AIR EMISSIONS FROM A TAYMAC BOILER

TRIALING WOODCHIP AT SOUTHERN INSTITUTE OF TECHNOLOGY

INTRODUCTION

SPEAKERS

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- About SIT
- What are the drivers for trailing woodchip
- Methodology
- Results
- Lessons learnt
- Emissions from other boilers

ABOUT....

Courses

5 Campuses + distant learning
218 Courses
33 Subjects

Zero fees

Launched in the late 1990s, SITs zero fees proposal was a radical idea to increase population, house prices and provide free education to Southlanders. By 2010, SITs economic impact was estimated at $210m.

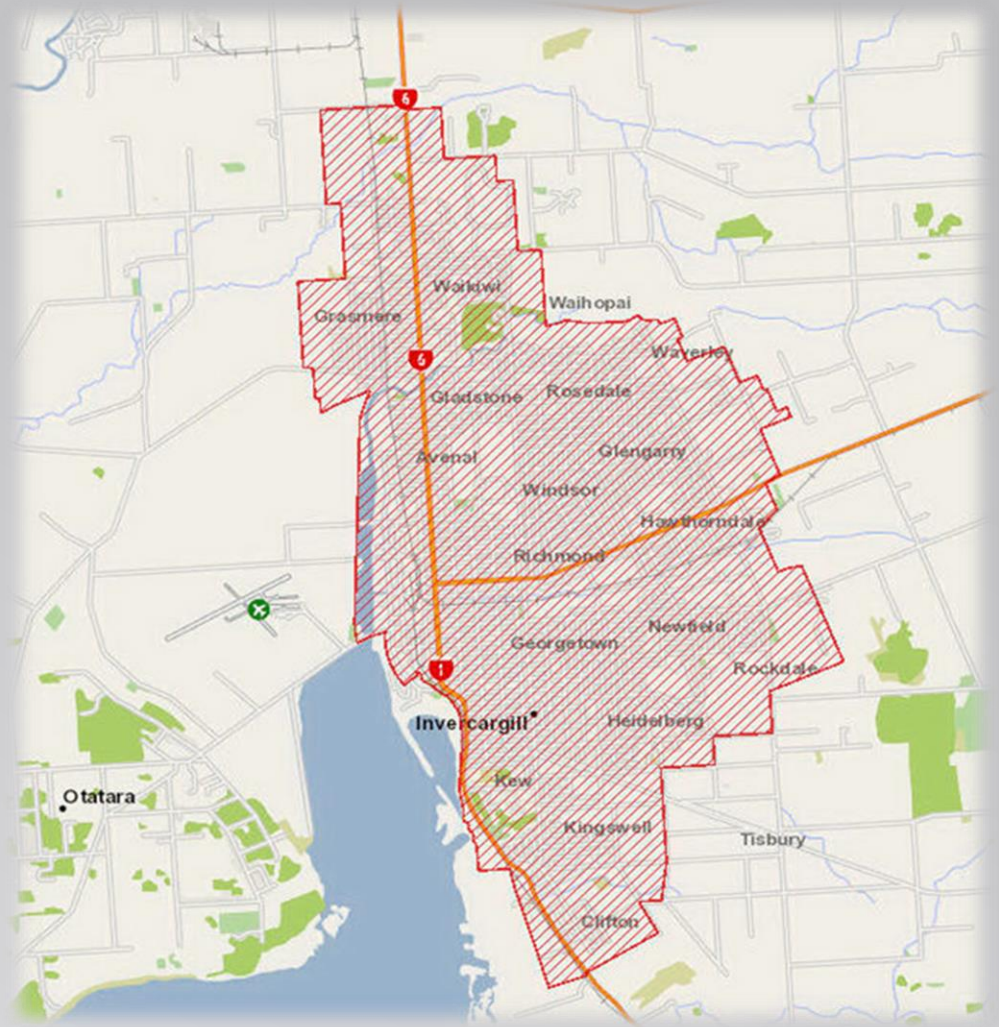
Research

SIT has a strong commitment to supporting and growing research activity. A broad range of research is carried out by staff, reflecting their areas of interests and expertise.

DRIVERS FOR A TRIAL

Key drivers

- SIT Engineering students competed a feasibility study that confirmed it was possible to switch boiler to woodchip
  - Boiler operating at 25% of capacity
  - Conclusion that the fuel feed system should be able to handle the additional requirements of woodchip
- Review of industrial air discharge regulations by Environment Southland
- Environmental leadership
- Funding support from WES



TRIAL METHODOLOGY

Main objectives

- Prove that the existing boiler is able to operate continuously and autonomously on woodchip while meeting demands for heat output
- Measure the efficiency of the boiler on woodchip and coal
- Record emissions output from the woodchip and coal system
- Provide a potential solution should Environment Southland tighten air discharge requirements in the future for SIT

TRIAL METHODOLOGY

The process

- Determine which boiler will operate on woodchip and make necessary changes to combustion.
- Arrange for delivery of woodchip into bunker
- Complete air emissions testing for coal and woodchip boiler.
- Return boiler to original coal settings
- Report results to Management

TRIAL METHODOLOGY

Safety considerations

Several safety issues were identified with the methodology:

- Auger jamming caused by woodchip size
- Burn back of wood fuel into the bunker
  - Mitigation measures
    - Fire hose onsite during trial
    - Small volume of chip in bunker
    - Burn fuel in boiler as a priority to exhaust

TRIAL METHODOLOGY

Emissions testing

- Carried out by independent auditor (Watercare Ltd)
- Two tests - three samples per test
- Conducted under similar flue gas velocity to ensure similar size particles are carried into the flue
- This allowed Watercare to extrapolate data for increased wood volumes

SIT PM10 Emissions		>PM_{10}	PM_{10}	Total (TSP)
		mg/m^3, dry, 0 °C, 1 Atm		
Test 1- Coal	1	15.7	43.8	59.5
	2	18.7	37.0	55.7
	3	23.5	90.2	113.7
	Average	**19.3**	**57.0**	**76.3**
Test 2- Wood	1	3.2	24.0	27.2
	2	3.3	21.5	24.8
	3	3.1	15.2	18.4
	Average	**3.2**	**20.2**	**23.4**

RESULTS

45-60% REDUCTION

45-60% reduction in PM10 based on 25% and 50% more woodchip being fed into boiler

$2,240 SAVINGS

There is a small savings as woodchip is slightly cheaper than coal.

425 TCO2-E

Carbon emissions reduction each year

LESSONS LEARNT

- Allocate sufficient time to tune the boiler for woodchip. Should be done prior to the testing and not on the day
- Burn-back is a real issue and occurred during this trial. This needs to be addressed when converting to woodchip
- The design of the auger needs to ensure sufficient fuel is fed to the grate

EMISSIONS FROM OTHER SYSTEMS

Sample		>PM_{10}	PM_{10}	Total	>PM_{10}	PM_{10}	Total
		mg/m^3, dry, 0 °C, 1 Atm			CO_2 Corrected concentration[1]		
Test 1- Coal	1	280	79	360	530	150	680
	2	270	78	350	510	150	660
	3	320	91	410	670	190	850
	Average	290	83	370	570	160	730
Test 2- Wood	1	3.5	100	105	3.3	96	99
	2	15	78	93	13	71	85
	3	9.9	69	79	9.0	63	72
	Average	9.3	83	92	8.5	77	85

EMISSIONS FROM OTHER SYSTEMS

		>PM_{10}	PM_{10}	Condensable	Total
		(mg/m^3, dry , 0°C, 1Atm)			
1 Invercargill	Boiler Un-scrubbed	910	420	540	1870
Vekos (Coal converted to Wood Chip)	Fresh Water Scrub	50	80	20	150
2 Vekos (Coal converted to Wood Pellet)	Boiler Un-scrubbed Converted the airflow for wood	11	55	~550	~600
3 Modern Wood specific Boiler	Boiler Un-scrubbed	54		~200	~250
4 Modern Vekos boiler	Boiler Un-scrubbed	24		>1000	>1000
5 Vekos (Coal converted to Wood Pellet)	Boiler Un-scrubbed Converted the airflow for wood Use wet and green wood	56	180	>1000	>1200
6 Vekos (Coal converted to Wood Pellet)	Boiler Un-scrubbed Use wet and green wood No conversion from coal to wood	1100		>1000	>2000
7 Vekos (Coal converted to Wood Pellet)	Above but after cyclone	500		>1000	>1500
8 Vekos (Coal converted to Wood Pellet)	Boiler with Baghouse	20		470	490
9 Wood Boiler Convertor	Electro Static Precipitator (ESP)	15		tbc	tbc

THANK YOU
QUESTIONS?