# Implementation Issues in the First 10 Years of a Co-Generation Project - From Idea to Operation

2011 ISSCT Workshop

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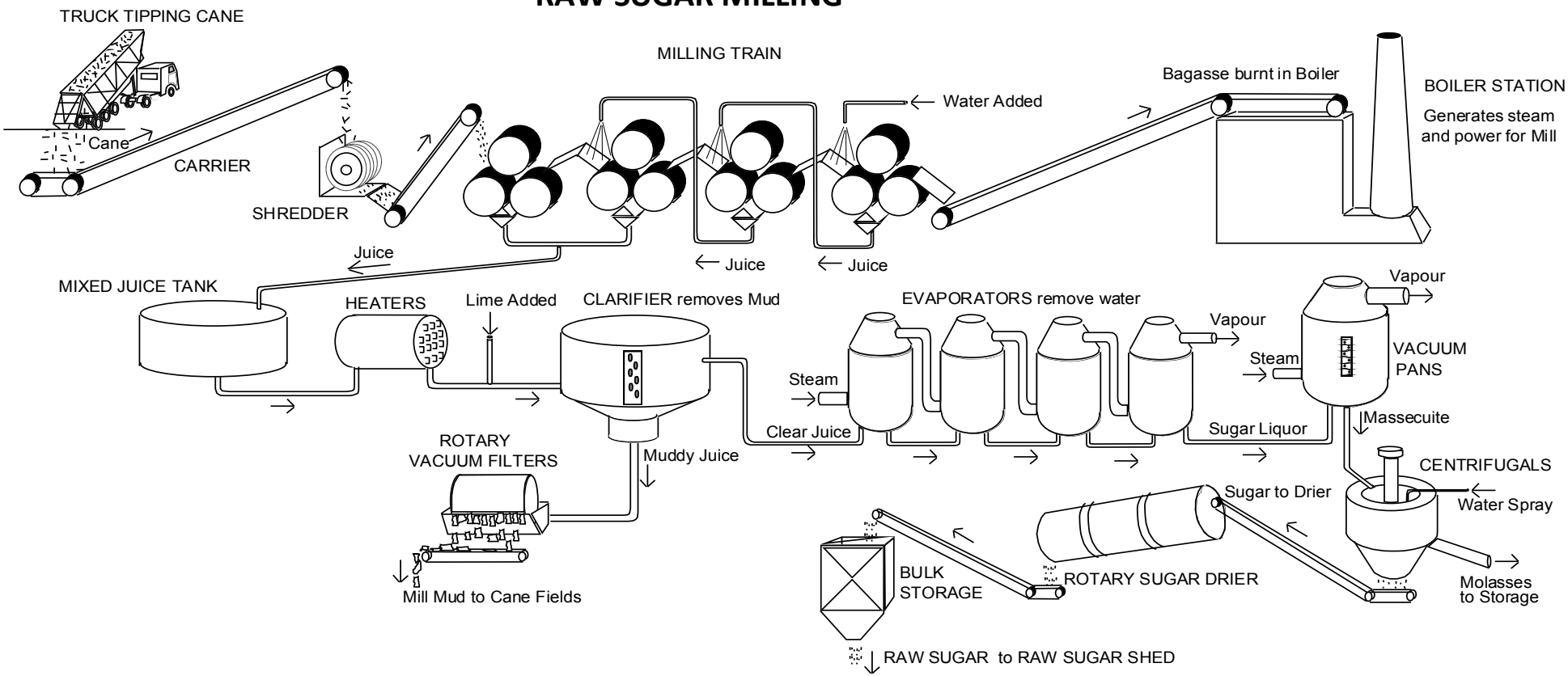
# Implementation Issues in the First 10 Years of a Co-Generation Project - From Idea to Operation

## Overview

- Background Information
- Project Details
- Project History
- Lessons Learnt

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# RAW SUGAR MILLING



# Existing Infrastructure

- 3 Large industrial Sites, Condong, Broadwater and Harwood Sugar Mills
- At 2 sites - very old boilers
- Will focus mainly on the issues associated with the project development at one site - Broadwater

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# Broadwater Boiler Plant

| Number of boilers | Date of manu-facture | Type | Steam conditions | Approx max steam output |
|---|---|---|---|---|
| 1 | 1965 | 12,000 sq ft Beta (JTA) suspension-fired with pinhole grate (since 1988) | 1750 kPag and 280 C | 70 t/h |
| 1 | 1995 | ABB – VU - 40 Two Drum, natural circulation water tube boiler C/W integral water cooled furnace, air heater and flue gas scrubber. | 4500 kPag and 450 C | 50 t/h |

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# Broadwater Boiler Limitations

- High maintenance costs with JTA boiler
- Need for increased capacity to accommodate a forecast increase in crushing rate and cane crop
- Unsustainably high wear rate around the gas pass baffles in the Thompson Beta boiler

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# Condong Boiler Plant

| Number of boilers | Date of manu-facture | Type | Steam conditions | Approx max steam output |
|---|---|---|---|---|
| 2 | 1960 | Fire-tube (Sargeants) with pyramid grate | 1050 kPag (saturated) | 2 x 5 t/h |
| 3 | 1925 | Fire-tube (Thompson Castlemaine) with pyramid grate | 560 kPag (saturated) | 3 x 4 t/h |
| 1 | 1951 | Fire-tube (Babcock & Wilcox) with pyramid grate | 560 kPag (saturated) | 4 t/h |
| 2 | 1912 | Water-tube (Stirling) with CSR stepped louvre, rocking grate | 1050 kPag (saturated) | 2 x 7 t/h |
| 1 | 1965 | 12,000 sq ft Beta (JTA) – suspension fired with pinhole grate since 1988 | 1750 kPag and 280 C | 60 t/h |

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# Condong Boiler Limitations

- Need to replace obsolete boilers at Condong
- Stack emissions
- Low thermal efficiency
- High maintenance costs
- 8 of 9 were very small with basic grates – intolerant of poor fuel
- High operational labour costs
- Occupational health and safety hazards
- Limited bagasse storage capacity
- Unsuitable steam conditions (for high efficiency generation)

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# Other Issues

- Need to Reduce and ultimately eliminate Field Burning of Cane
- Need for renewable forms of energy in response to global warming

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# Opportunities

- Various responses to national greenhouse gas reduction targets:
  - Greenpower – SEDA (NSW Govt.) initiative – since 1997
  - Mandated Renewable Energy Target
  - Greenhouse Gas Reduction NSW Retailer Benchmarks
- Biomass - a relatively cheap energy source
- Proven Technology (Bagasse Fired Boilers)
- Existing Infrastructure
- Solution to Boiler & Field Burning Issues
- Diversification - Industry Security

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# Broadwater Mill Project

- 200 GWh PA.
- New boiler (high pressure and temperature) .
- 30 MW Extraction Condensing Turbine/ Generator.
- New Stack (60 m high)
- New Fuel Storage System / Area
- Similar Plant to be installed at a 2nd site (Condong) concurrently

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# Broadwater Mill Project (cont)

- Fuel Handling System includes large stockpile area
- 90 % Cane Based Fuel
- 10 % Other Biomass Fuel
- All fuels to qualify as renewable energy sources under relevant (Federal and State) Legislation
- Adoption of Green Cane Harvest and collection of all cane stalk and leaf matter

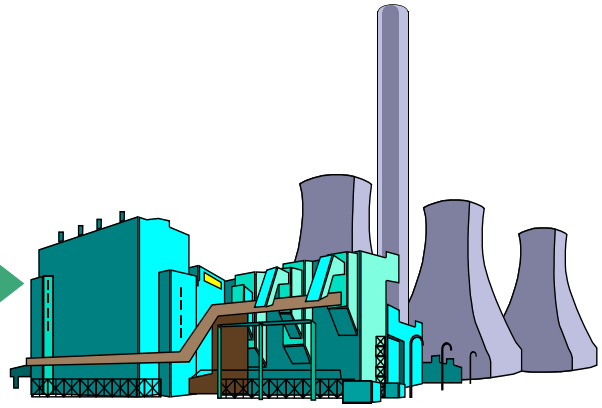
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# Carbon Cycle



Growing Sugar Cane absorbs Carbon Dioxide from the Air

Crop Residue



Power Plant

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# Project history

- Preliminary work 1993 – 1996
- Internal Feasibility Study – 1998
- Joint Feasibility Study with Delta Electricity (by Burns & Roe Worley)- Jul 1999
- Initial Tendering Process - Apr 2000
- Condong development consent - Dec 2000
- Finalisation of Joint Venture Agreement - Sept 2001
- Broadwater initial development consent - Dec 2002
- Broadwater final development consent - Nov 2003
- Re-Tender subject to DC conditions
- Financial close - May 2005
- First synchronisation: Cdg - Dec 2007, Bwr - Feb 2008
- Practical Completion: Cdg - Oct 2008, Bwr - Nov 2008

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# Feasibility Studies

- Initial feasibility study carried out by NSW Sugar Milling
- Second feasibility study – carried out in conjunction with future JV partner
- Budget proposal for Design and Construction of a power station at Broadwater

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# Tender Specification

- Performance based specification.
- Specified fuel data
- Specified required generation capacity & steam required by mill
- Tenderer to optimise plant configuration

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# Project Objectives

- Low Capital Cost
- High Efficiency
- Low environmental Impact
- Minimal Disruption to sugar mill operations
- Flexible operation – Fuel and Load
- 25 yr design life
- Low O&M Cost

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# Evaluation Criteria

- Statutory Compliance
- Compliance with the project objectives
- Whole of life financial performance based on Capital Cost and Guaranteed Performance levels.

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# Initial Tendering Process -2000

- Expressions of interest from 23 companies
- 10 companies were invited to tender
- Only Three final bids received
- Preferred tenderer (initially) decided 06 / 2001

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# Environmental Studies, eg BWR (2001-2002)

- Air Quality Impact
- Receiving Waters Impact
- Thermal Impact
- Aquatic Ecology Impact
- Groundwater Impact
- Noise Impact
- Flora and Fauna Assessment
- Archaeological Survey and Assessment
- Social and Economic Assessment
- Traffic Impact
- Preliminary Hazard Assessment

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# Development Application Process

- Submitted to the local council 2 / 2002
- Development Approval granted 12 / 2002
- Challenged in the Land and Environment Court – Case Heard 10 / 2003

- Final Development Approval granted 11 / 2003

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# Re-tendering

- Delays resulted in tender validity expiring
- Tenders recalled 10 / 2003
- 3 Tenderers
- Preferred tenderer announced 04 / 2004
- Project cost considerably higher than previous tender, due to prevailing construction market conditions

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# Contract Consolidation

- Financial Due diligence
- Finalising commercial conditions
- Value engineering process with contractor
- Development of final EPC contract

- Lenders input into EPC contract
- EPC Contract signed 5 / 2005

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# “Internal” Agreements

- Joint Venture
- Power purchase
- Energy transfer
- Asset management
- Operations and maintenance (O&M)
- Site leases
- Site capital works

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# “External” Agreements

- Finance agreements
- EPC (Engineering, Procurement, Construction) contract with DES/CBH consortium
- Condong water supply – treated effluent
- Condong switching station
- Property / airspace / riverbank / water leases
- Network Connection agreements
- Independent Technical Expert (SKM)
- Project manager / contract superintendent (Carsons – now Coffey Projects)

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# Finance

- Consortium of banks
  - CBA
  - ABN AMRO
  - Royal Bank of Scotland
- Non recourse project financed
- Total construction cost about $170M (Two turnkey plants) excluding development and finance costs.

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# Scope of Work – EPC Contract

- Boiler and its associated auxiliary plant
- Steam turbine generator and its auxiliary plant
- Fuel handling plant
- Water treatment plant
- Civil works including roads
- Electrical installations including 415 V, 3.3 kV and 11 kV systems, 11/66 kV transformer
- Control system.

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# Fuel Supply

- Predominantly bagasse - derived from harvesting and milling (almost) “whole” green cane
- Supplementary wood fuels - sawmill residues and camphor laurel
- Quantity of fuel is adequate
- Several technical & commercial issues
- Full resolution of all issues remains a work in progress

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# National Electricity Rules

- Automatic access requirements – Rules written around base load power plants.

- Small power plants are unable to meet all the automatic access requirements of the NEM.

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# National Electricity Rules

- Negotiated Access

- Need for stability studies and expert advice
- Outcome becomes part of Network Connection Agreement with local distribution company – Country Energy

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# Lessons – 1998 - 2008

- Long Timeline
- Core business concerns can change greatly over this timeline – (fluctuations in sugar price)
- Legislation changes throughout timeline – (Changes to renewable energy legislation) – (Initial model based on a sunset clause for eligibility for REC's)

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# Lessons

- Choose your partner carefully – NSWSMC & Delta
- Dedicate staff to the project and have them allocated consistently through different stages of the project
- Need for detailed environmental impact assessments and ongoing consultation with all stakeholders.
- Timing – eg: development approval before contract tendering, earlier involvement of lenders
- High overheads associated with project finance

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# Current Status

- Joint Venture currently managed by a receiver.
- Primary problem due to lower than forecast REC (Renewable Energy Certificate – Green Energy) prices
- Small crops due to seasonal conditions has also contributed

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