



Climate Change – The Heat is On? Edinburgh June 2008

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Energy Sources and Usage

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Introduction

Dairies are both sources of and users of energy

Manure to energy possibilities

Advanced energy production technologies

Conservation

Efficiency

California Demographics

Opportunities in the Carbon Marketplace

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Manure to Energy

Dairy cows are efficient recyclers
converting roughages and by-products to
human consumables

They also produce abundant manure

Manure can be a source of energy

Not a new idea

Burned for heat

Digested for gas

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Manure to Energy

Anaerobic digestion/co-digestion to produce
Methane

Electricity generation

Hot water production

Clean biomethane injection

Compressed and used as vehicle fuel

Direct raw gas use – further treatment

Nutrients and salts remain in effluent

Europe the recognized technological leader



Manure to Energy

Thermal Conversion

Direct or co-combustion to produce heat

Pyrolysis - produce oil or low Btu gas

Gasification - produce low to medium Btu gas

Hydrothermal liquefaction - produce oil and char for combustion

Potential for air emissions

Residuals disposal can be an issue

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Other Energy Sources

Solar

Photovoltaic

Passive – building design

Water heating

Geographic Resources

Wind

Hydrologic

Geothermal

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On –Farm Roadblocks

Capital cost is a primary problem

California digesters >\$1,000 per cow

Advanced technologies even more expensive
& unproven with manure

Returns are relatively low

Management priorities are elsewhere

California dairy energy costs = 2%

Feed costs = 52 - 61%

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Regulatory Roadblocks

Air and water regulations may impede development

Manure pond construction standards

Permitting difficulties

May increase or interfere with control of other important pollutants

NOx from generator IC engine operation

Sulfur content of biogas

Additional salt import from co-digestion

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Energy Usage

On-farm energy audits

Quantify energy needed by each end use

Comparative evaluations

Utility providers may assist

Workshops & Seminars

Dairy Farm Energy Management Guide

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Energy Usage

Conservation

Energy efficient equipment

VFD vacuum & irrigation pumps

Low energy use fans

Building design

Regular equipment maintenance

Utilities also a resource for conservation

Irrigation pump efficiency testing

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CA Central Valley Dairies

1460 dairies (2.5 million total head, 1.4 million milking)

25-30 new dairies proposed

30-40 Expansions/Modifications
Sizes: 2000 – 14,000 head

Historical annual growth rate 3%

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Western United Dairymen

Trade Association of 1100 dairy families

Milk pricing

Legislative advocacy

Regulatory policy

Manure to energy projects

California Dairy Power Production Program

Methane to vehicle fuel project

Manure technology assessment

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Carbon Marketplace Opportunity

Interest is growing in California

Learning from European leadership

Dairy farmers are innovative

New technologies on the horizon

Challenges become Opportunities

Regulatory mandates must be avoided to preserve reduction credits

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