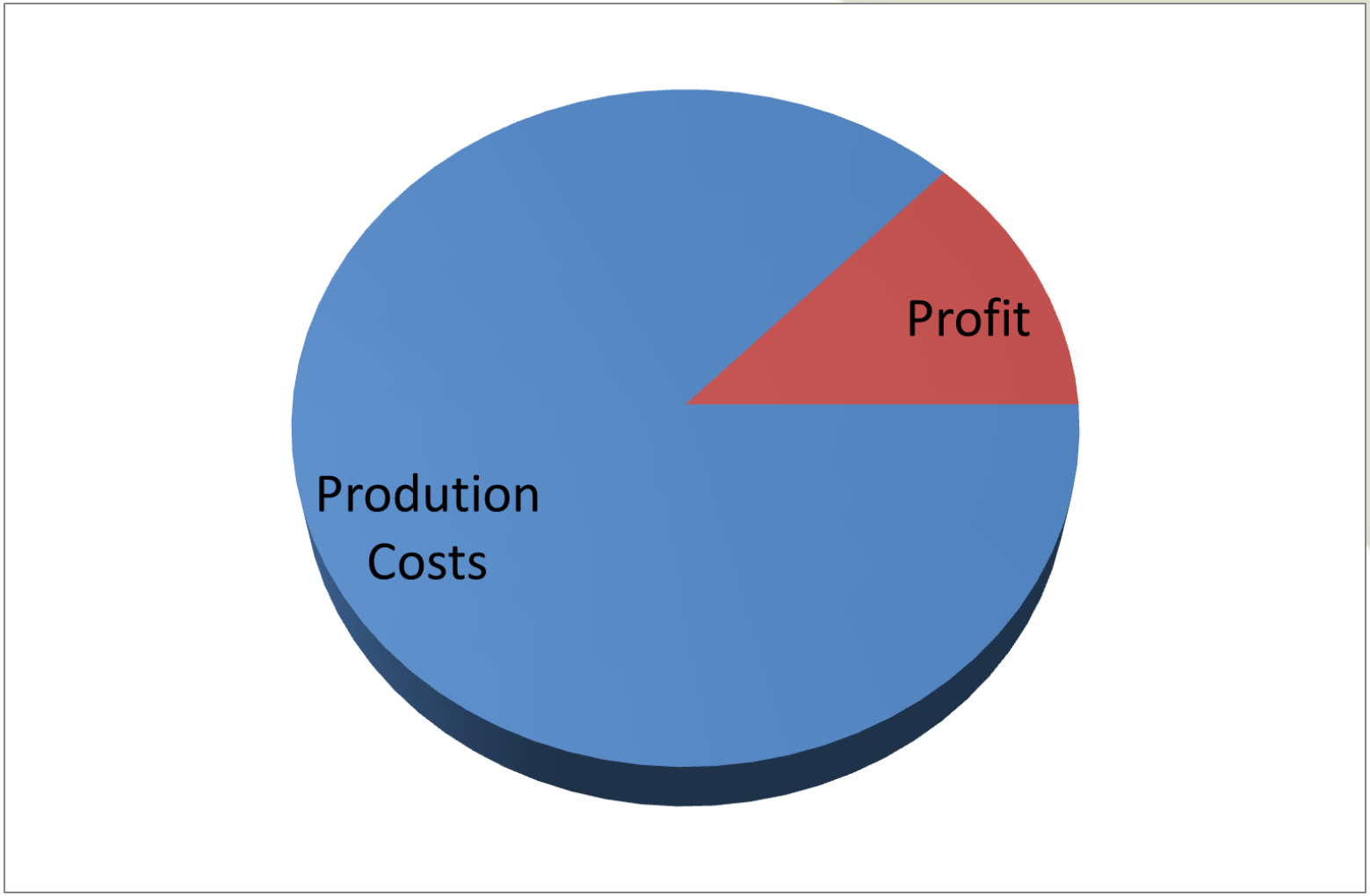
Why are we here?
Production Costs vs Profit



Reducing your Costs a little means increasing Profit a lot



Why focus on Energy in Sugar?

- Sugar production is energy intensive – based on machinery, fertilizer & pesticide inputs
- Fastest growing input cost to sugar prod'n
- Energy is the stuff we buy that allows machinery to do work. Measured in MegaJoules
- 1 Litre Diesel holds 38.4 MegaJoules
- 1 kiloWatt.hour Electricity holds 3.6 MegaJoules
- Efficiency is all about how well machinery converts Energy into useful work

What is Power? – what is Energy?

- Energy is the stuff you buy
- You buy Litres of Diesel or kiloWatt.hours of electricity
- Power rating is all about how fast you can burn the stuff you buy
- A motor with a big power rating in kiloWatts will burn the stuff you buy more quickly

Need irrigation but water is heavy. Needs lots of energy to shift it

- Water is very **HEAVY** material!!
- 1 Litre is a kilogram. 1000 litres is a tonne.
- 1 MegaLitre(ML) is 1000 tonnes= 20 B-double truck
- Need **Lots** of Energy to lift & move water
- 1 ML in this room (15m × 30m) is 2.2 m deep
- 1 ML on 1 ha is same as 100 mm rainfall
- Every ML per ha is 1000 tonnes per hectare

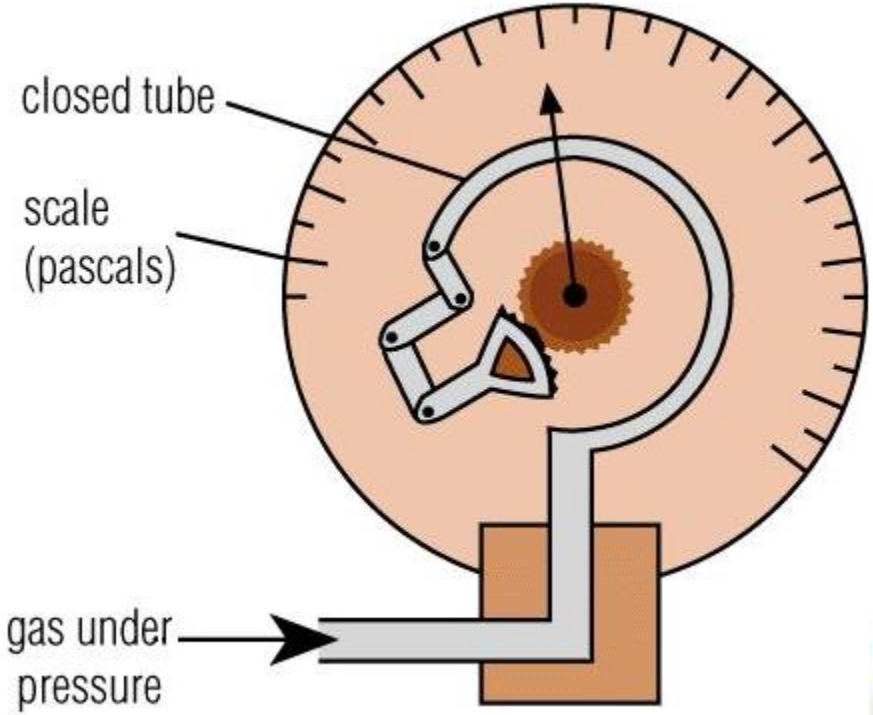
Lots of Energy needed to lift water

- 1 ML per ha is 20 B-double trucks per ha!!
- In an ideal world, each MegaLitre (ML) lifted up one metre of height uses 9.81 MegaJoules (MJ) or 2.725 kiloWatt.hours (kW.h) of Energy
- In the real world, to lift 1 ML up 1 metre, with pump efficiency of 80% and electric motor efficiency of 90% you need 3.785 kiloWatt.hours(kW.h) of Energy
- Best possible case is 3.2 kW.h per ML per metre lift
- Worst likely case is 10 kW.h per ML per metre lift

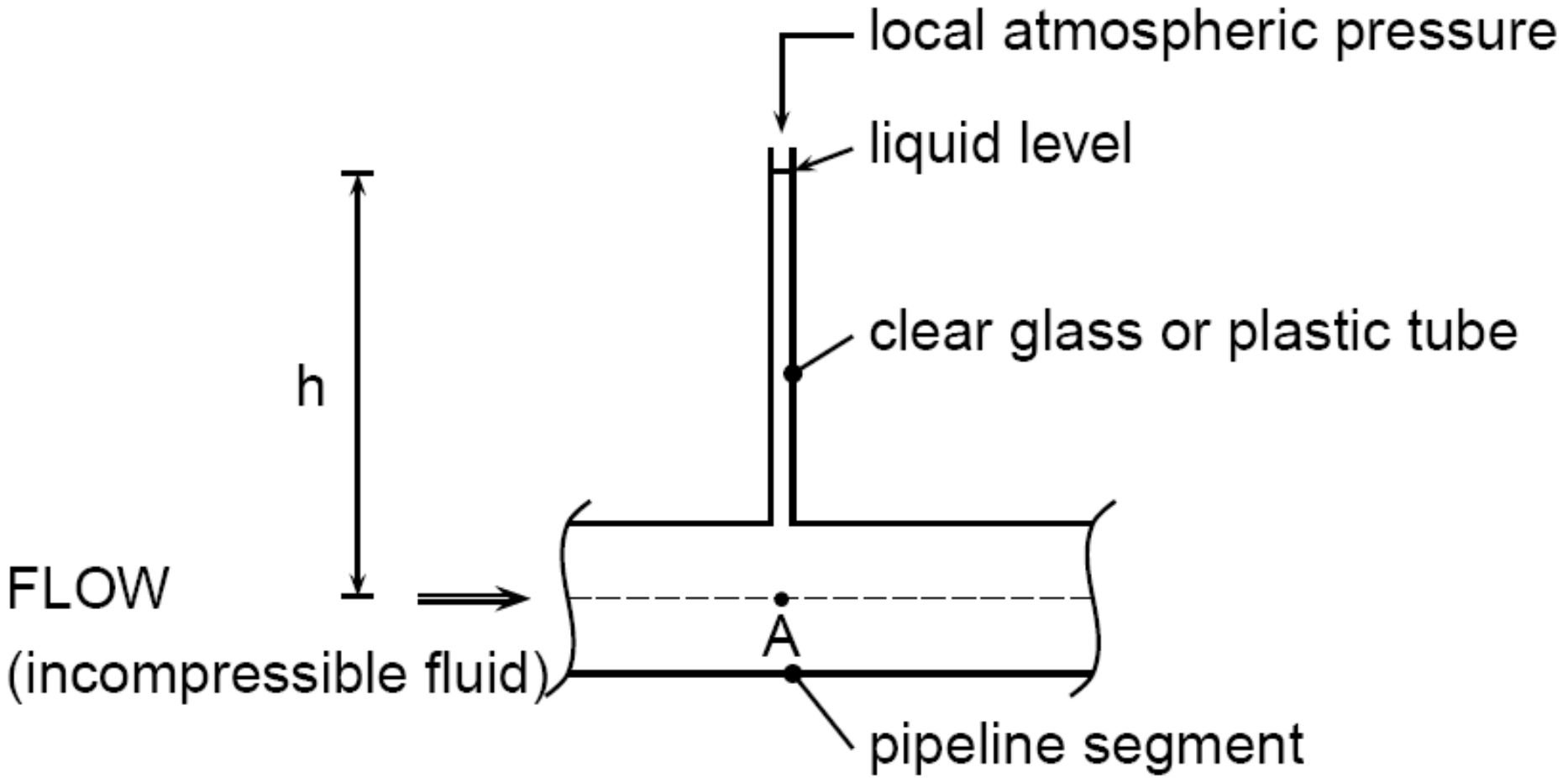
Energy use in Irrigation

- If we have groundwater at five metres depth, then might only have to lift each ML of water up by 8 metres
- Best possible case might be 25.6 kW.h perML
- Worst possible case = 80 kW.h per ML
- Channel water, best might be 16 kW.h per ML
- Channel water, worst case situation might be something like 160 kW.h per ML

Bourdon Gauge



Piezometer



- $p_A = \rho gh$ (gauge)

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