

# CSRP'08 conference

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## Production of Charcoal for Recarburisation Plant Trials



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# Aims and Objectives



- Organise recarburisation plant trials at SSM
- Produce sufficient quantity of charcoal required for at least 10 recarburising heats at OneSteel's SSM
  - About 3 tonnes
- Source wood and prepare charcoal
  - Pyrolysis
  - Drying
  - Crushing, screening and bagging
- Recarburising with renewable carbon will make only a small difference to total CO<sub>2</sub> emissions
  - Exercise in logistics, marketing and knowhow , not necessarily CO<sub>2</sub> abatement

# Recarburisation



- Addition of carbon to refined steel
  - Produce particular steel grade
- Recarburisers must have:
  - Low ash
  - Very dry
  - Low volatiles
  - High carbon content
- Traditional materials include calcined anthracite
- Charcoal is possible

# Previous work using charcoal



- Experimental work at CSIRO (2006-07) showed that:
  - Charcoal dissolved readily into molten steel
  - Carbon recovery to steel was indirectly related to volatile content
  - Alkali components in the ash can be reduced and report to the fume stream
  - High temperatures are needed to produce low volatile charcoal
- Sufficient promise to proceed to plant trials



# Corrimal Coke ovens



- Coke making from local coal since 1912
- Coke ovens (400 m<sup>3</sup>) heated from the combustion of volatile components above coal bed
- Operating temperatures of 1000 °C ideal for making low volatile charcoal

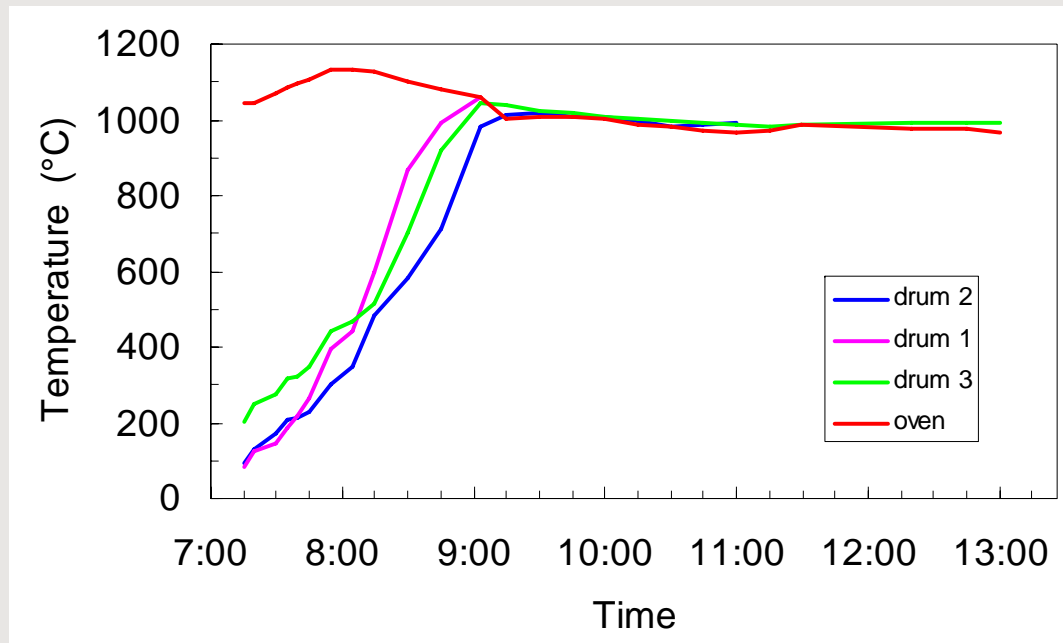


# Preliminary trial

- Aims:
  - Determine the time required to produce very low volatile charcoal from seasoned wood
- Procedure
  - Work carried out at a recently emptied coke oven
  - Wood stacked into 3 drums (200 kg) and loaded into ovens
  - Drums removed after 2, 4 and 6 hours
  - T/C's measured temperature of wood and of oven
  - Composition of charcoal determined after water quenching

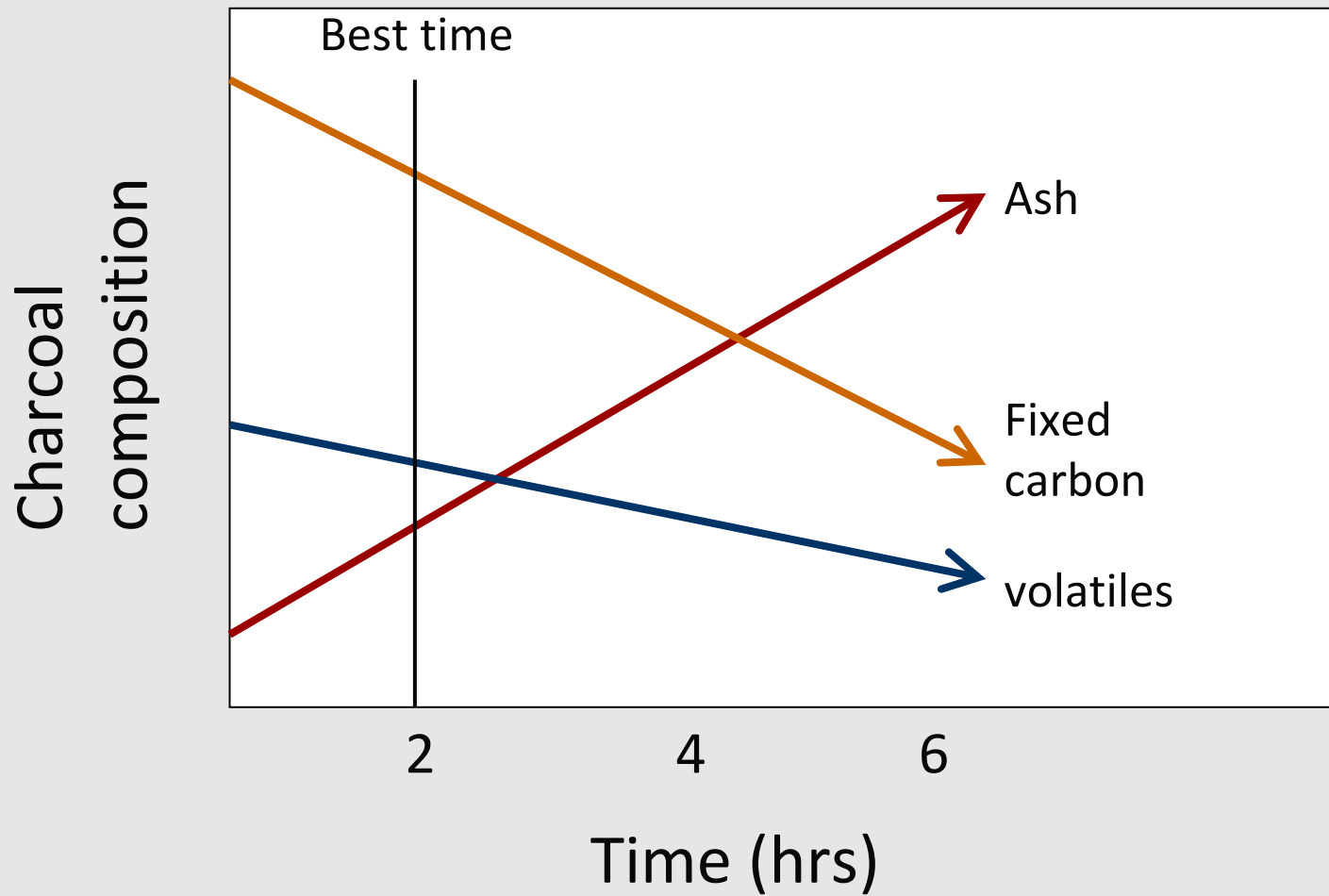


# Temperature trace



- 2 hours for wood to reach 1000 °C
- Oven temperature stayed at about 1000 °C

# Charcoal composition with time



# Conclusions from pyrolysis trial



- Two hours at 1000 °C was sufficient to produce charcoal of:
  - Low ash (1.5 %)
  - Low volatiles (0.7 %)
  - High fixed carbon (98%)
- Charcoal should be suitable for recarburisation
- Proceed with larger scale charcoal making
  - 20 tonnes of wood processed to produce 3-4 tonnes of charcoal

# Large scale charcoal making

- Aim:
  - produce sufficient low volatile charcoal for recarburising plant trials
- 20 tonnes of wood delivered in 1 tonne bundles
- Wood fed into in 5 empty coke ovens
- Measured temperature of wood during the process



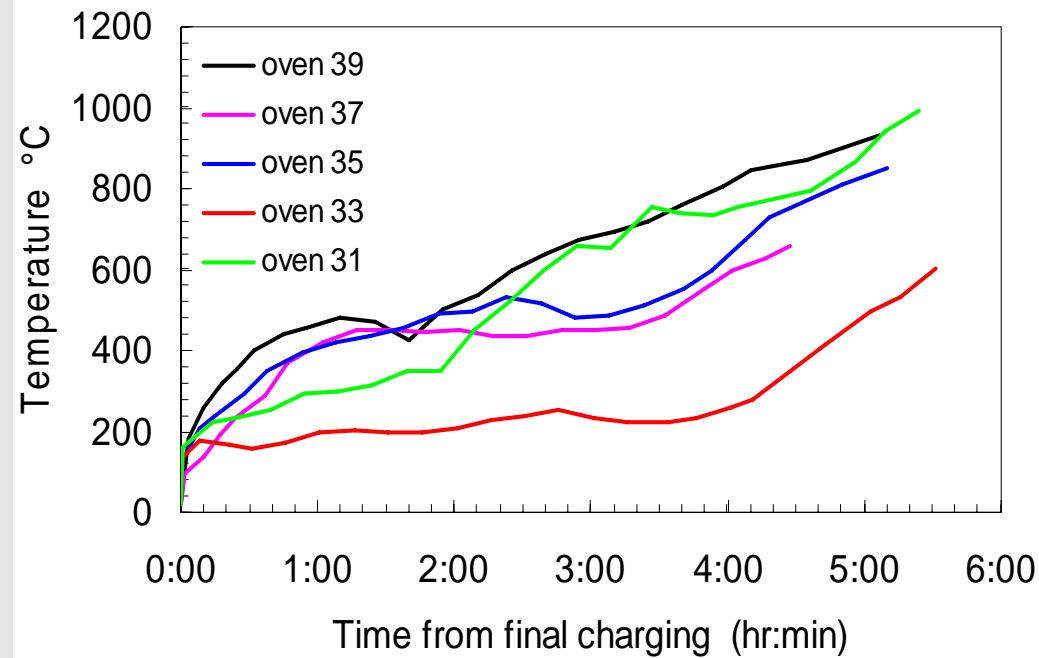
# Wood and charcoal handling

- Loading using a large fork lift
  - 4 bundles per oven



- Discharge using the coke ram into a loader bucket
- Water quenched
  - Minimise charcoal burning after exposure to air

# Wood temperature during pyrolysis



- Initial fast temperature rise
- Plateau at 200-400 °C for 3-4 hours
- Temperature reached 1000 °c after about 6 hours
  - Formation of a charcoal bed hindered heat transfer

# Charcoal product



- Volatiles: 0-0.8 %
- Ash: 0.5 - 1.6 5
- Fixed carbon: 98.3 – 99.5 %
  
- Charcoal suitable for recarburisation trials

## Further issues



- Producing a dry product , less than 1 % water
- Low density of charcoal, SG about 0.25, compared to coal SG about 1.2
- Resources and processing requirements for plant trials

# Acknowledgements



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