



# Defining Australia's Geothermal Heat Pump Industry

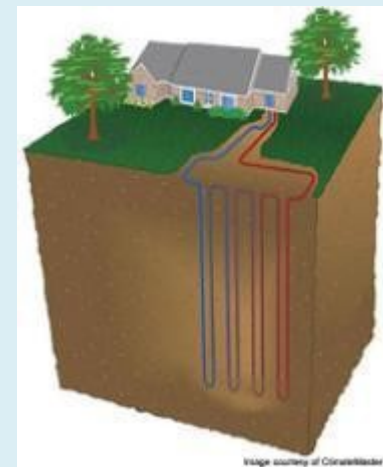
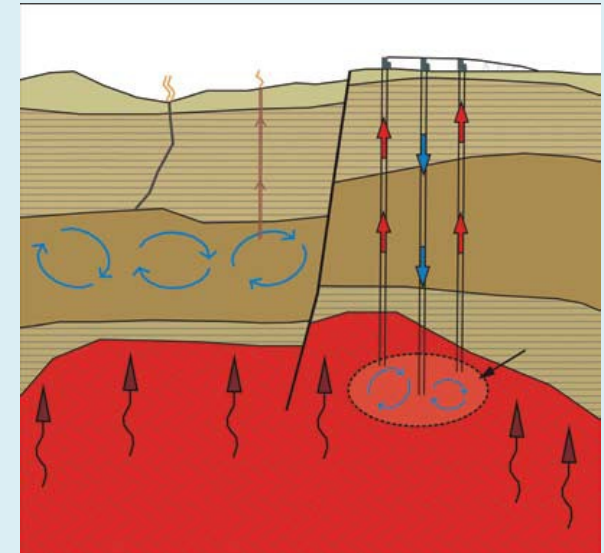
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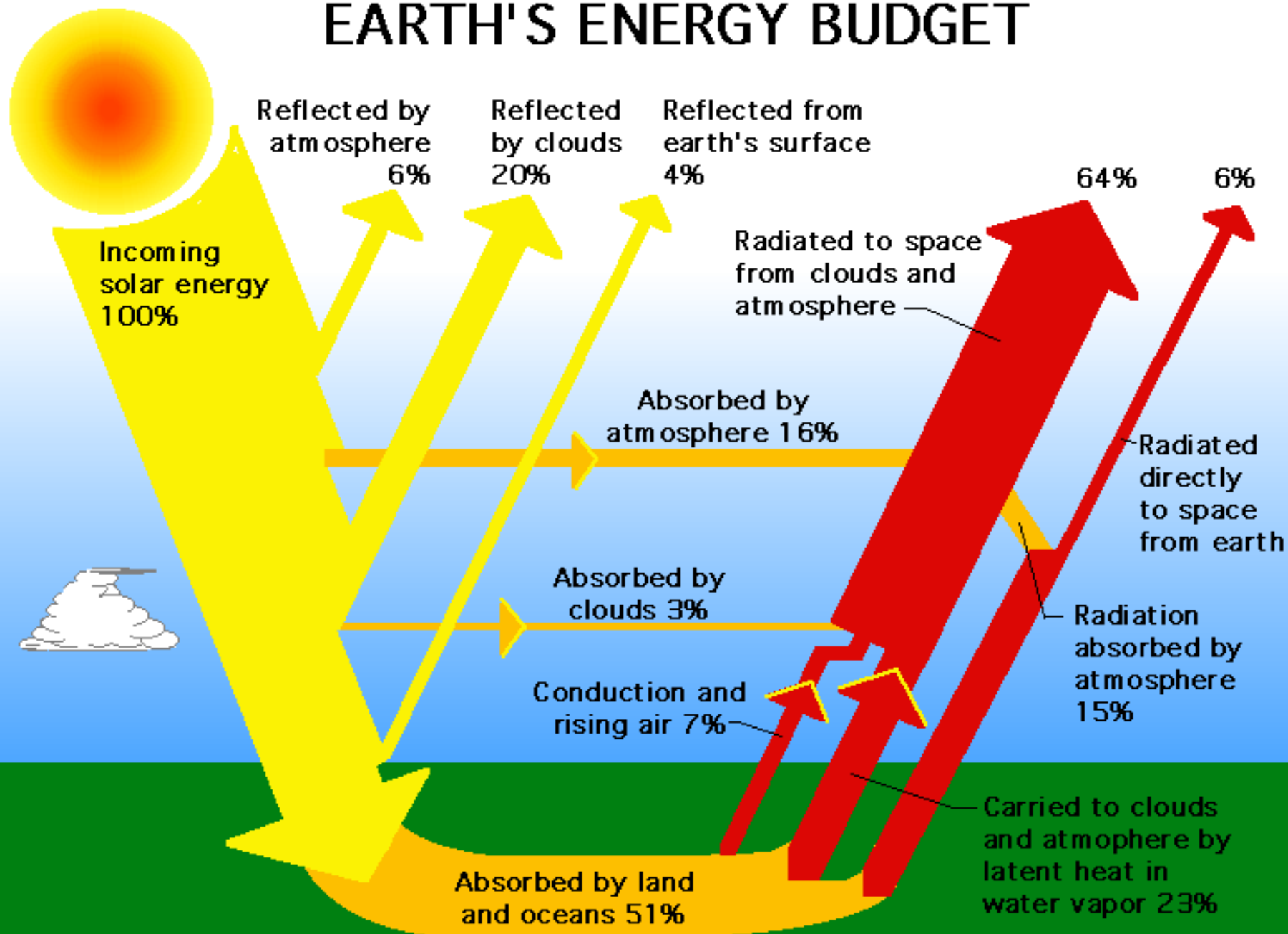


# Geothermal Energy



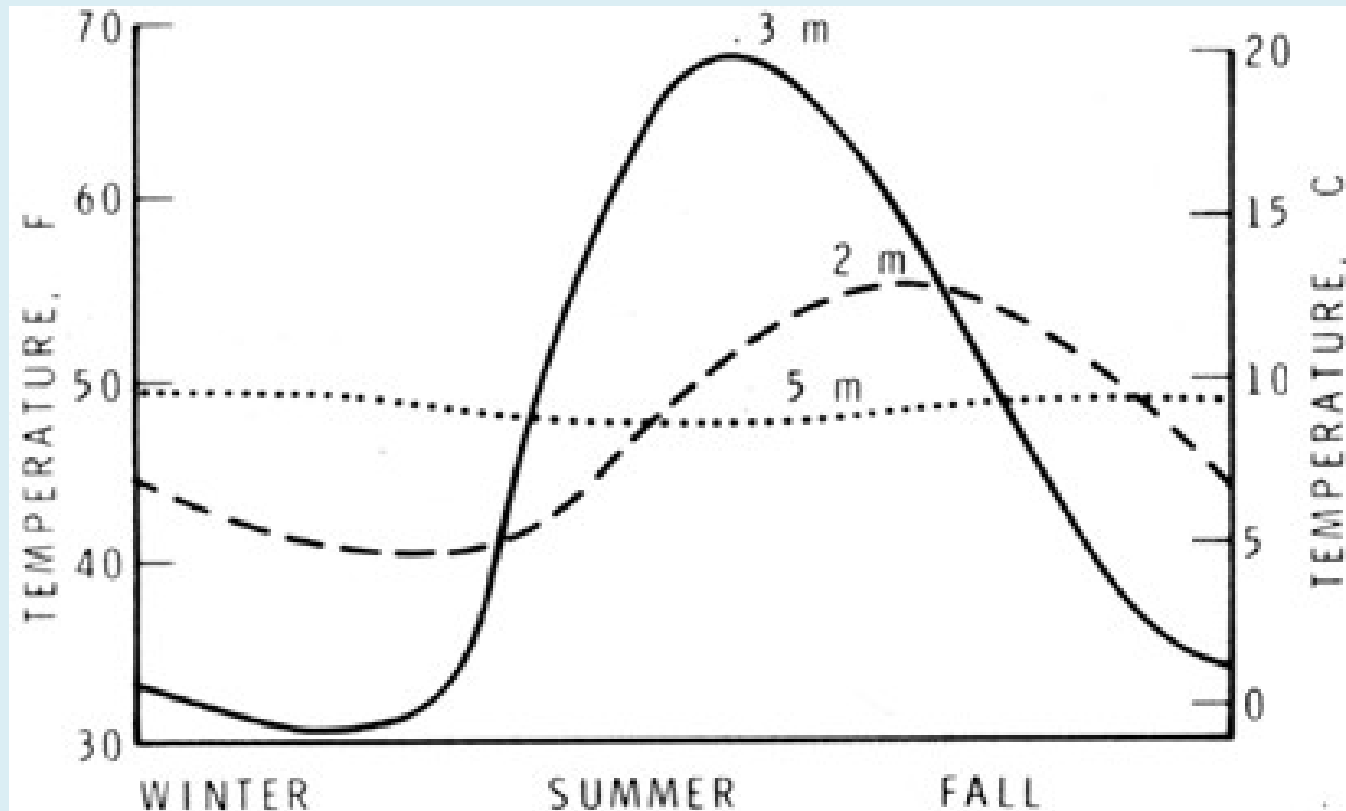
- **Indirect use: Electricity generation**
  - Hydrothermal - steam (cf. New Zealand)
  - Petrothermal - Hot Rock (Cooper Basin, Geodynamics, Petrathern)
  - 3 - 5 km deep**
- **Direct Use: Thermal transfer**
  - Space & District Heating (e.g. Portland, Vic)
  - Aquaculture, Balneology, Agriculture
  - Industrial Pre-heating, Desalination
  - Geothermal Heat Pumps
    - Water Loop (GX, **> 100-m**)
    - Refrigerant Loop (DX, **30-m, 90-m**)

# EARTH'S ENERGY BUDGET

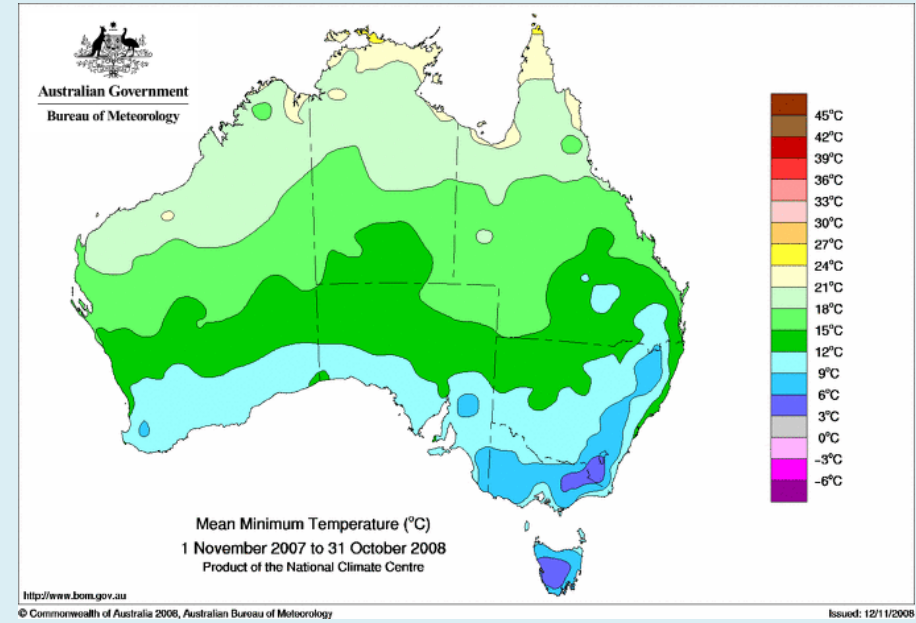
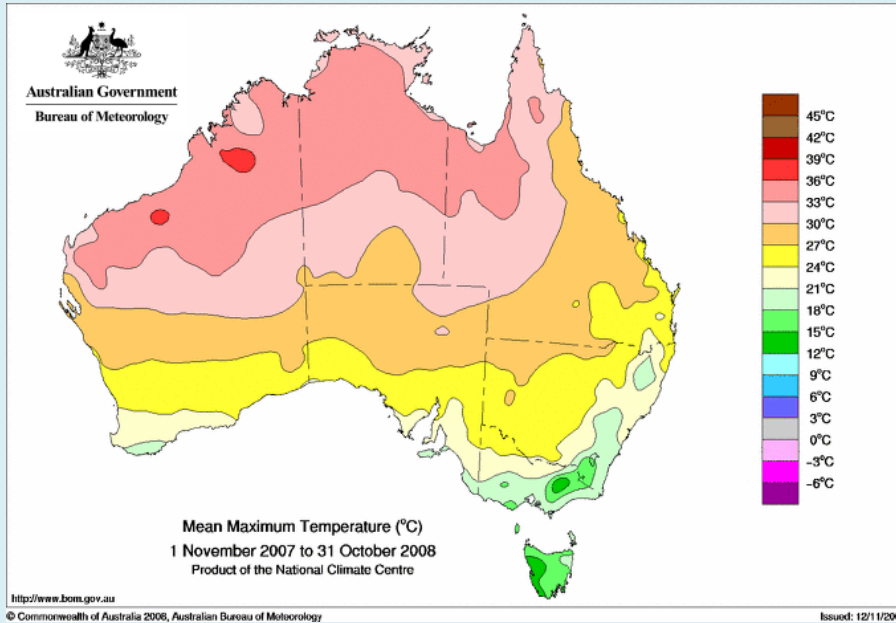


## *Earth temperature vs. depth*

- Ground dampens temp. variation
- Negligible variation below 5 m



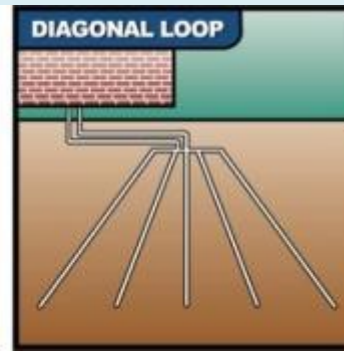
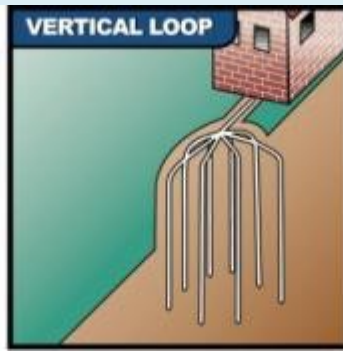
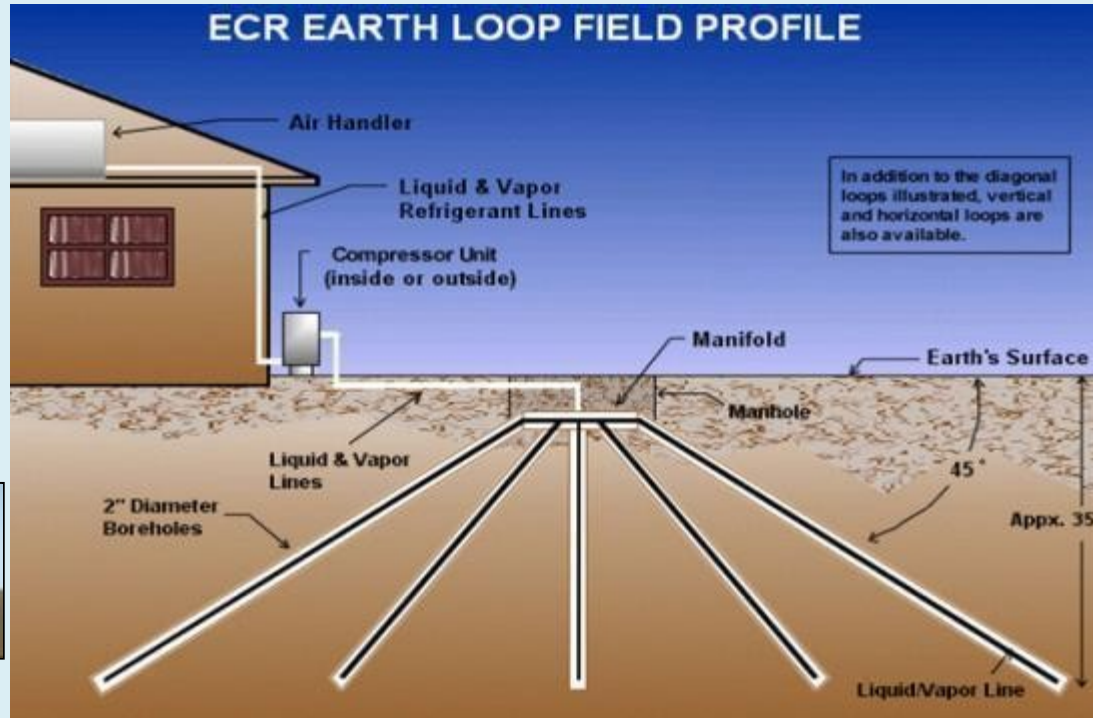
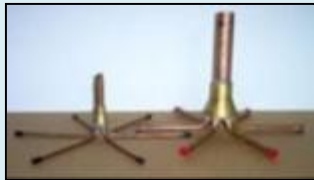
# Australia's Ground Temperatures



- Ground Temp: 10 – 20 C
- Alpine regions, 6 – 10 C
- Negligible frost line



# Geothermal Earth Loops

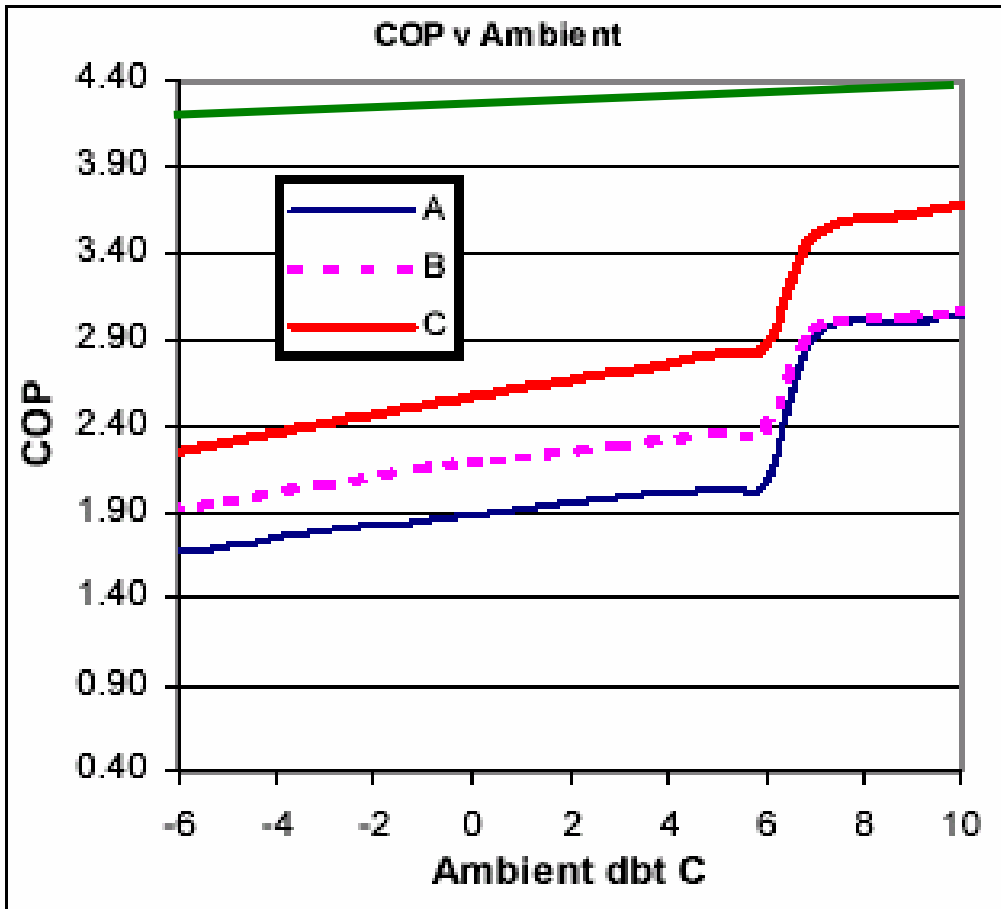


# *Copper vs. Water loops*

- Refrigerant vs. Water: 25% more efficient
- **Reduced drilling cost**
- 70-mm, 30-m hole (DX) vs. 150-mm, 100-m (water)
- **Copper** naturally occurring, **Cathodic Protection System** for saline or acidic ground



# Geo vs. Air Source Heat Pump



Geothermal

Air

H3

H2

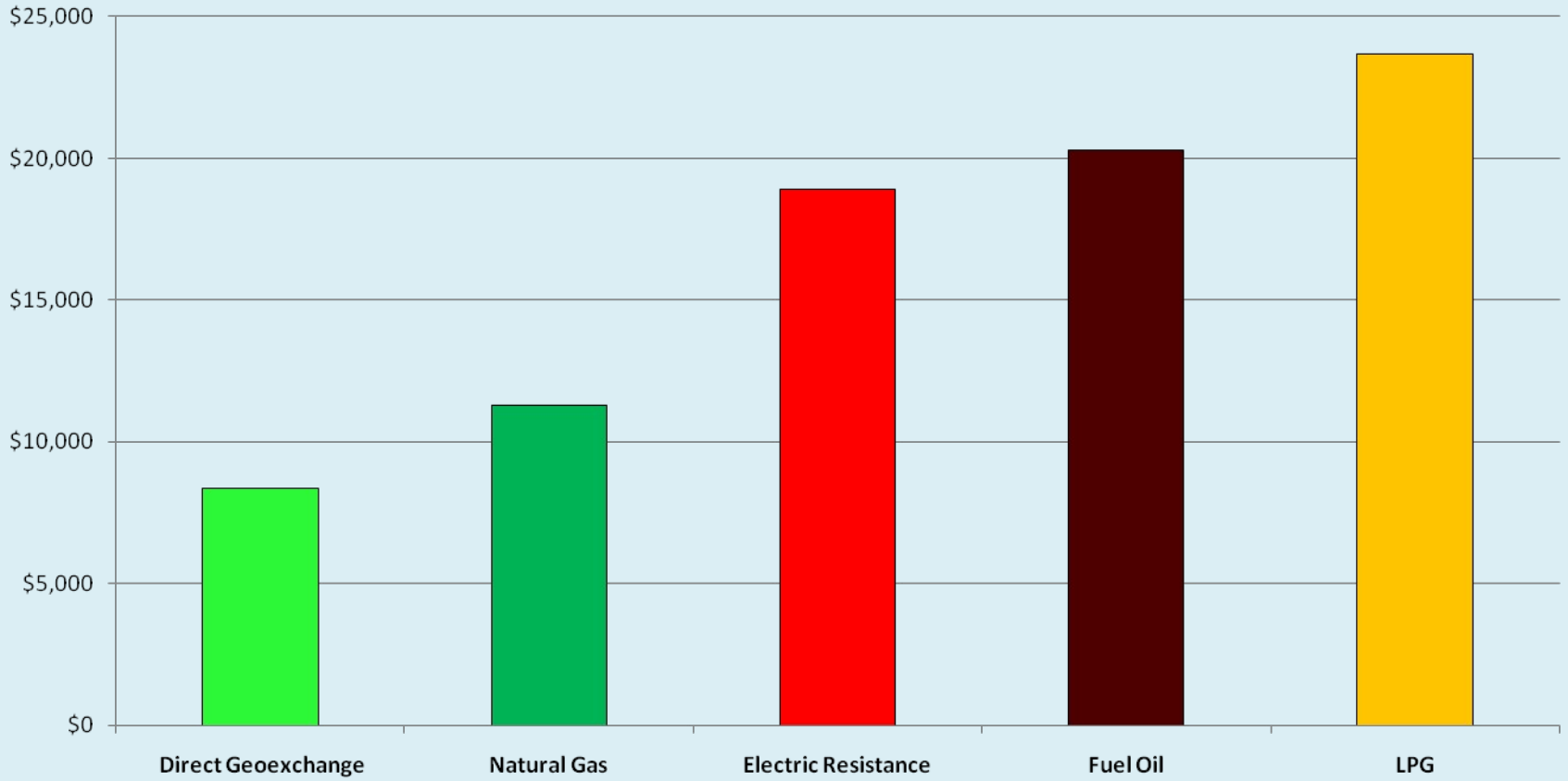
H1

AS 3823

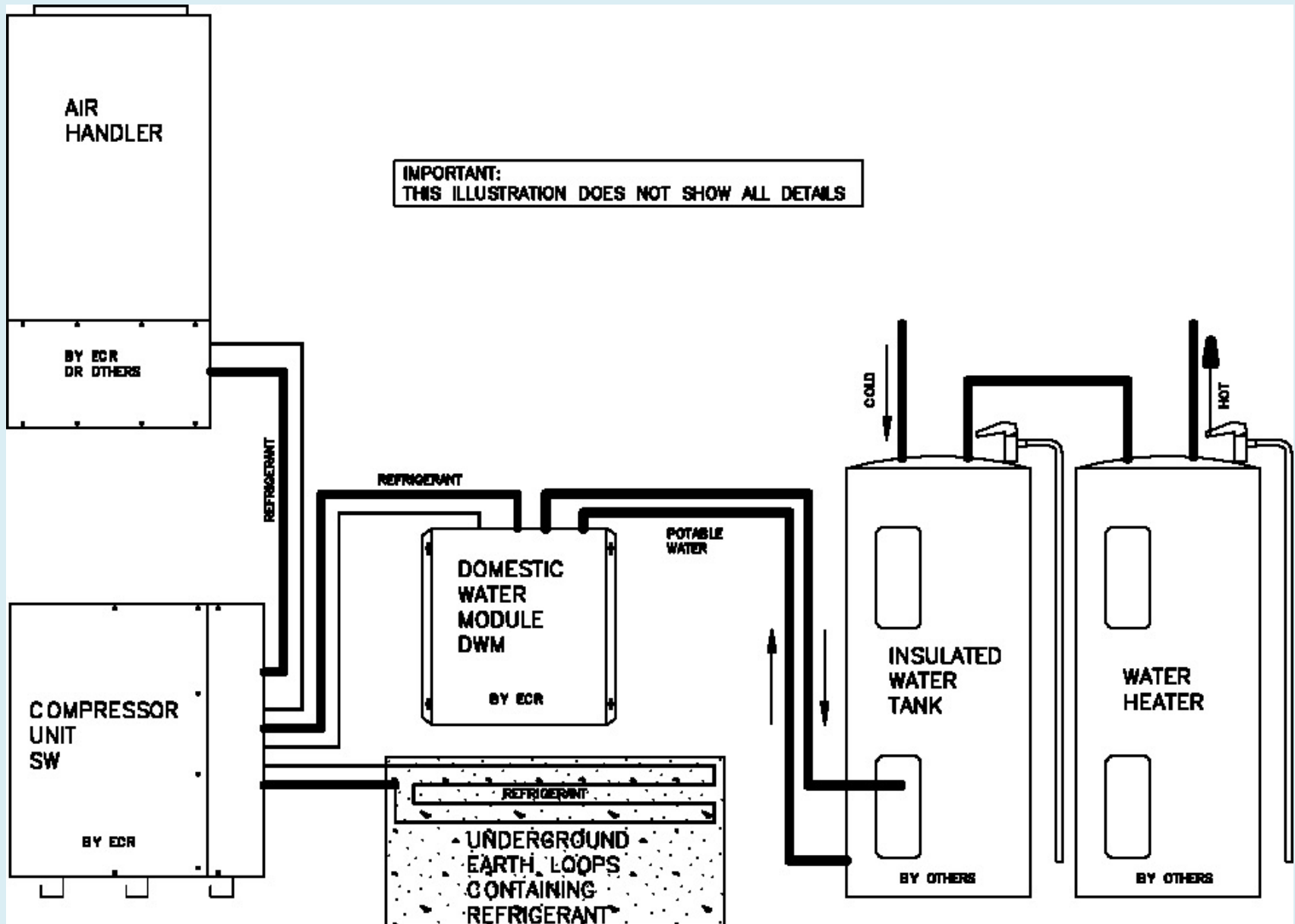
ARI 210/240

# Ongoing Savings

Heating & Cooling Annual Costs - estimate



# Dual System Design



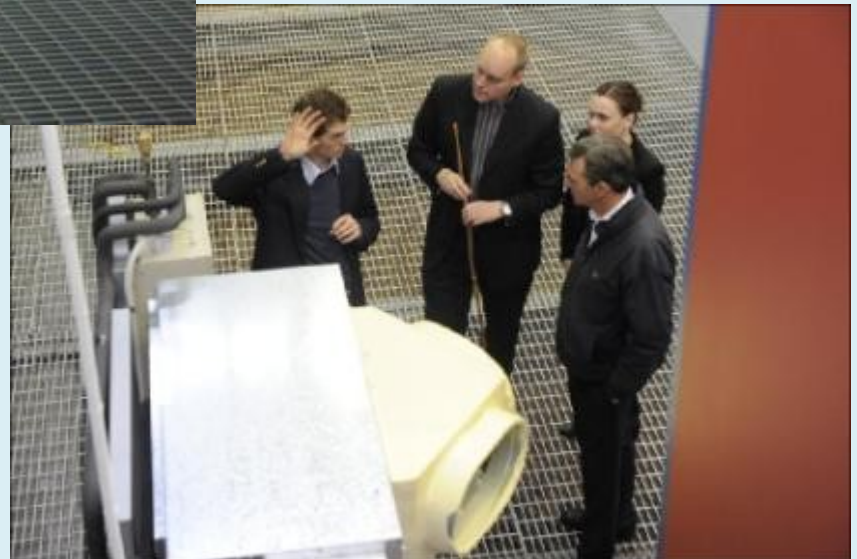
# Plumbing Industry Climate Action Centre



306 Albert St,  
Brunswick

Quality  
Training  
Awareness  
Education

Visit by appointment only



# Global GeoExchange

- Pioneered early 1980s
- USA ARI Direct GeoExchange®
- ARI Performance Certified & ETL Safety tested
- 9 US Patents, 7 Electric Utility Demos
- 5,000 – 8,000 installed: USA, Ireland, UK, France, Spain, Estonia, AfricaAustralia, NZ, and J apan
- Over 3 million GHPs globally



# Geothermal Heat Pumps Australia

## New South Wales

- Lithgow Hospital, Lithgow
- NPWS Tourist and Information Centre, Jindabyne
- Macquarie University, North Ryde
- Detention Centre, Dubbo
- Cowra Shire Council Offices, Cowra
- Wagga Wagga Civic Centre, Wagga Wagga
- Surry Hills Community Facility, Surry Hills
- Woolloomoolloo Wharves, Woolloomoolloo
- **CSIRO, ATNF, Marsfield**

## Australian Capital Territory

- ACTEW Corporation, Canberra
- Geoscience Australia, Canberra
- Duntroon Headquarters, Canberra
- Airport Caltex, Pialligo
- ANU Research Laboratory, Canberra
- **Solomon Islands High Commission, Canberra**
- **Belconnen Marketplace, Canberra (spec)**

## Tasmania

- Grand Chancellor Concert Hall, Hobart
- Queen Victoria Museum and Art Gallery, Launceston
- Southern Cross Homes/Aged Care, Moonah
- Antarctic Centre, Hobart
- Westpac Call Centre, Launceston
- Hobart Aquatic Centre, Hobart

## Victoria

- Victoria University of Technology, Werribee
- Paynesville Pool, Paynesville
- Station Pier, Port Melbourne
- Wangaratta High School, Wangaratta
- Monash University, Melbourne
- Bandiana ALTC, Bandiana
- East Melbourne Library
- **Mt Hotham Ski Lodge**
- **Corryong Council Offices, near Thredbo**
- **Acacia College, School, Memda**

## South Australia

- Royal Adelaide Hospital, North Terrace
- Bureau of Meteorology, Kent Town
- Garden East, 320 Apartments, Adelaide
- Coober Pedy Police Station, Coober Pedy
- Mt Barker TAFE, Mt Barker

## Queensland

- University of Southern Queensland swimming pool, Toowoomba
- Logan Institute of TAFE, Logan
- **RAAF Amberley, Air Force Base**

## Northern Territory

- Bureau of Meteorology, Darwin

## West Australia

- Challenge Stadium, Pool
- **CSIRO, ASKAP, Boolardy**

# *Small Residence (Surry Hills, 200 m<sup>2</sup>)*



- Renovation/retrofit
- 4 x 30-m holes
- 14.7 kW<sub>th</sub>
- SC-048-4B



# *Large Residence (Brighton, 1800 m<sup>2</sup>)*



# Commercial Buildings (Acacia College, Mernda)



- $10 \times 21 \text{ kW}_{\text{th}} = 210 \text{ kW}_{\text{th}}$ , 60 x 30-m (First stage)
- $14 \times 21 \text{ kW}_{\text{th}} = 294 \text{ kW}_{\text{th}}$ , 84 x 30-m (Second Stage)
- $10 \times 21 \text{ kW}_{\text{th}} = 210 \text{ kW}_{\text{th}}$ , 60 x 30-m (Third

# *Geothermal Pool Heating*



# Hydronic Heating (Hotham Ski Lodge)

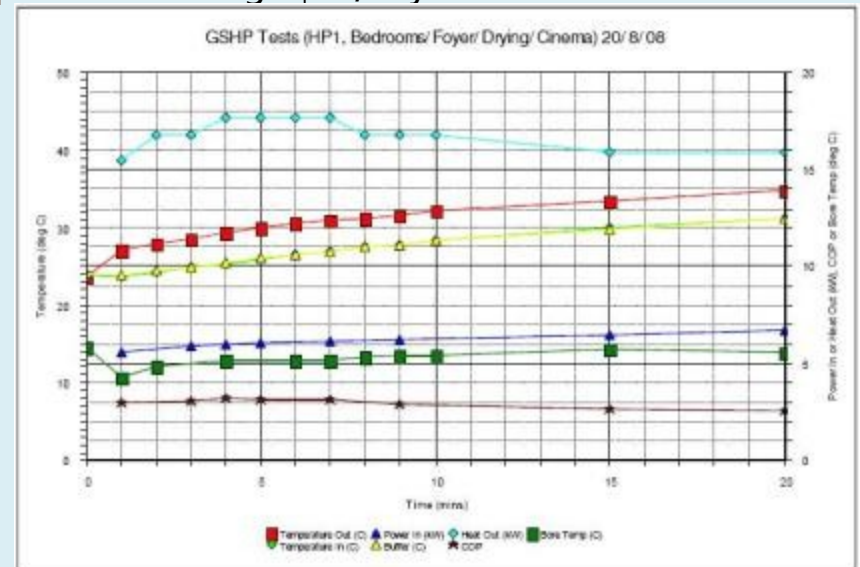
- Lounge, Dining area, Bedrooms
- Potable Hot Water
- 2 x 21 kW<sub>th</sub>
- Diagonal 1: 16 x 30-m holes
- Ground Temp 6 C



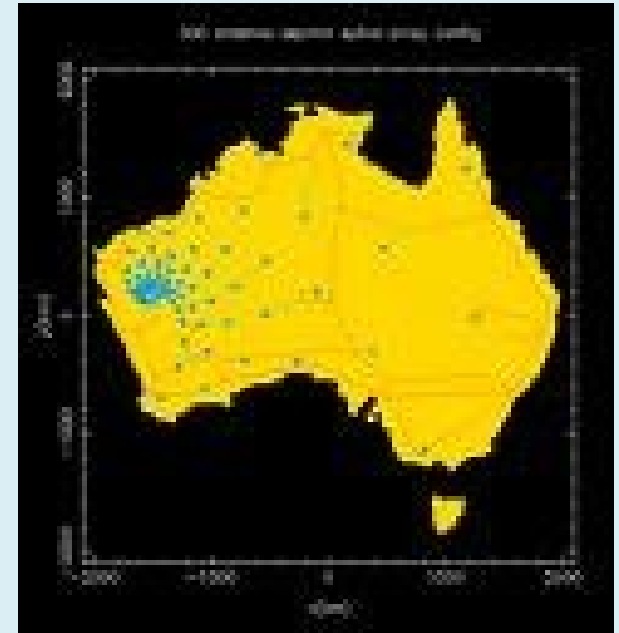
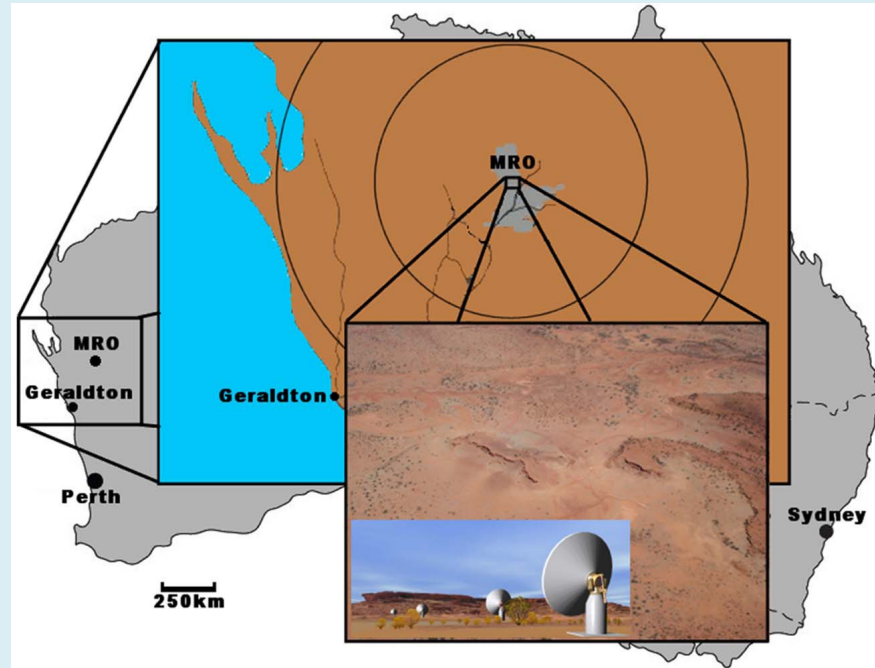
# Hydronic Heating (Hotham Ski Lodge)



- Water Set Point 37-40 C
- 60 L/min = 16 GPM
- COP 2.5 at 45 C = 113 F
- COP 3.0 at 41 C = 106 F
- COP 3.5 at 37 C = 98.6 F
- COP 3.9 at 32 C = 90 F
- 1<sup>st</sup> month, September 2008
- Propane (LPG) savings 98.4%
- Electricity up 27%, Firewood down 70%
- Savings \$50/day



# Australian Square Kilometer Array Pathfinder (ASKAP)



# Australian Square Kilometer Array Pathfinder (ASKAP)



# *Square Kilometer Array, CSIRO*



# *Manifold Pit*



# *Manifold Pit & Compressor*



# *Inserting the Ground Loops*



# Applications

- Phone Towers & Exchanges (~ 5,000)
- Property Developments: VicUrban (State Govt. Homes), Military housing, Resorts
- Abattoirs, Dairies, Piggeries, Wineries, Hydroponics
- Desalination Plant, Solar PV, Manufacturing
- Department of Education: Schools etc.
- Supplement any commercial water heating/cooling - retrofit existing systems
- Council, Infrastructure Spending, Hospitals, Retirement villages, Remote buildings, off-grid
- Retail chain outlets e.g McDonalds - Lend Lease
- HIA, MBA, home builders





# Further Information



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