

# Bioenergy Opportunities in Australia

Australia-India Energy and Minerals Forum  
Perth 8 June 2010



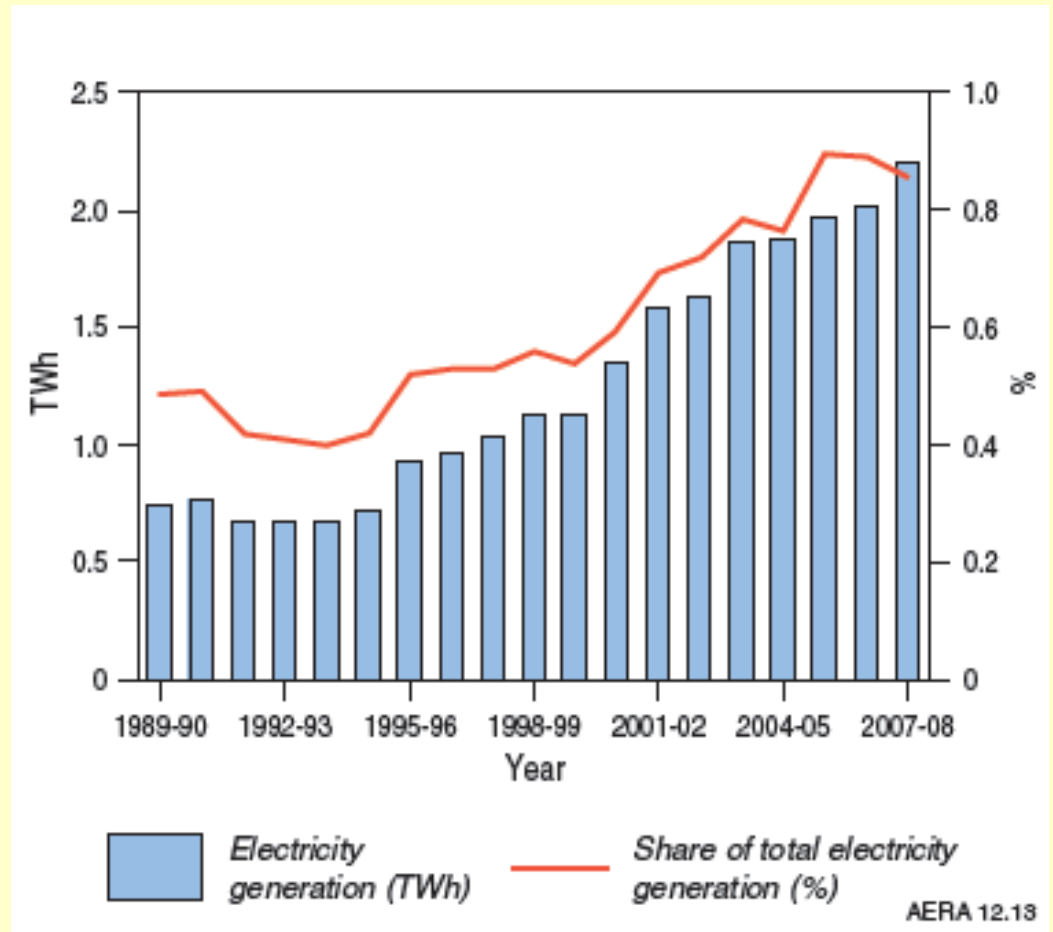
Dr Stephen Schuck  
Bioenergy Australia Manager  
Email:  
[sschuck@bigpond.net.au](mailto:sschuck@bigpond.net.au)  
Tel/Fax: (02) 9416 9246  
[www.bioenergyaustralia.org](http://www.bioenergyaustralia.org)

# Bioenergy Australia – a Government-Industry Forum

- Bioenergy Australia – currently 85 member organisations
  - Forum for exchange of authoritative information on biomass and bioenergy
  - Meets quarterly, holds annual conference, issues newsletters
  - Vehicle for IEA Bioenergy participation – 4 Tasks
    - Task 38 Greenhouse Gas Balances of Bioenergy Systems
    - Task 39 Commercialising 1<sup>st</sup> and 2<sup>nd</sup> Generation Biofuels
    - Task 42 Biorefineries: Coproduction of fuels, chemicals, power and materials from biomass
    - Task 43 Biomass Feedstocks for Energy Markets
- Possibility of joining in additional Tasks

# Market Penetration - Biomass

- Biomass 4% of TPES in 2007-08 (IEA) in Australia
- 78% to Australia's reported renewable energy
- Includes 4 million tonnes of firewood
- 0.9 percent of Australia's electricity generation
- Slightly less than a quarter of cumulative RECs
- 867MW of dedicated installed bioelectricity capacity (excluding co-firing)



Australian Bioelectricity Production

(source: ABARE)

	<b>Biogas</b>	<b>Bagasse</b>	<b>Wood Waste</b>	<b>Other bioenergy</b>	<b>Total bioenergy</b>
New South Wales (incl ACT)	73	81	42	3	199
Victoria	80	0	0	34	114
Queensland	19	377	15	4	415
South Australia	22	0	10	0	32
Western Australia	27	6	6	63	102
Tasmania	4	0	0	0	4
Northern Territory	1	0	0	0	1
<b>Australia</b>	<b>226</b>	<b>464</b>	<b>73</b>	<b>104</b>	<b>867</b>
Share of total renewable electricity capacity (%)	<b>2.2</b>	<b>4.4</b>	<b>0.7</b>	<b>1.0</b>	<b>8.3</b>

(source: Geoscience Australia)

## Australian Bioelectricity Generation (MW) 2009

<b>Project</b>	<b>Company</b>	<b>State</b>	<b>Type</b>	<b>Start Up</b>	<b>Capacity (MW)</b>
Tumut	Visy Paper	NSW	Wood waste	2001	17.0
Rocky Point	National Power and Babcock and Brown Joint Venture	QLD	Bagasse	2001	30.0
South Cardup	Landfill Management Services Ltd	WA	Landfill methane	2005	6.0
Werribee (AGL)	AGL	VIC	Sewage methane	2005	7.8
Pioneer 2	CSR Sugar Mills	QLD	Bagasse	2005	63.0
Woodlawn	Woodlawn Bioreactor Energy Pty Ltd	NSW	Landfill methane	2006	25.6
Carrum Downs 1 & 2	Melbourne Water	VIC	Sewage methane	2007	17.0
Eastern Creek 2	LMS Generation Pty Ltd	NSW	Landfill methane	2008	8.8
Condong	Sunshine Electricity	NSW	Bagasse	2008	30.0
Broadwater	Sunshine Electricity	NSW	Bagasse	2008	30.0

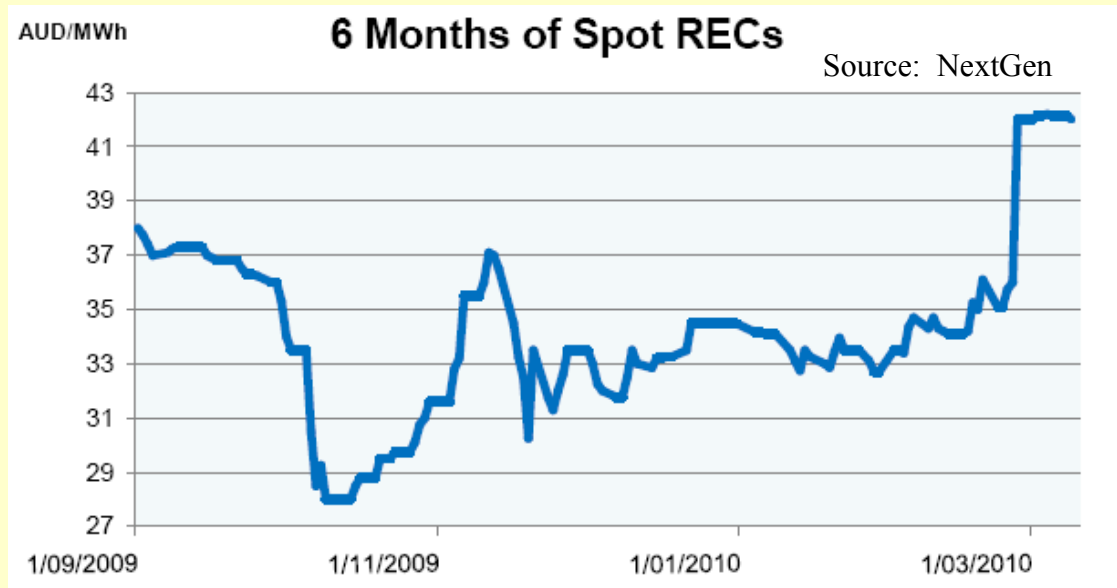
Source: Geoscience Australia; ABARE

## Recent Bioenergy Projects

# The Australian Bioenergy Market

Demand Aspects

REC Spot Price History



Electricity Price Over  
Past Year – Victoria



Source: <http://d-cyphatrade.com.au/>

# Bioheat

- No RET type scheme in Australia
- Applications
  - steam in sugar mills
  - thermal oil in plywood factories
  - steam for processing food
  - kiln drying of lumber at saw mills
  - steam at pulp and paper facilities.
  - Firewood for domestic and commercial space and water heating.

# Market Sectors

- Sugar
  - 28 sugar mill, 1,200GWh production 2006 → 7,800GWh 2050



Condong Sugar Mill 30MW  
Power Plant





# Market Sectors (contd)

- Landfill Gas (>170 MW)
- Biogas (mainly sewage gas)



Carrum Downs Waste Water Treatment Plant, Melbourne



AJ Bush Digester and Gas Engine, Bromelton, Qld



Oxley Creek  
Digester and  
Generator Set



# Market Sectors (contd)

- Agricultural and Food Processing Wastes - 791 GWh per year in 2020 → 50,566 GWh in 2050.
- Forestry Wastes



Bega Cheese Boiler House and Fuel Storage



1 MW pilot plant at Narrogin, WA (BEA 2006 conference tour)

<b>Client</b>	<b>Plant Location</b>	<b>Capacity MW</b>	<b>Product</b>	<b>Fuel</b>
Visy Pulp & Paper	Melbourne, Vic	30	Water tube boiler	Sludge & Wood waste
ITC	Launceston, TAS	3	Water tube boiler	Dry Chip / Shavings
Nestlé	Gympie, QLD	16	Water tube boiler	Coffee waste / Wood waste
FEA	Georgetown TAS	20	Water tube boiler	Wood waste
Hyne & Son	Tumbarumba, NSW	15	Thermal Oil Heater	Wood waste
Carter Holt Harvey	Oberon, NSW	12	Thermal Oil Heater/Fibre drying	Wood waste (MDF waste and sawmill waste)
AKD Sawmill	Colac, VIC	15	Thermal Oil Heater	Wood waste
Hyne & Son	Tuan, QLD	12.5	Thermal Oil Heater	Wood waste
Starwood Australia	TAS	22	Water tube boiler	Biomass
Laminex	Gympie, Qld	24	Thermal Oil Heater	Wood waste

## Wood Fuelled Energy Systems (source- RCR Energy Systems)

# Energy Pellets and Briquettes

- European market 12 million tonnes per year  
→ 30 million tonnes per year by 2020.
- European prices > €200 per tonne
- Plantation Energy Australia first large scale manufacturer and exporter. Has contracts with Electrabel and Essent in Europe.



# Wood Pellets



District heating plant



Les Awirs – converted  
from coal to pellets

# Market Sectors (contd)

- MSW and RDF
- Energy crops – mainly oil mallee eucalyptus

## The Future

- CEC Roadmap
  - 2020 10,624 GWh per year
  - 2050 ~72,629 GWh per year

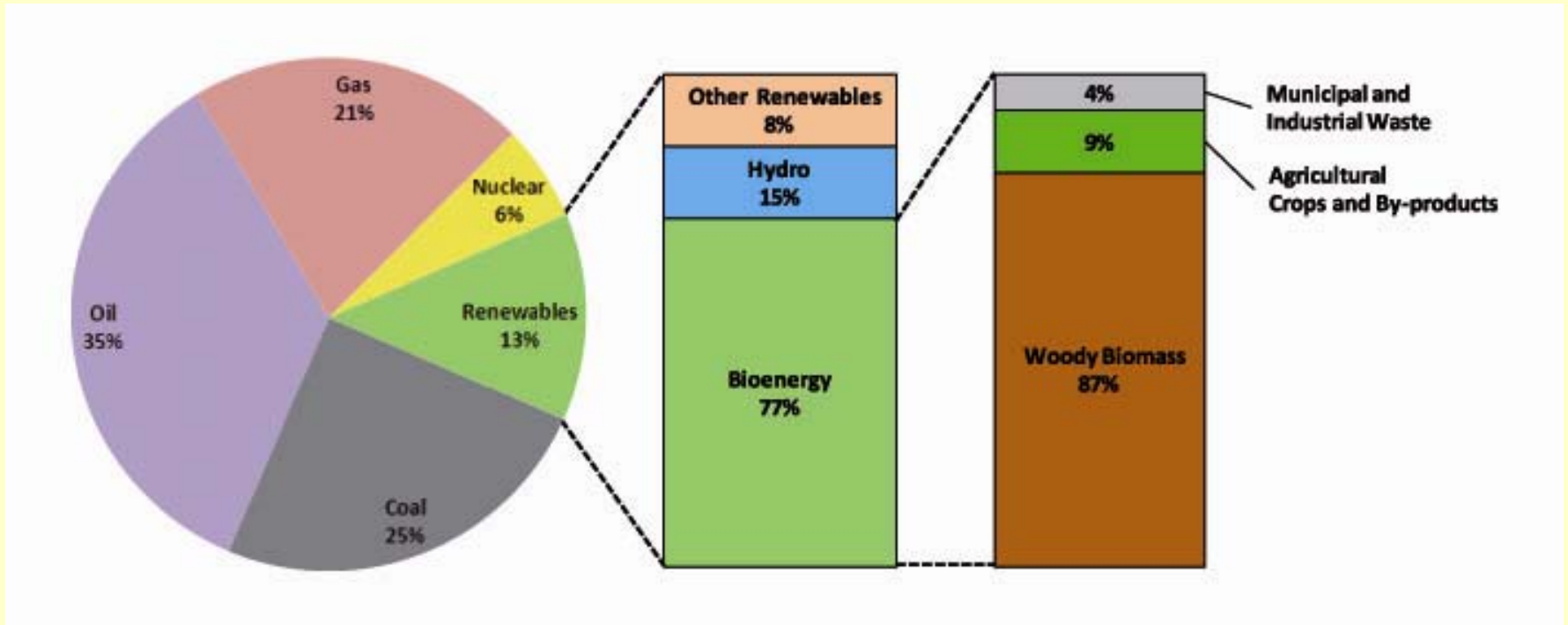
40 times current level - requires growth of 10% p.a. for the next 40 years.



# Regulatory Framework - Australia

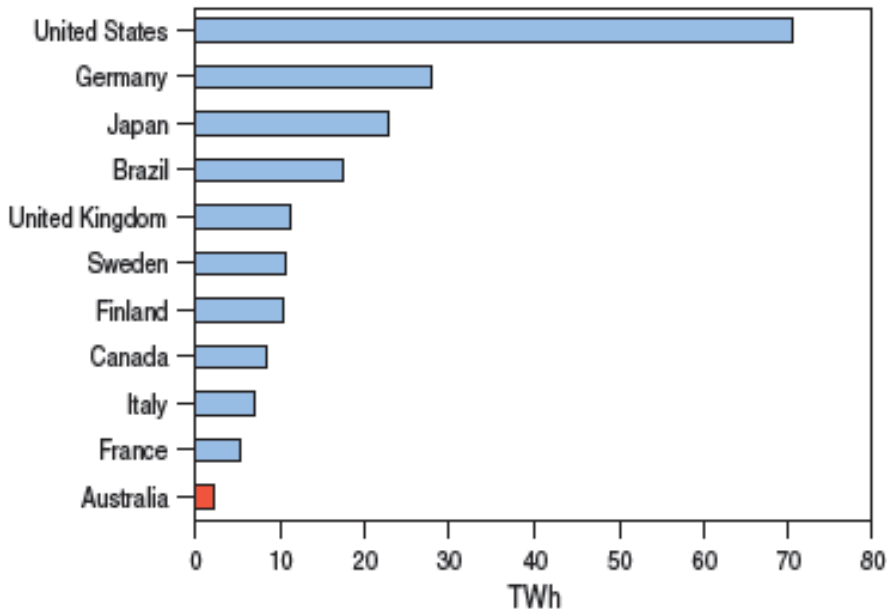
- RET Act specifies types of bioenergy systems (Sect 17)
  - (i) energy crops;
  - (j) wood waste;
  - (k) agricultural waste;
  - (l) waste from processing of agricultural products;
  - (m) food waste;
  - (n) food processing waste;
  - (o) bagasse;
  - (p) black liquor;
  - (q) biomass-based components of municipal solid waste;
  - (r) landfill gas;
  - (s) sewage gas and biomass-based components of sewage;
  - (t) any other energy source prescribed by the regulations.
- State Legislation takes precedence
  - e.g. NSW *Protection of the Environment Operations (General) Amendment (Burning of Bio-material) Regulation 2003* and *Guidance Note – Assessment of Non-Standard Fuels*.

# Overseas Market Trends

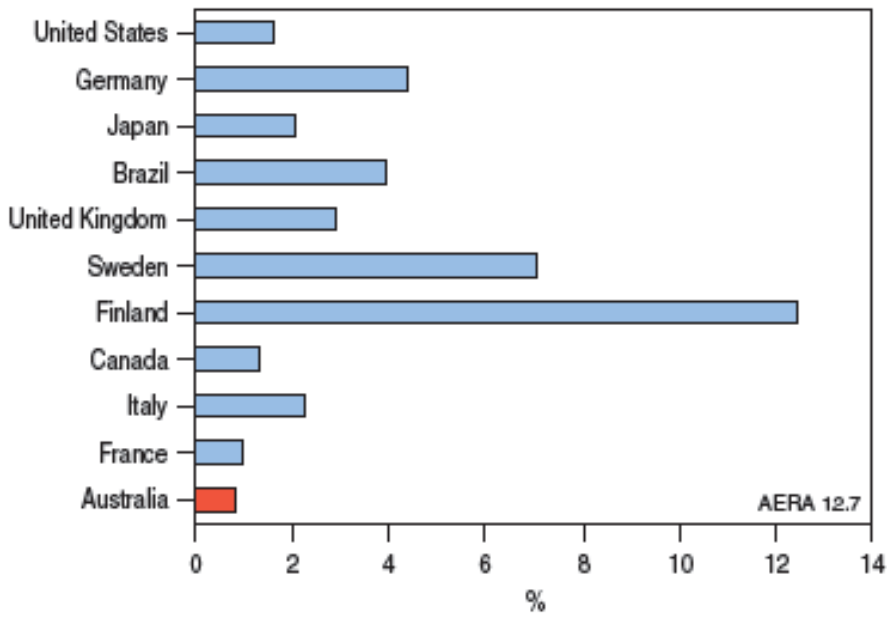


- Biomass provides 10% of TPES or 50 EJ
- Technical potential 1,500 EJ by 2050
- Sustainability consideration → 200-500 EJ
- Global bioelectricity 52 GW capacity

a) Electricity generation from bioenergy



b) Share in total electricity generation



## Bioelectricity by Country

(source: Geoscience Australia)

# Some Specific Technology Trends

- Mallee Eucalyptus and *Arundo donax*
- Pellets and Torrefaction
- Large scale power plants (for economy of scale)
- Gasification and BIGCC
- Pyrolysis and biochar
- Organic Rankine Cycles
- Fuel Cells
- Stirling engines
- Small Scale biogas
- Micro-turbines
- Vegetable oil fired engines and turbines
- Co-firing and multifuel operation
- Biorefineries



## Small Gasifiers – e.g. Real Power Solutions

Tasman Gasifier -  
demonstrated at BEA09  
conference







Ankur Gasifier dual firing a diesel genset - Huon Valley, Tasmania.



Värnamo BIGCC Plant, Sweden (source: IEA Bioenergy)



# Emerging Bioenergy Technologies – Stirling engines and Organic Rankine Cycle plants

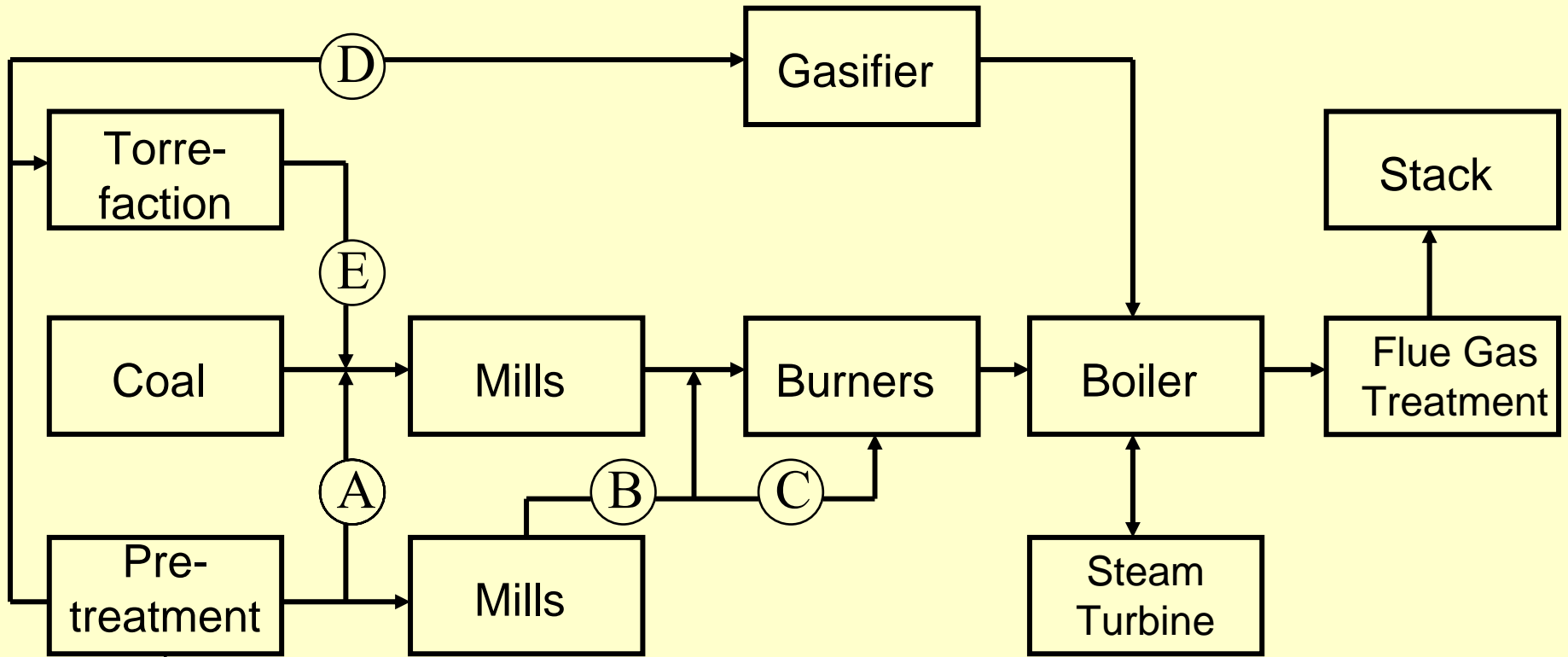


70 kW<sub>e</sub> Stirling engine - electric efficiency of ~12%. BIOS BIOENERGIESYSTEME GmbH, Austria



600 kW<sub>e</sub> Oerlinghausen–D ORC module fired by a biomass (Source: Turboden)





- A Co-milling of biomass with coal
- B Separate milling, injection in pulverised fuel lines, combustion in coal burners
- C Separate milling, combustion in dedicated biomass burners
- D Biomass gasification, syngas combusted in furnace
- E Co-milling of torrefied biomass with coal

# Co-Firing Regimes



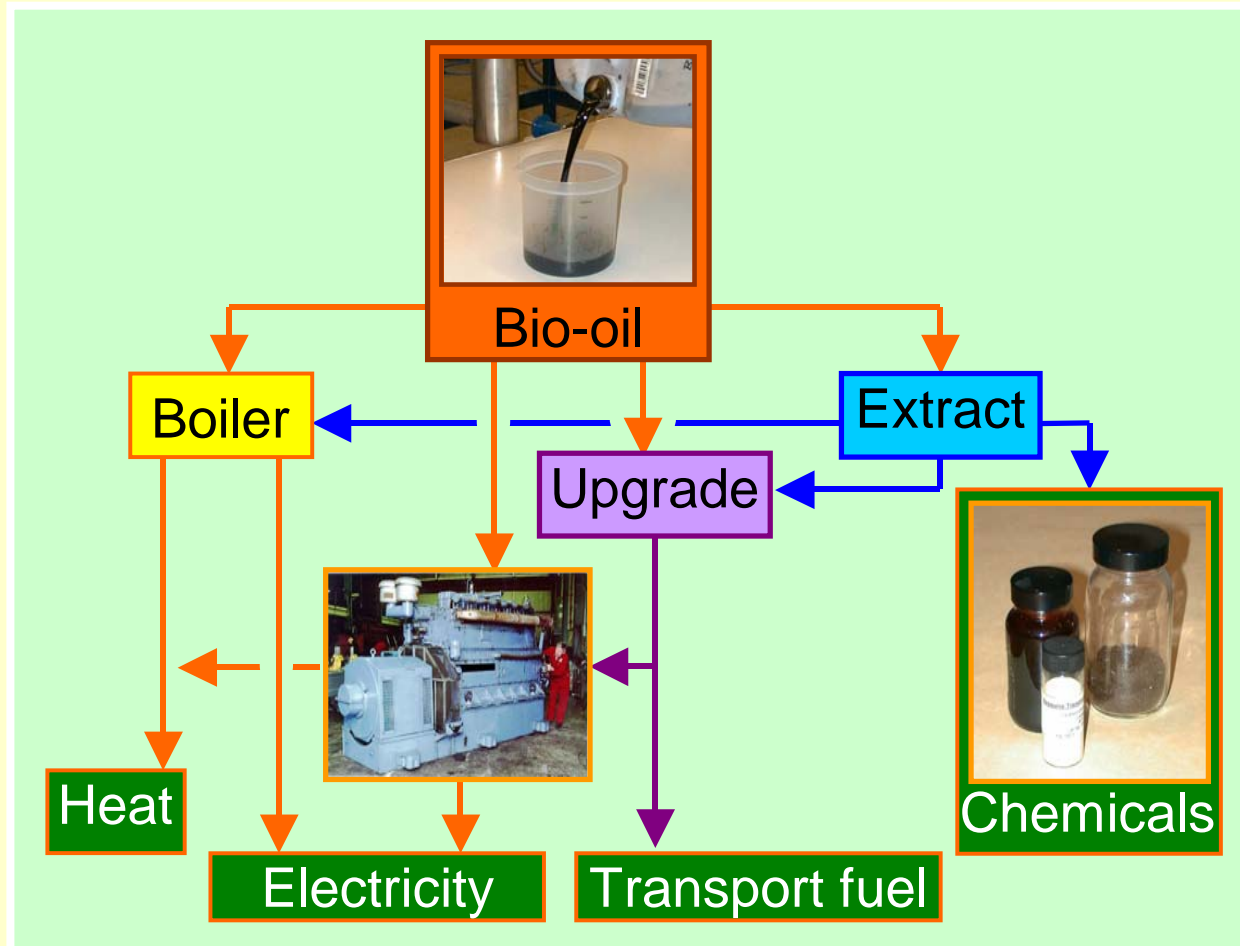
Wood Waste on Coal Conveyor Belt at  
Wallerawang Power Station (Source: Delta Electricity)

# Pyrolysis Bio-oil

- Dark brown mobile liquid
- Combustible
- Not miscible with hydrocarbons
- Heating value  $\sim 17$  MJ/kg (60%v diesel)
- Density  $\sim 1.2$  kg/l
- Acidic, pH  $\sim 2.5$
- Pungent odour
- Unstable - viscosity increases with time



# Bio-oil applications



Renewable Oil Corporation developing bio-oil

# Conclusions



- Bioenergy is under developed in Australia, but has significant potential
- Australia has some significant expertise in biomass feedstocks, energy conversion technologies, project management
- Some uncertainty remains regarding underpinning legislation – LRET. This should be settled in the coming months
- Issues remain... sustainability – ‘food vs fuel’, land use, water, nutrients, public acceptance.

For further information see: [www.bioenergyaustralia.org](http://www.bioenergyaustralia.org)