Biomass for bioenergy from sustainably managed private native forests in Southeast Queensland, Australia

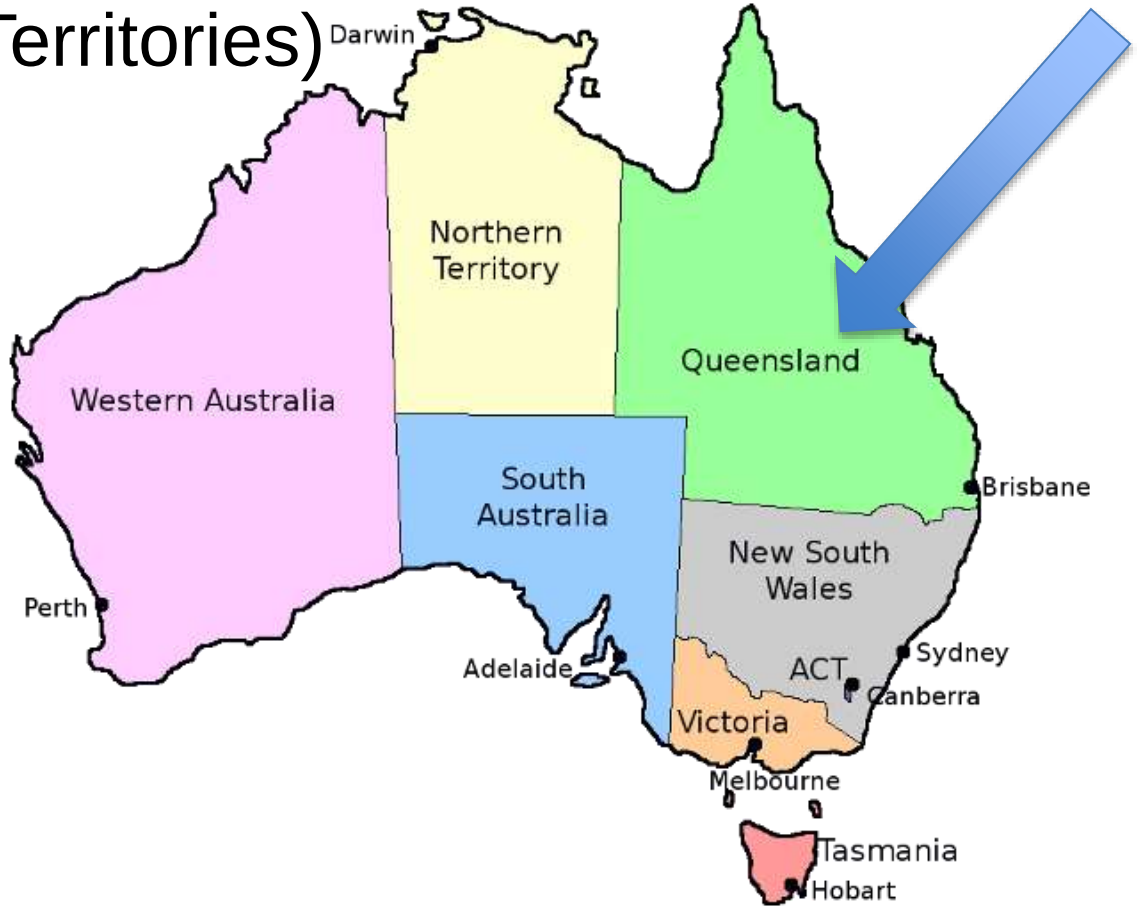
Inaugural Global Forest Biodiversity Initiative Conference
& GFBI-FECS Joint Symposium 2017
Forest Research in the Big Data Era
September 6-9, 2017 Beijing, China

Michael Ngugi, John Neldner, Sean Ryan, Tom Lewis, Jiaorong Li, Phil Norman, Michelle Mogilski
Queensland Herbarium, Brisbane

Australia

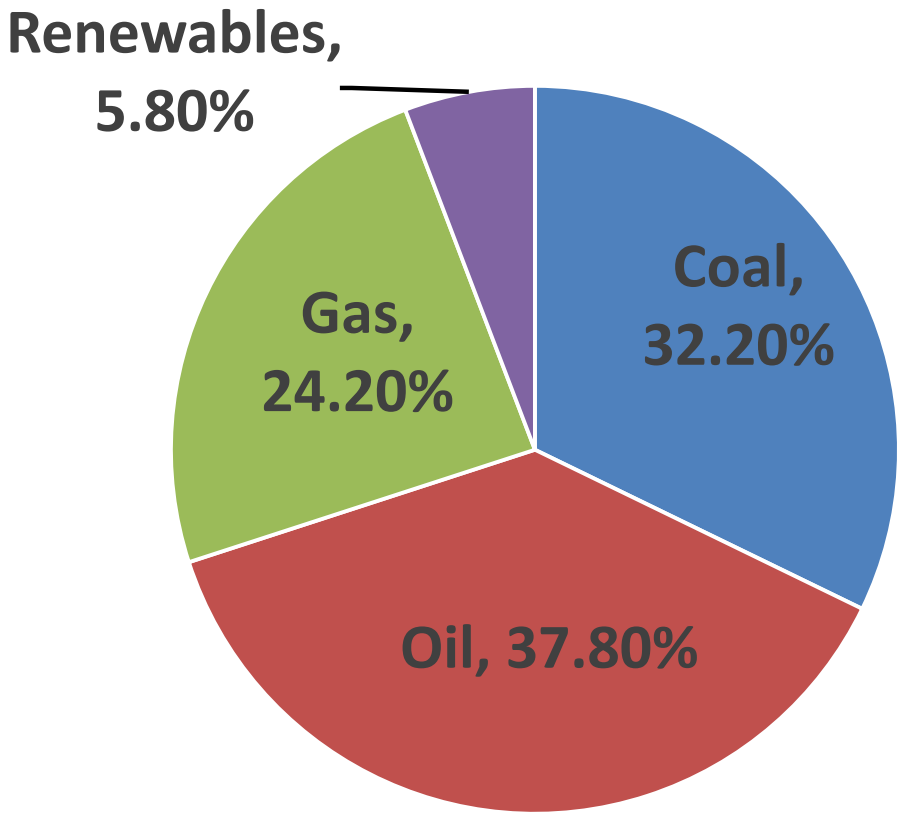
(States and Territories)

Eucalyptus racemosa native forest in Bellthorpe SEQ

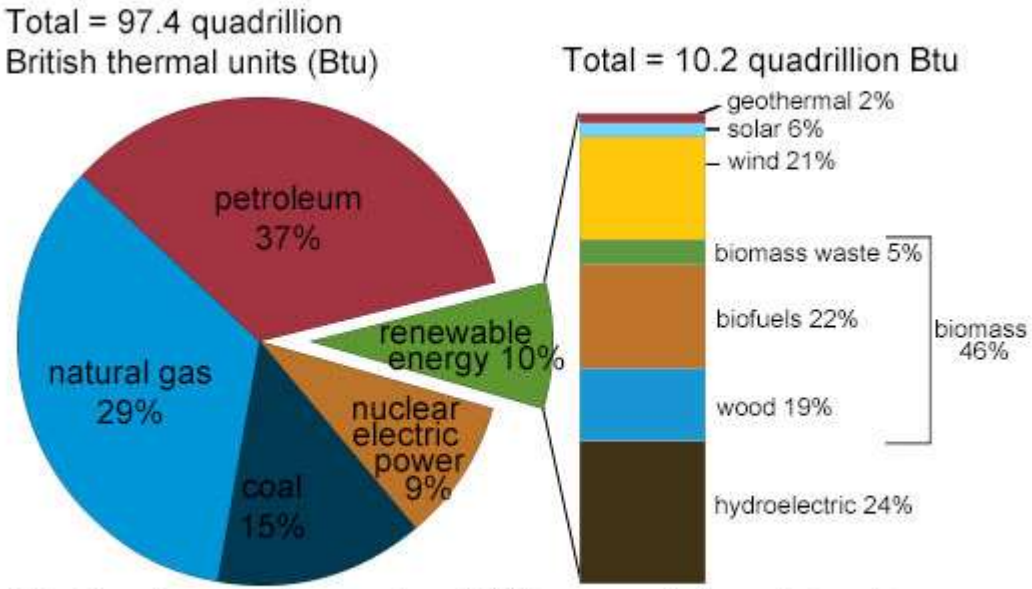


The Push for Renewable Energy

Australia Energy Consumption 2014-2015



U.S. energy consumption by energy source, 2016



Note: Sum of components may not equal 100% because of independent rounding.

Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2017, preliminary data

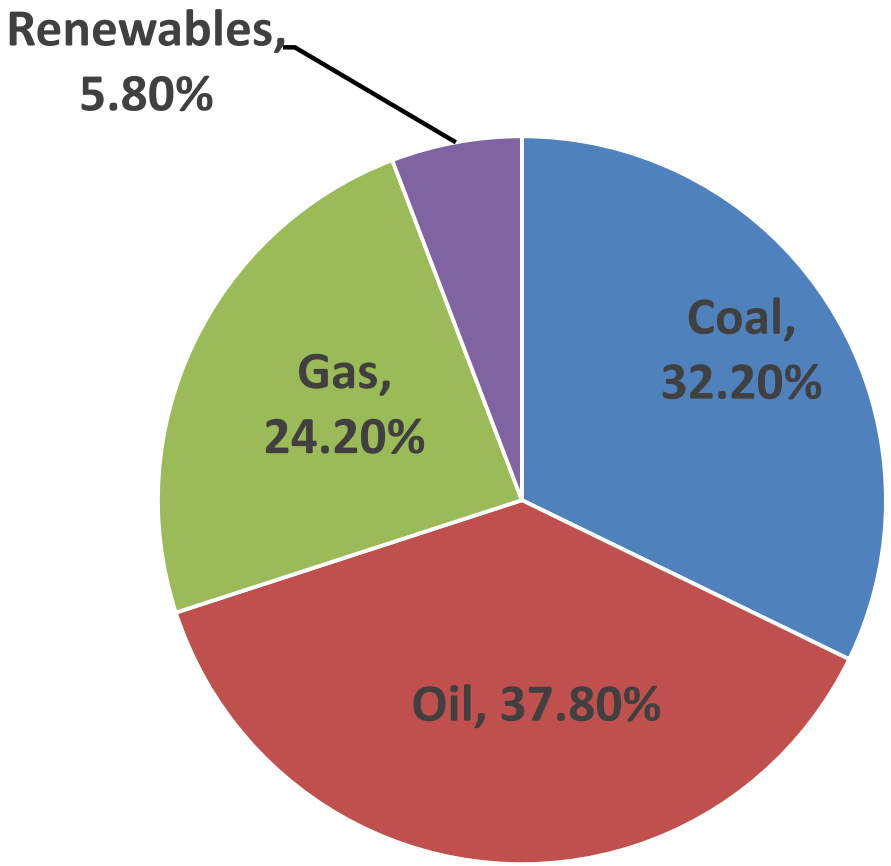
eia

Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*

Queensland Government

Australia Vs China Renewable Energy Consumption

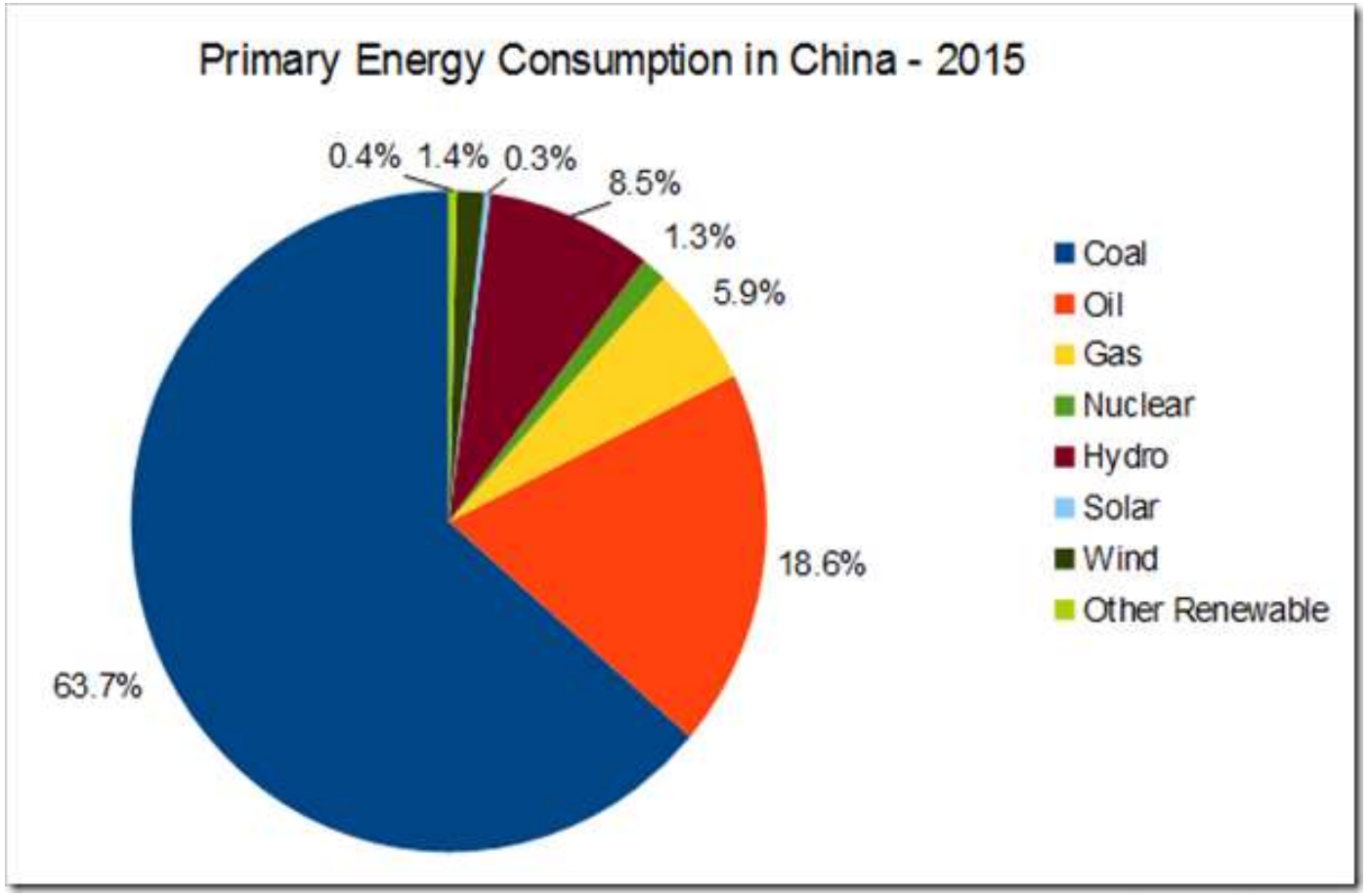
Australia 2014-2015



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*

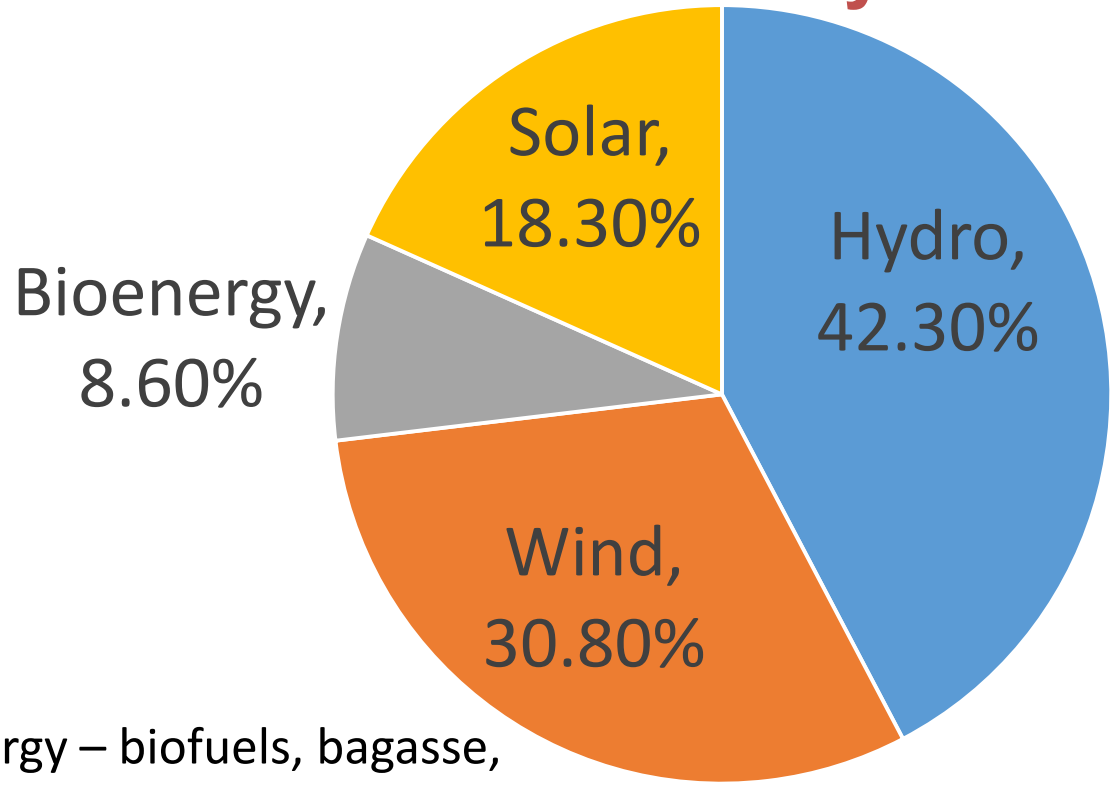
China 2015

Renewables 10.6%



Contribution of Bioenergy

2016 renewable energy supplied 17.3% of Australia's electricity

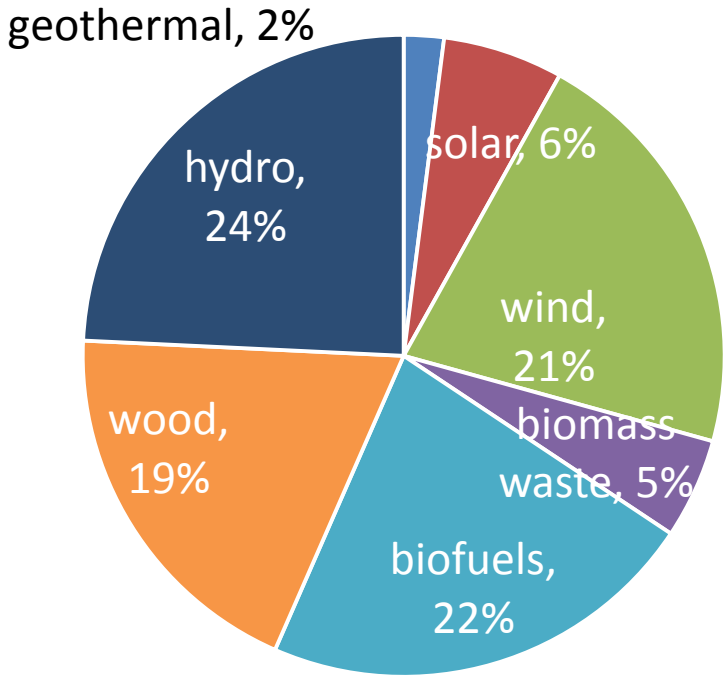


Bioenergy – biofuels, bagasse, landfill gas, wood waste

Source: Clean Energy Council, Clean energy Australia Report 2016

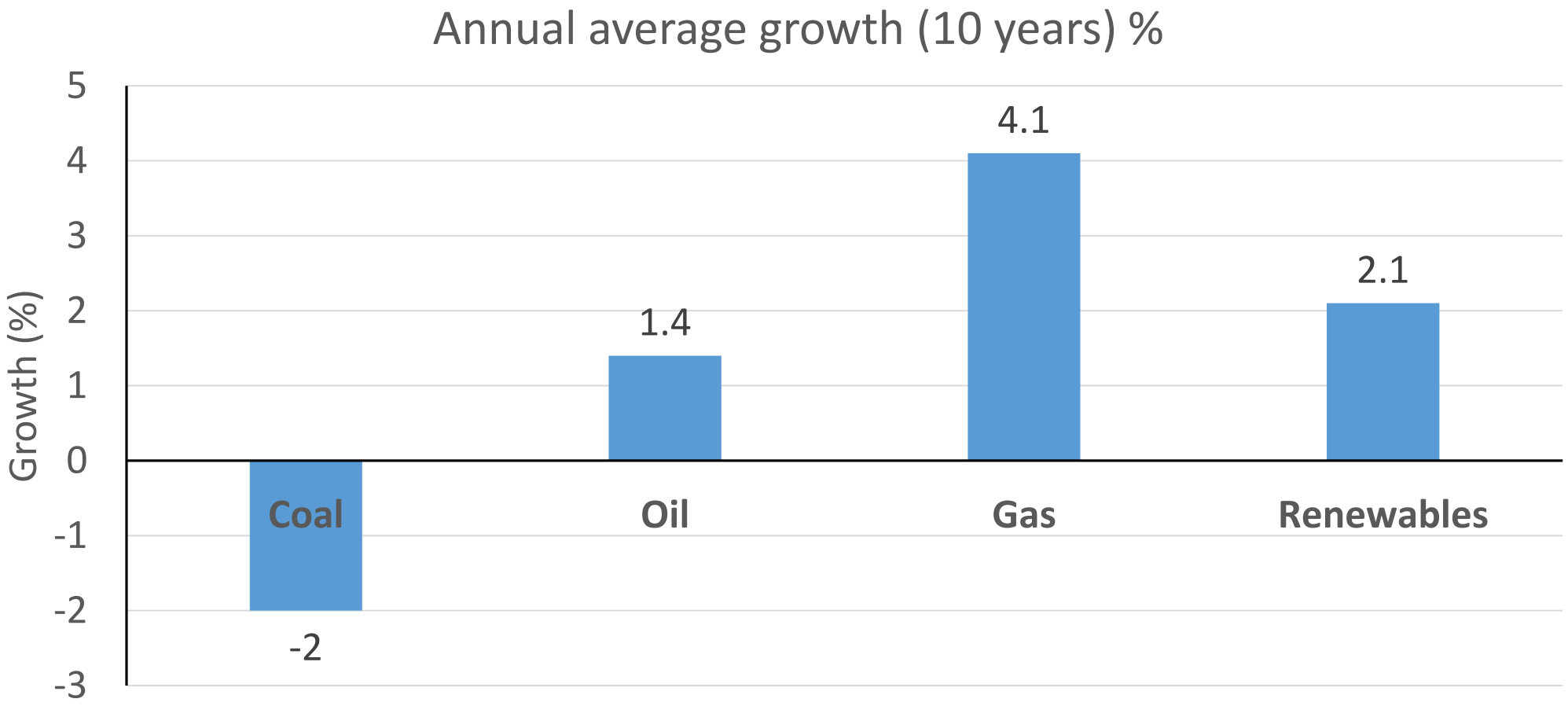
U.S 10% renewables 2016

Bioenergy (wood, biofuels, bio waste) = 46%



U.S. Energy Information Administration. Monthly Energy Review, Table 1.3 and 10.1, April 2017 preliminary data

Australia energy consumption growth by fuel type (2016)



Source: Department of Industry, Innovation and Science (2016) *Australian Energy Statistics*

Can native forests make a contribution to the growing renewable energy consumption?

Native forest dominated by *Eucalyptus pilularis*

Potential of native forests in Australia

- 125 million hectares in Australia – ranks 7th in the world
- 36.6 million hectares suitable and available for commercial wood production (2010-2011)
- 29.1 million hectares are under private ownership (80%)
- Private native forests in Queensland have limited or no silvicultural management- sawlog harvesting
- Community concerns for forest harvesting (Social licence)

Objective

Provide an estimate of current harvestable biomass for bioenergy in living trees on private native forests:

- determine biomass from integrated sawlog and non-merchantable silvicultural treatment harvest

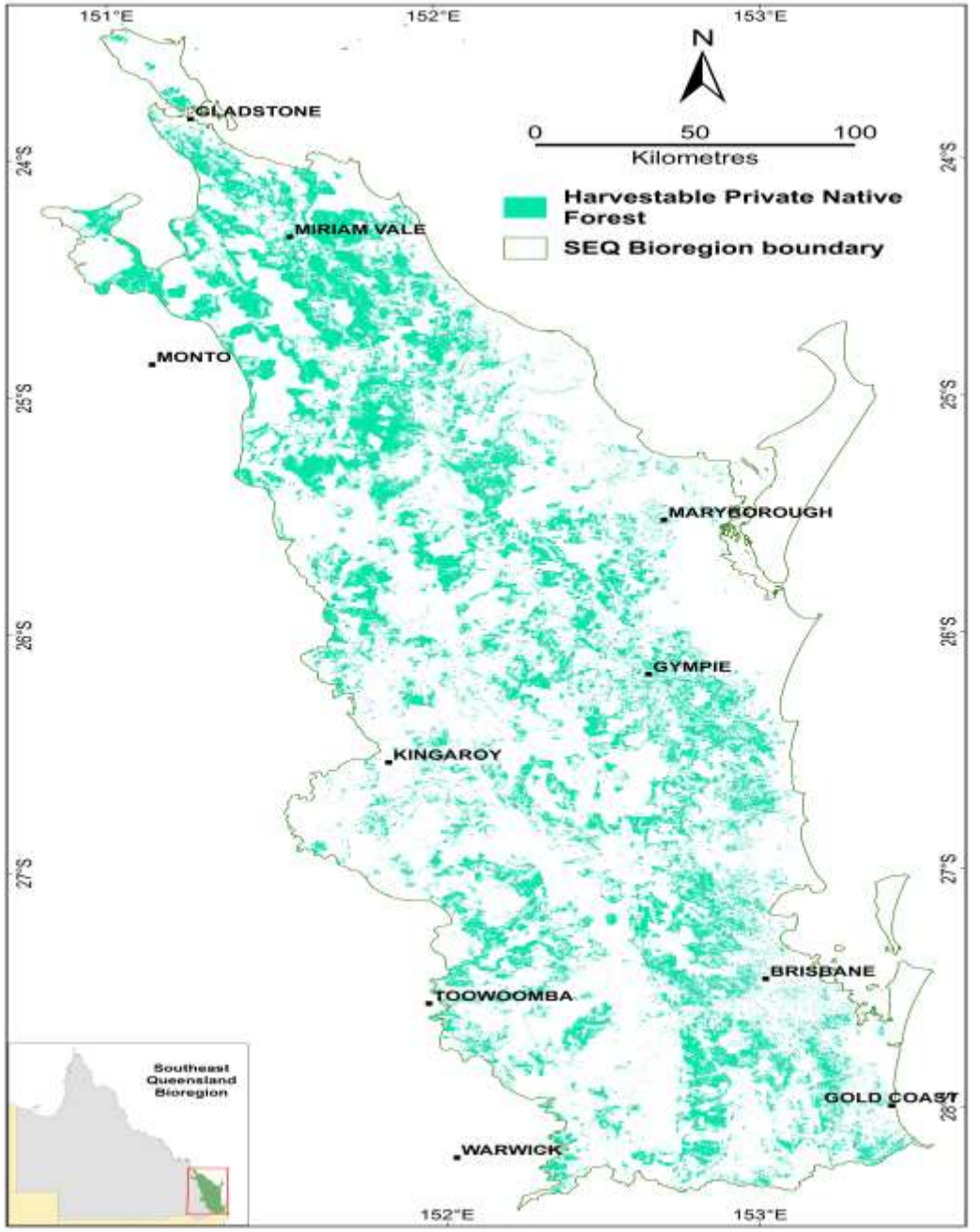
- determine biomass retained on-site for ecological purpose

Biomass for bioenergy = currently non-commercial harvest (includes, thinning and sawlog harvest residue and excludes biomass retained for ecological values)

Study Area

Private native forests in Southeast Queensland bioregion

Yandina private native forests from Point Glorious lookout, Mapleton



Data sets used for the study

- Regional Ecosystem mapping of native forests *(discrete vegetation community that is consistently associated with a particular combination of geology, landform and soil)*
  - for stratification
- Remote sensed foliage projective cover for the study area (FPC 2013)
- List of harvestable Regional Ecosystems (native forest code of practice)
- A total of 541 native forest inventory plots
- Plots varying in sizes (0.037 to 2.6 hectares)
- 53 130 measured trees

Silvicultural treatment of private native forests

Before thinning

(Location Ravensbourne)

After thinning

(Location Ravensbourne)

Estimating aboveground biomass

- Individual tree biomass using allometric equations
- Proportions (%) of tree biomass (stump, stem, bark and crown using Ximenes et al. 2008)

Ximenes FA, Gardner WD, Kathuria A (2008). Proportion of above-ground biomass in commercial logs and residues following the harvest of five commercial forest species in Australia. For Ecol Manag 256:335-346

Selective harvesting/thinning operation

Residual biomass for bioenergy from a sawlog operation

Examples

BVG	Vegetation description and dominant species	Sites (n=285)	Residual biomass (t ha^{-1})
9a	Moist eucalypt open forests dominated by *Eucalyptus siderophloia* plus others	38	3.12 ± 0.42
9h	Dry woodlands dominated by *Eucalyptus acmenoides* plus others	65	2.06 ± 0.20
10b	**Moist open forests dominated by *Corymbia citriodora* (spotted gum)**	69	1.97 ± 0.17
13d	Woodlands dominated by *Eucalyptus moluccana*	47	1.97 ± 0.24
16c	Woodlands dominated by *Eucalyptus tereticornis*	26	2.07 ± 0.26
	Mean		**2.38 ± 0.13**

Estimated harvestable biomass for bioenergy

Broad Vegetation group (1: 1M)	Sites n=450	Harvestable biomass for bioenergy (t ha^{-1})	Proportion of harvestable area 1.3 m ha (%)
2a Complex notophyll vine forests	8	23.1 ± 4.0	3.4
8a Wet tall open eucalypt forests	9	32.7 ± 4.1	2.2
8b Moist open forests *E. pilularis*	14	20.9 ± 3.0	2.7
9a Moist open eucalypt forests	69	15.6 ± 1.2	6.4
9h Dry woodlands – eucalypts	81	11.1 ± 0.7	7.4
10b Moist open forests *Corymbia* spp	156	10.5 ± 0.6	44.4
13d Woodlands of *E. moluccana*	64	11.5 ± 0.7	4.0
16c Open woodlands on floodplains	28	11.3 ± 1.1	7.9

forests dominated by *Corymbia citriodora* (spotted gum) – most extensive

Un-thinned site (Nanango)

Thinned site (Nanango)

Summary

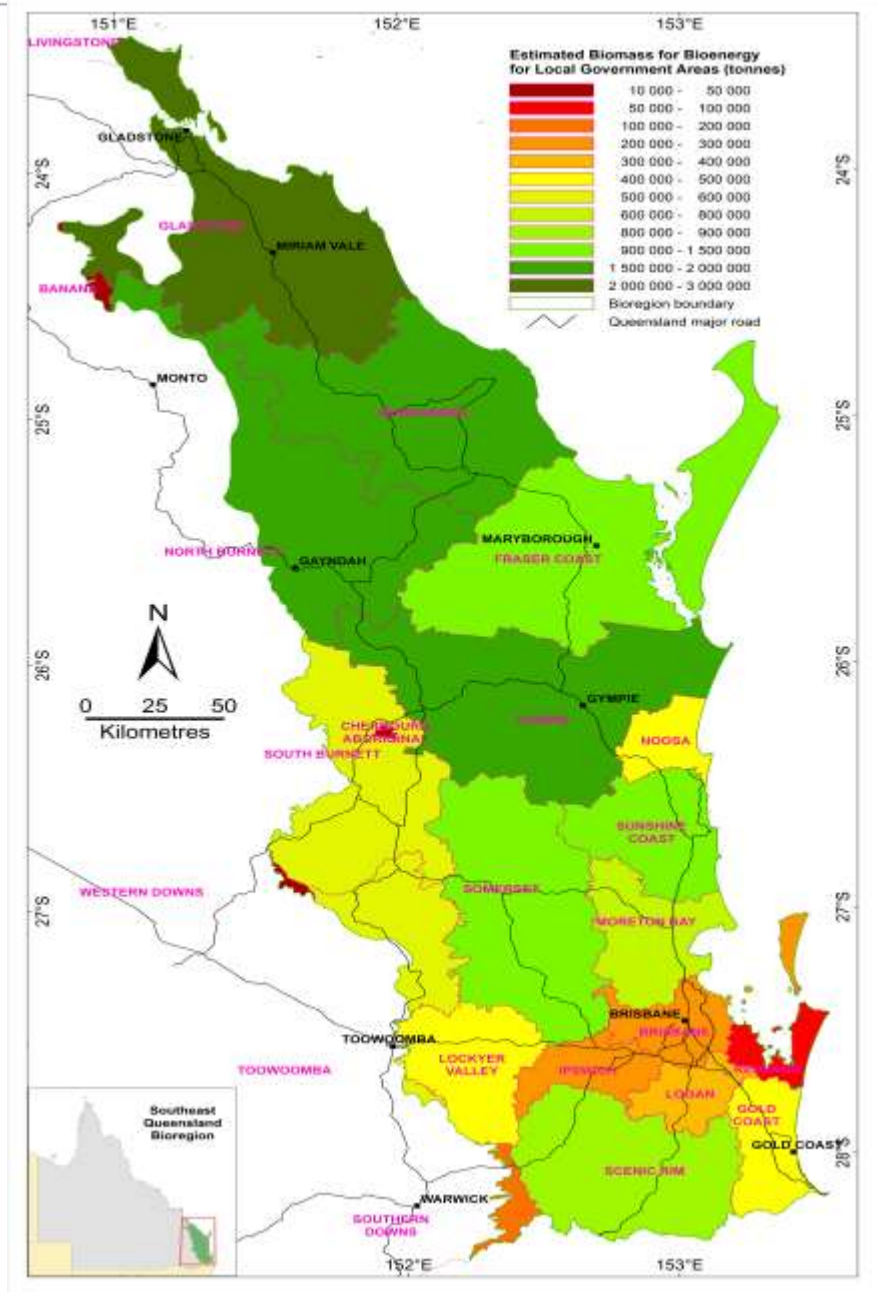
1. Biomass distribution map

2. 1.3 million hectares harvestable

3. 16.9 million tonnes (supply energy to a city of 50 000 households for 58 yrs)

4. 45% tree biomass retained on site for environmental values

5. Biomass within 200km to a coal-fired electricity generation facility



Acknowledgements

- Australian Biomass for Bioenergy Assessment (ABBA)
- Private Forestry Service Queensland (PFSQ)
- Department of Agriculture and Fisheries (DAF).
- The Queensland Herbarium (QH)

Coal-fired electricity generation facility