Case Studies of Successful Waste to Energy Projects - Keys to Viability

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Residues to Revenues
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- Burnable waste resources in New Zealand
- WtE project economics and challenges - Value added through project partnering
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- Where to from here?
Our residues to revenue story

- Winstone Pulp International
  - 12MWth Wood-waste fuelled heat plant
- DEC
  - 30MWth Coal fuelled district heating scheme
- Blue Mountain Lumber
  - 10 MWth and 1.4MWe Wood residue fuelled cogen plant
- Silver Fern Farms
  - 8.5MWth Waste fuelled heat plant

Profile for EFI

- Energy and utility services to industrial or institutional counterparties
- Normally long-term partnerships under Build, Own and Operate (BOO) arrangements
- EFI is part of Meridian Energy Limited
- Invested in excess of $35 million since 2000, with focus on process waste to energy and co-generation.
- Our ADHB and WPI projects have both been recognised with EECA EnergyWise awards
- For further information see our website: www.energyforindustry.co.nz.
NZ Residues and Markets

- NZ reportable has potential to use more than 5Mt per annum of process waste and residues.
- Currently, use of these residues for energy is largely contained to within the forest process industries – accounts for more than 30% of their energy needs.
- EFI utilise only 100,000 tonnes per annum of process waste and residues, so our scope for further growth in bioenergy remains high.
- In the last 10 years the base economics of WtE projects has been poor but fundamental changes are occurring:
  - Base economics are improving as other fuel costs rise
  - Value from environmental and risk management can be monetised
  - Site specific issues can improve viability
  - Attitudinal changes are happening – environmental responsibility
- Co-firing with coals is an emerging opportunity we are pursuing in our South Island markets.

Some Key Success Factors

- Customers are looking for a solution
  - There is a problem that needs fixing – usually environmental
  - The customer wants to spend as little as possible fixing this problem, and
  - The investment and development risks are found to be manageable
- Fuel supplies can be sourced reliably, are consistent in quality and are affordable over the long term.
- The projects investment economics can carry the appropriate levels of plant operating support, fuels management capability and contractor performance.
- Plant owner and customer see eye to eye – usually only a narrow window of opportunity to change approach – often when something else is also being done.
Potential value of long term partnering

- **Lower cost** lower life cycle cost – rather than being determined by asset cost mentality.

- **Greater financial certainty** through the transfer of risks; asset development, performance, on-going operation, future asset obsolescence and external market costs.

- **Innovation and efficiency** through a focus on service delivery and outputs rather than asset procurement and inputs.

- **Sharing capacity** asset utilisation, expertise, experience and support services required to operate a portfolio.

- **Earlier delivery of benefits** discretionary projects funded where it would not otherwise budget.

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Case study1: WPI Karioi Pulpmill

- Based at the Karioi Mill site, Central North Island
- Chemi-mechanical pulp for niche export markets
- Energy requirements include:
  - 25 to 35MW of electricity, predominantly for pulp grinding
  - 8 to 12MW of heat predominately for pulp drying.
- In 2003 WPI and EFI initiated a 15 year partnership covering:
  - Supply of electricity from the grid
  - Heat from a new 12MW thermal fluid heater, sludge dewatering and drying system and fuel blending to replace a smaller obsolete unit
- Balance of process heat is from LPG.
- Recently completed an additional $3.5m heat recovery project to further reduce LPG usage.
WPI Karioi - EFI heat plant

Combustion system:
- vibrating water cooled grate with preheated primary combustion air
- flue gas recirculation system to limit radiant heat flux and control slagging on heat transfer surfaces

Outcomes:
- can burn very wet bio fuels with up to 62% w/w moisture content (wet basis)
- containing up to 40% w/w pulp sludges.
- Reduced energy supply costs – LPG use reduced by ~ 4m litres/y
- Reduced landfill – by ~ 6,000t/y
- Reduced GHG emissions – estimated by ~ 30,000t CO2e/y.

WPI Karioi – fuel management

- Rocks
- Sawdust
- Post peelings
- And a truck diff!
WPI Karioi – operating challenges

- Fuel ash abrasion – extreme wear
- Para-screw fatigue failures resolved with attention to detail
- Sludge dewatering performance – practical considerations outweigh technical capability
- Heat supply and demand interaction – understand/control the effects on each
- Operator acceptance and support

Case study 2: SFF Finegand meat works

- Based at the Finegand meat processing site at Balclutha
- 5 chains processing beef and sheep meat
- BAU situation was:
  - Steam from coal fired boilers
  - WWTP sludge dewatered and composted
- WWTP upgrade resulted in 15,000t/y sludge disposal problem
- Expanded composting requires space, wood residue, has odour issues – and produces a low value product
- EFI developed an alternative solution - a 8.5MW BFB boiler with full baghouse
- In 2006 SFF and EFI initiated a 15 year partnership covering a BFB boiler.
Finegand - EFI BFB boiler plant

Combustion system:
- Bubbling fluidised bed with preheated combustion air
- Flue gas recirculation system for bed temperature control
- Full baghouse

Outcomes
- Generate 35,000t/y steam
- Displacing 6,000t/y Kai-point coal
- Reducing GHG emissions by 10,000t/y CO₂
- Reducing site’s particulate and sulphur emissions
- First NZ reference site for technology

Bubbling fluidised bed boilers

- Suitable for wet and/or high ash fuels
- Burn fuels in an air-suspended bed of hot sand particles
- Thermal mass of sand bed gives stable combustion
- Bed drainage to remove clinkers and ash contaminants
- Can be used to reduce SO₂ and NOx
Finegand - modular design

Finegand - experience to date

- Sand quality - critical to bed management and weekly restarts
- Sludge handling – keep it warm otherwise it can turn into solid lumps
- Operator learning curve - slowed commissioning and operating procedures changing as experience grows
- Fuel delivery house keeping – to avoid wind blown contamination
Finegand - outcomes

- High level of sludge dewatering achieved and proven to be an excellent fuel
- Generate 35,000t/y steam
- Displacing 6,000t/y Kai-point coal
- Reducing GHG emissions by 10,000t/y CO₂
- Reducing site’s particulate and sulphur emissions
- First NZ reference site for small scale BFB technology
- EECA award this year; winner in Innovation and highly commended in Renewable Energy categories

Current bio-energy gaps...

- Current market needs in process waste/residues are:
  - Better options for customers – less complicated and more certainty
  - Reliable supply of forest and other residues
  - Long term supply cost agreements for residues
  - Carbon/ETS regime agreed – carbon costs need to be in the market
  - Technology solutions for more difficult bio-fuels
Filling the Gaps - Residues ++

- Process wastes and slurges
- discharged in waste water or separated, dewatered and landfilled
- with appropriate pre-treatment can be used as a bio fuel.

- Energy trees and crops with relatively low moisture content (9 – 15%) and a good CV (17–18 GJ/tonne wet).
- applying European technology and forestry practices
- NZ economics are gradually improving and technology transfer is underway.

Processing residues: Bark, sawdust, shavings and sawmill offcuts
- Forest residues
- waste log butts, thinnings
- residues left scattered in the forest

Outlook for bioenergy

- Not easy but becoming commercially viable
- Understand your fuel/s
- Use proven technology with reference sites
- Don’t try to do it on the cheap
- If in doubt, get a specialist partner