Biomass Energy for Greenhouses

by: Sohum Gandhi

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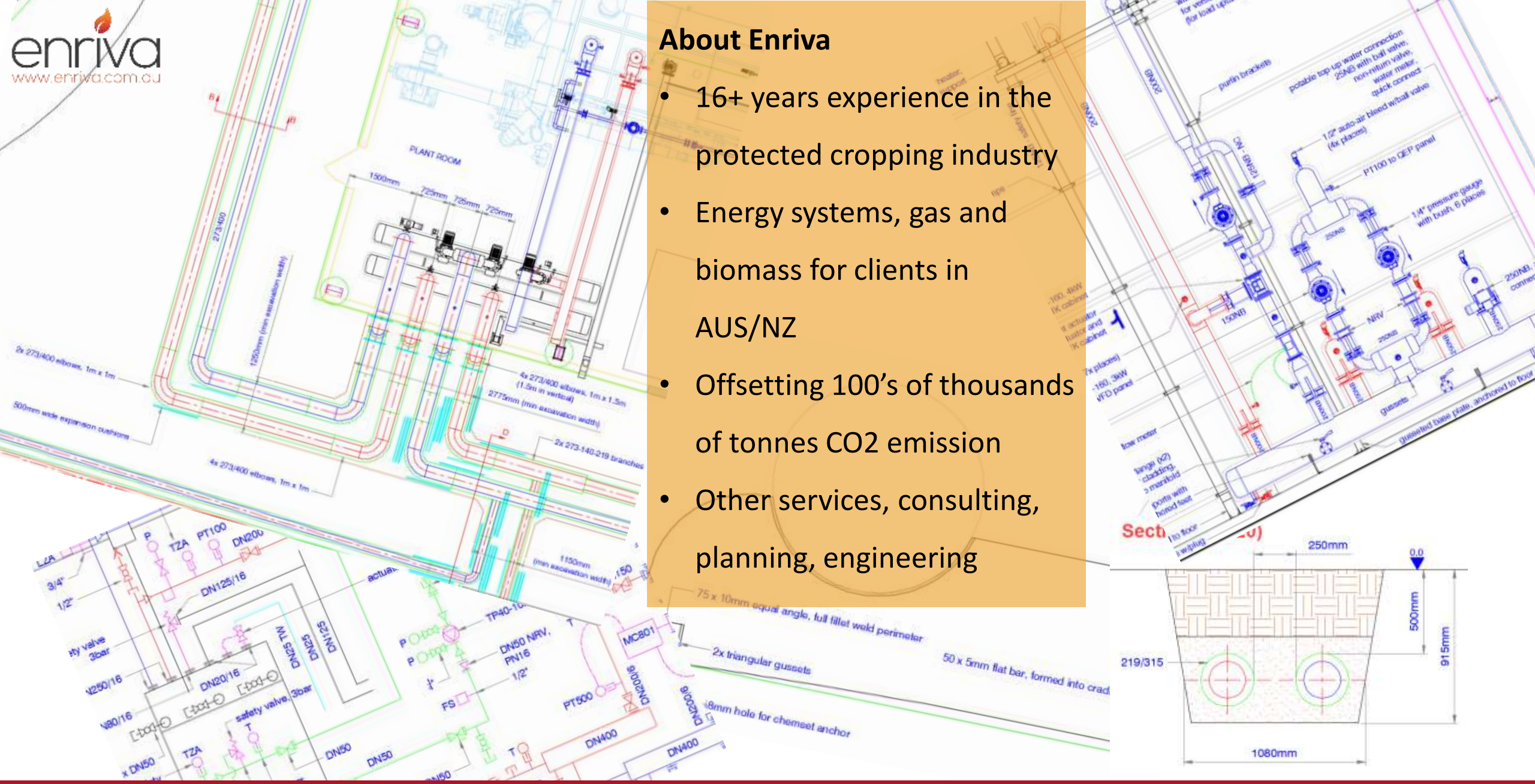
About Enriva

- 16+ years experience in the protected cropping industry
- Energy systems, gas and biomass for clients in AUS/NZ
- Offsetting 100’s of thousands of tonnes CO2 emission
- Other services, consulting, planning, engineering



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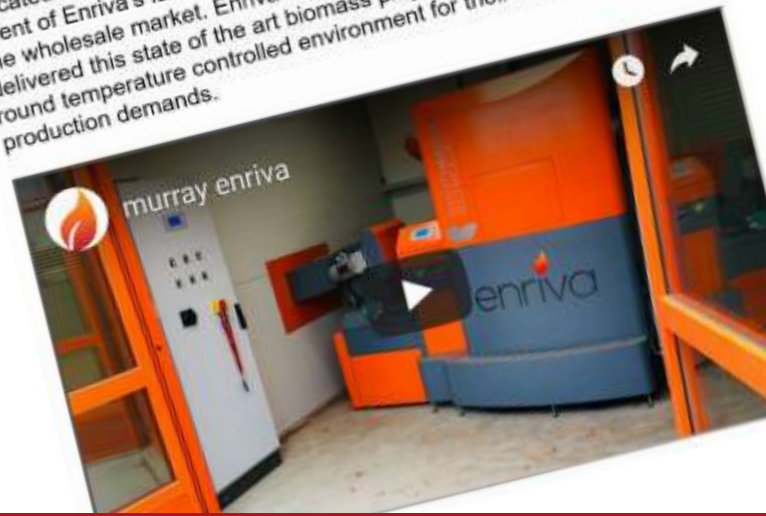
Enriva Biohouse

Video: Turn-key bioenergy implementation launched

Located on the Victorian side of the Murray River, this horticultural client of Enriva's is a family run business growing food and plants for the wholesale market. Enriva in conjunction with Smart Heating delivered this state of the art biomass project which provides a year round temperature controlled environment for their ever expanding production demands.



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Photosynthesis (The Renewability)

- Plant matter high in carbon
- Carbon absorbed from air through stomata, 400PPM
- Photosynthesis, sunlight driving the conversion of water and CO2 into carbohydrates and oxygen

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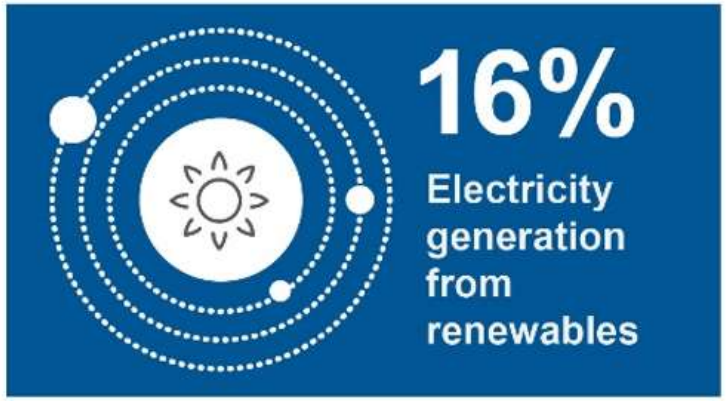
Australian Government
Department of the Environment and Energy

Australian Energy Update 2018



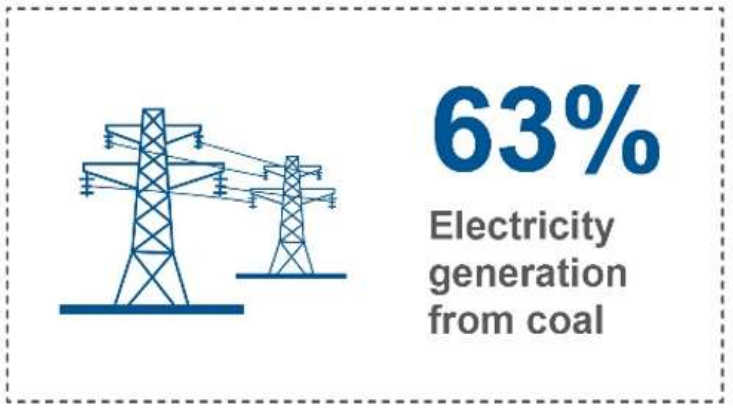


Table 2.1: Australian energy consumption, by fuel type

	2016–17		Average annual growth	
	PJ	share (per cent)	2016–17 (per cent)	10 years (per cent)
Coal	1,936.9	31.5	-1.0	-1.9
Oil	2,315.4	37.7	2.1	1.7
Gas	1,515.0	24.7	1.1	2.9
Renewables	378.7	6.2	5.3	3.2
Total	**6,145.8**	**100.0**	**1.1**	**0.8**

Source: Department of the Environment and Energy (2018) *Australian Energy Statistics*, Table C

Table 2.2: Australian renewable energy consumption, by fuel type

	2016–17		Average annual growth	
	PJ	share (per cent)	2016–17 (per cent)	10 years (per cent)
Biomass	205.4	54.2	5.0	-0.2
- wood, woodwaste, sulphite lyes	95.1	25.1	1.9	-0.4
- bagasse	110.3	29.1	7.9	-0.1
Municipal & industrial waste	2.6	0.7	0.3	na
Biogas	15.0	4.0	-4.1	3.7
- landfill gas	12.2	3.2	-6.5	na
- other biogas	2.8	0.7	8.0	na
Biofuels	7.1	1.9	-5.3	5.3
- ethanol	6.4	1.7	3.4	na
- biodiesel	0.6	0.2	-48.7	na
Hydro	58.6	15.5	6.3	3.4
Wind	45.3	12.0	3.3	16.9
Solar PV	29.1	7.7	18.0	59.2
Solar hot water	15.7	4.2	5.7	10.0
Total	**378.7**	**100.0**	**5.3**	**3.2**

Source: Department of the Environment and Energy (2018) *Australian Energy Statistics*, Tables D, F, O

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41%

LNG exports increased

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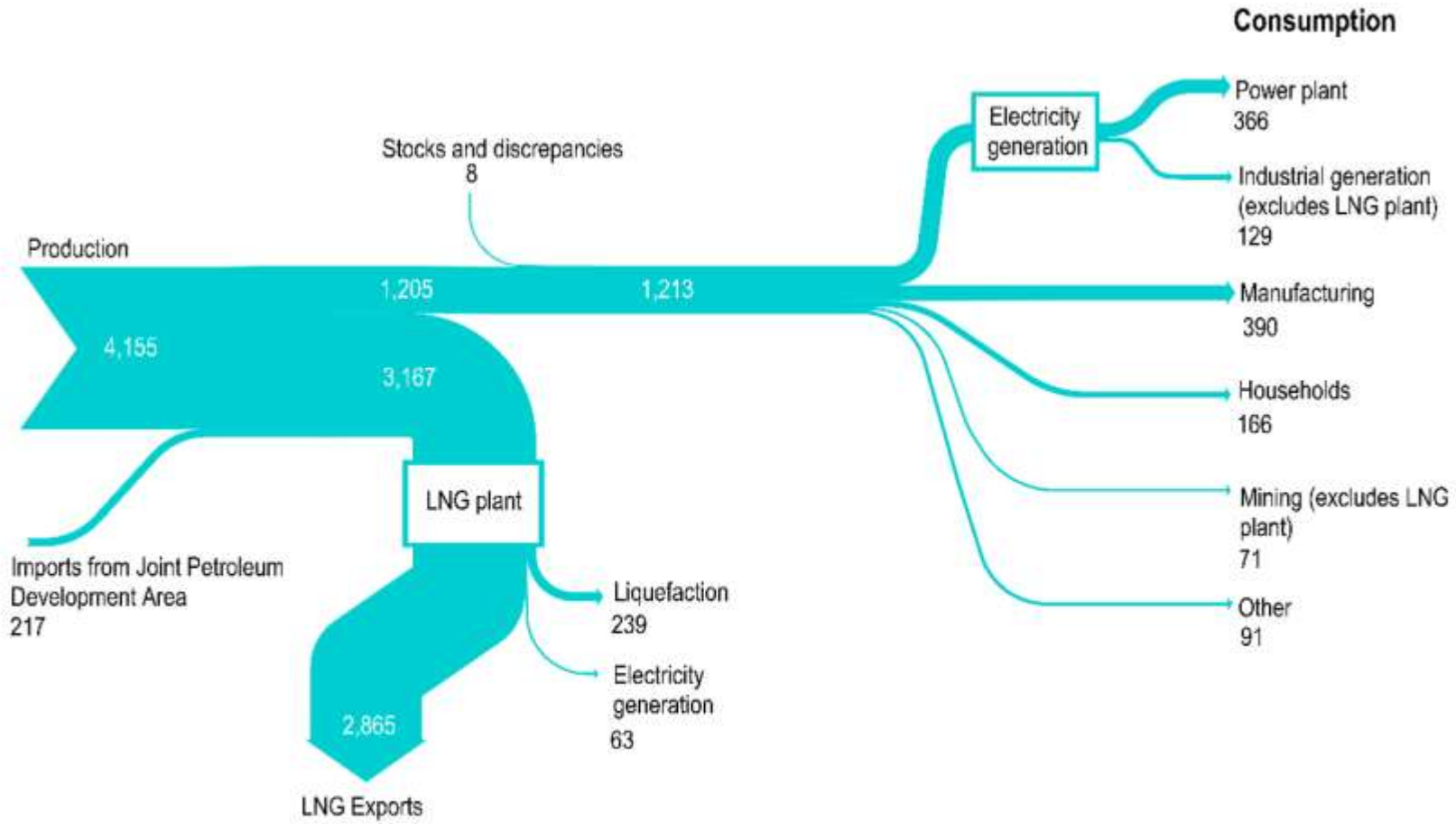
Increasing Gas Prices

- Supply and demand
- Shipping to Japan, Korea, China
- Now 7, soon 10 export plants liquefying and shipping
- Trajectories show doubling of production required to meet export demands within 6 years

Figure 2.3: Australian natural gas flows, petajoules, 2016–17



Note: Gas used at LNG plants for liquefaction and electricity generation is included in total gas consumption in the AES, but has been disaggregated in this figure.

Source: Department of the Environment and Energy (2018) *Australian Energy Statistics*, Tables A and F and internal sources

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Energy Requirement

- Only one of many questions
- Crop dependent (ie. setpoint)
- Climate dependent (ie. temp profile)
- Technology dependent, screens, structure has a significant impact
- Peak load supply vs. load averaging
- MCR vs. nominal rating
- Economy of peak load supplementation

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<u>More Considerations</u>

- Heating expenditure
- Fuel and equipment selection
- Running costs and CO2 availability
- Informed analysis
- Profitability and sustainability

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Positives Pre-commercial Carbon Capture: CO2 from Biomass Flue

- Like gas, high in CO2
- Technology functional however pre-commercial in terms of reliability, and financial feasibility
- Chemical solvent (Amine) absorbs CO2, rejects pollutants
- Solvent heated to make CO2 available

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Pre-commercial: CO2 from air

- Capturing CO2 from air
- CO2 in air is captured in a filter, then heated to release CO2
- Filter is made of porous granulates modified with amines
- CO2 is concentrated and stored for supply to users
- Expect production cost of around $600 USD/tonne, therefore not yet commercial however could drop by 50% with next generation of technology

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Long standing family business just outside of Melbourne

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A wholesale grower

Specialising in many flower varieties

Grown in heated greenhouse environments for premium year round production

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2.5x increase in natural gas price

Replaced old technology

Invested in modern, renewable biomass plant

Kept business sustainable

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Plant Room Building

Required custom design

With under floor recesses

With large concrete fuel bunker for biomass storage

Live floor and sub surface structures

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Completion of concrete works in plant room

Steel anchors tied into the concrete,

imperative for the live floor loads

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Heat store foundation;

earthworks,

blinding concrete,

the final pour

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2ML heat store;

part of thermal design,

load buffering,

peak power delivery

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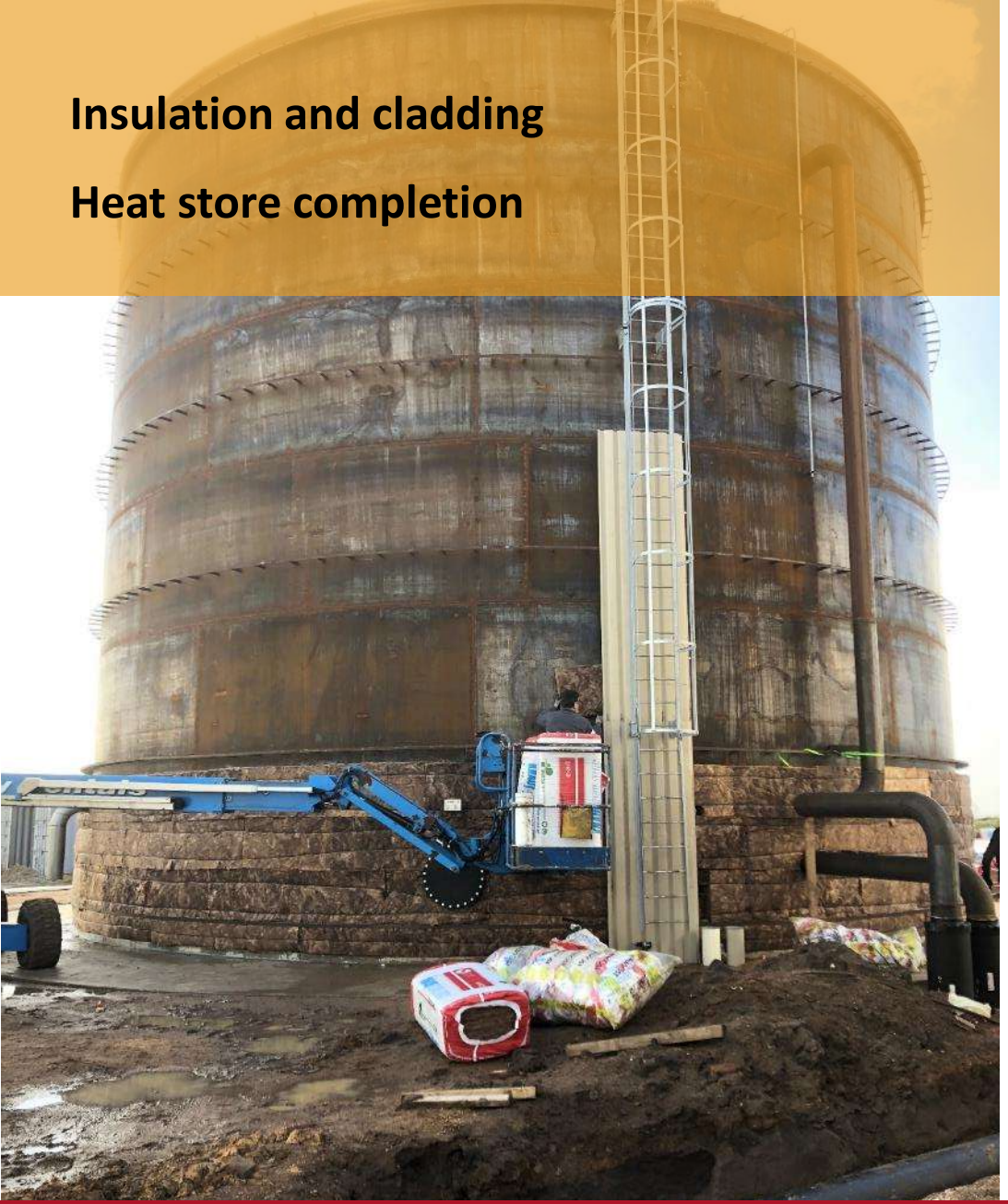
Insulation and cladding

Heat store completion



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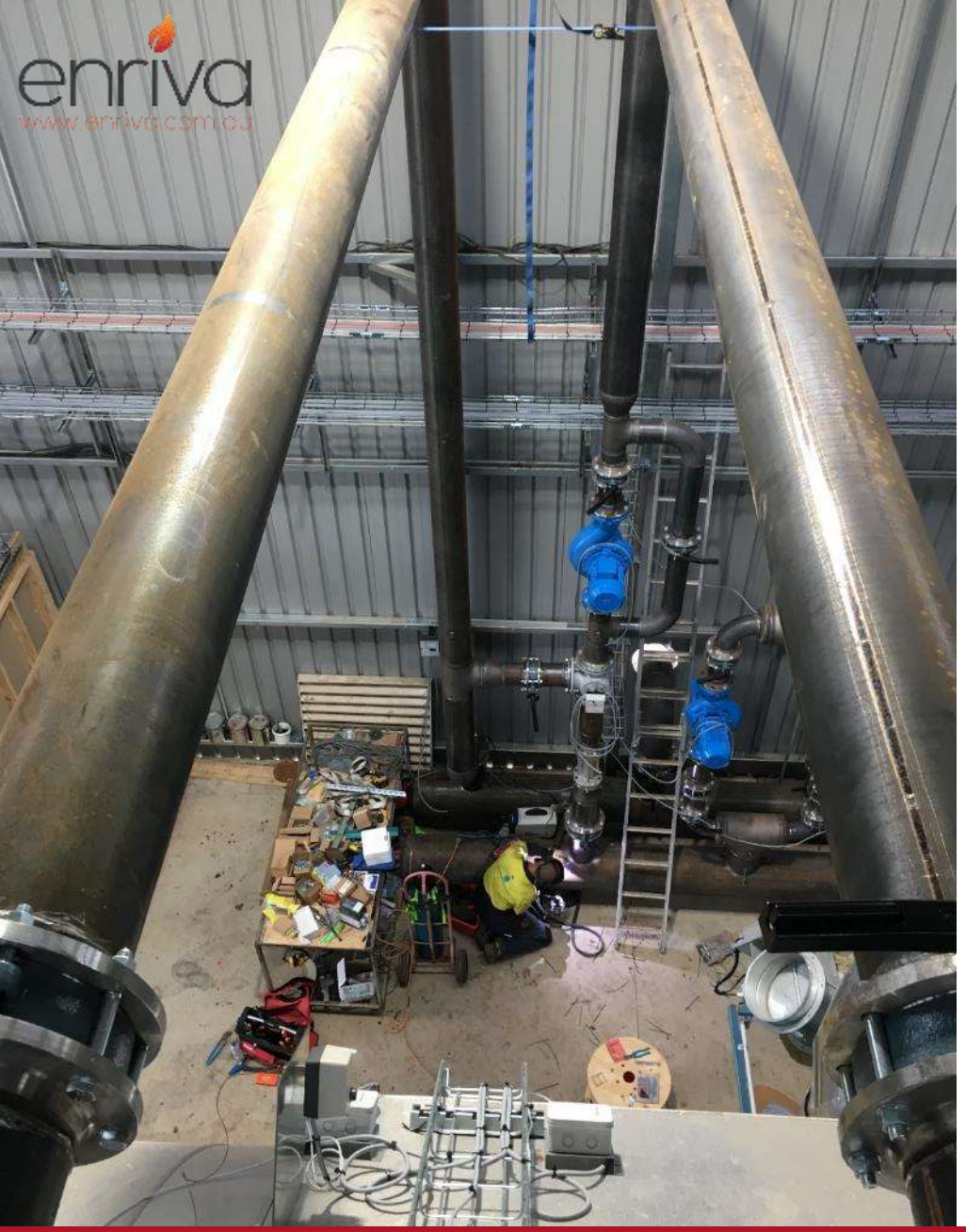

Hydraulics;

Plant connection

Pre-insulated transport main

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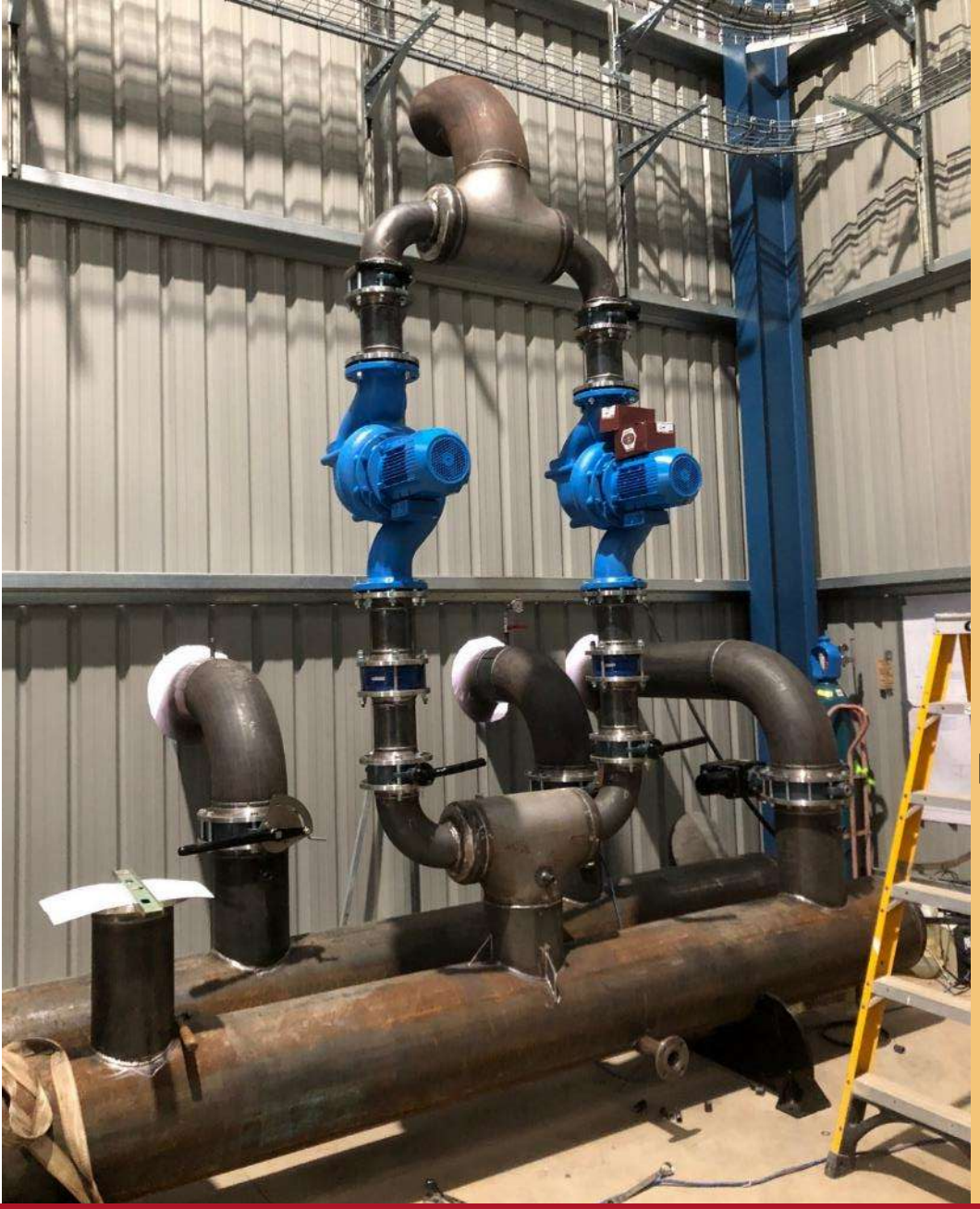

Hydraulics;

Plant Room

Pumps

Piping

Load Management

Optimised energy delivery

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Plant Install;

- **Advanced biomass plant**
- **Emissions control system**
- **Fuel handling system**

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Completed plant install

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Outcomes:

- **Turned off gas**
- **Under 4 year payback by using waste biomass**
- **Offsets 60,000 tonnes carbon emissions**

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Biohouse:

- **Located on Murray river, Victorian side**
- **Family business; food and plants for wholesale**
- **Design, pre-built, disassembled, shipped, erected and commissioned**

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Project completed:

Small packaged biomass plant (<500kW)

Delivered with integrated building, fuel store, storage tanks

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