

An overview of New Zealand's biogas potential

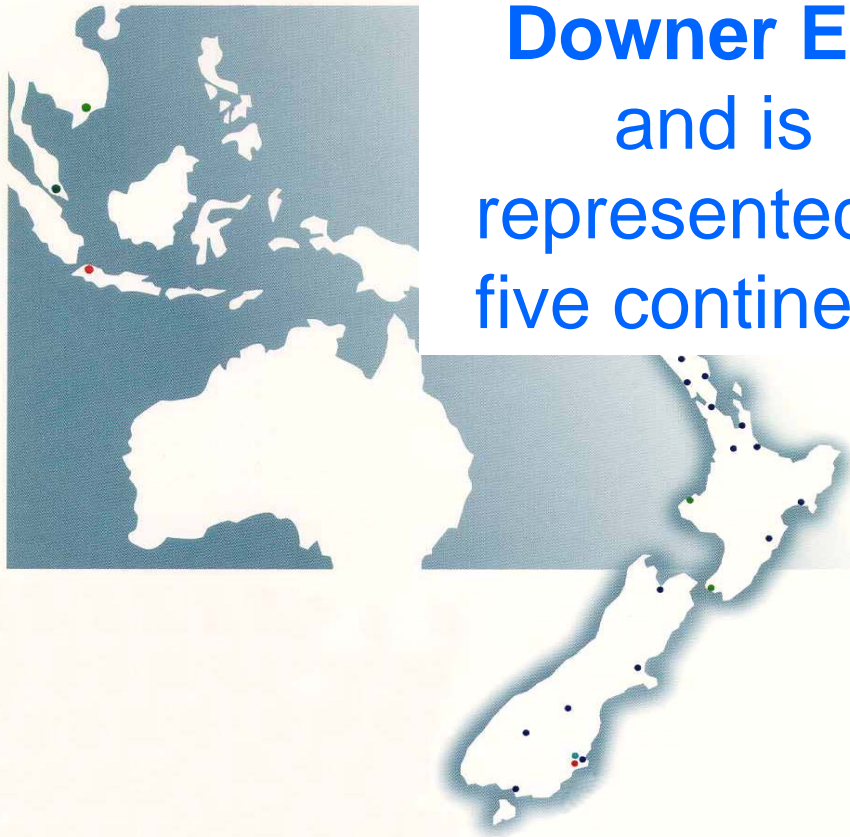
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Waste Solutions
is part of
Downer EDI
and is
represented in
five continents



Waste Solutions Ltd designs Anaerobic Digestion (AD) facilities for over 30 years.

In the last 8 years more than 19 large digester facilities were completed in New Zealand, Australia and South East Asia.

Numerous digester facilities treat piggery waste, starch pdn waste, alcohol pdn. waste and organic municipal waste.

Anaerobic Digestion (AD) Facility Examples



Overall Linked Energyscape Project (lead by NIWA)

2000 2005 2030 2050

Resource maps and related constraints:

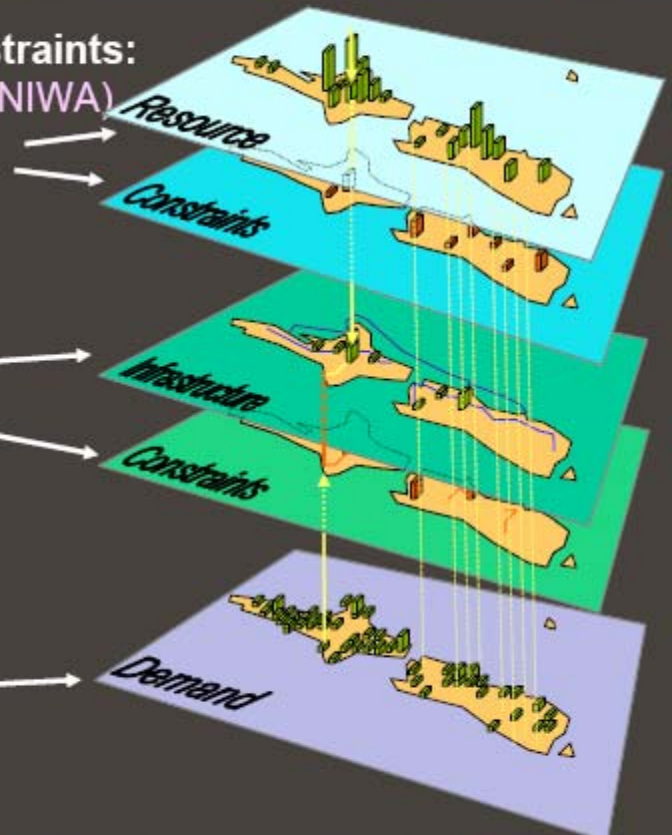
- Climate-driven (wind, hydro, etc., NIWA)
- Earth (coal, oil, gas, etc., NIWA)
- Bioenergy (lead by Scion)
- CCS (lead by GNS)
- Constraints

Infrastructure maps:

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

Demand maps (lead by CRL):

- Current
- Forecast



New Zealand's EnergyScape



WSL was subcontracted by SCION for the NZ Anaerobic Digestion Pathway as part of the "Bio-energy Options" project: PROJ-12011-ORI-FR10



How much AD resource is there ?

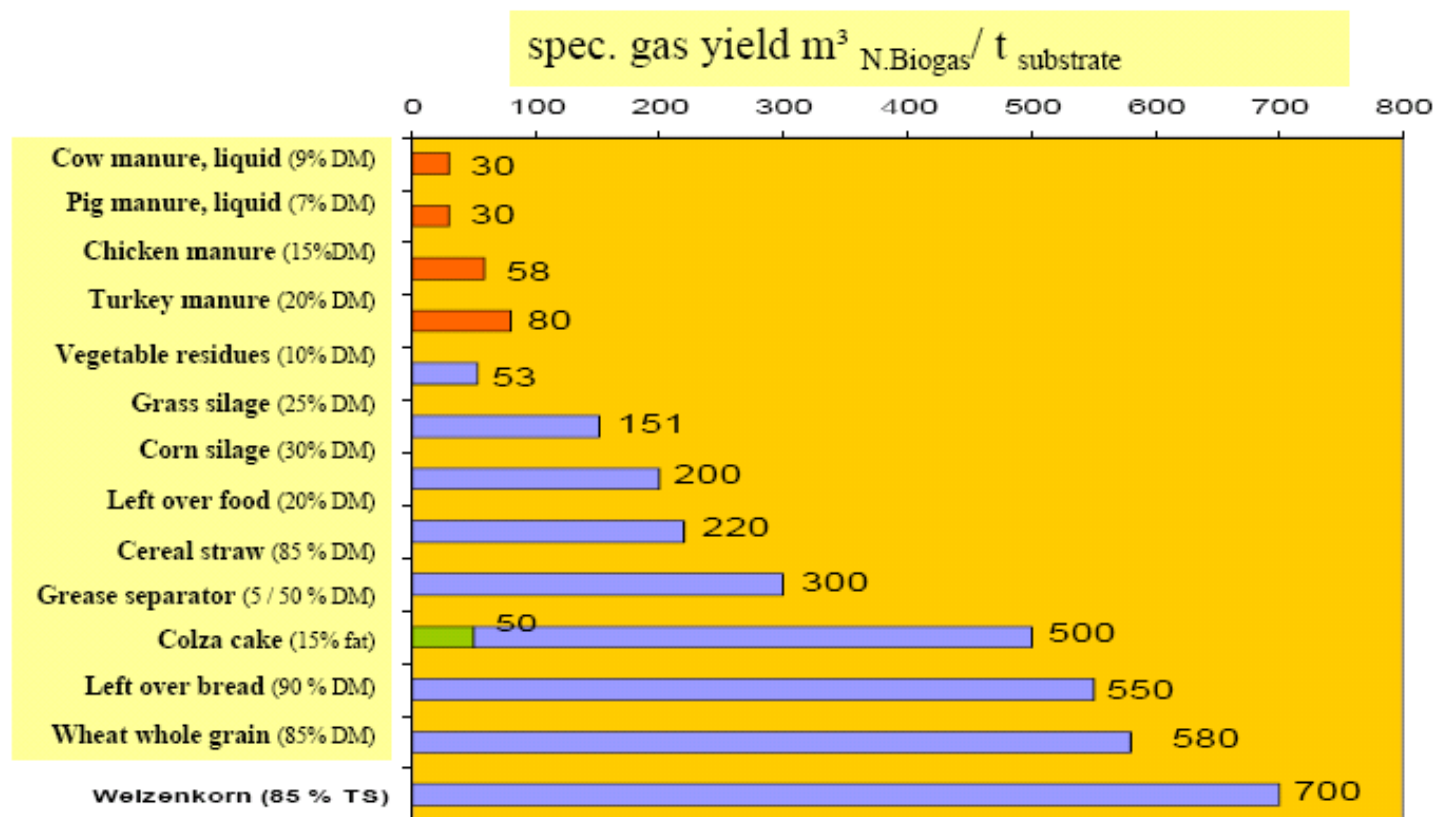
- 2006 NZ production data from government statistics as input (MAF, MfE, StatsNZ, Fonterra, meat producers, municipalities)
- Conservative assumptions about resource availability (broad brush approach)
- Actual operating digester performance data = net biogas yield
- Biogas end use (process heat, power, vehicle fuel) open for debate

Constraints controlling resource

- Exclude dairy farms < 400 hd
- Exclude crop residues
- Include dairy shed effluent, piggery effluent
- Include municipal biosolids + industrial, commercial solid waste
- Include biosolids from current industrial effluent treatment (dairy, meat processing)
- Include paunch grass from meat processing
- Seasonality of waste supply considered

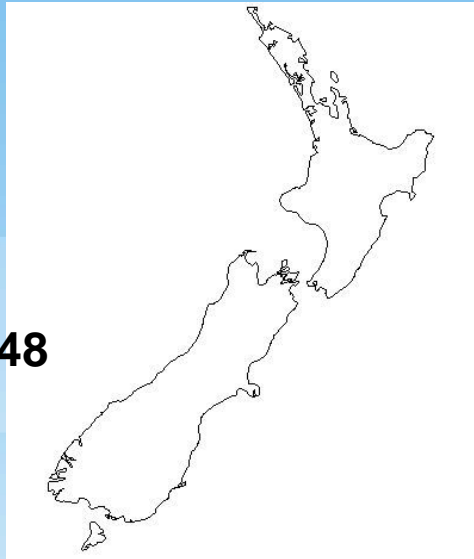
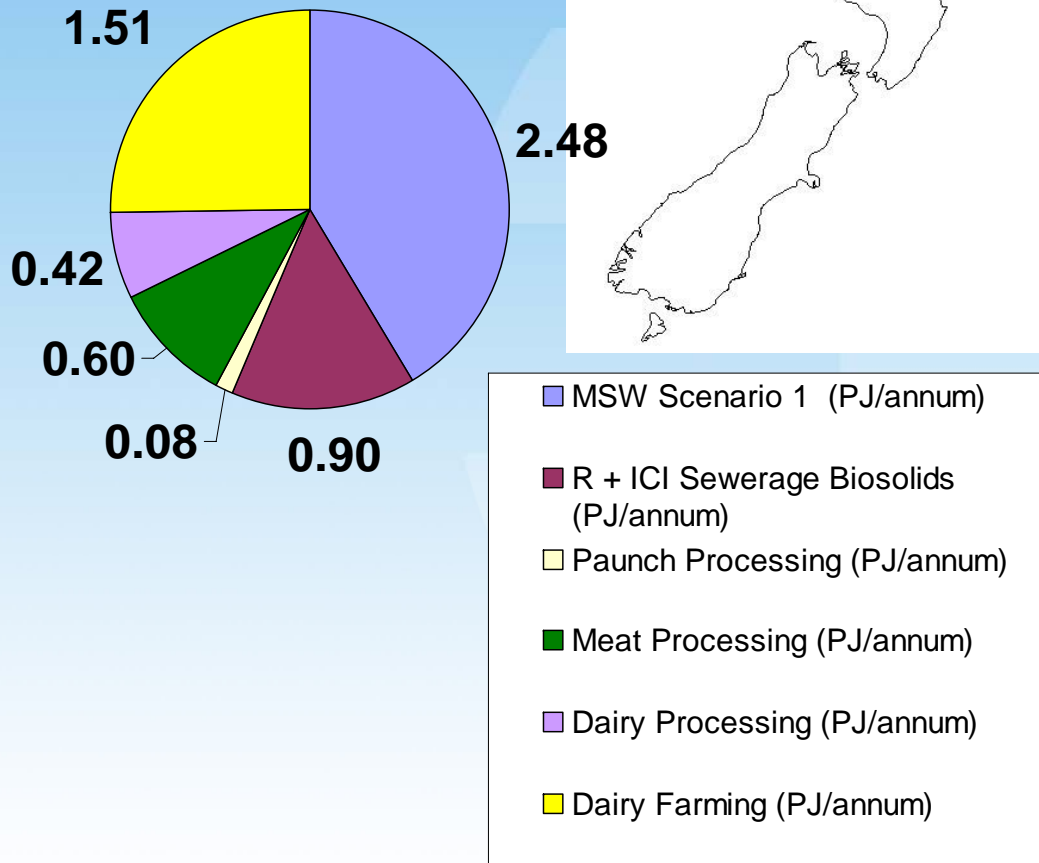
Constraints controlling biogas yield

Biogas yields from different substrates



How much biogas consumer energy is nationally available ?

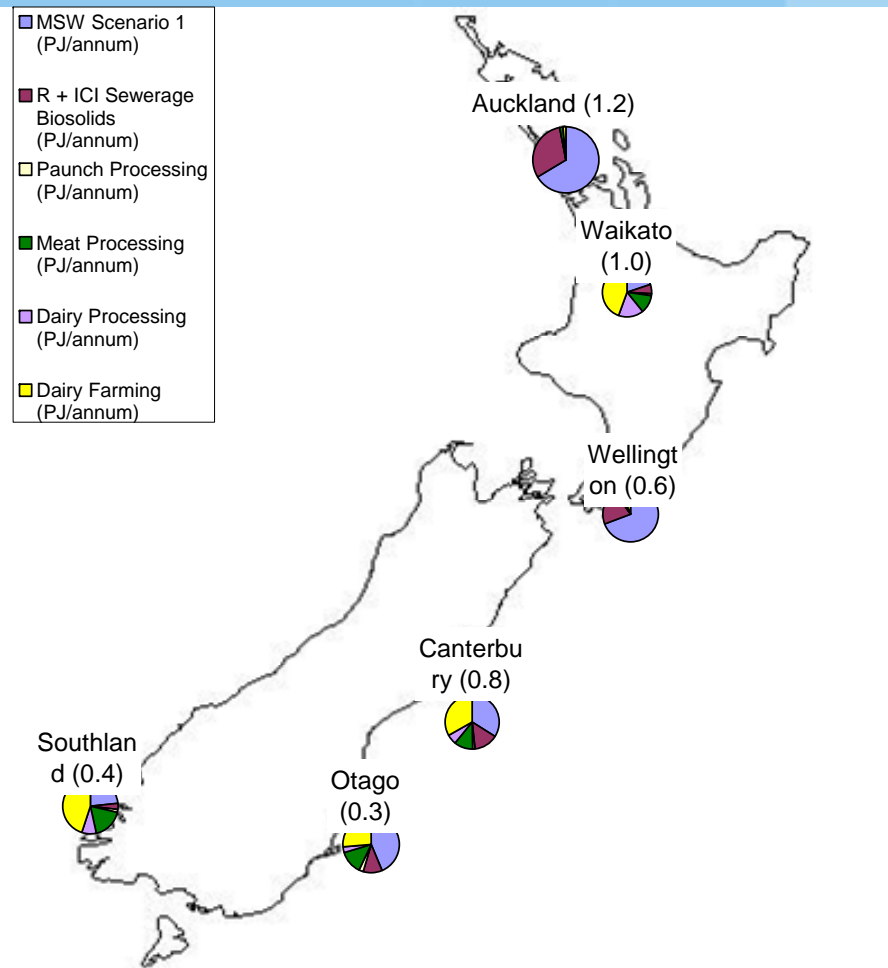
- 1 PJ biogas produces 97.2 million kWh electricity
- 1 PJ biogas produces 22.2 million liter diesel fuel



Municipal solid waste	2.5 PJ
Dairy shed waste	1.5 PJ
Sewage biosolids	0.9 PJ
Meat processing biosolids	0.6 PJ
Dairy processing biosolids	0.4 PJ

Total: 5.9 PJ
Net biogas potential
(per annum)

Biogas resource hot spots in 2006 !



Auckland 1.2 PJ

Waikato 1.0 PJ

Canterbury 0.9 PJ

Wellington 0.6 PJ

Southland 0.4 PJ

Otago 0.3 PJ

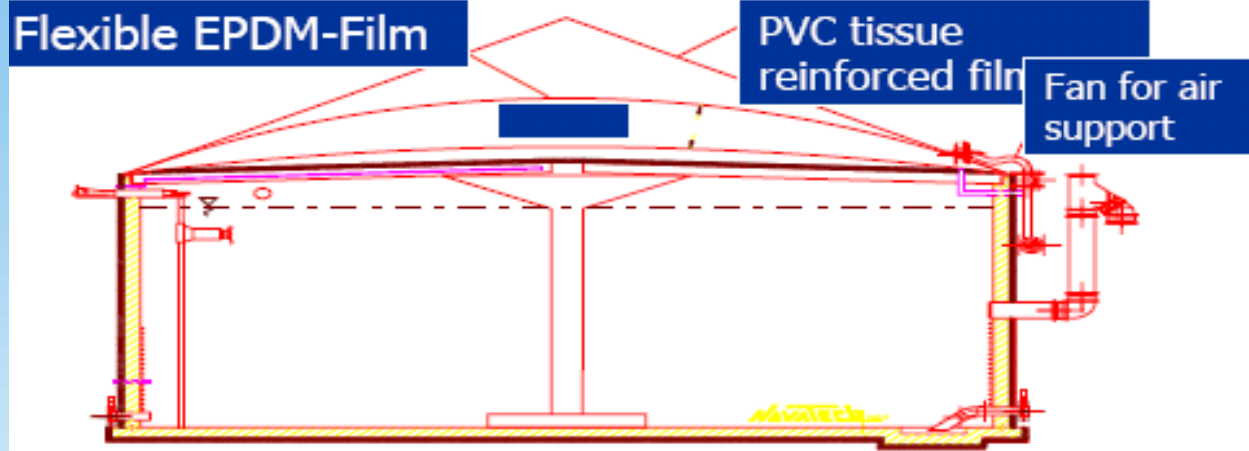
Total: 4.4 PJ

Effective, modern technology is available

Concrete digester with double membrane cover



User friendly and robust



Advantages:

- simple digester repair
- integrated gas holder
- well weather proofed
- easy indication of gas yield

Disadvantages:

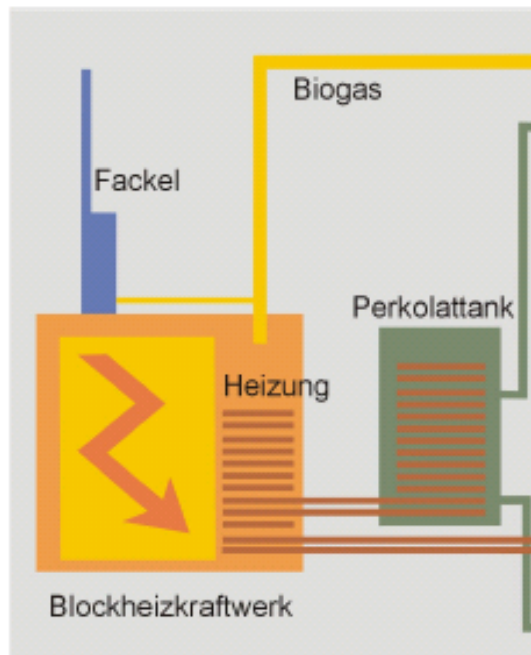
- more expensive than one cover
- not 100% gastight
- permanent energy consumption through air fan



Options for solid farm and food waste

Dry Fermentation System for Biomass over 20% DS

„garage type“ digester



A flexible future is possible !

- Pollution prevention and odour reduction driver
- **About 4.4 PJ (net) biogas energy** potential is concentrated in six regions (Auckland, Waikato, Wellington, Canterbury, Southland, Otago)
 - about 110 million liter diesel equivalent/annum
 - or about 440 million MWh electricity/annum
 - or a mixture of both
- In addition, about **5-6 PJ of bioethanol** from whey, straw and paper waste (bioethanol report for EECA)
- For comparison: NZ transport fuel use: **about 250 PJ**

This can build a new national industry based on available waste materials:

- Example Denmark, Germany, Austria, Sweden:

Biogas in Germany 2005

<u>Biogas in Germany</u>	
Amount of Biogas Plants	ca. 2.700
Installed Electrical Capacity (Cumulated)	650 MW el.
Growth against prev. Year	70 %
New Capacity	250 MW el.
Est. Turn Over Installation	650 Mio. EUR
Growth against prev. Year	80 %
Employment	> 5.000
Avoided Climatic Emissions	2,8 Mio t CO ₂ -Eq.

- E.ON Gas Sverige AB sells compressed natural gas and biogas at 20 public filling stations in the south of Sweden

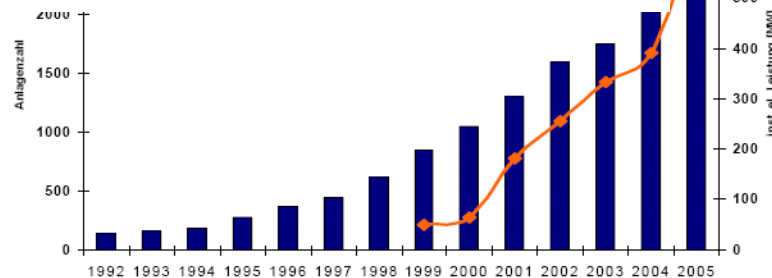
6 busdepots

The yearly volume is 170 GWh - replacing about 17 million liters of gasoline/diesel

- 25 % is biogas

Target:

- Supply 400 GWh/year in 2010, of which biogas will account for 25-50 %



Fachverband
Biogas e.V.



Liquified biomethane



- Cryogenic technology used for up-grading and purification of biogas or landfill gas
- Two products, liquified biomethane (-160°C) and liquified CO2 (-78° C)
- Cost and energy efficiency in transportation of liquified methane
- Refueling stations with both compressed and liquid methane, and 2/3 saving on maintenance and operational costs.

Thank you