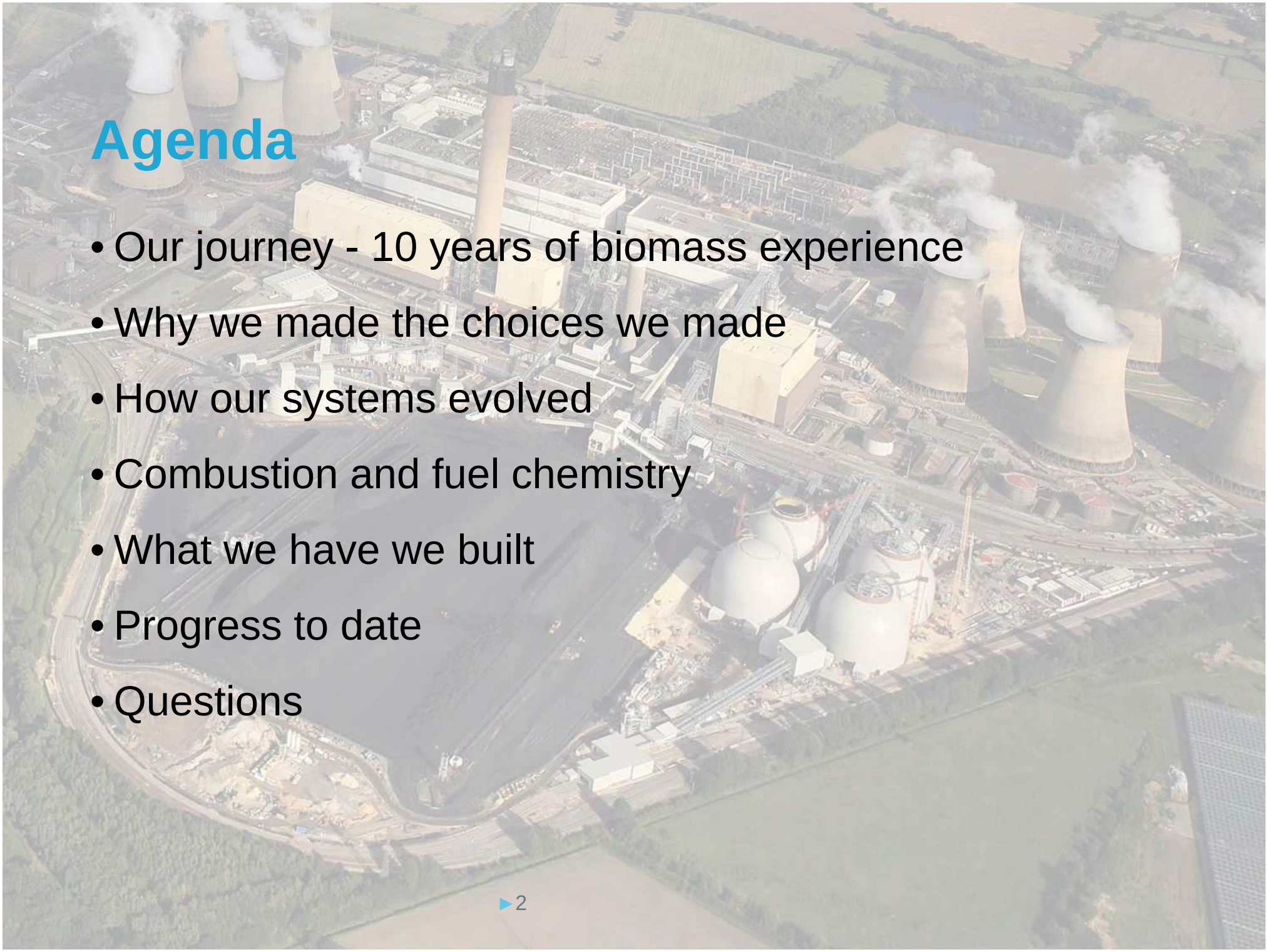
Engineering the transformation

Capital Markets Day

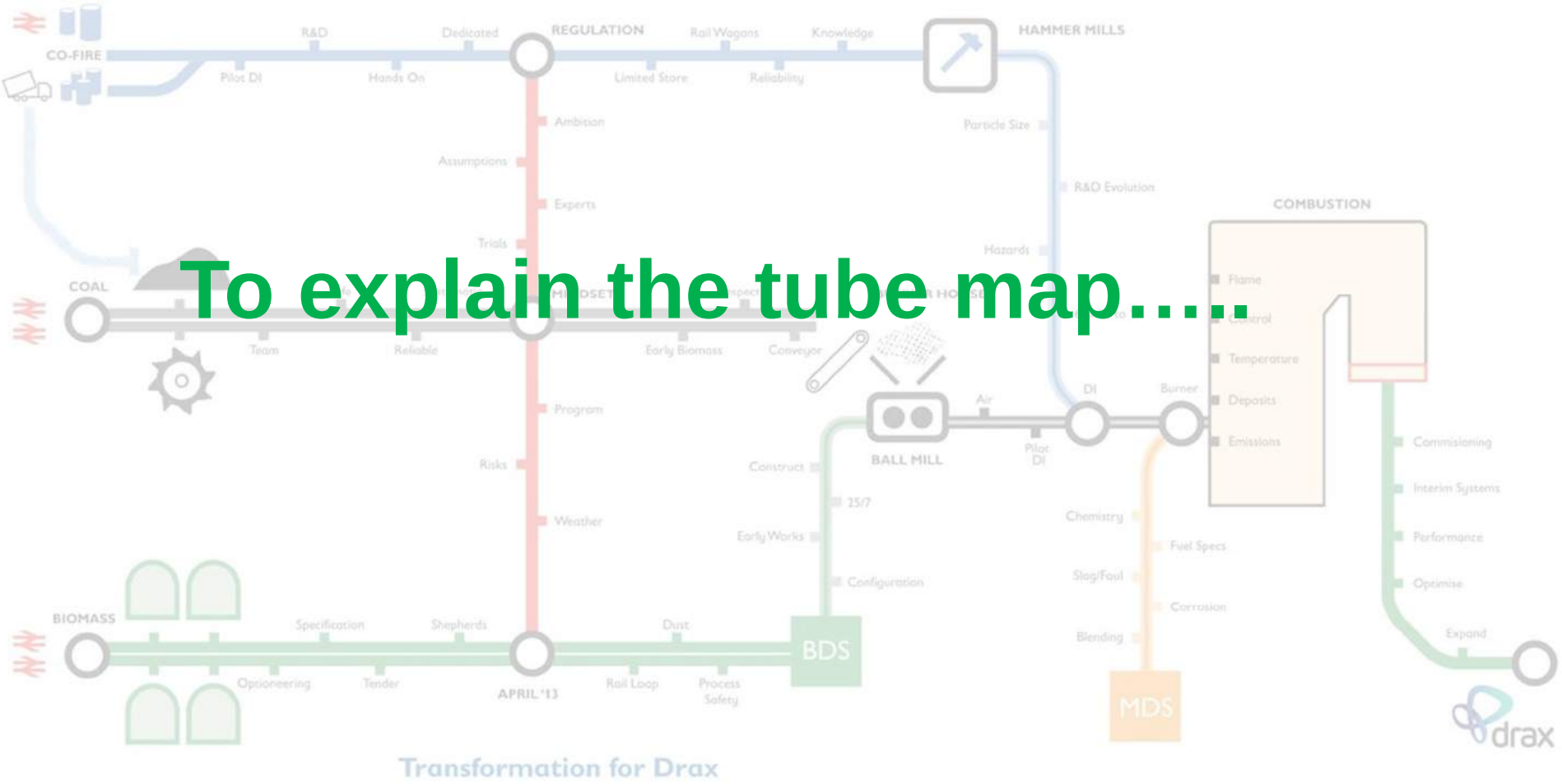
17 October 2013

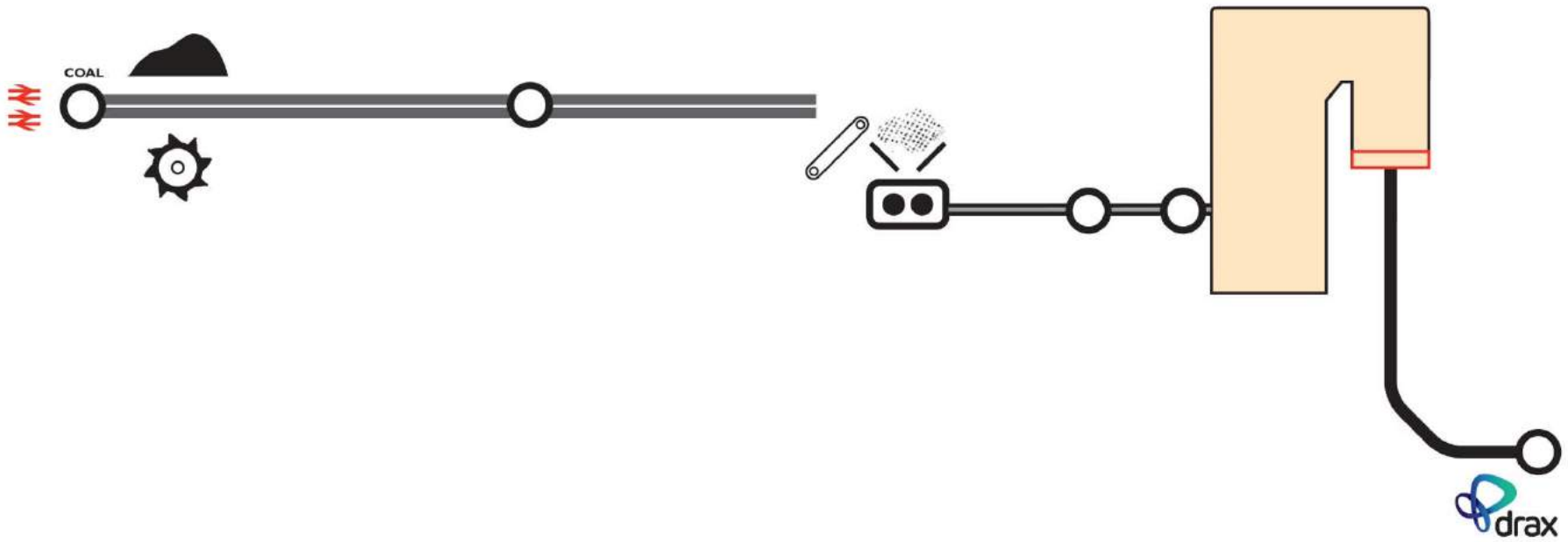
Brian Greensmith
Jason Shipstone



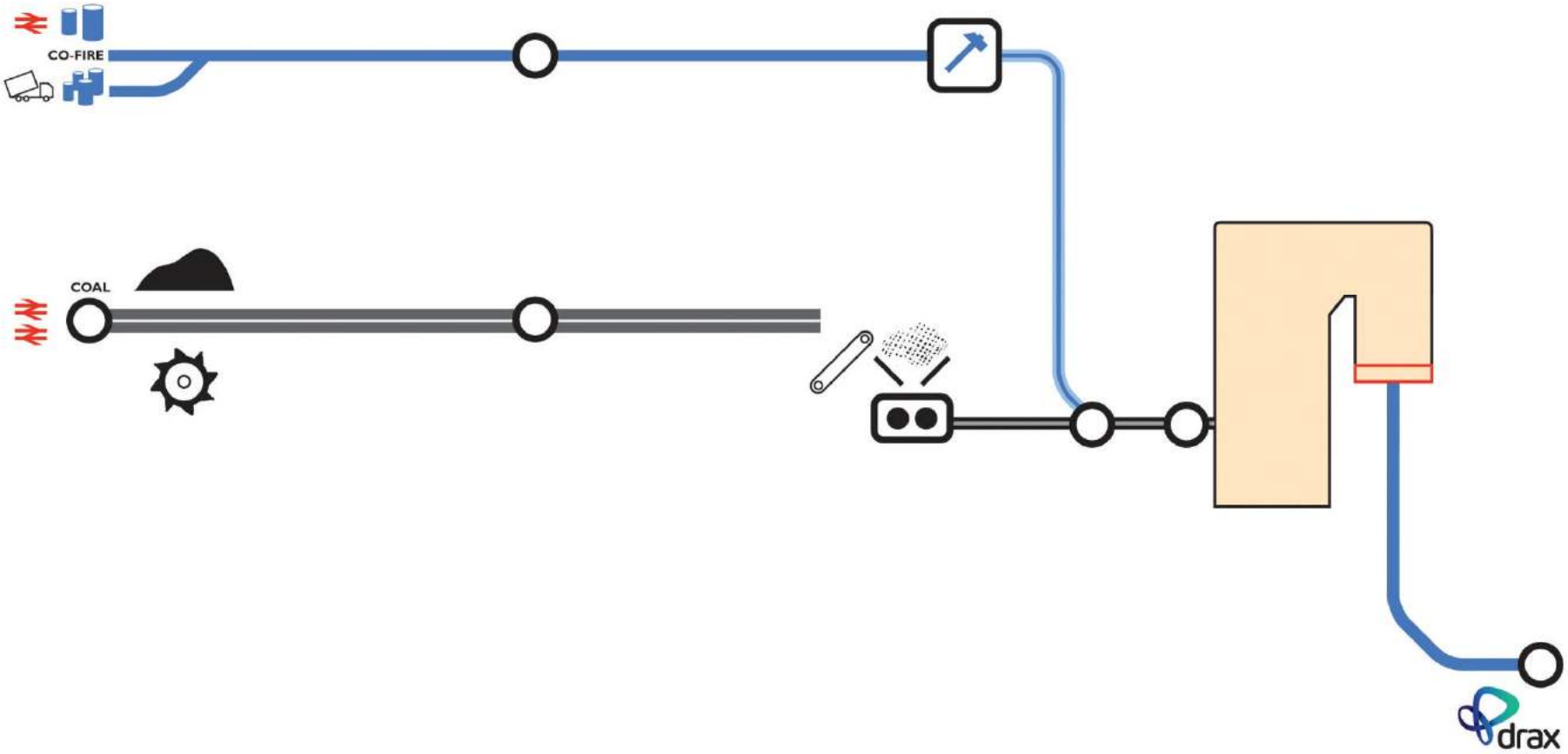
Agenda

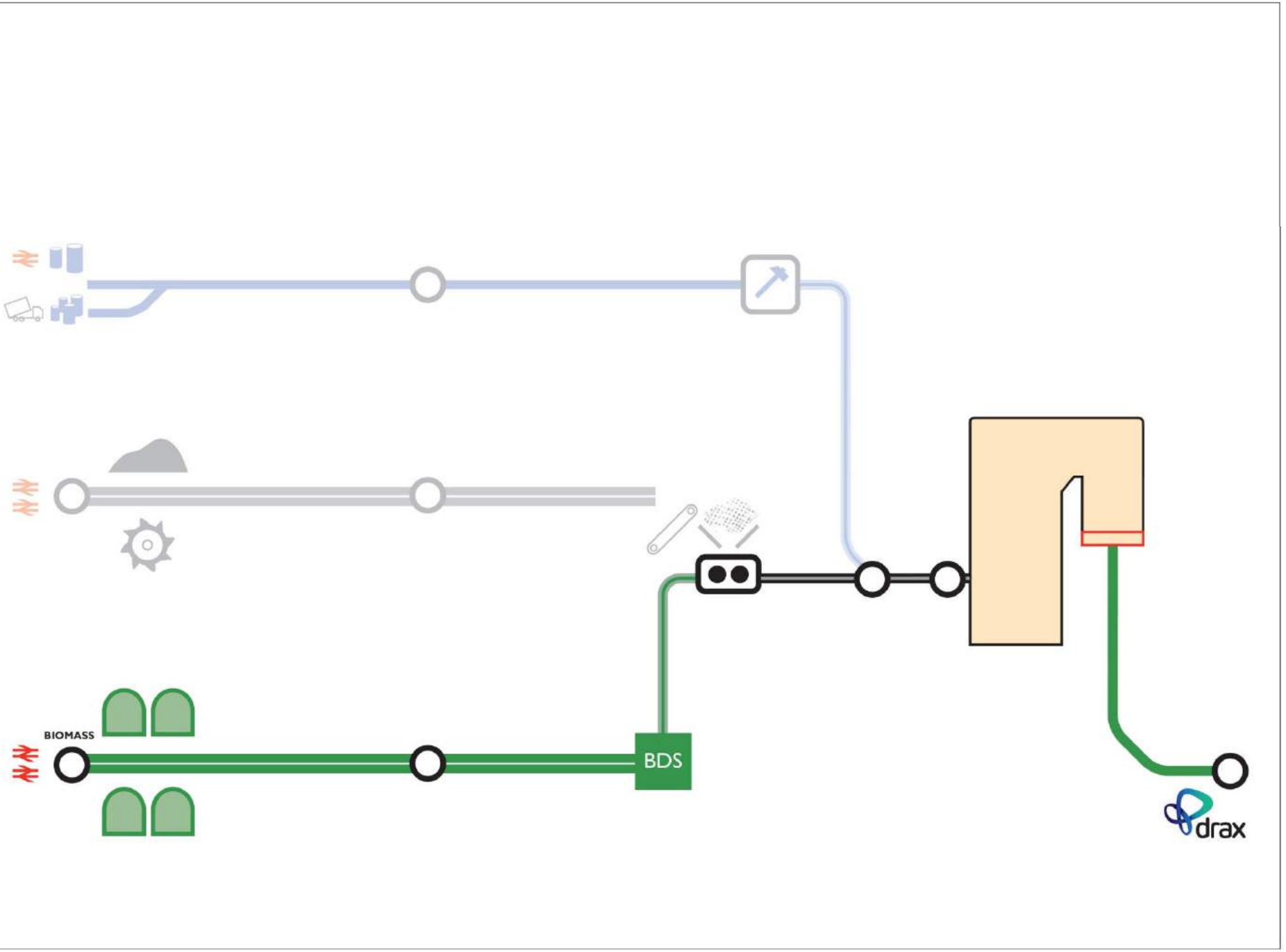
- Our journey - 10 years of biomass experience
- Why we made the choices we made
- How our systems evolved
- Combustion and fuel chemistry
- What we have we built
- Progress to date
- Questions

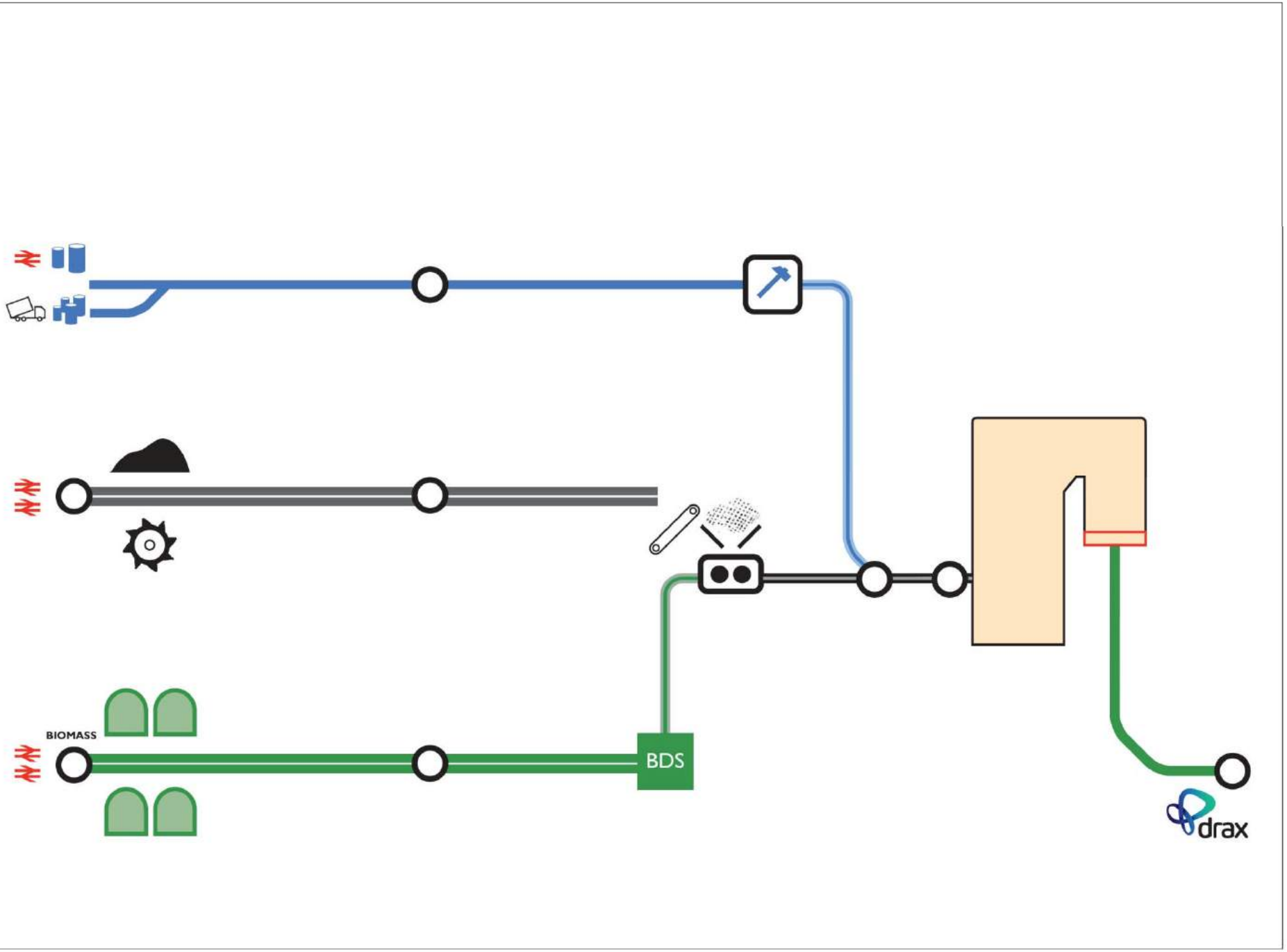

To explain the tube map…..
CO-FIRE
R&D
Dedicated
REGULATION
Rail Wagons
Knowledge
HAMMER MILLS
Pilot DI
Hands On
Limited Store
Reliability
Ambition
Particle Size
Assumptions
R&D Evolution
COMBUSTION
Experts
Trials
Hazards
COAL
Flame
Temperature
Deposits
Emissions
Team
Reliable
Early Biomass
Conveyor
Program
Air
DI
Burner
BALL MILL
Pilot DI
Risks
Construct
Commissioning
Interim Systems
Performance
Optimise
Expand
Weather
15/7
Chemistry
Early Works
Fuel Specs
Configuration
Slag/Foul
Corrosion
Blending
BIOMASS
Specification
Shepherds
Dust
BDS
Opioneering
Tender
APRIL '13
Rail Loop
Process Safety
MDS
drax
Transformation for Drax

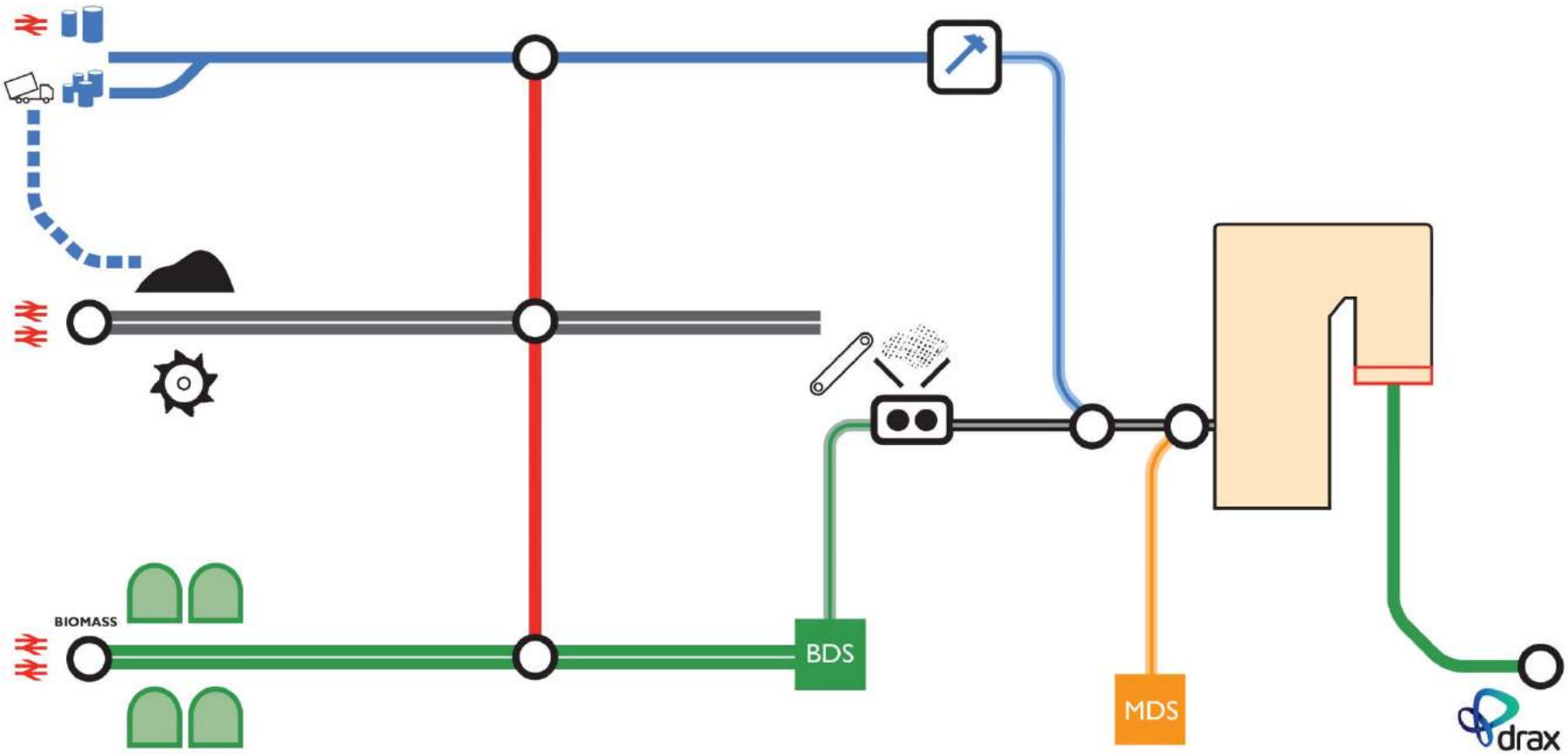


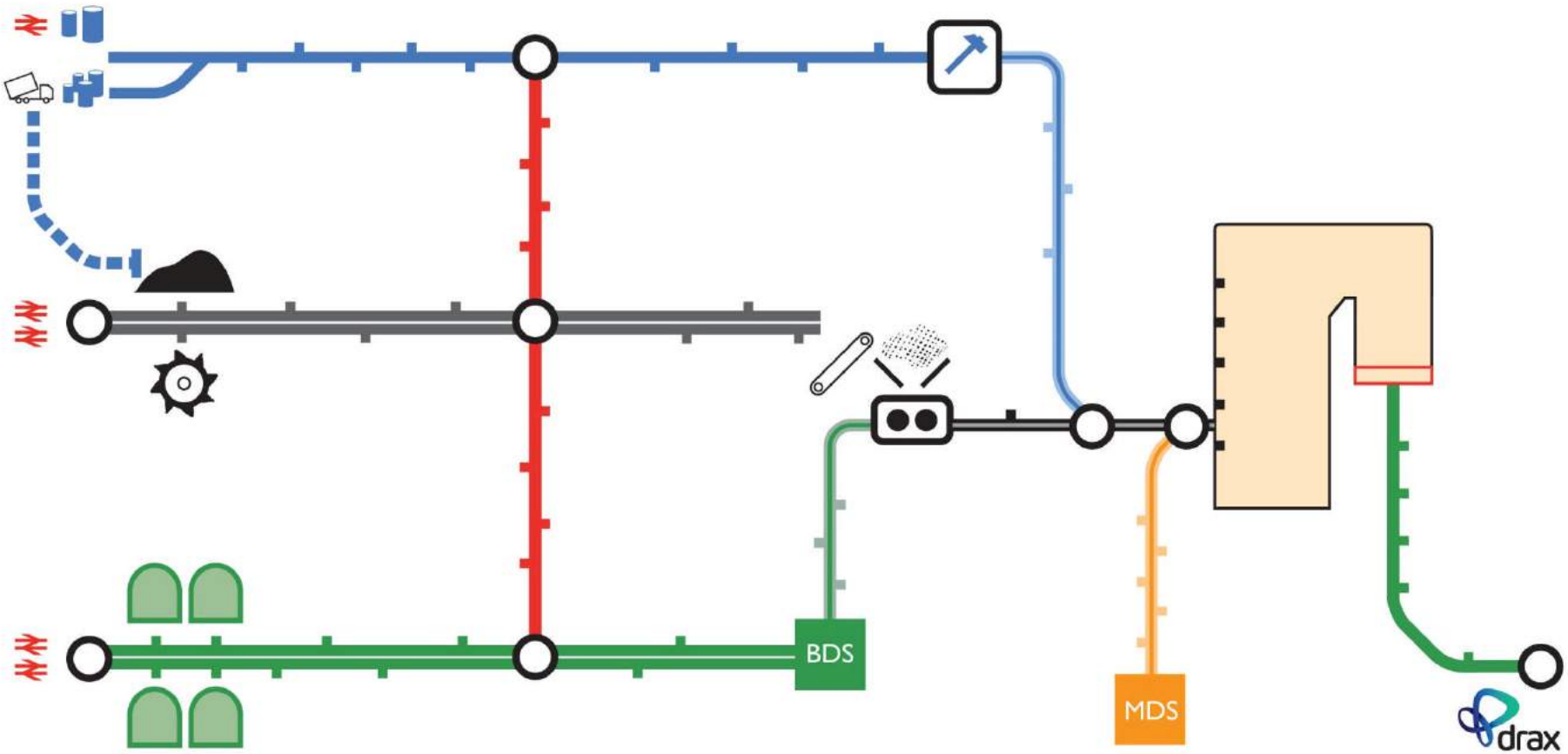
09/10/13

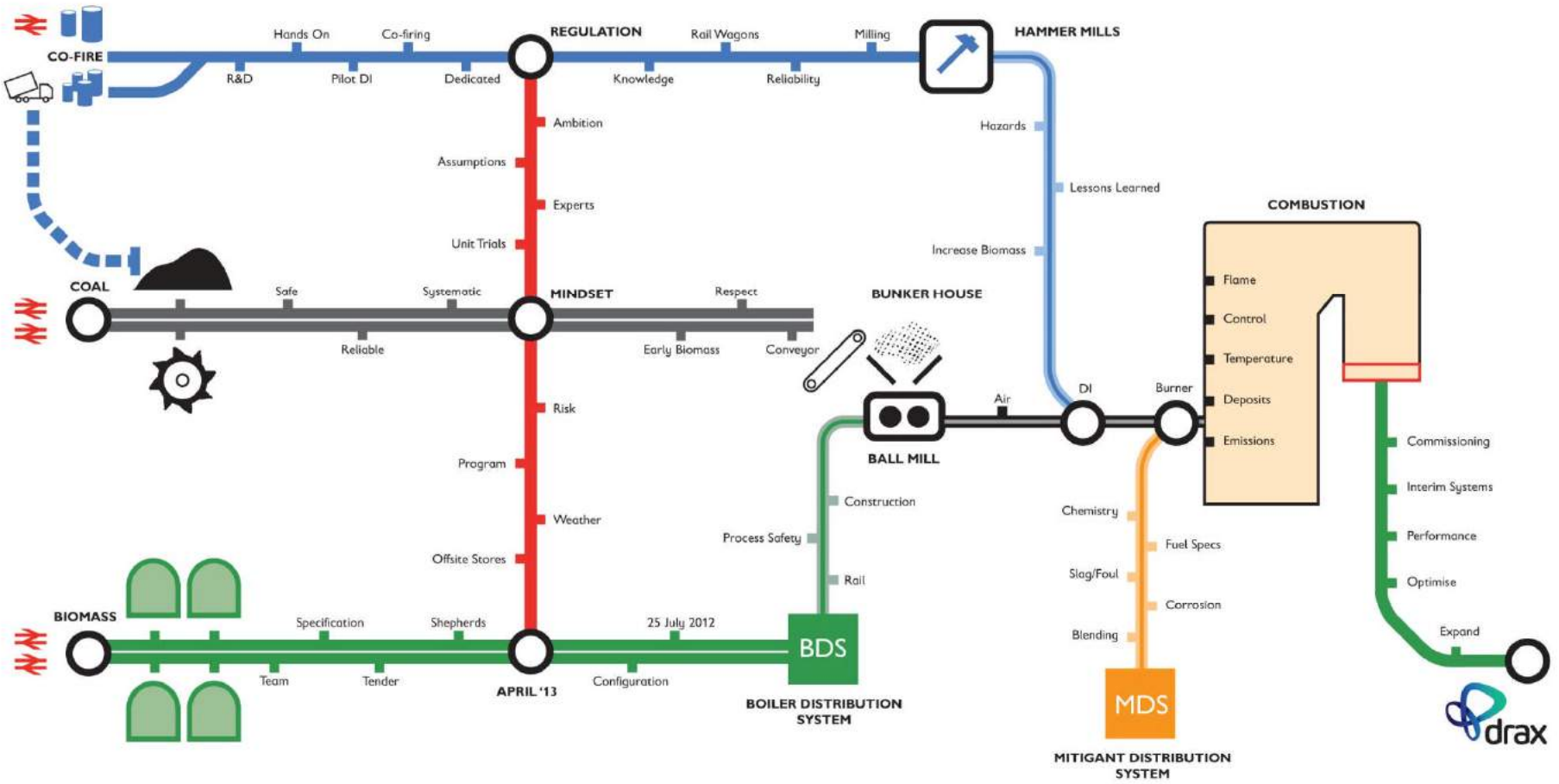

CO-FIRE
COAL
drax


BIOMASS
BDS
drax

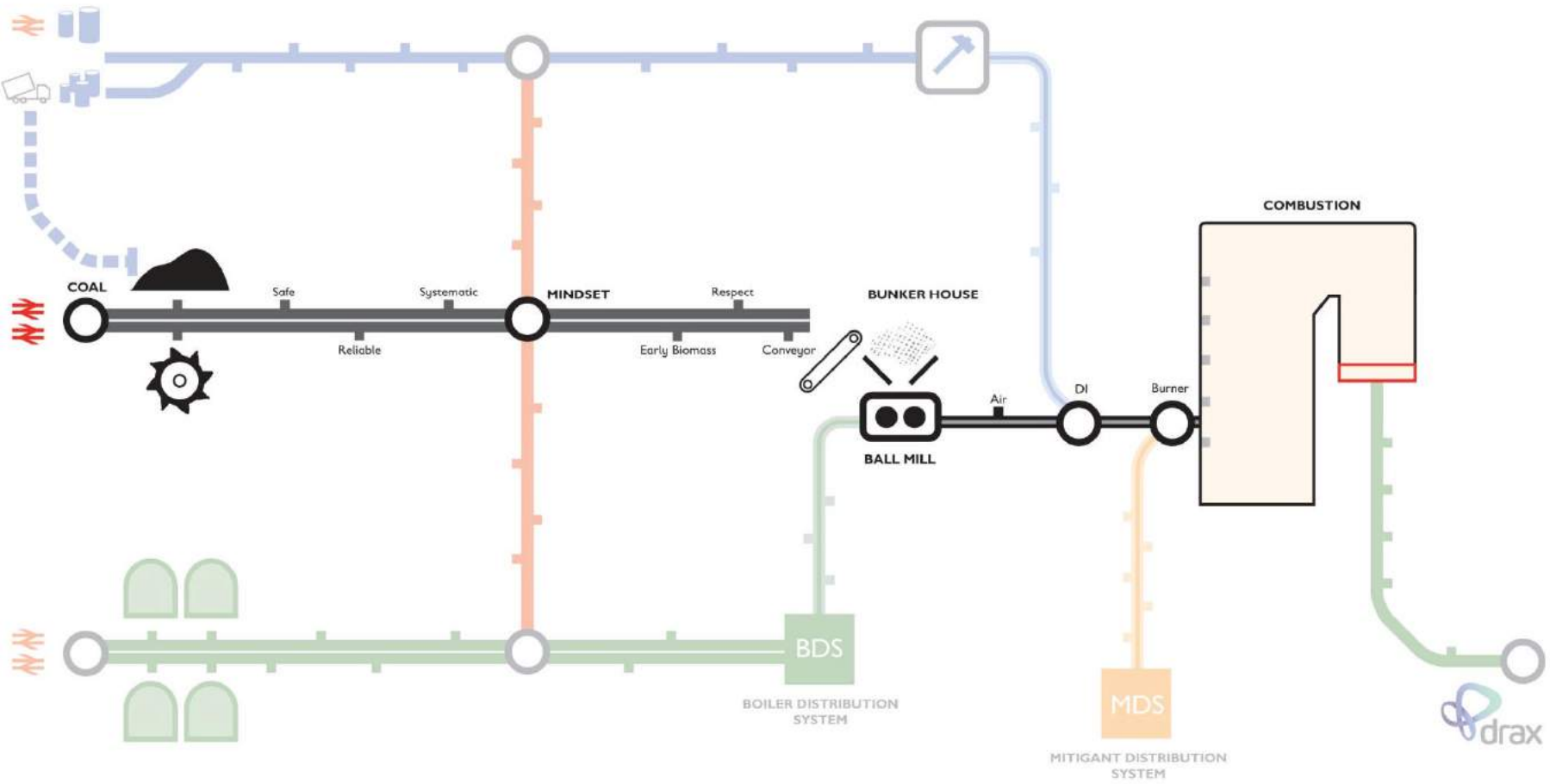

BIOMASS
BDS
drax


BIOMASS
BDS
MDS
drax

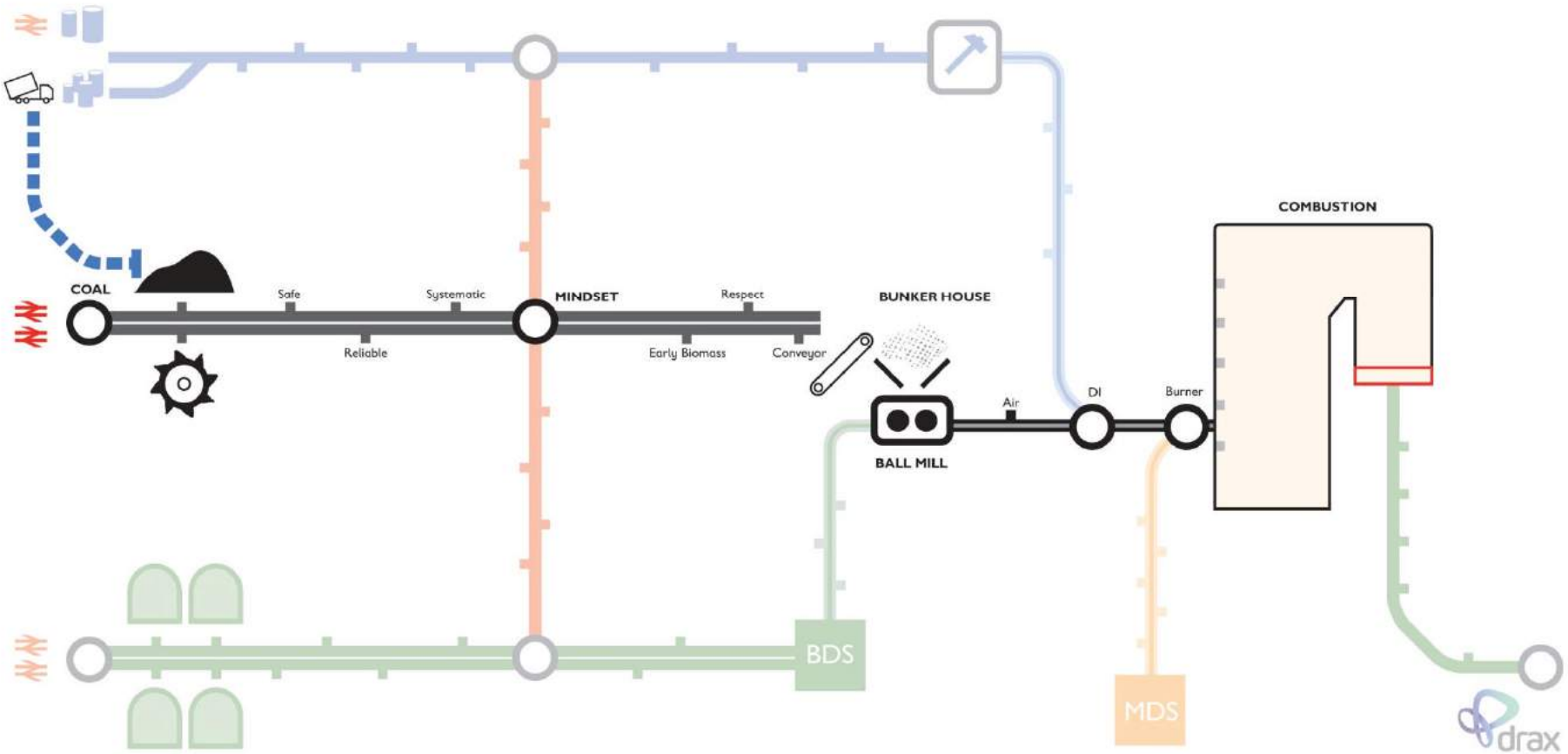

BDS
MDS
drax


CO-FIRE
R&D
Pilot DI
Hands On
Co-firing
Dedicated
REGULATION
Knowledge
Rail Wagons
Reliability
Milling
HAMMER MILLS
Ambition
Assumptions
Experts
Unit Trials
Hazards
Lessons Learned
Increase Biomass
COMBUSTION
Flame
Control
Temperature
Deposits
Emissions
COAL
Safe
Reliable
Systematic
MINDSET
Early Biomass
Respect
Conveyor
BUNKER HOUSE
Air
DI
Burner
BALL MILL
Risk
Program
Weather
Offsite Stores
Construction
Process Safety
Rail
Chemistry
Fuel Specs
Slag/Foul
Corrosion
Blending
Commissioning
Interim Systems
Performance
Optimise
Expand
BIOMASS
Specification
Team
Tender
Shepherds
APRIL '13
25 July 2012
Configuration
BDS
BOILER DISTRIBUTION SYSTEM
MDS
MITIGANT DISTRIBUTION SYSTEM
drax

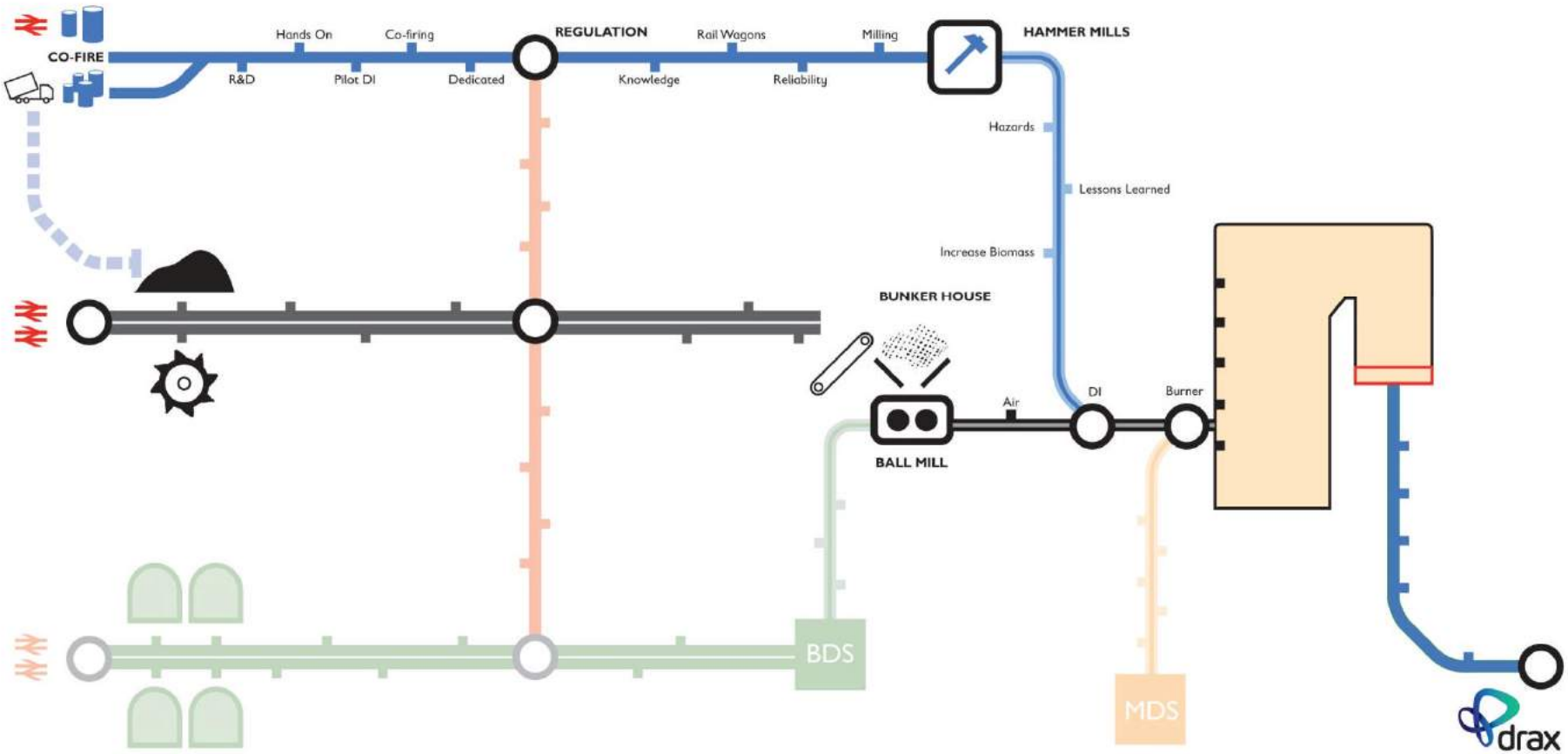
Coal


COAL
Safe
Reliable
Systematic
MINDSET
Respect
Early Biomass
Conveyor
BUNKER HOUSE
Air
DI
Burner
BALL MILL
COMBUSTION
BDS
BOILER DISTRIBUTION SYSTEM
MDS
MITIGANT DISTRIBUTION SYSTEM
drax

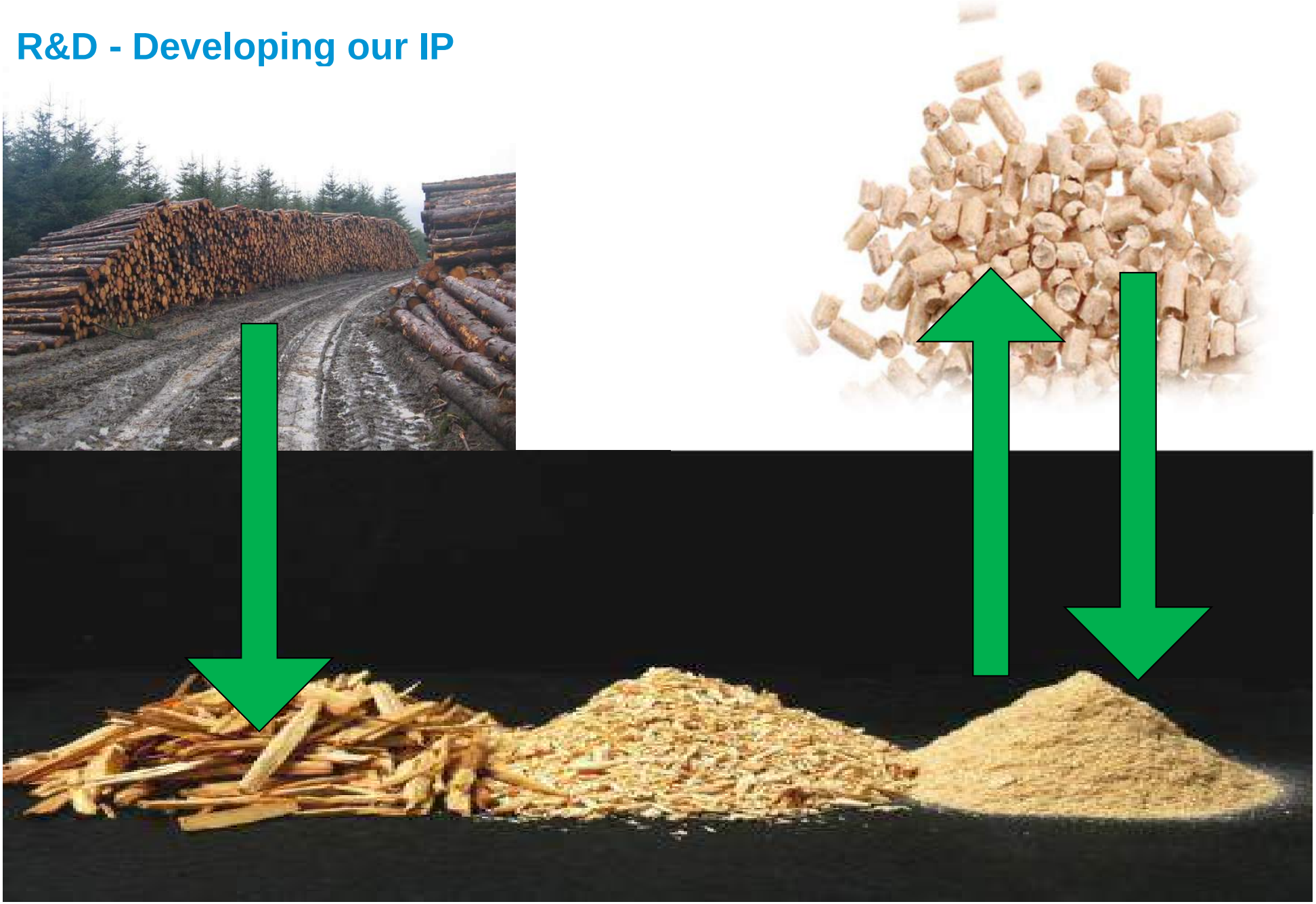
Coal and Early Biomass



Co-firing


CO-FIRE
Hands On
Co-firing
REGULATION
Rail Wagons
Milling
HAMMER MILLS
R&D
Pilot DI
Dedicated
Knowledge
Reliability
Hazards
Lessons Learned
Increase Biomass
BUNKER HOUSE
Air
DI
Burner
BALL MILL
BDS
MDS
drax

R&D - Developing our IP



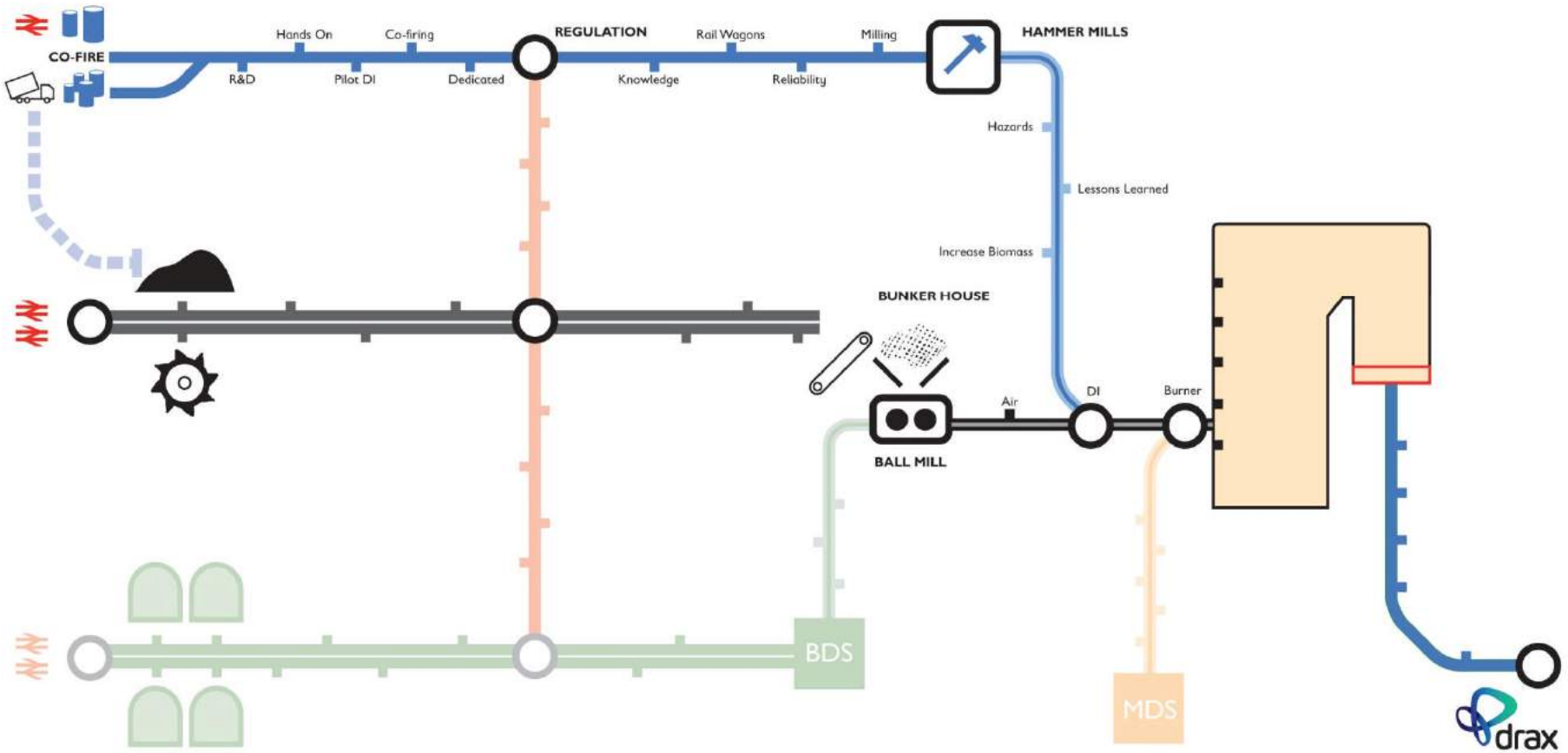
R&D - Developing our IP

Pilot DI (Direct injection)

Co-firing facility

Dedicated biomass plant

Co-firing


CO-FIRE
R&D
Pilot DI
Dedicated
Hands On
Co-firing
REGULATION
Knowledge
Rail Wagons
Reliability
Milling
HAMMER MILLS
Hazards
Lessons Learned
Increase Biomass
BUNKER HOUSE
BALL MILL
Air
DI
Burner
BDS
MDS
drax

Bespoke rail loading, transport and unloading

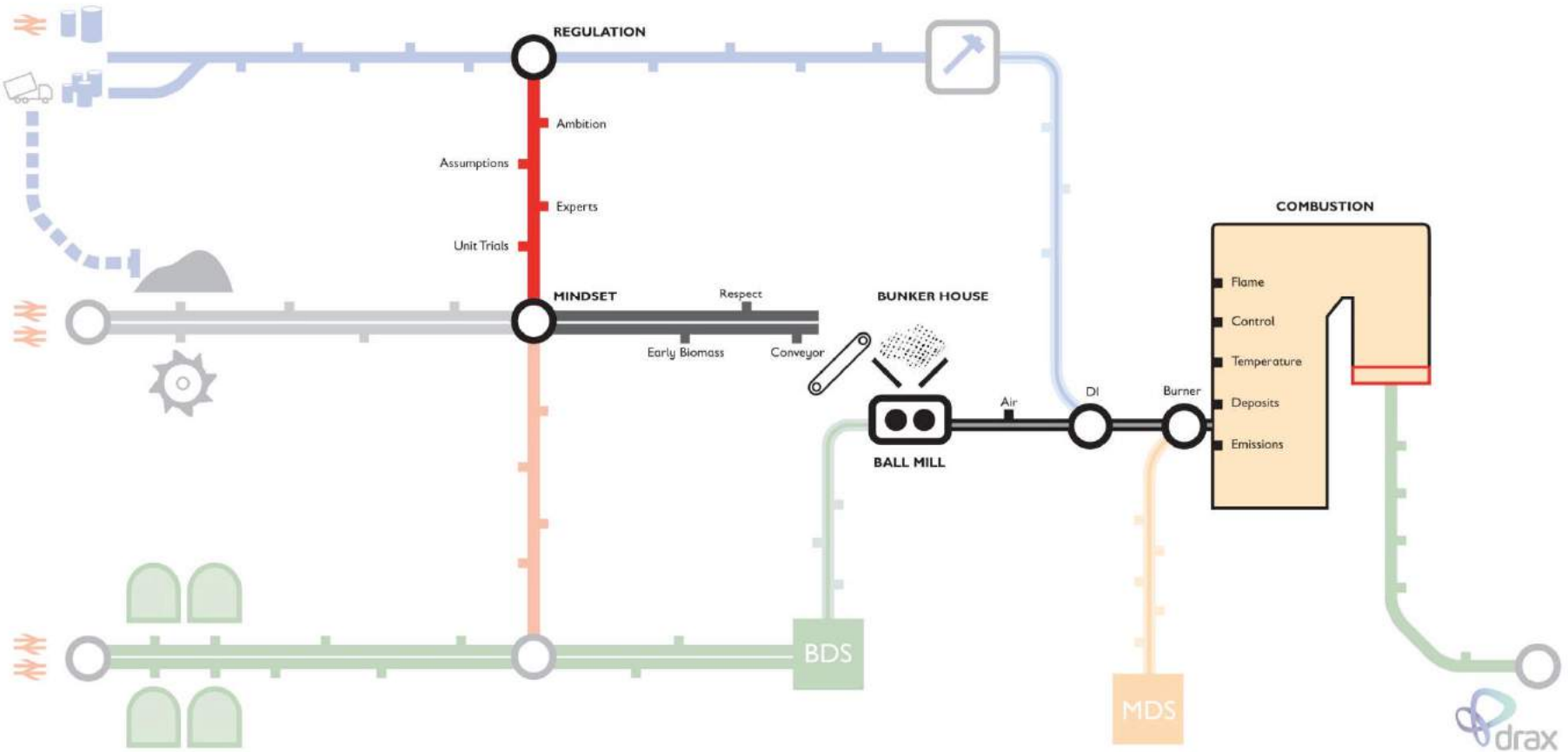
Milling – what did we learn?

Ball mill

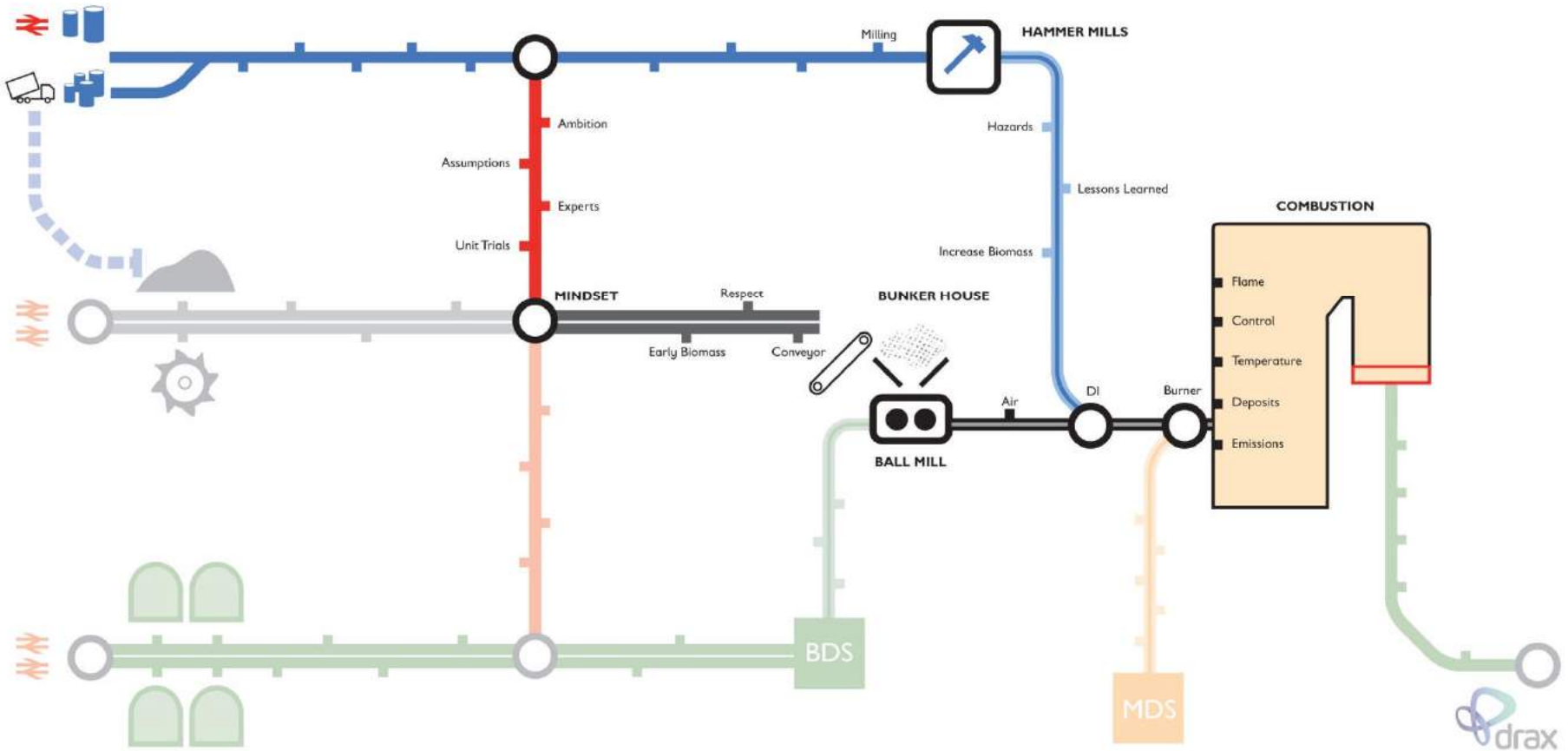
Hammer mill

Hazards – key lessons learned

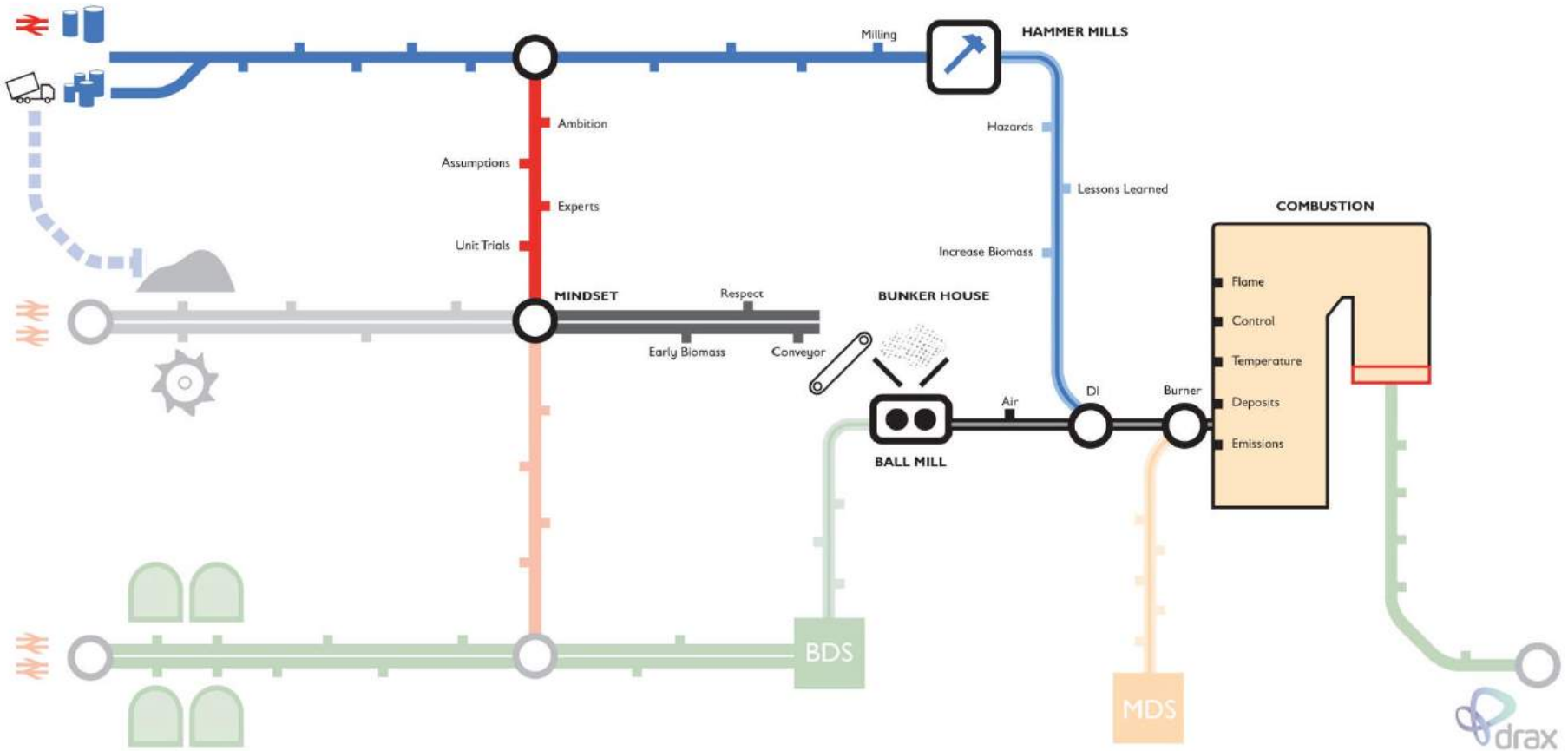
Ambition “Predominantly Biomass”



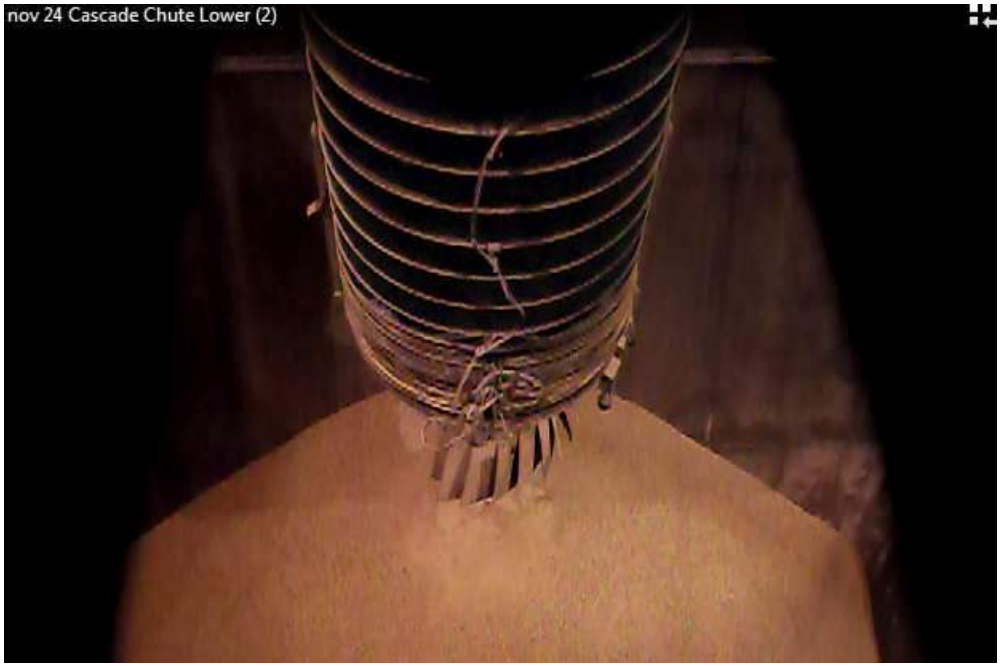
Full scale unit trials – increasing the percentage



Full scale unit trials – increasing the percentage

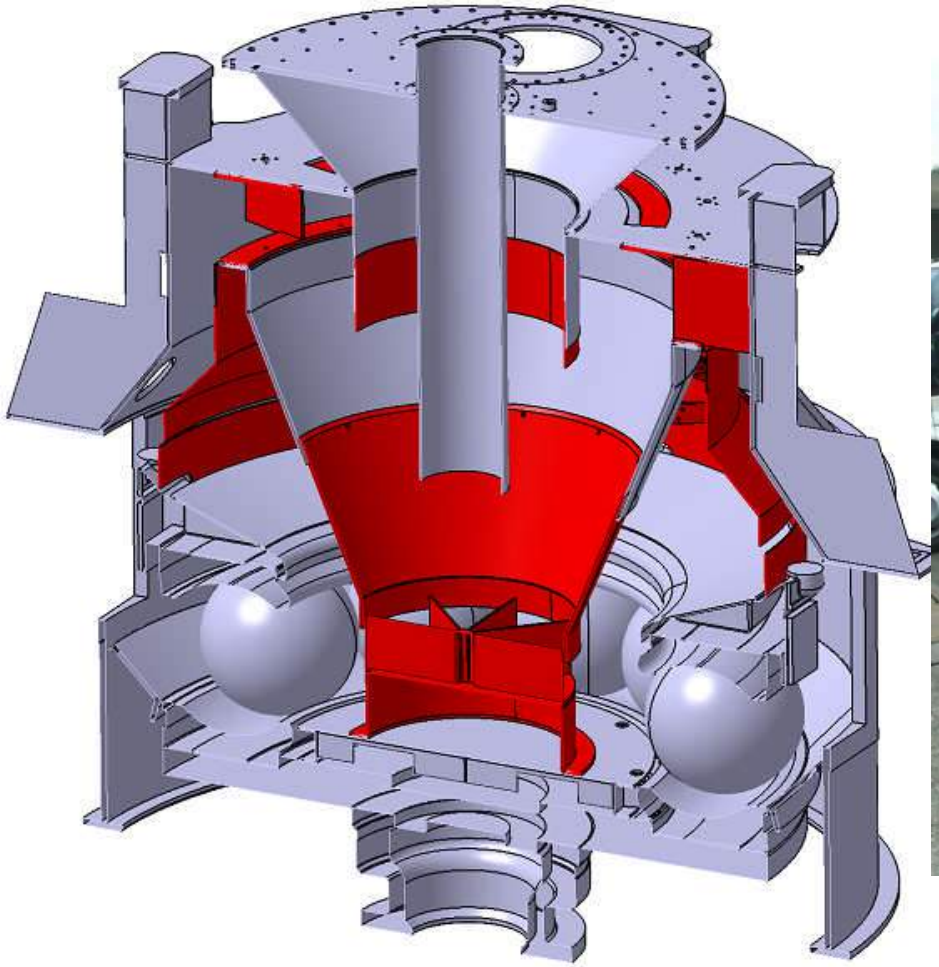


Bunker dust management



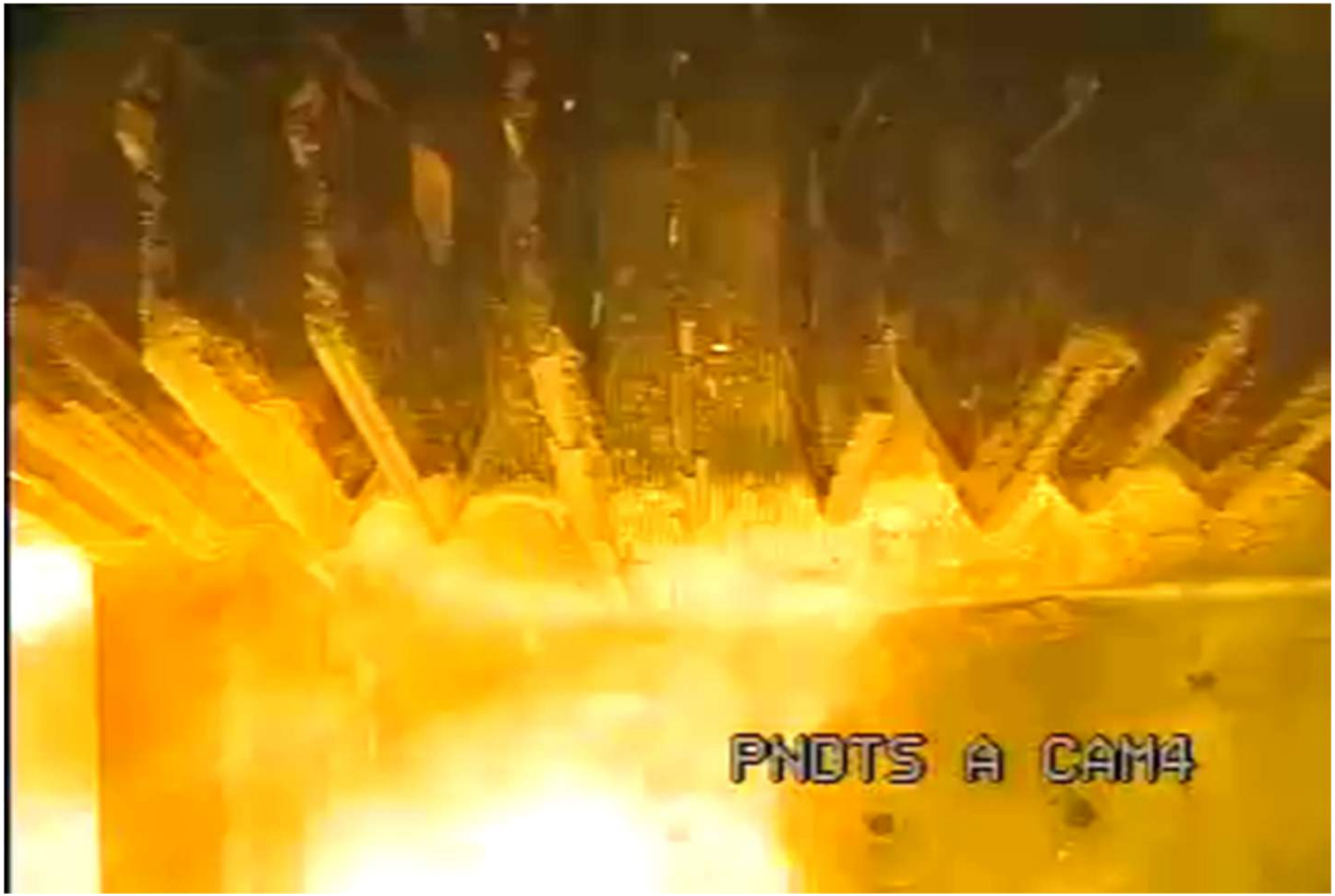
Combustion modifications

Mills

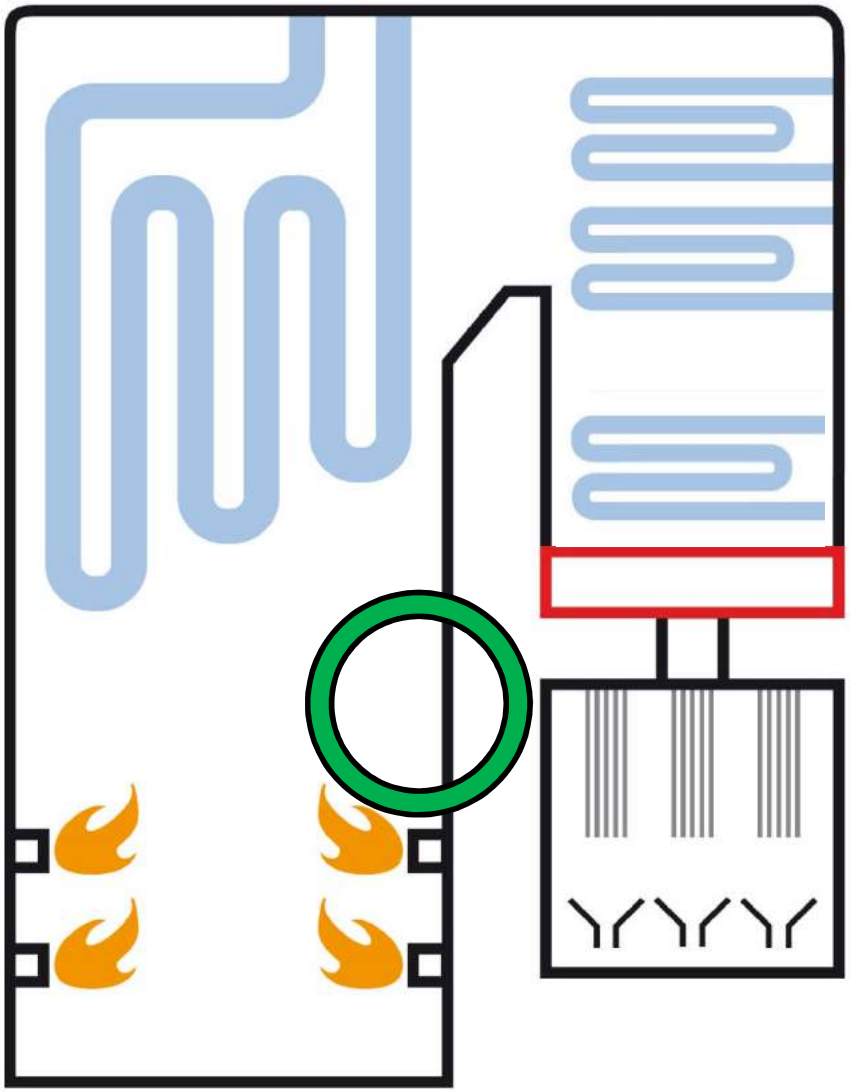


Burners

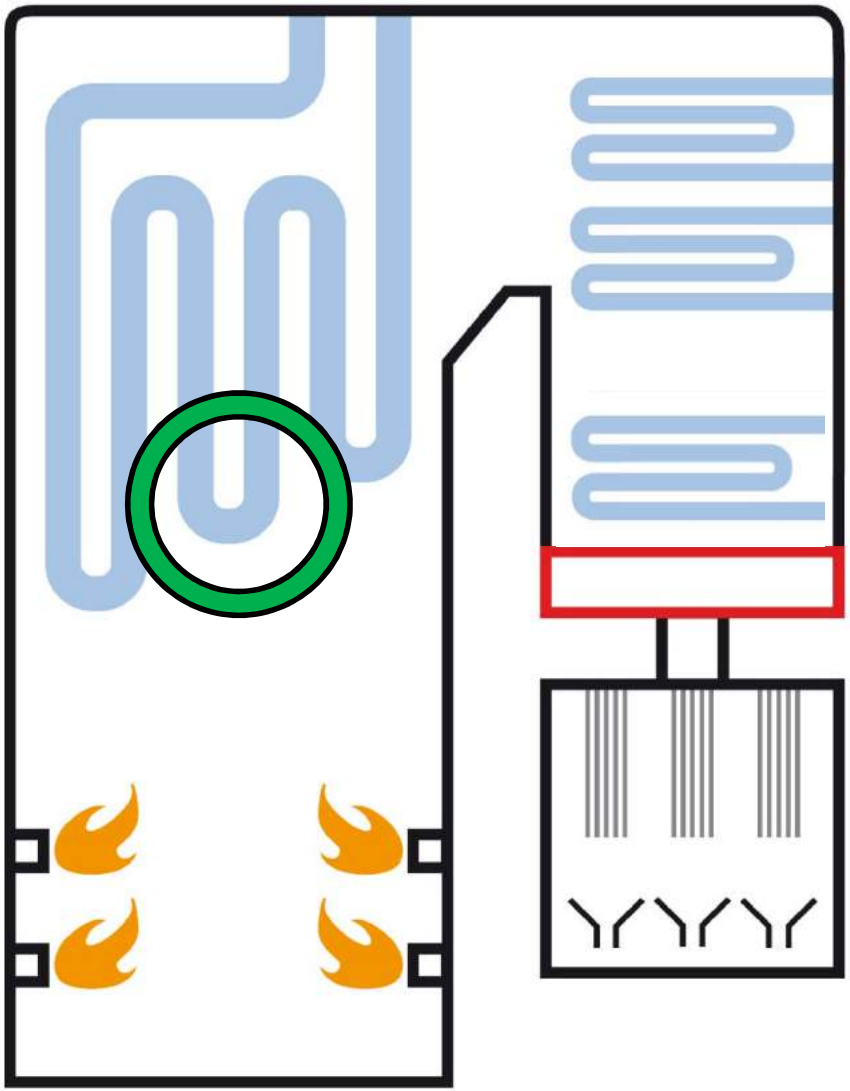
Combustion modifications



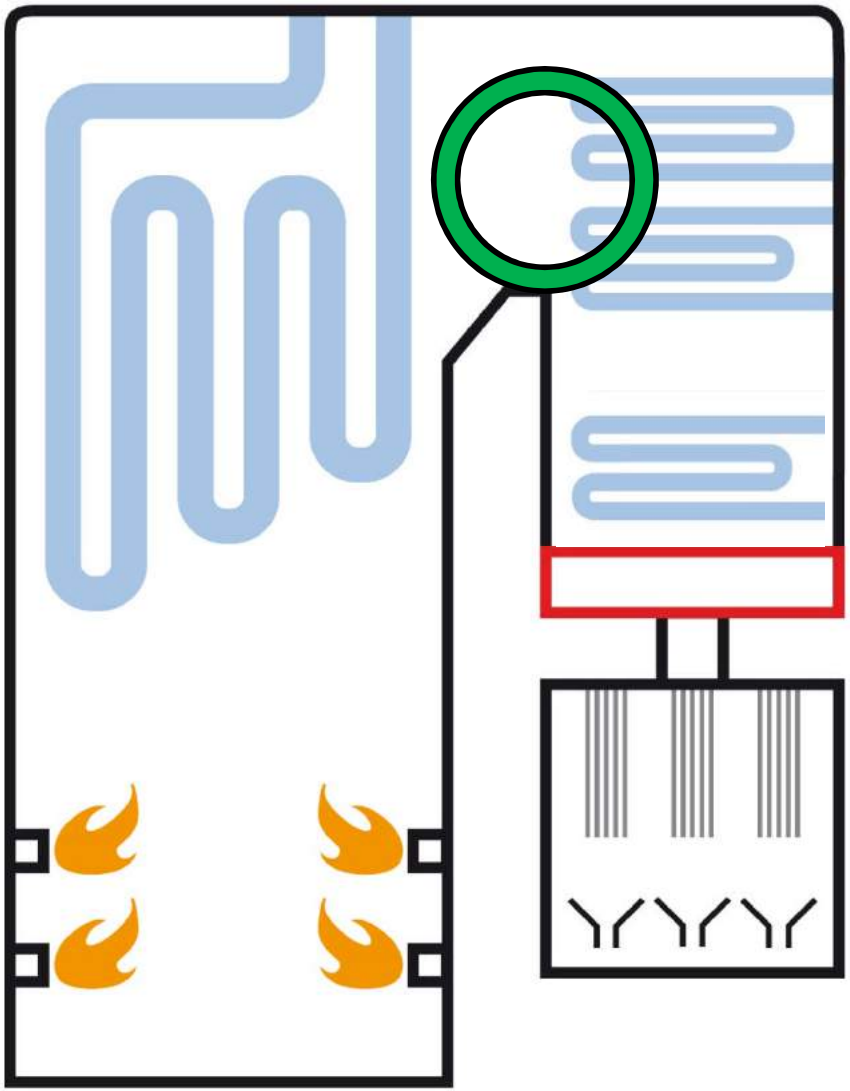
Wall tube slag



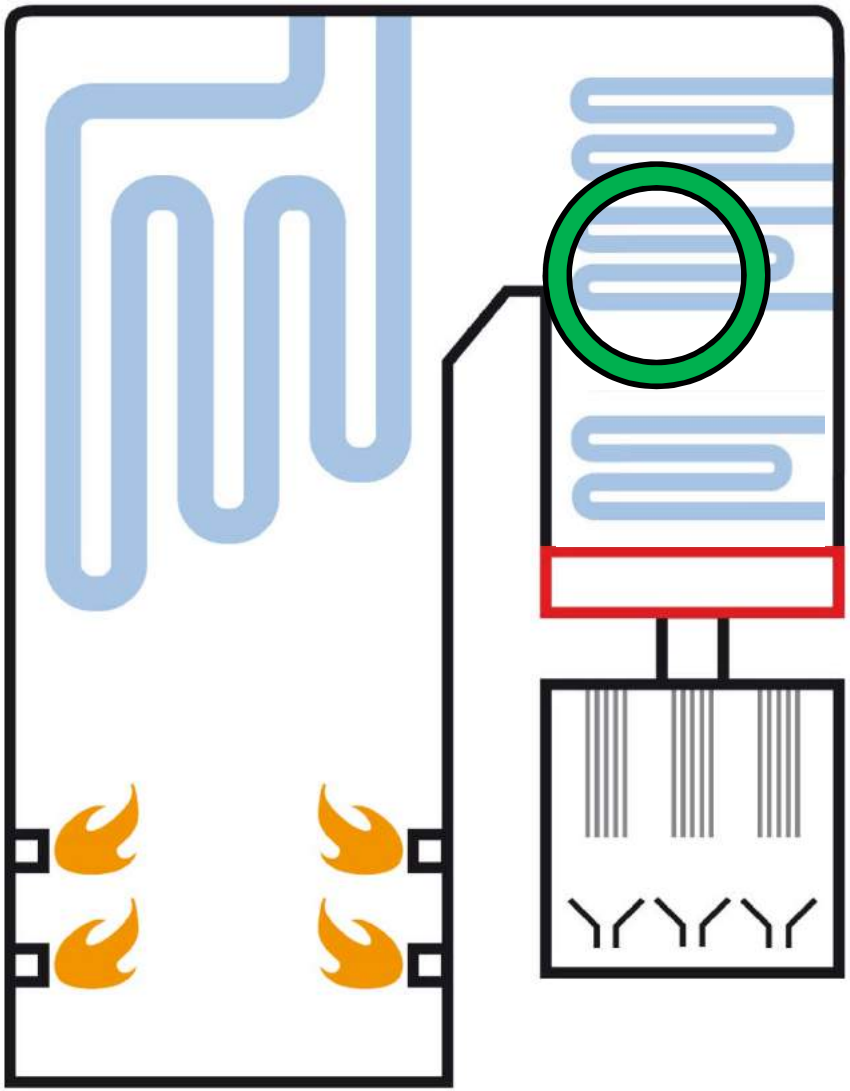
Pendant tube slag

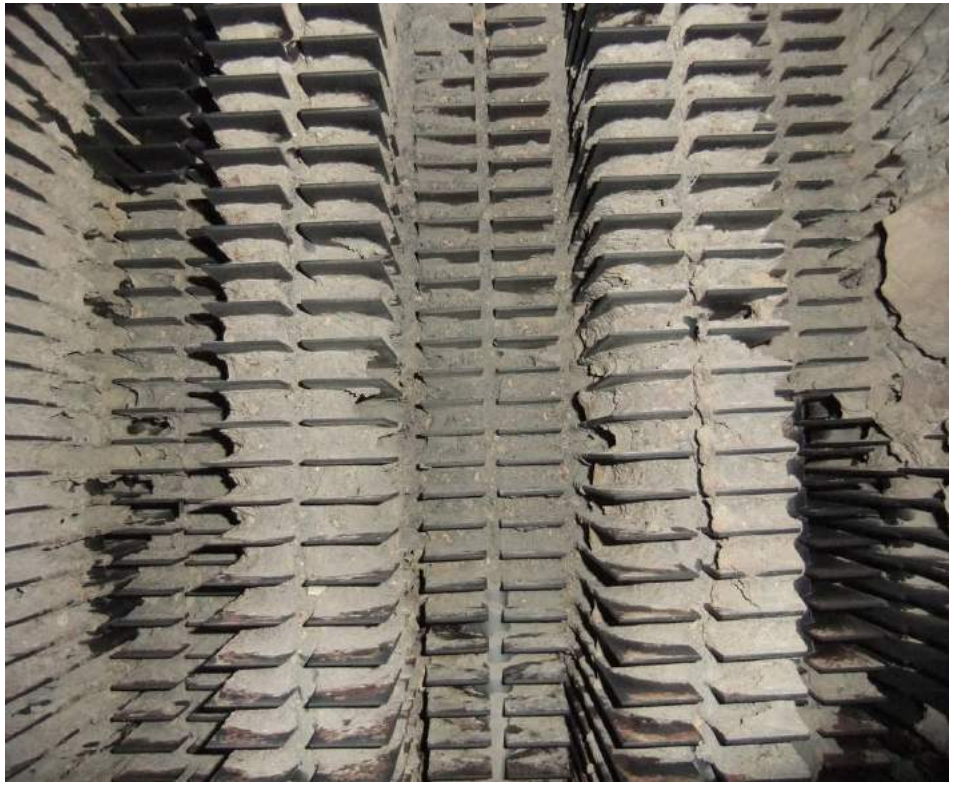


Late combustion

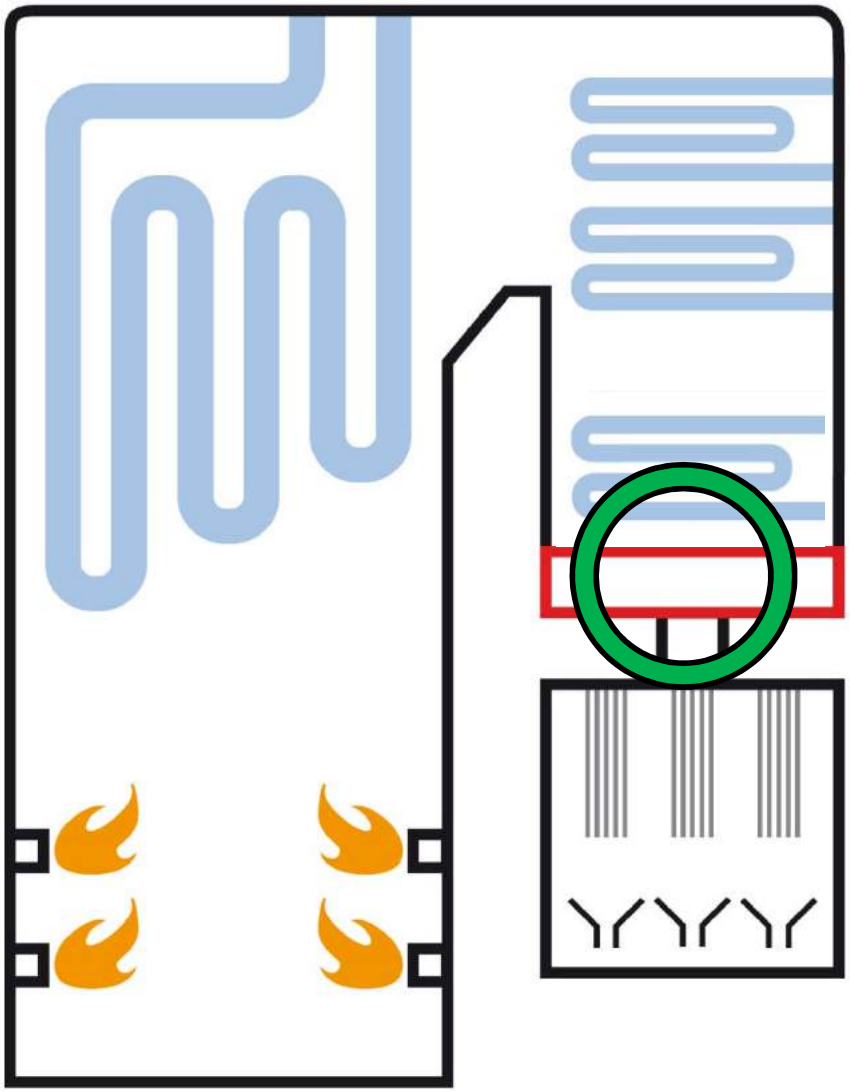


Tube fouling

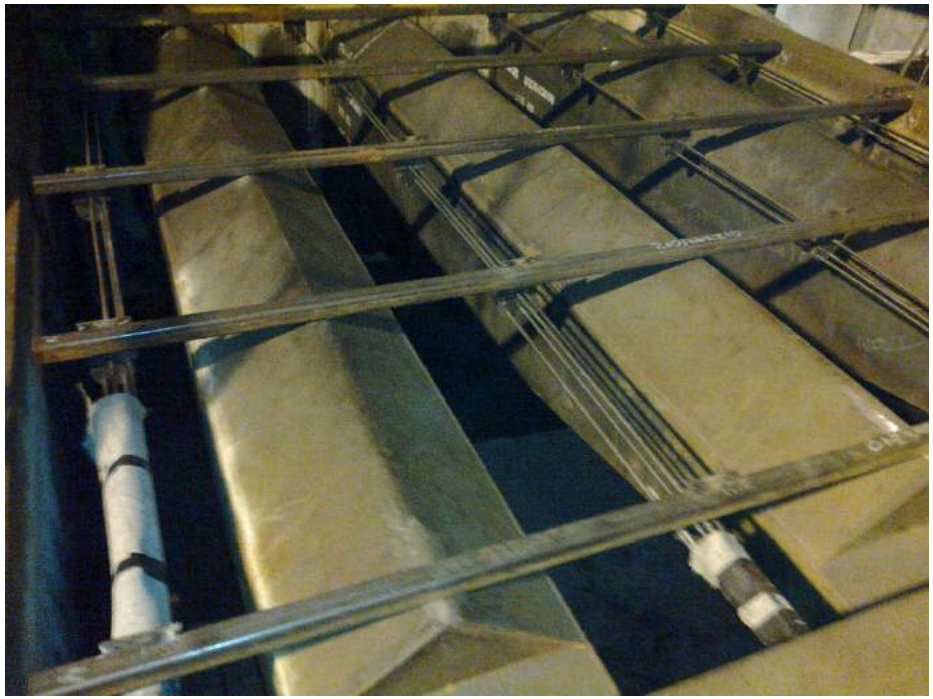




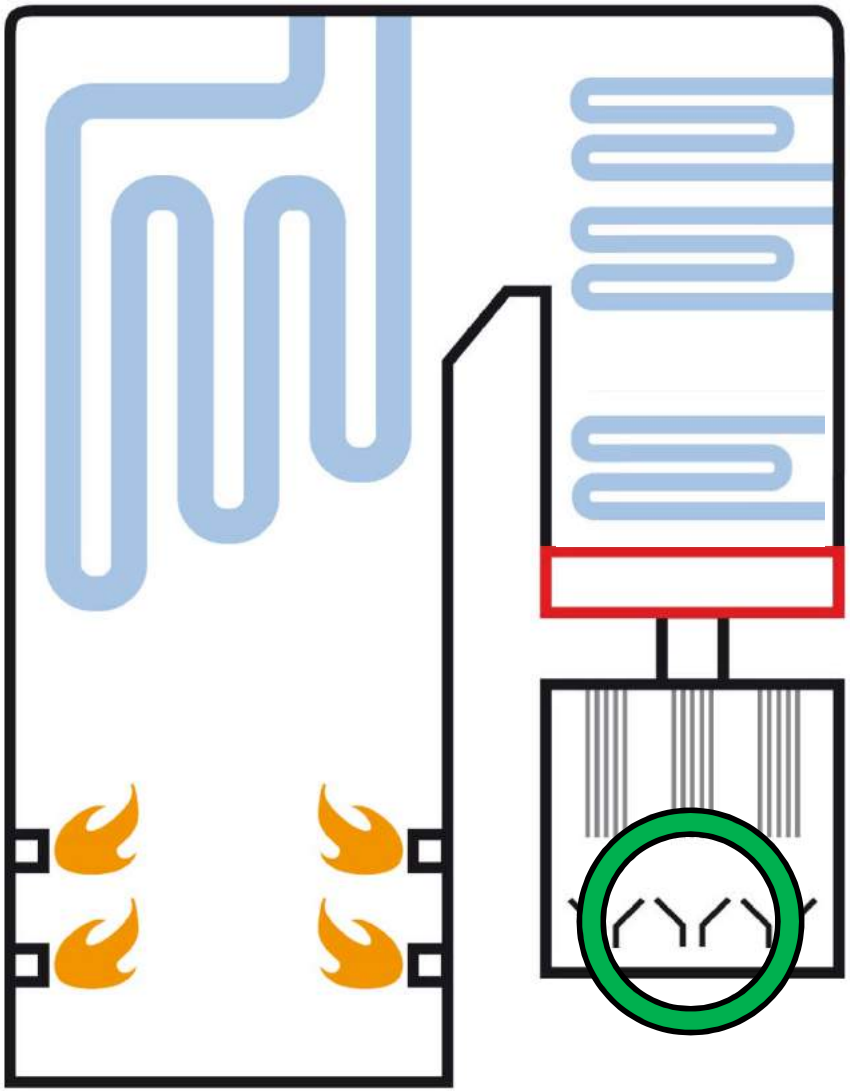
High exit temperature



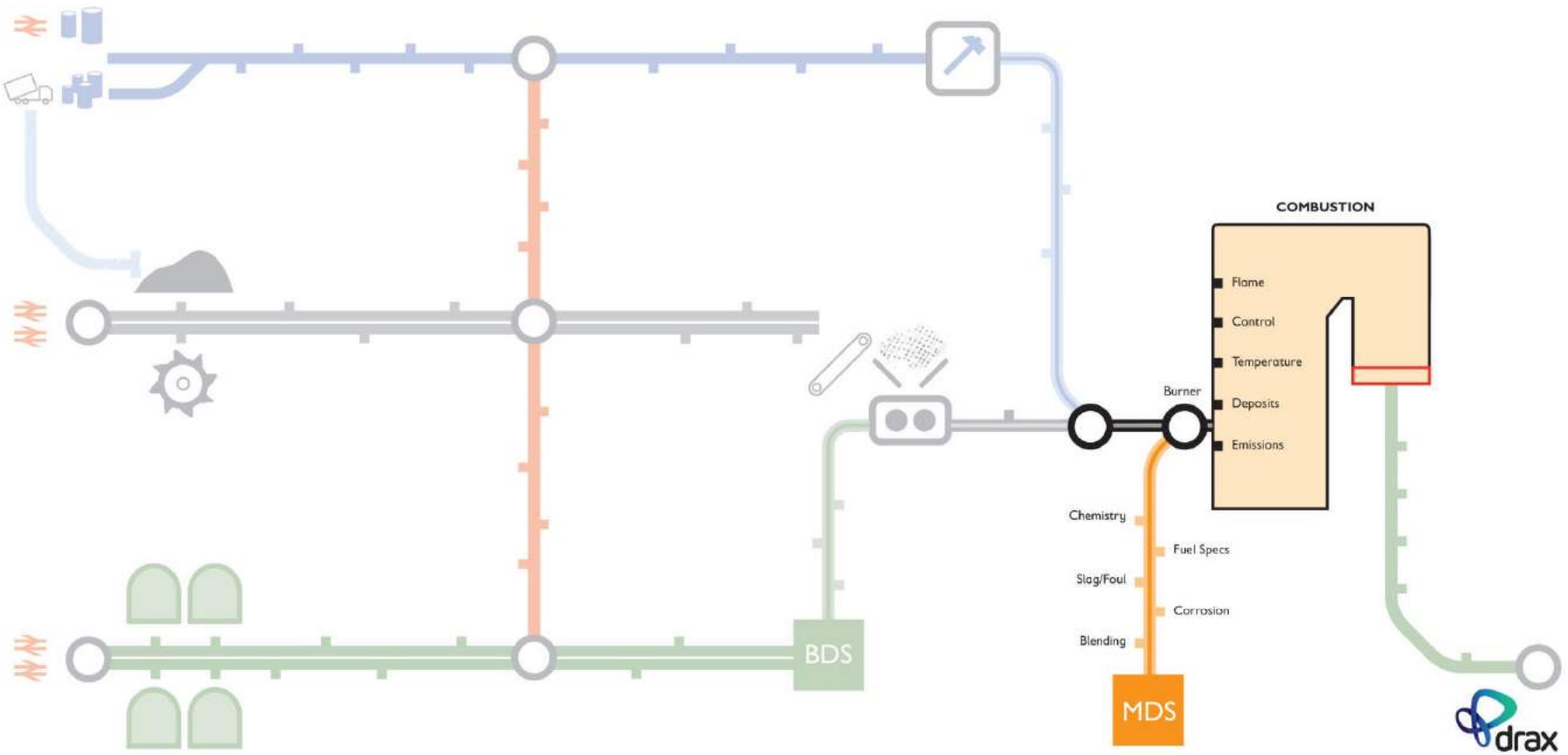
Primary Air Cooler

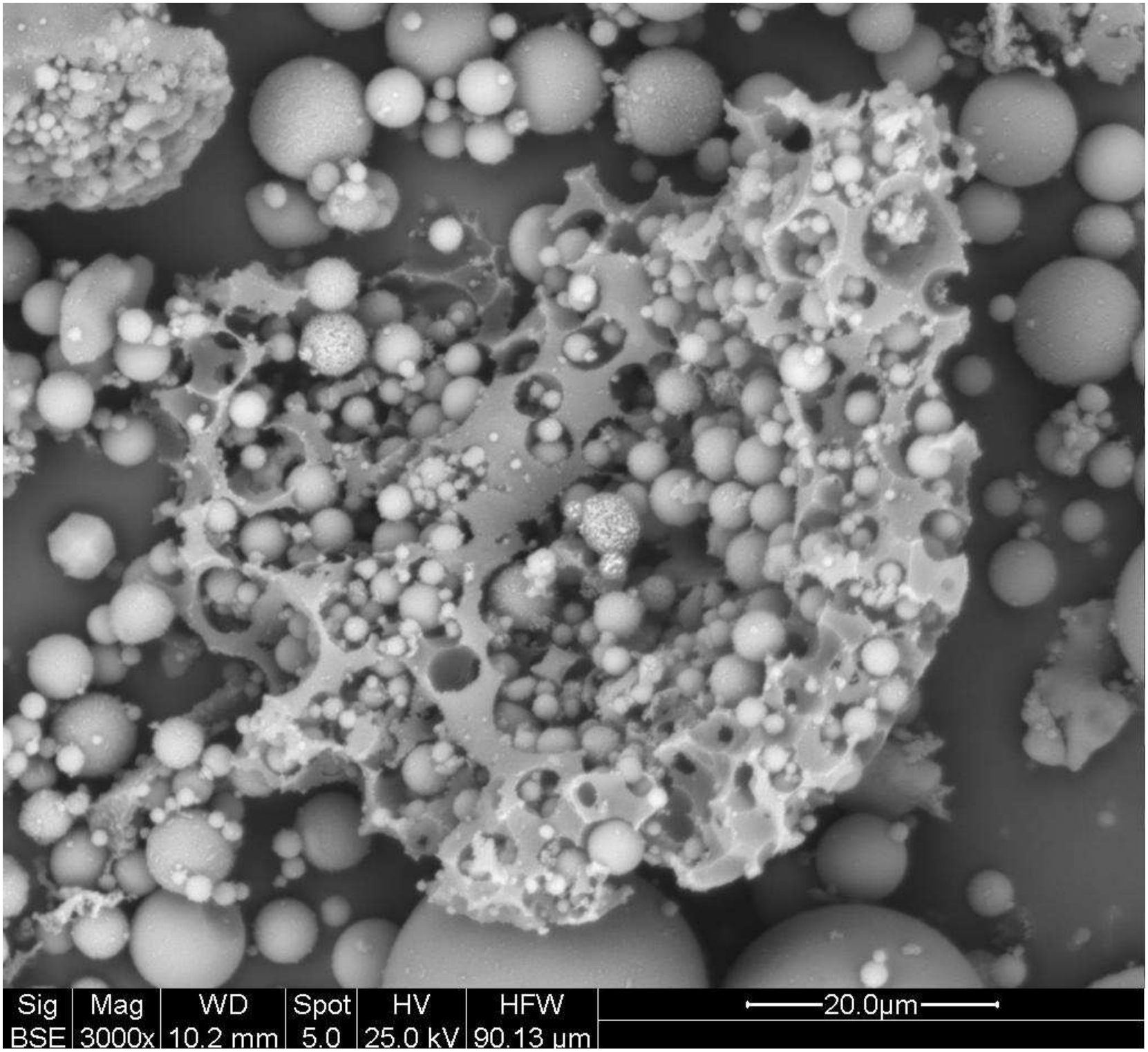


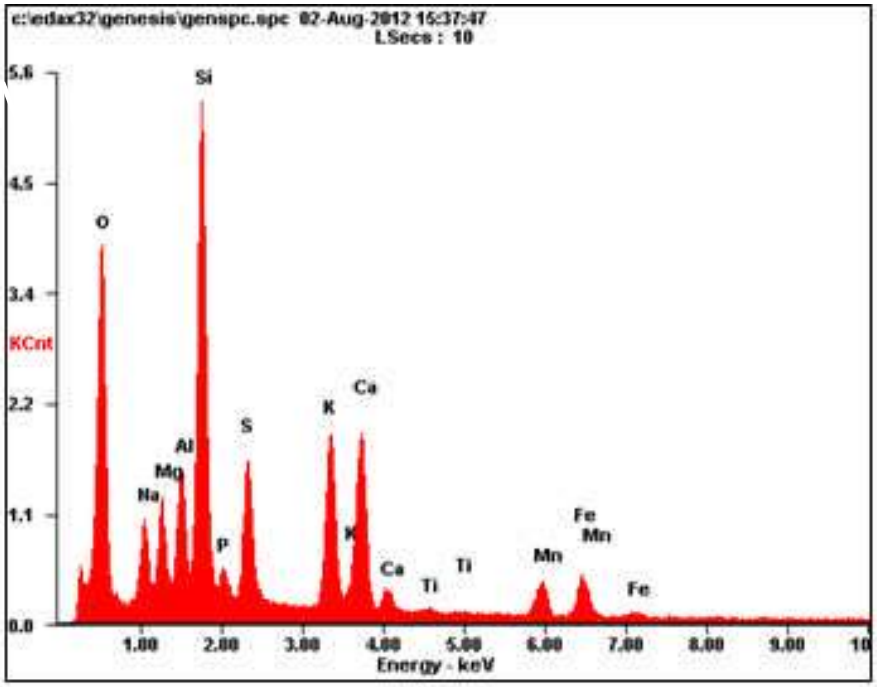
Precipitator fouling



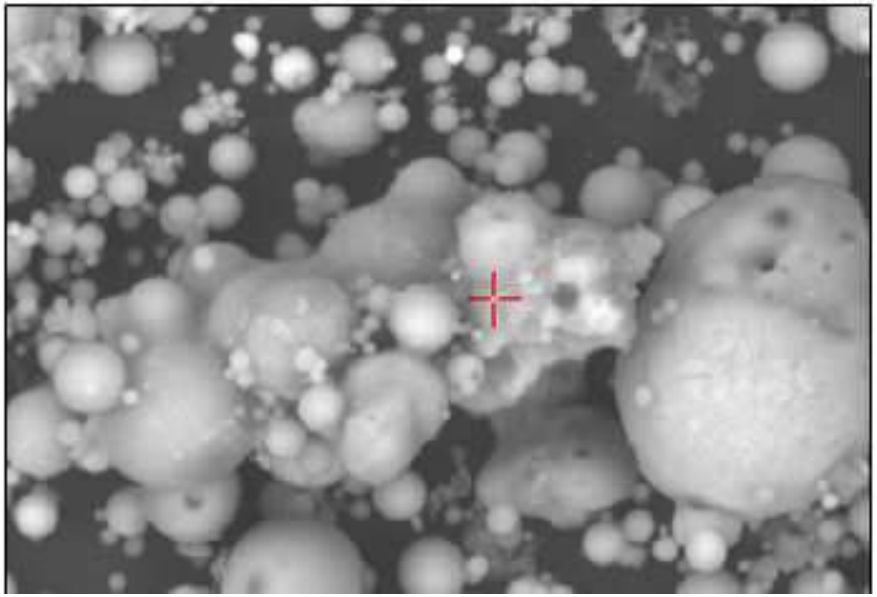
Fuel portfolio chemistry

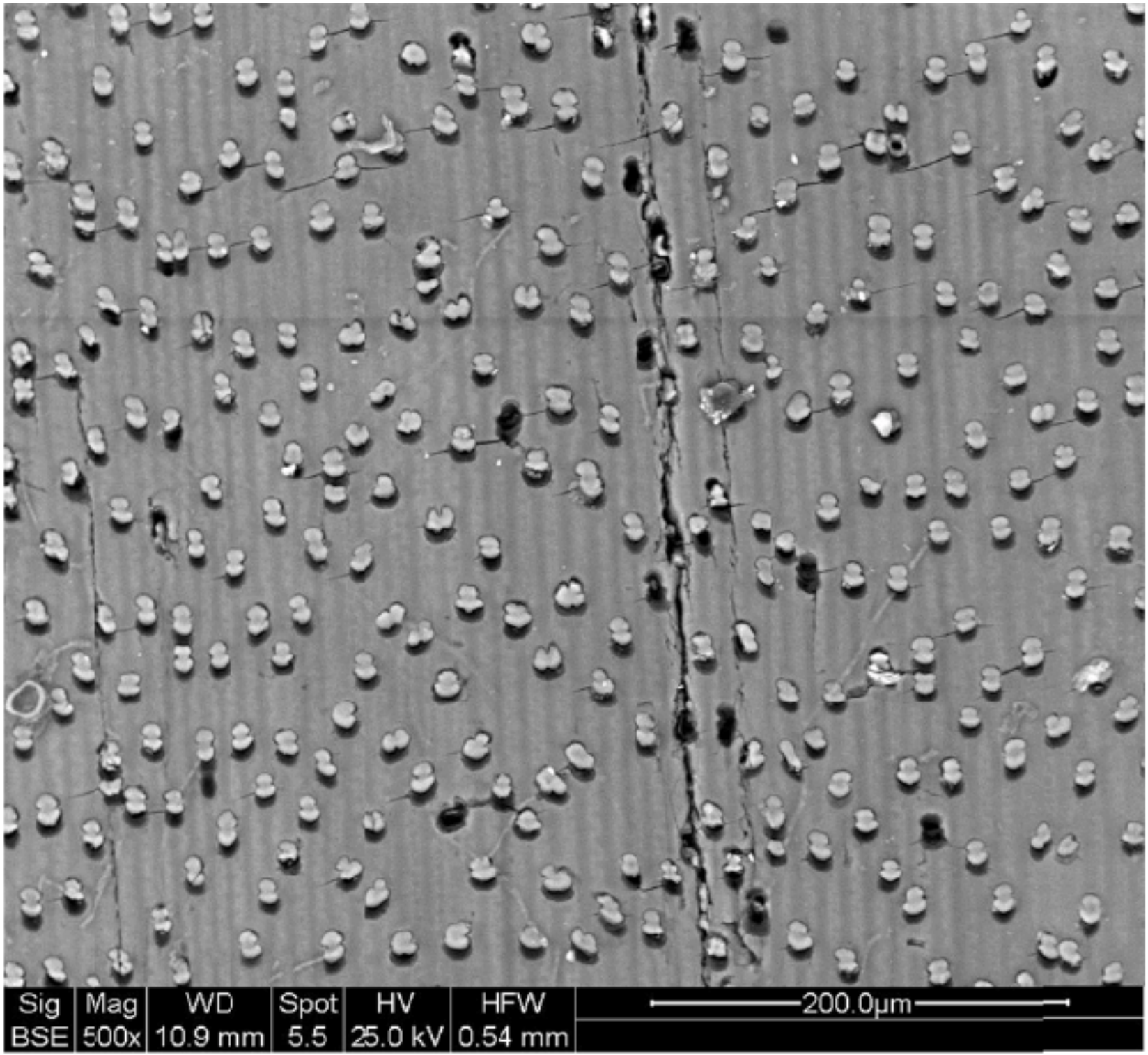



Sig
BSE
Mag
3000x
WD
10.2 mm
Spot
5.0
HV
25.0 kV
HFW
90.13 µm
20.0µm

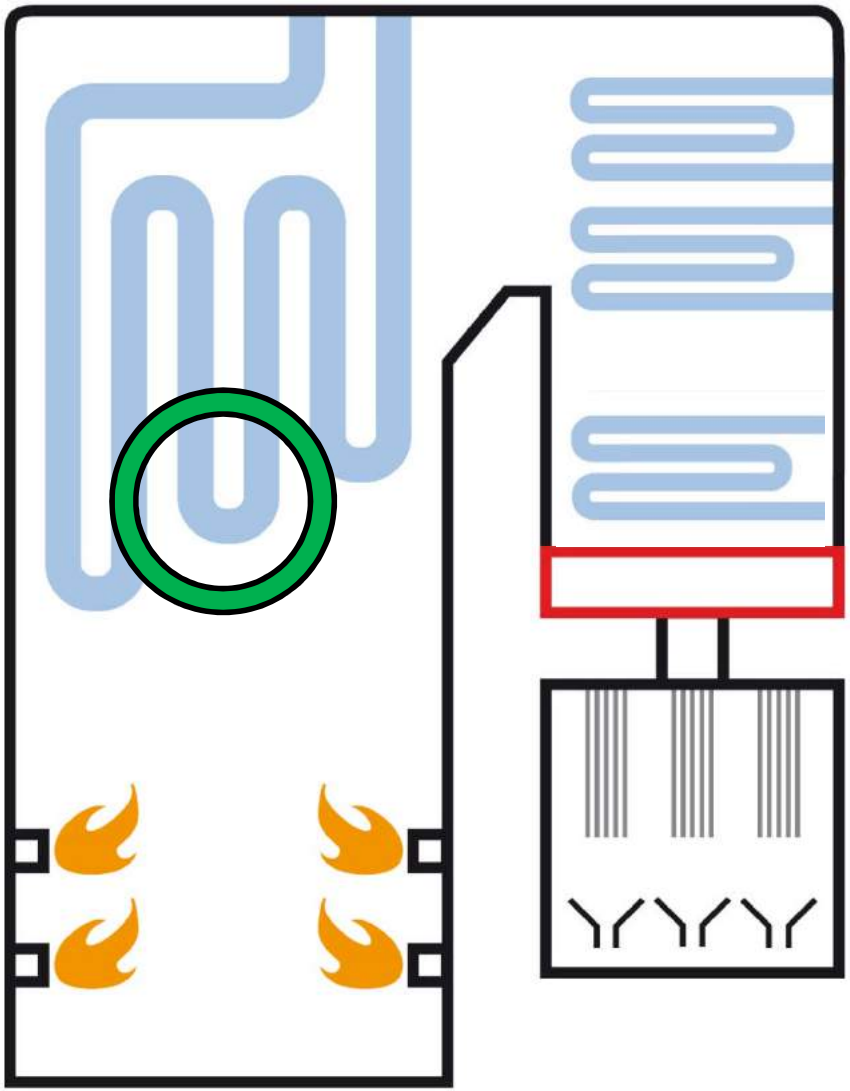


Element	Wt%	At%
OK	54.38	69.57
NaK	04.29	03.82
MgK	04.01	03.37
AlK	04.22	03.20
SiK	13.94	10.16
PK	00.92	00.61
SK	03.86	02.46
KK	04.95	02.59
CaK	05.13	02.62
TiK	00.09	00.04
MnK	01.87	00.70
FeK	02.33	00.85
Matrix	Correction	ZAF

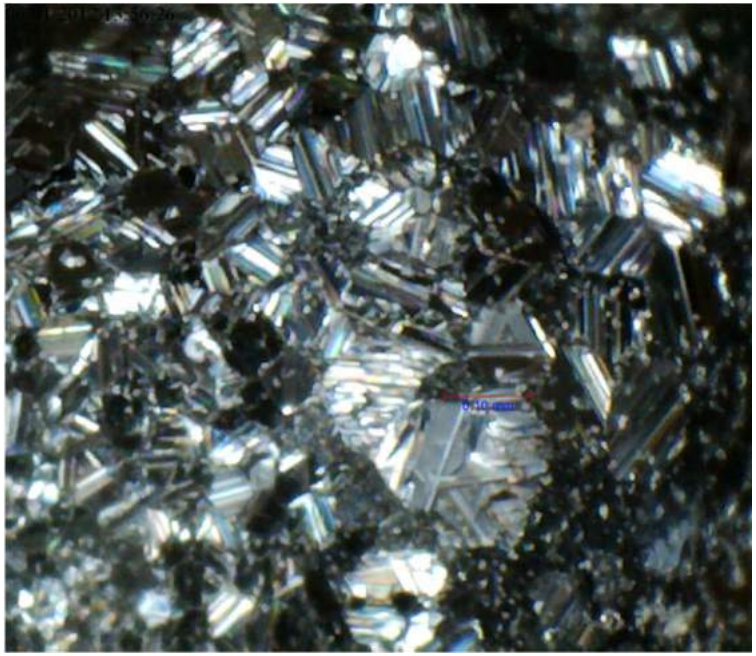


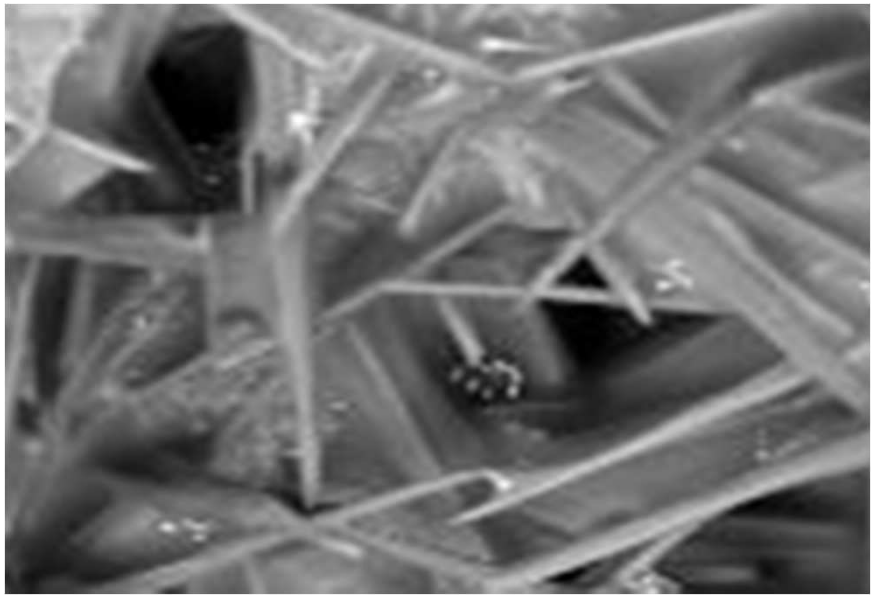

Sig
BSE
Mag
500x
WD
10.9 mm
Spot
5.5
HV
25.0 kV
HFW
0.54 mm
200.0µm

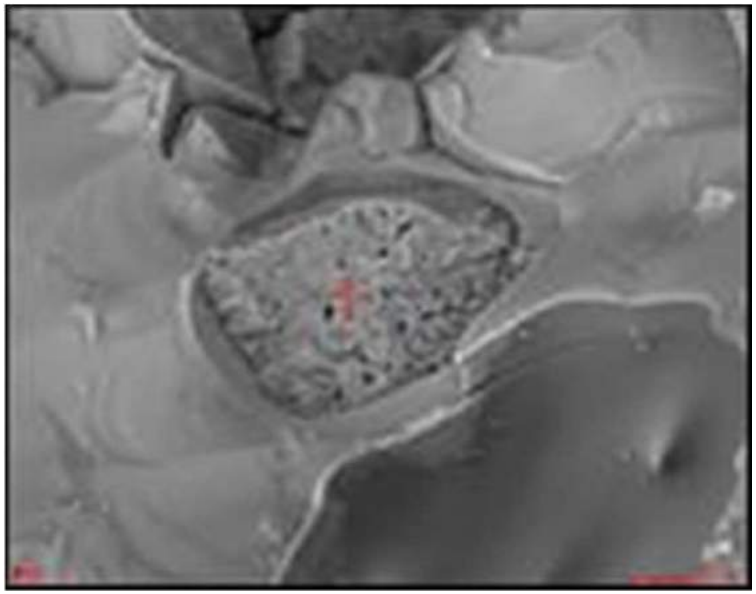
Additive trials



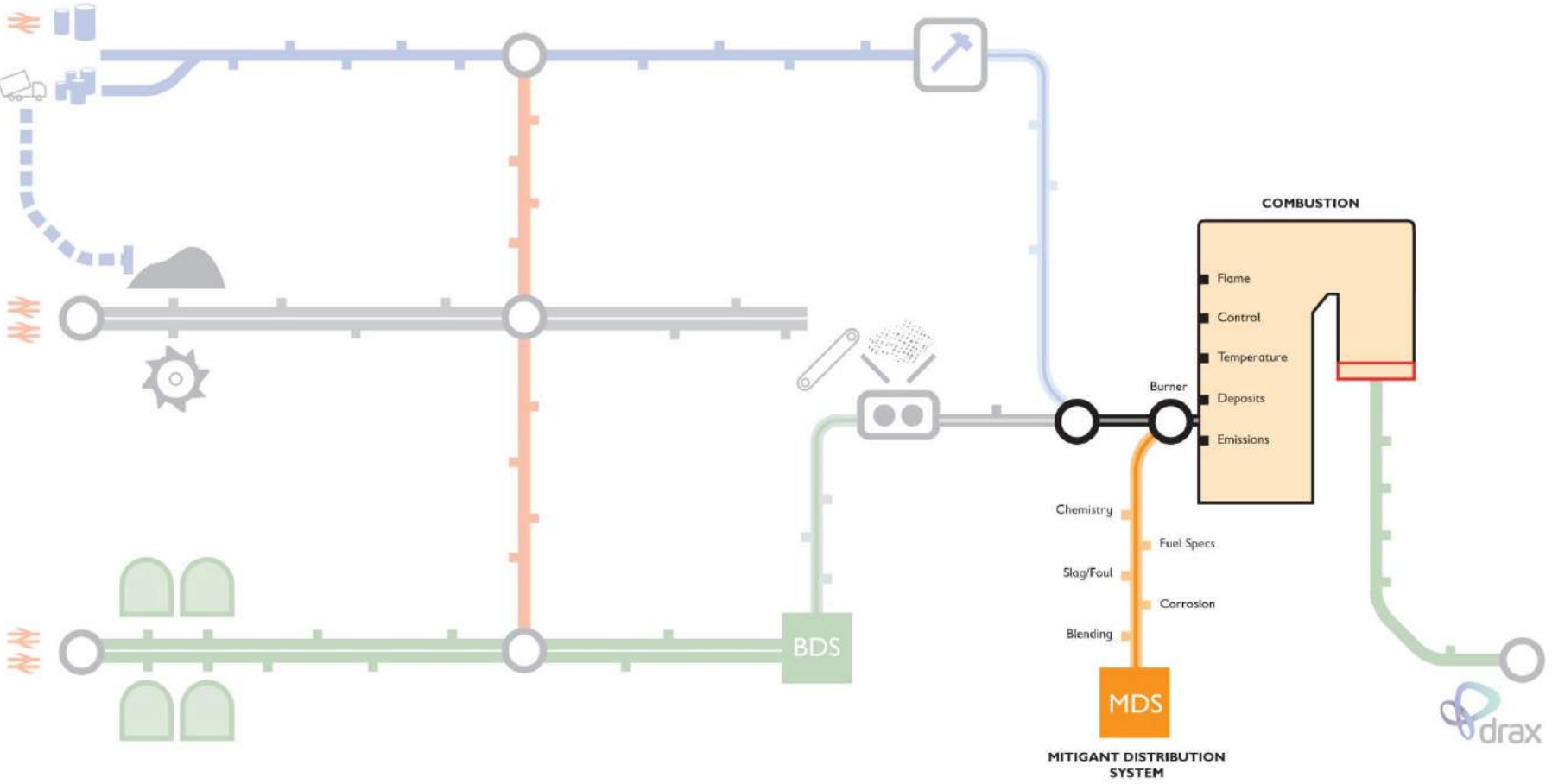
Additive “trials”

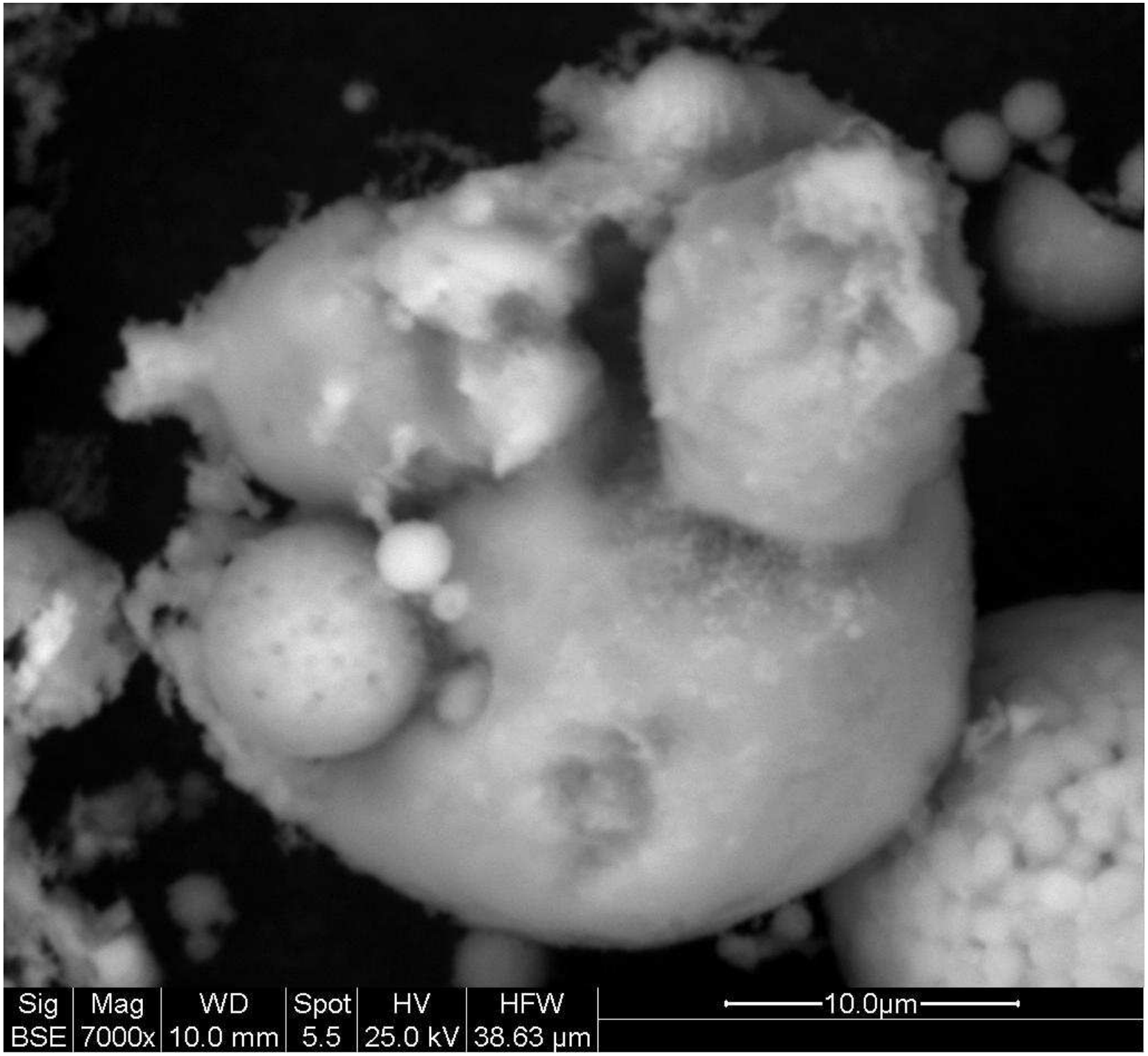




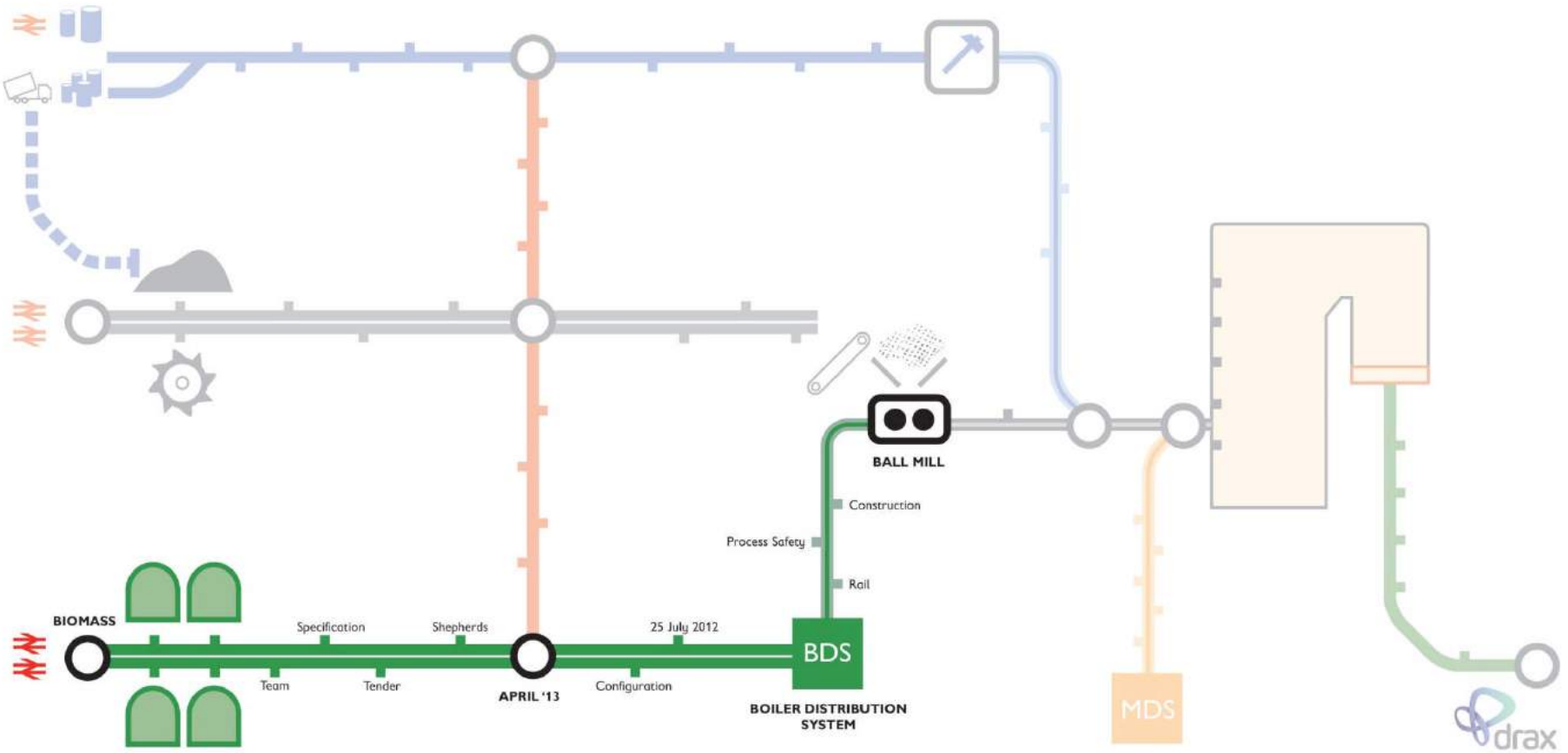


Fuel portfolio chemistry




Sig
BSE
Mag
7000x
WD
10.0 mm
Spot
5.5
HV
25.0 kV
HFW
38.63 µm
10.0µm

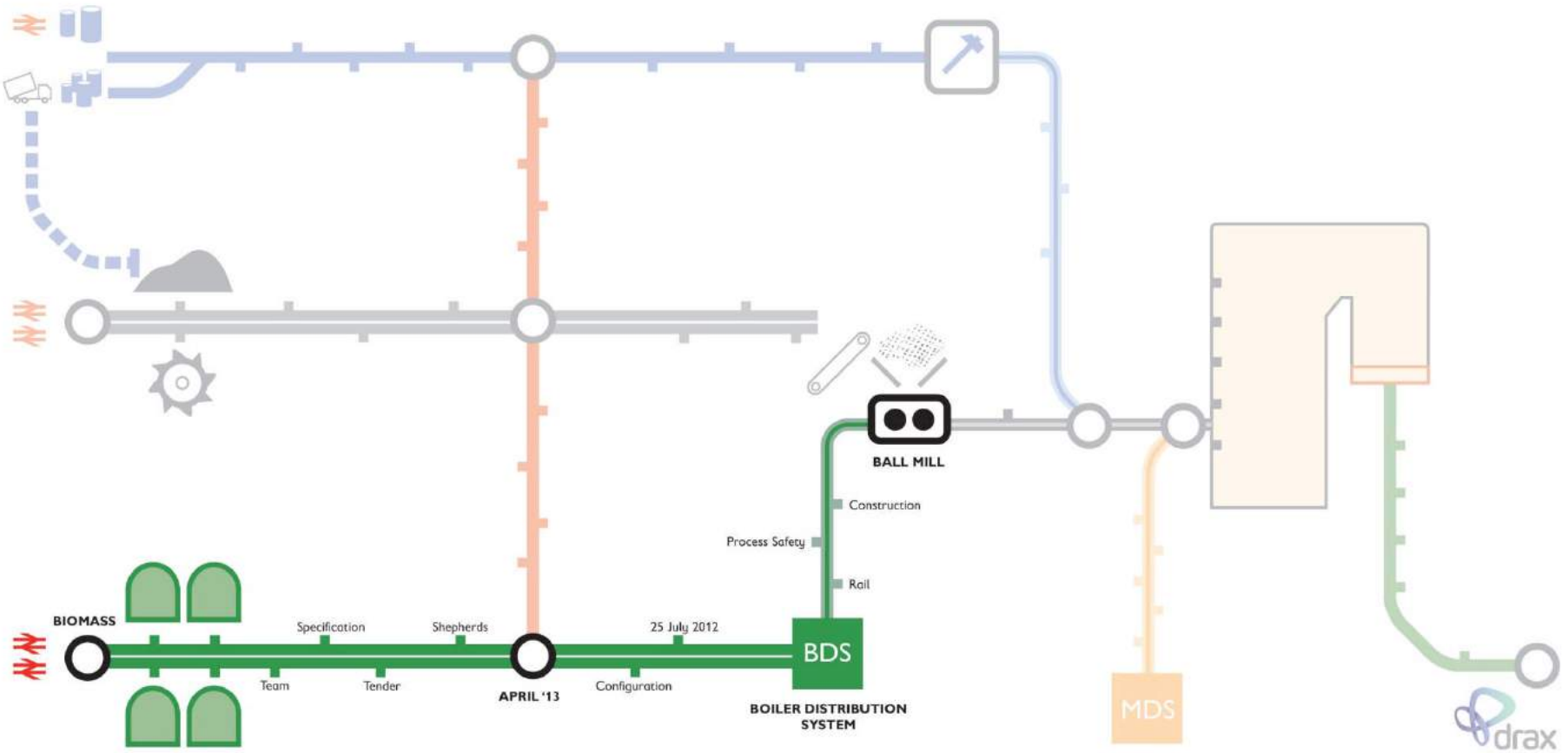
Ecostore & Boiler Distribution System



Tender process


Portasilo
Bulk Handling Systems
ERIEZ
ATKINS
Roofdec Ltd
Trackwork
Volker
AIR PRODUCTS
capula
HARE
SES
ABB
ABB Limited
Hanover Place
Sunderland
SR4 6BY
ROBSON
HANDLING TECHNOLOGY
billington
TEi
Shepherd
SKM
RPS
TUNRA
BULK SOLIDS
chenckprocess
METFABS
making metal - work
DOME
TECHNOLOGY
H&K
HIGH PEAK
ROOFDEC LIMITED
BRAITHWELL WAY,
HELLABY INDUSTRIAL ESTATE,
ROTHERHAM S66 8QY.
TEL: 01709 546421
FAX: 01709 701409
E-MAIL: jay@roofdec.com

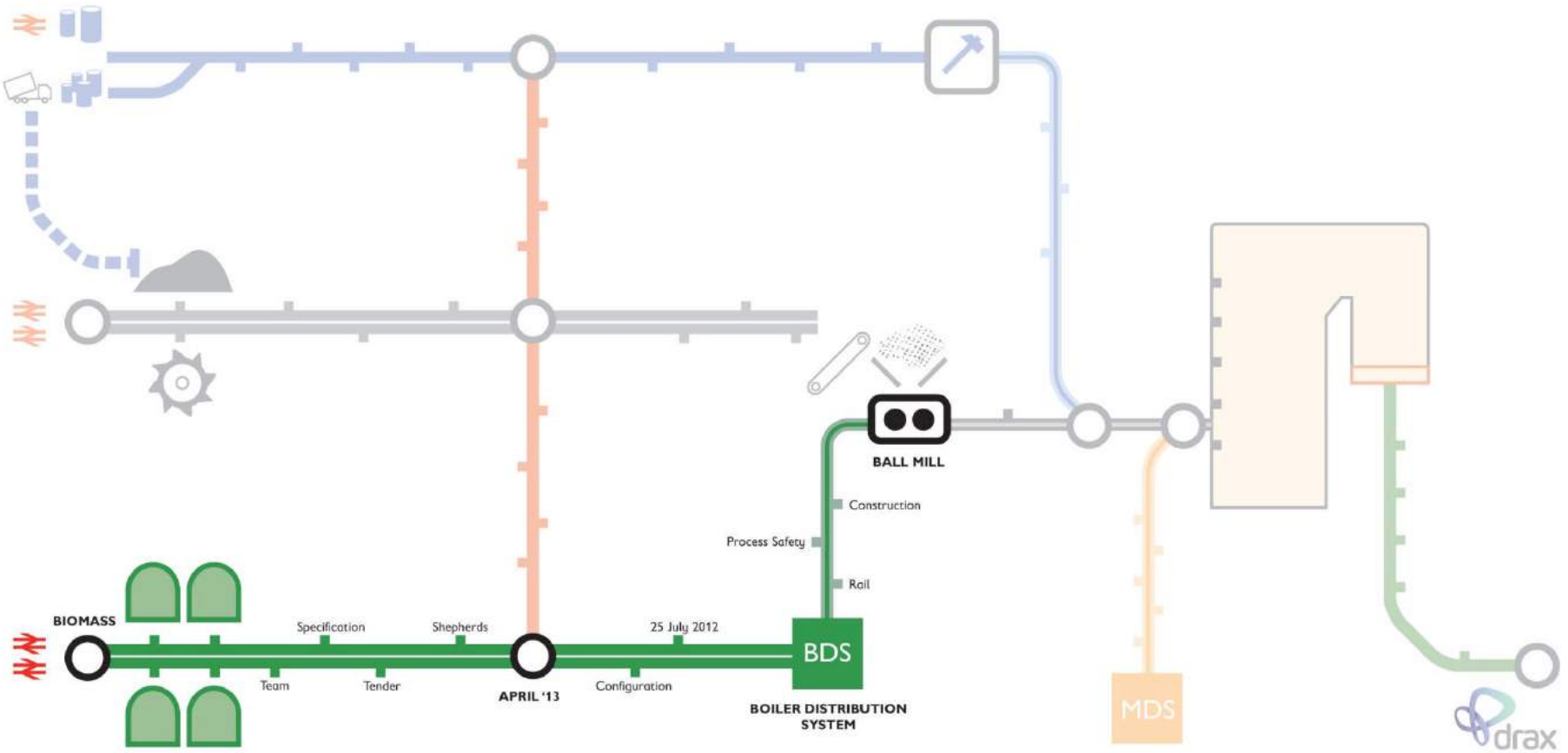
Ecostore & Boiler Distribution System



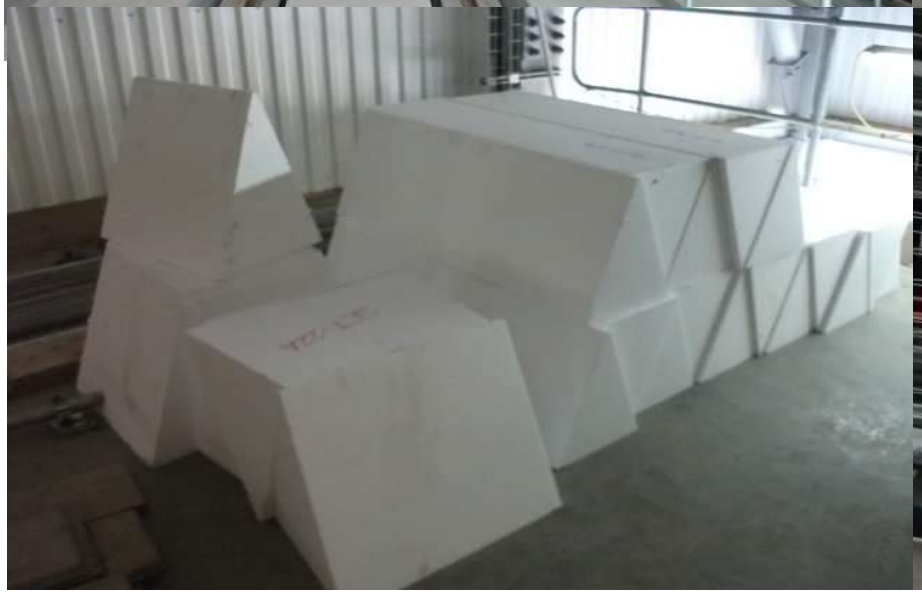

CAT
HEWDEN

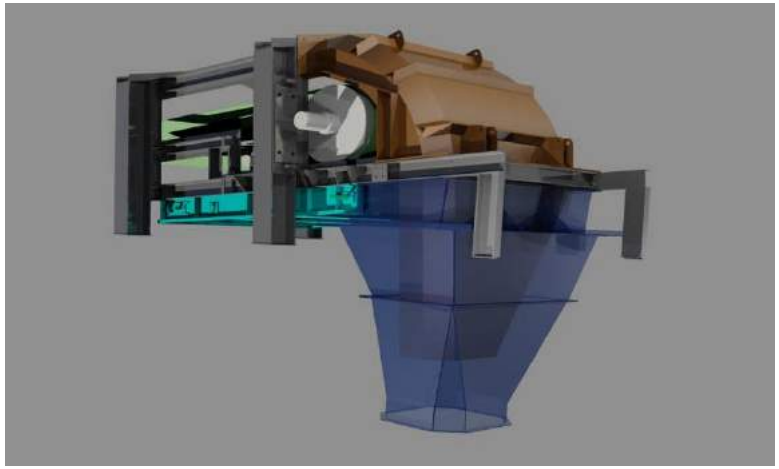

STOP

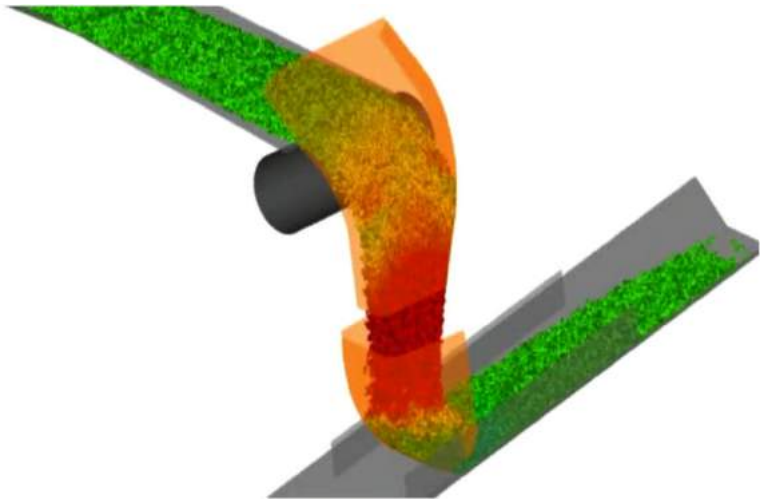
Ecostore & Boiler Distribution System

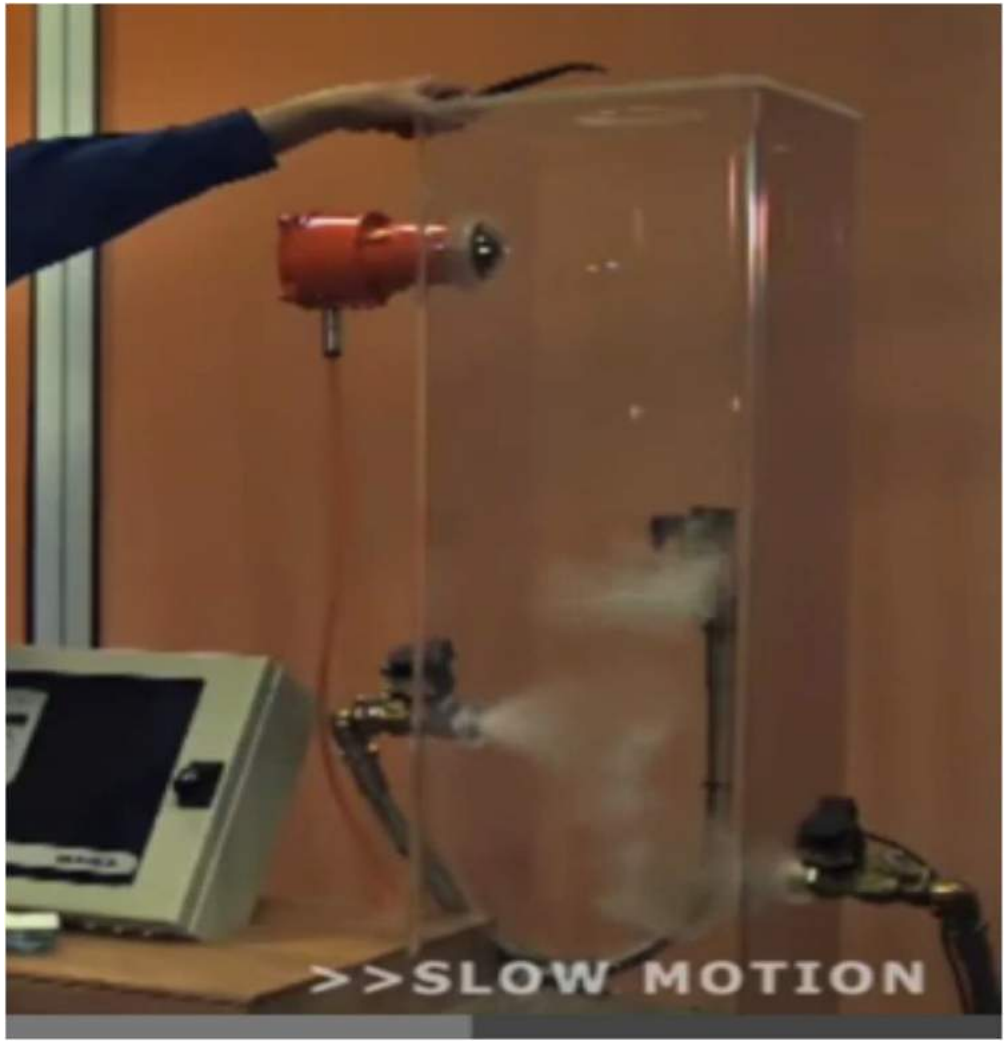


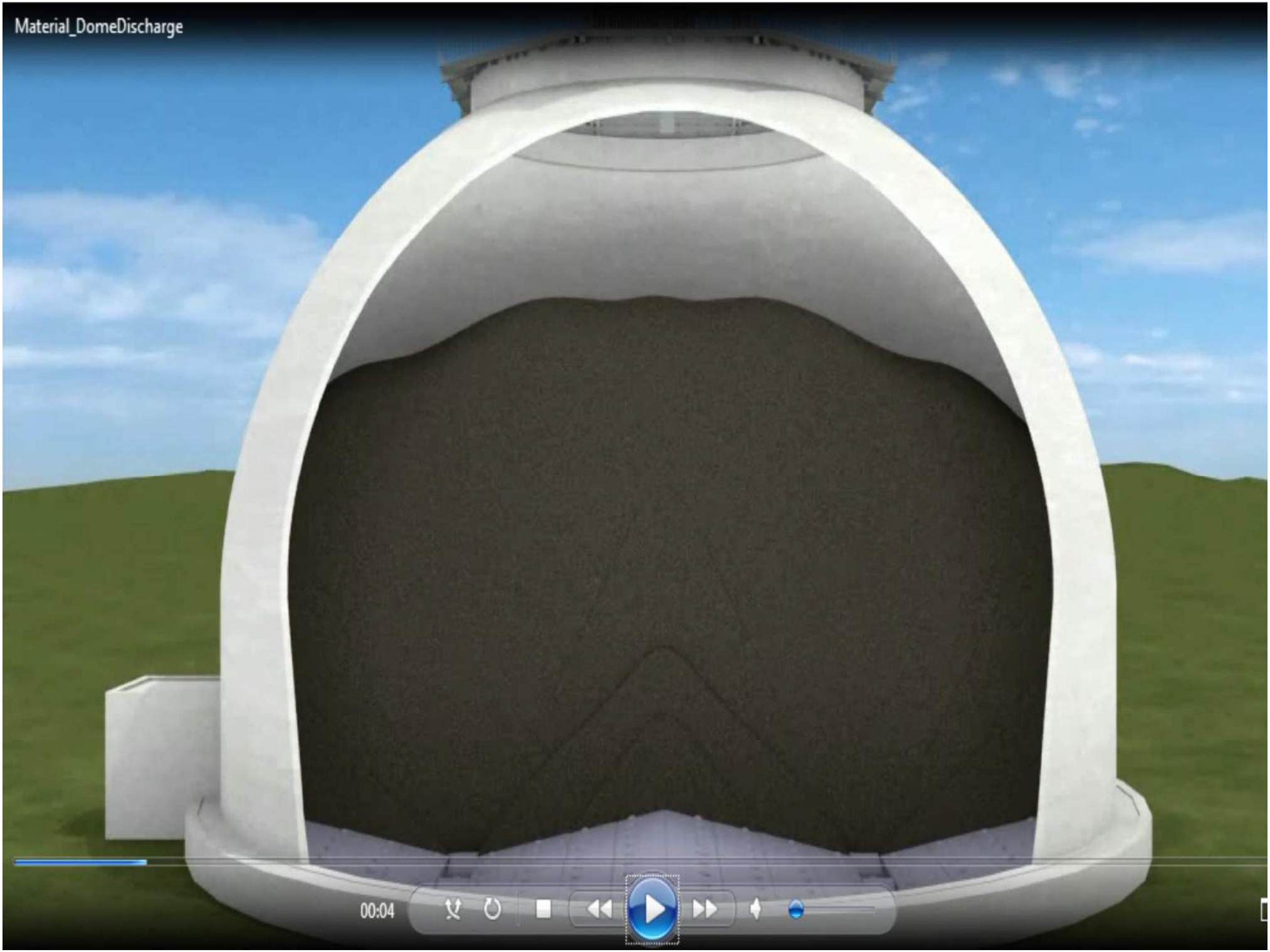

BC34



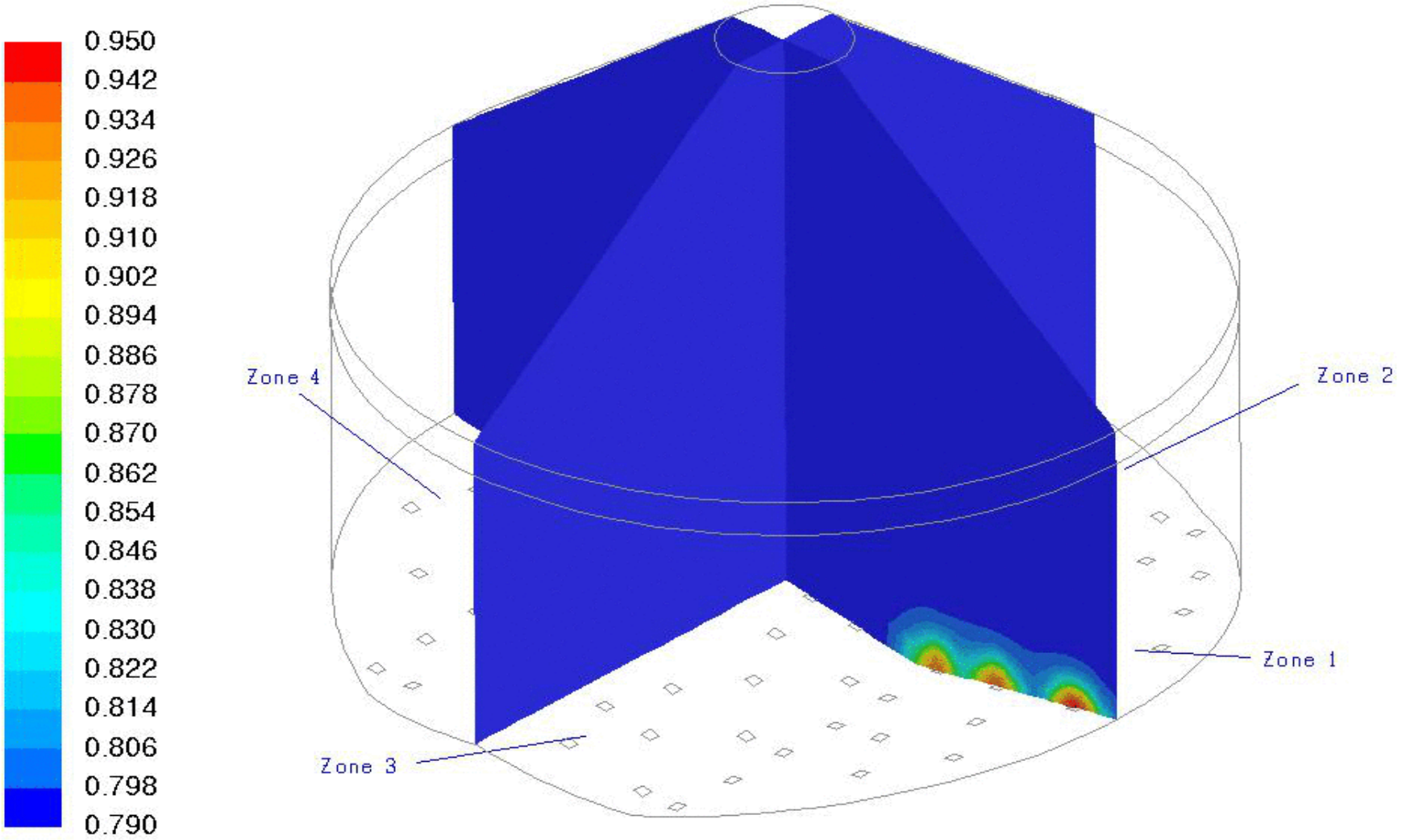




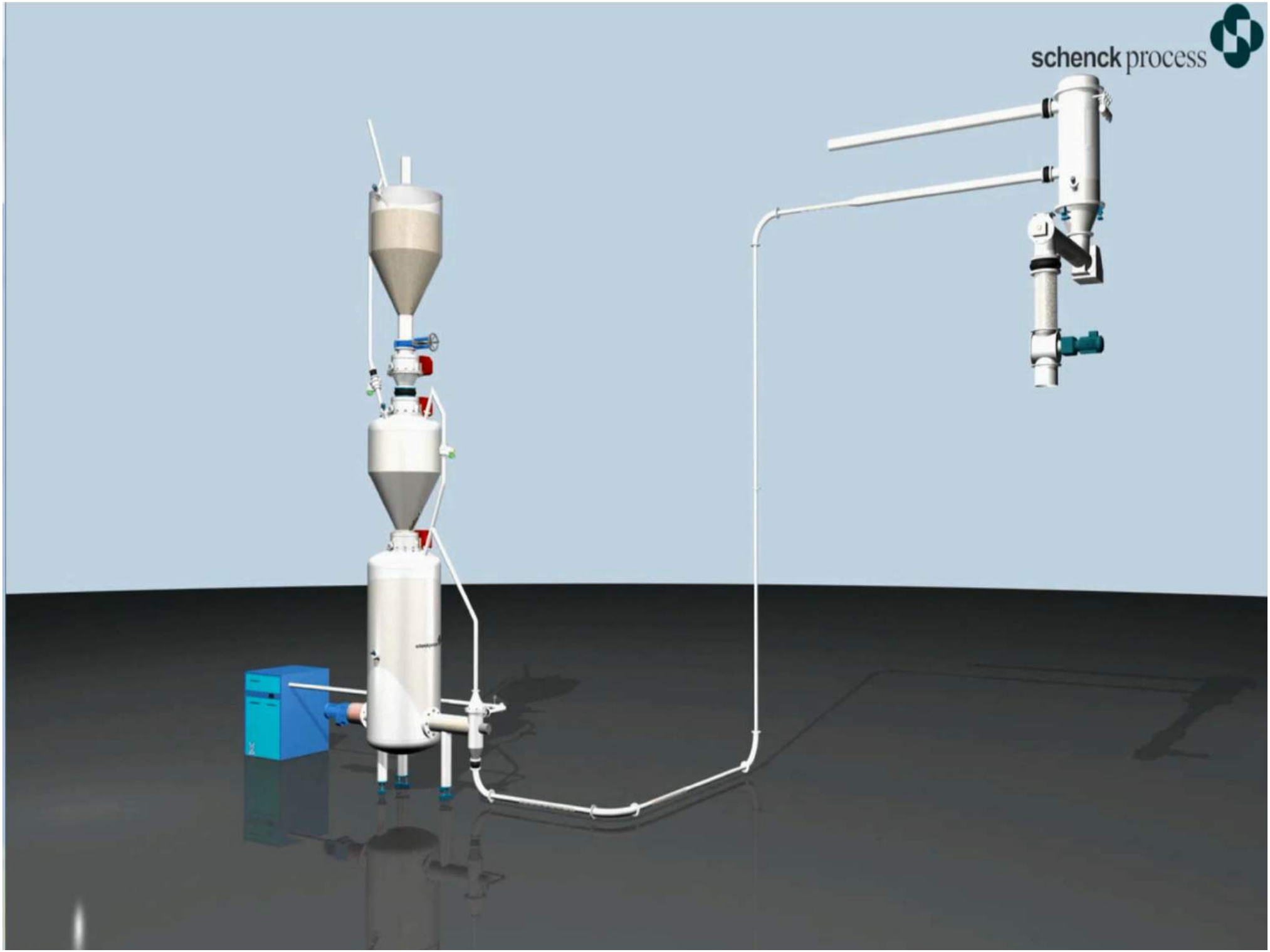

>>SLOW MOTION


Material_DomeDischarge
00:04


CO2 snow horn shorter 14.6.13

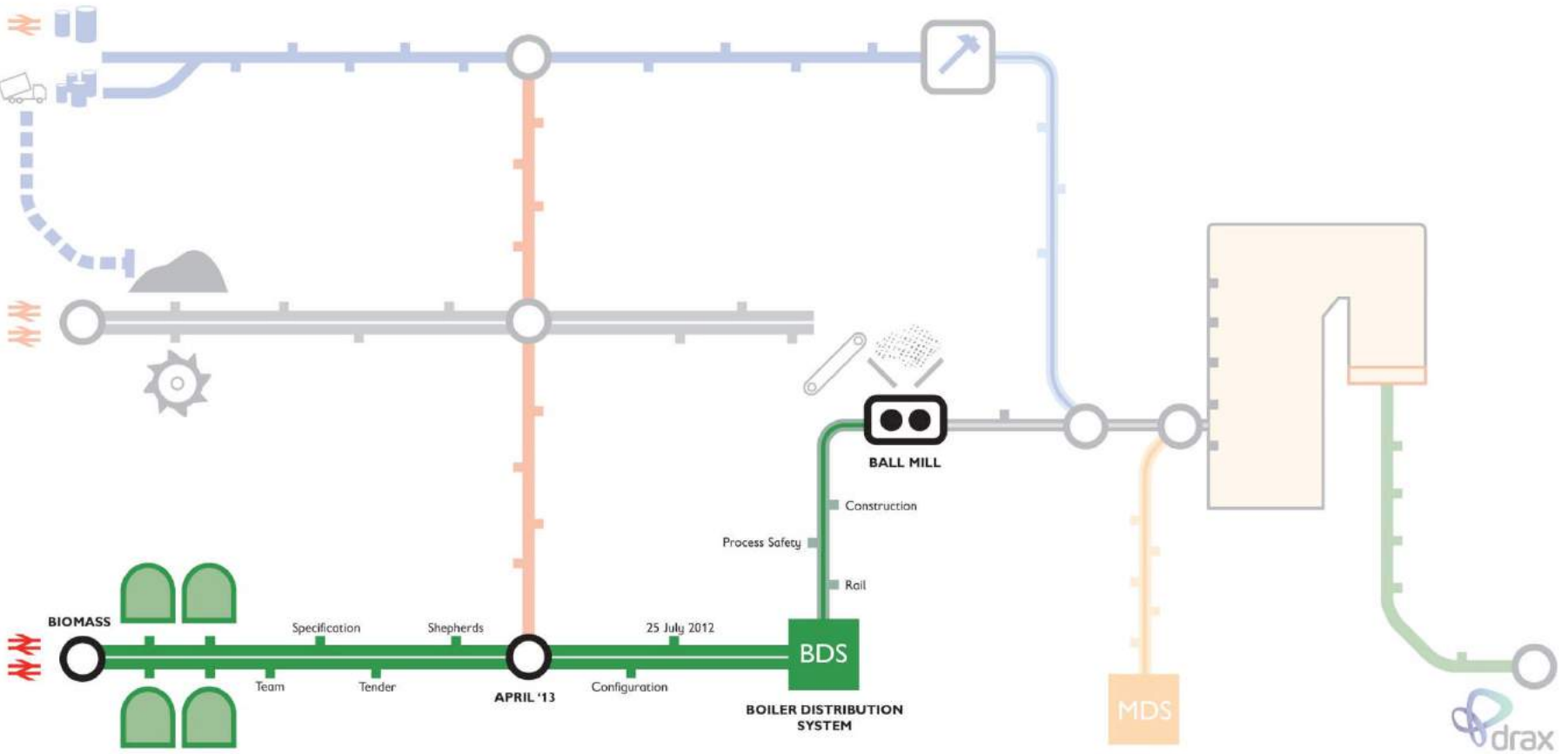


Contours of Mole fraction of n2 (Time=6.0000e+02)
0.17 hours


schenck process

Construction

From start to commissioning….




REILLY


SHEET PILING (UK) LTD
01772 794141

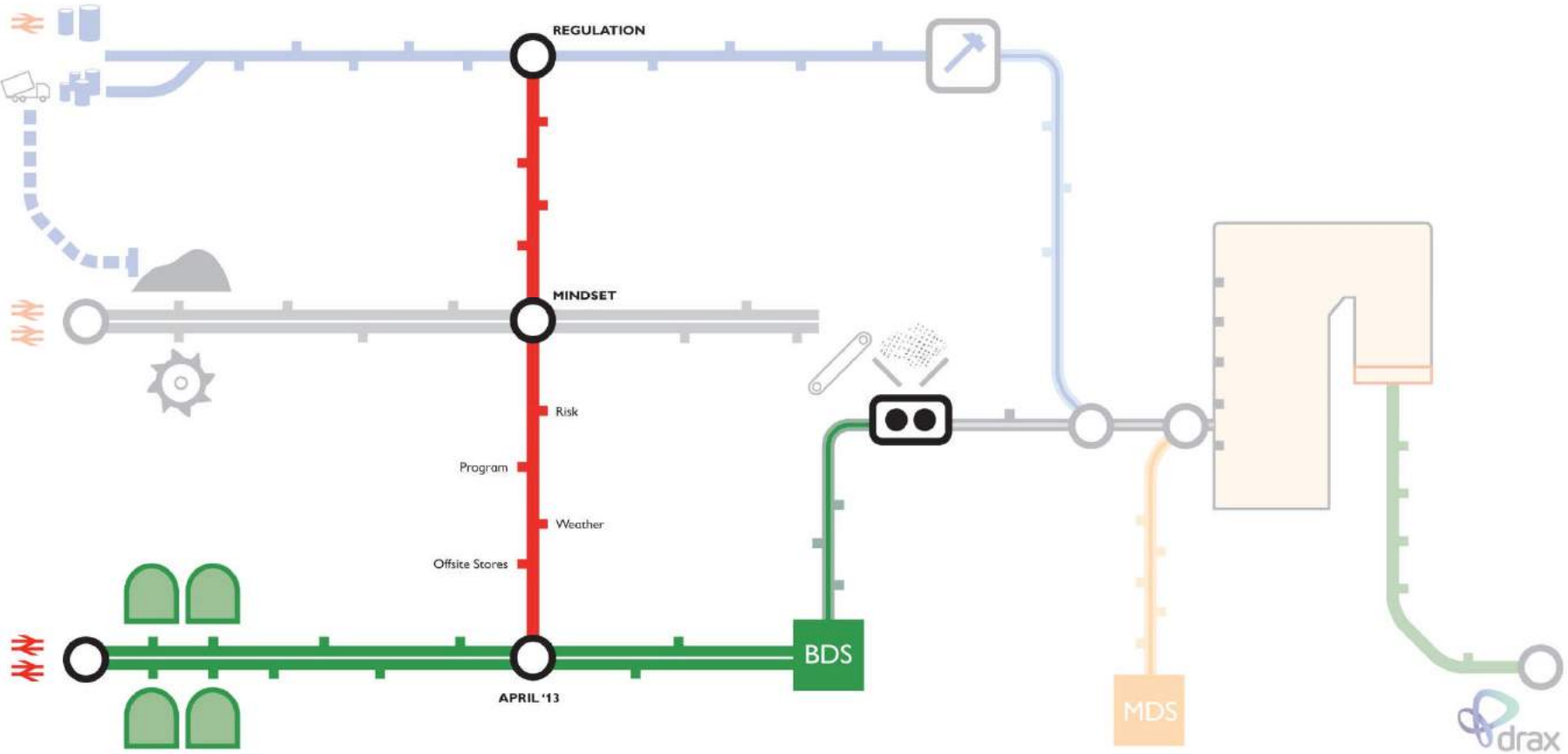

COMPLETE


JCB


JKL

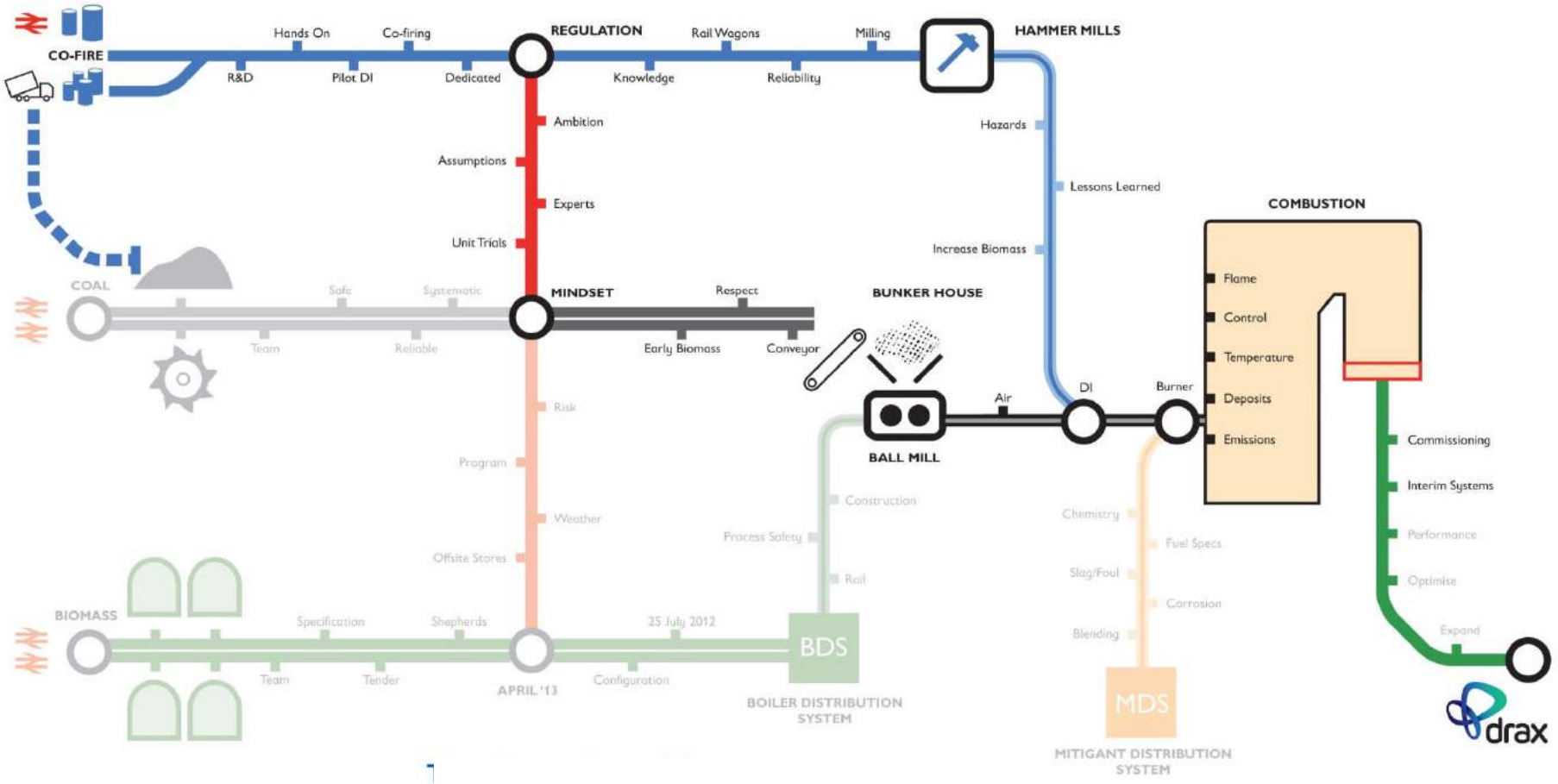
Today

Program risk management



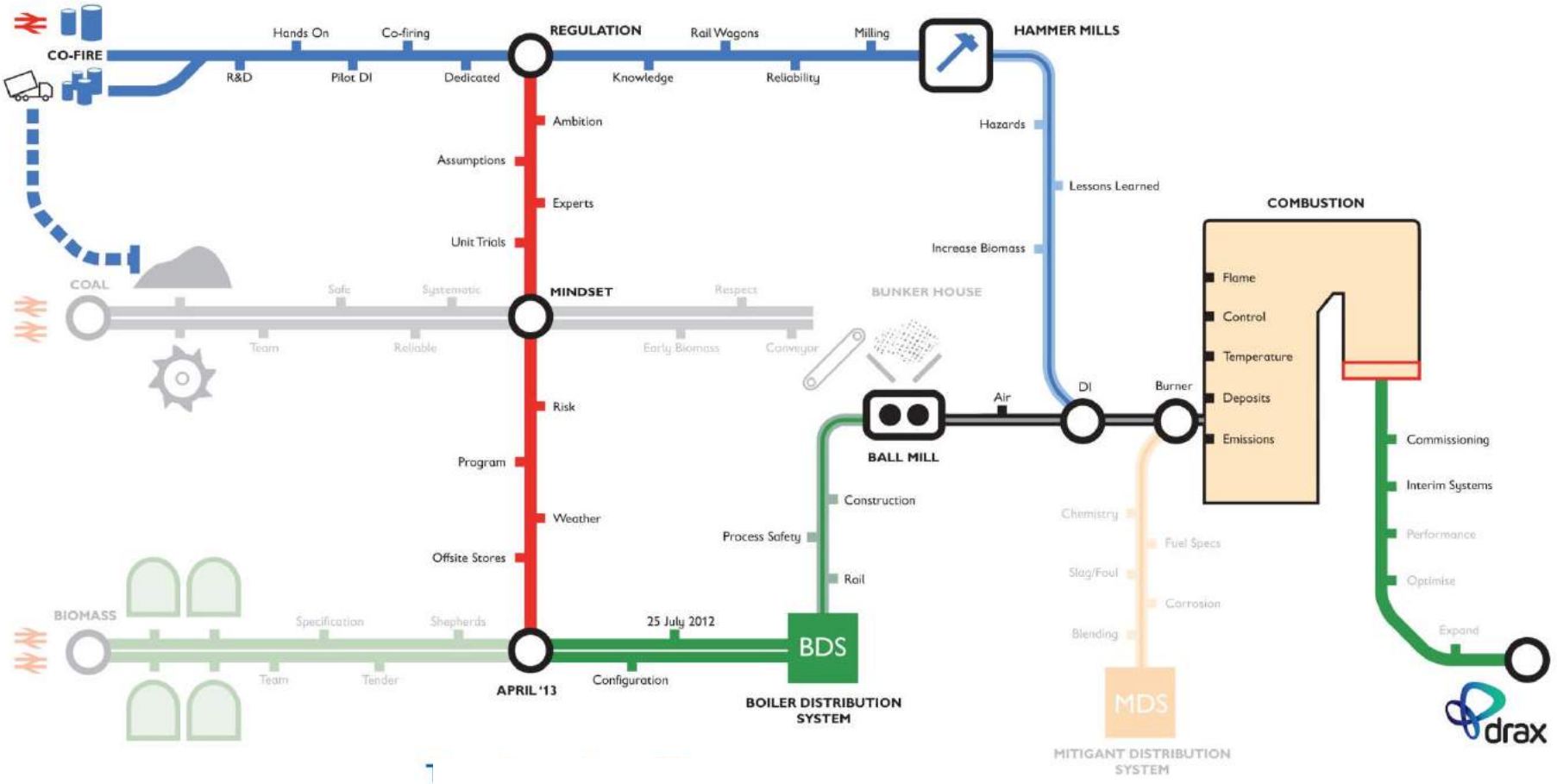
Commissioning

Interim systems 1



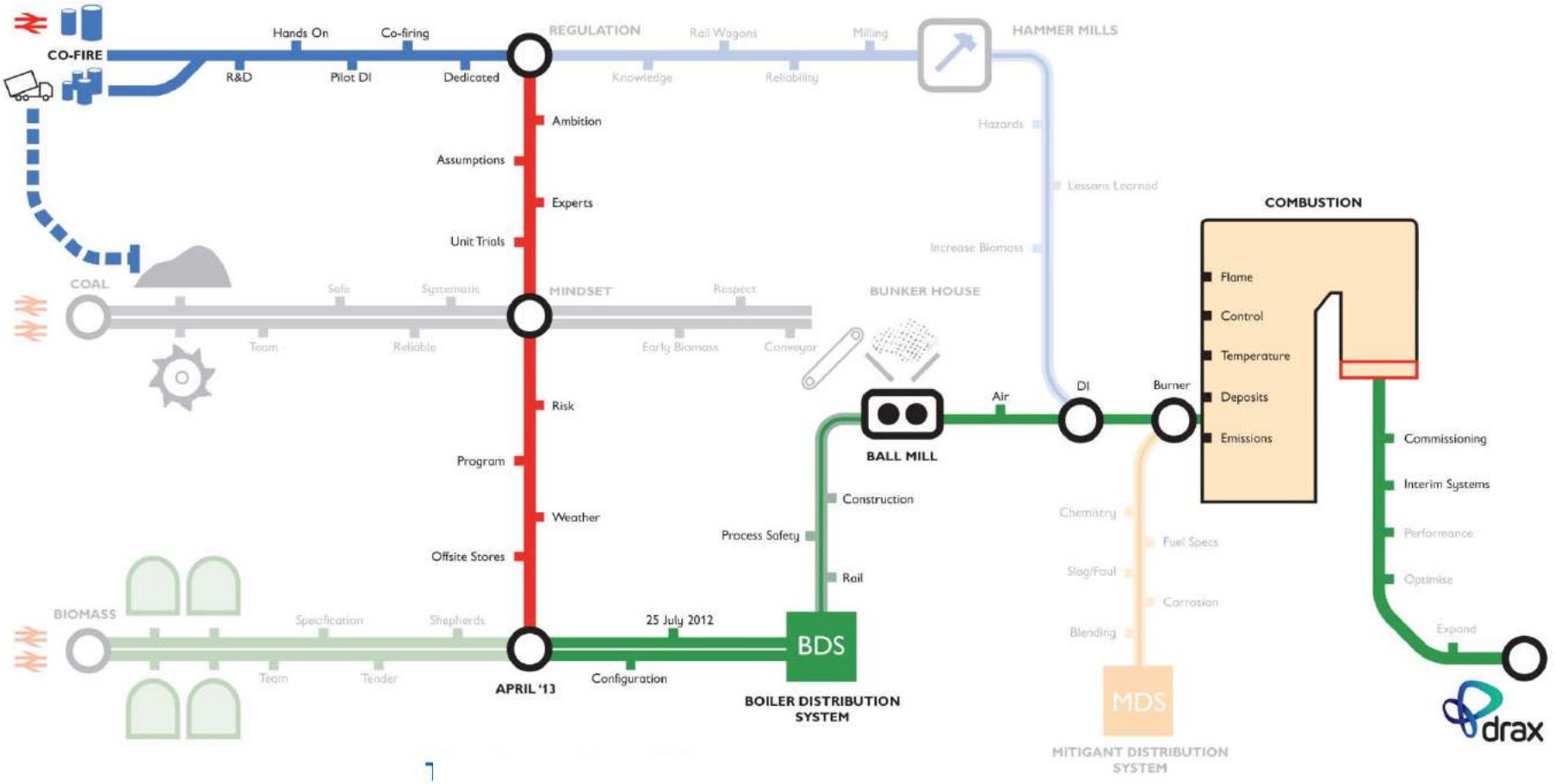
Commissioning

Interim systems 2



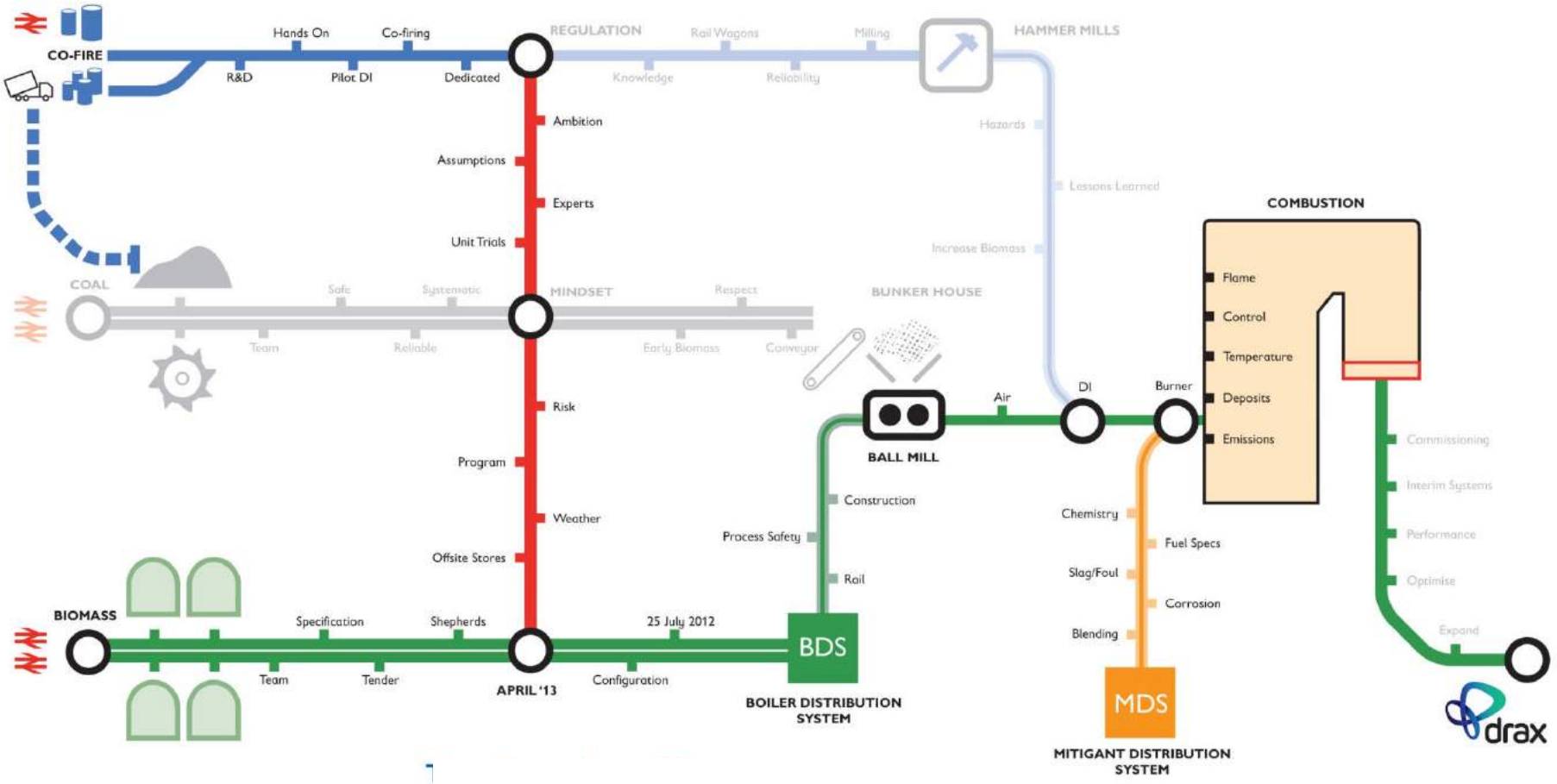
Commissioning

Interim systems 3



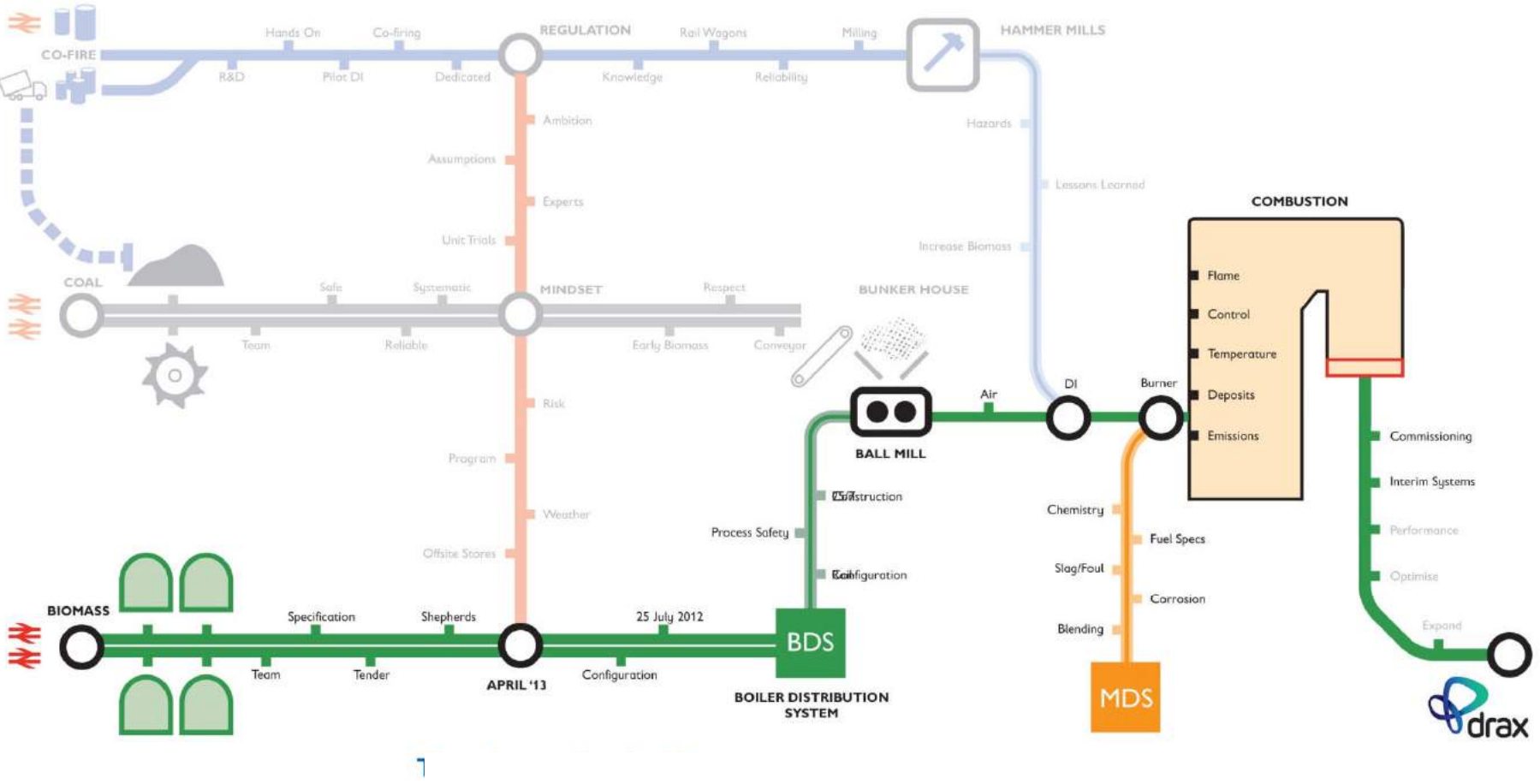
Commissioning

Interim systems 4



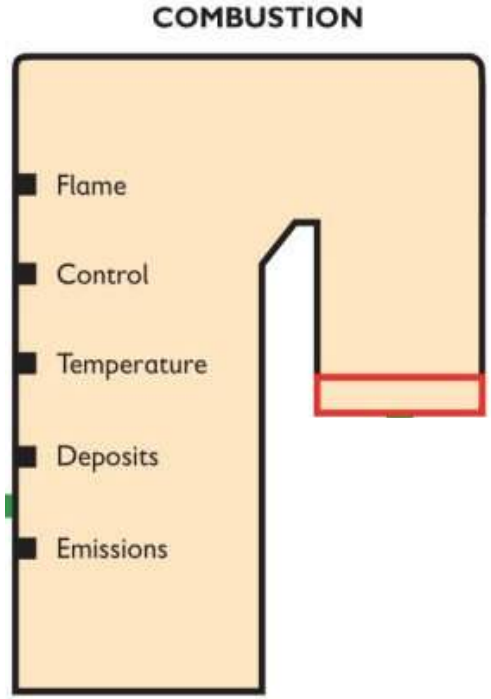
Commissioning

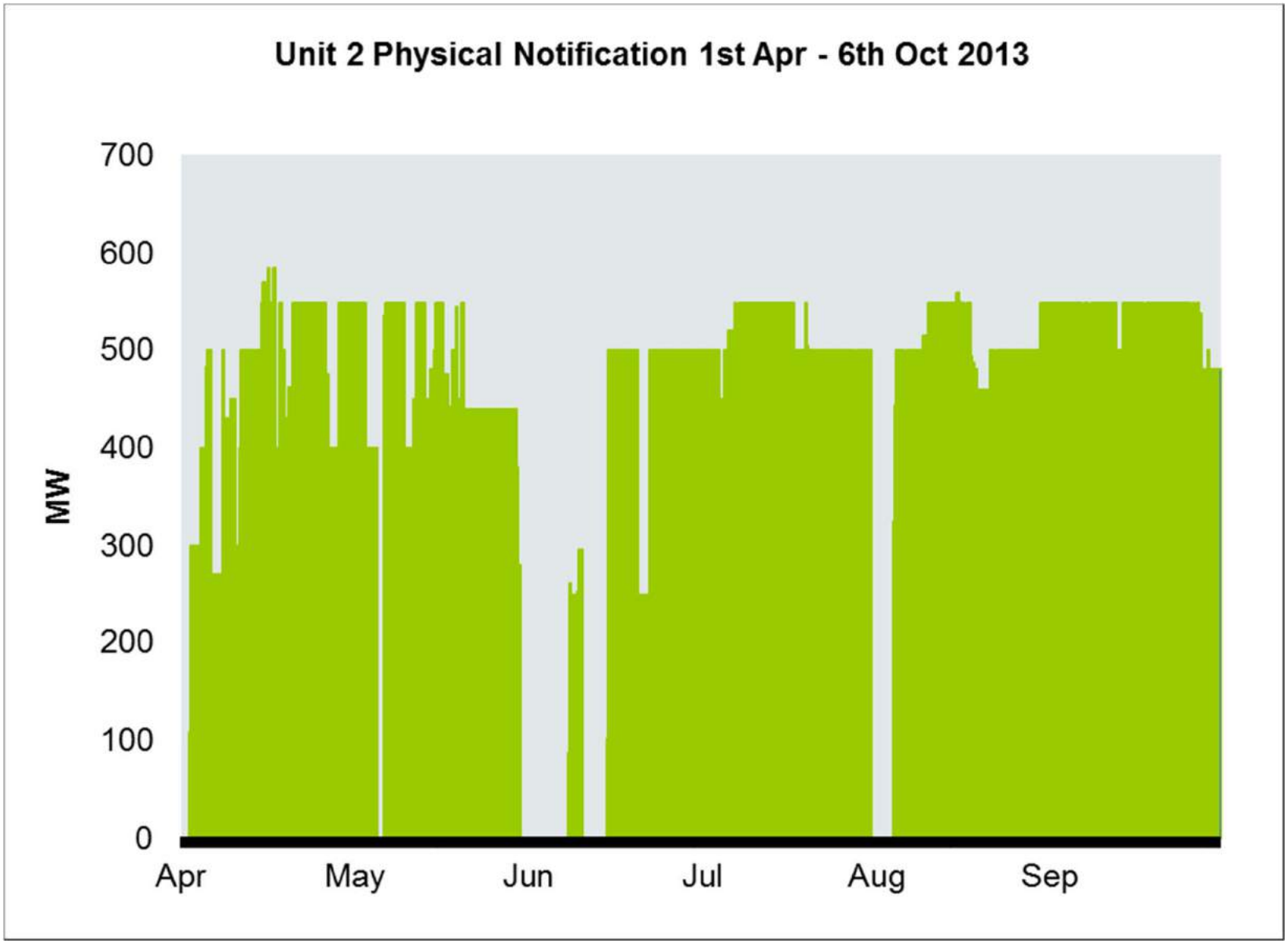
Interim systems 5



Commissioning

Performance



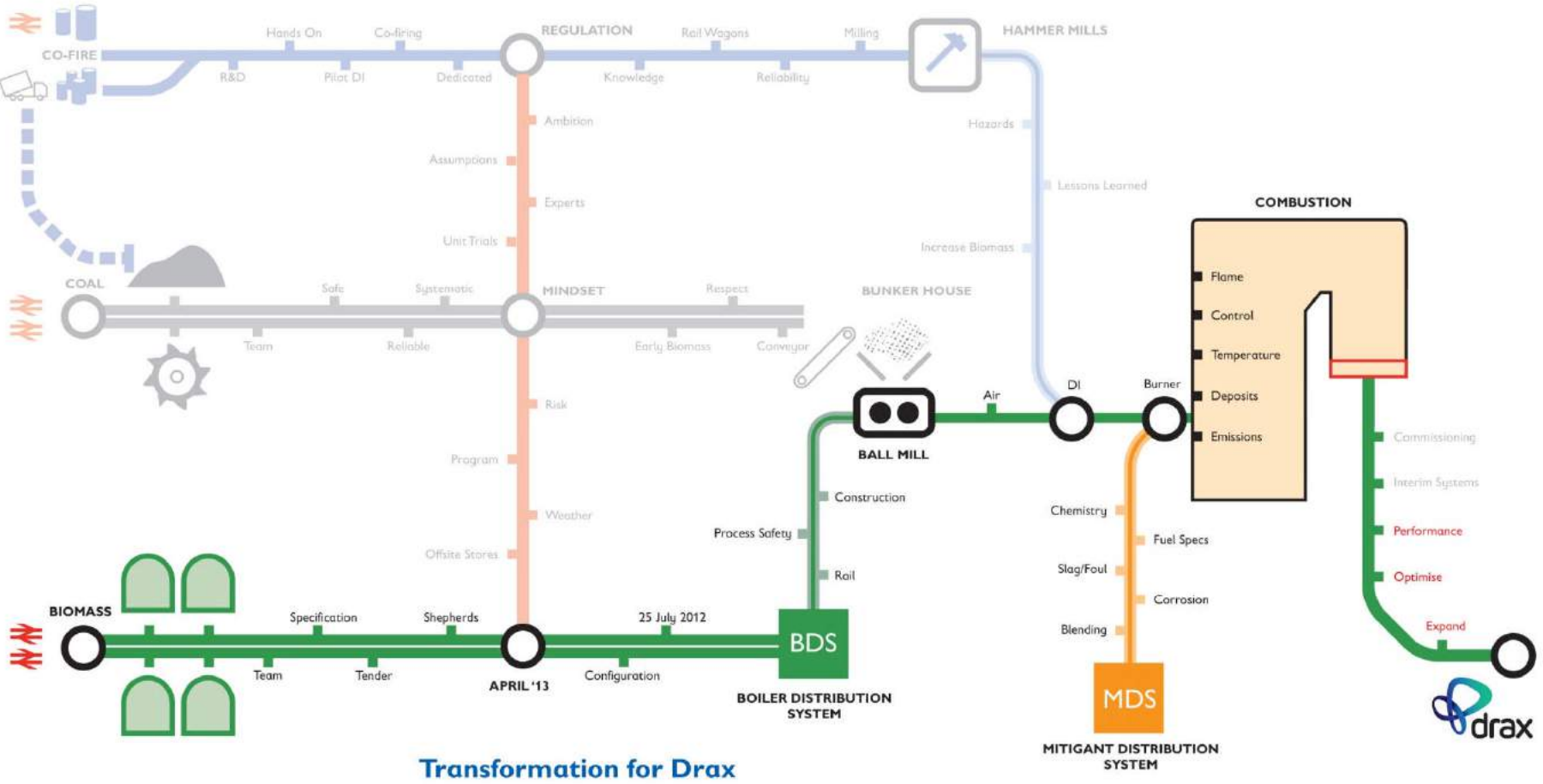

Unit 2 Physical Notification 1st Apr - 6th Oct 2013
MW
700
600
500
400
300
200
100
0
Apr
May
Jun
Jul
Aug
Sep

Performance

Commissioning

Optimisation

Expansion



Transformation for Drax

Transition to Permanent Biomass Facilities

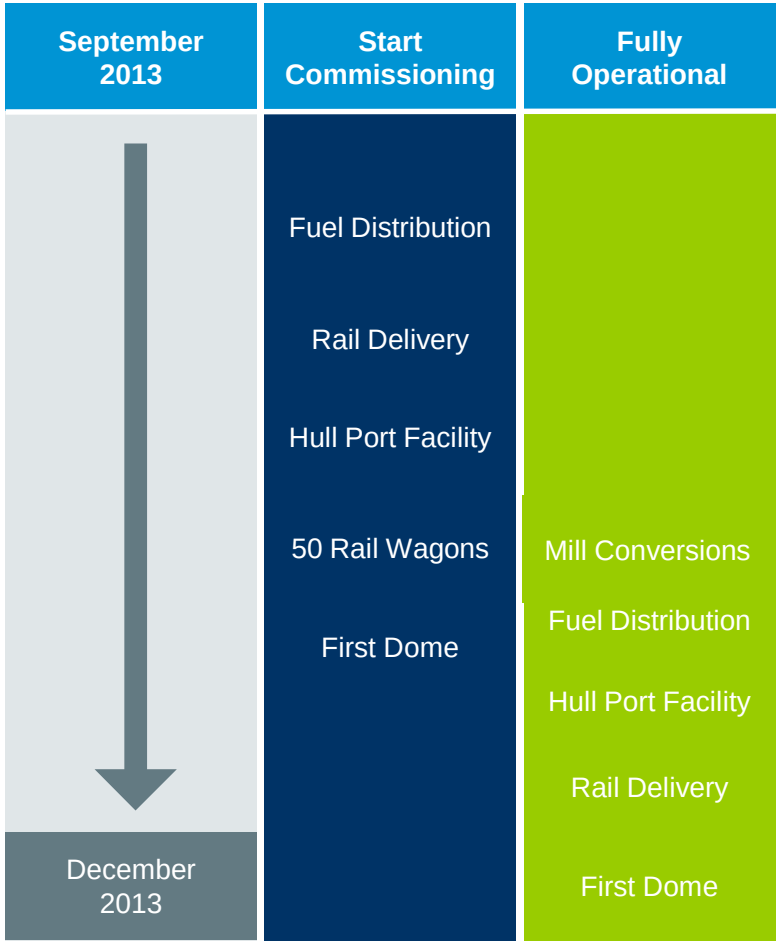
Transition of 1st converted unit

- Q4 2013 phased commissioning of new on-site facilities
  - Fuel delivery and distribution
  - Storage – 1 dome in service
  - Unit modifications
- On schedule to be complete by year end

2014 schedule

- Q1 – 2 domes in service
- Q3 – all 4 domes in service
- Summer 2014 conversion of 2nd unit
- Optimisation work continuing
  - Efficiency management, fuel envelope, NOx

Timeline for First Unit Transition



Engineering the transformation

Capital Markets Day

Any Questions?

Brian Greensmith
Jason Shipstone