



## Delivering Sustainable Waste Solutions for Dubai Municipality

### The Warsan Waste Management Company Energy from Waste Facility

**Tim Clarke**  
**CEO WWMC**



# Dubai Government Vision

Ruler of Dubai HH Sheikh Mohammed bin Rashid Al Maktoum's SMART and Sustainable City initiative

Dubai Municipality policy - Zero to Landfill 2030

UAE President HH Sheikh Mohamed bin Zayed Al Nahyan declared 2023 the UAE Year of Sustainability

Primary Strategy for Energy from Waste – reduction of landfill

## The WWMC Dubai EfW facility

- Reduces volume of waste to landfill by 45%
  - Reduces Greenhouse gas emissions from landfill sites
  - Recovery of energy reduces Greenhouse Gas emissions by replacing fossil fuel generation capacity
  - High efficiency recovers greater proportion of available energy - 34% efficiency of electrical energy production
- Net 65mTonnes CO<sub>2</sub>equivalent emissions reduced over the 35-year Project life



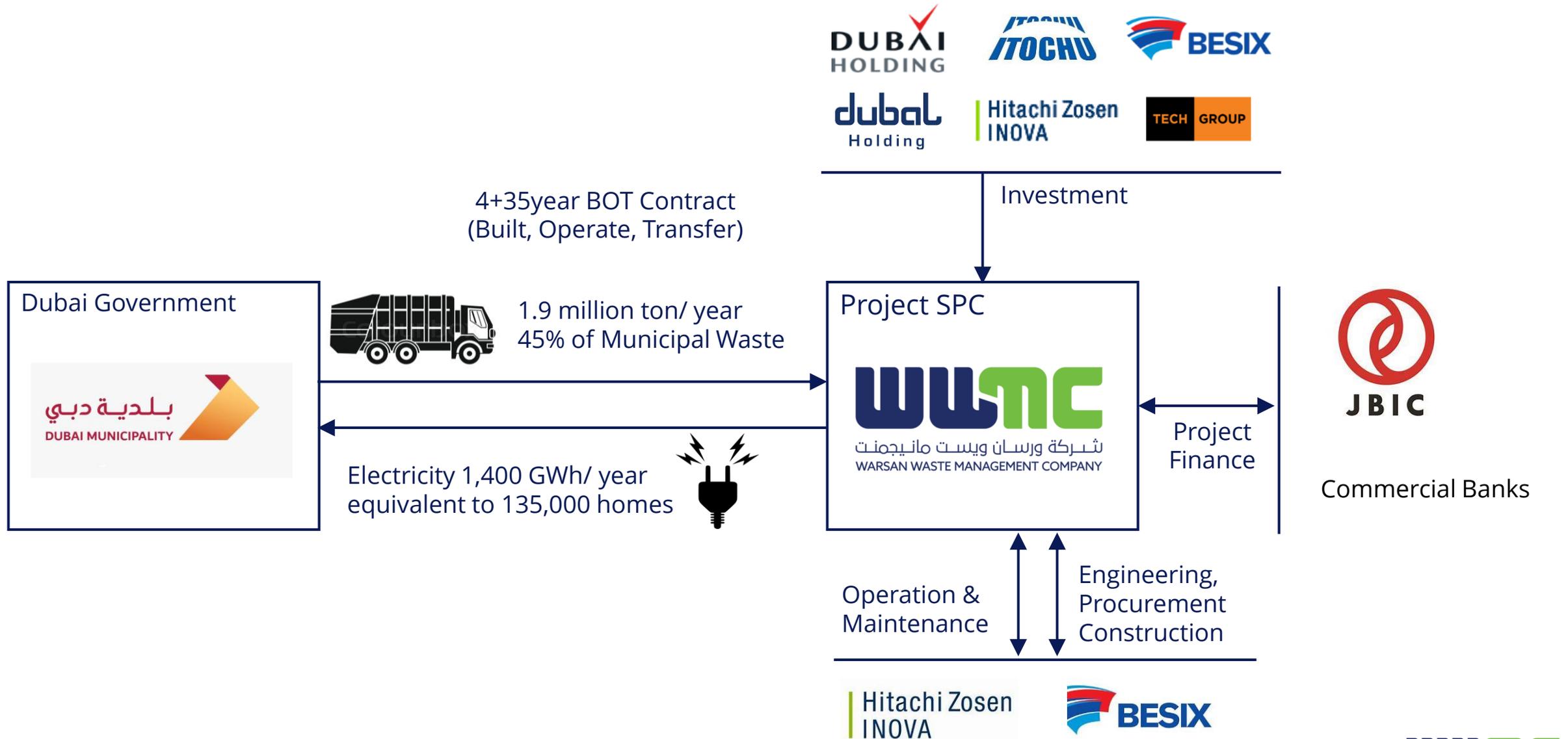
Dubai - Al Qusais Landfill



Worlds Largest EfW facility  
1.9m Tonnes waste per year  
1,100 Waste Trucks per day  
5 Boiler lines  
12m x15m 5-lane grate burning area  
124MW Thermal Boilers  
34% Efficiency  
215MW Electrical Power Generation



# Project Structure: Dubai EfW Project



# Stakeholders: Dubai EfW Project

## 6 Owners

## 4 Shareholders

Shareholders



Dubai Holding 40%

DI Holding 31%

Ecosix WTE holding 19%

Hitachi Zosen Innova 10%

50% UAE holding



11 Board Members (Non-Exec) - Quarterly  
7 Management Committee members (Non-Exec) - Monthly

Project Finance



Lead Financing and Credit cover

9 Commercial Banks  
General Facility Agent  
Lenders Technical Advisor  
Lenders Legal Advisor

Monthly credit and interest submissions  
LTA Monthly reporting and on demand visits

Concession Agreement



Projects Department  
Waste Operations Department  
Waste Strategy Department  
Environment Department  
Irrigation Department  
Building Department  
Land Department  
IT Department  
Finance Department  
Electrical Distribution Department  
Health and Safety Department  
Environmental Health Department

Director General Supervisory Board  
CA CEO meetings  
Operations Committee  
Construction liaison  
DM Technical Advisor  
Distribution Operations Coordination Group  
Reporting  
Tariff and weighbridge reconciliation process

Other Dubai Government Authorities

Dubai Civil Defense  
Roads Traffic Department  
Ministry of Finance  
Dubai, Sharjah and Ras Al Kaimah Customs  
Regulation and Safety Board  
Dubai Electricity and Water Authority  
Ministry of Industry

Approvals meetings  
Roads Management meetings  
Customs Approval (per shipment)  
Quarterly RSB meetings and reporting  
DEWA liaison for connections and import billing  
Industrial Permits and licences renewal

Major Contracts

O&M Company Shou'alah  
EPC Contractor  
Metal Sales  
Insurance Broker

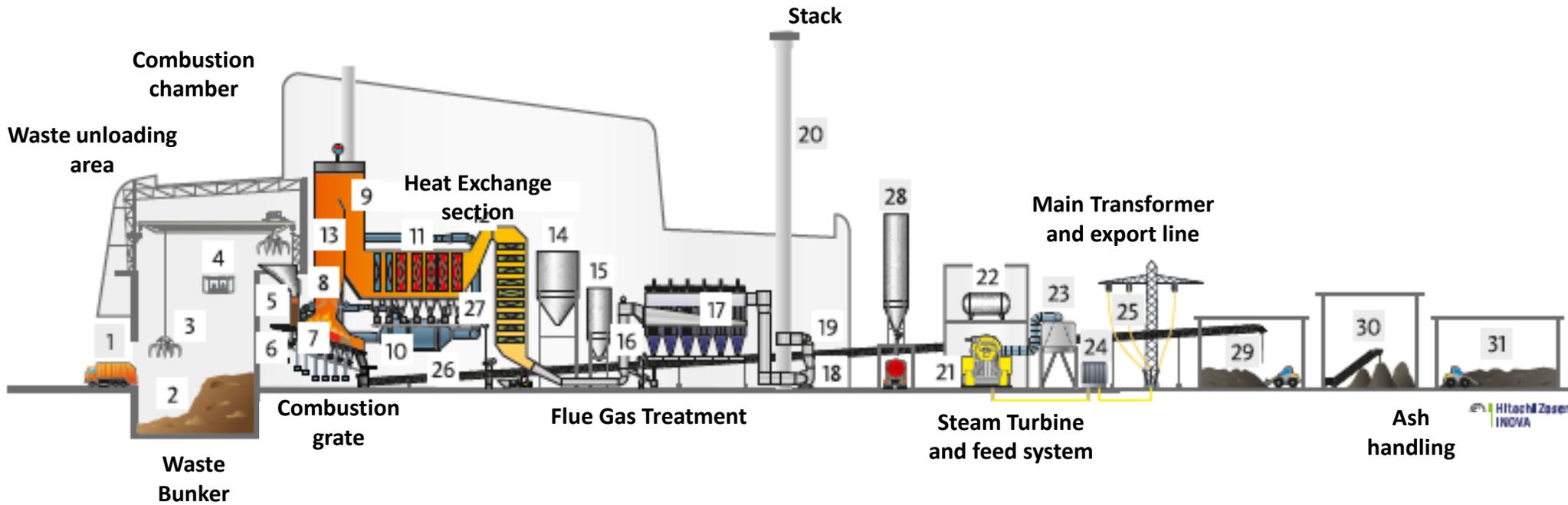


Day to Day Management of site issues  
Insurance Monthly reporting  
Insurance syndication

Community

Local Community Contacts, public information Booths, Visitors centre – target 1,000 visitors to site per year

# General Schematic of Energy from Waste facility



Waste Delivery and Storage	Combustion and Boiler	Flue Gas Treatment	Energy Recovery	Residue Handling and Treatment
1 Tipping area	5 Feed hopper	13 SNCR DyNOR®	21 Steam turbine	26 Bottom ash extractor
2 Waste bunker	6 Ram feeder	14 Lime slaker	22 Feed water tank	27 Boiler ash discharge
3 Waste crane	7 HZI Grate	15 Additive silo (lime)	23 Air cooled condenser	28 Residue silos
4 Control room	8 Secondary air	16 XeroSorp (dry sorption)	24 Transformer	29 Bottom ash pre-storage area
	9 Four-pass boiler	17 Fabric filter	25 Electrical power distribution	30 Bottom ash treatment plant
	10 Primary air	18 Induced draught fan		31 Maturation area
	11 Superheater	19 Silencer		
	12 Economiser	20 Stack		

# Project Delivery

## The EPC Construction Contract – Hitachi Zosen Innova\* and B6

- 4-year construction period under the
- Concession Agreement – July 2020 to 1<sup>st</sup> July 2024
- Project construction completed on time (1<sup>st</sup> March 2024) and under budget
- Early operation period of all 5 boilers at full facility capacity interrupted by a major storm flood April 2024.
  - Consequently, Commercial Operation date delayed 31 days whilst repairs undertaken to 132kv connection
- Performance tests exceeded project guarantee levels.
  - All emissions within regulated parameters (UAE equivalent of European Union emissions standards for EfW plants)
  - 3% waste input overload proven – over 49 tonnes waste feed per hour per boiler
  - Boiler steam outlet flow proven at 103%
  - Facility efficiency proven at 2.5% net electrical power output over guarantee
- All completion certificates signed off without exceptions.
- 1,400 truck drivers trained in tipping at WWMC facility
- 150 Operations and Maintenance company staff recruited and trained for seamless handover at Commercial Operation date.



- \* Now Kanadevia Inova



# Combustion and Emissions

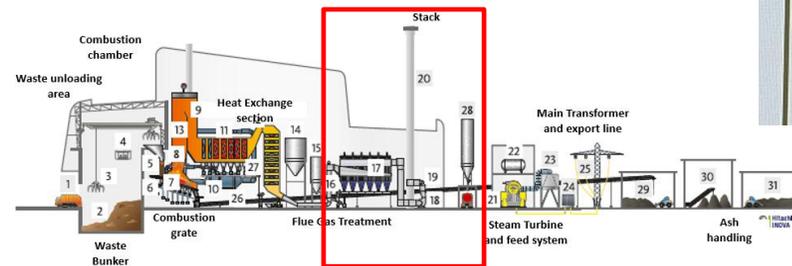
Waste is fed onto the boiler grates where it is combusted at over 850c to ensure all harmful components are completely oxidized



Emissions to atmosphere are monitored continuously for compliance to UAE emissions limits (EU equivalent)

- Continuous relay of CEMS data and Air Quality monitoring data to Environment agency

14-07		CEMS / Stack	
11CFB20CQ901-XE01	HC1	10	mg/m <sup>3</sup> i.N., dry
11CFB30CQ901-XE01	SO2	7	mg/m <sup>3</sup> i.N., dry
11CFB40CQ901-XE01	NOx	170	mg/m <sup>3</sup> i.N., dry
11CFB41CQ901-XE01	NO	111	mg/m <sup>3</sup> i.N., dry
11CFB42CQ901-XE01	NO2	1.2	mg/m <sup>3</sup> i.N., dry
11CFB43CQ901-XE01	NH3	0.0	mg/m <sup>3</sup> i.N., dry
11CFB50CQ901-XE01	CO	3	mg/m <sup>3</sup> i.N., dry
11CFB51CQ901-XE01	CO2	9.0	Vol-%, dry
11CFB60CQ901-XE01	O2	8.5	Vol-%, dry
11CFB70CQ901-XE01	H2O	20.2	Vol-%
11CFB10CQ901-XE01	Dust	2	mg/m <sup>3</sup> i.N., dry
11CFB80CQ901-XE01	VOC	0.1	mg/m <sup>3</sup> i.N., dry



# Facility overview



# Year 1 operational performance

- Waste received & processed exceeded Baseline contract target of 1,865,000 tonnes ✓
- All emissions pollutants maintained in accordance with emissions license ✓
  - Non compliant waste causes occasional Carbon monoxide spikes
- Energy export below Baseline contract target – due to low net calorific value, non-compliant waste and turbine control issues
- Ash exports all in accordance with offtaker specifications ✓
- Flue Gas Treatment Residue all exported to offtaker without issue ✓
- Metal extracted from ash in accordance with expected ratios and exported to off-taker for sale. ✓
- 5 initial boiler outages all conducted within planned time frames ✓
- 2 Turbine trip events in the year – 97.2% availability
- Customer satisfaction high, all payments made on time. ✓
- Average 1300 truck movements and automatic weighings each day ✓

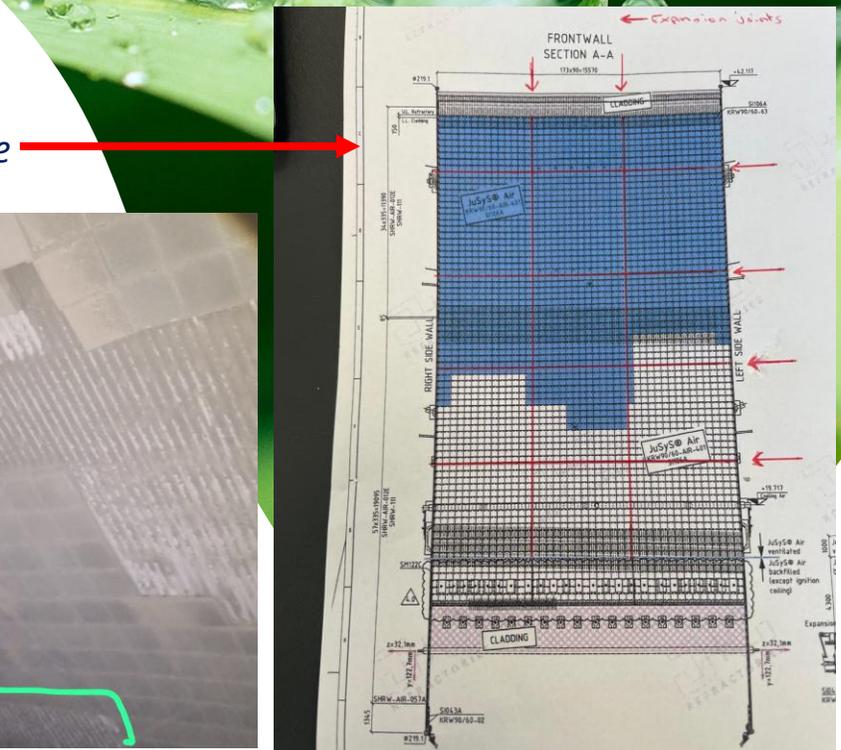
# Year 1 operations experience

## Operational issues faced in year 1 operations. – 16,000 operating hours

### 1. Boiler refractory linings

1. *WWMC boilers have 4 main types of combustion chamber lining*

- *Cemented refractory tile linings in the lower combustion chamber ✓*
  - *Floating air backed refractory tile linings in the upper combustion chamber - large areas of the upper combustion chamber have lost the tiles during operations*
  - *Inconel coatings above grate and combustion chamber roof ✓*
  - *Gunned refractory over grate ash discharge – the gunned refractory has delaminated and detached during operations*
- *RCA has shown the issues are associated with the differential expansion of the tube walls and the refractory tiles, expansion joints introduced to relieve the expansion and compression.  
For the gunned refractory, the anchors per m2 increased by 50%*



Inconel coating –no degradation



SNCR reagent impingement



Deliquescent salts



# Year 1 operations experience

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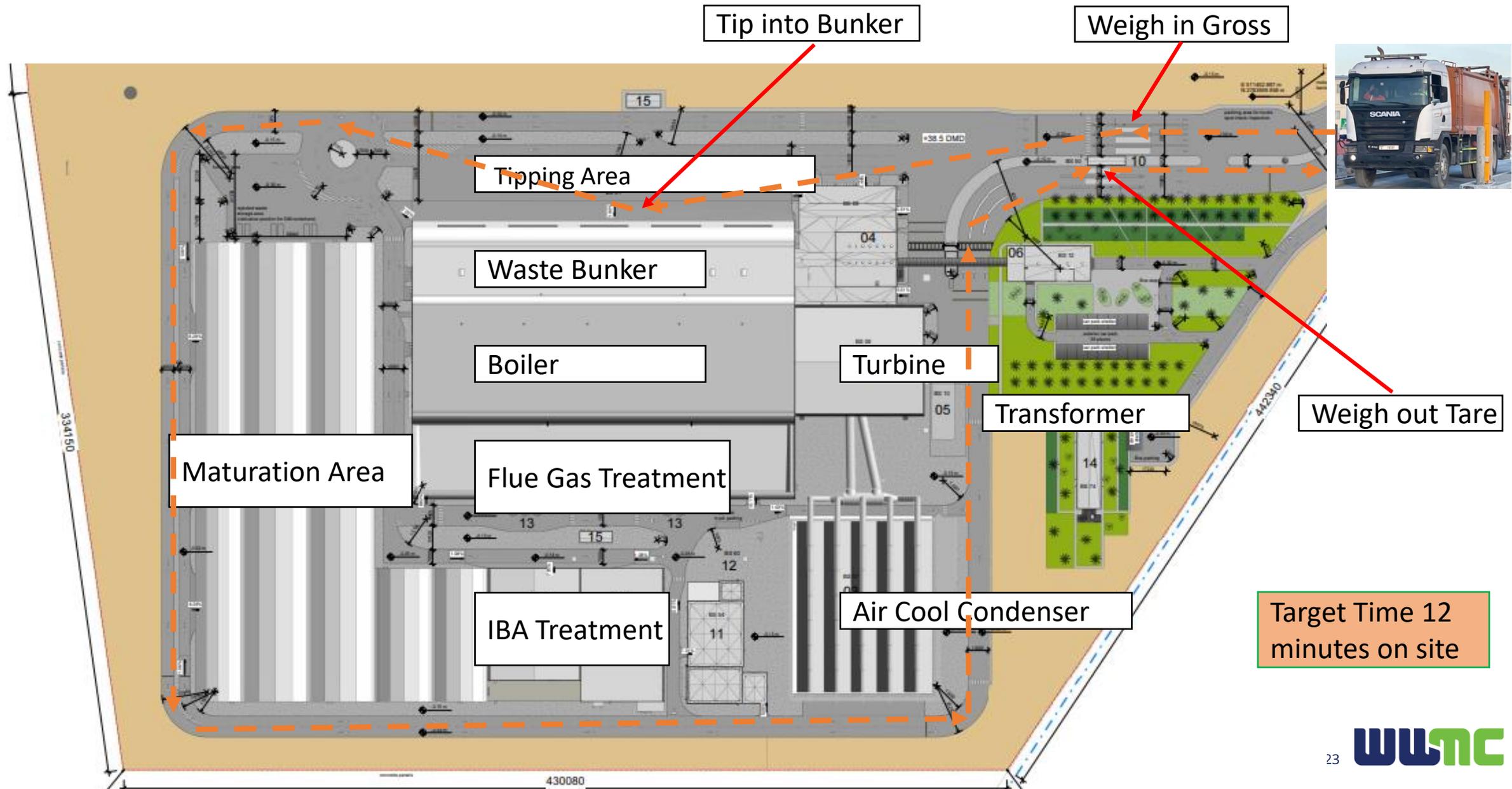
### 2. **Waste crane reliability**

- *The waste cranes have suffered a number of breakdowns which has restricted waste receipt and loading availability*
  - *Vibrations associated in particular with long travel.*
  - *Broken crane rails and gauge spread.*
  - *Waste crane controls and priority*
  - *Waste crane supply cables damage – grab umbilical cables and e-chain conveyer failure*

### 3. **Waste unloading system**

- *Coordination between weighbridge entry, tipping floor management of drivers, coordination with waste crane programme – creates truck delays at peak delivery times,*
  - *spillage of waste on tipping floor,*
  - *waste tipping bay door damage*
  - *Inability of waste cranes to maintain tipping trench clear*
  - *Driver behavior – clearing out /tipping waste outside of bunker*
  - *Open tipping floor - Windblown waste around site*

# WWMC EfW Project: Plant Layout – Top Overview



Target Time 12 minutes on site

# Waste is delivered to site via automated gates into the waste bunker



# Year 1 operations experience

## Operational issues faced in year 1 operations. – 16,000 operating hours

### 4. Truck leachate spillage on tipping floor and around site

- *Free water in waste deliveries by compactor trucks – water in bunker, spillage on tipping floor & on the site roads*

### 5. **Maintaining turbine at full load**

1. *The 5 boilers into 1 turbine control system leads to output power losses*
  1. *Primary Air Temperature control*
  2. *Air condenser air leaks and air ejector performance*
  3. *Control system oscillations due to layered control loops/long time constants.*



# Year 1 operations experience

## Operational issues faced in year 1 operations. – 16,000 operating hours

### 6. Bottom ash extractor performance

- *Ash Conveyer design carried too much water over into ash handling process*
- *Additional handling required to dry the ash before metals processing*
- *Below grate riddling ducts fouling, excessive cleaning required*

### 7. Moving grate hydraulic cylinder leakage

- *Short life of hydraulic cylinder seals – 300 installed, service life 25% of 16,000 hour design*
- *High temperature under grate and abrasive contamination ingress*

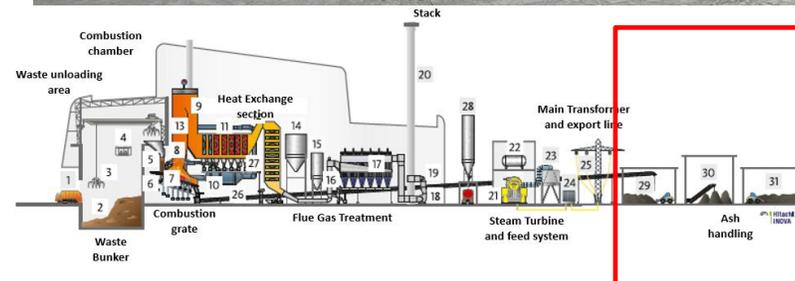
### 8. Electrical system quality failures

- *Variable speed drive module's reliability*
- *Quality of some 132kv insulators supplied by subcontractors.*
- *Single site electrical auxiliaries supply*

### 9. Fire system installation quality and diversification

- *A number of leaks have occurred in the fire mains due to installation quality errors.*
- *The fire zone connections would benefit from more diversification, some sections of fire mains require substantial main equipment to be out of service to maintain*

# Ash sorting reclaims metals for recycling and matures ash for reuse in construction



# THANK YOU



**WUATC**

