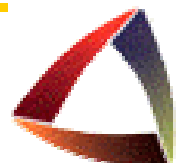
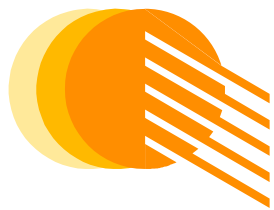


Jobs and Investment Potential of Renewable Energy for Australia

I.F. MacGill and M.E. Watt*

School of Electrical Engineering and Telecommunications
*ACRE and the Centre for Photovoltaics Engineering
University of New South Wales
Tel: +61 2 9385 4920
E-mail: i.macgill@unsw.edu.au
www.acre.ee.unsw.edu.au



Energy and sustainability

ACRE

- Energy services play a critical role in society
  - Australians using average 8kW (ABS, 2001)
- Our present energy sector has very high environmental and social externalities
  - 1.8 billion people worldwide without electricity (IEA, 2002)
  - Stationary energy sector contributes ~50% of Australia's GHG emissions (AGO, 2002)
- These externalities are unsustainable
  - BAU energy sector development means 1.4 billion people without electricity in 2030 (IEA, 2002)
  - BAU for Australian stationary sector means GHG emissions up 50% by 2020 (AGO, 2002)

Energy, sustainability + renewables

ACRE

- Required energy sector transformation is large
  - *"Over this century the world is going to have to reduce its global greenhouse gas emissions by some 50-60%"* Dr Kemp, Federal Environment Minister (The Age, 2002)
- This transformation need not be hard
  - Many 'no regrets' measures available (IPCC, 2001)
  - Energy is only a small component of GDP
    - Australian household expenditure on stationary energy only ~2% of total spending (ABS, 2002)
    - For vast majority of businesses - stationary energy costs <3% of input costs
- **…and Renewable Energy will play a valuable role**

Motivation – Value of renewables

ACRE

- Growing awareness of economic, social + environmental value of renewables
  - Environmental + energy security concerns with fossil fuels
  - Falling costs of many renewables
  - Needs of the 2 billion people without commercial power supply
  - **Economic development + job creation potential of renewables**

Renewables + 'Strategies into Action'

ACRE

- Regional development
  - "Regional Australia stands to benefit from a greater update of renewable generation technologies" COAG Draft Energy Market Review
- Industry development
  - MRET (Renewable Energy Bill, 2000) objectives:
    - to accelerate the uptake of renewable energy in grid-based applications, so as to reduce GHG emissions
    - **…provide an ongoing base for the development of commercially competitive renewable energy and…. internationally competitive industries**

AEPG Project

ACRE

- AEPG study of investment + job creation prospects in the Australian Renewable Energy Industry

- *Study focussed on wider 'economic' values of renewables*
  - No attempt to estimate any ecological 'values'
- *Study results support view that these wider economic values are significant*
  - Hence, supports value of ecological transition

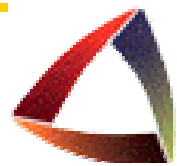
Global energy technology markets

ACRE

Source	Average annual growth rate (%) over 1990-2000
Wind power	25
Solar photovoltaics	20
Solar thermal (Europe)	18
Biomass	3
Natural gas	1.6
Coal	-1.0

- Future growth projections generally optimistic given
  - Present trends
  - Environmental drivers + related policy developments
  - Technical advances

Aust. sustainable energy market



- Non-hydro renewables only minor contributor to stationary energy sector
  - <1% of electricity generation (IEA, 2002)
- Little data on industry turnover + employment
  - NSW renewables + EE industry estimated sales of $1.8b + 5900 jobs in yr2000 (SEDA, 1999)
  - Grid wind 100MW => ~$200m investment + 800 jobyears (MacGill, 2002)
  - PV has annual sales $113m + 600 jobs (Watt, 2002)
- Future growth projections cautiously 'optimistic'
  - MRET has key role yet a low (2% by 2010) target

Renewables for $investment + jobs

ACRE

- Investment + economic development
  - Large potential market
  - Present strong growth
  - Rapid technical progress and innovation
    - Innovation and knowledge underpinning tech. development recognised as critical drivers for econ. development + growth
  - *Regional investment focus from best availability of renewable resources, high value applications*
- Jobs (arising from above), also
  - Tech. characteristics: small unit sizes, distributed application, biomass = labour intensive fuel provision
  - Present small scale of industry

Analysis - scale

ACRE

- Project case studies
  - *AEPG Stage I*
- Industry sector, by country or region
  - *Stage II*
- Macro-economic modelling of wider impacts of renewables or policy scenarios at regional or national level
  - *Stage III?*

Analysis - scope

ACRE

- Direct development and employment outcomes
  AEPG Stage I & II
- Outcomes given substitution for the economic activity and job creation of conventional energy options used otherwise
  Approximated in AEPG Stage I & II
- Macroeconomic modelling
  - impacts + opportunity costs of investment in renewables compared to other options
  - type I & type II multipliers for supply chain + wages spending

  AEPG Stage III?

Analysis - methodology

ACRE

- Surveys
  - Applicable for project, industry sector studies

    AEPG Stage I & II conducted select company + industry surveying + also surveys in international lit.
- Input – Output Analysis
  - Economy wide statistics on industries used to link inputs of an industry to outputs of all supply industries => multipliers for indirect and induced impacts
  - Required for macro-economic analysis

    Not used in AEPG study, however estimates of Australian content of investment do play key role

Analysis – renewables industry

ACRE

- Usual challenges in measuring, analysing, modelling + projecting industry economic + job outcomes
- For renewables industry, add its
  - Great diversity
  - Relative youth of many sectors
  - Rapid growth and evolution
  - Generally distributed implementation
  - Common integration with other activities
    - Eg. use of agricultural waste streams.
- Data availability is poor worldwide, very poor in Aust. => a major motivation for AEPG study

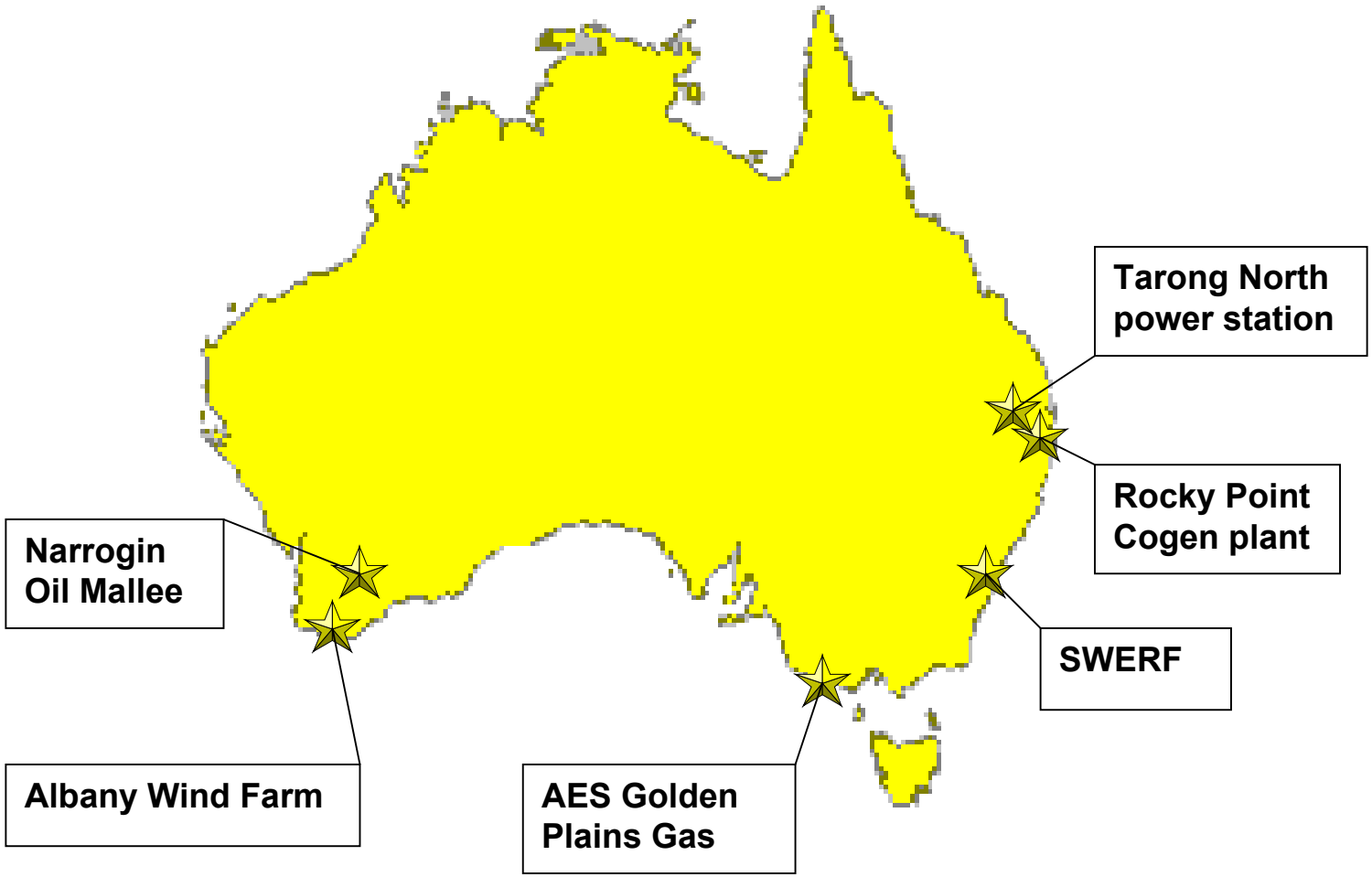
Analysis: $$ + job indicators

ACRE

Indicator	Units	Comments
Energy production	GWh	Estimated annual energy production
Capital Investment	A$ millions (1991 dollars)	Total expenditure to develop installed capacity including equipment and construction
Australian investment component	A$ millions	Amount of this capital investment spent in Australia.
O&M expenditure	A$ millions	Total expenditure on Operations and Maintenance of installed capacity
Aust. Manufacturing & construction jobs	Jobyears	*Total direct Australian jobs created by local manufacture of equipment and its installation in Aust.*
Aust. O&M jobs	Jobs	Total direct Australian ongoing jobs for O&M of installed capacity

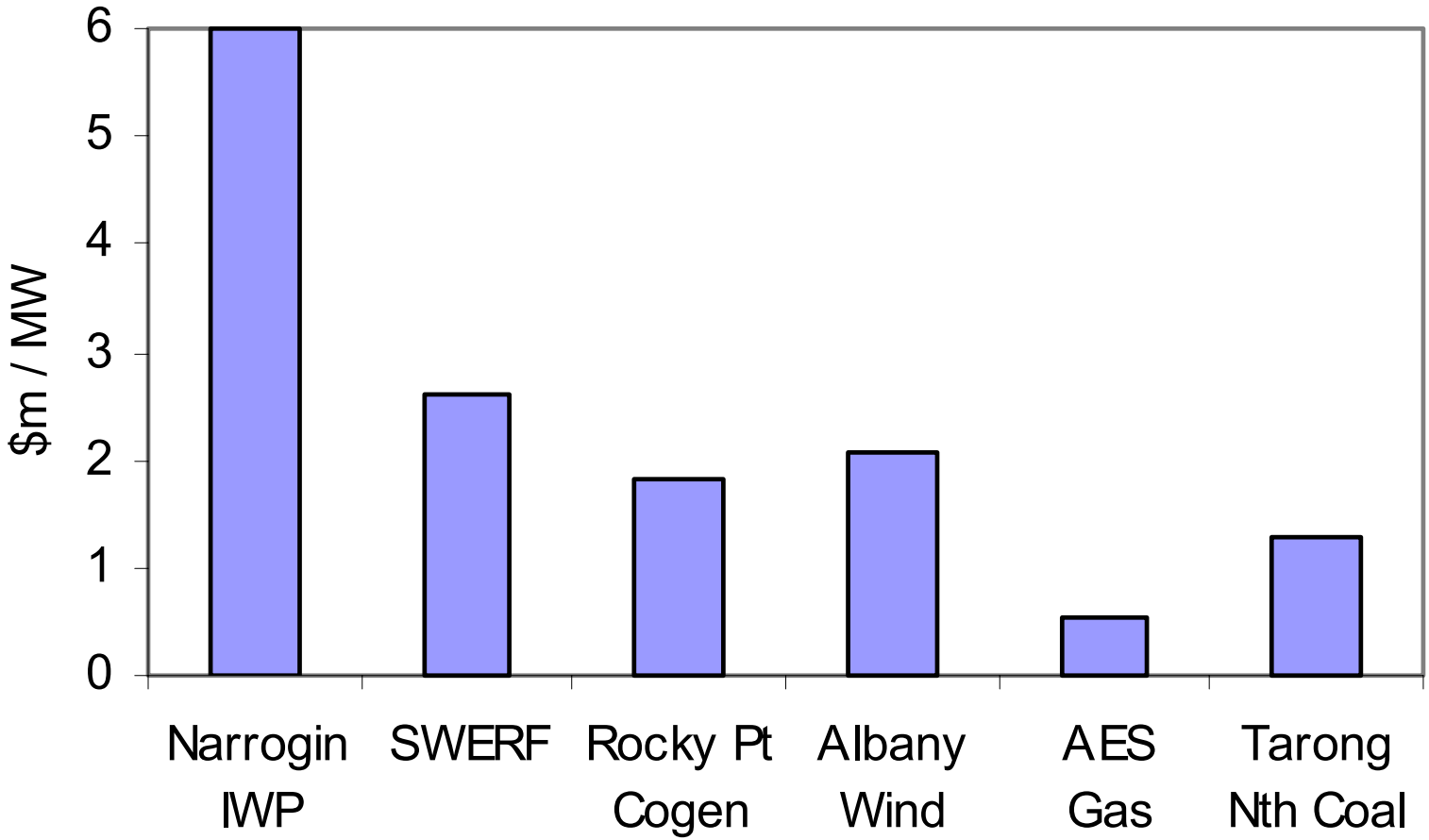
Stage I - Aust. Case studies

ACRE



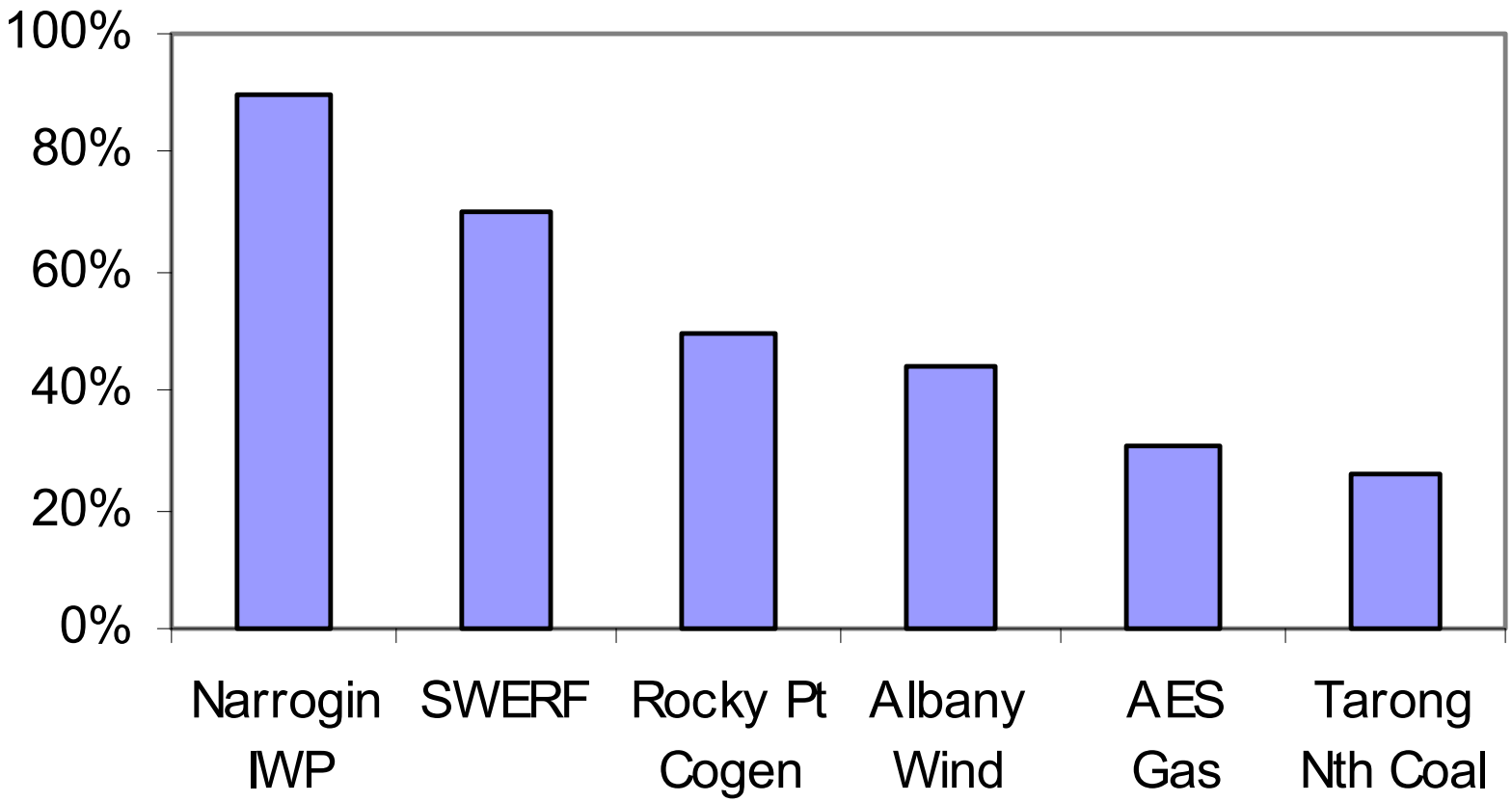
Comparative capital investment

ACRE



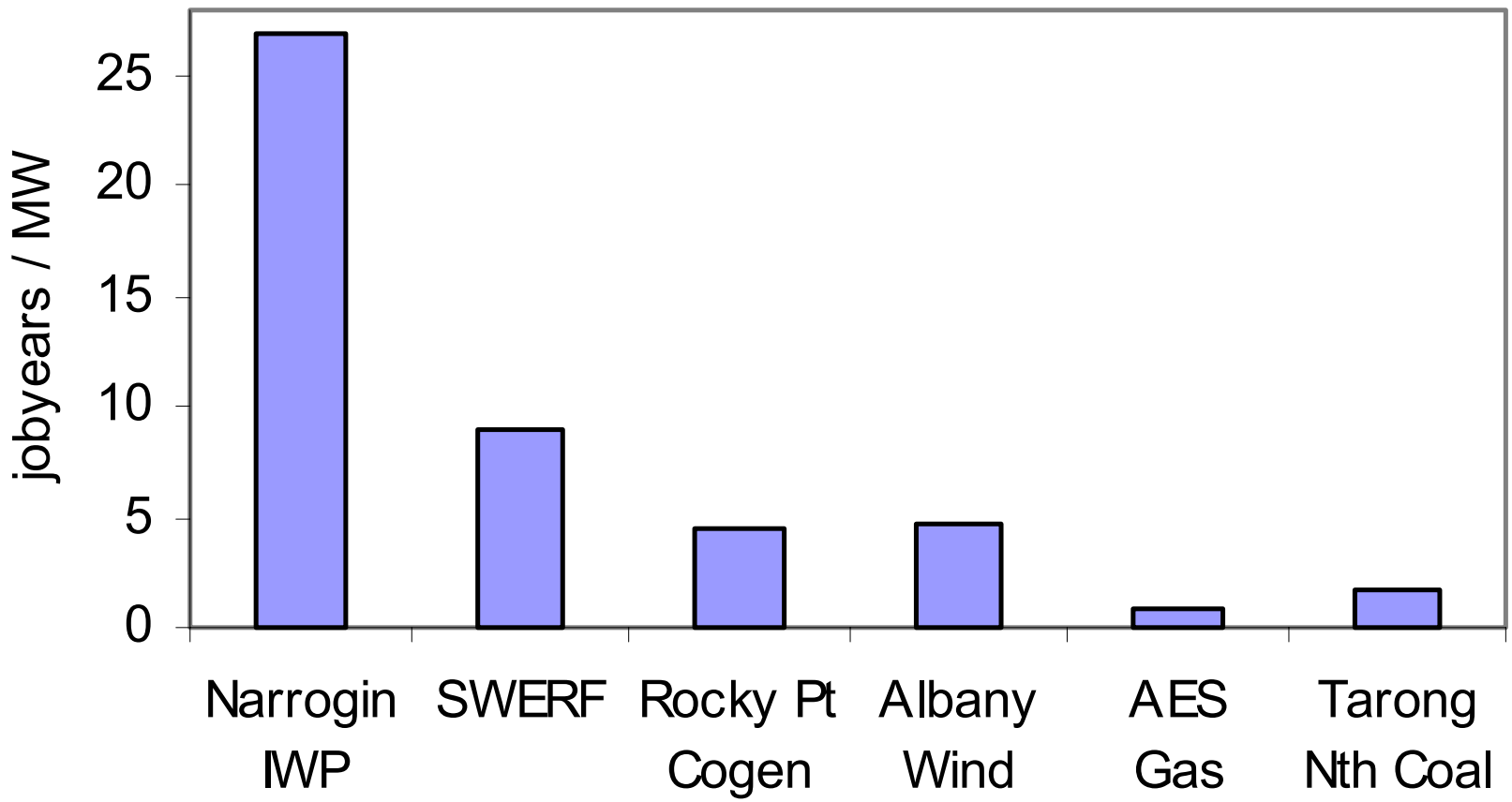
Comparative Aust. content

ACRE



Aust. Manufacturing + Constrn jobs

ACRE



Stage II - Renewable Industry Scenarios

ACRE

- **Wind** + Photovoltaics completed
- Biomass + Solar Hot Water coming
- Example: Australian wind industry scenarios

Scenario	Aust. Wind capacity in 2010 (MW)	Comments
Low	**1000**	Existing MRET and projected Greenpower requirement
Medium	3000	5% MRET target
High	5000	AusWEA and Greenpeace target

Analysis methodology

ACRE

Factor	**2002 indicator for scenarios**	**Indicator change to 2010**
Capital investment	$1.8m /MW	Reduction at 5% annually to $1.2m/MW in 2010 (2001 dollars) – an overall 33% reduction.
Australian content	50%	Linear increase to 90% by 2008 then steady
Total Australian jobyears for manufacture + installation	3.7 jobyear /MW (ie. 50% Aust. Content)	Reflects falling total jobyears yet increasing Australian content giving 4.5 jobyears /MW for installations in 2010
Ongoing Australian O&M jobs	0.12 jobs /MW	Falls at 9% annually to 0.06 jobs/MW for installations in 2010 – an overall 50% reduction.
Ongoing O&M expenditure	$18k /MW per year	Falls with falling capital costs to $12k /MW for installations in 2010

Scenario outcomes

ACRE

- Cumulative impacts 2002-2010

Scenario	Total Cap. investment (A$m)	Total Aust. Component (A$m)	Aust. Manuf. & construction jobs (jobyears)	O&M expenditure (A$m)	Aust. O&M jobyears
Low	1400	1000	4000	50	230
Medium	4000	3200	13000	160	840
High	6700	5400	22000	260	1400

- Industry size in 2010

Scenario	Annual Aust. installations (MW)	Annual Cap. investment (A$m)	Annual Aust. Component (A$m)	Aust. Manuf. & construction jobs	Aust. O&M jobs
Low	300	390	310	1300	80
Medium	600	740	670	2800	210
High	1100	1300	1100	4800	360

Comparisons with conventional energy sectors

ACRE

- Expand coal + gas project case studies?
  - Very conservative (generous) assumptions
  - How to capture overall direction of industry?

- Incorporate wider trends
  - NSW coal industry now <10,000 jobs
    (NSW power stations take only 25% of production)
  - 'BAU' coal jobs projected to fall 40% by 2010
    (PC, 1999)

Where next…

ACRE

- Worldwide, renewables show great potential
- Australian *renewables* offers significant $ + jobs potential
- Export opportunities too…

- ***BUT* industry support to develop local markets will be required (expanded MRET + more)**

Acknowledgements

- Funded by ACRE Energy Policy Group
  - Business Council for Sustainable Energy
  - Renewable Energy Generators of Australia

- Industry contributors to data + methodology
  - Authors remain responsible for any and all possible errors