AUTOMATION REVOLUTION FOR MUNICIPAL WASTE TREATMENT FACILITIES?

2018 EEC/WTERT Bi-Annual Conference
Sustainable Waste Management: The Forefront of Innovation
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TURNKEY PROJECT
DESIGNER AND SUPPLIER
FOR ENVIRONMENT AND ENERGY…

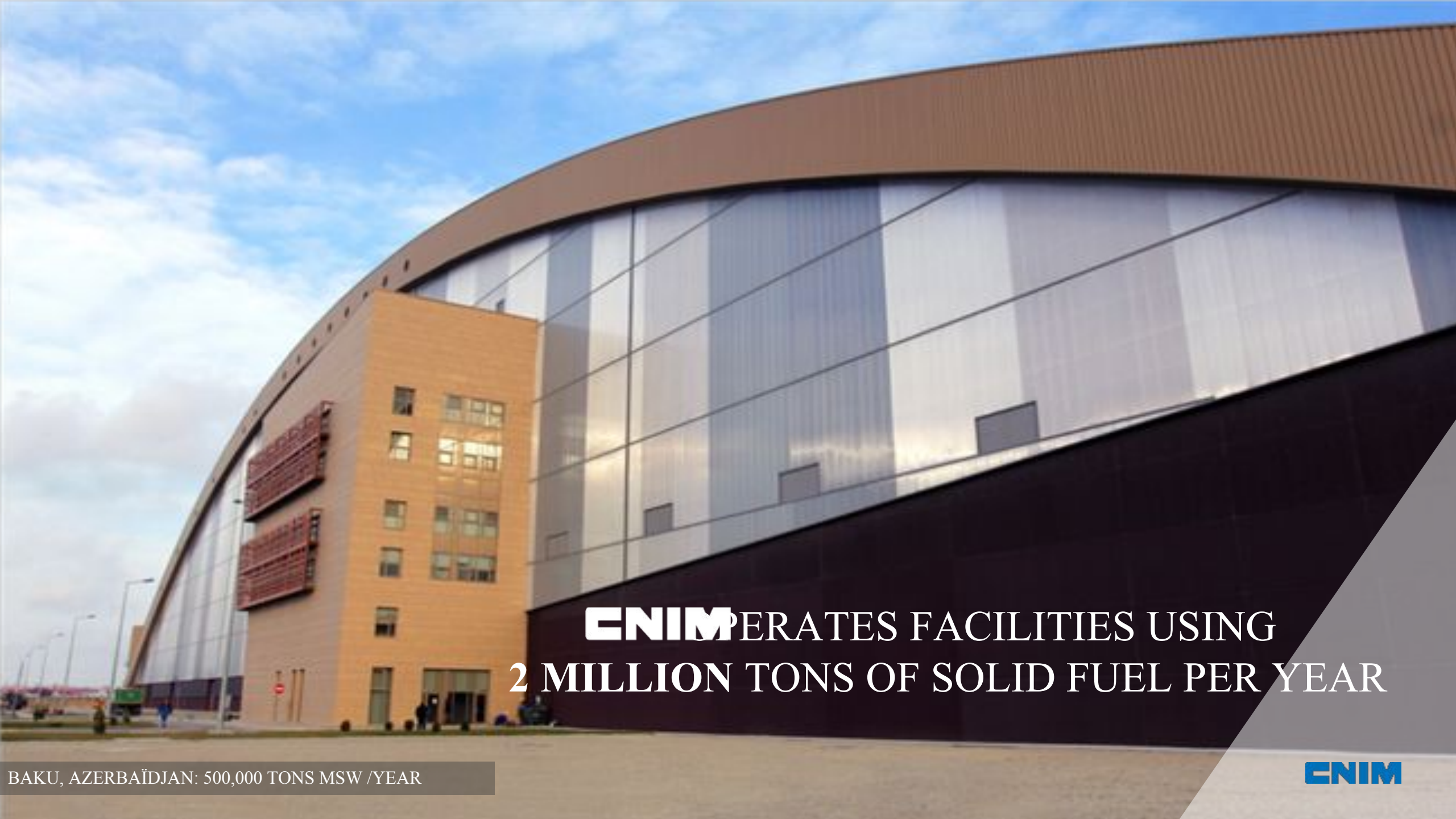
EfW SHEFFIELD, UK

CNIM

…COMPLETED BY SERVICES
SUCH AS ENGINEERING, PROJECT MANAGEMENT,
COMMISSIONING, OPERATION & MAINTENANCE,
RETROFITTING…

WTE PLANTS RECOVER ENERGY FROM MUNICIPAL SOLID WASTE OF **100 MILLION** PEOPLE AROUND THE WORLD

TORINO EfW 421,000tMSW/a, ITALY – ARCHITECTUR BY



CNIM OPERATES FACILITIES USING 2 MILLION TONS OF SOLID FUEL PER YEAR

BAKU, AZERBAÏDJAN: 500,000 TONS MSW /YEAR

150 MILLION PEOPLE WASTE COMBUSTION FLUE GASES CLEANED BY Lab

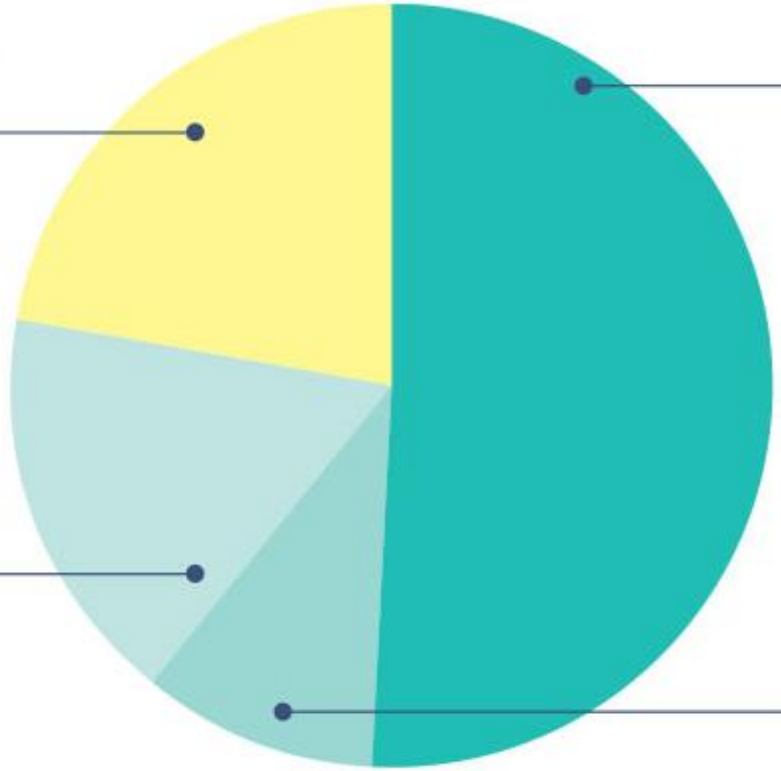
Credit : BIG

EfW AMAGERFORBRAENDING, COPENHAGEN, DENMARK

CNIM ENVIRONMENT & ENERGY 2017 TURNOVER

22%
Services

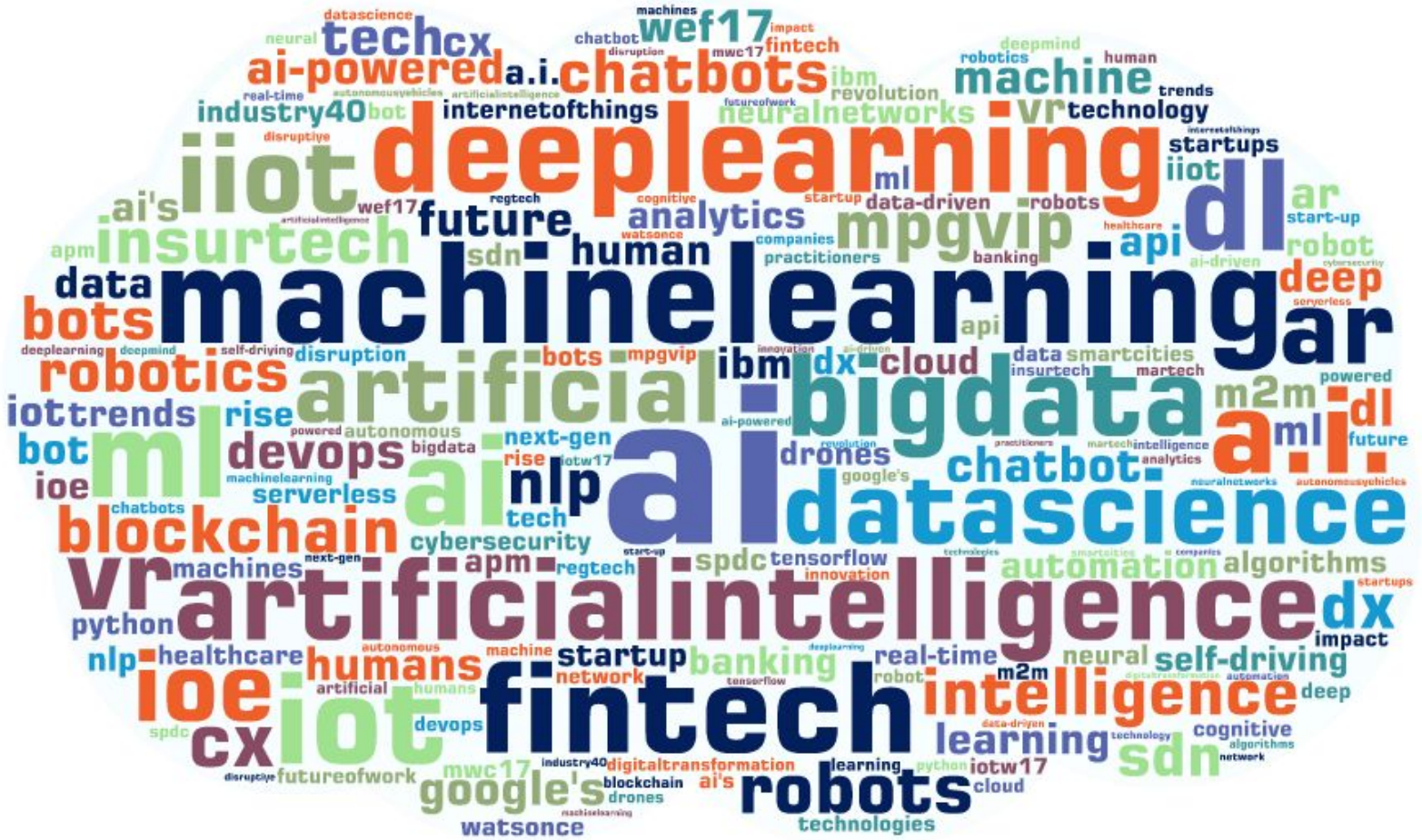
17%
Operation & Maintenance



51%
Turnkey plants

10%
Systems

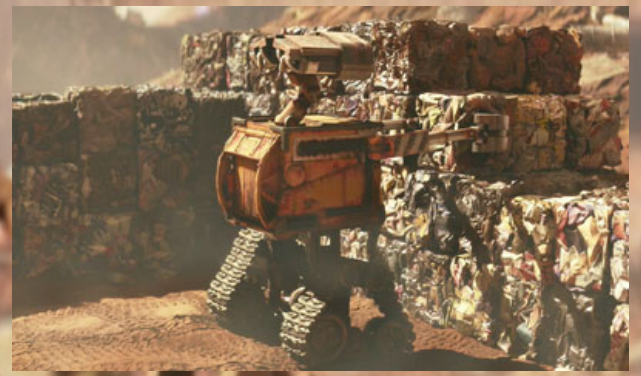
A FASHION TOPIC!



WHAT‘S THE FUTURE FOR WASTE?

ROBOT WALL-E ?

(*WASTE ALLOCATION LOAD LIFTER-EARTHCLASS*)

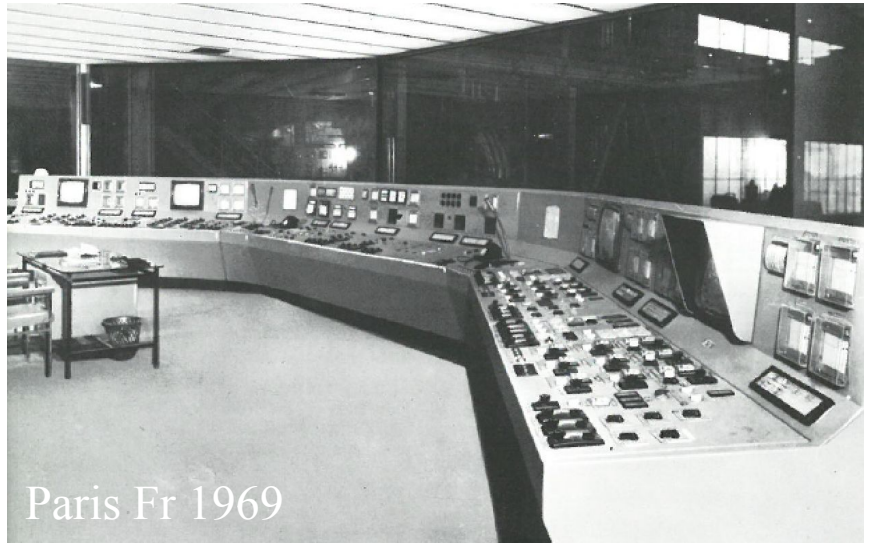


A PERFECT FUTURE …WITH AUTOMATION FOR WASTE???

ALREADY A LONG &VISIBLE STRONG EVOLUTION!

LAST CENTURY CNIM WTE CONTROL ROOMS

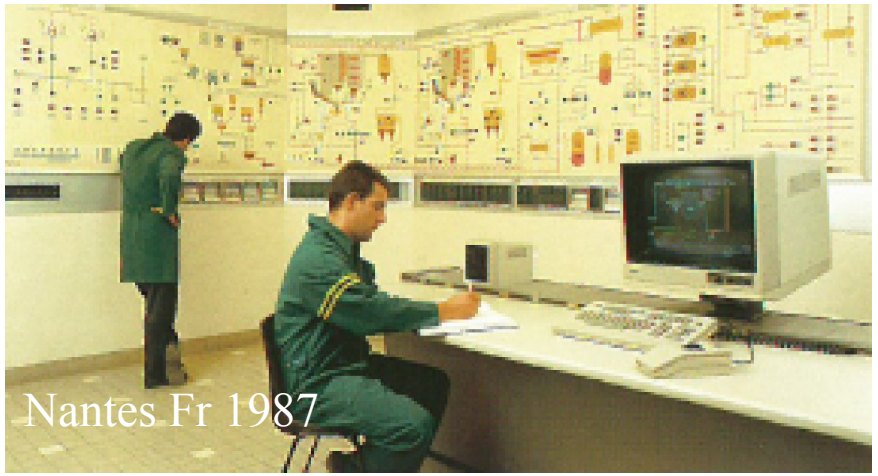
1960-70's



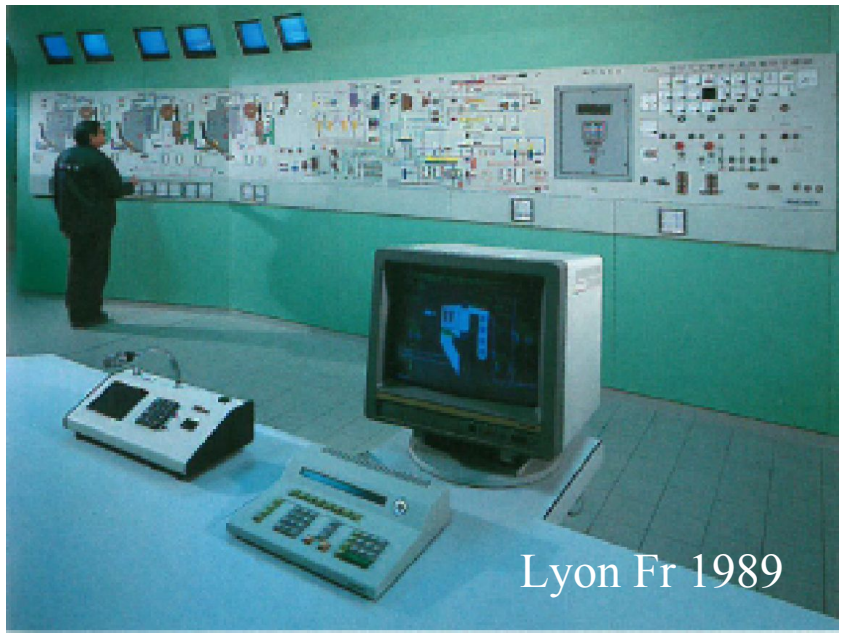
LAST CENTURY CNIM WTE CONTROL ROOMS

1980's


Rungis Fr


Nantes Fr 1987

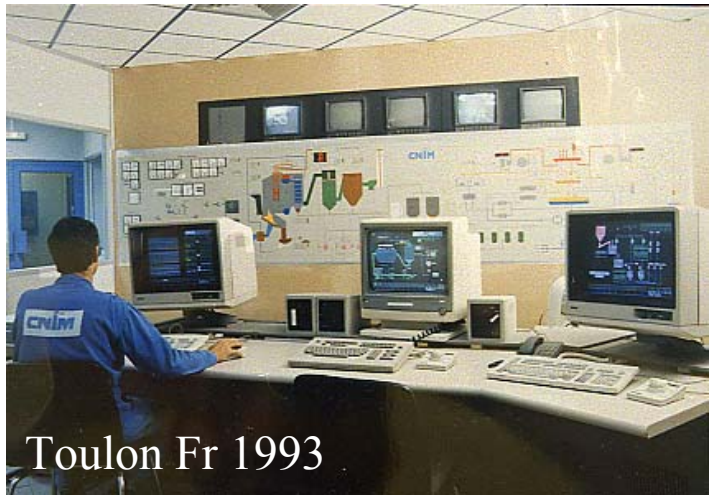

Brussels Be 1985


Lyon Fr 1989

LAST CENTURY CNIM WTE CONTROL ROOMS

1990's


Toulon Fr
Revamped in operation
(1985 version to 1993)


Toulon Fr 1993


London UK 1994


Mataro Sp 1994


Lons Fr 1994
with only 1person /shift


Avignon Fr 1997

XXI TH CENTURY CNIM WTE CONTROL ROOMS


Saumur Fr 2004

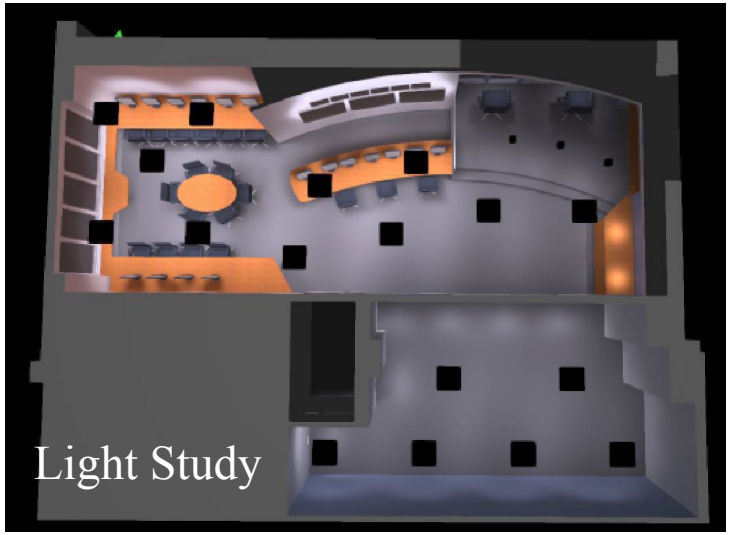

Porto **revamping** Pt 2014

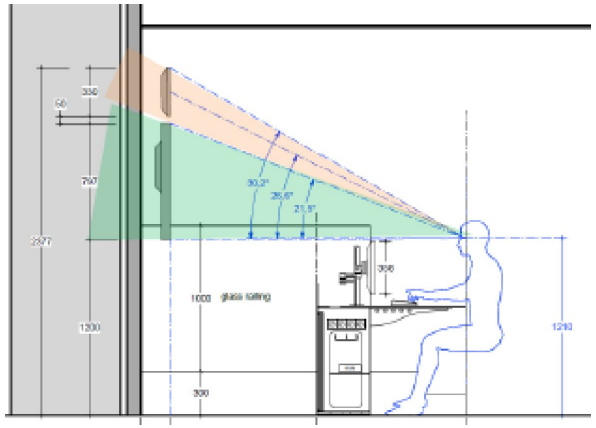

Oxford UK 2014

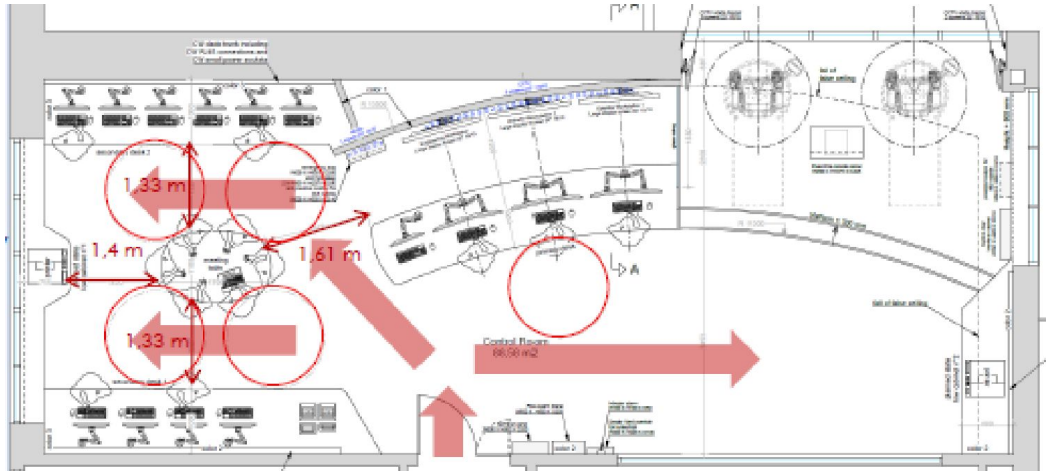
Baku Az 2012


Torino It 2013

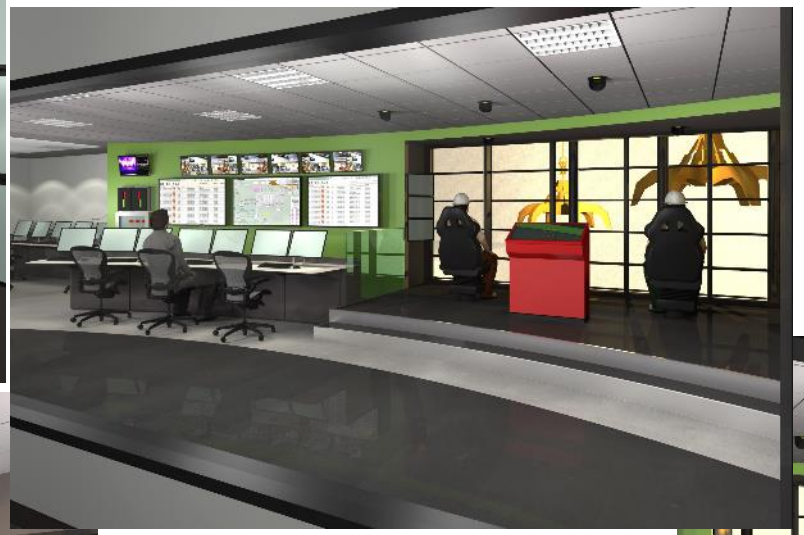
ERGONOMY
(LIGHT, COLOR, ACCESS, VISITORS…)

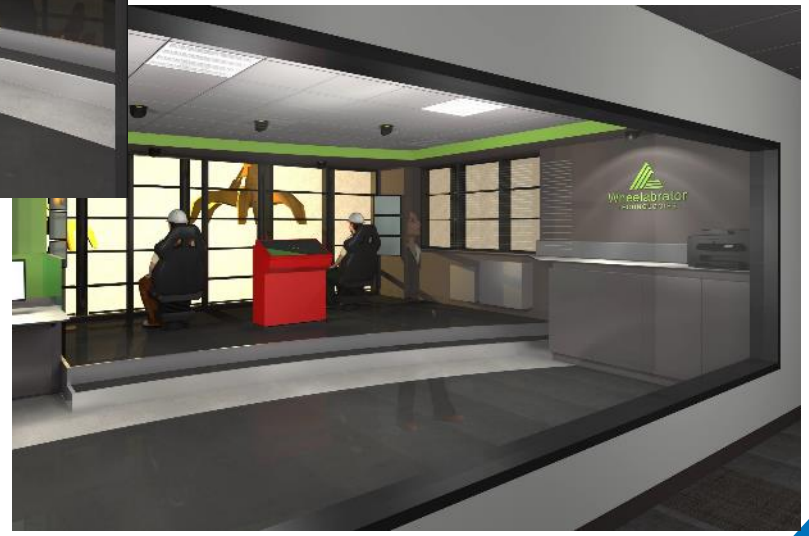




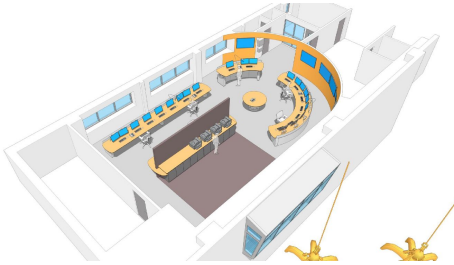


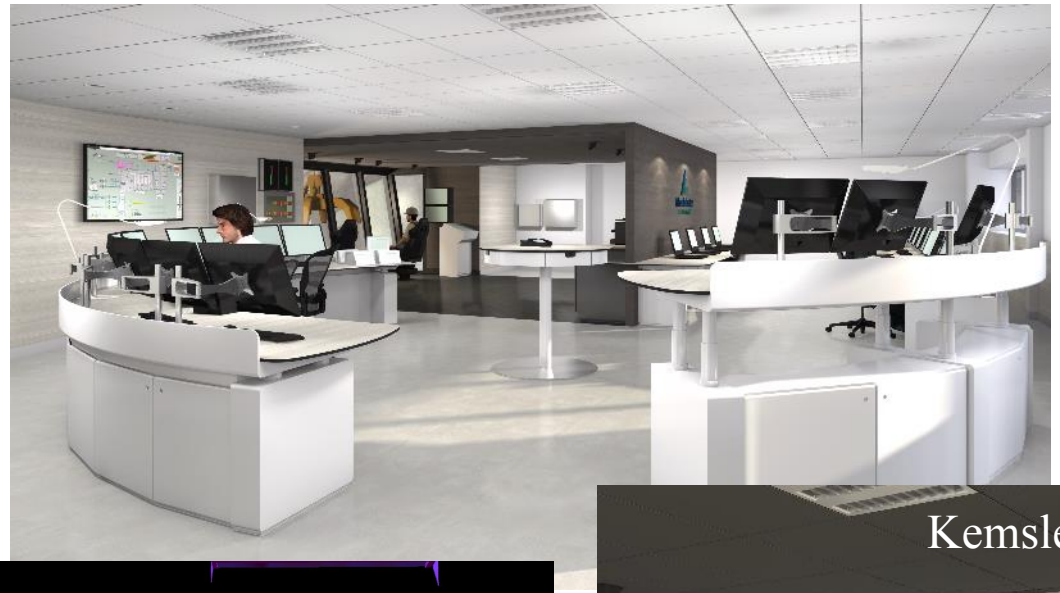
ERGONOMY - PARK ADFER WTE UK

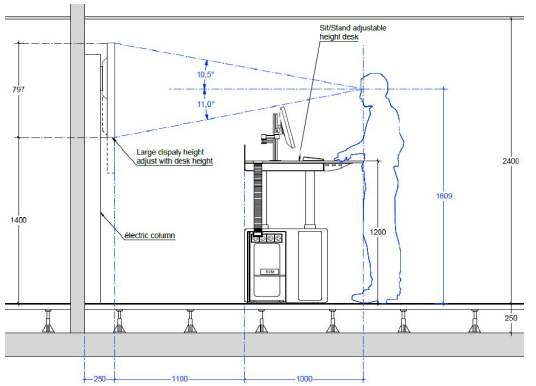




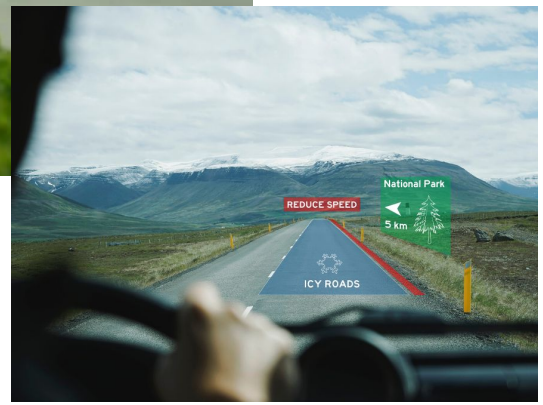
ERGONOMY - KEMSLEY UK WTE



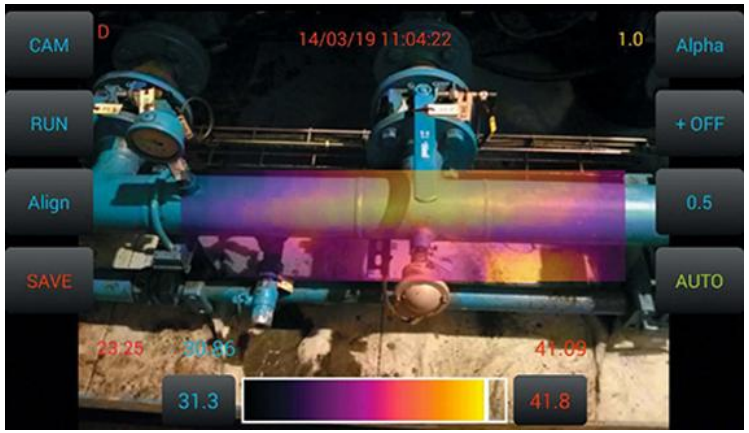


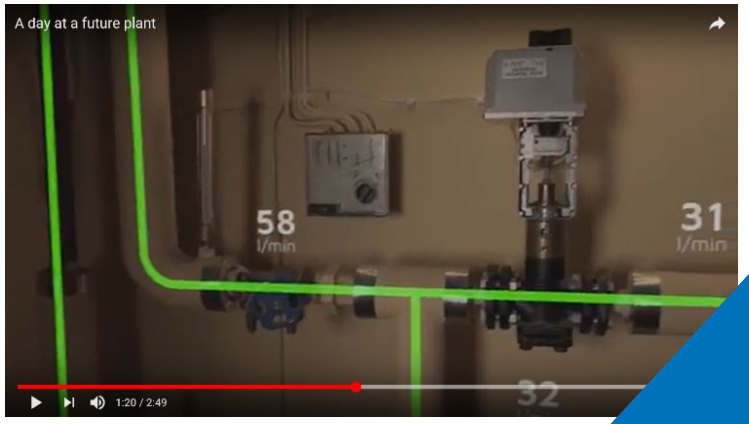


PROCESS INFORMATION DETACHED FROM CONTROL ROOM AND TRANSFERRED ON-SITE



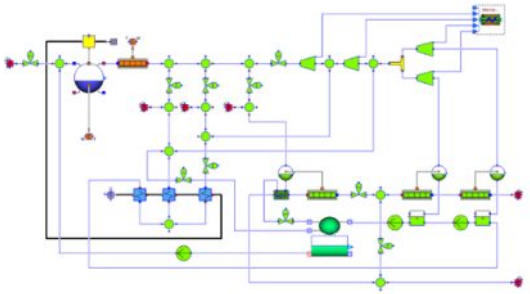
AUGMENTED/VIRTUAL REALITY GLASSES… FOR MAINTENANCE

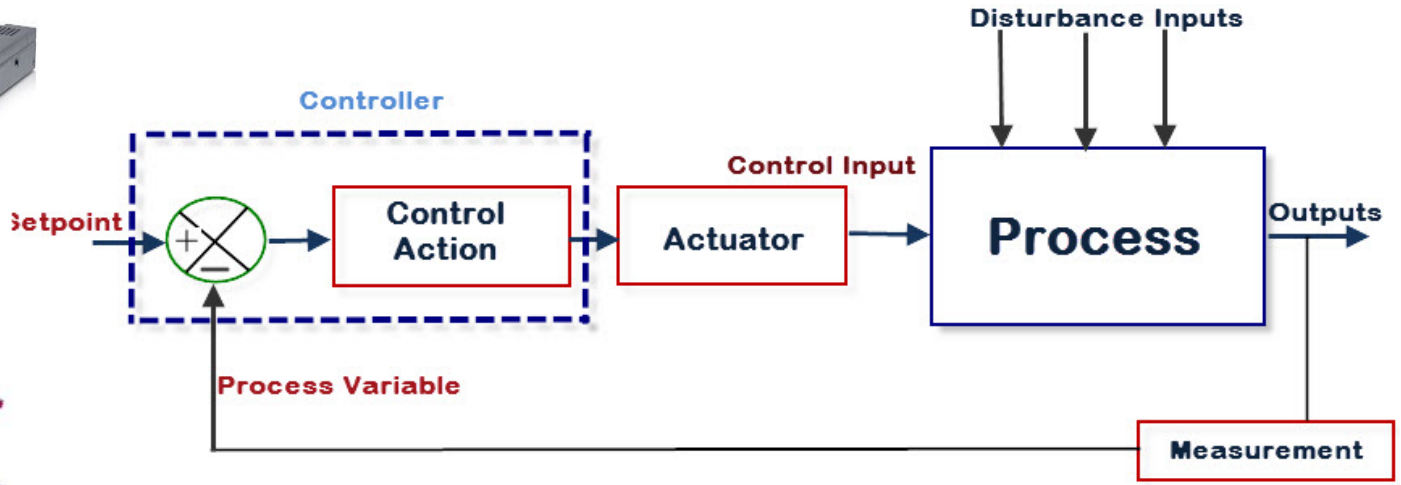




WHAT ELSE COULD I.T. AND AUTOMATION IMPROVE?

- Understand and control the **process**
- Collect and monitor **measurement** data
- React to manipulate **actuators**





Real plant

But not changing physical principles :
Process, instrumentation & actuators are not virtual

- **Integrated approach** necessary between technologies and I.T. to impact on design, building and operation & maintenance

…WE ARE DEALING WITH **WASTE**!

WASTE, PROCESS, INSTRUMENTATION & ACTUATORS ARE NOT VIRTUAL!

WE NEED TO INCREASE:

- Flexibility,
- Availability
- Reliability,
- Safety

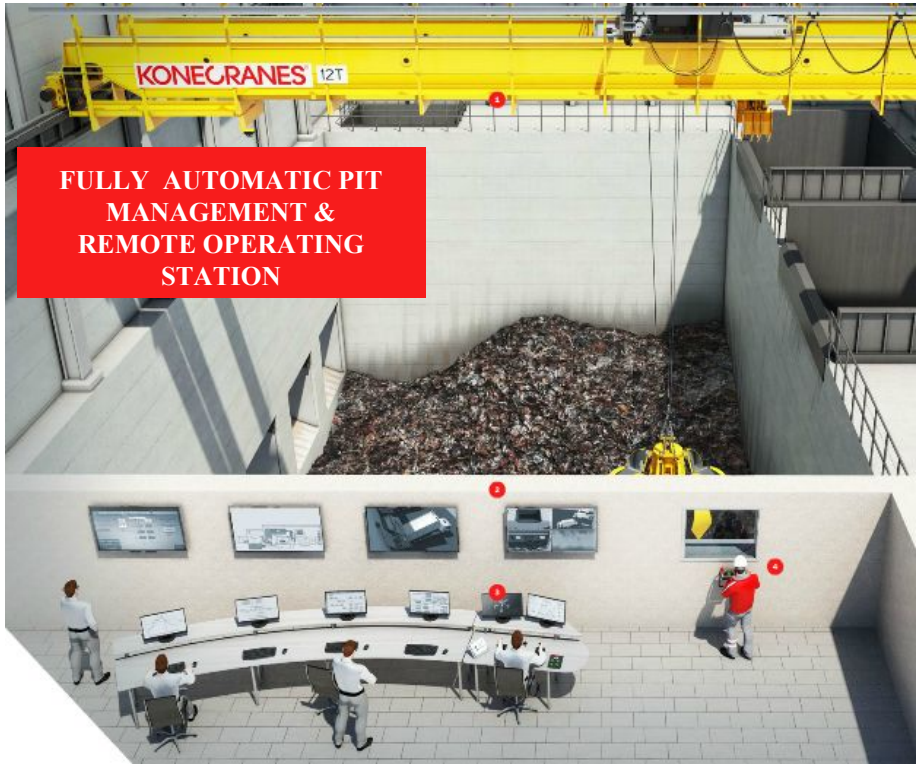
IN DIFFICULT CONDITIONS FOR:

- Advanced process controls
- Advanced performances & emissions monitoring

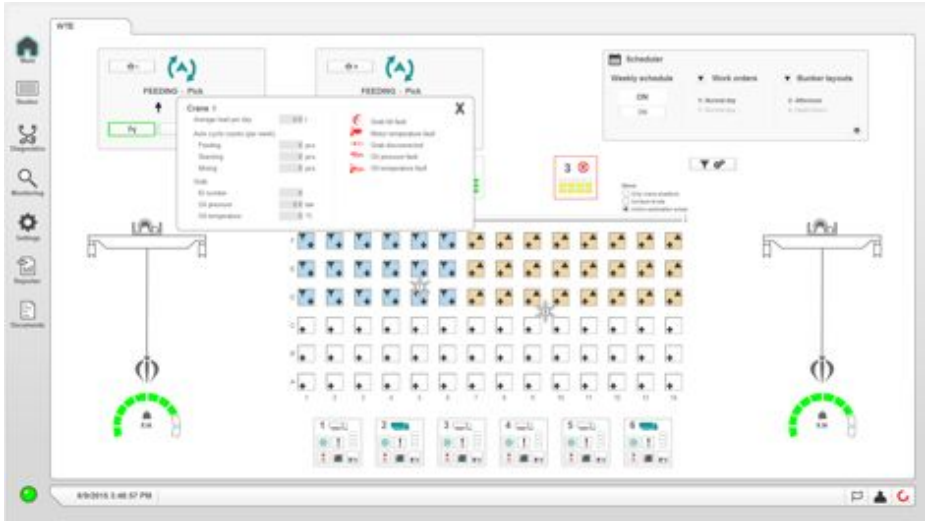
AT LOWER COSTS ==> PRAGMATIC INTEGRATED SOLUTIONS

WTE AUTOMATIC WASTE PIT MANAGEMENT

WTE CRANES OPERATION MODES

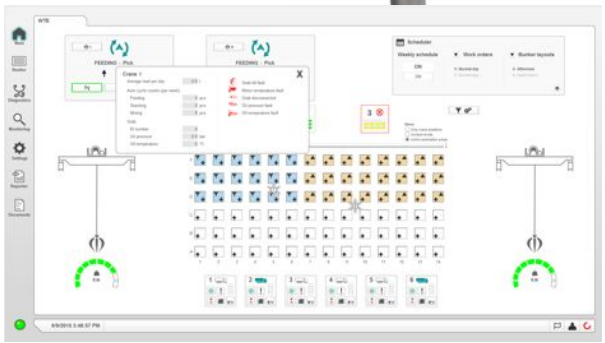


- Manual
- Semi-automation (Feeding)
- Feeding automation
- Unmanned full automation:
  - Feeding
  - Stacking (Receiving)
  - Mixing
  - Recasting
- Operated either from :
  - touch screen HMI panel in manual and semi-automation operator's seat
  - or through Main User Interface (MUI) in unmanned full-automation



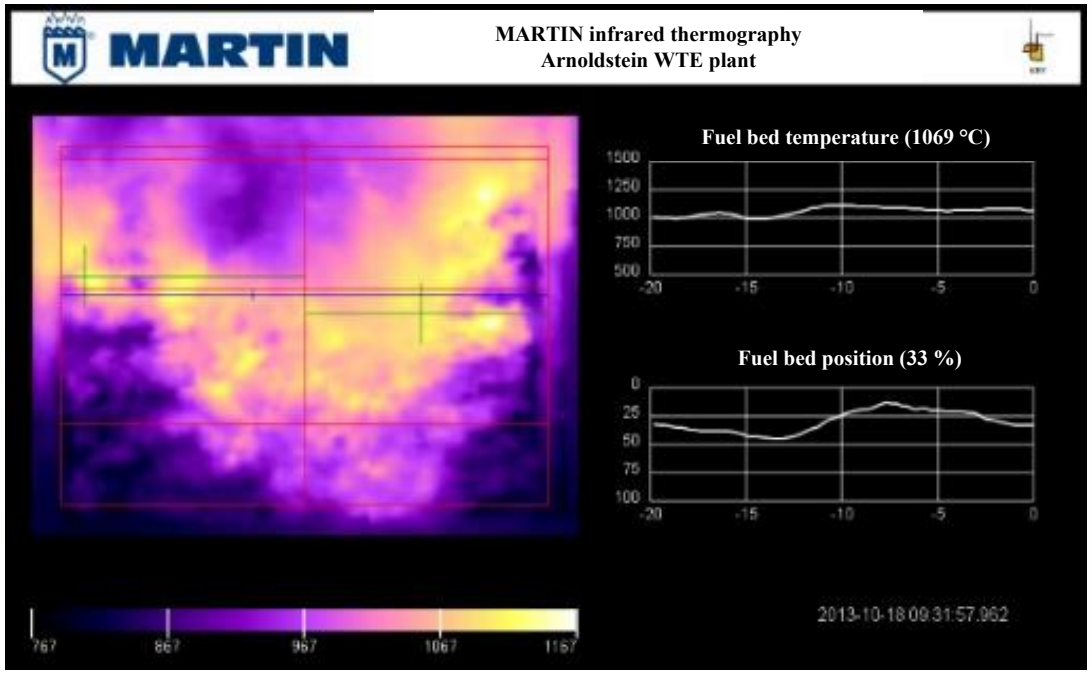
WTE CRANE AUTOMATIC OPERATION – REMOTE SYSTE

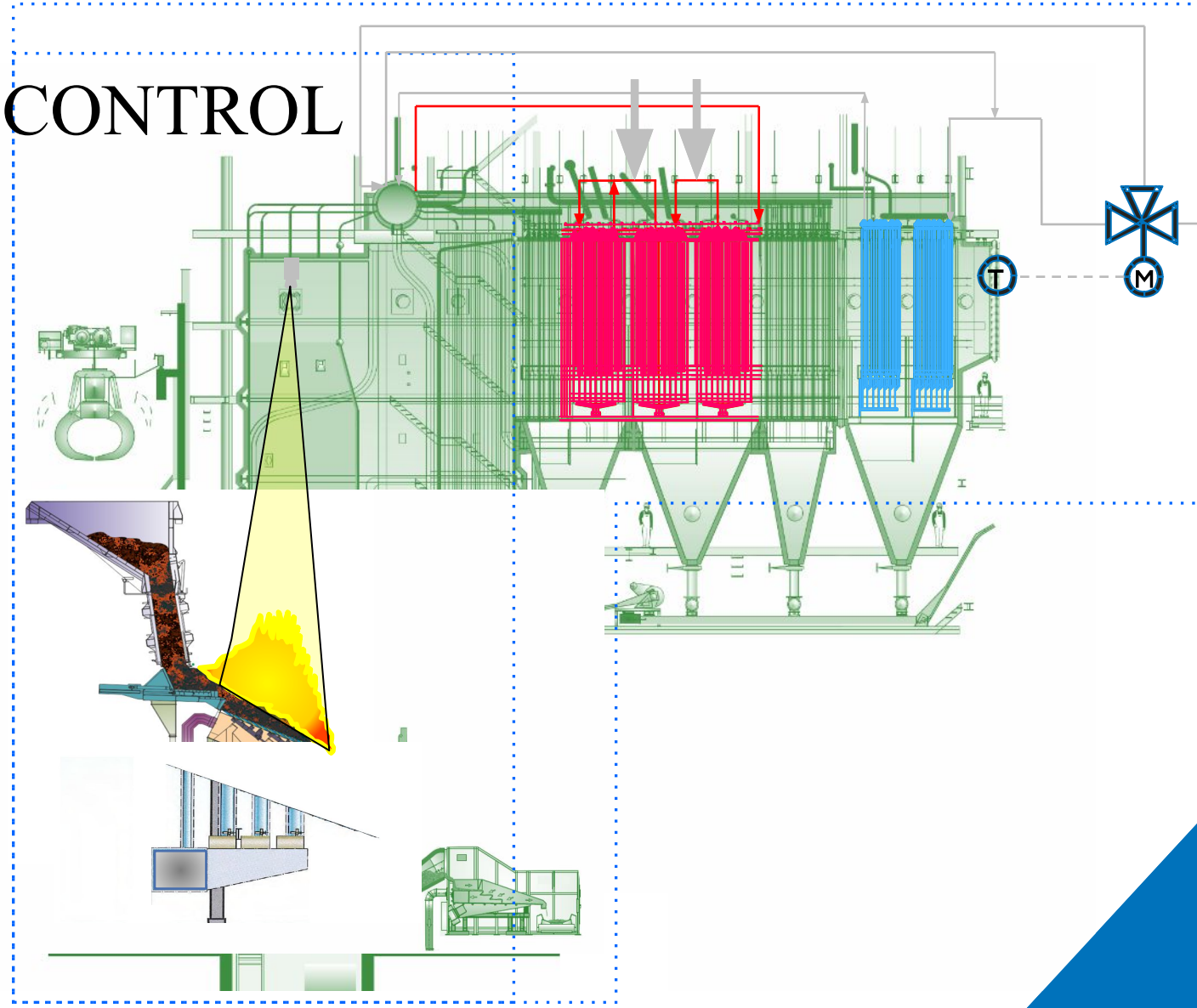
VERSUS



MICC - IR COMBUSTION CONTROL

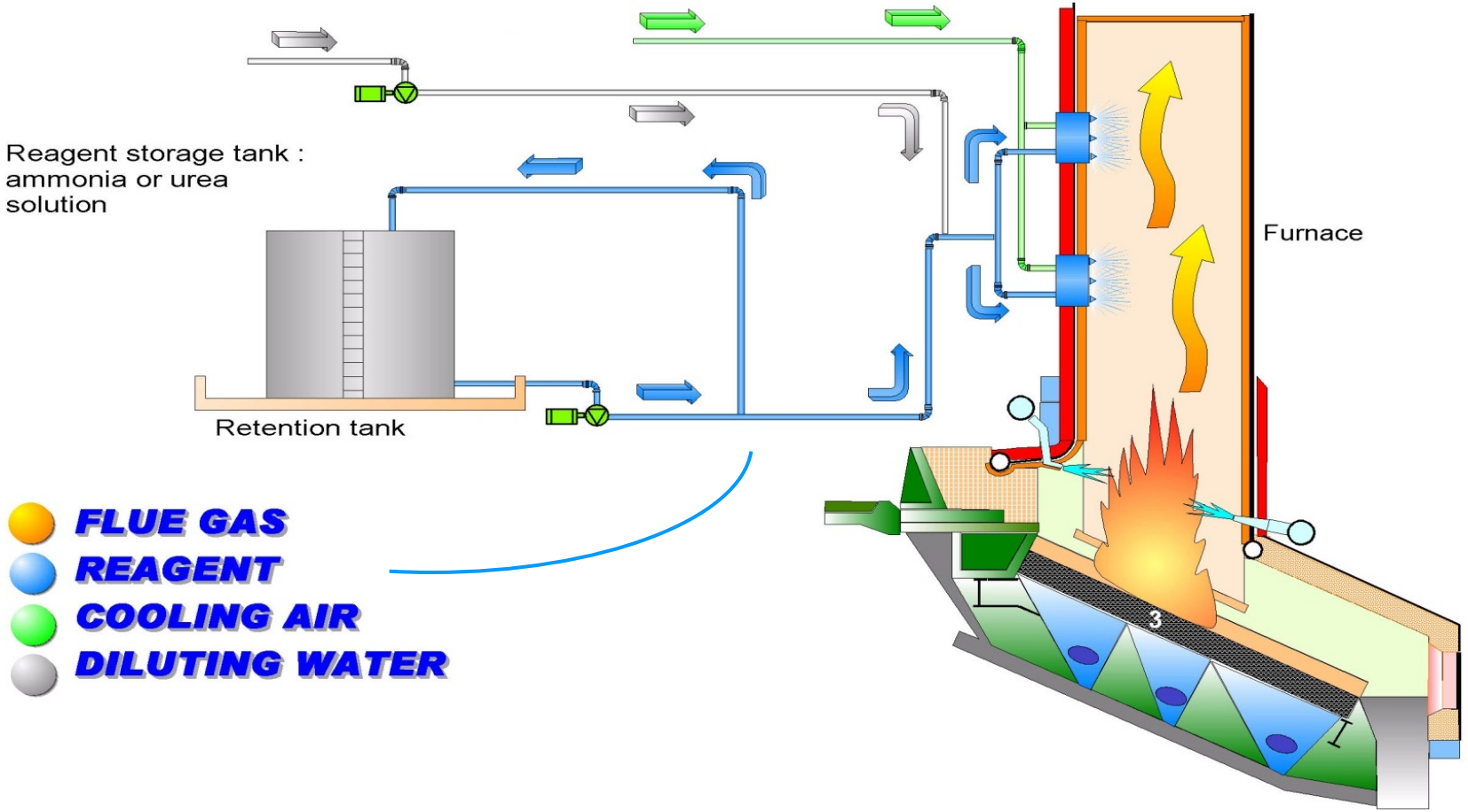
- Fuzzy control concept
- with integrated Infra-Red camera
- Operation in DCS



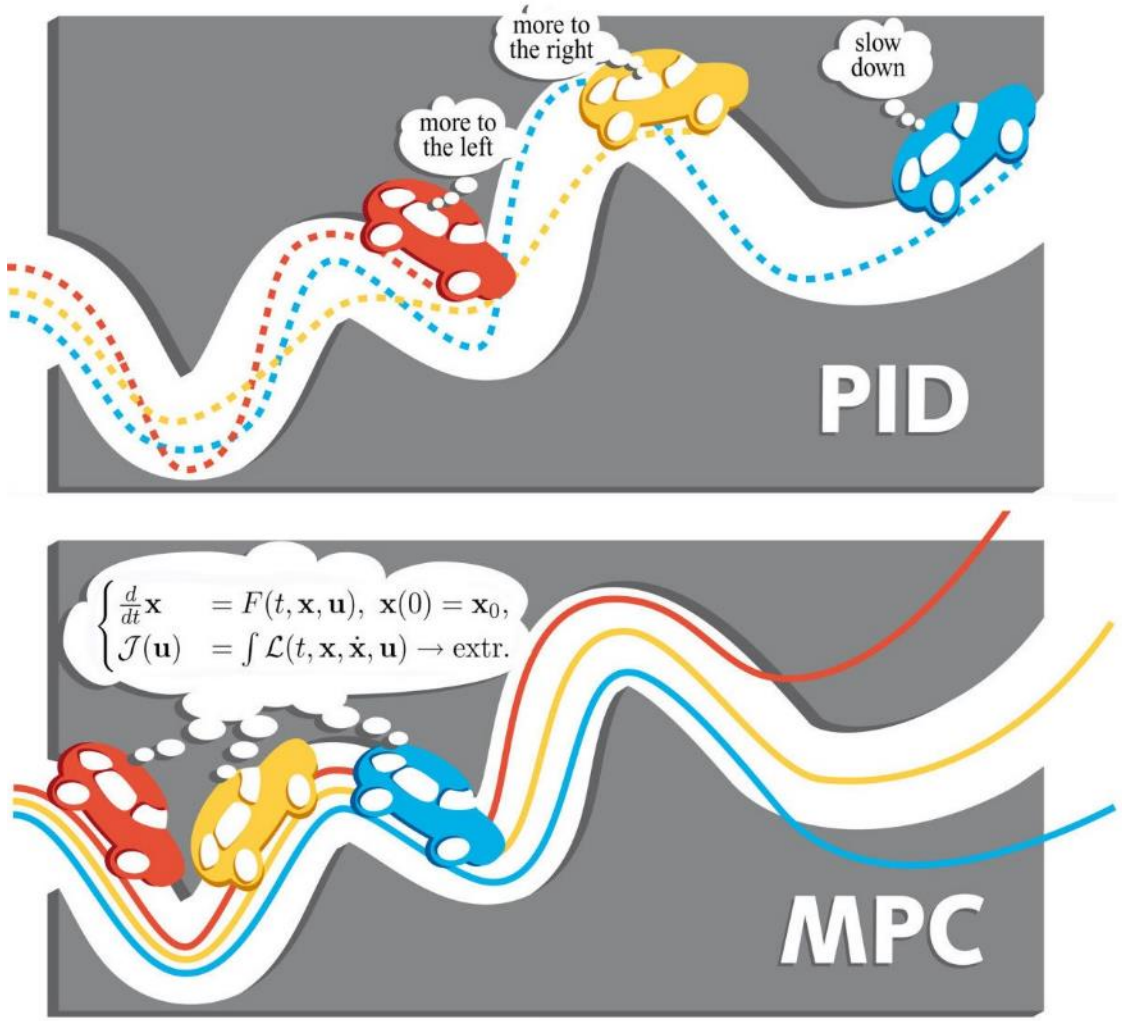


« SNCR (SELECTIVE NON CATALYTIC REDUCTION) DENO$_X$

INJECTION OF AMMONIA OR UREA SOLUTION OR DRY IN THE COMBUSTION CHAMBER AT HIGH TEMPERATURE (800 – 900°C)



PID VS MPC : AUTONOMOUS VEHICLE EXAMPLE



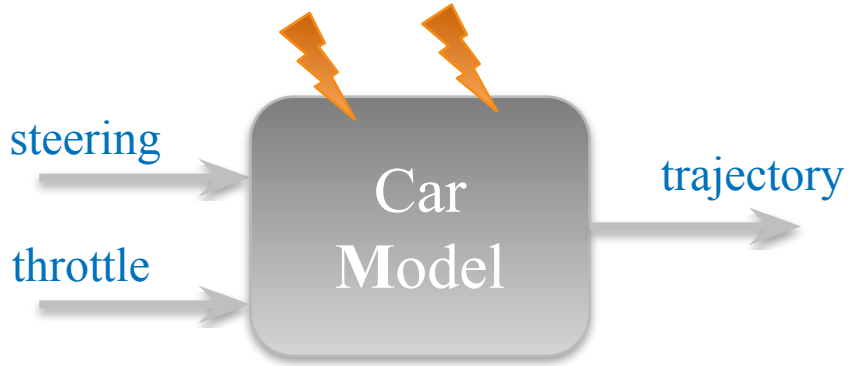
CHANGE FROM

PROPORTIONAL-INTEGRAL-DERIVATIVE CONTROL FUNCTION (PID)

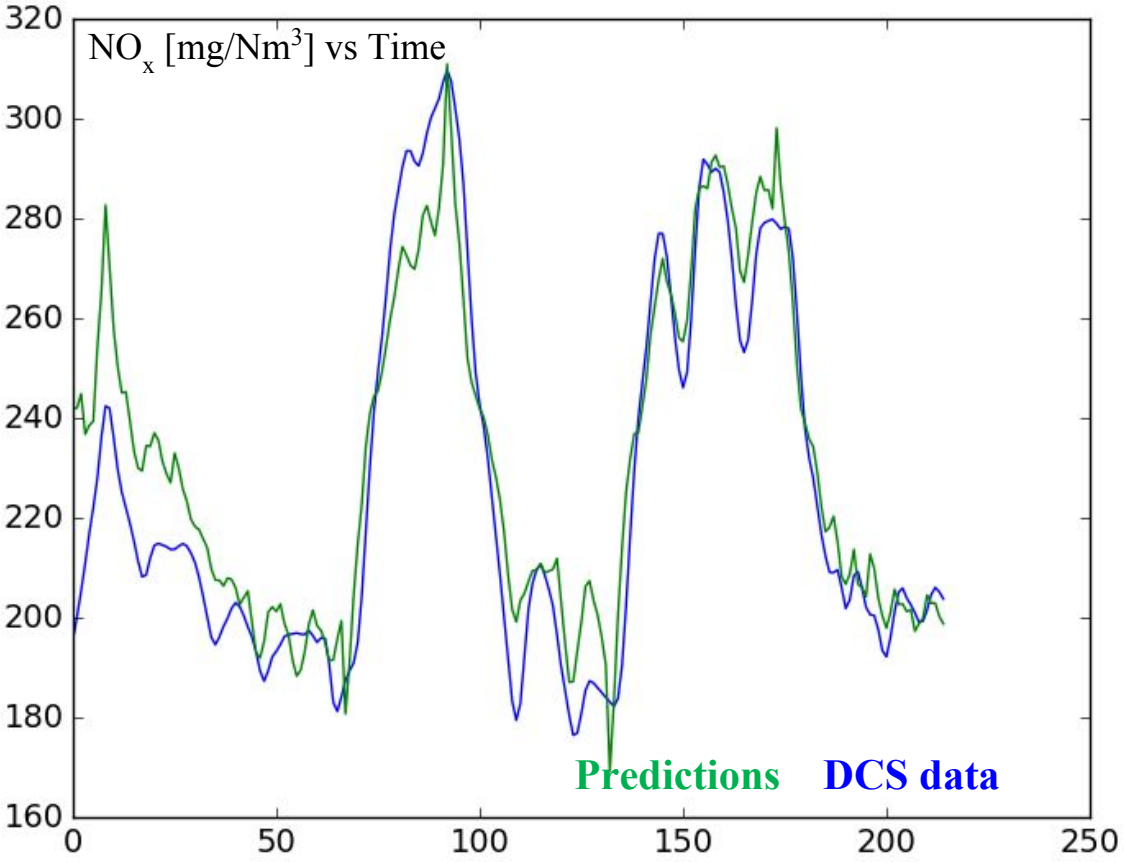
TO

SCNR+ WITH A **MODEL PREDICTIVE CONTROL** (MPC)

UREA SET POINT = ADVANCED FUNCTION (NOX, NH3, OTHERS?)

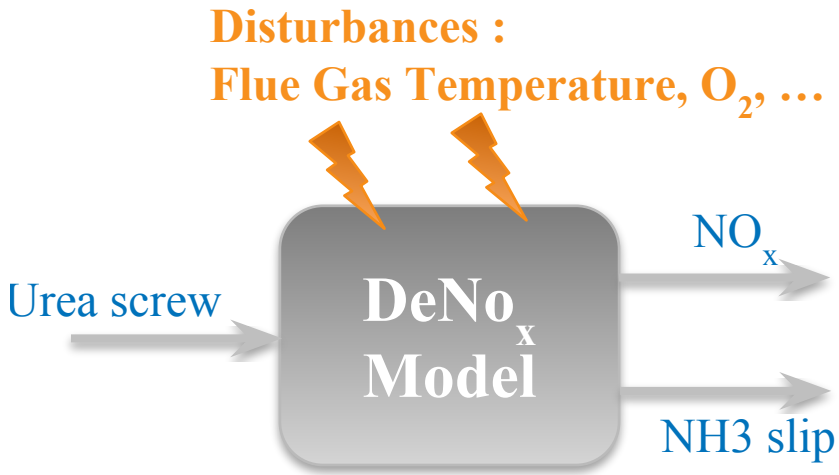


SNCR+ WITH MODEL PREDICTIVE CONTROL

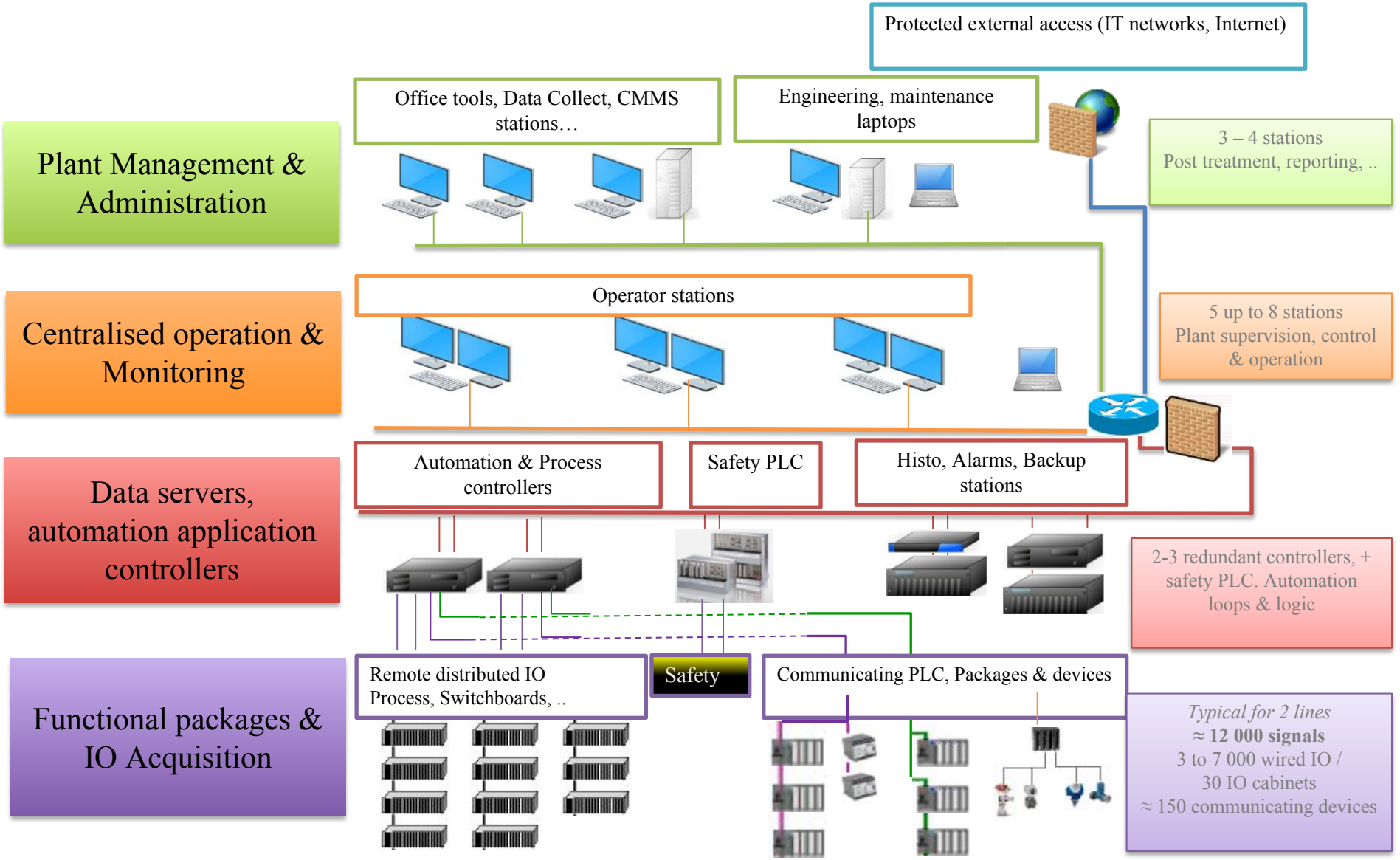


NO$_X$ RAW VALUES AT STACK
WELL PREDICTED BY SNCR+ MODEL

PERFORMANCES INCREASE



TYPICAL DCS ARCHITECTURE PRINCIPLES



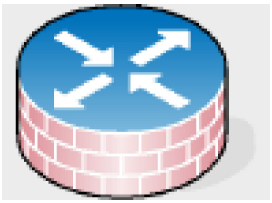
CCTV AREA

CENTRALISED OPERATION
AND
MONITORING

PLANT MANAGEMENT
&
ADMINISTRATION

HMI – SUPERVISION
NETWORK

DMZ – DEMILITARIZED AREA
NETWORK



BUILDING MANAGEMENT AREA

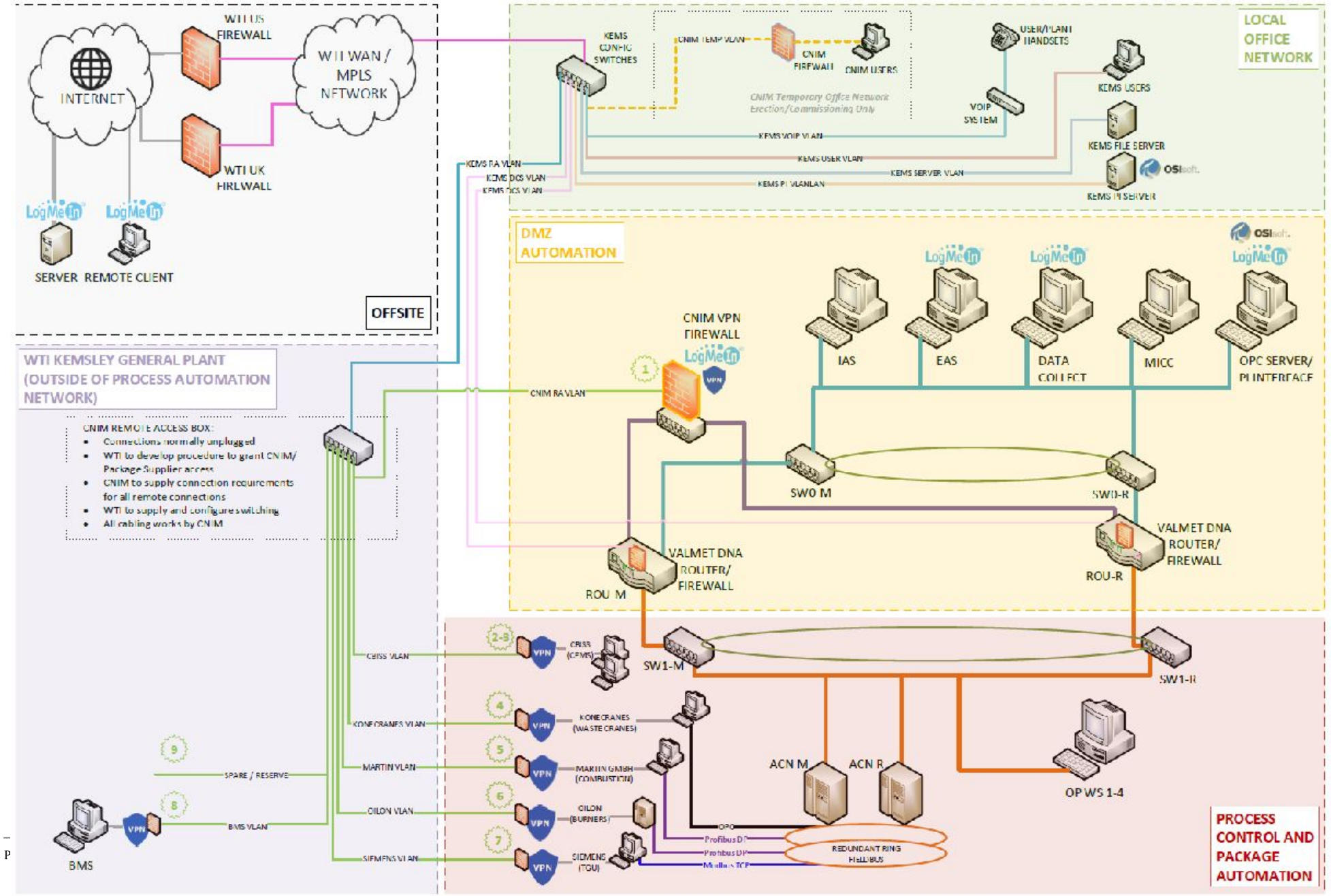
AUTOMATION
NETWORK

DATA SERVERS
AUTOMATION CONTROLLERS

I/O ACQUISITION
&
FUNCTIONAL PACKAGE UNITS

Energy From Waste

SIMPLIFIED FIREWALL ARCHITECTURE



21 WTE PLANTS AUTOMATION BUILT IN PARTNERSHIP WITH VALMET

100% OF THE NEW BUILD PROJECTS SINCE 2010

21 and counting

Framework for success with CNIM

Constructions Industrielles de la Méditerranée (CNIM), a French leading builder of turnkey biomass and waste-to-energy plants in Europe, has chosen Valmet as a partner for delivering automation systems to waste-to-energy plant projects through 2018.

TEXT Lisa Kettman-Kervinen

Turin waste-to-energy plant in Italy. CNIM, together with Valmet, carried it out in 2011.

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> CUSTOMER'S VOICE

Over the years, CNIM has been very successful in the waste-to-energy and biomass-to-energy market in Europe. To date, 21 of these plants have been built in partnership with Valmet, and 100 percent of the new build projects since 2010 have been carried out together.

Gilles Cappadoro, Manager of CNIM Process and System, first contacted Valmet in 1997. "From 1997 to 1999, Valmet supplied the DCS hardware and applications for two waste-to-energy plants built and operated by CNIM in the UK and one in Italy." Again in 2002 and 2007, CNIM turned to Valmet for new waste-to-energy plants in Italy. At that time, CNIM began to develop the entire plant application internally.

Making collaboration count

"With the Energonut waste-to-energy plant in Italy in 2002, our partnership really started to solidify. The French Valmet team assisted and trained us with a very high level of cooperation, and Valmet's technical support has turned these projects into a success."

"Over the years, we worked with Valmet's technical and commercial teams to optimize the DCS structure and procedure," says Cappadoro. "To cooperate constructively, we needed to find an efficient way to do business together. Valmet teams are extremely adaptable, and its DCS product is very stable. Now that we know each other, trust is well established."

CNIM's **Jean-Pierre Robin**, head of DCS engineering and design, has been in charge of all projects since 2013: "Valmet has a valuable ability to listen and respond to specific requests. I appreciate the scalability and modularity of the solutions. Valmet has a powerful ability to stick to the notion of 'remote and distributed.'"

Expanding into new territory

In 2017, CNIM remained one of the most successful EPCs in Europe, winning contracts and taking strong positions in Eastern Europe, the Middle East and Africa. Anticipating an increasing workload, CNIM selected some partners with which to sign agreements to be more efficient during the procurement phase.

Jean-Francois Ache, Head of Environment Purchasing at CNIM, describes the decision: "The DCS fulfills the criteria for critical plant equipment – requiring efficient collaboration from both parties and high-level interface with other equipment."

He goes on to explain how he evaluates potential suppliers. "For a key package like the DCS, it's all about performance: bid performance, realization stage performance, equipment reliability and after-sales service performance."

"Valmet addresses urgent issues in 'fast-track mode', understanding our evolving needs, proposing innovations for mutual benefit and making decisions with us beyond the current project," Ache says. "We signed the agreement with Valmet because of the performance of our long-lasting close business relationship. We took time to formalize it, enabling both parties to anticipate the challenges of executing projects beyond Europe."

11 years of cooperation

"We are now celebrating our 11th year of cooperation. CNIM requires a high level of partnership in the extremely competitive EPC market," says **Etienne Guyon** of Valmet France. "Valmet provides its state-of-the-art DCS technology. CNIM handles DCS project coordination, application and commissioning, while we handle hardware, system engineering and technical support for project execution. Syncing these roles requires a high degree of trust, teamwork and flexibility."

"Because a 'Shared Journey Forward' is Valmet's services approach, we have been working together to develop and create innovative solutions for our customers who operate power plants in challenging environments," adds Hédi Azzouz, Country Manager at Valmet. ■

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Jean-Francois Ache, Head of Environment Purchasing at CNIM

Jean-Pierre Robin, Head of CNIM's DCS engineering and design

Gilles Cappadoro, Manager of Process and System at CNIM

Hédi Azzouz, Country Manager France, Valmet

Etienne Guyon, Sales Manager, Valmet

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Valmet

CNIM

CNIM DEDICATED APPROACH FOR DCS

FIELDS OF ACTION

- **Development of Digital Control Systems** in collaboration with DCS manufacturers
  - Programming of the DCS logics
  - Implementation of the plant's views in the DCS
  - Programming of the safety system logics
  - Factory Acceptance Tests
- Commissioning of Digital Control Systems
- **Technical assistance to customers**
  - **Remote assistance (25 sites connected)**
  - On-site-preventive maintenance
  - **Training** for operation and maintenance staff
  - DCS upgrade
- **Computer Assisted Maintenance Management System**

AUTOMATION & CONTROLLERS

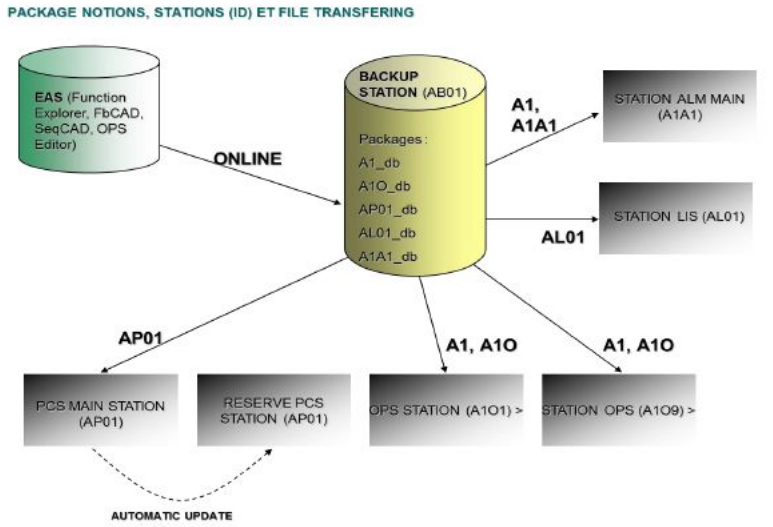
CONTROLLERS & IO

- Based on reliable and proven technology
- Redundant controllers, 1 per line, 1 for common parts on redundant networks
- Independent Safety PLC for SIL rated loops
- Redundant remote IO bus (ethernet optical) and local star networks
- Profibus DP & Modbus TCP rings

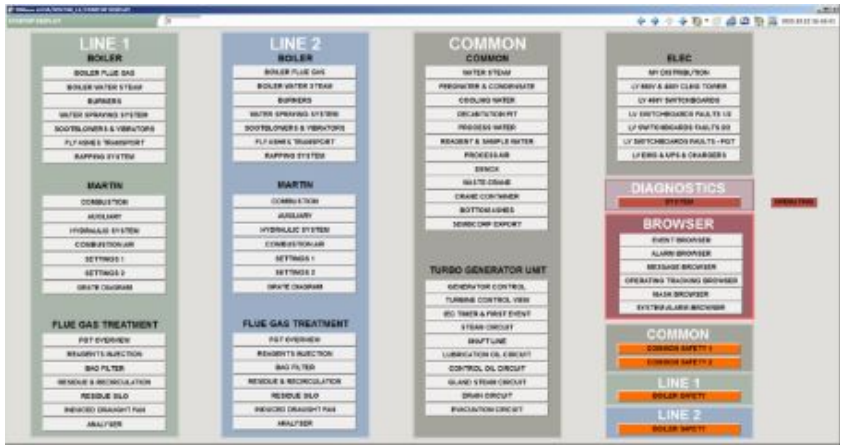
DCS DATABASE

- Unique database distributed for all automation
- All mimic views available for any Op. station
- Zone based alarming & event logging
- Redundant buffered historian & trending tools
- Sequences, loop, logical, templates available

Each item in the DCS (sensor measurment, engine, valve…) is a complex object including different functions. Such as alarms, graphic display, history. When a loop is downloaded, the updated functions are spread into several computers specializing in very precise tasks.

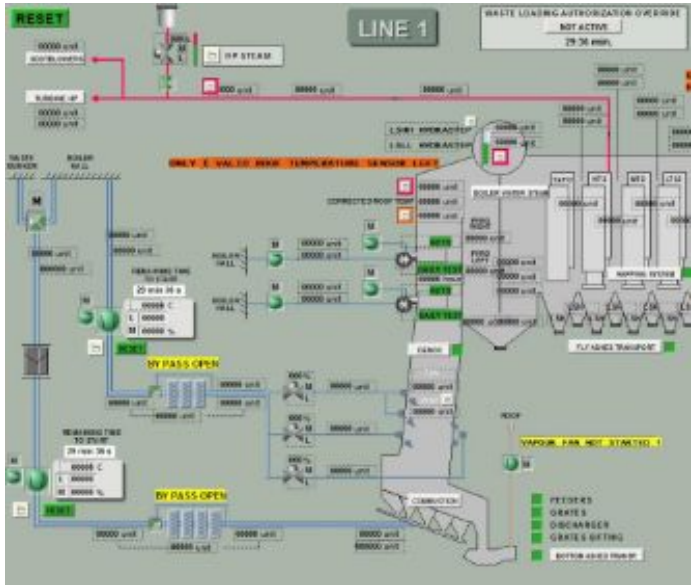


SUPERVISION AND CONTROL



SUPERVISION

- Each operator station with at least 2 x 24” screens,
- Each operator station can access any mimic views,
- Nb of views: typical for 2 lines ≈ 80 views (not incl diag, pop-ups, alarm & trending)
- Validated typical and standard objects (EEMUA 201/191)
- On demand trending tools, alarm filtering
- Packages remote operator station (TGU, Emissions, HV/MV)



AUTOMATION AND CONTROL

- Proven models and functionalities
- Local and remote control through DCS
- Appropriate operating modes to help operator
- On-line monitoring of automatic sequences, logical loops, interlocks
- Pop-up for control loops face plate, motor and valves operations

...:39:217 | 1HNA10CT030XQ02 | FGT IN FG TEMP | Meas. < LL

DNAuse A1O1/#arealabel/Control Panel

DNAuse A1O1/BEDD/STARTUP DISPLAY

STARTUP DISPLAY

LINE 1
BOILER
- BOILER FLUE GAS
- BOILER WATER STEAM
- BURNERS
- WATER SPRAYING SYSTEM
- SOOTBLOWERS & VIBRATORS
- FLY ASHES TRANSPORT
- RAPPING SYSTEM

MARTIN
- COMBUSTION
- AUXILIARY
- HYDRAULIC SYSTEM
- COMBUSTION AIR
- SETTINGS 1
- SETTINGS 2
- GRATE DIAGRAM

LINE 2
BOILER
- BOILER FLUE GAS
- BOILER WATER STEAM
- BURNERS
- WATER SPRAYING SYSTEM
- SOOTBLOWERS & VIBRATORS
- FLY ASHES TRANSPORT
- RAPPING SYSTEM

MARTIN
- COMBUSTION
- AUXILIARY
- HYDRAULIC SYSTEM
- COMBUSTION AIR
- SETTINGS 1
- SETTINGS 2
- GRATE DIAGRAM

FLUE GAS TREATMENT
- FGT OVERVIEW
- REAGENTS INJECTION
- BAG FILTER
- RESIDUE & RECIRCULATION
- RESIDUE SILO
- INDUCED DRAUGHT FAN
- ANALYSER

COMMON
COMMON
- WATER STEAM
- DEMINERALISED WATER
- COOLING WATER
- DECANTATION PIT
- PROCESS WATER
- REAGENT & SAMPLE WATER
- PROCESS AIR
- DENOX
- WASTE CRANE
- BOTTOM ASHES
- DIESEL OIL

TURBO GENERATOR UNIT
- GENERATOR CONTROL
- TURBINE CONTROL VIEW
- IEC TIMER & FIRST EVENT
- STEAM CIRCUIT
- SHAFT LINE
- LUBRICATION OIL CIRCUIT
- CONTROL OIL CIRCUIT
- ST SEAL & GLAND STEAM
- DRAIN CIRCUIT
- START-UP / SHUT-DOWN

COMMON
ELECTRICAL
- MV DISTRIBUTION
- LV 660V & 400V CLNG TOWER
- LV 400V SWITCHBOARDS
- LV SWBD CABINETS FAULTS
- LV I/O CABINETS FAULTS
- LV EMG & UPS & CHARGERS
- DIESEL GENERATOR

Valmet

TEACHER

DIAGNOSTICS
SYSTEM

BROWSER
- EVENT BROWSER
- ALARM BROWSER
- MESSAGE BROWSER
- TRACKING BROWSER
- MASK BROWSER
- SYSTEM ALARM BROWSER

COMMON
COMMON SAFETY

LINE 1
BOILER SAFETY

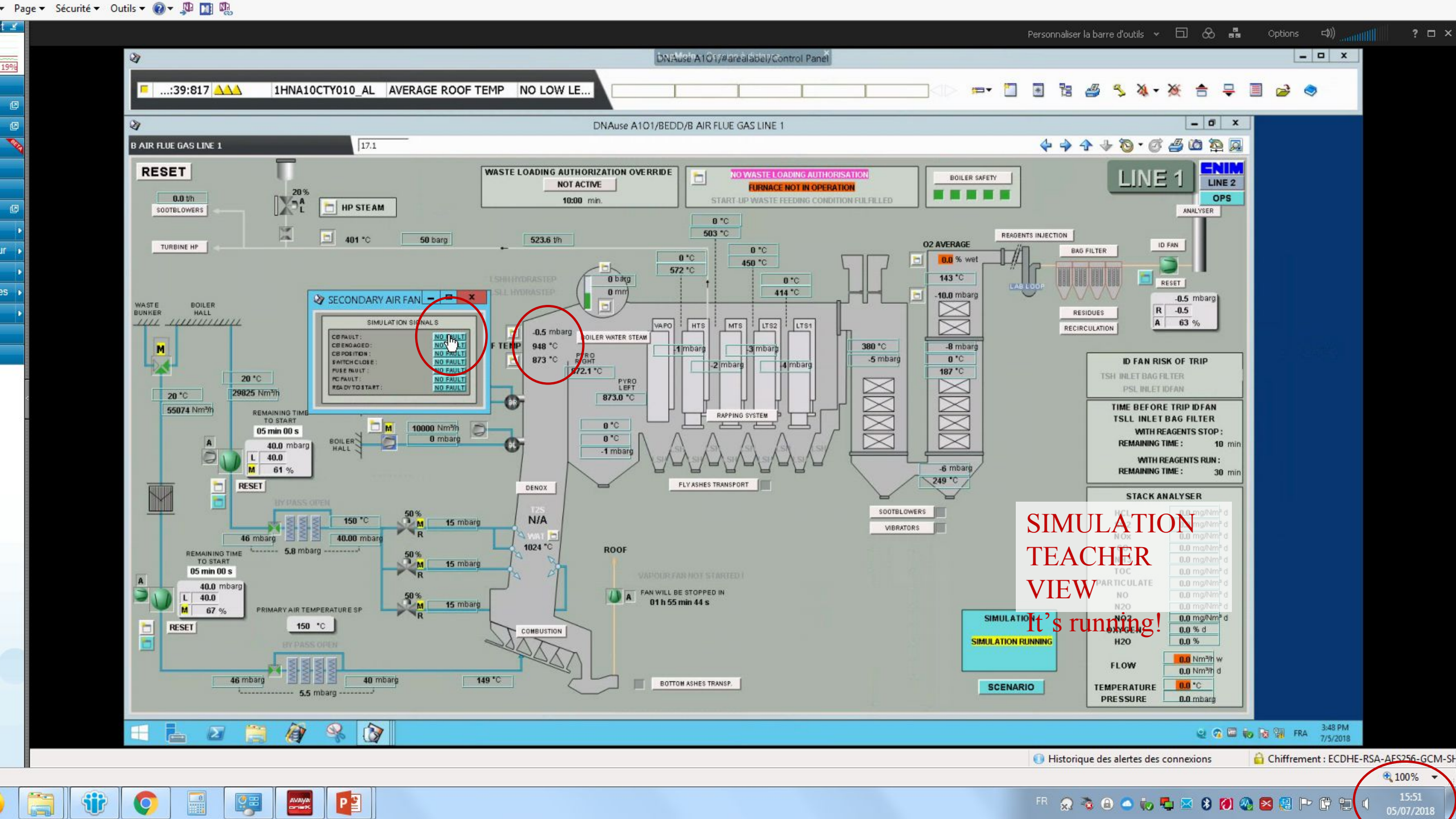
LINE 2
BOILER SAFETY

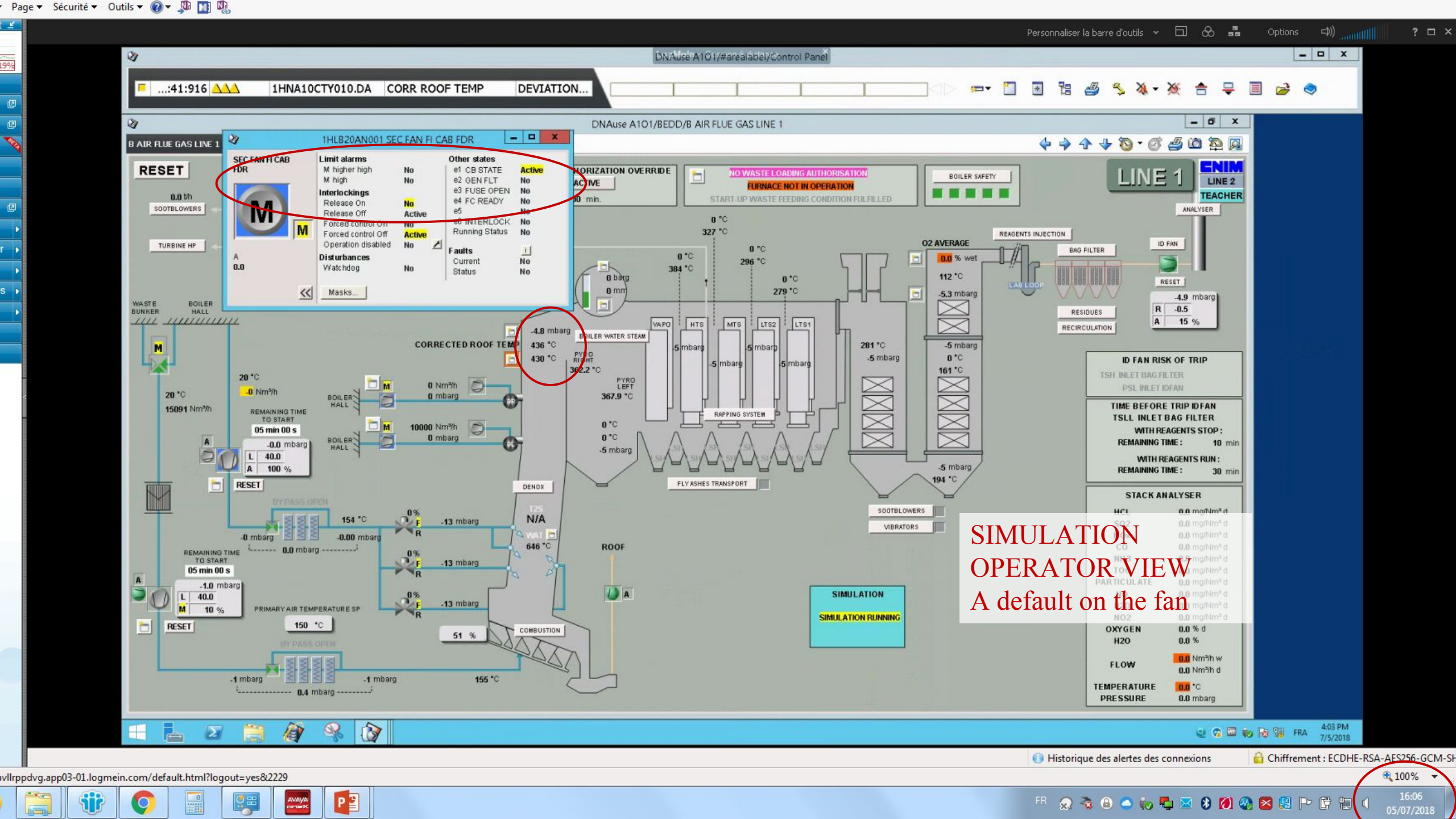
Historique des alertes des connexions

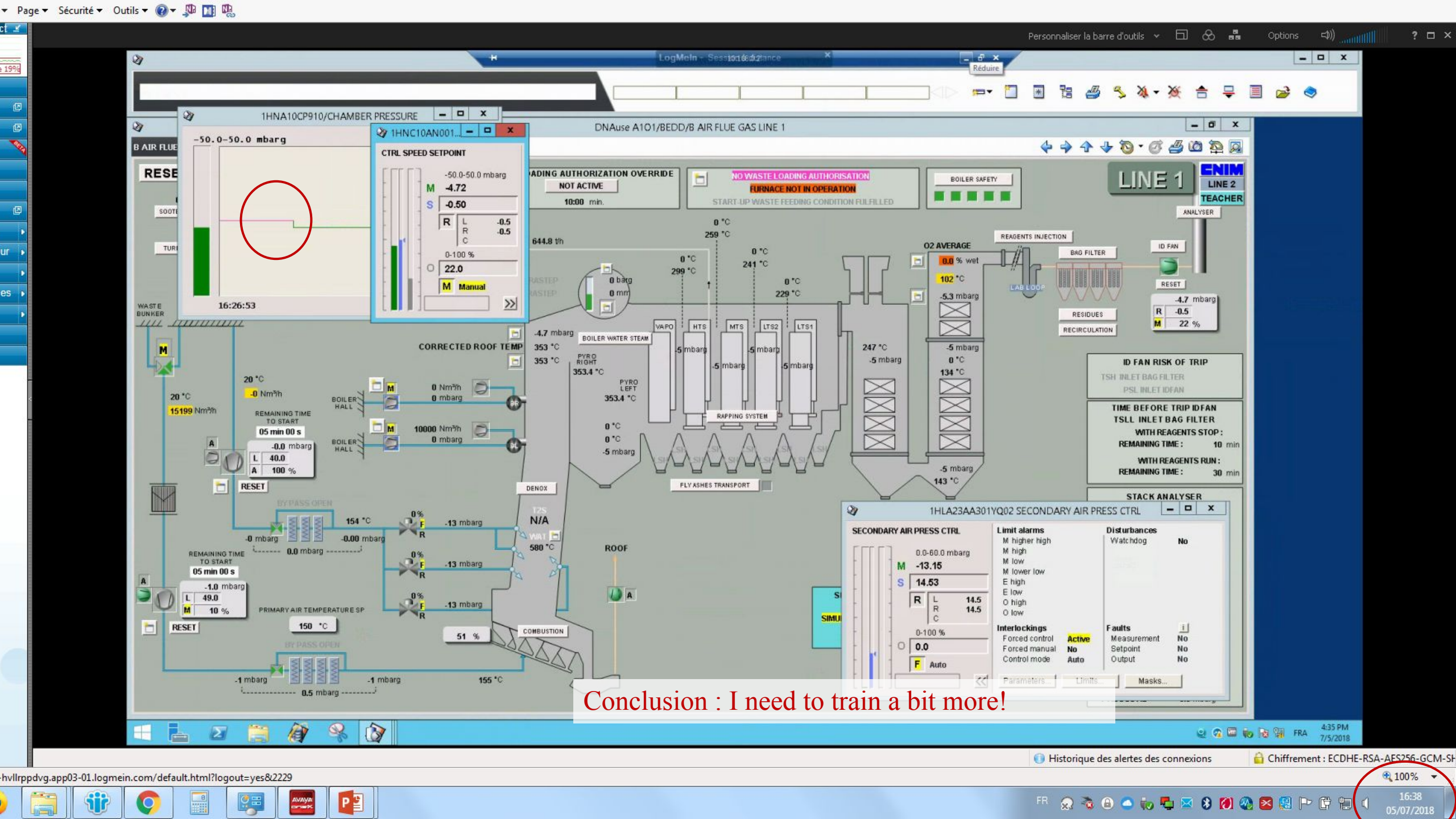
Chiffrement : ECDHE-RSA-AES256-GCM-SH

100%

16:27
05/07/2018


DNAuse A1O1/#arealabel/Control Panel
...:39:817
1HNA10CTY010_AL
AVERAGE ROOF TEMP
NO LOW LE...
DNAuse A1O1/BEDD/B AIR FLUE GAS LINE 1
B AIR FLUE GAS LINE 1
17.1
RESET
WASTE LOADING AUTHORIZATION OVERRIDE
NOT ACTIVE
10:00 min.
NO WASTE LOADING AUTHORISATION
FURNACE NOT IN OPERATION
START-UP WASTE FEEDING CONDITION FULFILLED
BOILER SAFETY
LINE 1
ENIM
LINE 2
OPS
ANALYSER
HP STEAM
401 °C
50 barg
523.6 t/h
TURBINE HP
0.0 t/h
SOOTBLOWERS
SECONDARY AIR FAN
SIMULATION SIGNALS
CB FAULT :
CB ENGAGED :
CB POSITION :
SWITCH CLOSE :
FUSE FAULT :
PC FAULT :
READY TO START :
NO FAULT
-0.5 mbarg
948 °C
873 °C
BOILER WATER STEAM
VAPO
HTS
MTS
LTS2
LTS1
PYRO RIGHT
872.1 °C
PYRO LEFT
873.0 °C
RAPPING SYSTEM
FLY ASHES TRANSPORT
O2 AVERAGE
0.0 % wet
REAGENTS INJECTION
BAG FILTER
ID FAN
LAB LOOP
RESIDUES
RECIRCULATION
WASTE BUNKER
BOILER HALL
20 °C
29825 Nm³/h
55074 Nm³/h
REMAINING TIME TO START
05 min 00 s
40.0 mbarg
40.0
61 %
10000 Nm³/h
0 mbarg
DENOX
T2S
N/A
WAT
1024 °C
ROOF
FAN WILL BE STOPPED IN
01 h 55 min 44 s
SOOTBLOWERS
VIBRATORS
BY PASS OPEN
150 °C
46 mbarg
40.00 mbarg
5.8 mbarg
50 %
15 mbarg
67 %
PRIMARY AIR TEMPERATURE SP
150 °C
COMBUSTION
40 mbarg
149 °C
5.5 mbarg
BOTTOM ASHES TRANSP.
ID FAN RISK OF TRIP
TSH INLET BAG FILTER
PSL INLET IDFAN
TIME BEFORE TRIP IDFAN
TSLL INLET BAG FILTER
WITH REAGENTS STOP :
REMAINING TIME : 10 min
WITH REAGENTS RUN :
REMAINING TIME : 30 min
STACK ANALYSER
SIMULATION
SIMULATION RUNNING
SCENARIO
FLOW
TEMPERATURE
PRESSURE
SIMULATION TEACHER VIEW
It's running!


DNAuse A1O1/#arealabel/Control Panel
...:41:916
1HNA10CTY010.DA
CORR ROOF TEMP
DEVIATION...
DNAuse A1O1/BEDD/B AIR FLUE GAS LINE 1
B AIR FLUE GAS LINE 1
1HLB20AN001 SEC FAN FI CAB FDR
SEC FAN FI CAB FDR
Limit alarms
M higher high No
M high No
Interlockings
Release On No
Release Off Active
Forced control On No
Forced control Off Active
Operation disabled No
Disturbances
Watchdog No
Other states
e1 CB STATE Active
e2 GEN FLT No
e3 FUSE OPEN No
e4 FC READY No
e5 No
e6 INTERLOCK No
Running Status No
Faults
Current No
Status No
Masks...
RESET
SOOTBLOWERS
TURBINE HP
WASTE BUNKER
BOILER HALL
CORRECTED ROOF TEMP
-4.8 mbarg
436 °C
430 °C
BOILER WATER STEAM
PYRO RIGHT
362.2 °C
PYRO LEFT
367.9 °C
VAPO
HTS
MTS
LTS2
LTS1
RAPPING SYSTEM
FLY ASHES TRANSPORT
DENOX
COMBUSTION
ROOF
SOOTBLOWERS
VIBRATORS
O2 AVERAGE
0.0 % wet
REAGENTS INJECTION
BAG FILTER
ID FAN
ANALYSER
LAB LOOP
RESIDUES
RECIRCULATION
NO WASTE LOADING AUTHORISATION
FURNACE NOT IN OPERATION
START-UP WASTE FEEDING CONDITION FULFILLED
BOILER SAFETY
LINE 1
ENIM
LINE 2
TEACHER
ID FAN RISK OF TRIP
TSH INLET BAG FILTER
PSL INLET IDFAN
TIME BEFORE TRIP IDFAN
TSLL INLET BAG FILTER
WITH REAGENTS STOP :
REMAINING TIME : 10 min
WITH REAGENTS RUN :
REMAINING TIME : 30 min
STACK ANALYSER
OXYGEN 0.0 % d
H2O 0.0 %
FLOW 0.0 Nm³/h w
0.0 Nm³/h d
TEMPERATURE 0.0 °C
PRESSURE 0.0 mbarg
SIMULATION
SIMULATION RUNNING
REMAINING TIME TO START
05 min 00 s
PRIMARY AIR TEMPERATURE SP
150 °C
51 %
SIMULATION
OPERATOR VIEW
A default on the fan


1HNA10CP910/CHAMBER PRESSURE
-50.0-50.0 mbarg
16:26:53
1HNC10AN001...
CTRL SPEED SETPOINT
-50.0-50.0 mbarg
M -4.72
S -0.50
R L -0.5 R -0.5 C
0-100 %
22.0
M Manual
DNAuse A1O1/BEDD/B AIR FLUE GAS LINE 1
LINE 1
ENIM
LINE 2
TEACHER
NO WASTE LOADING AUTHORISATION
FURNACE NOT IN OPERATION
START-UP WASTE FEEDING CONDITION FULFILLED
BOILER SAFETY
NOT ACTIVE
10:00 min.
644.8 t/h
O2 AVERAGE
0.0 % wet
102 °C
-5.3 mbarg
REAGENTS INJECTION
BAG FILTER
ID FAN
ANALYSER
LAB LOOP
RESIDUES
RECIRCULATION
RESET
-4.7 mbarg
R -0.5
M 22 %
WASTE BUNKER
CORRECTED ROOF TEMP
BOILER WATER STEAM
VAPO
HTS
MTS
LTS2
LTS1
-4.7 mbarg
353 °C
353 °C
PYRO RIGHT
353.4 °C
PYRO LEFT
353.4 °C
-5 mbarg
RAPPING SYSTEM
FLY ASHES TRANSPORT
247 °C
143 °C
ID FAN RISK OF TRIP
TSH INLET BAG FILTER
PSL INLET IDFAN
TIME BEFORE TRIP IDFAN
TSLL INLET BAG FILTER
WITH REAGENTS STOP :
REMAINING TIME : 10 min
WITH REAGENTS RUN :
REMAINING TIME : 30 min
STACK ANALYSER
20 °C
15199 Nm³/h
-0 Nm³/h
REMAINING TIME TO START
05 min 00 s
-0.0 mbarg
L 40.0
A 100 %
RESET
BOILER HALL
0 Nm³/h
0 mbarg
10000 Nm³/h
0 mbarg
DENOX
T2S
N/A
WAT
580 °C
ROOF
BY PASS OPEN
154 °C
-0 mbarg
-0.00 mbarg
0.0 mbarg
0 %
-13 mbarg
REMAINING TIME TO START
05 min 00 s
-1.0 mbarg
L 49.0
M 10 %
RESET
PRIMARY AIR TEMPERATURE SP
150 °C
51 %
COMBUSTION
-1 mbarg
-1 mbarg
155 °C
0.5 mbarg
1HLA23AA301YQ02 SECONDARY AIR PRESS CTRL
SECONDARY AIR PRESS CTRL
0.0-60.0 mbarg
M -13.15
S 14.53
R L 14.5 R 14.5 C
0-100 %
0.0
F Auto
Limit alarms
M higher high
M high
M low
M lower low
E high
E low
O high
O low
Interlockings
Forced control Active
Forced manual No
Control mode Auto
Disturbances
Watchdog No
Faults
Measurement No
Setpoint No
Output No
Parameters...
Limits...
Masks...
Conclusion : I need to train a bit more!

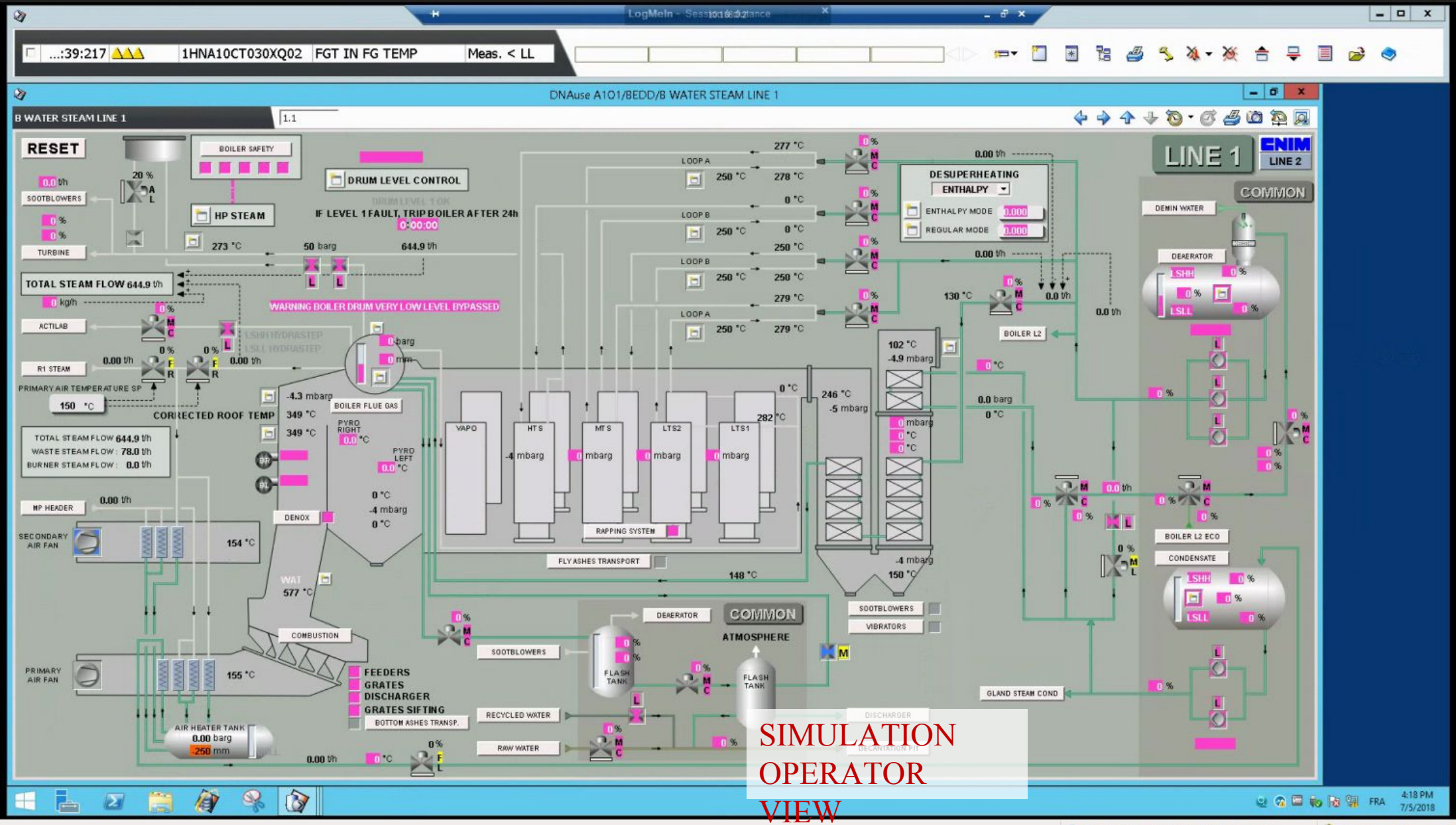
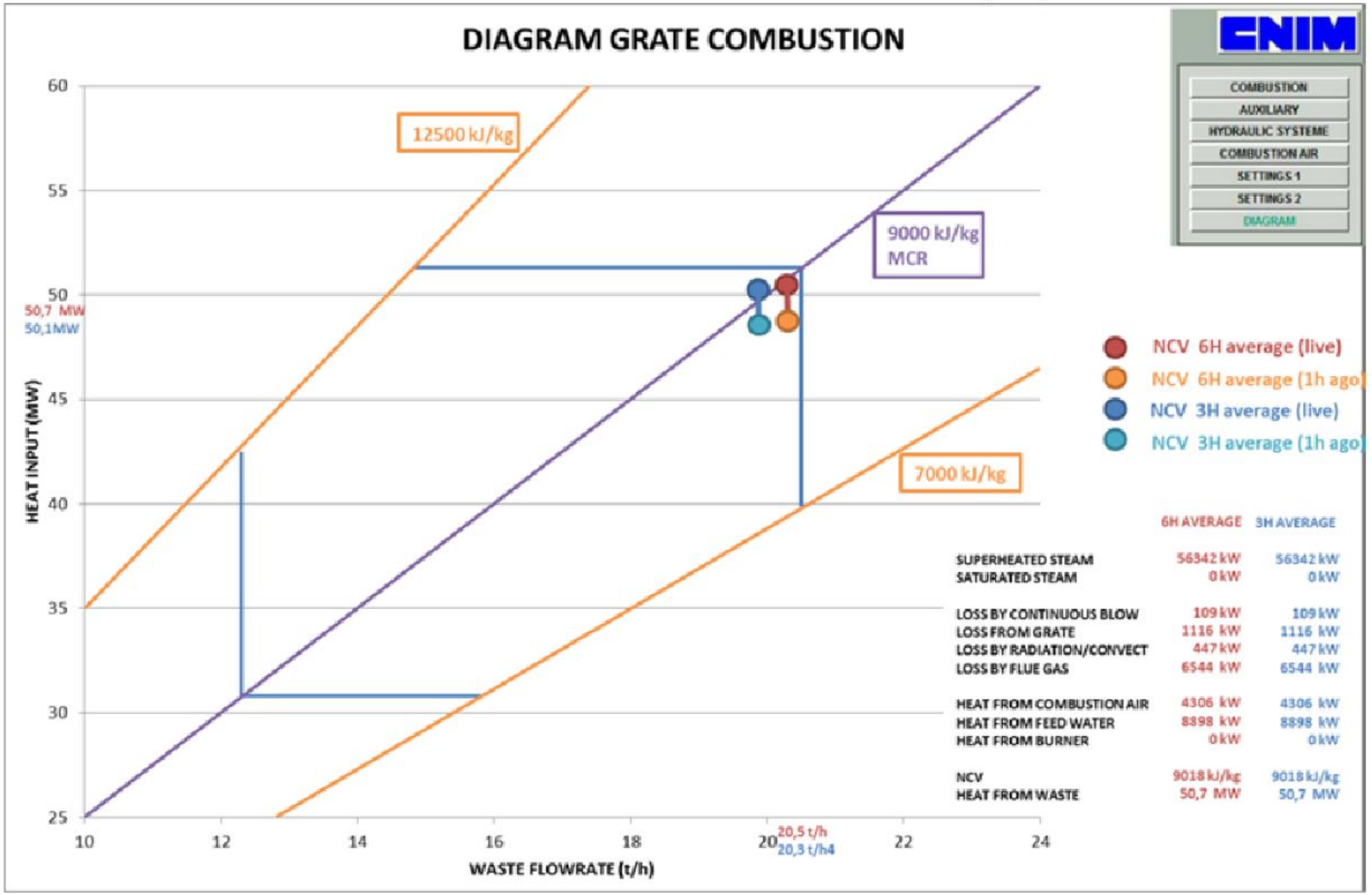

...:39:217
1HNA10CT030XQ02
FGT IN FG TEMP
Meas. < LL
DNAuse A1O1/BEDD/B WATER STEAM LINE 1
B WATER STEAM LINE 1
RESET
BOILER SAFETY
DRUM LEVEL CONTROL
IF LEVEL 1 FAULT, TRIP BOILER AFTER 24h
HP STEAM
TURBINE
TOTAL STEAM FLOW 644.9 t/h
WARNING BOILER DRUM VERY LOW LEVEL BYPASSED
ACTILAB
R1 STEAM
PRIMARY AIR TEMPERATURE SP
CORRECTED ROOF TEMP
BOILER FLUE GAS
DENOX
RAPPING SYSTEM
FLY ASHES TRANSPORT
SECONDARY AIR FAN
PRIMARY AIR FAN
COMBUSTION
FEEDERS
GRATES
DISCHARGER
GRATES SIFTING
BOTTOM ASHES TRANSP.
AIR HEATER TANK
SOOTBLOWERS
VIBRATORS
DEAERATOR
COMMON
ATMOSPHERE
FLASH TANK
RECYCLED WATER
RAW WATER
DESUPERHEATING
ENTHALPY
ENTHALPY MODE
REGULAR MODE
LINE 1
LINE 2
ENIM
DEMIN WATER
BOILER L2
BOILER L2 ECO
CONDENSATE
GLAND STEAM COND
SIMULATION
OPERATOR
VIEW

DIAGRAM GRATE COMBUSTION



CNIM

- COMBUSTION
- AUXILIARY
- HYDRAULIC SYSTEME
- COMBUSTION AIR
- SETTINGS 1
- SETTINGS 2
- DIAGRAM

	6H AVERAGE	3H AVERAGE
SUPERHEATED STEAM	56342 kW	56342 kW
SATURATED STEAM	0 kW	0 kW
LOSS BY CONTINUOUS BLOW	109 kW	109 kW
LOSS FROM GRATE	1116 kW	1116 kW
LOSS BY RADIATION/CONVECT	447 kW	447 kW
LOSS BY FLUE GAS	6544 kW	6544 kW
HEAT FROM COMBUSTION AIR	4306 kW	4306 kW
HEAT FROM FEED WATER	8898 kW	8898 kW
HEAT FROM BURNER	0 kW	0 kW
NCV	9018 kJ/kg	9018 kJ/kg
HEAT FROM WASTE	50,7 MW	50,7 MW

CIRCULAR ECONOMY
MECHANICAL WASTE TREATMENT
FOR SORTING & MATERIAL RECYCLING

SYCTOM PARIS XVII
FRANCE

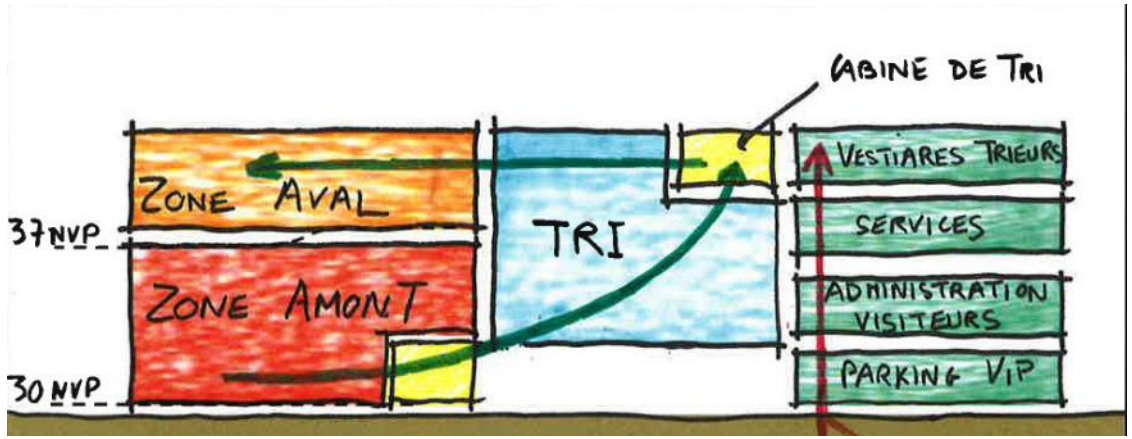
CNIM

Courtesy: Ateliers Monique Labbé

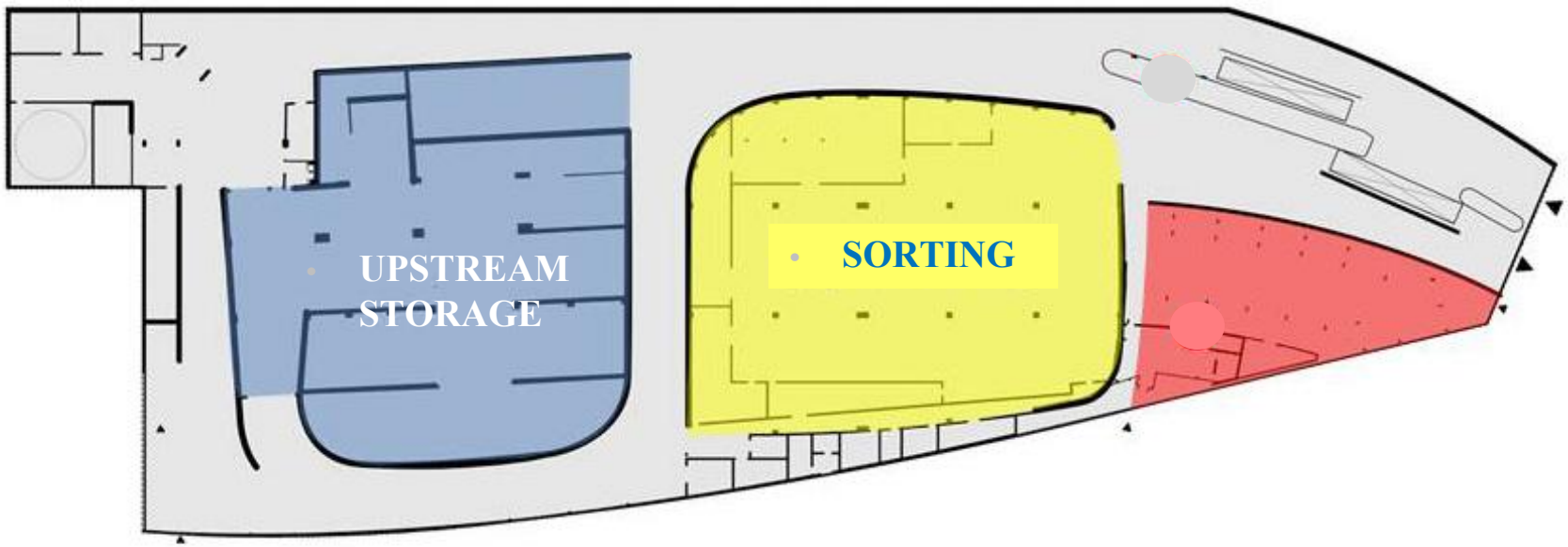
WASTE SORTING FACILITY FOR PARIS XVII (SYCTOM)

- CONTRACT OBTAINED BY CNIM CONSORTIUM FOR DESIGN, BUILD AND OPERATE
- 45,000 TONS OF DRY AND CLEAN WASTE FROM SELECTIVE COLLECTION IN PARIS AND SUBURBS
- 

WASTE SORTING FACILITY FOR PARIS XVII (SYCTOM)



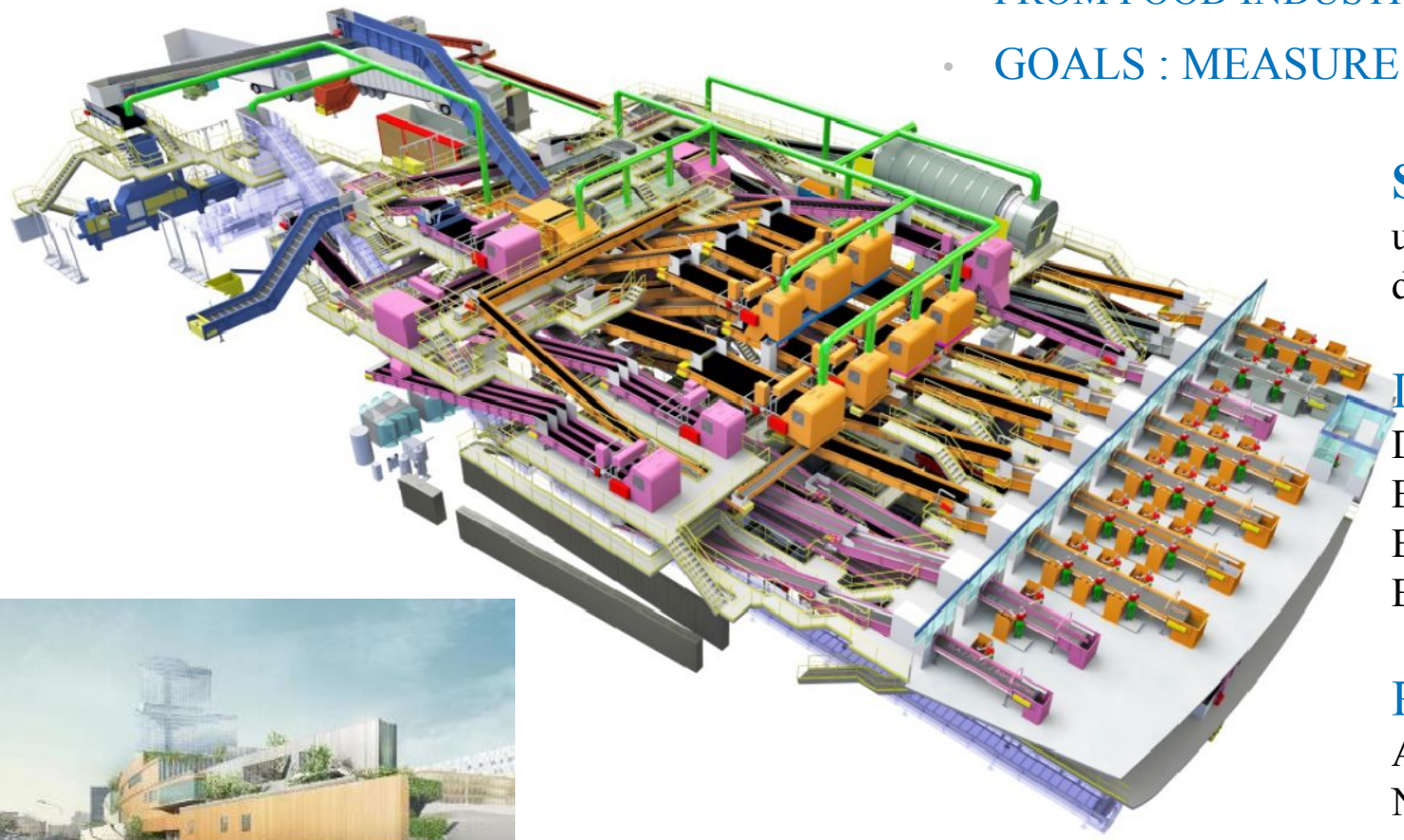
- CONTRACT OBTAINED BY CNIM CONSORTIUM FOR DESIGN, BUILD AND OPERATE
- 45,000 TONS OF DRY AND CLEAN WASTE FROM SELECTIVE COLLECTION IN PARIS AND SUBURBS
- CAPACITY 15 TONS /H
- 12 OPTICAL SORTING FACILITIES



CAPM: COMPUTER ASSISTED PRODUCTION MANAGEMENT

WASTE SORTING FACILITY FOR PARIS XVII (SYCTOM)

- 12 OPTICAL SORTING FACILITIES
- LINKED TO DCS (DISTRIBUTED CONTROL SYSTEM) ADAPTED FROM FOOD INDUSTRY
- GOALS : MEASURE PERFORMANCES & HELP FOR OPERATION



SENSORS : WEIGHT FOR EACH FLOW

upstream on inlet
downstream on material storage

IMMEDIATE **REPORTS**

Daily
By lot from one collection source
By team
By recycled material

PRODUCTIVITY INCREASE

Automatic Baling
No storage oversizing :
continuous flow

CAPM: COMPUTER ASSISTED PRODUCTION MANAGEMENT

BILANS DE PRODUCTION DU CENTRE DE TRI

NUMERO DE LOT : 20060614092133_SIDEFAGE

PRODUIT : EMB VRAC 5T SEEDR

TYPE DE FLUX : Emballage leger

COLLECTIVITE : SIDEFAGE — COLLECTE : Apports volontaires

EQUIPE : A — (Trieurs : 0 , Connexes : 0)

DATE DE DEBUT : 14/06/2006 09:21:59 — DATE DE FIN : 14/06/2006 11:12:16

MATERIAUX	POIDS	%	DEBIT
Acier	129,6 Kg	2,11 %	96 Kg/h
Aluminium	72 Kg	1,17 %	53,33 Kg/h
EMR - Cartons	32 Kg	0,52 %	23,7 Kg/h
EMR - Cartonnette	26 Kg	0,42 %	19,26 Kg/h
ELA	79 Kg	1,29 %	58,52 Kg/h
PET incolore	909 Kg	14,79 %	673,33 Kg/h
PET colore	2152 Kg	35,01 %	1594,07 Kg/h
PEHD	1347 Kg	21,92 %	997,78 Kg/h
Journaux magazines	0 Kg	0 %	0 Kg/h
GM	212 Kg	3,45 %	157,04 Kg/h
Refus	1187,8 Kg	19,33 %	879,85 Kg/h

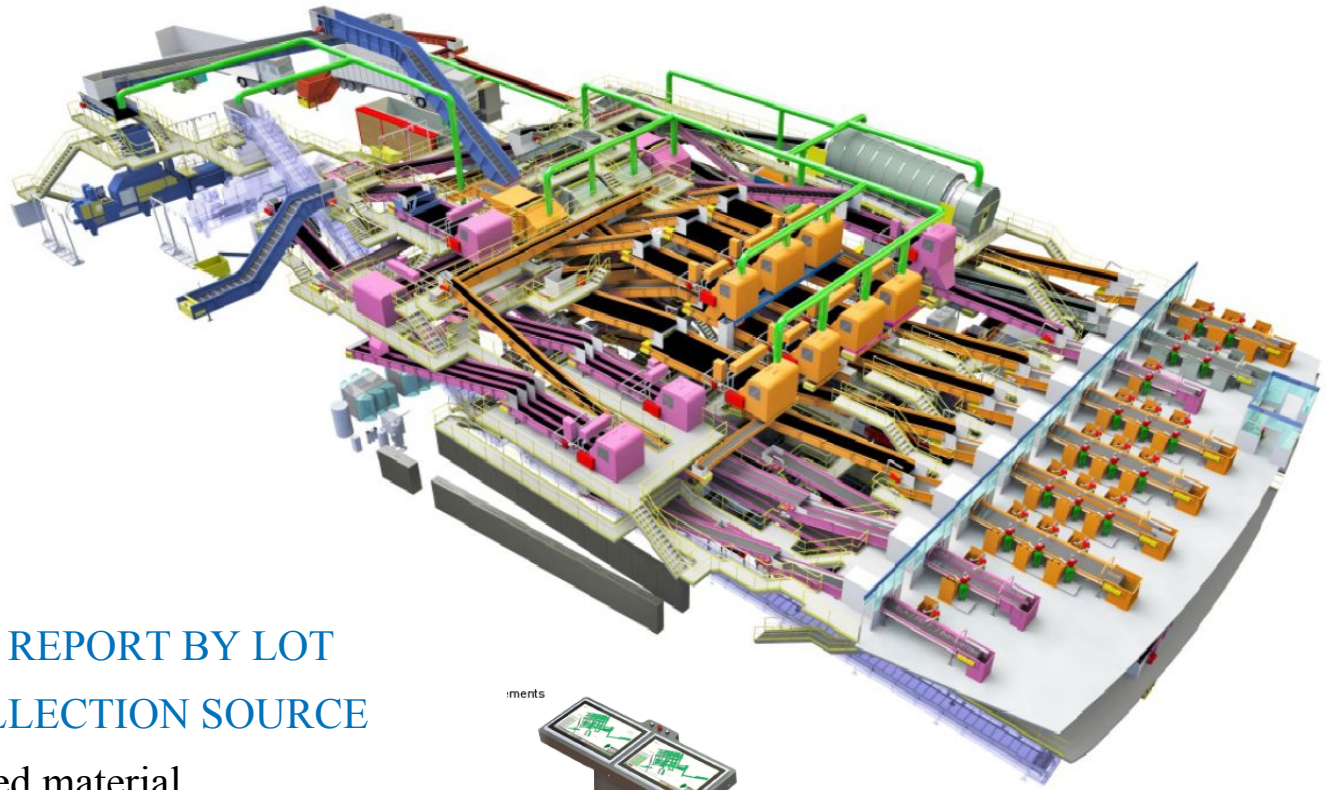
TOTAL PRODUIT TRIES : 6146,4 Kg
DEBIT MOYEN PRODUITS TRIES : 4,55 T/h
TOTAL SORTIE TREMIE 1 : 5970 Kg
TOTAL SORTIE TREMIE 2 : 0 Kg
POIDS TRIES PAR PERSONNE : 0 Kg/h/trieur
PRODUCTIVITE DU PROCESS : 0 Kg/h/trieur
PRODUCTIVITE DE L'EXPLOITATION : 0 Kg/h/trieur

TRIEURS PRE-TRI : 0
TRIEURS JRM1 : 0
TRIEURS JRM2 : 0
TRIEURS GM : 0
TRIEURS CC1 : 0
TRIEURS CC2 : 0
CONNEXES : 0

TEMPS DE PRODUCTION THEORIQUE : 0
TEMPS DE VIDANGE THEORIQUE : 0
TEMPS DE NETTOYAGE THEORIQUE : 0
TEMPS D'OUVERTURE : 0 h

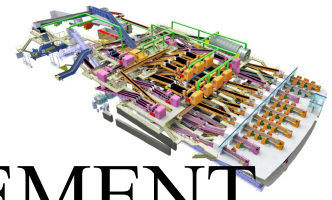
TRS : 0 %
T arret volontaire : 0 %
TRG : 0 %

TEMPS DE TRI REEL : 1,35 h
TEMPS DE VIDANGE REEL : 0 h
TEMPS D'ARRET VOLONTAIRE : 0 h
TEMPS DE FONCTIONNEMENT : 1,35 h
TEMPS DE NON FONCTIONNEMENT : -1,35 h



EXAMPLE OF REPORT BY LOT
FOR ONE COLLECTION SOURCE

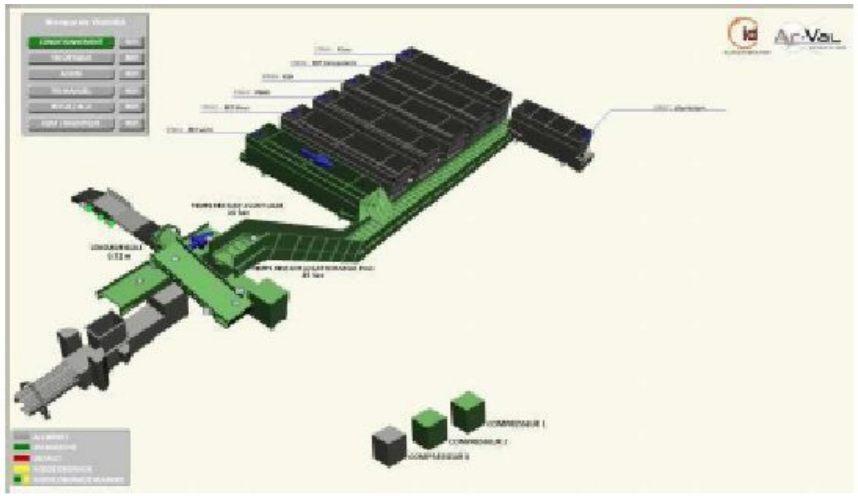
- By recycled material
- By team
- In weights
- In flows

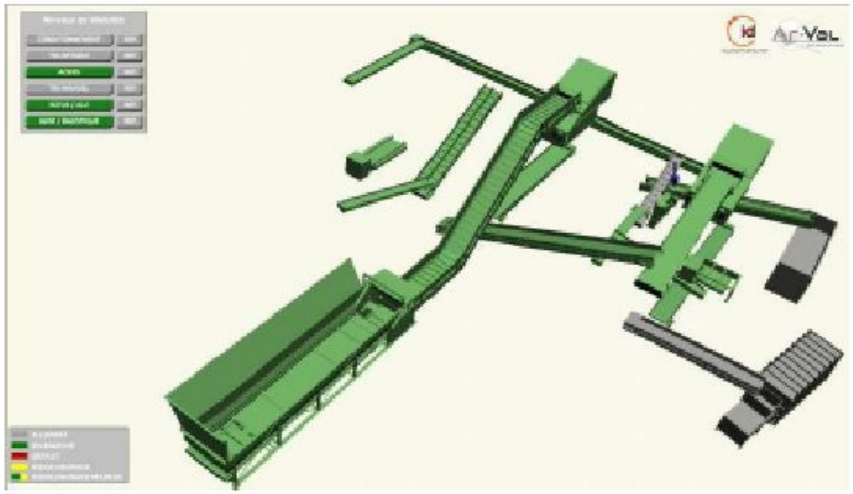


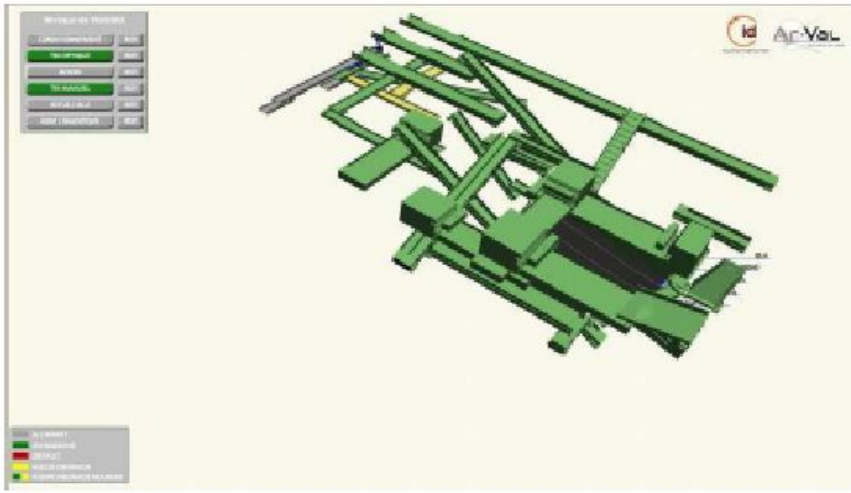
CAPM: COMPUTER ASSISTED PRODUCTION MANAGEMENT

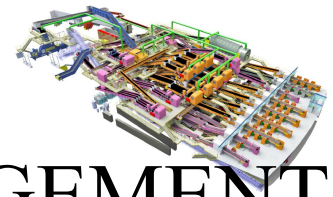
3 D SUPERVISION BY ZONES

- Inlet and refuses
- Optical sorting and manual checking
- Storage and baling



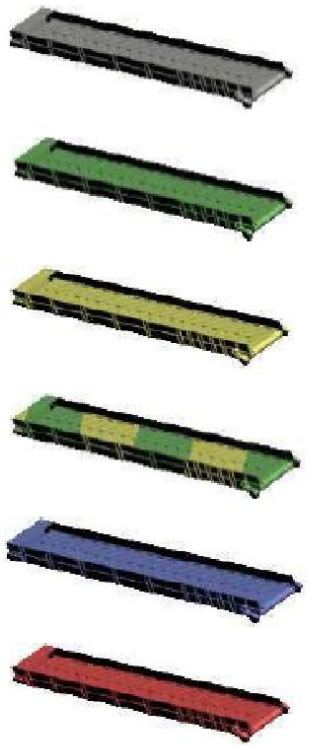




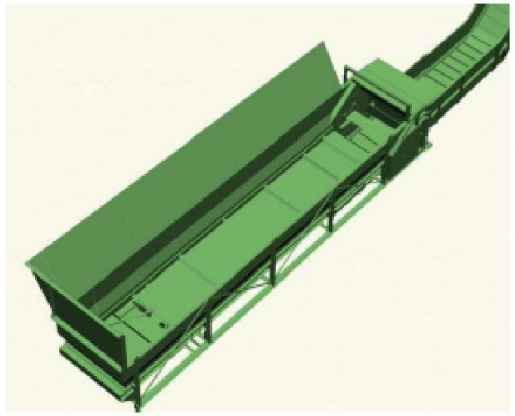


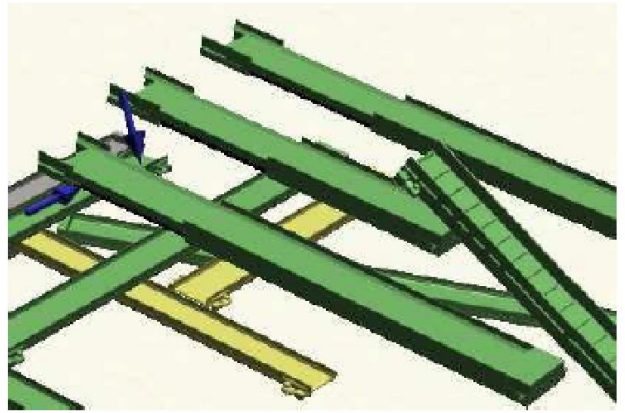
CAPM: COMPUTER ASSISTED MAINTENANCE MANAGEMENT

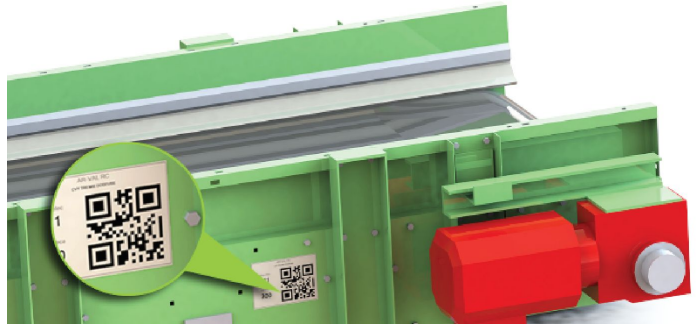
3 D ANIMATIONS



- Stop (automatic)
- Run (automatic)
- Stop in degraded operation (manual)
- Run in degraded operation (manual)
- Maintenance
- In default







TROYES (FRANCE) –SDEDA

- THE contract for a greenfield project in France in the last 5 years
- CNIM turnkey DB supplier as sub-contractor of Veolia for a public service delegation
- 1 line process excl. CW 60,000tpa @ LCV 11.7MJ/kg

CNIM LATEST REFERENCES IN BRITISH ISLANDS

DESIGN AND BUILD OF ENERGY-FROM-WASTE / FLUE GAS TREATMENT PLANTS

Cardiff, Viridor 2015
EfW: 2 x23t/h "DB" v

Shropshire, Veolia 2015
EfW: 1 x12t/h "DB" v

Ridham Dock, MVV 2015
Polluted Biomass :
1x103MWth "DB" V

Leeds, Veolia 2016
EfW: 1 x20.5t/h "DB"

Wilton, Sita 2016
EfW: 2x29.2t/h "DB" V

Gloucester, Urbaser 2017
FGT EfW : 1 x 23t/h "DB"

South London, Viridor 2018
EfW: 1 x17.6t/h "DB" V

Avonmouth, Viridor 2019
EfW: 2 x20,6 t/h "DB"

Legend: (D) Design , (B) Build , (F) Finance, (O) Operate/Own, (M) Maintenance, (T) Transfer, (FGT) Flue Gas Treatment

CNIM LATEST TURNKEY REFERENCES IN UK

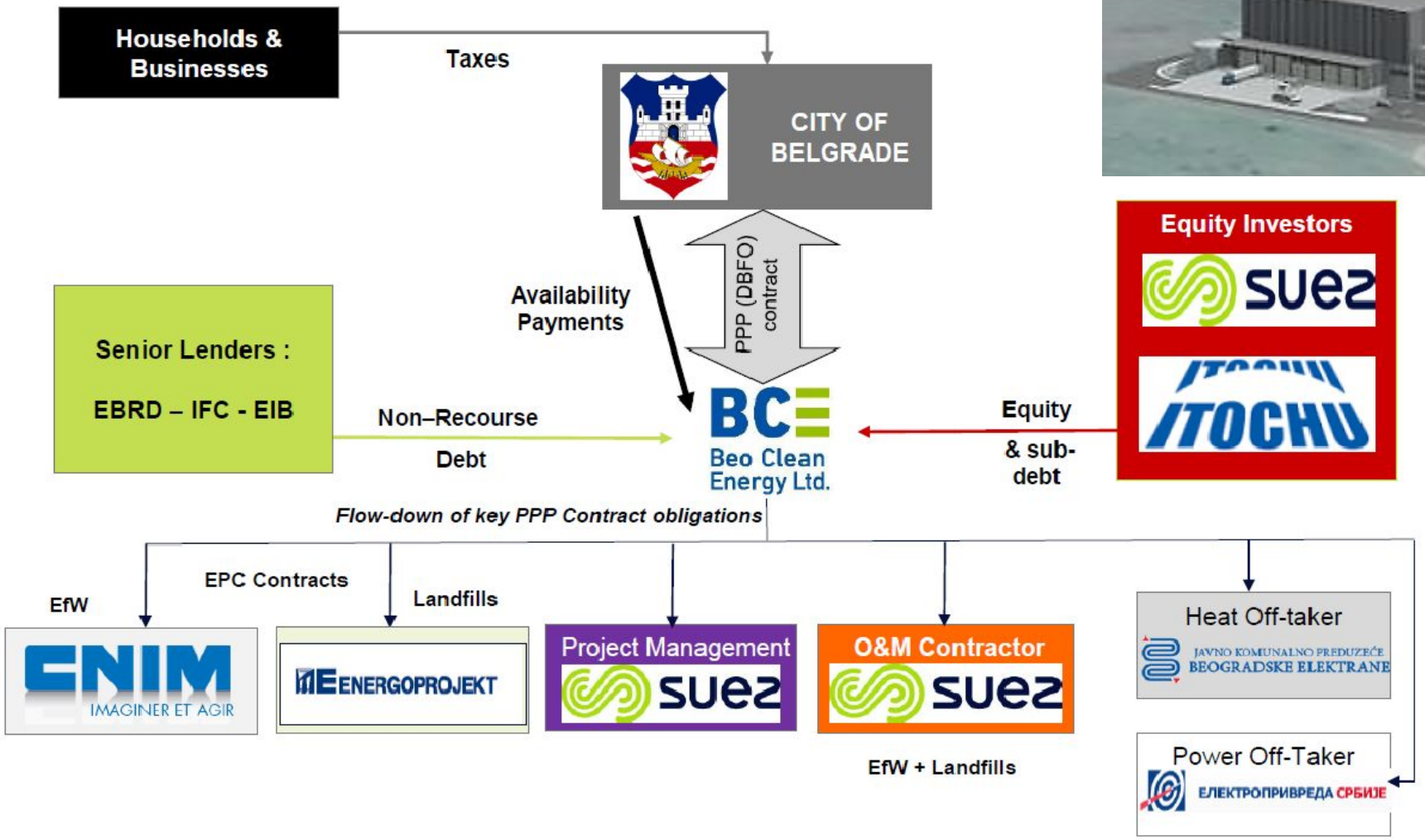
DESIGN AND BUILD OF ENERGY-FROM-WASTE / FLUE GAS TREATMENT PLANTS

KEMSLEY Wheelabrator 2018
EfW: 2 x35 t/h "DB"

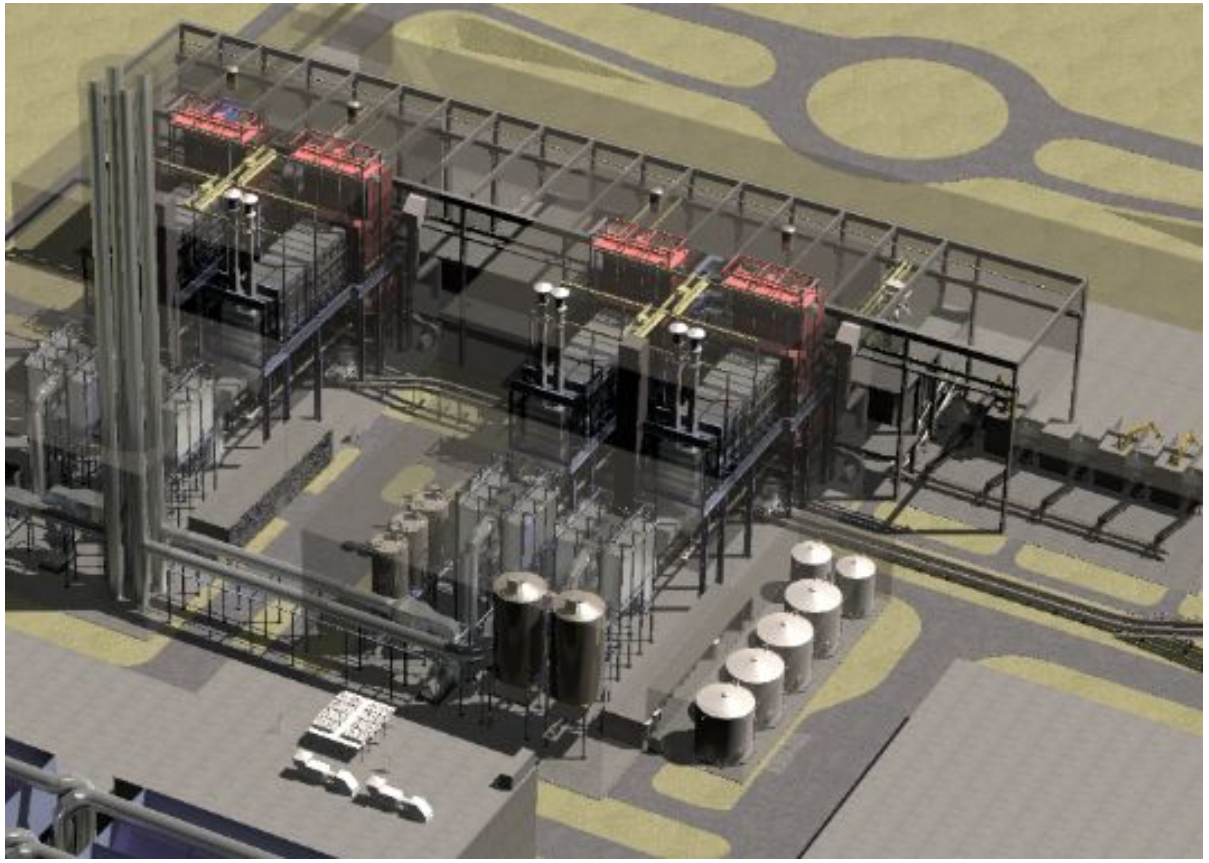
PARC ADFER North Wales Wheelabrator, 2019
EfW: 1x26.3t/h "DB"

Legend: (D) Design , (B) Build , (F) Finance, (O) Operate/Own, (M) Maintenance, (T) Transfer, (FGT) Flue Gas Treatment

BELGRADE (SERBIA) PPP PROJECT DELIVERY STRUCTURE



KUWAIT - KABD



CNIM, GIC AND AL MULLA CONSORTIUM SELECTED FOR THE WASTE TO ENERGY PROJECT IN KUWAIT

PREFERRED INVESTOR FOR THE PROJECT OF EFW PLANT OF 1MILLION TONNES PER YEAR

DESIGN, BUILD, OPERATE & MAINTENANCE AND SPONSOR FOR FINANCING

FOR 25 YEARS FOLLOWING COMPLETION OF CONSTRUCTION

مؤسسة الخليج للاستثمار
Gulf Investment Corporation

مجموعة المال
AL MULLA GROUP

CNIM

AUTOMATION EVOLUTION FOR MUNICIPAL WASTE TREATMENT FACILITIES!

2018 EEC/WTERT Bi-Annual Conference
Sustainable Waste Management: The Forefront of Innovation
NEW YORK (USA) October 4th – 5th 2018

Christophe CORD'HOMME - ccordhomme@cnim.com

PROVEN, STATE OF THE ART AND PRAGMATIC CNIM AUTOMATION SOLUTION FOR WASTE MANAGEMENT

Not new topic, but in constant evolution!

Reliable wide automation solution for waste management plant

With strong partners and benefices of integrated experience of CNM

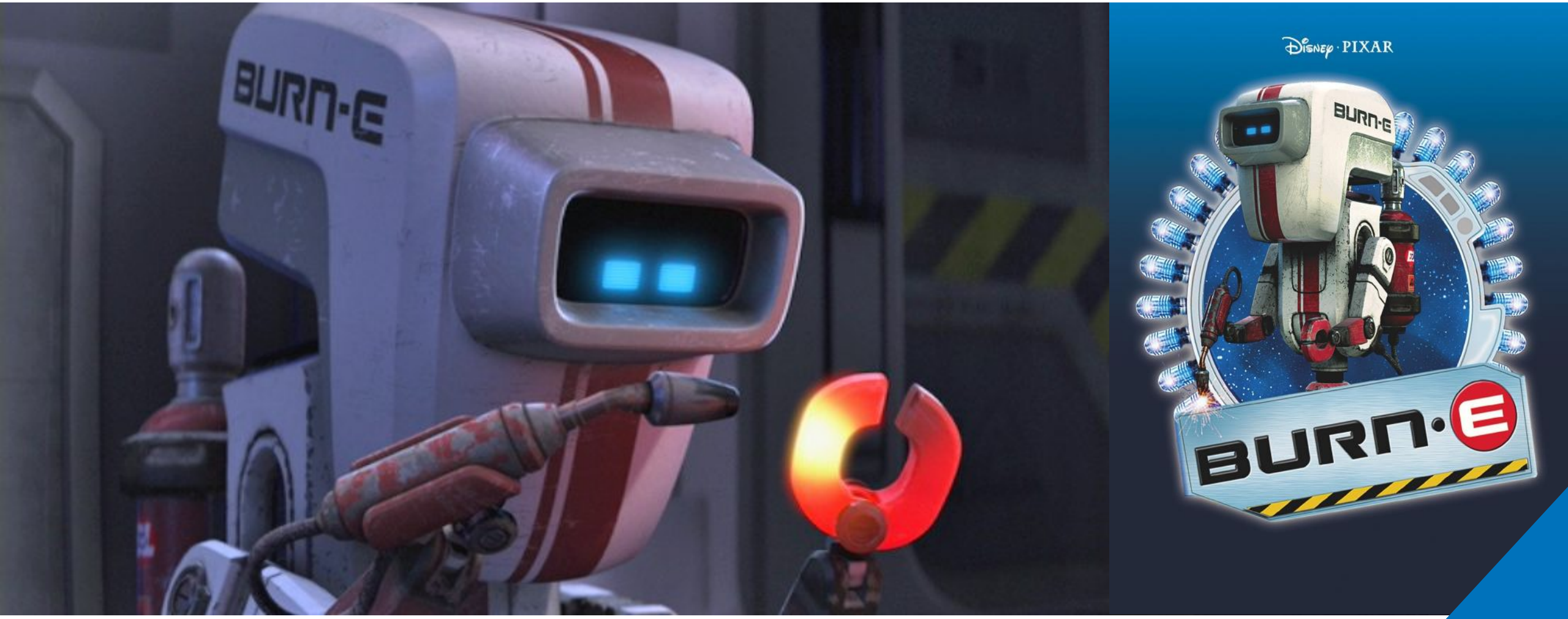
- **Modern DCS with full redundancy and security**
- **Experienced project services for timely turnkey delivery**
- **Integrated process control and safety systems**

Comprehensive lifecycle services with performance monitoring solution, remote access, utilized industrial Internet, simulation…

Computer Assisted Production and Maintenance Management

- **ILS = integrated logistic support**
- **RAMS = reliability, availability, maintainability & safety**

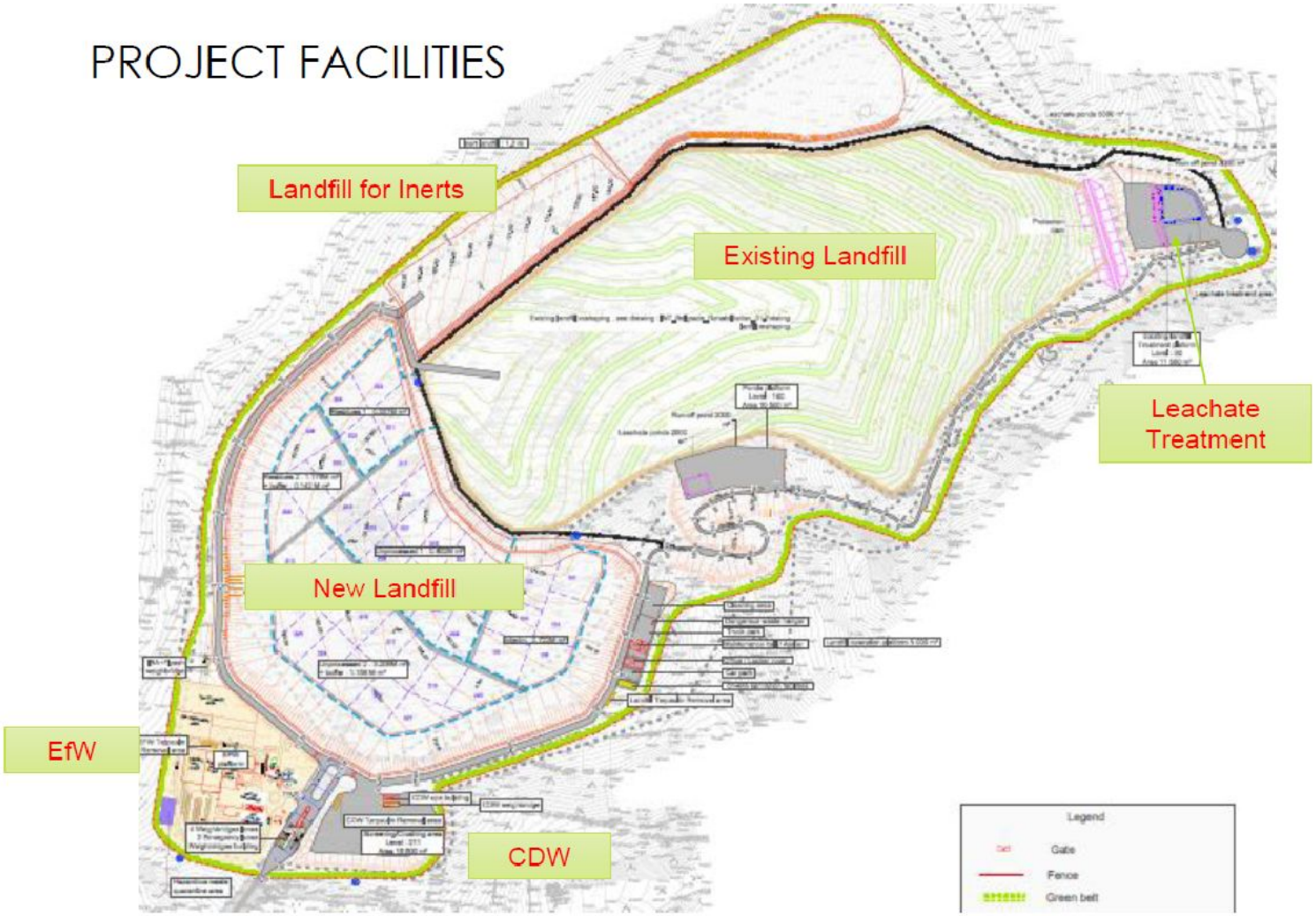
ROBOT "BURN-E"
"BASIC UTILITY REPAIR NANO ENGINEER"?



TALLIN MAARDU (ESTONIA) – EESTI ENERGIA

- Drivers
  - Land fill tax raise of 20% to 30€/ton in 2015
  - Heat network priority by law for renewable sources with subsidies : 50€/MWh for energy produced from renewable fuel (including bio waste)
- CNIM turnkey DB supplier
  - Single line 31 t/hr at 9.3 MJ/kg
  - Thermal capacity per line: 80.2 MW
  - Steam output per line: 111.3 t/hr , 43 bar, 403 °C
  - Turbine generator output: 17MWel
  - Heat production : 50 MWth

BELGRADE (SERBIA) PROJECT FACILITIES



FIRST EFW IN SERBIA AND THE BALKANS

CNIM TURNKEY DELIVERY INCL. CIVILS

- Single line 103MW therm
- Capacity: 340k t/y
- MCR: 49t/h @ 7.8 MJ/kg
- Location of the project: Vinca site in Belgrade

CNIM LATEST REFERENCES IN BRITISH ISLANDS

DESIGN AND BUILD OF ENERGY-FROM-WASTE / FLUE GAS TREATMENT PLANTS

Jersey, State 2011
EfW: 2x8.1t/h "DB"

Teeside, Sita 2011
FGT EfW 1 x 10t/h "DB" V

Meath, Indaver (IRL), 2012
FGT EfW : 1 x27t/h "DB"

Lincolnshire, WRG-FCC 2013
EfW: 1 x19.2t/h "DB"

Staffordshire, Veolia 2013
EfW: 2 x20 t/h "DB"

Ardley, Oxfordshire, Viridor 2014
EfW: 2 x 19.2t/h "DB"

Suffolk, Sita 2014
EfW : 1 x 15.8t/h "DB"

Plymouth, MVV 2014
FGT EfW: 2 x13t/h "DB"

Legend: (D) Design , (B) Build , (F) Finance, (O) Operate/Own, (M) Maintenance, (T) Transfer, (FGT) Flue Gas Treatment

CNIM DEDICATED APPROACH FOR DCS : REFERENCES

DEVELOPMENT, SUPPLY AND COMMISIONING OF A FULL NEW DCS:

- Valmet DNA: Energonut - Lincoln - Tallinn - Stafford - Kogeban - CBEM - Oxford - Suffolk - Cardiff - Ridhamdock - Shropshire - Leeds – Wilton
- Siemens PCS7: Jersey – Flamoval
- Siemens T3000: Baku
- ABB: Marseille

UPDATING OF AN EXISTING DCS:

- Thiverval - Toulon - Selchp - Brive - Pluzunet

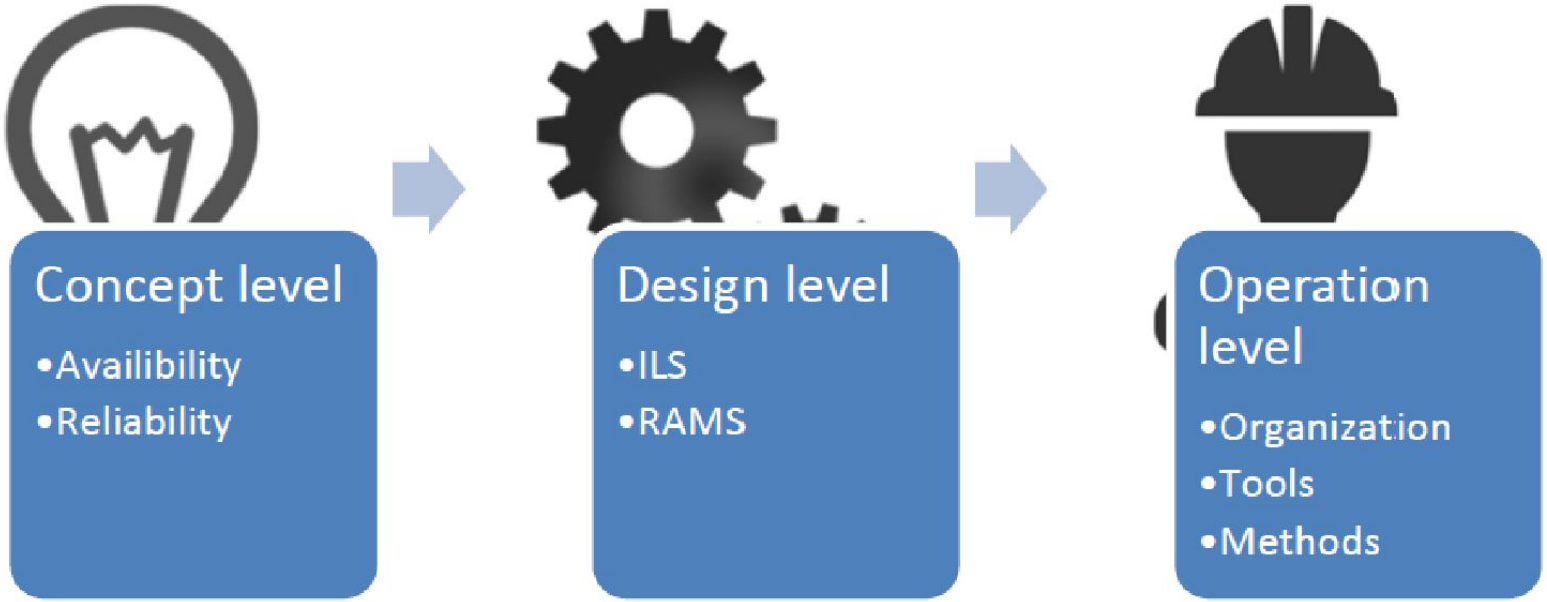
UPDATING OF SUPERVISION, UPDATING OF CONTROLLER (METSO), EXTENSION FOR DCS :

- Dudley – Wolverhampton - Stoke On Trent - Thiverval

CAMM COMPUTER ASSISTED MAINTENANCE MANAGEMENT

ILS = INTEGRATED LOGISTIC SUPPORT

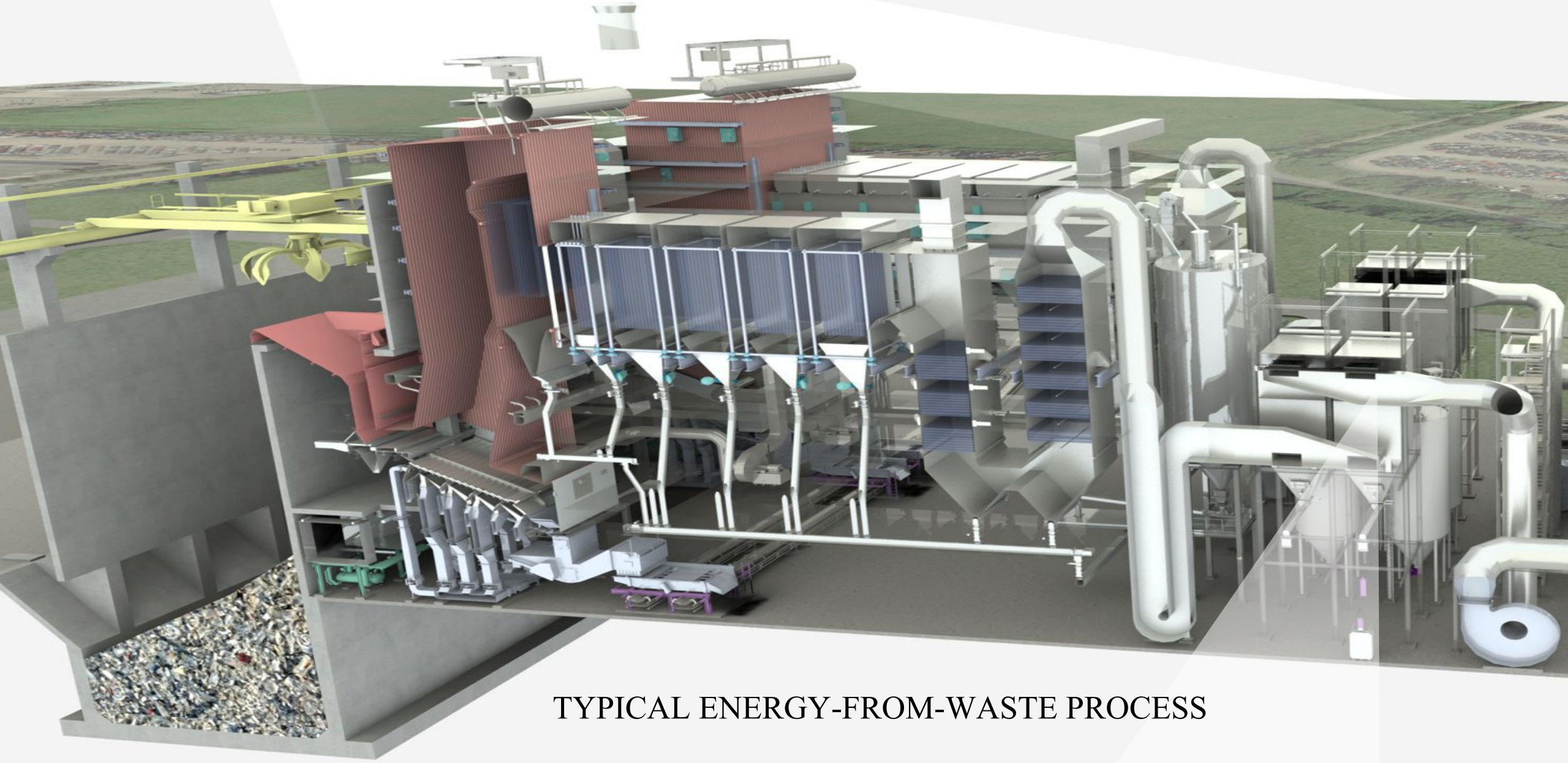
RAMS = RELIABILITY, AVAILABILITY, MAINTAINABILITY & SAFETY



WHAT DO MODERN WASTE-TO-ENERGY PLANTS EXPECT FROM PROCESS AUTOMATION?

PROVIDE EFFICIENT WASTE VOLUME REDUCTION & ENVIRONMENTALLY FRIENDLY WAY TO PRODUCE ENERGY

Challenge	Solution	Results
Wide variation in waste composition	Automation system created over the years to support waste-to-energy plants • Including advanced operator interface and analysis tools • Plant wide automation and information system • Both industrial and utility power plants	More operational flexibility
Differences in some properties with a significant effect on the Incineration process	Turnkey delivery from hardware design to commissioning • Green field plants and retrofit projects	Reliability
May lead to high process instability	Shared Journey Forward: Lifecycle services including feasibility studies, availability services and performance solutions • Industrial Internet utilized e.g. in remote services	Availability



TYPICAL ENERGY-FROM-WASTE PROCESS