



Biosolids and Effluents – Resources, Uses and Life Cycle Analysis

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Biosolids and Effluent Resources

- Resource analysis

- data sources factored for 2006

- Statistics NZ

- Ministry for the Environment reports

- EECA reports

- Industry practitioners

- restricted to NZ resource materials that are

- wet (70-99 % water content)

- putrescible (i.e low in lignocellulose materials)

- waste products

- NZ made (i.e. not imported)



First order resource analysis ctd

- **Resource bioenergy amount**
 - “parasitic” energy used in energy recovery is deducted
 - corrected for amounts potentially dedicated to competing uses (animal feed, fertiliser)
 - broken down for regions in New Zealand
 - analysed for constraints (seasonality, economy of scale, transport energy/costs, residue disposal, requirement for co-processed materials)
- **Data presented as NETT enduser bioenergy**

- **Anaerobic digestion is suited and a mature technology**
- **It produces a high quality biogas (22-24 MJ/m³)**
 - production of industrial heat (75-85 % conversion)
 - production of residential heat (75-85 % conversion)
 - cogeneration (gas motor genset, 42 % el, 42 % heat)
 - cogeneration (gas turbine genset, 30 % el, 50 % heat)
 - cogeneration (steam turbine genset, 30 % el, 50 % heat)
- **The biogas can be upgraded to biomethane**
 - “pipeline quality” (80-90 % conversion, large facilities)
 - “vehicle fuel quality” (70 – 80 % conversion, large facilities)
 - biomethanol (70-80 %, conversion, large facilities)

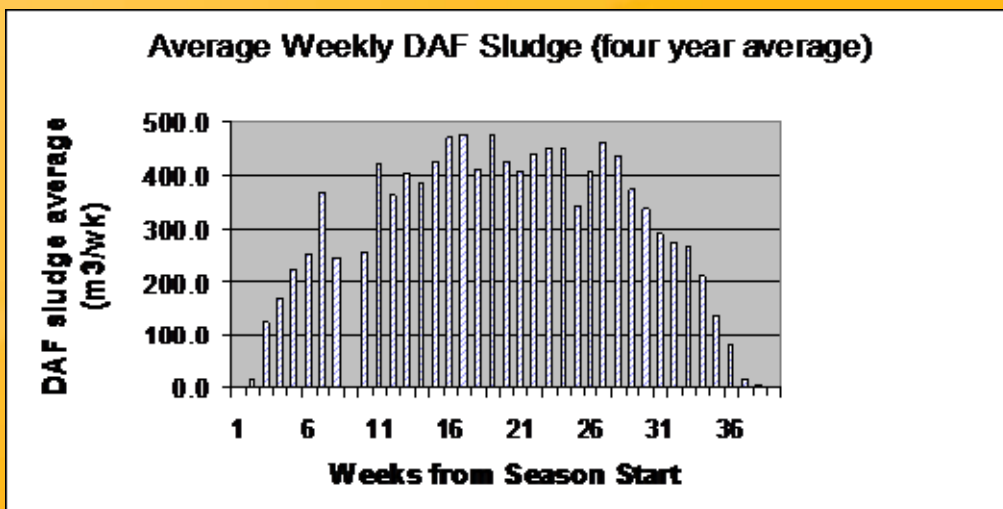
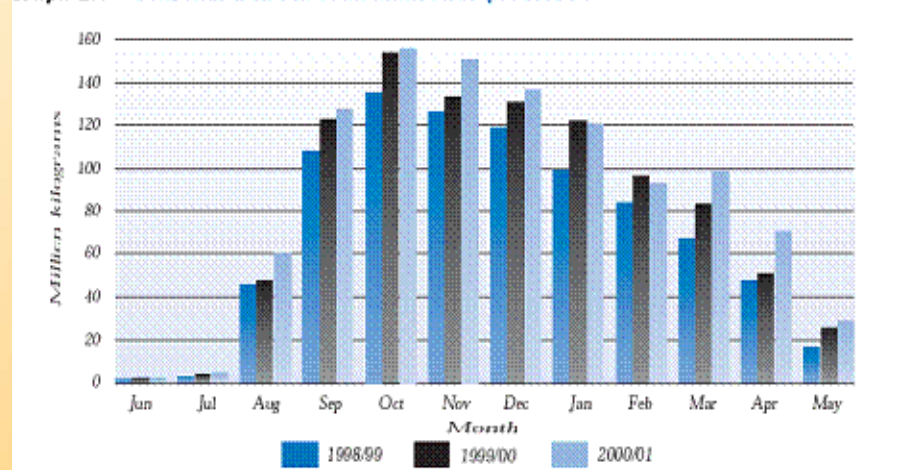
Major findings ctd ...

- Suitable feedstocks are available in New Zealand mostly throughout the year from
 - organic fraction of Municipal solid waste
 - the biosolids generated in sewage treatment
 - residential (R)
 - industrial, commercial, institutional (ICI)
 - dairy cattle manure (dairy shed effluent only)
 - dairy factory processing wastewater (solids)
 - meat processing wastewater (solids)
 - paunch content from cattle and sheep slaughtering
- Insignificant resources are
 - Wool processing wastewater (very small resource)
 - Cheese whey (alternative uses – ethanol, dry milk products)

Seasonality constraints

- Dairy manure, dairy factory processing wastewater follow mainly the “milk production curve”

Graph 2.1 Seasonal trend in total milksolids processed



- meat processing wastewater and paunch content have a slightly different seasonality
- Sewage biosolids and municipal waste organics were assumed to have “no seasonality”



Economy of scale constraints 2006

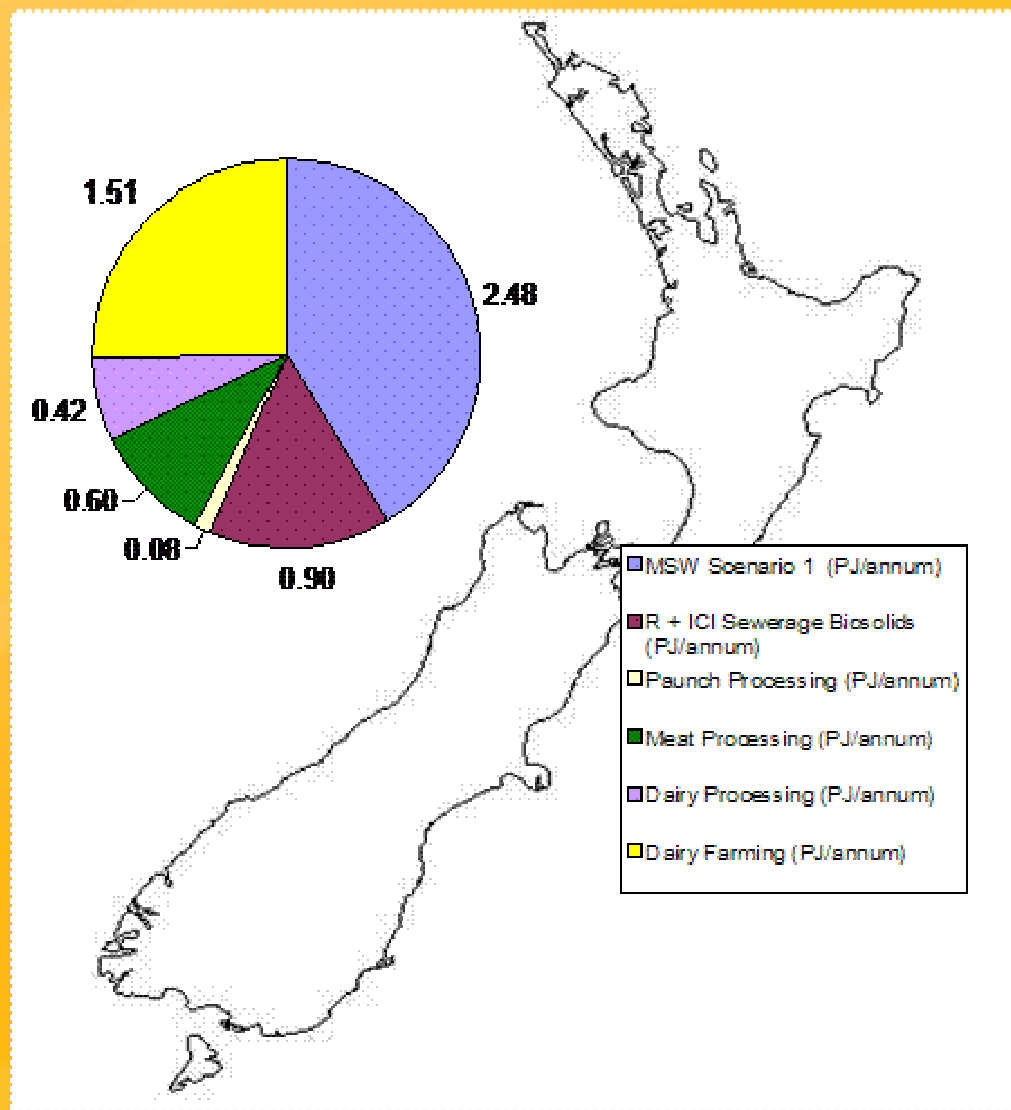
- Exclude dairy farms < 400 hd
- Exclude use of crop residues and energy crops
- Include dairy shed effluent, piggery effluent
- Include municipal solid waste + industrial, commercial solid waste (org. fraction only)
- Include biosolids from current industrial effluent treatment (dairy, meat processing)
- Include paunch grass from slaughtering
- Constraints in 2020 expected similar to 2006

How much is there ?

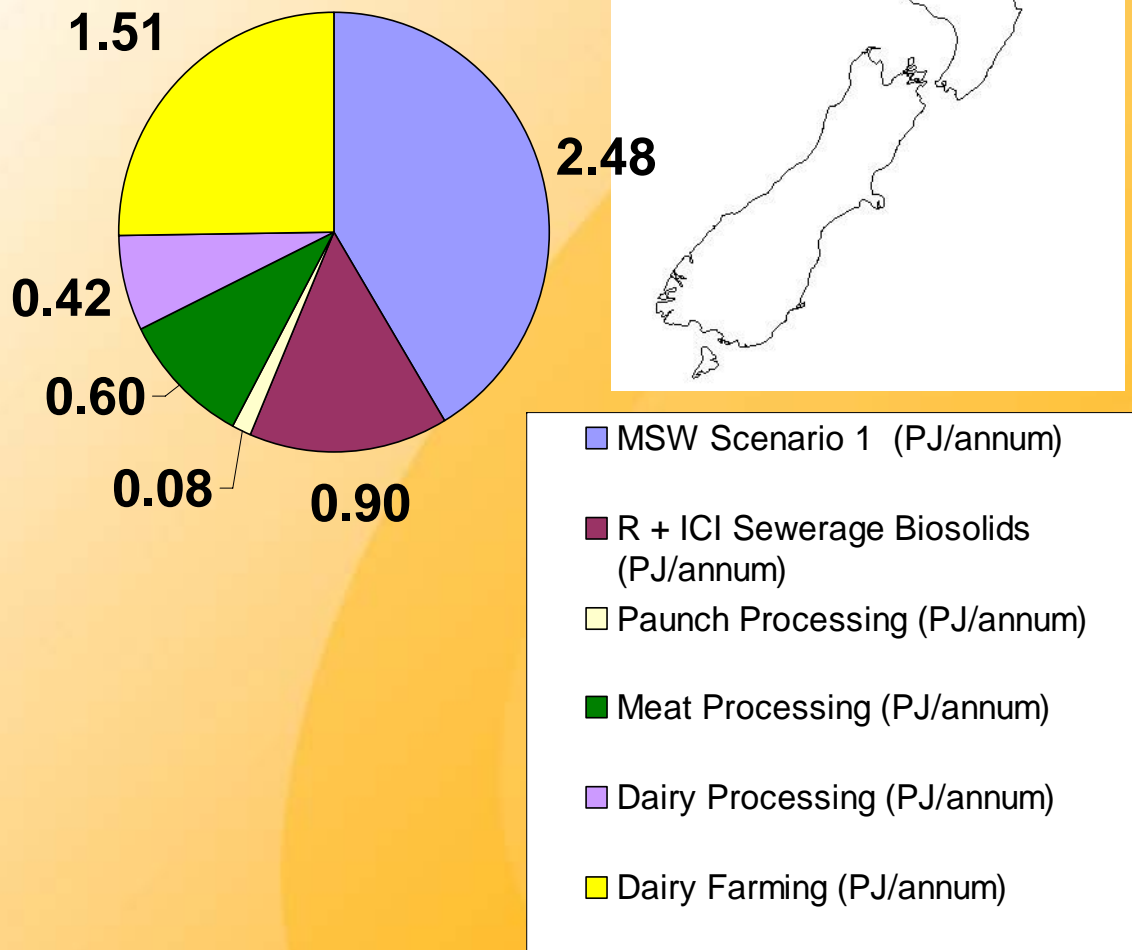
Total 2006:

**6 PJ/annum NETT
7.5 PJ/annum GROSS**

**Total 2020:
About the same**



Estimate of New Zealand methane blowing potential from each sector (given in PJ methane blowing/year)
Note: The processing energy requirement (heat, power) is assumed to be covered from the produced methane and is already subtracted



Municipal solid waste
(scenario 1) 2.5 PJ
(scenario 2) 3 PJ

Dairy shed waste 1.5 PJ

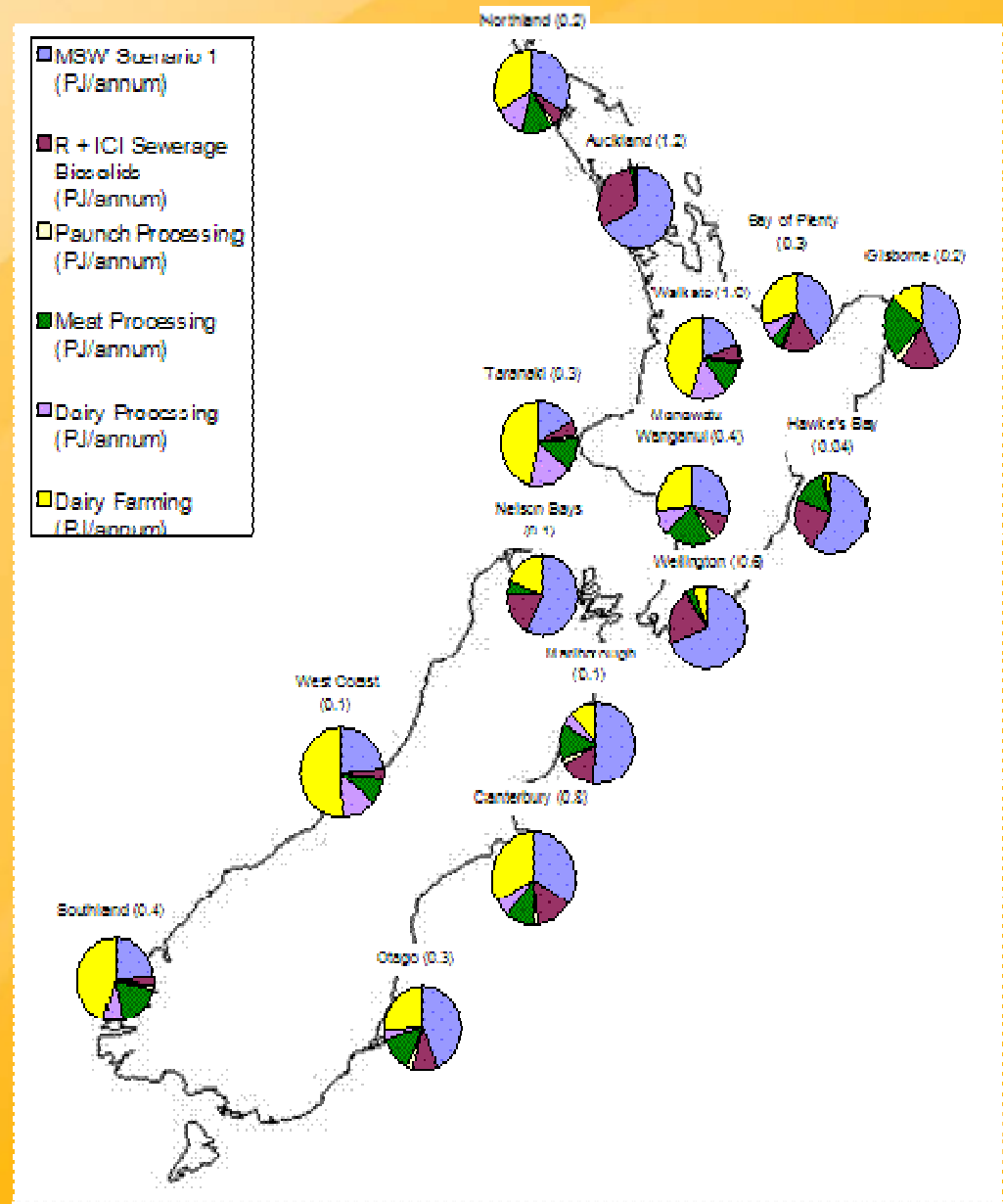
Sewage biosolids
0.9 PJ

Meat processing
biosolids 0.7 PJ

Dairy processing
biosolids 0.4 PJ

Total: 6 PJ
Nett (per annum)

Biogas enduser NETT energy distribution in 2006

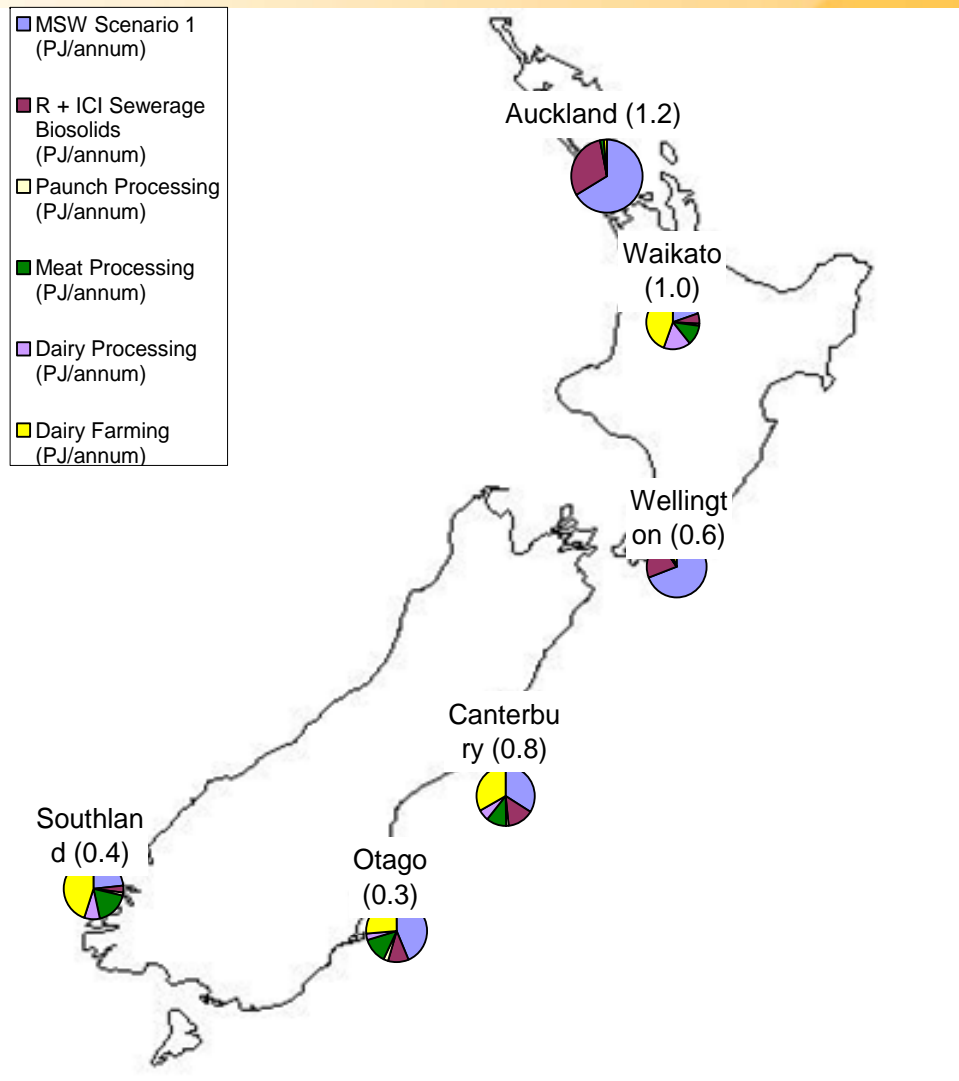


Regional breakdown of current Net methane biogas production potential from major wastes in regional areas. The process energy required for methane production (power, heat) is already subtracted.

The estimated total recoverable methane energy value for each region is given in PJ/annum in parenthesis. Values were calculated using MSW Scenario 1 and biocellid processing from domestic sewage + ICI sewage.



Feedstock “rich” regions in 2006 ctd....



Auckland 1.2 PJ

Waikato 1.0 PJ

Canterbury 0.9 PJ

Wellington 0.6 PJ

Southland 0.4 PJ

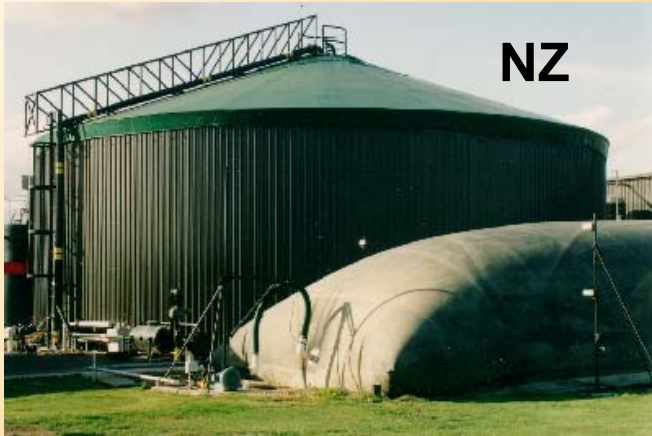
Otago 0.3 PJ

Total: 4.4 PJ

NETT

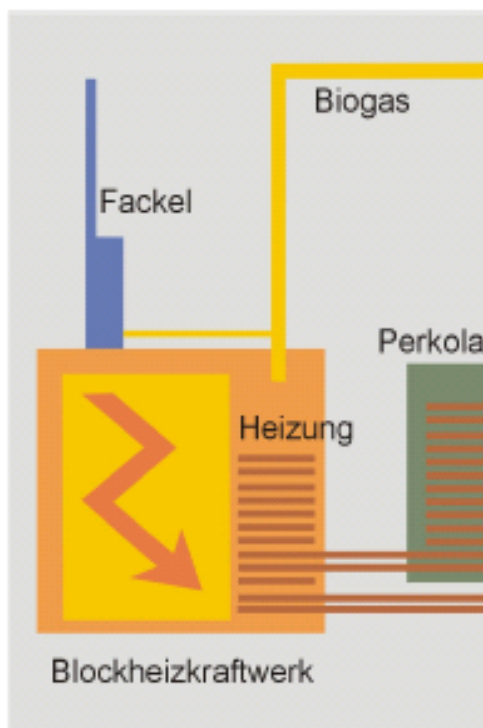


How can the potential be accessed ?



Example of Option for Solid Farm and Food waste

Dry Fermentation System for Biomass over 20% DS „garage type“ digester



Betonfermenter mit Wand- und Bodenheizung

Drainsystem für Perkolat

chtes

Biogas Upgrade to Vehicle Fuel

- 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 25-50 %





Summary from Life Cycle analysis

- Plant construction energy less than 5 % of bioenergy produced over lifetime
- Typical annual energy balance (GJ_{out} / GJ_{in}): 5 – 10
- Typical waste transport energy GJ_{in} / GJ_{out}): 0.1 – 0.3
(only large regional facilities, 40 km radius)
- Fertiliser quality of feed materials preserved YES
- Typical GHG emission reduction: 370 t CO₂-equ/TJ electricity produced (excludes N₂O)
- Substantial further GHG reduction possible (incl. N₂O abatement)
- Power production costs in regional facilities: range from 8 c/kwh to 25 c/kwh



Thank you

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