Its Amazing -
What You Can Do Directly

New Zealand Geothermal Association Seminar
Wednesday 12th October 2011
Brian Carey

GNS SCIENCE
TE PŪ AO

Todays talk

- Units - Refresher
- World – Historical + Predictions
- Low temperature geothermal @ GNS
- Technologies
- Social Understanding
- Heating and Cooling Energy Data
- Challenges
- Test

Refresher on units

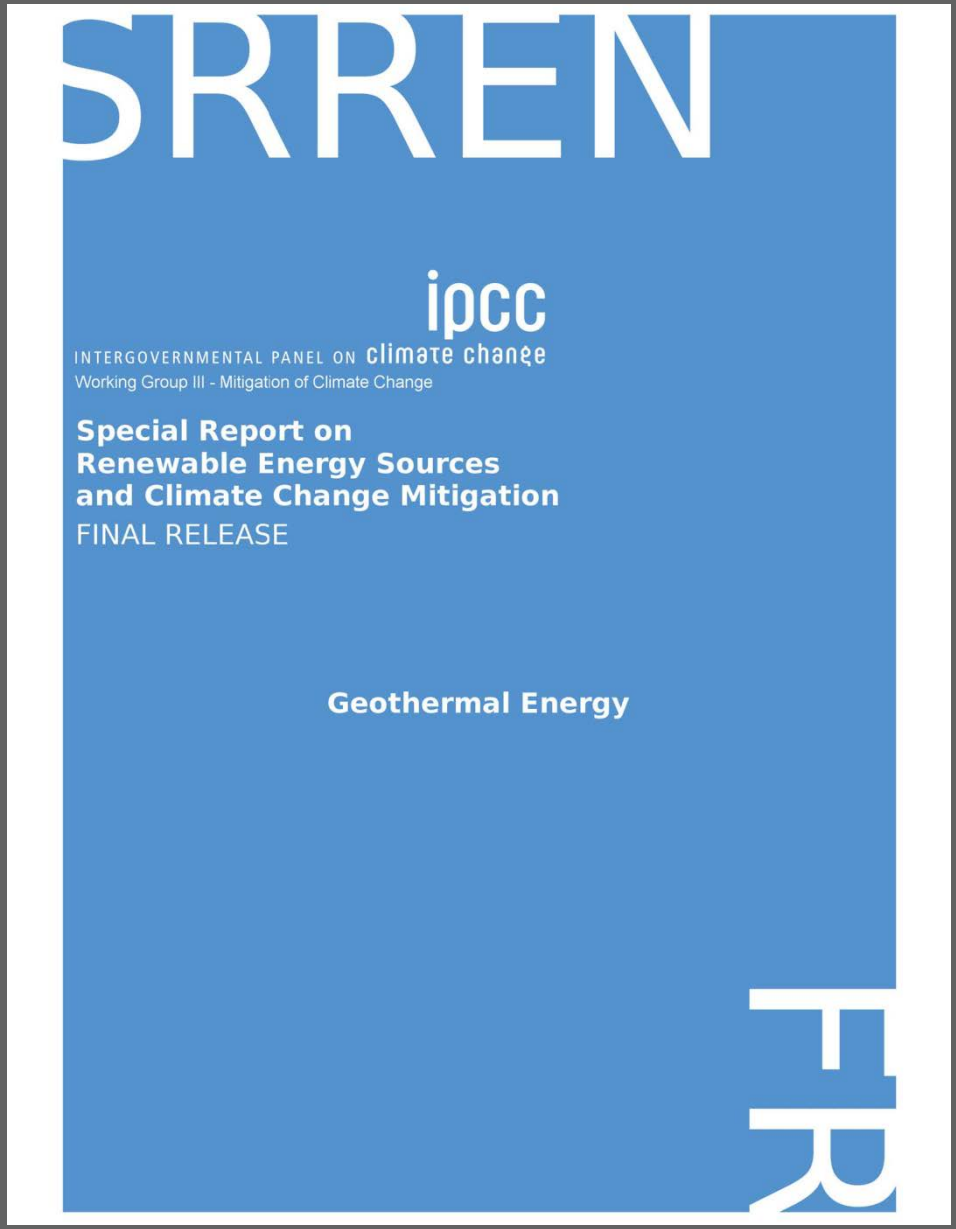
Terms and units

- Capacity
  - kW, MW, GW, TW
- Energy – capacity times time
  - kWh, MWh, GWh
  - kJ, Mj, Gj, Tj, Pj, Ej
- Multiplier of 1000 between

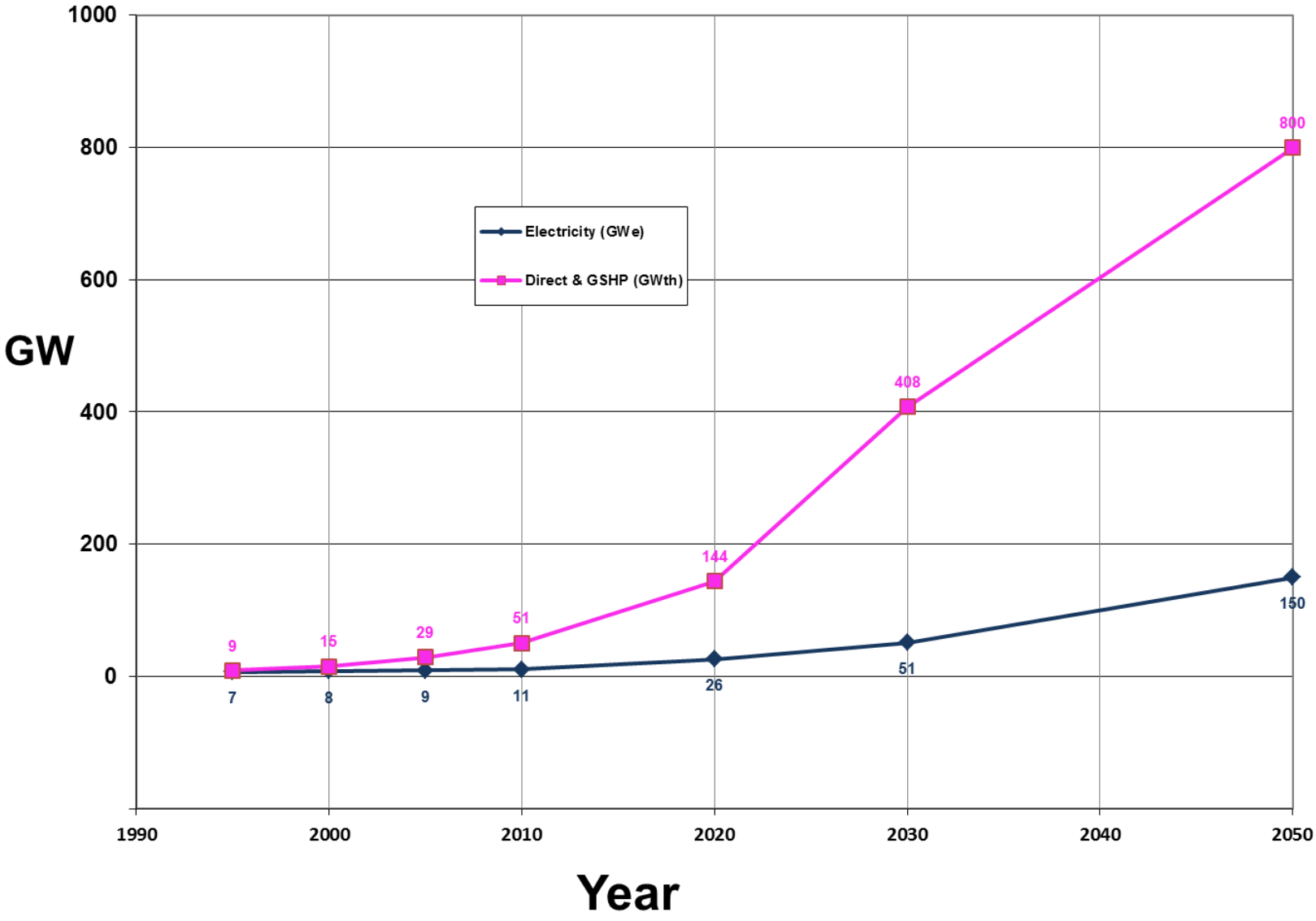
World Scene

Looking forward

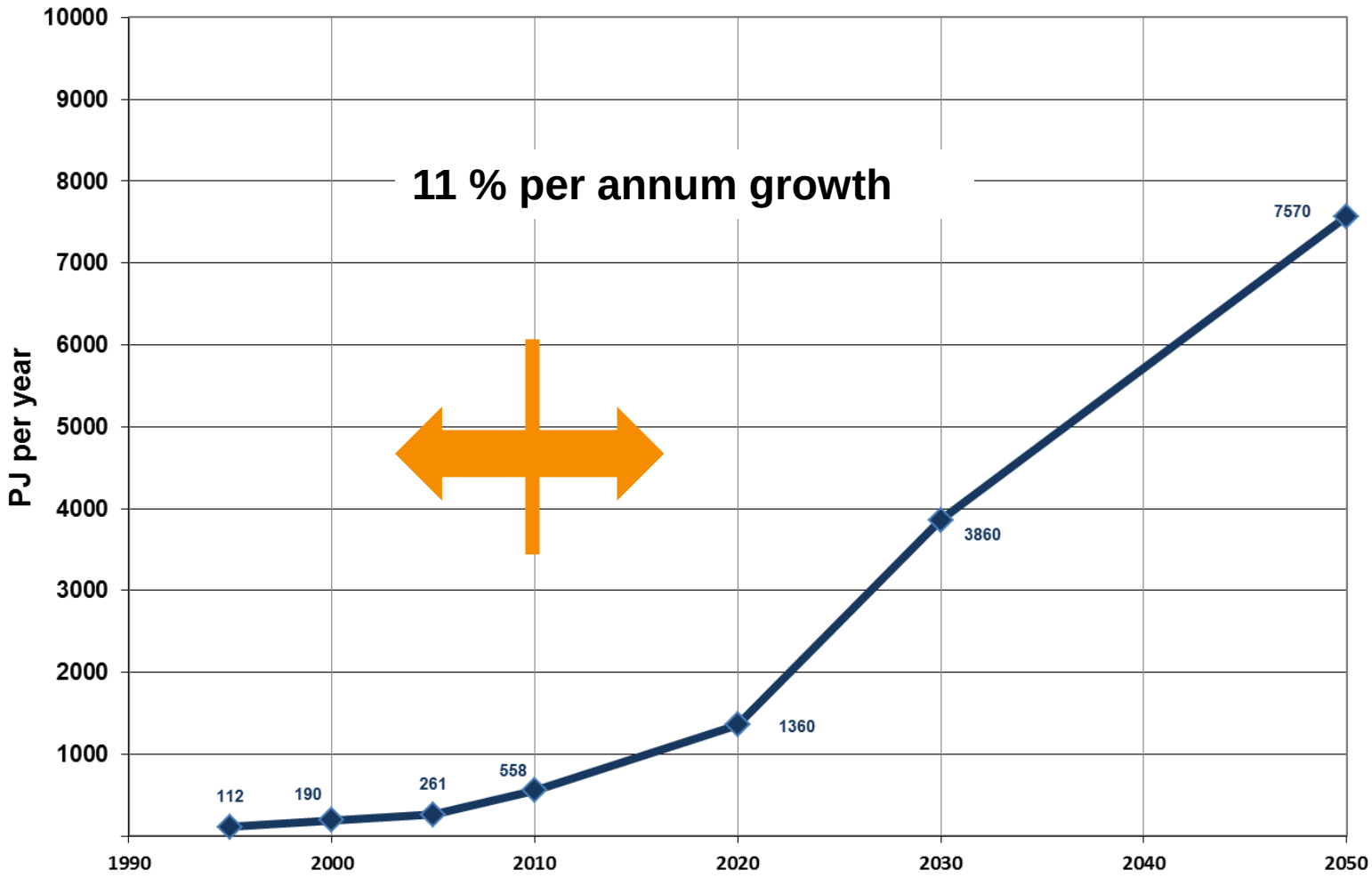
- Chris Bromley
  - Lead author



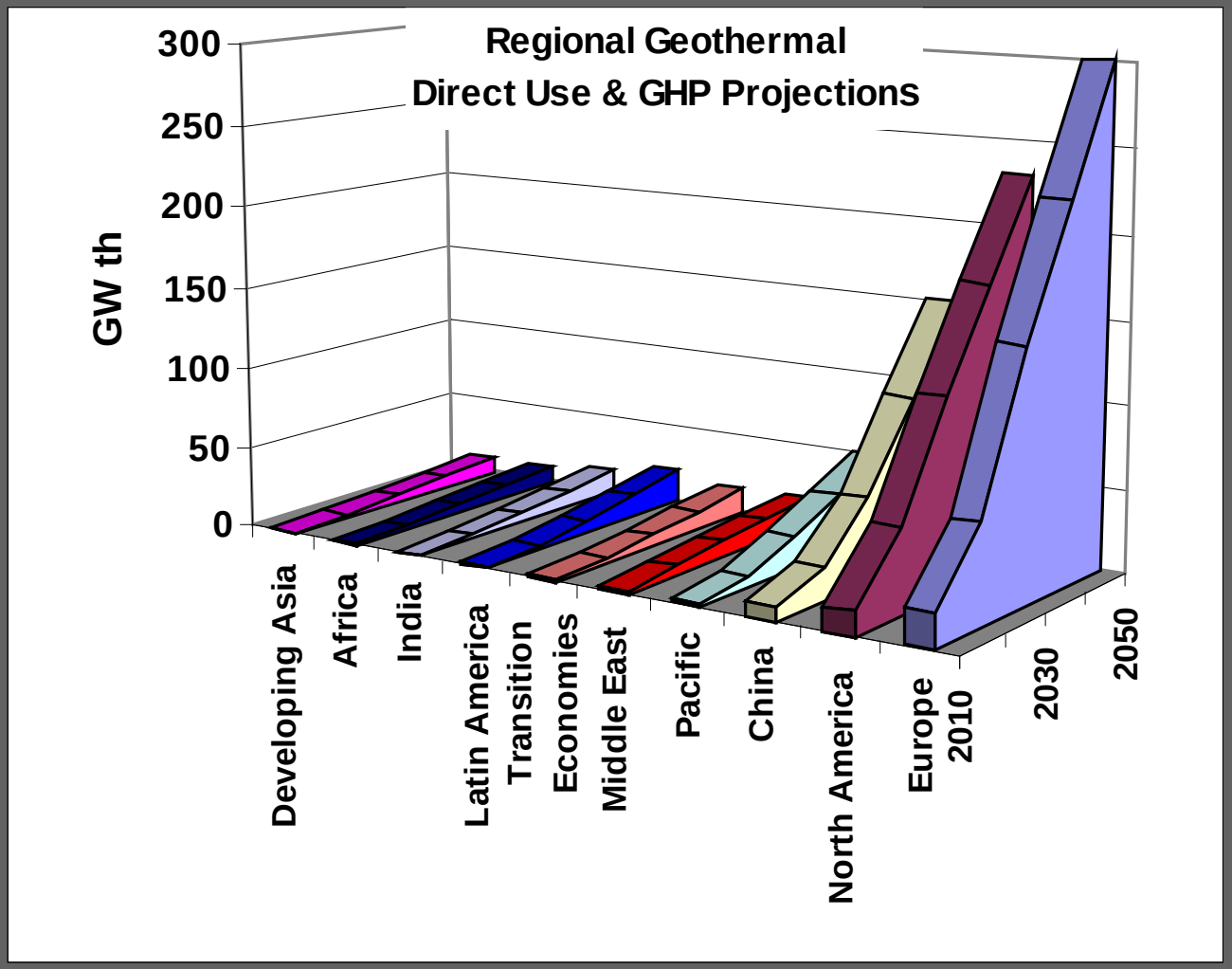
World Geothermal Capacity



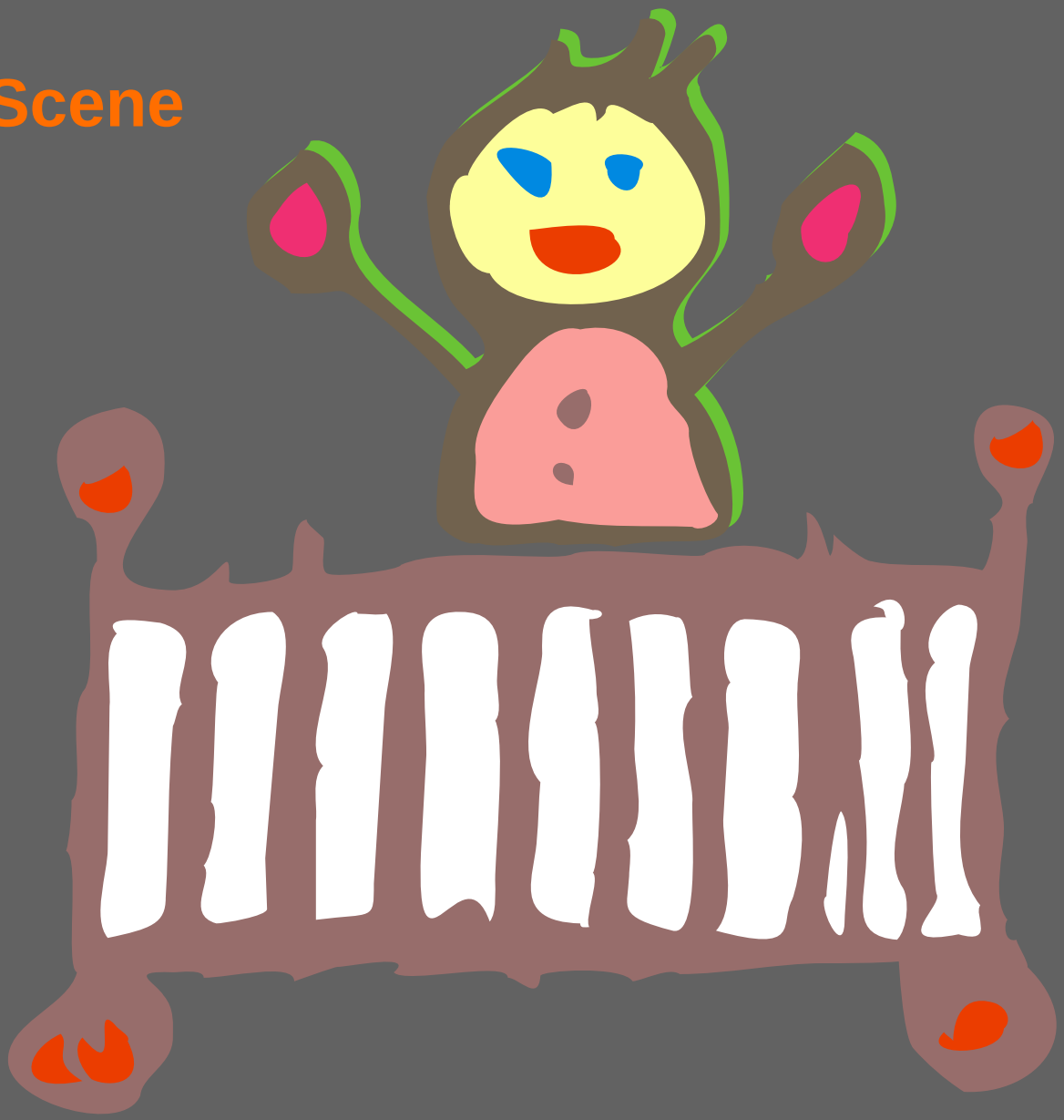
Geothermal Direct Use + GSHP – Energy per annum



Direct by Region – 2010 to 2050



New Zealand Scene



Low temperature geothermal @ GNS Science

Commenced in 2008

A three (plus) year FRST programme

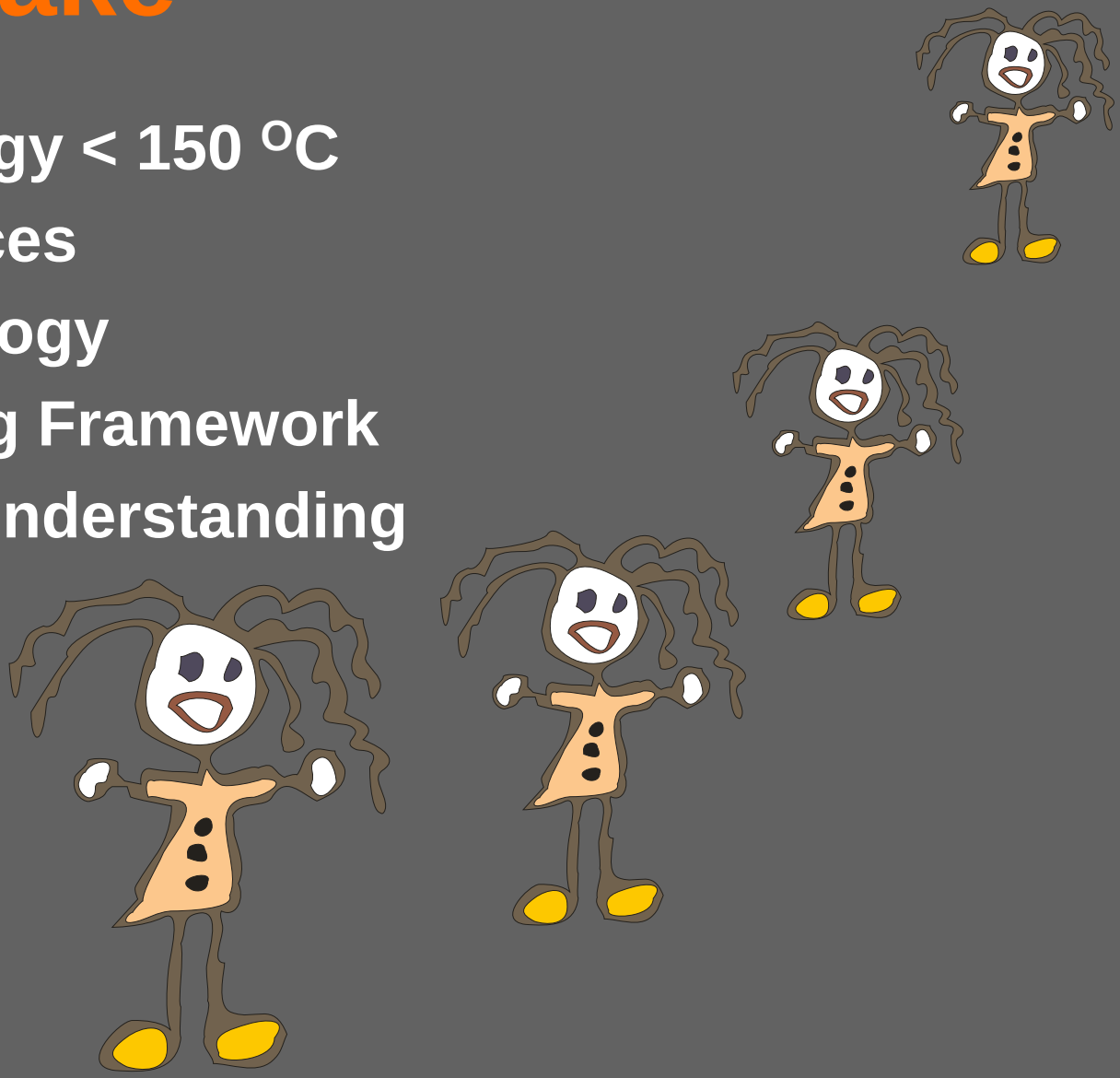
Lead variously by

Lisa Lind
Chemical Engineer
Wairakei Research Centre
Email l.lind@gns.cri.nz

And Brian Carey

Stock Take

- Earth energy < 150 ^{o}C
  - Resources
  - Technology
  - Planning Framework
  - Social Understanding



Low temperature geothermal @ GNS

- A range of organisations
- A number of todays presentations will present material developed under the programme

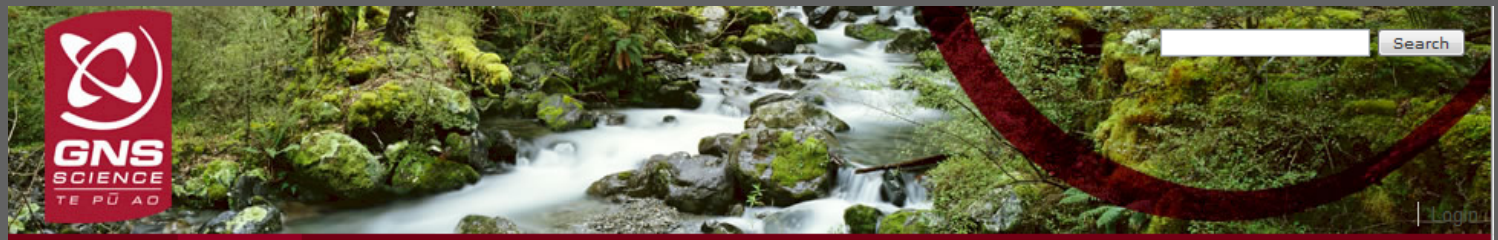
Low temperature geothermal @ GNS

- Completed reports are freely available
- Visit the GNS Science web site
- Down load

Quick access addresses

For reports
http://www.gns.cri.nz/Home/Our-Science/Energy-Resources/Geothermal-Energy/Reports-and-Publications

For general Information
http://www.gns.cri.nz/earthenergy



Geothermal Energy
- Research
- Consultancy
- Training
- Analytical Services
- Project Examples
- Reports and Publications
- Team
- Links

Reports and Publications

The following reports are relevant to low temperature geothermal energy use.

Visit the Learning Zone for more information about Geothermal - Earth Energy!

Technical Information

- Residential householders' heating and cooling practises and views on energy...pdf (1.25 MB)
  GNS Science, 111 pages. 2011.
- Low temperature geothermal energy - Planning Assessment.pdf (1.53 MB)
  EMS, 63 pages. 2011.
- *Sources of solutes and heat in low-enthalpy systems.pdf (2.68 MB)*
  GNS Science, A. Reyes, 63 pages. 2011.
- Swedish Ground Source Heat Pump Case Study (2010).pdf (1.23 MB)
  GNS Science, 31 pages. 2011.
- Building people into plans - Insights into decisions about heating and cooling NZ homes .pdf (140.80 kB)
  GNS Science, 11 pages. 2010.
- Heating & Cooling Homes - A study of residential householders practises and views .pdf (1.17 MB)
  GNS Science, 91 pages. 2010
- Low temperature geothermal energy - Technology Review.pdf (4.61 MB)
  GNS Science, 59 pages. 2010.
- Energy demand estimation for cooling and heating in NZ.pdf (1.17 MB)
  GNS Science, 1.2MB PDF, 38 pages, 2010
- A practical guide to exploiting low temperature geothermal resources.pdf (3.47 MB)
  GNS Science, 79 pages. 2006.
- An assessment of geothermal direct heat use in NZ.pdf (1.16 MB)
  NZ Geothermal Association report, 30 pages. 2005.

General Information

- Five maori trust groups' perspectives on low temperature geothermal energy resources.pdf (1.74 MB)
  GNS Science, 28 pages, 2011
- Using low temperature geothermal resources.pdf (2.02 MB)
  GNS Science; 8 pages. 2006.
- A preliminary evaluation of sources of geothermal energy for direct use.pdf (1.64 MB)

Today – I will draw on material from

- **Technology review**
  Cito Gazo + Lisa Lind
- **Social Understanding Study**
  Brendan Doody + Julia Becker
- **Heating and Cooling Demand Study**
  Pieter Rossouw + Lisa Lind

What You Can Do Directly

- Heat and cool
- Create clean steam
- Desalinate water
- Pump the heat
  - Ground source heat (GSHP)
  - Geothermal heat pumps (GHP)
  - Use aquifer waters
- Tourism

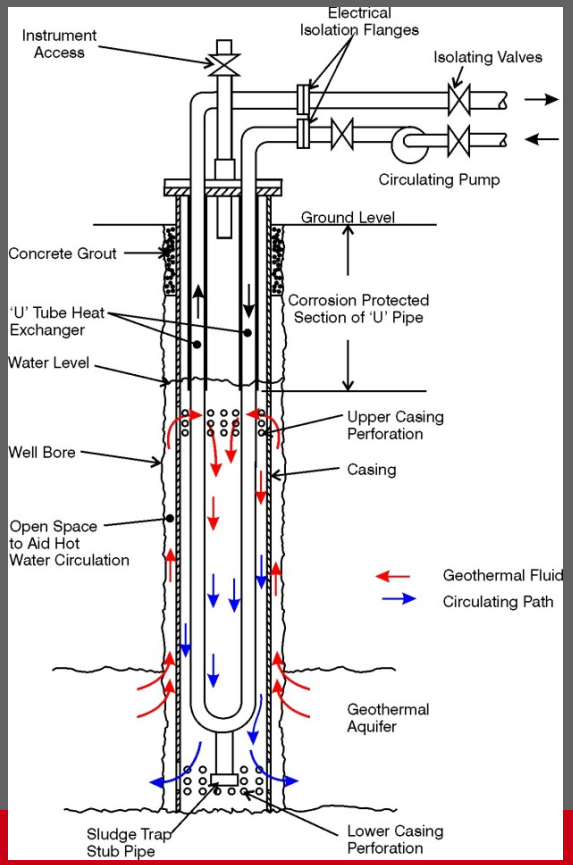
Smorgasbord of uses

Two Basic Ways Moving Earth Energy

- **Closed Loop**
- **Fluid abstraction**

Closed Loop

- Fluid transfers heat as it is pumped around :
  a piping system buried in the ground, or
  immersed in under ground water
- GSHP
- Down hole heat exchangers

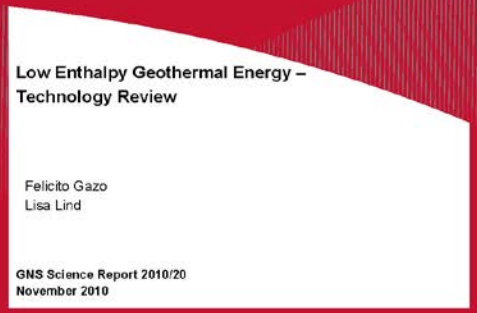


Fluid Abstraction

- Underground fluids are brought to the surface
  - Self discharge / artesian
  - Pumped to the surface
- Energy is transferred
- Fluid is returned underground / discharged

- Larger energy capability than closed loop

Technology Report



Have a read

Low temperature geothermal energy – Technology Review

Cito Gazo + Lisa Lind 2010

Hybrid Technologies

- Keep watching this space
- Very energy effective

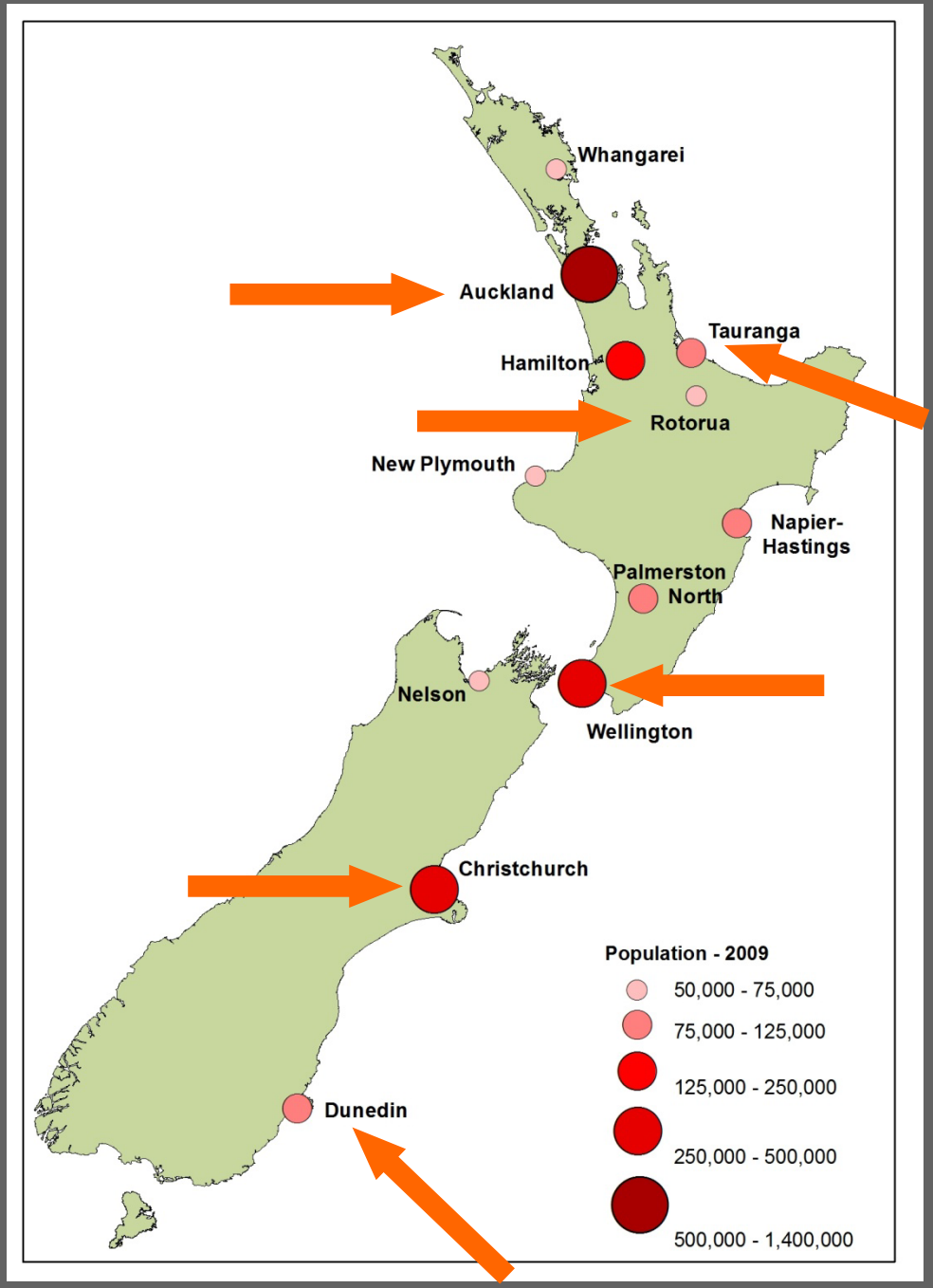
  GSHP and solar systems

Social Understanding - Survey

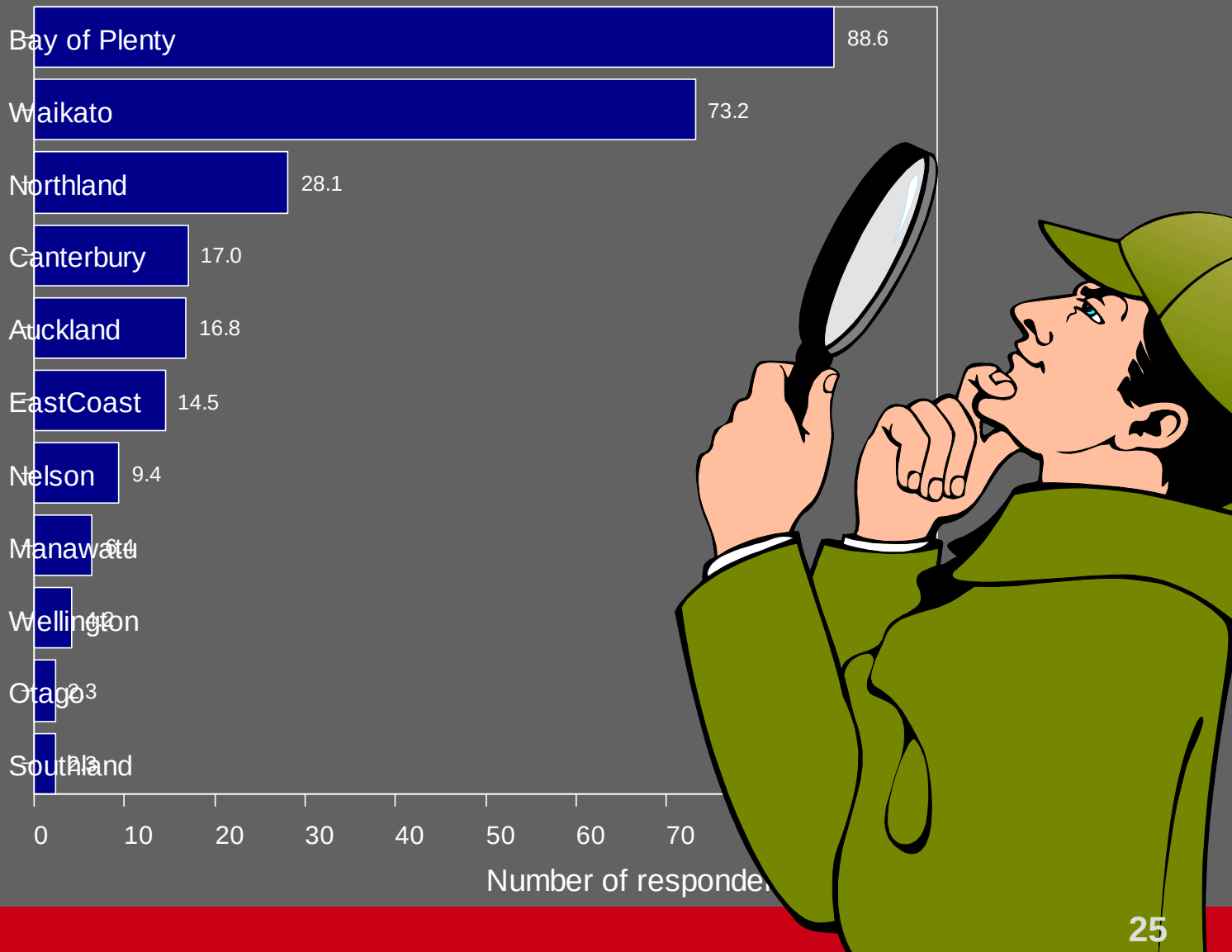
- Residential Focus
- Behavioural drivers - consumer energy use
- Examine public knowledge and understanding of Low Temperature Geothermal
  - Ground Sourced Heat Pumps (GSHP)

Quantitative Survey

- Qualitative - Interviews
- Quantitative Survey
  - 3500 Random Households
- 716 returned



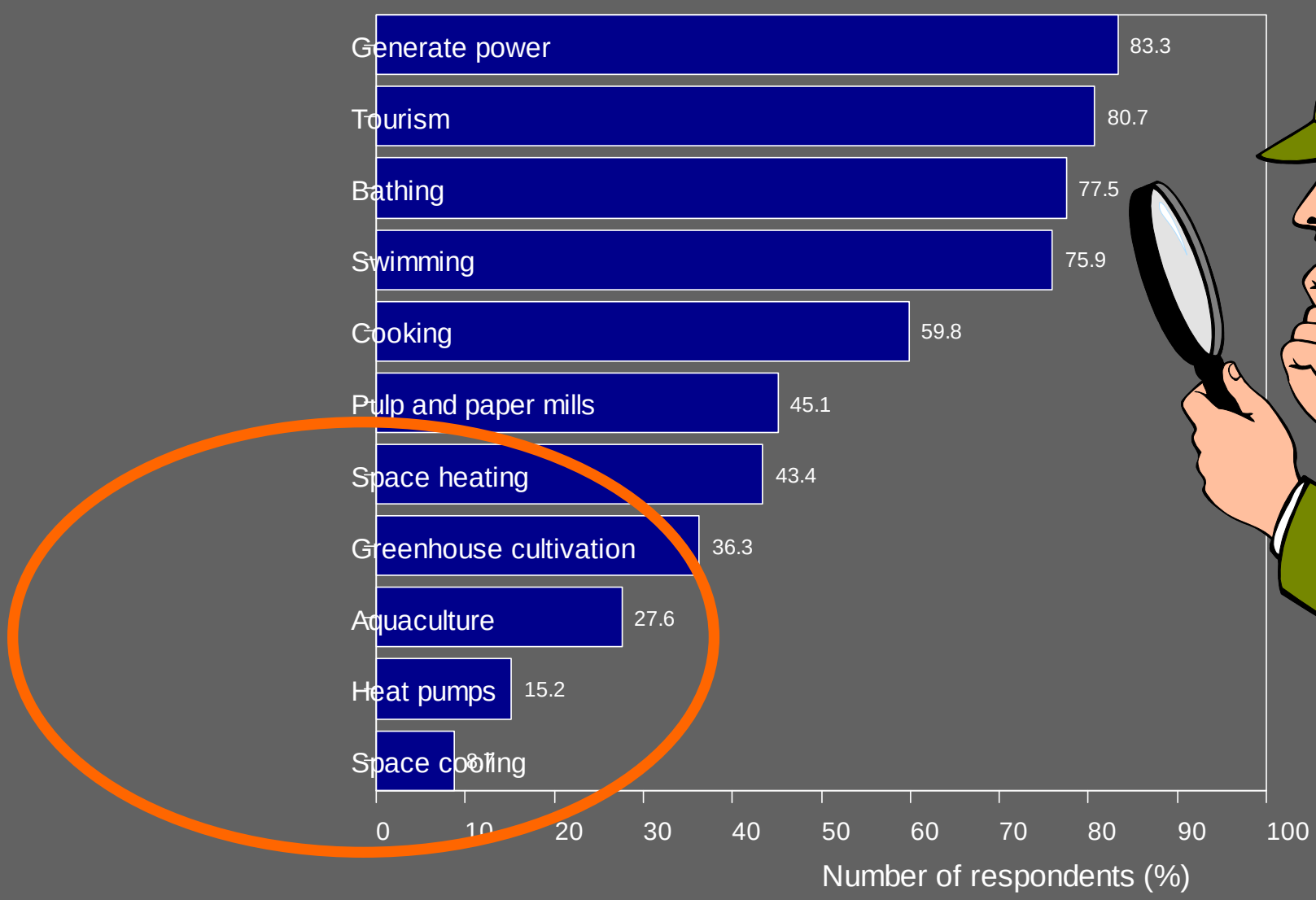
Regional Perceptions of Geothermal Resources



Low-temperature geothermal

- Low level of understanding
- Most people unaware
  - "Never heard of it".
- Some offered suggestions:
  - "Not very hot steam".
  - "Using geothermal services which aren't quite [at] as high temperatures […] Maybe it's using the residual energy and hot water that's coming out of a power plant"

Geothermal Energy Use Perceptions



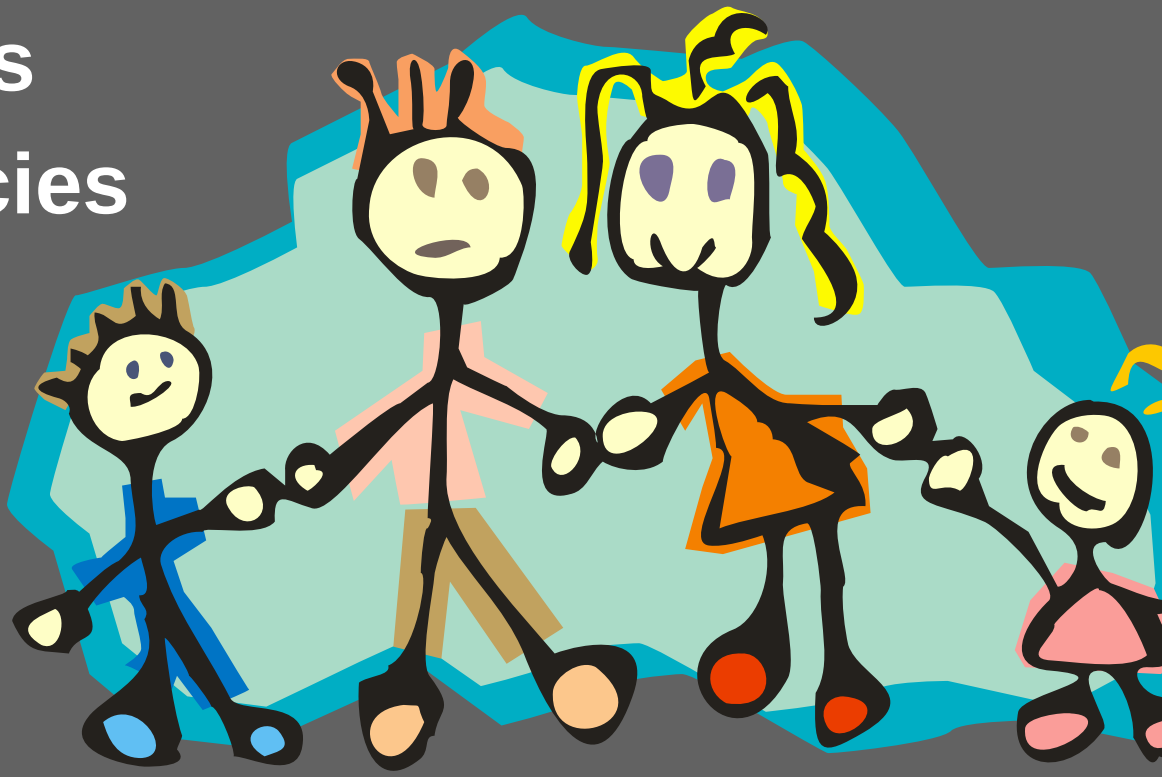
Residential householders' heating and cooling practices report

Have a read

Brendan Doody + Julia Becker

Technology Transfer

- Social Process
- Trusted agencies



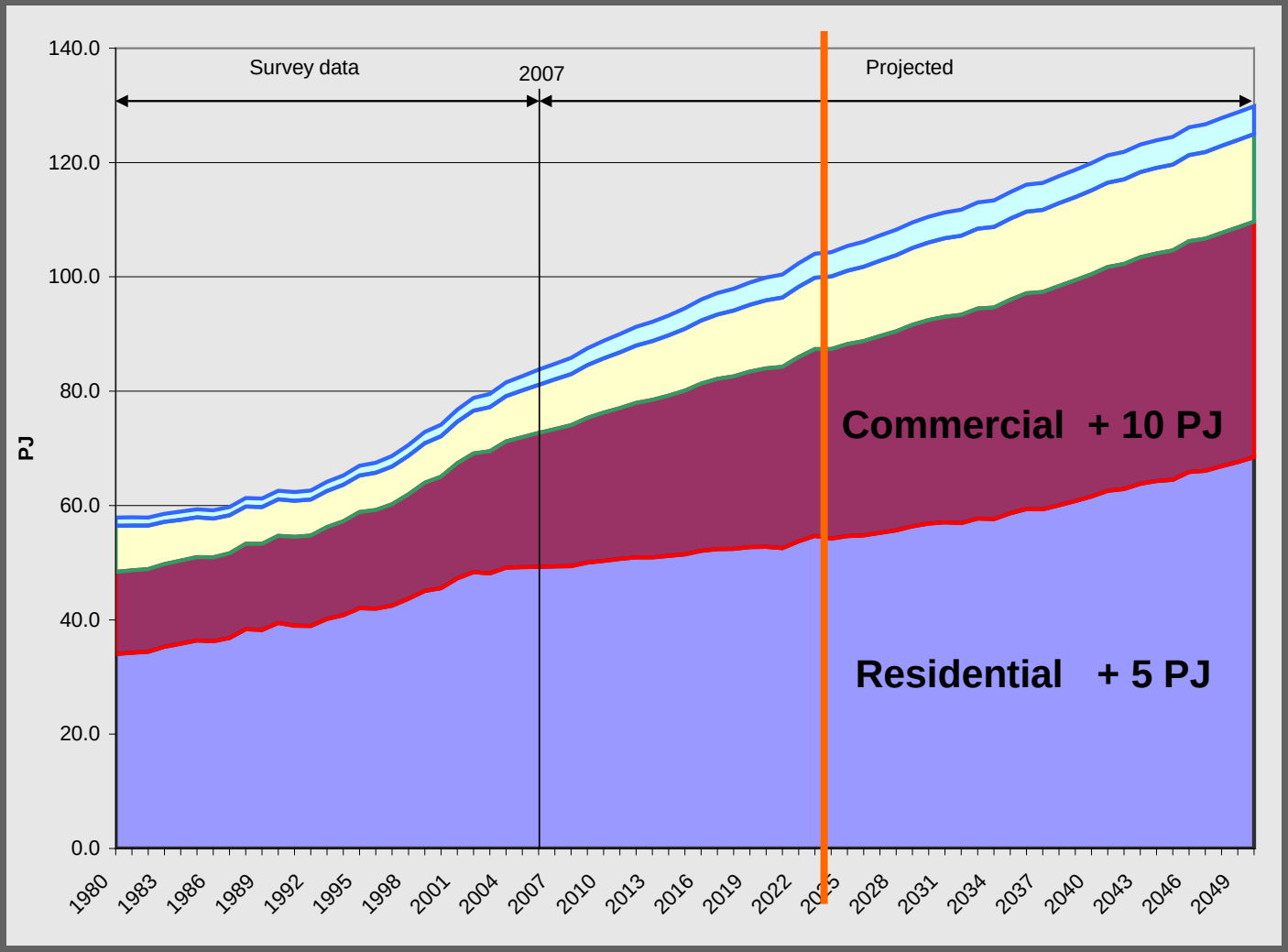
Heating and Cooling Energy Data

- 2007 Historical data
- Demand predictions - 2025
  - By sector
  - By temperature range
    - < 100 ^{o}C
    - < 150 ^{o}C
- Report

  Energy Demand estimation for cooling and heating in NZ

  Pieter Rossouw + Lisa Lind 2010

< 100°C H+C Energy Demand Growth – 20 PJ

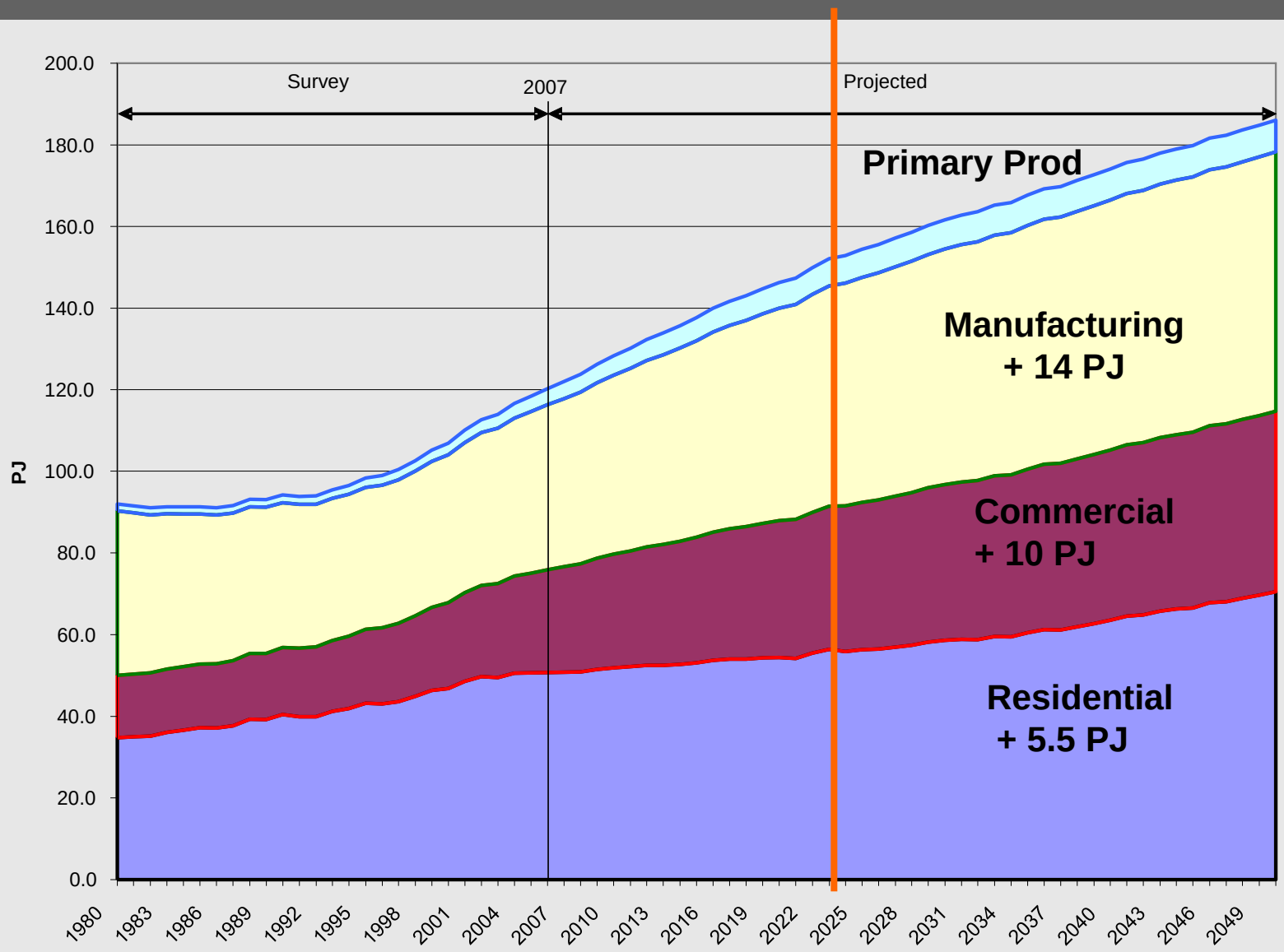


Primary Prod

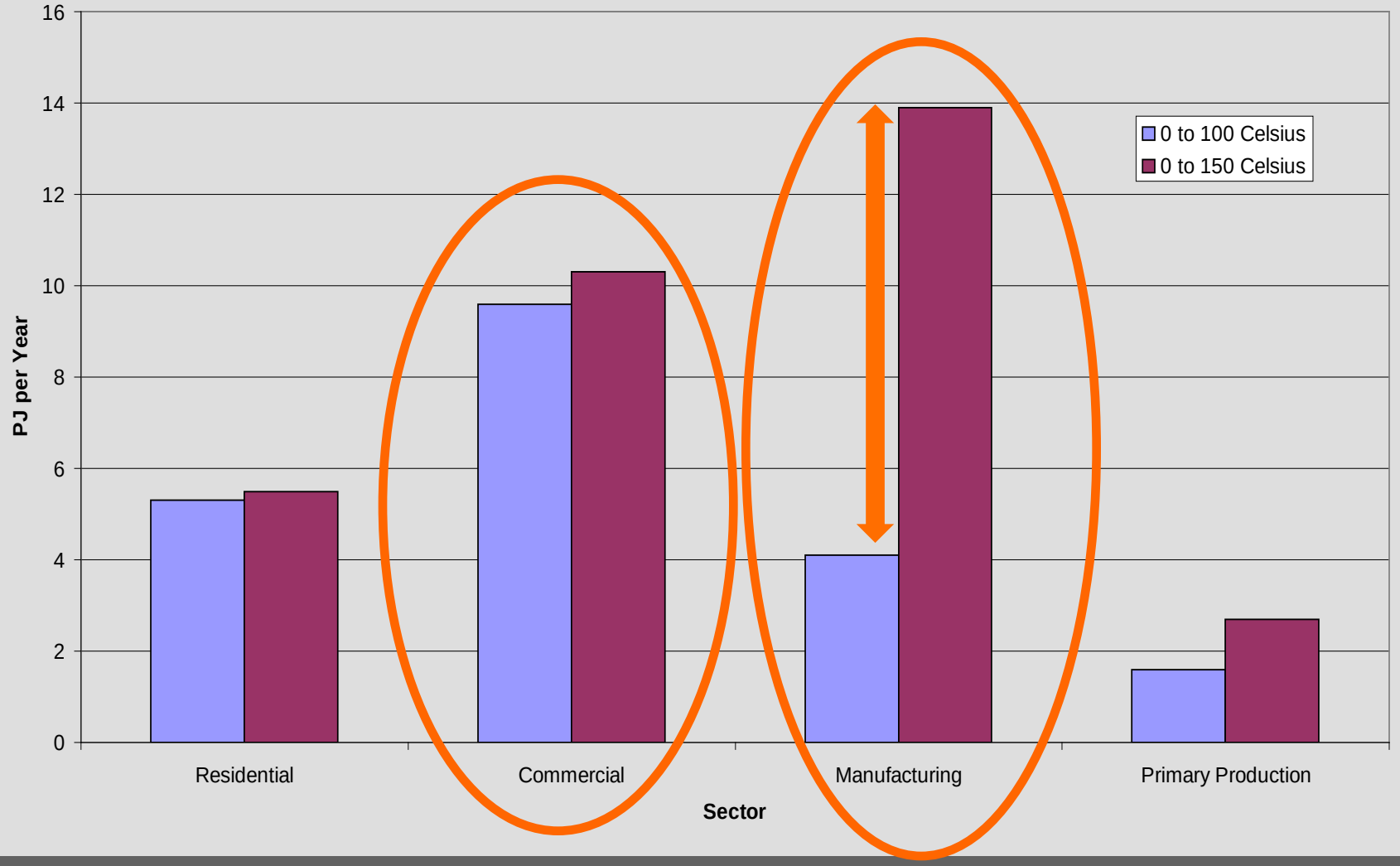
Manufacturing

+ 4 PJ

< 150°C H + C Energy Demand Growth – 32 PJ



Focus - 2 PJ or more increase by 2025



Two Sector Focus

- **Manufacturing 100°C to 150°C**
  - **Taupo volcanic zone and**
  - **Possibly natural thermal gradient for larger size installations**
- **Commercial < 100°C**
  - **GSHP's ?**

Low temperature geothermal @ GNS

Forward Initiatives

- Communications
- Case Studies
- Interagency working groups
    - Ground Source Heat Pump working group

Challenges

- Coordinated approach
- Sound Practise
- Available and trusted energy advice
- The right technology in the right place
- Show case
- Communicate

We - You and me

Talk and communicate

Direct geothermal is amazing

Help grow it

Thank you