New Zealand's EnergyScape

1st Stakeholder Workshop

An Introduction to Energyscape

9 August 2007

Agenda

2000 2005 2030 2050

- Overview of overall project.
- Overviews from individual projects:
  - Hydrogen Economy.
  - Bioenergy Options.
  - Indigenous Energy Options and Energyscape.
- Questions and feedback.

We are developing a high level process to develop strategy …

Have we got it right?

Overall Project Overview – Andrew Campbell

2000 2005 2030 2050

- Background.
- The linked projects
- Project stages and timing.
- Where to from here.

Background

2000 2005 2030 2050

- National Energy Strategy: "… two major long term energy challenges …"
  - Responding to climate change …

    à low carbon energy options.
  - Delivering secure, clean, affordable, energy while being environmentally responsible.

… but for New Zealand:

- What are our indigenous energy options?
- How can we best use them?
- What will New Zealand's future "energyscape" look like?
- Need a high level tool to assess those futures.

à To identify the priority research to best prepare us.

Four Linked Projects

2000 2005 2030 2050

- Hydrogen Economy
- Bioenergy Options
- Indigenous Resources
- (… and now) CCS

… to a consortium of CRL Energy, IRL, Scion, GNS, NIWA and associates

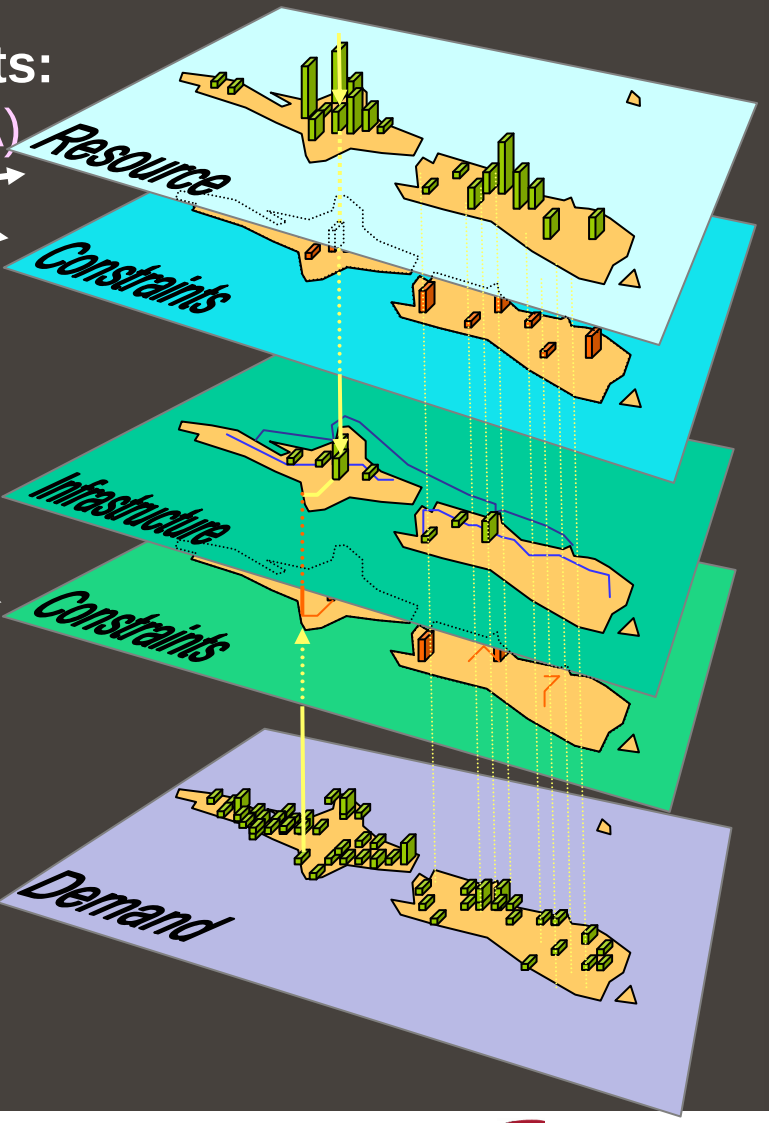
Overall Linked Energyscape Project (lead by NIWA)

2000 2005 2030 2050

Resource maps and related constraints:
- Climate-driven (wind, hydro, etc., NIWA)
- Earth (coal, oil, gas, etc., NIWA)
- Bioenergy (lead by Scion)
- CCS (lead by GNS)
- Constraints

Infrastructure maps:
- Current
- Potential
- Imported energy use
- Hydrogen (lead by CRL)
- Constraints

Demand maps (lead by CRL):
- Current
- Forecast



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Project Outputs

2000 2005 2030 2050

1. Multiple spatial maps:
- Resource and constraints à gaps
- Infrastructure and constraints à gaps

2. Single energy pathway calculations:
- Energy
- Economic
- Emissions
- Demand

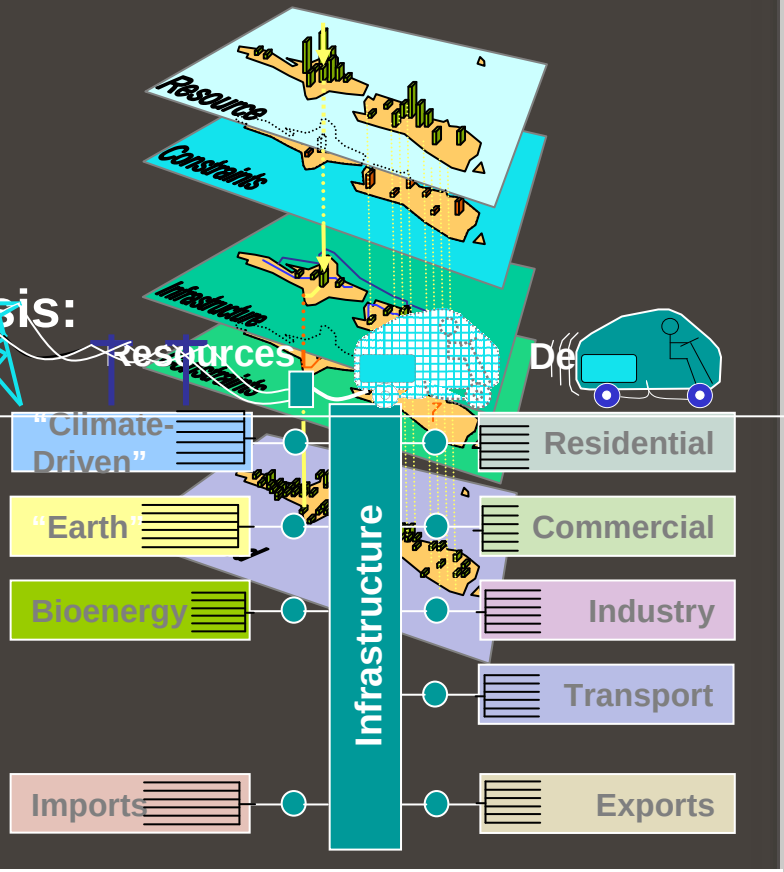
à identify NZ's possible future EnergyScape

à further gaps

à research plan to get us there

3. Future scenario, multi-pathway analysis:
- Development of analysis framework.

4. Stakeholder and public "outreach"



Framework Capabilities

2000 2005 2030 2050

- Flexible – able to test various energy futures, whatever the drivers:
  - energy security?
  - climate change?
  - … or will there be a new calamity? … water?
- Working at a high level – paradigm shifts.
- To identify the show-stoppers.
- To consider physical attributes, not demand side behaviour change.
- Able to be updated.
- Accessible.

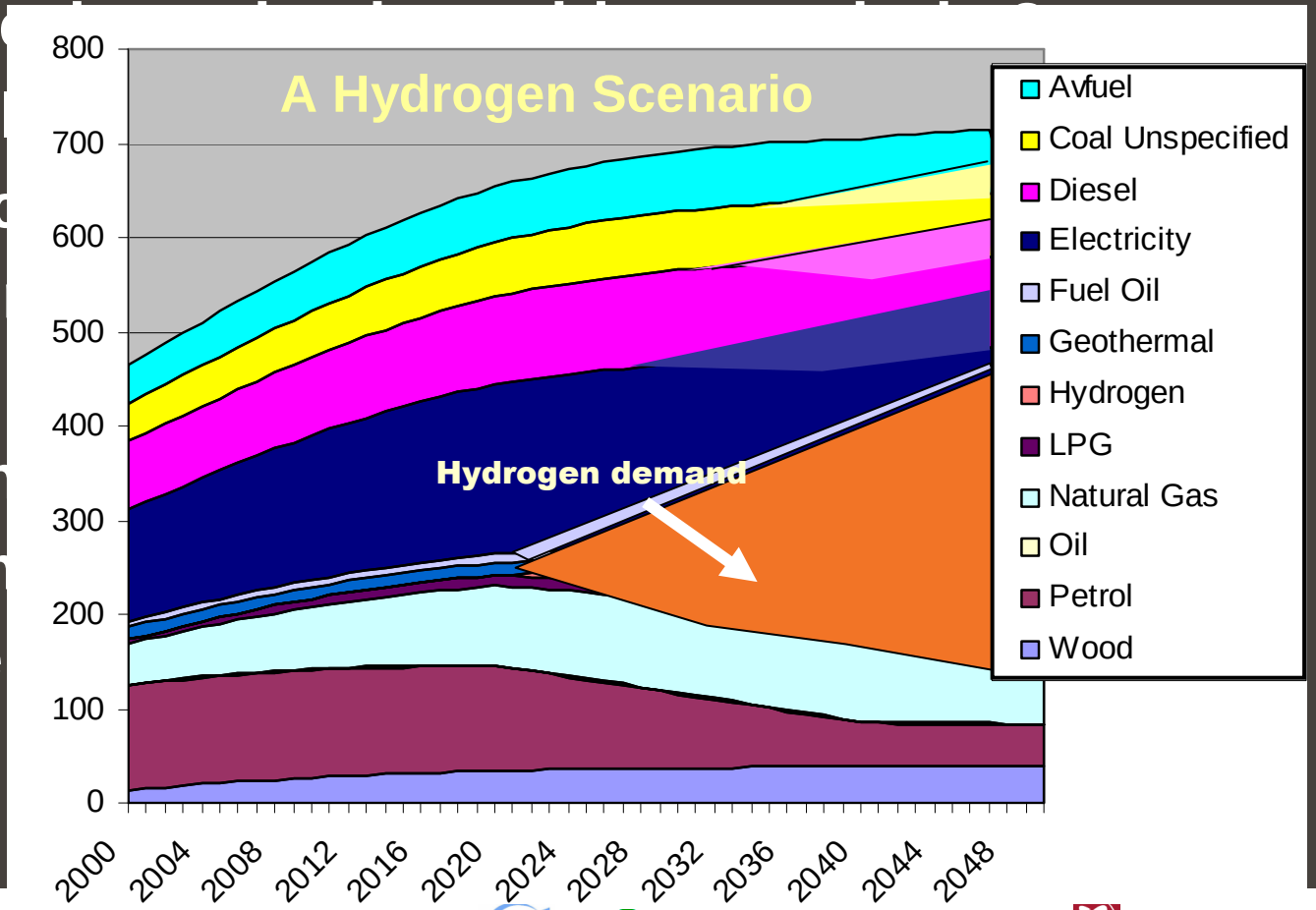
Future Scenarios

2000 2005 2030 2050

- Used to test limits …
  - What will the drivers be?
  - What br
- For exampl
  - All vehic
  - 100% re
  - All light
  - 50% ligh

à Identify wh

à And where



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Gaps in Understanding and Research Types

2000 2005 2030 2050

- "Mainstream" and likely to come from overseas.
- New Zealand-specific (e.g., climate, land use-related, etc.).
- Mainstream but a business case for New Zealand research.
- A range of research providers including: industry; CRIs/CRL; and universities.

Process Validation

2000 2005 2030 2050

- "Steering" Committee
  - Leaders in industry and government.
- "Government Group"
  - MED, MoT/MfE, EECA and linkages to "whole of government".
- Stakeholders
  - Today's introduction.
  - Two ½-day workshops – Nov '07 and March '08.
  - Specific meetings/requests for information/input.
- Other
  - Conferences and seminars.

Timetable ...

2000 2005 2030 2050

Stage 1: Provision of Situation Analysis
- Resources and issues maps.
- Infrastructure and issues maps
- First pathway assessments

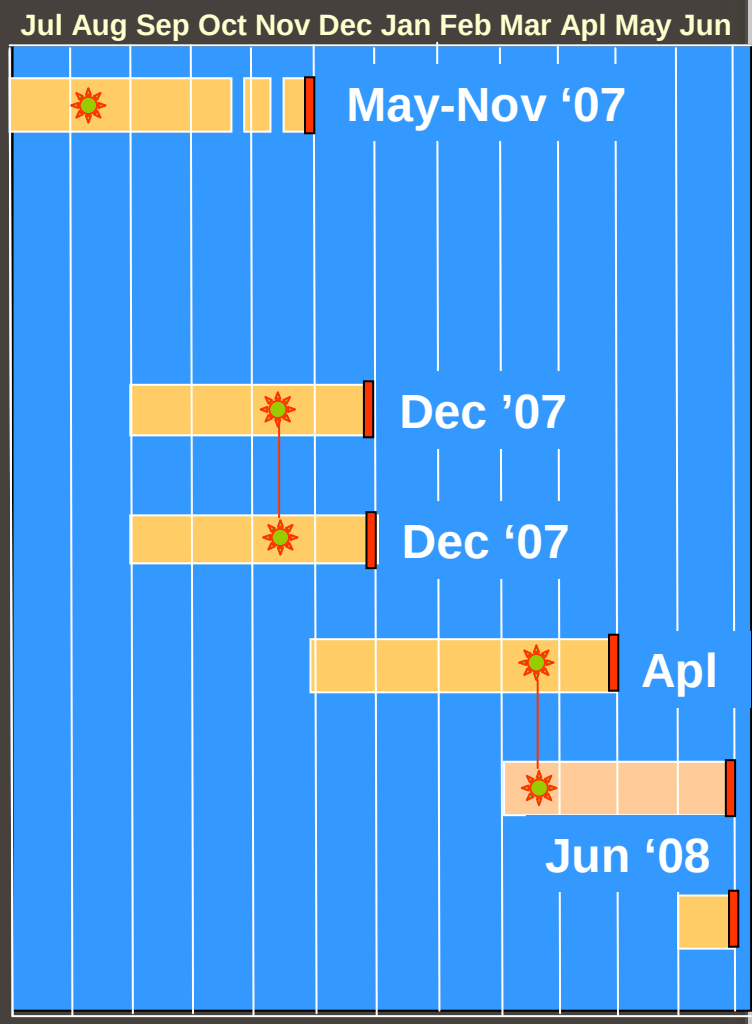
Stage 2: Selection of Favoured Pathways

Stage 2-3: Theme/Scenario Development

Stage 3: Theme/Scenario Analysis

Stage 4: Gap Analysis

Final Report

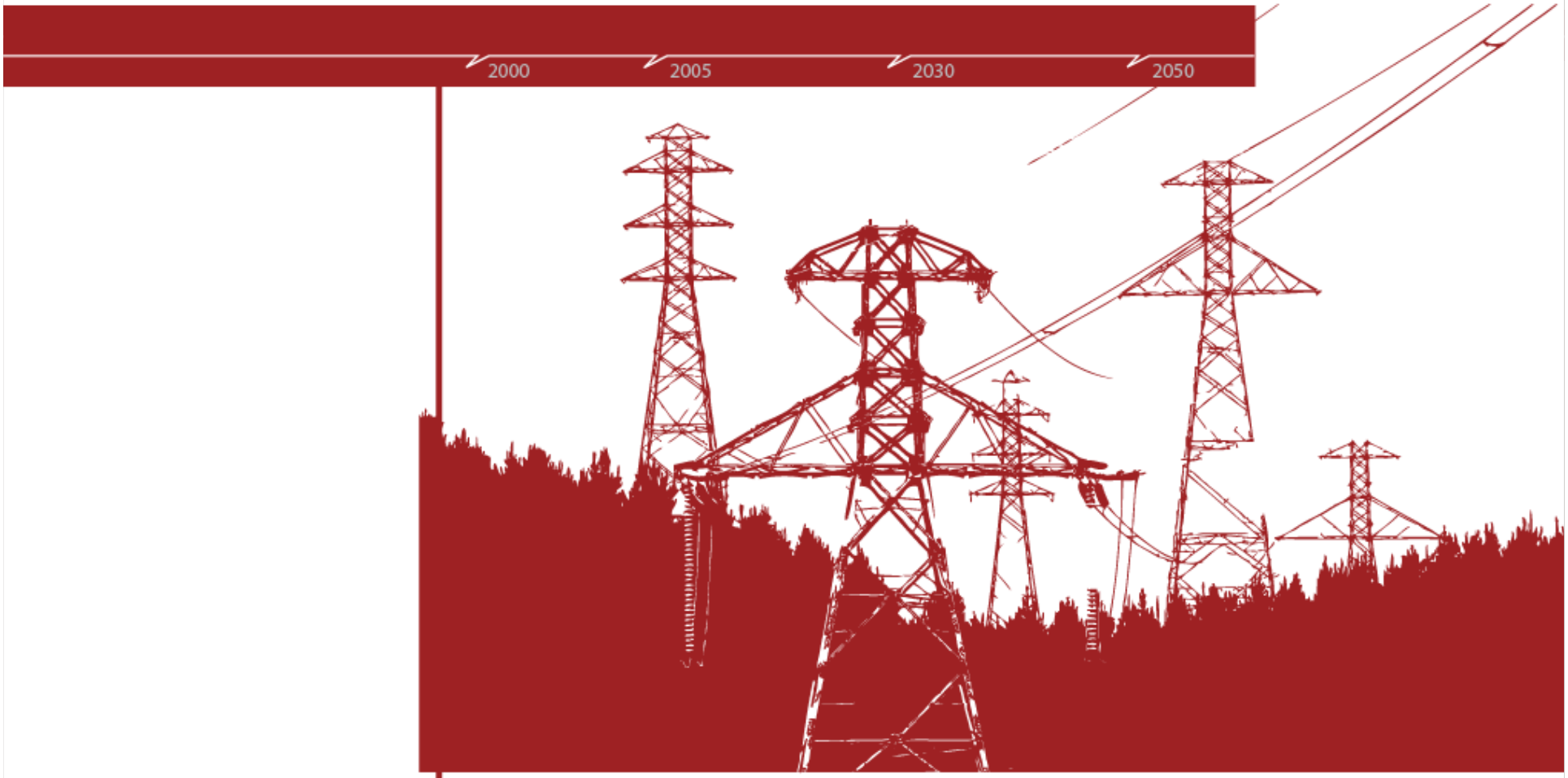


Have we got it right?

2000 2005 2030 2050

We are developing a high level process to develop strategy … including for the identification of energy research priorities for New Zealand:

- **Have we got the methodology right? …**
- **Have we got the scope right?**
- **What do you see as the priority outputs?**
- **Have we got the level of stakeholder engagement right?**
- **What changes would you suggest?**



Further Questions?

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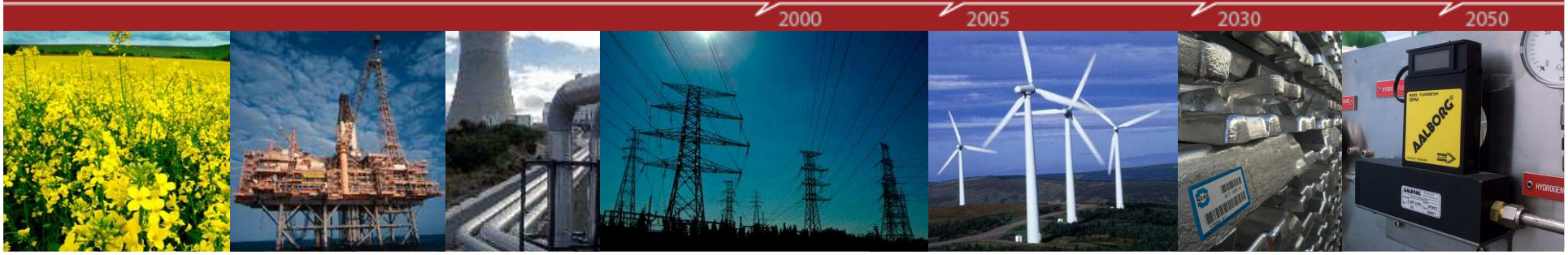
1st Stakeholder Workshop

Indigenous Resources and Energyscape

Rilke de Vos (NIWA)

9 August 2007



EnergyScape question?

2000 2005 2030 2050

What is wrong with New Zealand's Energy system?

- Insufficient investment?
- Dependence on imports?
- Regulation?
- Lack of planning?
- Mixed signals?
- Risk averse?
- Lack of knowledge?
- Access to technology?
- Skills/capacity?
- Enthusiasm?
- Limited demand?
- Limited capital?

ü Lack of ...

Collaboration & consensus

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Solution?

2000 2005 2030 2050

Common / shared filing system…

- Built with an understanding of end-use
  - ng
  - w
  - ost, GHG, risk
  - ions
- Accessible &
  - Self explan
  - Modifiable
  - Transpare
    - uncertainty

LEAP software w
databases

- Infrastructure limitation

EnergyScape framework

2000 2005 2030 2050

- Imports
- Exports

Resources

- Renewable
  - Hydro
  - Wind
  - Solar
  - Marine
- “Earth”
  - Geothermal
  - Gas
  - Oil
  - Coal
- Biofuels
- Dist. Generation

Infrastructure

- Traditional
  - Road
  - Elec. grid / network
  - Gas distrib.
- Transport
- Conversion
  - Fertilizer
  - Coal to liquids
  - Sequestration
  - Wasteà biogas
- Hydrogen

Demand

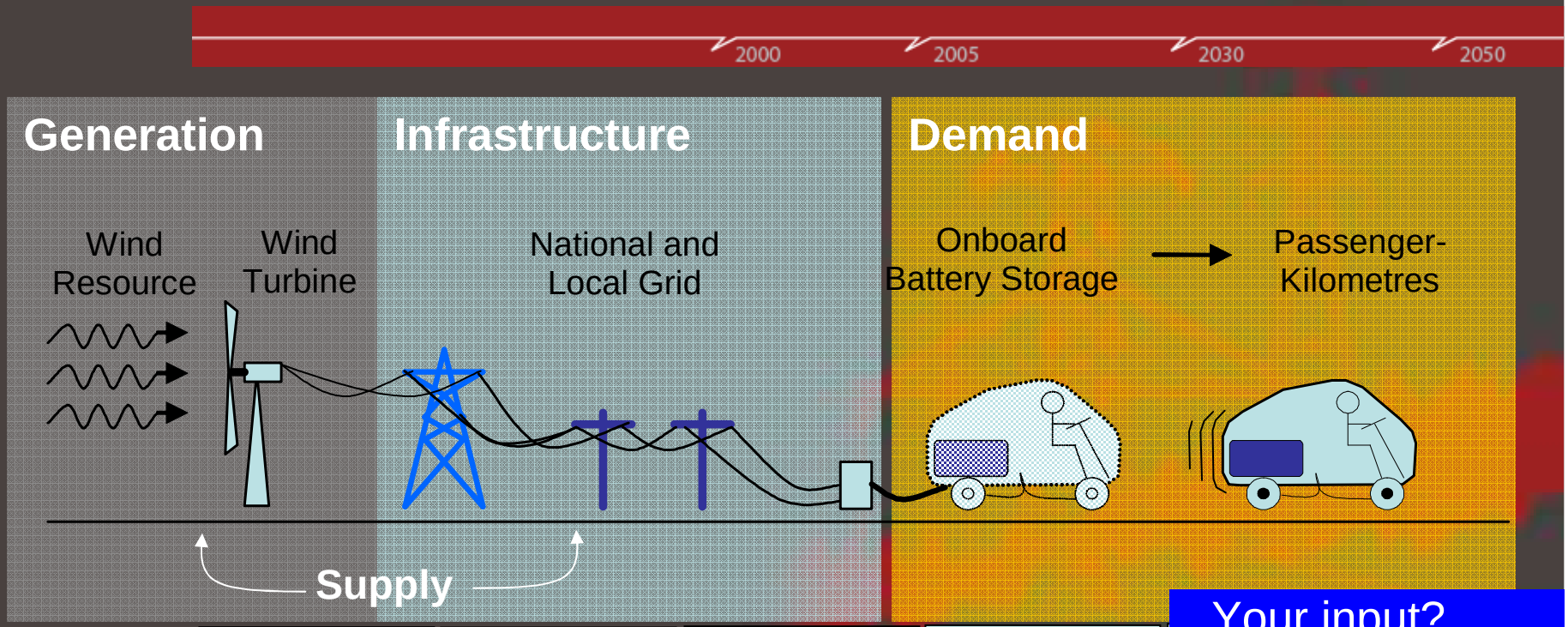
- Mobility
  - Aviation
  - Shipping / rail
  - Heavy trans.
  - Passenger
- High grade heat
  - Cooking
  - Distillation

Low grade heat

  - Space heating
  - Water heating
- Electricity
  - Appliances

- Behavior
- Efficiency

Pathways ...



Your input?

Fertiliser	Wood pellets	Comb Heat Power	Algae liquids	Electric rail	
Distributed Gen	Fisher Tropp	Solar Tower	MSW gassifier	Waste biodigestion	Bio refinery
Coal to Liquids	Hydrogen Ref	Hydrazine	Wind dam	REDOX batteries	Sequestration
CNG /LNG	MeOH fuel cells	Thermo-elec	Methane hydrates	Organic PV	Hot dry rock
1°, 2° & 3° biofuels	Electric vehicles	Petroleum refinery	Solar Hot Water	Supercritical water	Wave energy

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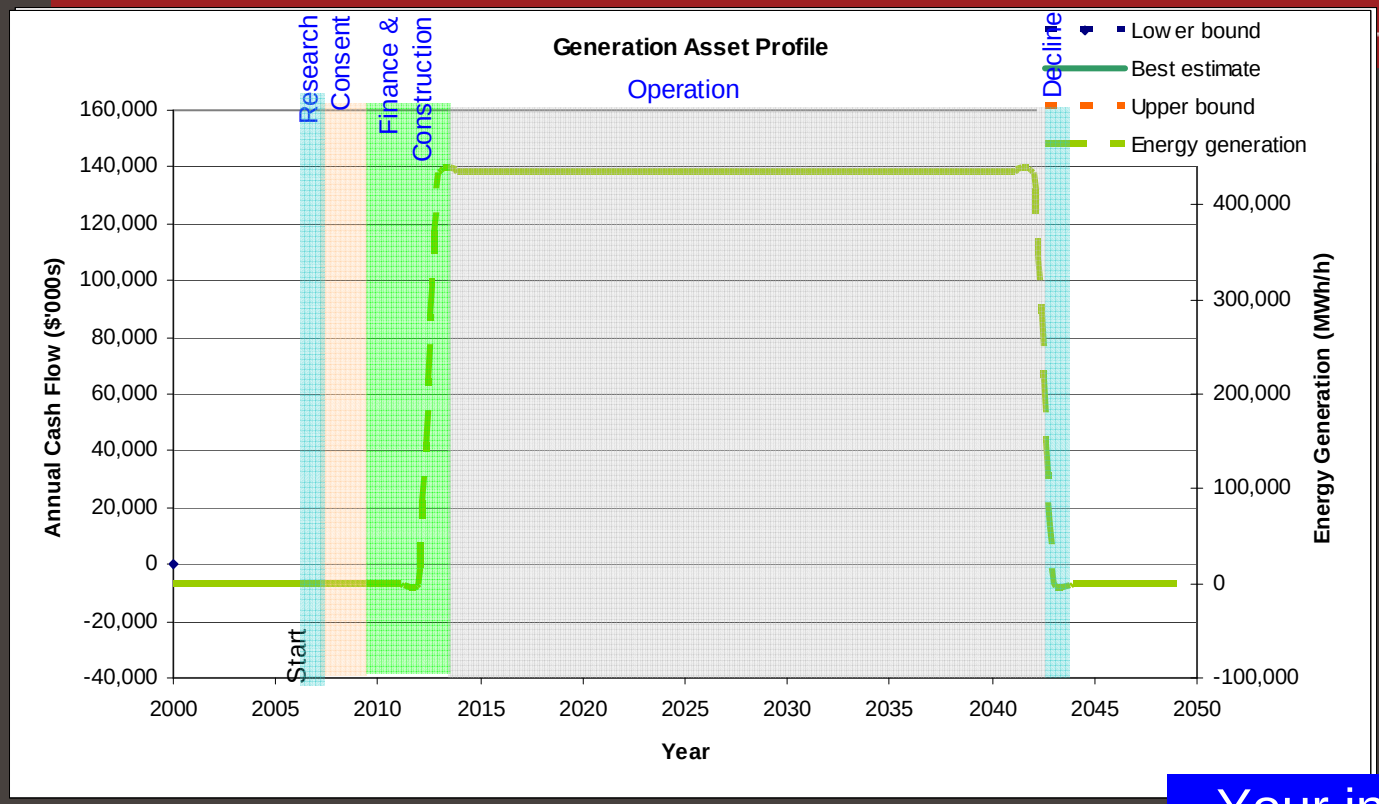
Resource & infrastructure data

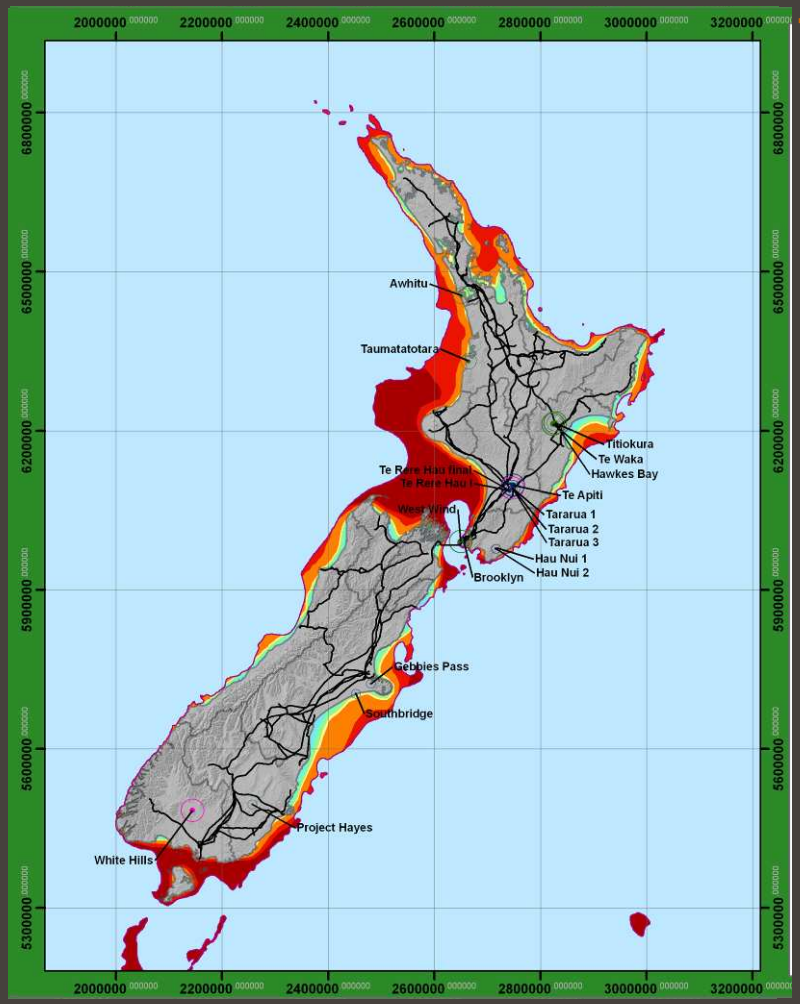


Your input?

- Asset parameters
  - Start / commission date
  - Project & research delay
  - Longevity
  - Capacity – Firm; Peak
  - Efficiency
  - Geo –location
- Detail per phase
  - Duration
  - Cost (capital / operating)
  - Risk (0-5 stars)
  - GHG
  - Water demand

Example - wind resource

2000 2005 2030 2050



A universal technology, just looking for appropriate price!

- Existing asset register
  - Peak capacity
    - MED, EHMS & NZWEA
  - Firm capacity
    - EC dataset?
- Potential resource
  - NIWA climate network
  - NZLAM output
  - Vestas V63 curve
- Realisable
  - Urban areas / local opposition
  - DOC / Maori lands
  - Slope & elevation

Populate the database with good data!!

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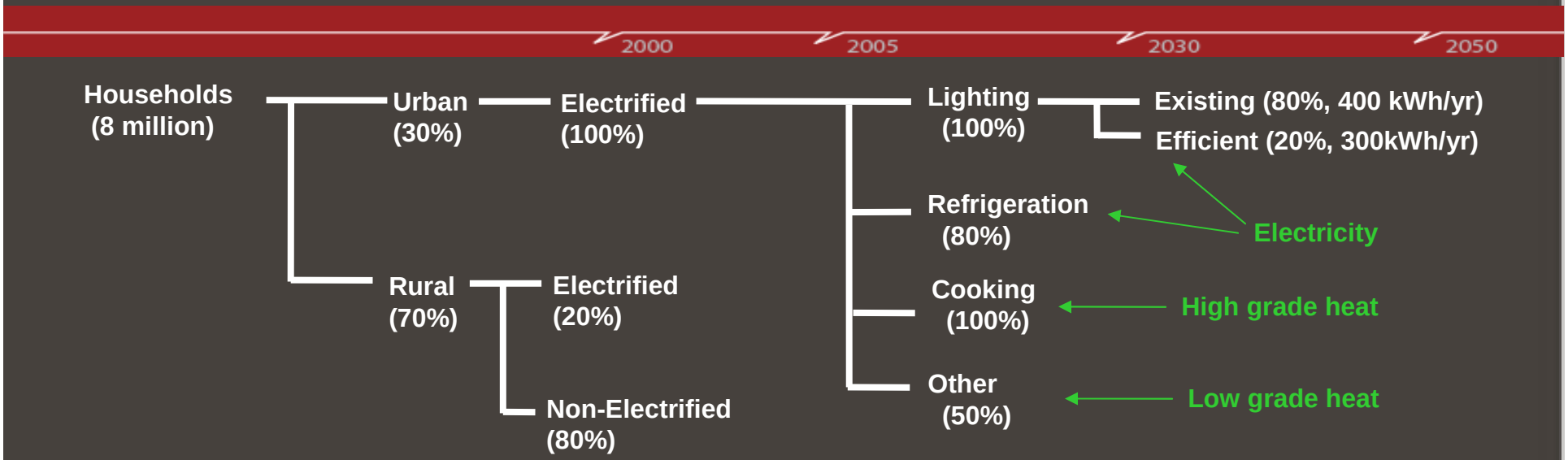
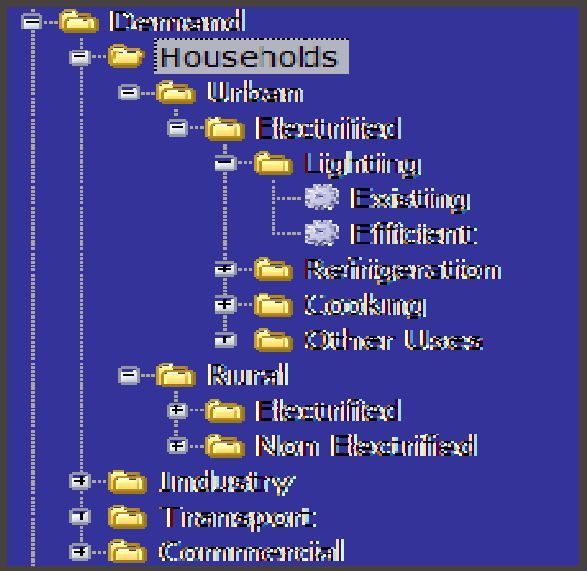
Wind resource

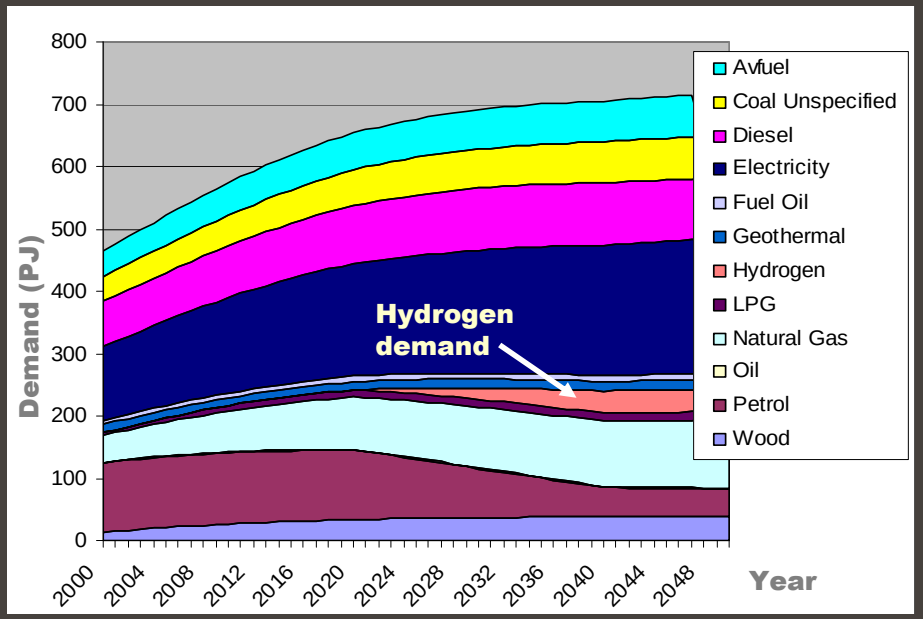
2000 2005 2030 2050

- Delays
  - 1 year research
  - 1 year consent
  - 2 year finance & construction
- Risk
  - 2 star consent
  - 0 stars in all other phases
- Longevity
  - 20 - 30 years
- Cost
  - Typically €1.18±0.35 million/MW
- GHG
  - Minimal GHG emissions except land clearance & emergy

Example - LEAP demand







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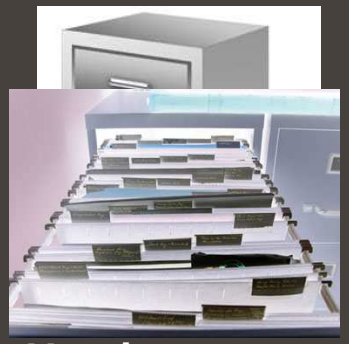
Forecasting …

2000 2005 2030 2050

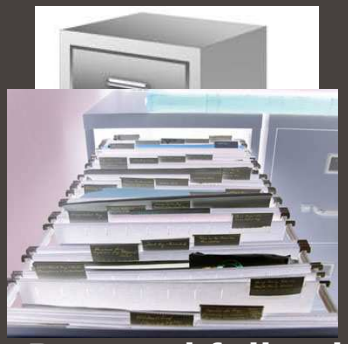
Resources

- Commodity prices
- NZ dollar



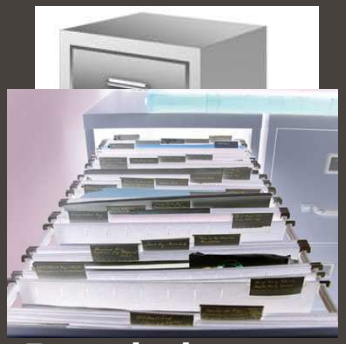
- Uptake rates
  - SHW / PV
  - Elect. Vech.
  - Industrial CHP
- Larger assets
  - Cost
  - GHG impact
  - Env. impact
  - Regulatory signals

Infrastructure



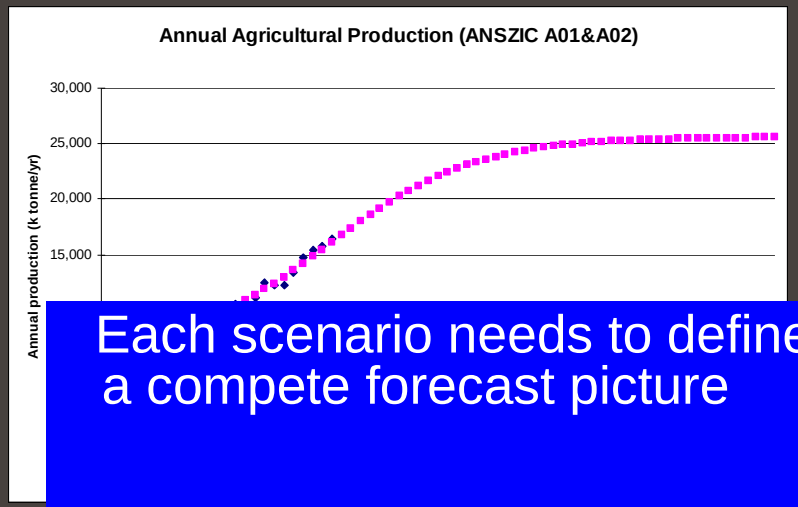
- Demand following
- Planning
- Absolutes eg. Glenbrooke Steel

Demand



- Population
- GDP
- Behavior
- Efficiency

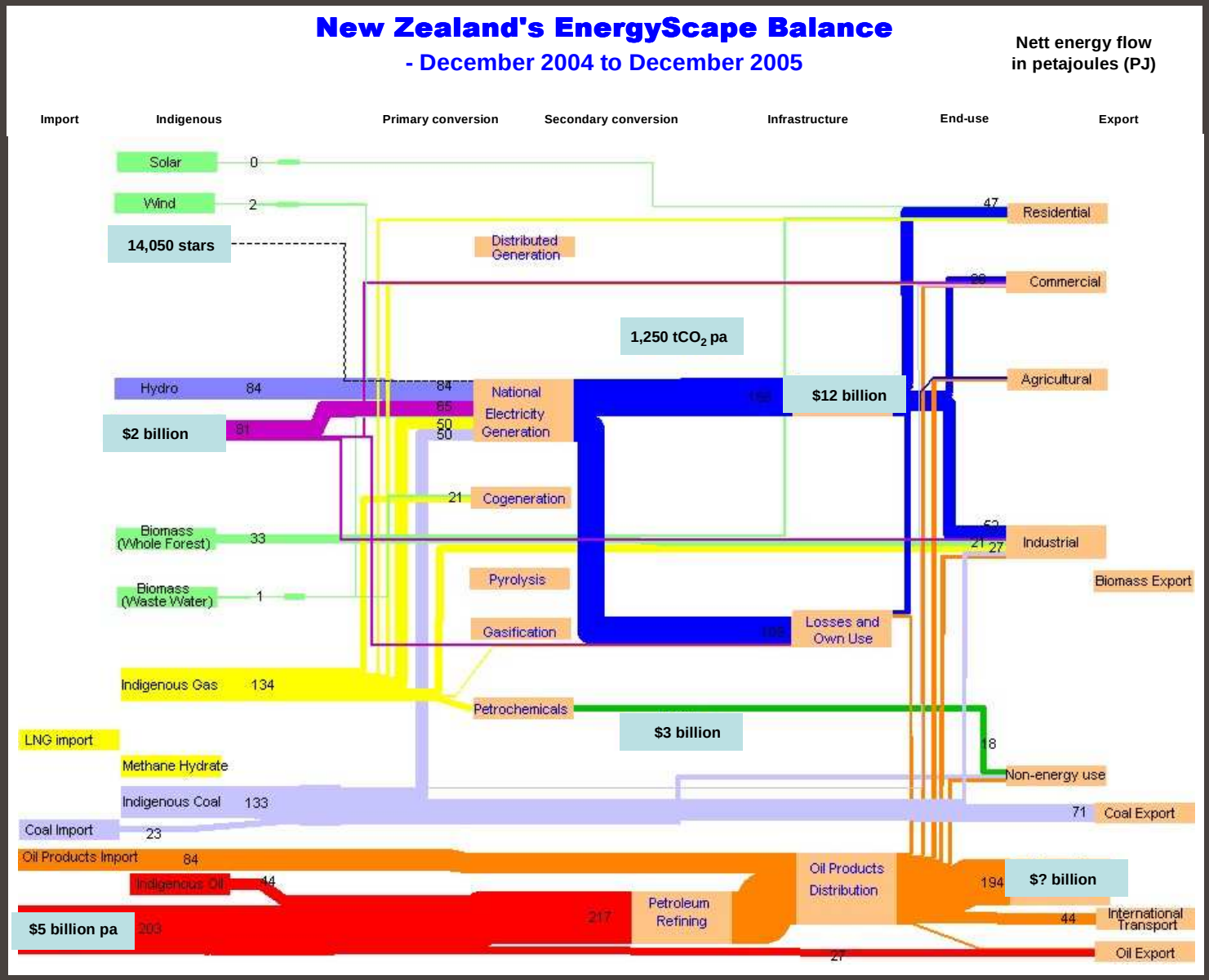
- Population proxies
- Commercial proxies & logistic growth



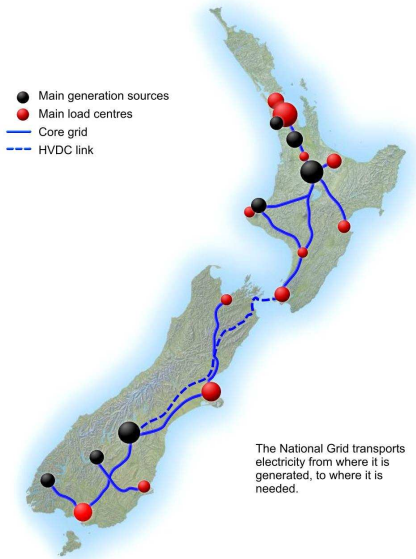
Each scenario needs to define a compete forecast picture

Sankey outputs

2000 2005 2030 2050

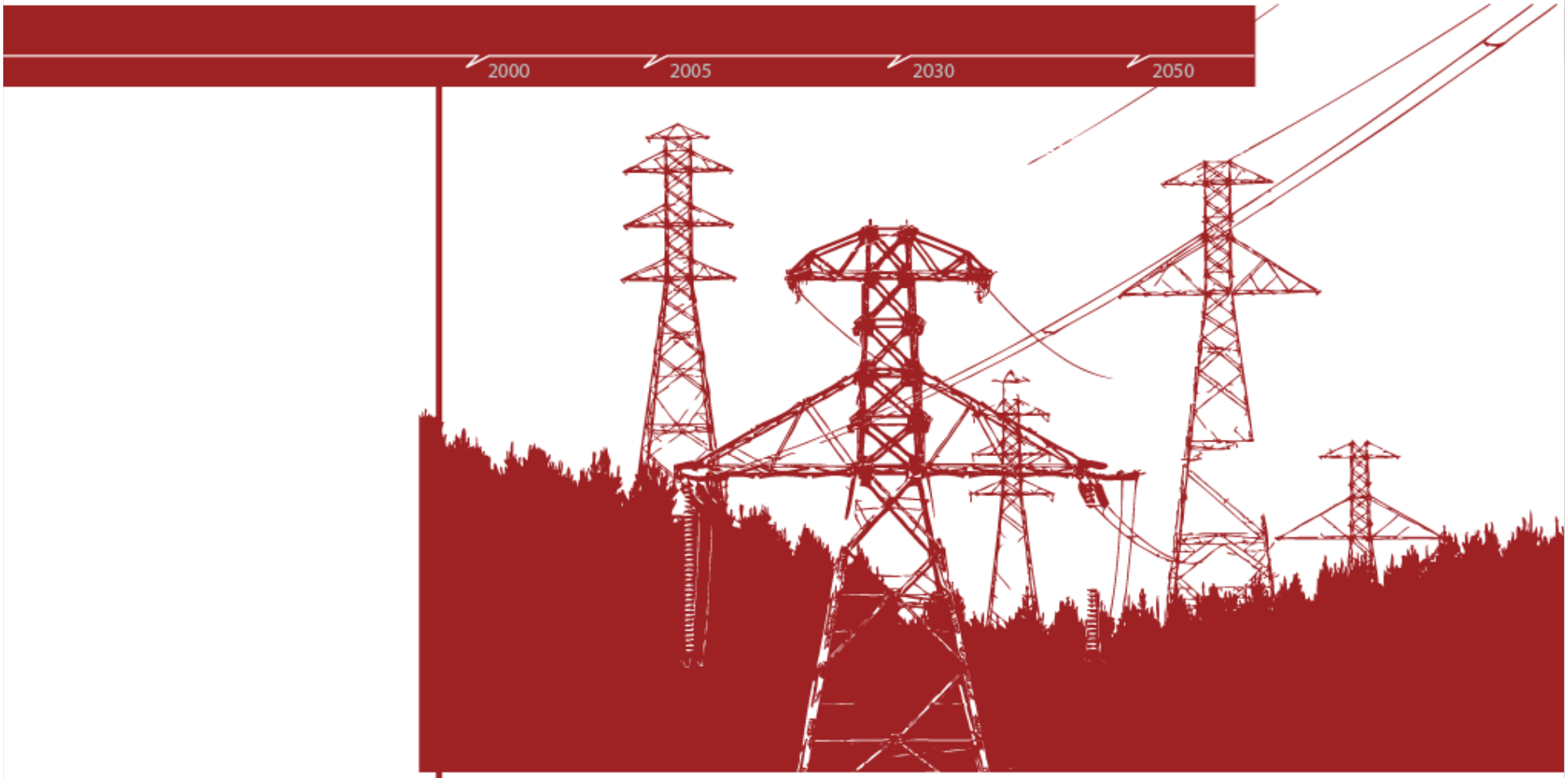


Bringing it all together



2000 2005 2030 2050

- Bridging a need
  - Framework for common communication
  - Identifying complete set of pathways
  - Progressive data input / scenario runs
  - Tools to review potential impact of policy
  - Identifying variability / uncertainty
  - Myth busting
- Improving energy information
  - Not just awareness
  - Order of magnitude
  - Relationships with GHG, water
  - Climate change surveys (Nielson & BBC)
- Regionalising for councils & Maori
- Energy community can play a role in development



Short Questions?

2000 2005 2030 2050

Panel questions?

Have we got it right?

2000 2005 2030 2050

A high level process to develop strategy …

1. Have we got the methodology right?
2. Have we got the scope right?
3. What do you see as the priority outputs?
4. Have we got the level of stakeholder engagement right?
5. What changes would you suggest?

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