

Sustainable Energy Myths and Realities

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Thanks to Dr Mark Diesendorf for some slides

Gross Material & Energy **In**-Efficiency!!

- n **Material Flows (North America) - 1% ends up in products & is still in use 6 months after sale.**
- n **Energy Efficiency - only a few percent for most efficient countries.**

(Source: Hawken et al, 1999:81)

The Pinnacle of Fossil Fuel Use



Problems with the Options

"Clean" Coal and Nuclear - The Oxymorons

- n Inherently 'dirty fuels'
- n Pollution – costly
- n Limited resource life
- n Inefficient conversion
- n Nimbyism
- n 1000 yrs Waste Disposal and Storage problems—beyond civilisations
- n Future hidden & external costs
- n Nuclear proliferation
- n International In-Security

Sustainable Energy Pathway

Renewables

- Solar
- Hydro
- Wind / Wave
- Biomass
- Geothermal
- Tidal

Non-renewables

Gas and Cleaner Coal
as back-up

Energy Efficiency

- Better technology
- Fuel switching
- Behavioural change

Structural change to:

Decentralised / Distributed
Infrastructure

- Energy/water
- Cities - nodes
- Industry – clean
production
- Efficient transport

Problems with the Options

Renewables - The No-brainer

- Nimbyism
- Visual and noise – wind farms
- Air Pollution – biomass plant
- Displacement of food production for energy crops

Current World Energy Supply

Renewables VS Non-renewable Sources

3%?

Solar
Wind
Hydro
Biomass
Tidal
Wave
Geothermal



Simply Tapping into
a Natural Flow



Coal
Oil
Gas
Uranium

85%

6%



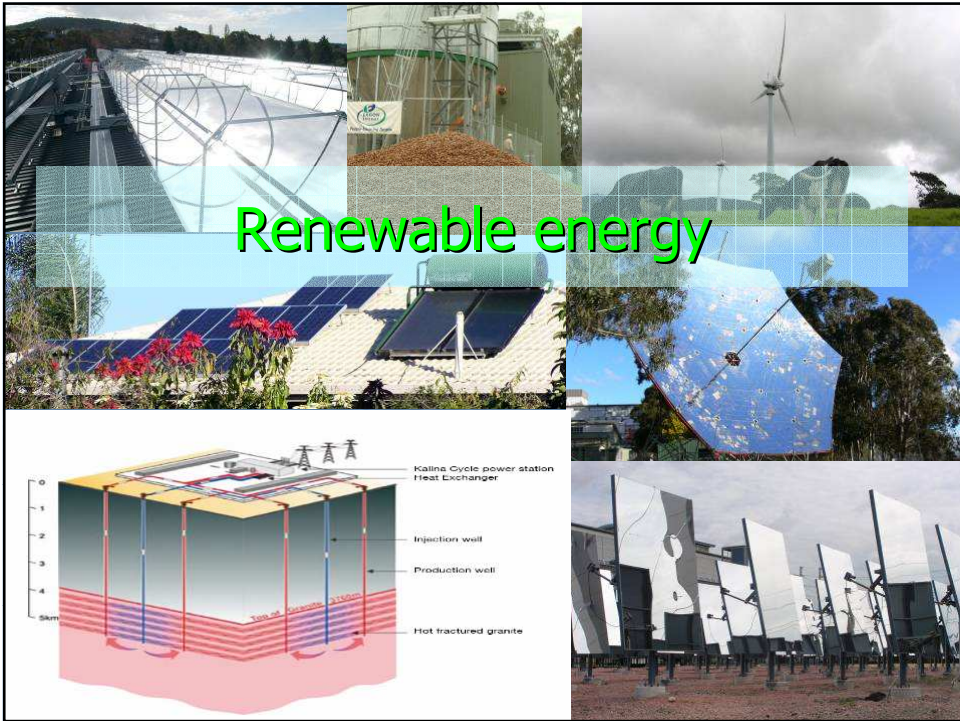
Continuously
Adds:
- Pollutants
- GH Gases
- Heat

Renewable Energy Resource = 15,000 x Current Energy Use

n Solar	80,000TW
n Hydro	40,000TW
n Wind/Wave	300TW
n Biomass	30TW
n Geothermal	30TW
n Tidal	3TW

(1TW = 10^{12} Watts
Or 1000 x 1000MW power
stations)



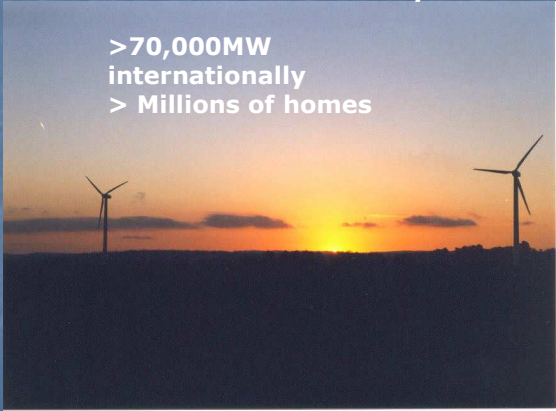


Renewable energy

Green Power: Wind farms

1 x 2MW Wind Turbine
 > 700 homes electricity

> 70,000MW
 internationally
 > Millions of homes



Green Power: Biomass

Conversion of Plant / Animal matter



- n Bagasse
- n Woody Wastes
- n Biofuel crops
- n Animal Wastes / Sewerage Treatment Works (methane)
- n Rubbish Tips (methane)

Green Power: Hydro

large, mini or micro



Solar Thermal Electric

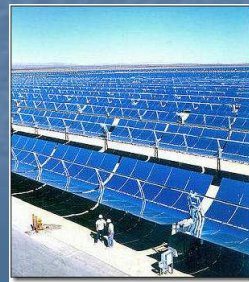
Concentrating Dish



Power Tower



Concentrating Trough



International CSP Project Developments

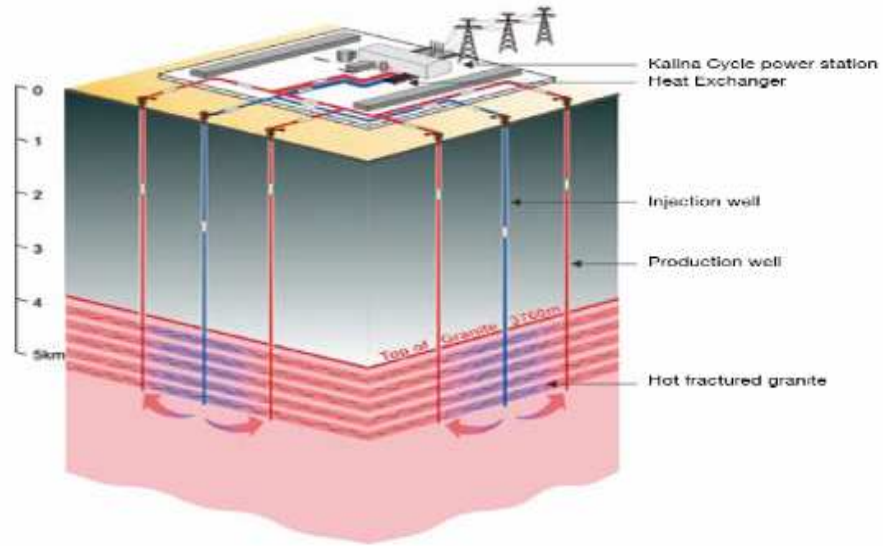


Predicted Growth

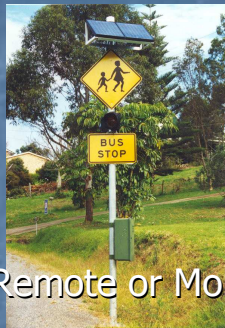
21,000MW by 2020
600,000MW by 2040

Source: CSIRO / World Bank

Geothermal



Photovoltaics



Remote or Mobile Power



Grid Connected Power



Energy Efficiency: Residential

- n **Solar efficient design in new buildings & retrofits**
- n **Insulation of buildings**
- n **Solar Water Heating**
- n **Efficient lighting & appliances**
- n **Efficient heating & cooling**
- n **Efficient showers taps**



Christie Walk, Adelaide City

Targets

- n **EU** **20% Renewables by 2020**
- n **California** **25% Reduction GHG by 2020 thru RE and EE**
- n **ISES** **20% RE Electricity by 2020**
50% Primary Energy by 2050
- n **IEA** **First acceptance that "business as usual" is unsustainable**
- n **High RE Contributions in Denmark, Germany, Sweden due to strong supportive policy**

Australia 2040 Clean Electricity Generation Mix

Efficient energy use to reduce demand. Then:

Natural gas:	30%
Bioenergy from crop residues & oil mallee:	30%
Wind power:	20%
Coal: (78% now)	8%
Hydro: (8% now)	7%
Solar electricity (conservative estimate)	5%

Achieves 80% reduction in CO₂ emissions from electricity

Source: Saddler, Diesendorf & Denniss (2004). Clean Energy Future for Australia

Qld Example – replace each 750 MW of Coal Power with:

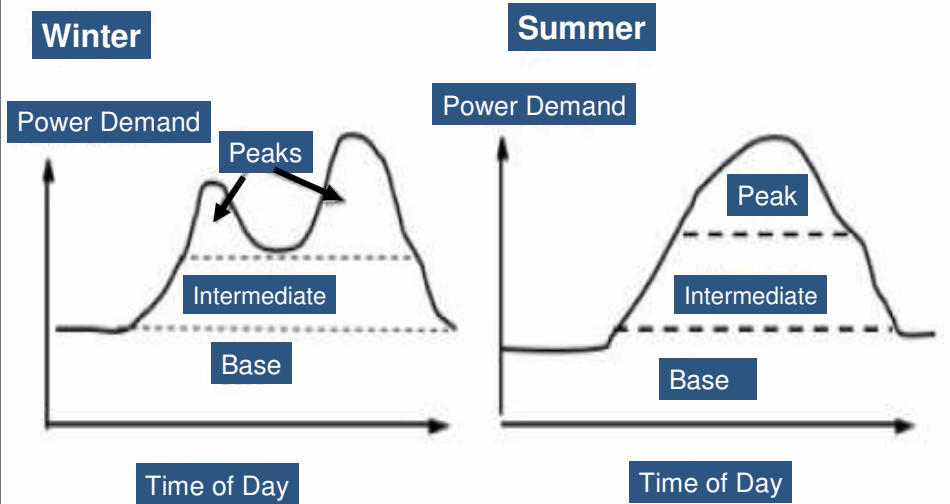
- n **200 MW of Biomass Plant**
 - n **200 MW of Gas Plant**
 - n **200 MW of Wind**
 - n **530 MW of Energy Efficiency (EE)**
- n **Result**
- > **1/4 of GHG and other emissions**
 - > **Lower Cost than New Coal Plant due to EE**

Source: Diesendorf (2004). Clean Energy Future for Qld.

Myth 1

- Renewables can't provide BASE Load Power

Load Curves



Base Load from SE - Yes

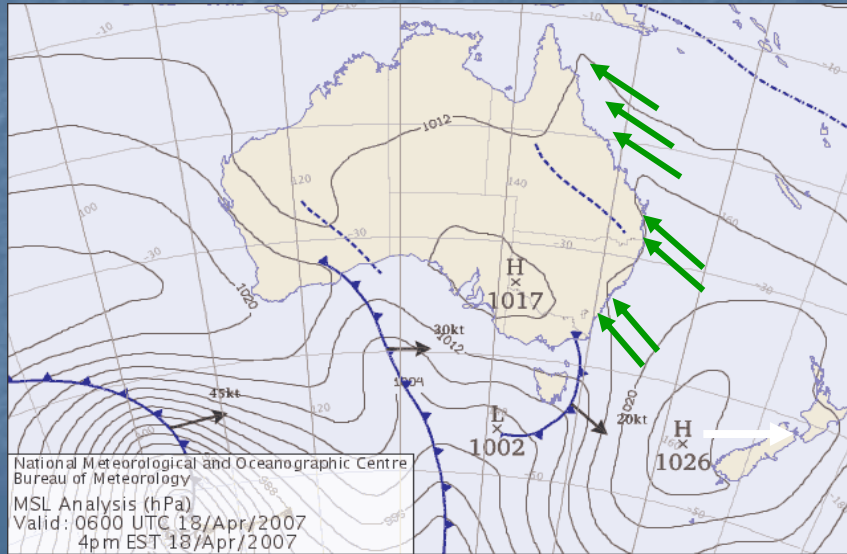
- n **Biomass**
- n **Gas**
- n **Hydro**
- n **Solar Thermal Electric with heat / chemical storage**
- n **Dispersed Wind**

- n **Energy Efficiency/Demand Management**
- n **Fuel Switching Eg. Solar Hot Water**
- n **Behavioural change**

Myth 2

- n Solar and Wind is intermittent so:
- n What happens when the wind doesn't blow and the sun doesn't shine?

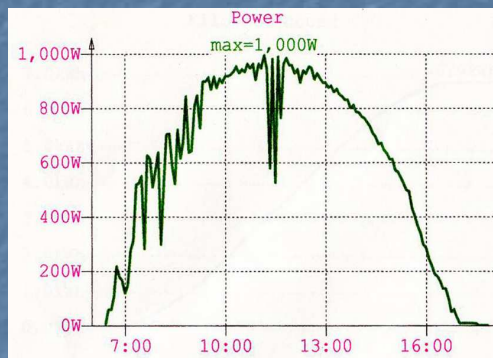
Intermittency - Wind



Intermittency – Solar PV

n Solar PV - meets summer peak demand
Eg. air conditioning

> High Value to PV power



Solar is too expensive?? or Coal/Nuclear is too cheap!!



Stern Review of Economic Costs

- n **Cost of business-as-usual and DELAYED response will be huge:
5–20% of annual global GDP by 2050**
- n **Costs equivalent to a world war or a major economic depression**
- n **Costs of greenhouse response NOW will be small:
about 1% of annual global GDP by 2050**

Cleaner Energy Mix: Direct Local Jobs per Unit of Electricity Generated

Source of electricity	Relative number of jobs in Australia
Coal electricity + coal mining	1
Wind power with 50% Australian content	2–3
Bio-electricity with 50% Australian content	Approx. 3.5 (mostly rural)
Wind power with 80% Australian content	3.5–5

(Source: Diesendorf 2007)

Energy Efficient Design principles



- Orientation
- Zoning
- Building materials and colours
- Thermal Mass
- Glazing
- Insulation
- Windows / Ventilation
- Shading
- Landscaping
- Internal fittings

Best Practice – New Homes

- n Passive Design
- n SWH
- n PVs
- n Solar Pool / Cover
- n EE appliances



Best Practice in Retrofitting

- n Passive design
 - Extra insulation
 - Shading control
- n Efficient appliances & Lights
- n Solar Hot Water
- n PVs
- n Rain water tanks
- n Grey water recycling
- n Cost \$20,000
- n Return >\$1000 pa.

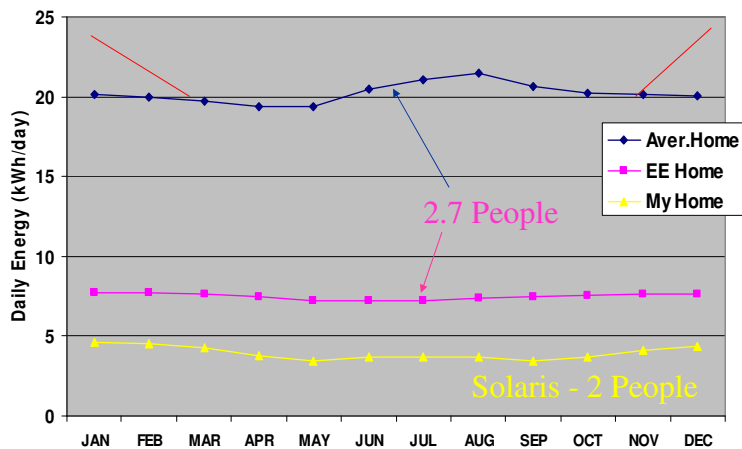


RESULTS

Energy Use > 1/3 per person

Water Use > 70% Less per person

Comparison of Aver. Home and EE Homes

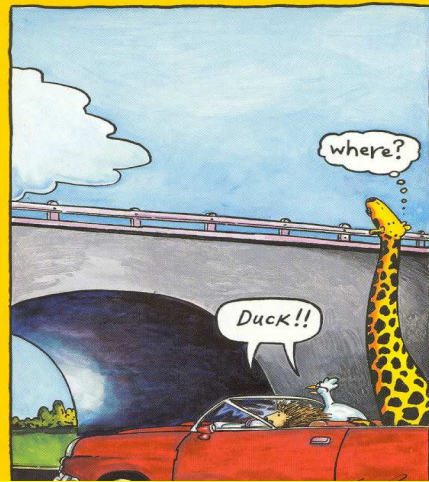


Crossroads

- n The climate is changing – act now
- n To expand the American Dream, there is simply not enough Fossil and Nuclear Fuel
- n Need 3 - 4 more planet Earths to supply current energy / materials & absorb the wastes
- n Current pathway is unsustainable – business as usual is no longer an option.

Only RE and EE provide immediate CO₂ Reductions

- n We have RE & EE technologies now
- n We know how to use RE & EE, and it doesn't cost the earth!
- n Failing to use it may!



Sometimes we lack the vision to take the right action?