



Submission: Low emissions economy - Ecozest

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Date: 02 October 2017

Area of focus: Industrial, public and dairy effluent emissions.

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Introduction

Indigo has developed and proven a technology that will mitigate or significantly reduce greenhouse gas emissions from industrial, public and dairy organic effluent treatment systems by increasing the efficiency of anaerobic and aerobic autotrophic bacteria.

We propose an alternative, affordable organic effluent processing system. By utilising our technology, Ecozest, methane production will be mitigated and the recycling loop can be closed resulting in a product that has a sustainable, commercial market. The system is a low cost, climate adaptation design. It occupies a lower environmental and capital foot print than traditional treatment systems and can operate within individual communities.

Ecozest can also be seamlessly integrated into New Zealand’s existing centralised largescale effluent treatment systems to increase efficiency and reduce emission.

We provide emphatic evidence that greenhouse gas is due to the operation of an inefficient bio processing system. Increasing the efficiency of the biological system will mitigate pollution and turn organic waste to an economically valuable by-product. Mimicking and supporting the natural system reduces capital costs, mitigates engineered inefficiencies and supports climate adaptation strategies.

We provide proof that transition to a lower net-emissions economy improves economic and environmental outcomes; the Productivity Commission will be able to debunk the myth that transition to a lower net-emissions economy will cause economic harm and stifle growth and productivity.

Existing Municipal Wastewater Treatment

To illustrate application in existing wastewater treatment systems we present a cost benefit study carried out in 2002 at the Watercare Mangere wastewater treatment plant to illustrate that transition to a lower net-emissions economy offers a significant economic growth opportunity.

ECOZEST		
MANGERE WASTEWATER TREATMENT PLANT		
COST BENEFIT ANALYSIS		
THICKENED SLUDGE		
Old system produced 2300 cubic meters of primary thickened sludge		
New system adds secondary thickened activated sludge.		
Assume for this analysis that the volume has doubled		
Therefore estimated thickened sludge inflow into the anaerobic digesters is		
4600 cubic meters		
WASTED SLUDGE		
Current sludge disposal is 270 T per day (was 120 T per day), projected to rise to 400T		
POWER / BIOGAS GENERATION		
Current peak power requirement is 18MW		
Biogas produced is enough to supply nearly 1/2 this requirement.		
Assume for this analysis that the Biogas generates 9MW of power		
CARBON TRADING		
The government has indicated that the cost /tonne CO2 will be \$20		
Digester Gas is 61.5% methane and 30%carbon dioxide, density 0.67		
Methane has global warming potential of 21 times that of CO ₂ .		
Current biogas production 41,000cuM per day.		
	Per Day	Per Annum
COST		
Estimated 4600cuM thickened sludge treated @30ppm Ecozest	\$2,760	\$1,007,400
Cost of Labour	\$50	\$18,000
BENEFIT / SLUDGE REDUCTION		
Assume only 50% reduction of sludge		
@ \$45/T processing & disposal cost	\$6,075	\$2,217,375
BENEFIT / BIOGAS POWER GENERATION		
Assume 25% increase in Biogas production		
Assume \$50 per MVh power cost	\$2,700	\$985,500
BENEFIT / CARBON TRADING		
30Kt/year CO2 emission reduction @ \$20/ t	\$1,644	\$600,000
	TOTAL COST	\$2,810
	TOTAL BENEFIT	\$10,419
	NET COST (-) / BENEFIT (+)	\$7,609
Ecozest will deliver ecoefficiency benefits at a profit not cost.		
One off "hot shooting" the total volume of MLSS in the 7 anaerobic reactors will be		\$58,800
One off set up cost e.g.. dosing system allowance		\$100,000
Allowance for gradual process rate increase at start up period		\$521,500
Therefore the net benefit in 1st year		\$2,097,175
Therefore the net benefit in 1st year excluding "Carbon Trading" benefit		\$1,497,175
Ongoing net benefit		\$2,777,475
Ongoing net benefit excluding "Carbon Trading" benefit		\$2,177,475

The cost benefit analysis was done after carrying out proof of concept trials that confirmed biogas (methane) generation can be increased by 37% and sludge can be reduced by up to 50%. The increased biogas is converted to 21 times less global warming potential gas CO₂ and heat during the electricity co-generation process.

Farm Effluent Treatment

We also provide a cost benefit analysis carried out on a farm effluent treatment system (basic system). This cost benefit analysis was done after proving that sludge can be reduced and the nitrogen in the effluent can be fixed in microbial proteins (biological nutrient removal (BNR)), preventing emission of ammonia, nitrous oxide and leaching of nutrients.

Dairy Case Study Cost Analysis

2004

Pond emptied approximately 20 times per season (should be more than this according to regulations)

Each emptying takes whole day.

Fuel used 185 litres @ 58.3 cents per litre X 20 times \$2140

Tractor \$50 X 20 times including other equipment R&M and depreciation \$1000

Labour @ \$12/hr X 4 hours X 20 times \$ 960

Anaerobic pond normally would have needed 2 solids (desludging) emptying but because of use of "ecozest" only one was done in November, and the May desludging was not needed

Anaerobic pond desludging (1 X only) \$1300

TOTAL **\$5400**

Cost Saving by using "ecozest"

Reduction in hose length – at least halved
This will lead to 1/3 the energy requirement

Fuel cost \$ 700

Need less HP, shorter length of hose and less R&M

Tractor \$35 X 20 \$ 700

Reduction in area covered means shifting from one paddock to another is significantly reduced

Labour @12/hr X2 hours X 20 \$ 480

Anaerobic pond desludging – once every 5 years only \$ 260

TOTAL **\$2140**

QUANTIFIABLE COST SAVING **\$3260**

Cost of ecozest 200 cows X \$10 per cow per season **\$2000**

NET QUANTIFIABLE BENEFIT **\$1260**

Other Benefits

More land for normal grazing. – land needed for application halved.

Pathogen counts will be reduced in the effluent; more effective management of somatic cell counts in milk.

Risk of hoof rot incidence reduced.

Risk of environmental liabilities reduced, as effluent treatment system is easily manageable at reduced cost.

Reduced stock withholding period required as odour and solids content in pre-treated effluent is reduced.

Enables sustainable management practice.

Our evidence based proposal debunks the myth that transition to a lower net-emissions economy will cause economic harm, on the contrary it improves economic and environmental outcomes.

Ecozest Sludge Processing and Composting

By treating sludge with Ecozest, dewatering the sludge and composting it will mitigate the generation of methane when the sludge is dumped in landfills. Instead the waste product can be converted to valuable biofertilizer. The process is low impact (environmentally and financially), can be carried out utilising standard, low-cost infrastructure and without high costs such as methane extraction or sludge stabilization and disposal fees. The end product is a saleable by-product – high quality compost.

The process is as follows:

Standard influent clarifiers: The clarified primary sludge is treated at the rate of 30ppm with Ecozest (cost 60c per m³ of thickened sludge). The now much lower organic matter loaded supernatant is discharged into an aerobic waste water treatment system. The emission of biogas (methane) is mitigated because the primary sludge (biosolids) do not go through the anaerobic bioreactor process.

Following aerobic treatment of the supernatant the effluent is discharged into another clarifier to remove the secondary sludge (the bacterial cells from the aerobic digester). This thickened secondary sludge is also treated at the rate of 30ppm with Ecozest (cost 60c per m³ of thickened sludge.)

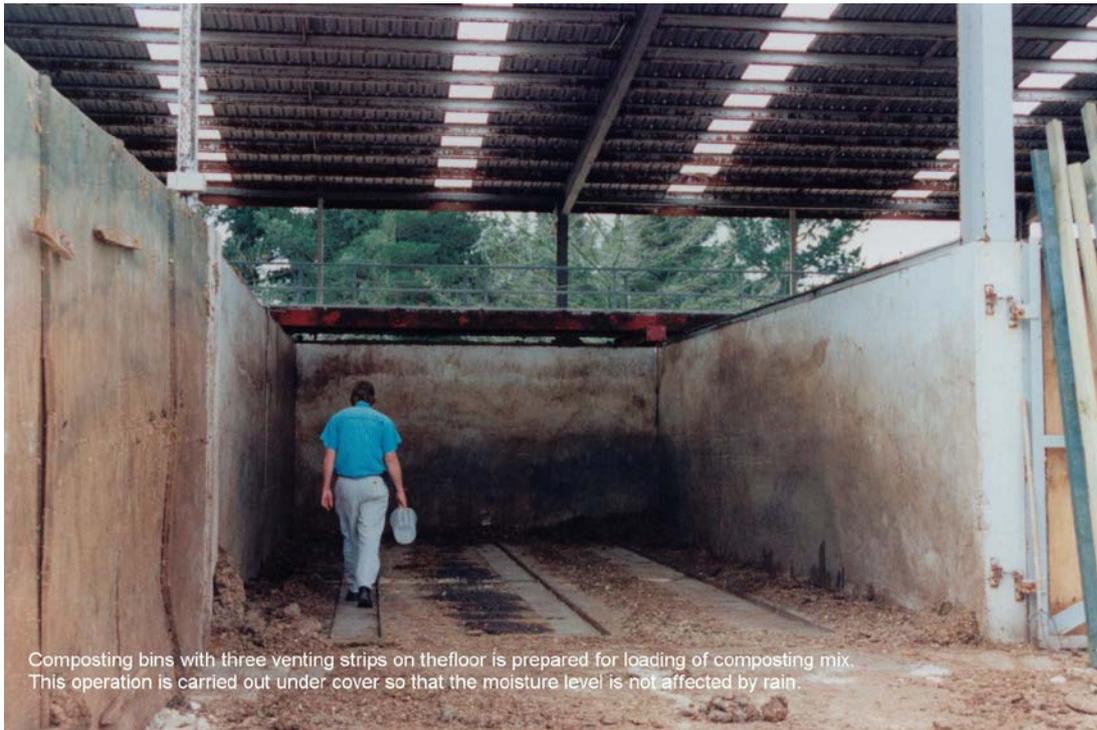
Treatment with Ecozest also mitigates odour nuisance.

The Ecozest treated primary and secondary sludge is dewatered through a standard dewatering plant



Thickened wastewater sludge treated with polymers and dewatered.

Composting bins with under floor air venting facility are required



Composting bins with three venting strips on the floor is prepared for loading of composting mix. This operation is carried out under cover so that the moisture level is not affected by rain.

The thickened sludge is mixed with shredded green waste and the composting bins are filled.



Composting bin filled with freshly mixed dewatered wastewater sludge, ecoZest and green waste.

The compressor for aeration is connected and is ready to be automatically switched on.

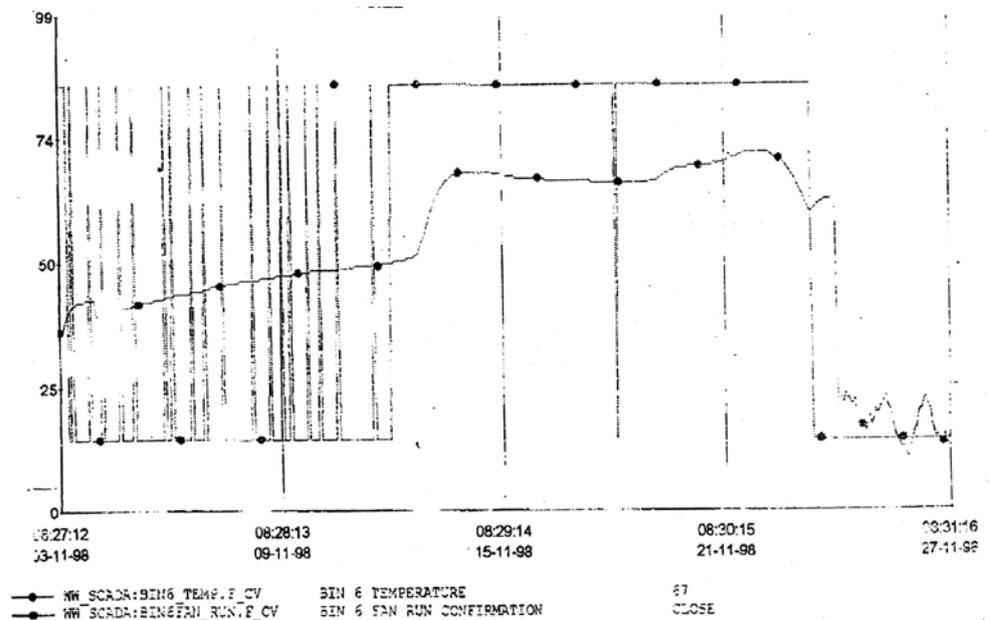


Three to five days after the bin had been filled and the temperature has risen to over 45 degree centigrate the aerator is switched on.

Dewatered Sludge Composting Data

The following information is from a trial carried out at the Rotorua Waste Water Treatment plant in November 1998.

The temperature and air compressor operating pattern was recorded electronically. The compressor switched off automatically if the temperature fell below 50 °C.



The Ecozest treated bin showed a gradual temperature rise in the mesophilic stage. The temperature rose to the thermophilic level and the compressor was run continuously. The thermophilic temperature held around 67 °C over the 3 weeks period. It fell at the end of the composting period

indicating stable compost has been achieved and the organic matter has turned to humus. No cold spots were found in the bin. Oxidation of organic matter produces no objectionable odour.

The high thermophilic temperatures will destroy pathogenic bacteria, protozoa and some weed seeds. Aerobic composting therefore has a “double whammy” effect in destroying pathogenic bacteria. Firstly by the high temperature and later through the induced growth of actinomycetes and their production of antibiotics. The aerobic composting system does not generate methane.

When this compost process was applied in a fertilizer composting plant the resulting compost was tested (applying food standards) for pathogens. The tests confirmed that the proposed composting process can result in a pathogen safe product.

So, not only is the cost of landfill disposal avoided, the sludge is transformed into a saleable product (compost currently sells over \$ 70/M³).



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Attention: Clive Sinclair

Job Number:	05NR015588
Client Code:	PACBIOFERT
Submission Number:	53567
Order Number:	Not Given
Date Despatched:	25/05/2005
Date Received:	25/05/2005
Temp On Arrival (°C):	N/A

Results

Report Number: 328062

Laboratory No	05N029999	05N030000	05N030001	05N030017
Product Type	Fertiliser Composite	Fertiliser Composite	Fertiliser Composite	Fertiliser Composite
Client Sample ID	Bin 1 Air On	Bin 3 Air On	Bin 4 Air On	Bin 2 Air On
Sample Description	25/05/05	25/05/05	25/05/05	25/05/05
Cypher / Date				
Clostridium perfringens* Unit: cfu/g APHA 4th Ed.Ch.34	<10	<10	<10	<10
E.coli Count, Petrifilm Unit: cfu/g MIMM Edition 4; 8.4	90	<10	<10	100
Listeria Detection/125g* Unit: /125g FDA BAM 8th Ed 1998 (mod)	ABS	ABS	ABS	ABS
Salmonella/125g* Unit: /125g ISO 6579:2002(E)	Absent	Absent	Absent	Absent

Authorised By: Kate Fletcher B.Sc.
Team Leader - Microbiology

Signature:

Authorised By: Mohammed Marza B.Sc.
Team Leader Pathogens

Signature:

Authorised By: Mohammed Marza B.Sc.
Team Leader Pathogen

Signature:

- Indicates Not Required.

* Indicates IANZ Accredited Test.

The tests were performed on the samples as received, as they were not drawn by Gribbles Analytical Laboratories staff.
All samples received in good condition unless otherwise noted.
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Reported: Wednesday, 01 June 2005

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Community-based Wastewater Treatment: Methane Mitigation Technology

Supported by the trials and data presented above, we propose an opportunity to move away from centralised wastewater treatment plants which often have frequent failures and nuisance issues to community-based wastewater treatment.

We propose a low cost effluent treatment system that will mitigate generation of greenhouse gases (methane and nitrous oxide) and enhance BNR (biological nutrient removal) and reduction of biological oxidation demand (BOD) resulting in discharge of higher quality effluent suitable for irrigating parks, reserves, crops and plantations. The system is climate adaptation design and has a small environmental footprint.

With the addition of Ecozest to the treatment process wastewater and sludge can be composted faster and to a higher standard without significant environmental impact or nuisance (odour). Because Ecozest enables the treatment of both wastewater and sludge (producing a high quality final effluent and compost), without complex or costly engineering, wastewater treatment plants can operate without massive infrastructure investments currently required for both wastewater treatment and biogas (methane) extraction.

Wastewater treatment becomes more economical at a smaller scale and can be carried out closer to individual communities/within the same catchment. This will substantially reduce both the cost and environmental impact of infrastructure manufacturing and installation as well as the impact of the operation and maintenance of wastewater treatment plants.

Benefits

The proposed system allows communities to avoid the high costs of conventional sewerage systems, meet health and environmental goals and costs more effectively. The system is cheaper, cleaner, more reliable and proven.

The benefits include

- Closer matching of capacity growth to the demand curve through incremental implementation of smaller units. "Build -as -you-need, pay-as-you-go" ties up less capital, reduces forecasting risk, and creates "option value" by allowing future changes in technology, management and service strategy not possible with large scale systems.
- Avoid diseconomies of larger collection systems due to a smaller environmental footprint, increased pipe size and length and increased need for pumping stations as service area expands.
- Targeting of treatment upgrades to smaller, problematic units within a watershed
- Greater control over the waste stream, and thereby increased biosolids and effluent usability and value.
- Localised water reuse, which reduces or avoids water purchases or ground water pumping and may increase property values in water short areas.
- Reduced externalities centralised systems may impose on local economies and residents; for example business down time and automotive wear caused by tearing up streets, parks, and other areas for installation or repair of sewers.
- Reduced pressure on growth due to extensions of sewers, the integration of decentralised options with "smart growth" planning; i.e. using advanced on site and cluster treatment to direct growth away from prime habitat and farmland to areas with less natural resource value that may not support conventional septic systems or otherwise have high sewerage costs (e.g. rocky areas/coastal areas).

- Increased groundwater recharge and stream/wetland base flow through reduced interbasin transfer of water. Such transfers occur in large systems where collection systems transport end-use water and inflow/infiltration water to treatment facilities outside the basin of origin.

Further Opportunities

Pesticide and heavy metal bioremediation

Based on a laboratory test of the activity of Ecozest treated bioremediation bacteria on PCB's (<http://www.indigobiotech.com/ecozest.html>) and the above commercial composting results, Ecozest treatment of wastewater sludge composts could be an economic and feasible bioremediation technique for pesticides and heavy metals found in water sludge.

Biofertilisers

We have also proven that biofertilizers can be produced by composting phosphate rock and other minerals. The biofertilizers are more effective than chemical fertilizers.

Conclusion.

We have the technology to address emissions from waste water treatment plants.

Ecozest can be seamlessly integrated into New Zealand's existing effluent treatment systems to transition to a lower net-emissions economy.

By increasing bioprocess efficiency net economic and environmental gains are realised. Ecozest also enables the design of an innovative wastewater treatment system that mitigates the production of methane during the wastewater treatment process.

Transitioning to a lower net-emissions economy can increase productivity and will have wide reaching, positive economic repercussions and environmental outcomes.

Transitioning to a lower net-emissions economy will not have a negative economic impact.

We now need clear pathway for collaboration and implementation of emissions reduction technologies so that New Zealand can immediately benefit both environmentally and economically.