operational excellence

ScottishPower

energy wholesale

Practical Large Scale Co-Firing Experience at ScottishPower

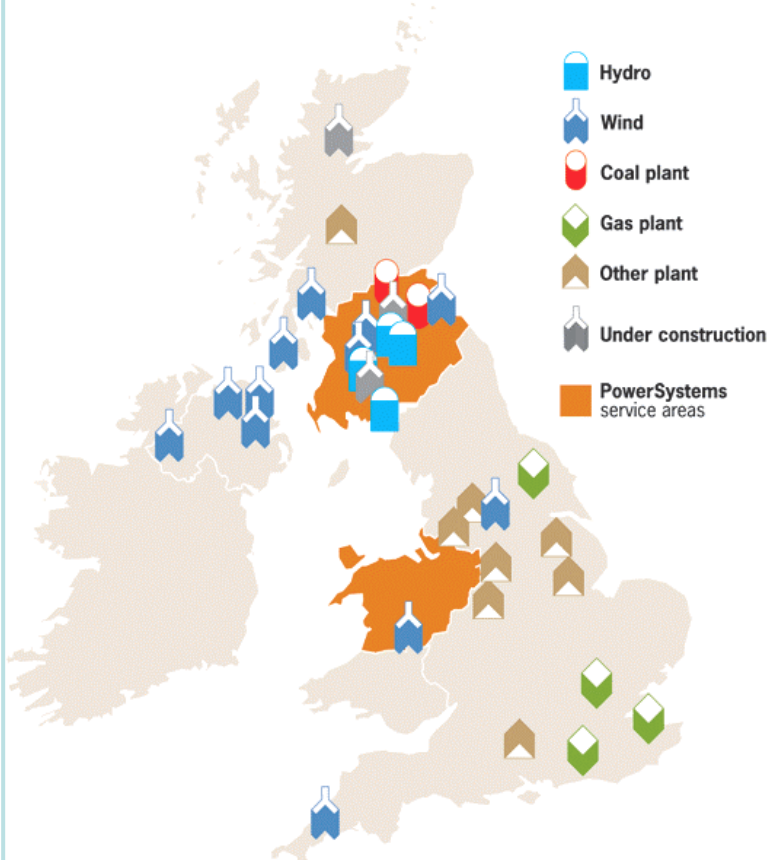
Presentation Overview

- Safety contact 

- ScottishPower in the UK
- Sewage Sludge Derived Fuel (WDF)
- Project Ariel – Biomass Co-firing
- Conclusions

ScottishPower in the UK

- 10% UK share of domestic energy market
- 5.2m customers
- Generation 6.4GW - mix of coal, gas, hydro, wind and biomass
- Leading generator of wind energy in the UK
- 3rd largest distribution company in the UK
- Investing £3bn+ in UK generation and networks in next 5 years



Generation Major Plants

LONGANNET

2304MW

4 x 576MW

Coal/Gas

Fife

230 Staff

COCKENZIE

1152MW

4 x 288MW

Coal

Edinburgh

150 Staff

RYE HOUSE

715MW

3GT + 1ST

CCGT

Hoddesdon

40 Staff

Damhead Creek

800MW

CCGT

Kent

40 Staff

Generation Major Plants

SHOREHAM

400MW

1GT/ST

CCGT

Shoreham

28 Staff

CRUACHAN

440MW

2x100MW
2x120MW

Pump Store

nr. Oban

31 Staff

HYDROS

118MW

8 Stations

Hydro

Galloway, Lanark

60 staff

WIND FARMS

315MW Operational

493MW Under construction or through planning

UK and Eire

Longannet facts & figures

Second largest coal fired power station in UK

2304MWso from 4 x 576MW Units

Commissioned in 1972

Chimney (1 shield / 4 flues)
183m high (London Eye is 135m)

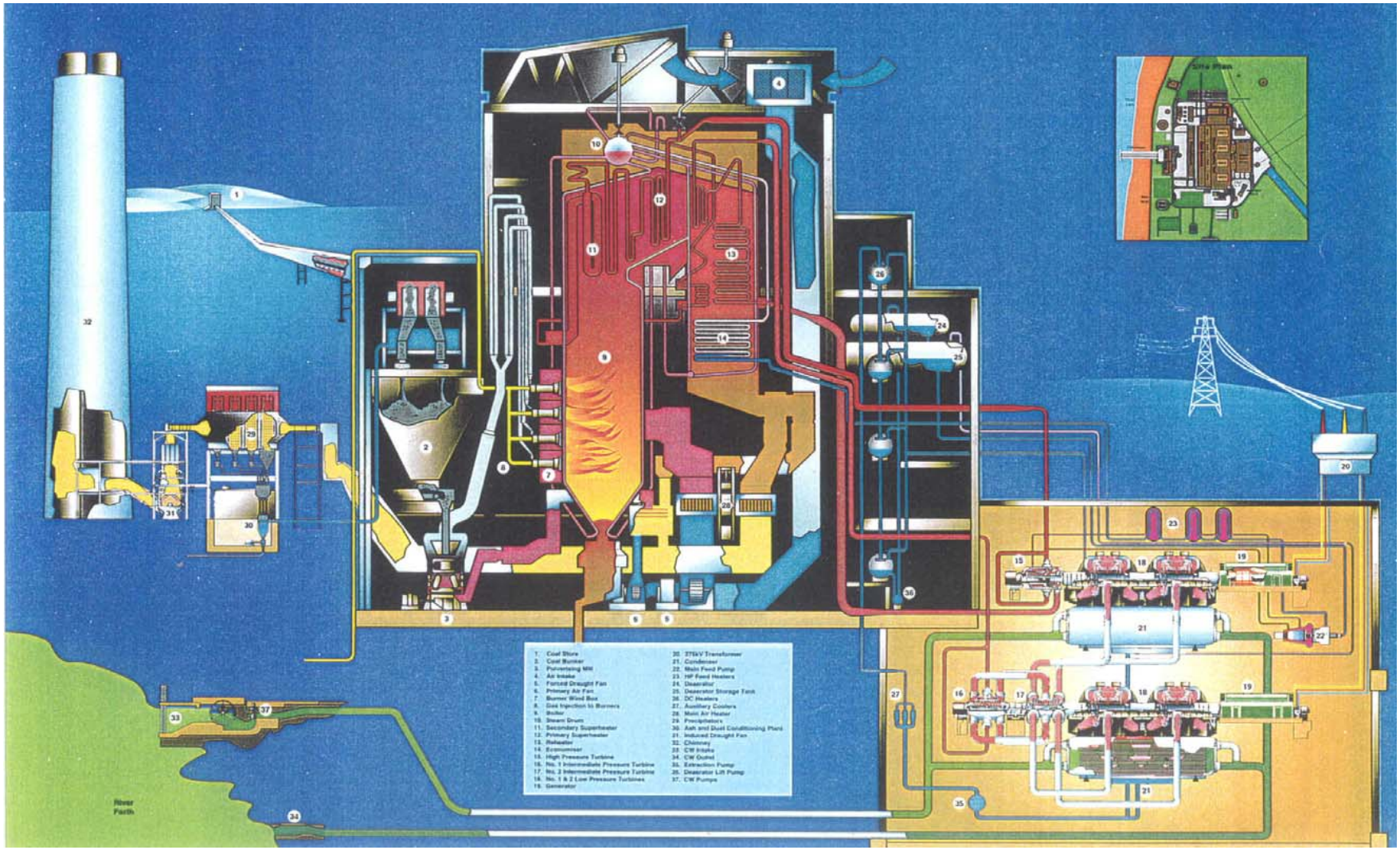
Boilers (4) 60 m high
9,000 m3 of volume (60 houses)
250 miles of pipework

Cross compound Turbines – 8 separate turbine lines, HP Steam at 167 bar, 568 degC.

Condensers use18 million gallons of Cooling Water per hour

Generators (4: 2x300MW per Unit) - 576MWso (power for 1/2m people)

Longannet layout



Longannet future plans

Longannet now Opted-in under LCPD

Major investment decision taken to fit FGD to Units 1, 2 & 3. Cost in the region of £170m

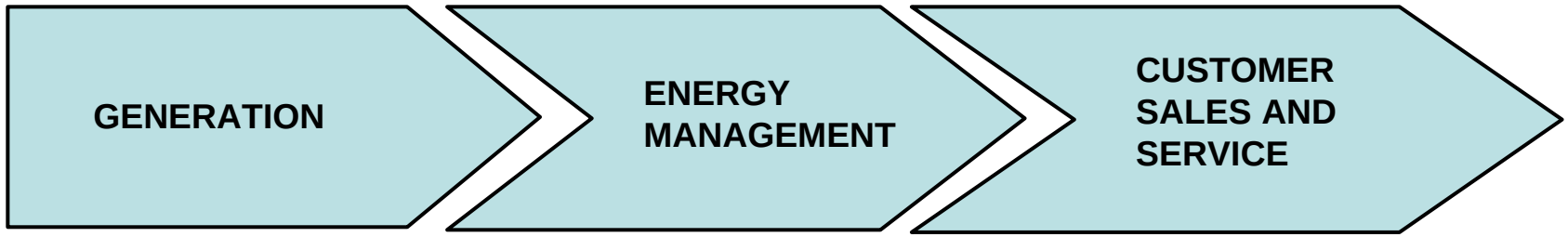
FGD to utilise sea water scrubbing rather then Limestone / Gypsum process

Provides balanced portfolio well into next decade

Increased demand for indigenous coal alongside low sulphur imports

Long term options to extend station life, explore clean coal technology

Generation Wholesale - Integrated Value Chain



- We are both a Supplier and Generator of Electricity and are hence involved at both ends of the ROC market

- Independent of the ROC issues, ScottishPower has for many years been interested in Renewable Generation

- This now includes biomass co-firing and planning for generation from dedicated biomass plants

Sewage Sludge Derived Fuel (WDF)

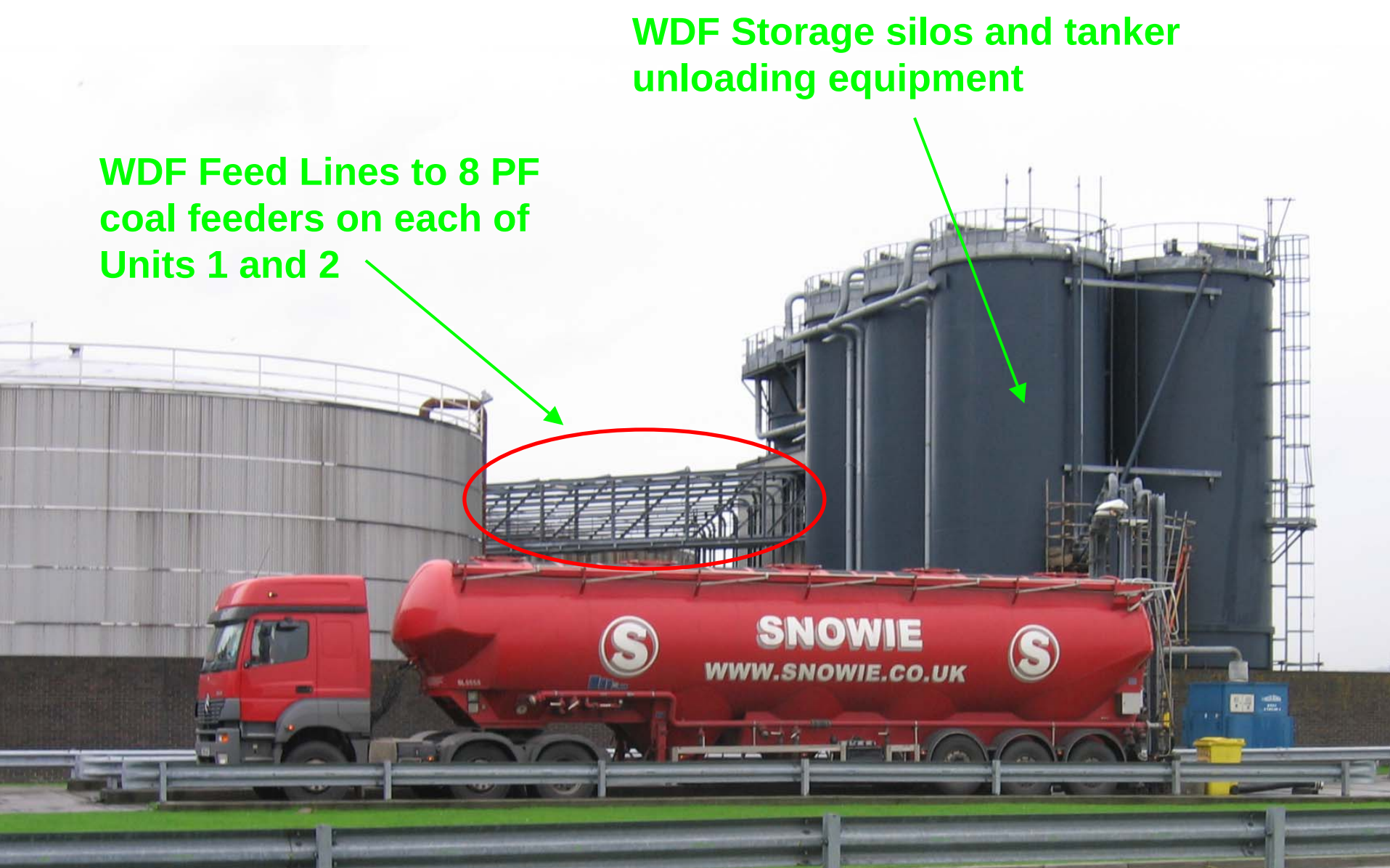
- Longannet was the first coal fired station in the UK to receive ROCs for any biomass co-firing

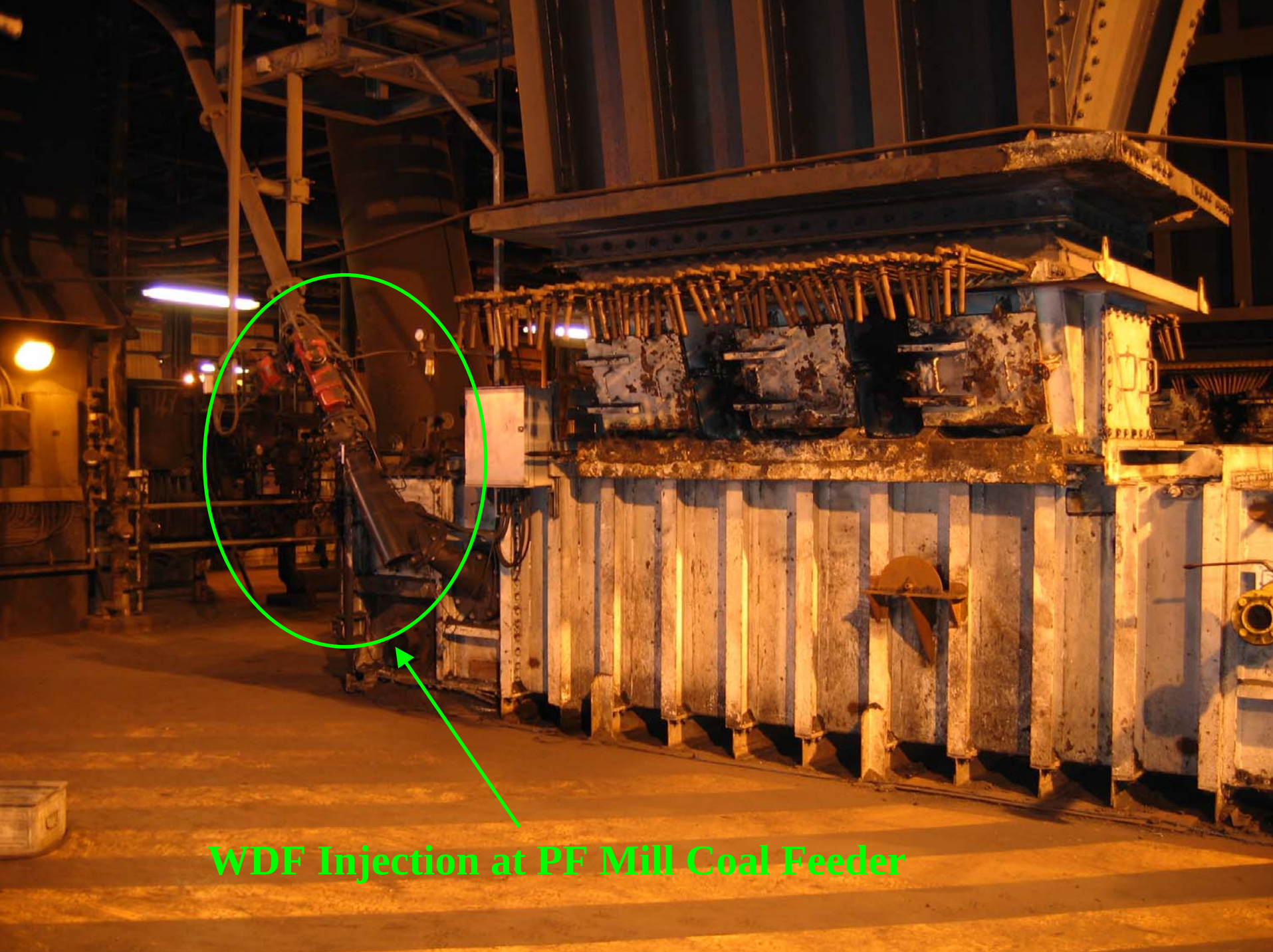
- The facilities at Longannet were built as part of a PFI project to build a sewage sludge treatment plant at Daldowie near Glasgow.

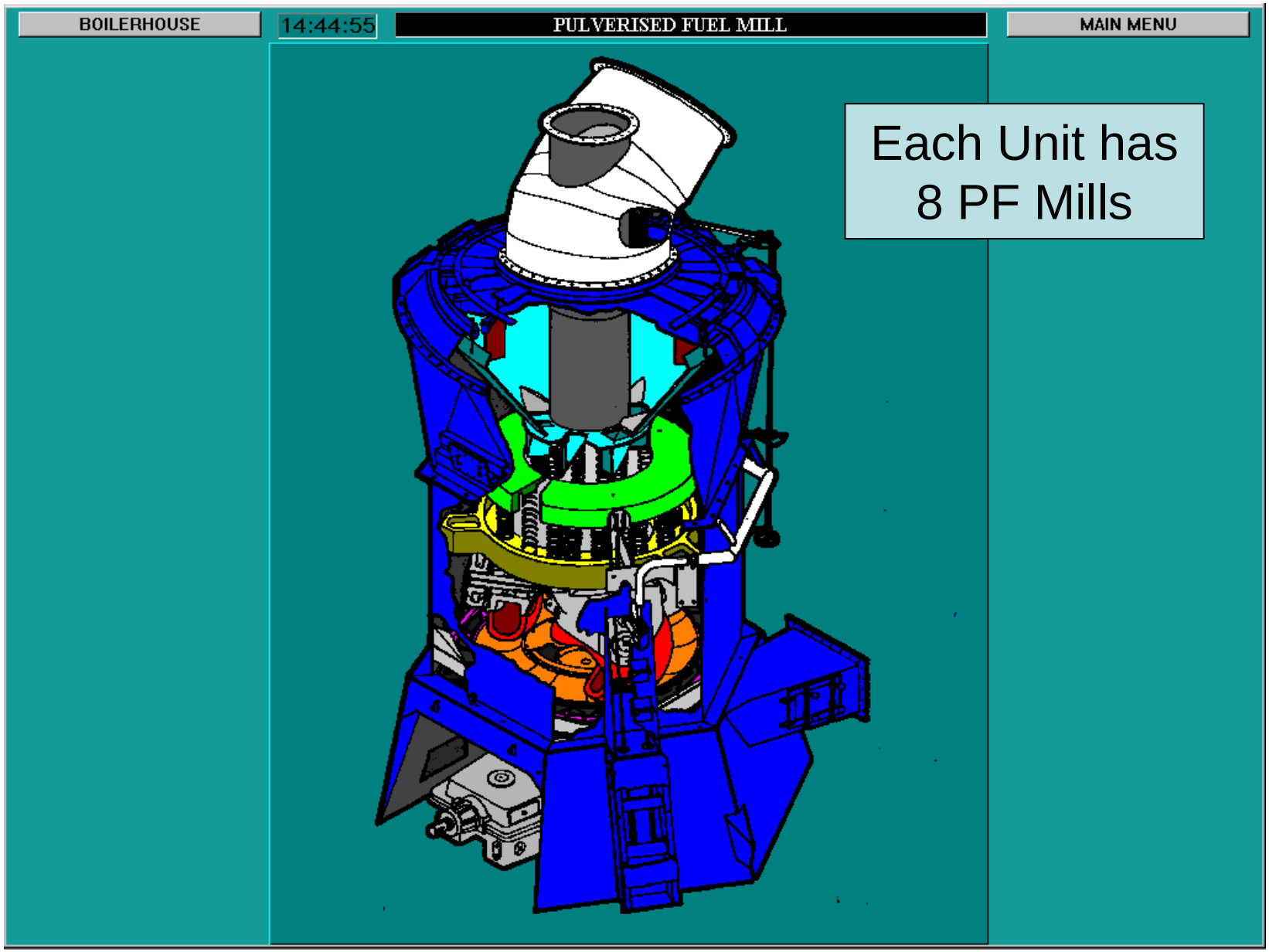
- Daldowie produces around 50 to 55,000 tonnes/yr of thermally dried sewage sludge (currently known as WDF)

DALDOWIE WDF PLANT

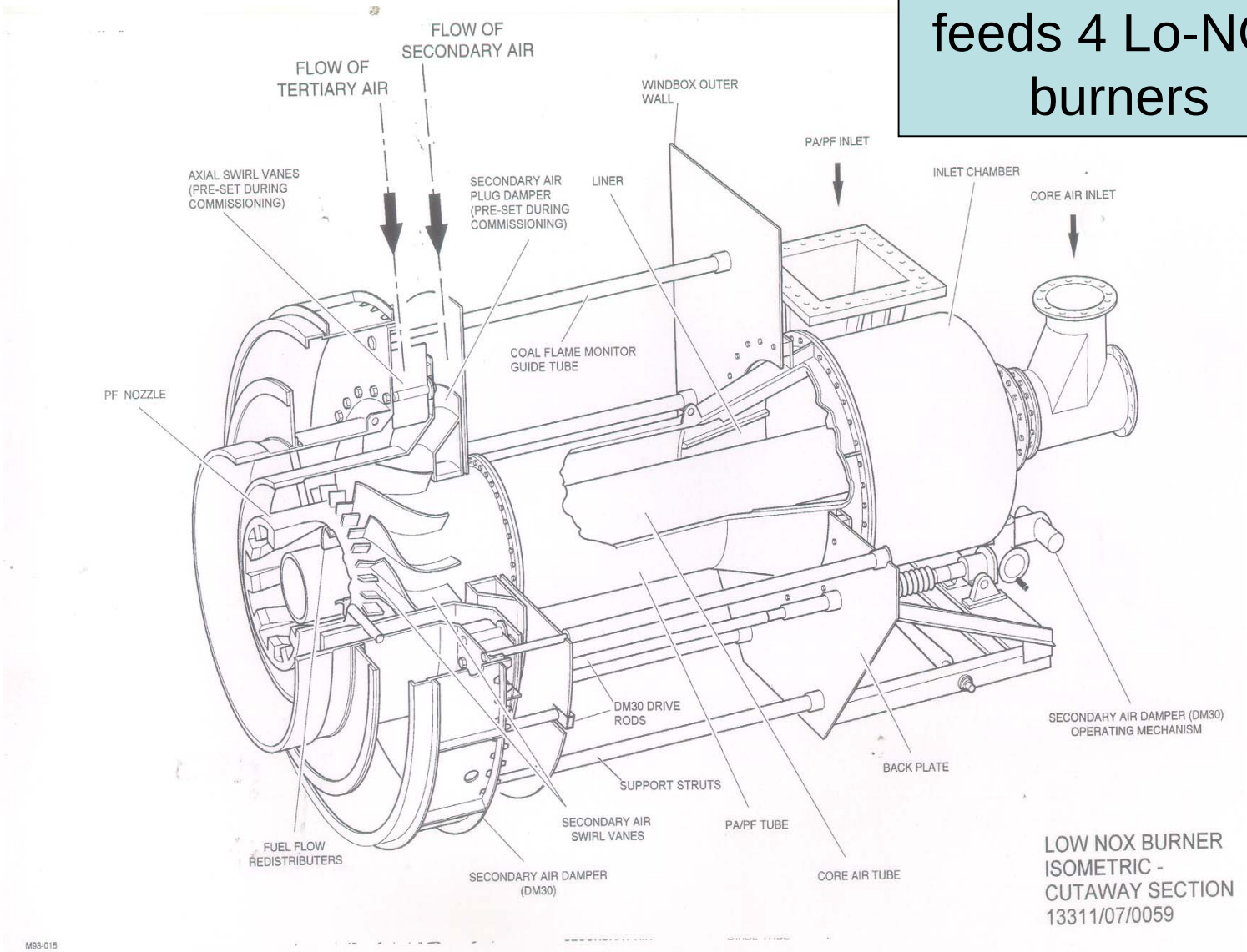
WDF Facilities at Longannet




WDF Injection at PF Mill Coal Feeder


BOILERHOUSE
14:44:55
PULVERISED FUEL MILL
MAIN MENU
Each Unit has
8 PF Mills

Each PF Mill feeds 4 Lo-NOx burners



Project Ariel

- Project Ariel was ScottishPower's project to secure ROCs from Biomass co-firing

- There were 3 parts to Project Ariel

1) Introduce additional WDF burn at Longannet
2) Introduce biomass Co-firing at Cockenzie
3) Introduce other biomass Co-firing at Longannet

Project Ariel Objective 1 - WDF

- There was unfilled capacity of approx 45,000 tonnes/year of WDF in our IPC authorisation at Longannet.
- The unfilled capacity represented an opportunity to secure additional ROCs
- Alternative sources of WDF were identified and trialled through the plant
- There were IPC and materials handling issues, but trials were successful
- The result of a ruling on the “waste” status of WDF and the implications of the WID have impacted on ScottishPower’s ability to secure additional supplies of WDF.
- Plans are now well in hand for the construction of a dedicated standalone Biomass Plant adjacent to the Longannet site

Project Ariel Objective 2 – Cockenzie

• Introducing biomass co-firing at Cockenzie was far from easy

Needed to:

- find a biomass material that was attractive (commercially and technically)
- identify how the biomass was to be co-fired (for trial and commercially)
- secure an IPC authorisation(s) for trials
- conduct the trials (establishing percentage mix)
- identify facilities for on-site mixing
- build the facilities
- secure IPC authorisation for commercial co-firing and on-site mixing

Project Ariel Objective 2 – Cockenzie

Method	Advantages	Disadvantages
Off-site blending of biomass with coal	Immediate Operation. No IPC or planning issues associated with on-site facilities	Relies on co-milling Once mixed, biomass % cannot be varied. Large volume of material to keep dry Tied to the owner of the facility Ofgem requirements still not clear
Blending of biomass with coal on the coal plant (typically on-belt)	Can store and protect biomass separate from coal Mix control is in your own hands	Relies on co-milling Once mixed, biomass % cannot be varied. Lead time and capital cost to build Planning and IPC issues to address
Blending of biomass with the coal just prior to the mill (as per Longannet's WDF system)	As "on coal plant" plus Biomass mix % controllable	As "on coal plant" but Greater interface with existing plant More expensive
Direct injection of biomass to the furnace (using dedicated milling plant, fans, ductwork and perhaps burners)	As "prior to mill" plus Co-firing rates independent of mill capacity	More expensive still. Longest lead Can demand tight biomass specification

Project Ariel Objective 2 – Cockenzie

• In selecting our co-firing facilities we considered
- Existing plant
- Quantities, types and cost of biomass
- Capital Cost and programme
- ROC rules (as they existed in 2003 and evolved in 2004)
- Delivery logistics (sources, road/rail delivery etc)

• We settled upon
- off-site mixing for trial (to prove the concept and secure data for the commercial co-firing IPC authorisation in the shortest possible time)
- on-site mixing for commercial operation (dropping biomass onto the top of coal is relatively simple cheap and quick to install, but does rely on co-milling which limits biomass selection and maximum co-firing percentage).


Cockenzie Biomass Shed


POWERSCREEN

Project Ariel Objective 3 – Longannet

•We used the same approach at Longannet that proved successful at Cockenzie (learning some lessons along the way)

- IPC authorisation for trial
- Biomass Trial
- Parallel activity on procuring on-site mixing facilities
- Secured IPC authorisation for commercial co-firing and on-site mixing facilities
- Some additional work required at Longannet post installation to fit additional dust extraction equipment at main conveyor loading point.


Longannet Biomass Shed


Biomass Hopper


Biomass Conveyor


Discharge Hood


Flap Valve

Comparison of Biomass chemical analysis

	Wood Pellets Latvia (June 05)	Sunflower Husk Pellets (Bio 58)	WDF
Total Moisture	8.4	9.41	8
Ash	1.1	3.5	24
Volatile Matter	75.6	68.27	58
DAF Volatile Matter	83.2	78.39	86
Gross CV	18394	19320	16500
Nett CV	17033	17930	15500
DAF CV	20325	22180	24500
Sulphur	0.08	0.29	0.7
Carbon	45.16	47.49	37
Hydrogen	5.67	5.7	5.3
Nitrogen	0.3	0.92	4
Chlorine	0.02	0.071	0.05
Oxygen	39.3	45.89	20

Conclusions

- To secure the ROCs, the plant needs to support the auditable measurement of the quantity and quality of biomass burned (to Ofgem's exacting requirements).

- To be able to co-fire at all, the plant needs to satisfy the EA's/SEPA's requirements for IPC consent.

- It is possible to build plant better, cheaper and faster than it can be bought turnkey.

- Biomass co-firing is here, its working, it is delivering renewable energy now.

- The next steps are to build the dedicated Biomass Plant to handle WDF and investigate further Co-firing options at Longannet.

- Comments on any experience of co-firing are most welcome.