Whitegate Independent Power Plant

Engineers Ireland Site Visit

23rd March 2010

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Agenda

- Presentation of project and progress to date.
- Site Tour
- Close Out

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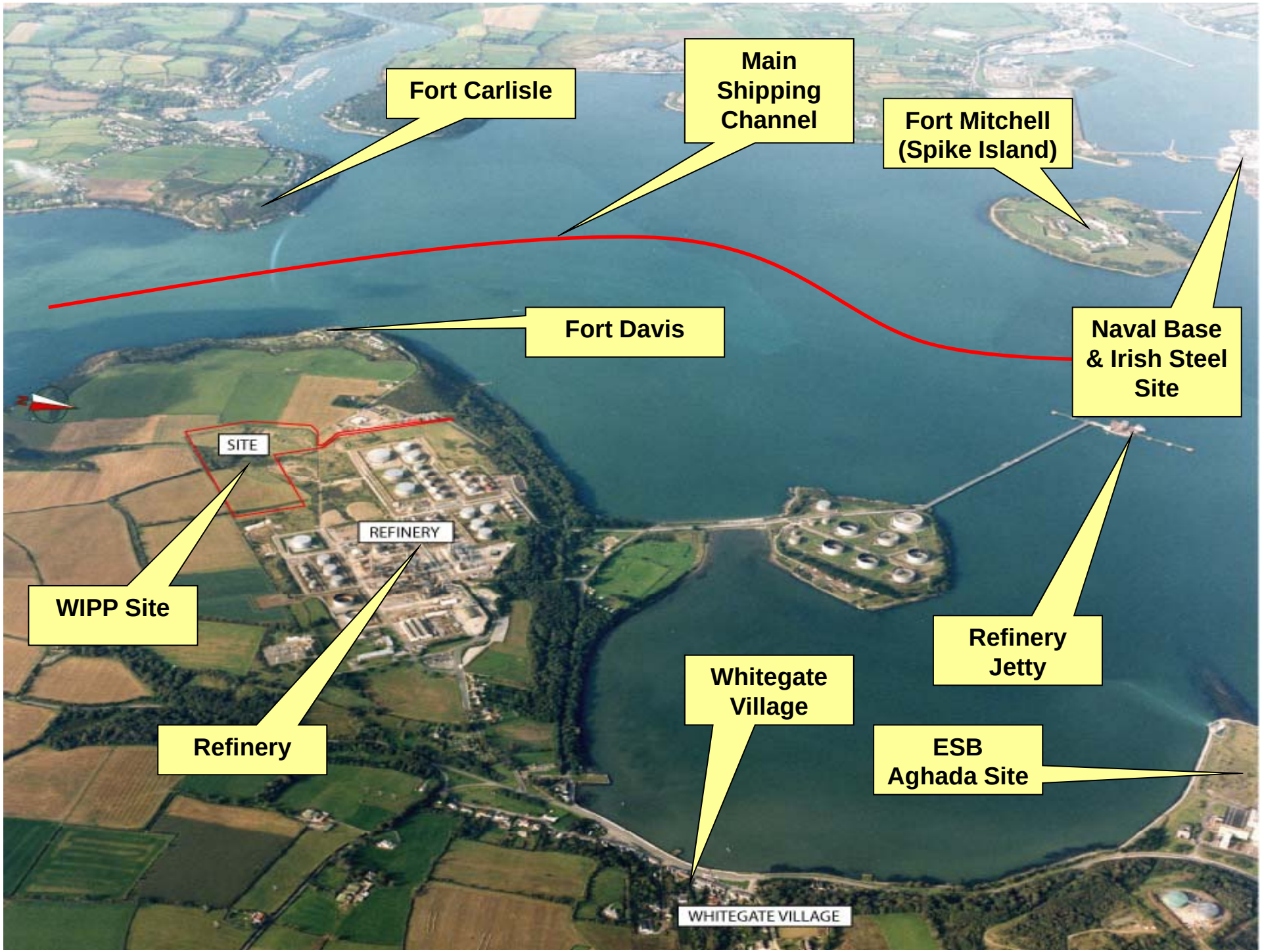
Fort Carlisle
Main Shipping Channel
Fort Mitchell (Spike Island)
Fort Davis
Naval Base & Irish Steel Site
SITE
REFINERY
WIPP Site
Refinery
Refinery Jetty
Whitegate Village
ESB Aghada Site
WHITEGATE VILLAGE

WIPP Project Summary

- **Bord Gáis are constructing a 450 MW Combined Cycle Power Plant (CCGT), located in Whitegate, Co. Cork.**
  - **At 450 MW, this is the equivalent of powering approximately 135,000 homes.**
- **Bord Gáis leased 25 acres of land from the adjacent ConocoPhillips oil refinery.**
- **The power plant and refinery agreed a suite of interfaces covering the supply of distillate, steam, natural gas and refinery off gas.**
- **The project is managed within the Investments Group of Bord Gáis.**
- **The power plant is being constructed under an Engineer, Procure & Construct (EPC) contract.**
- **General Electric and Gama (GE-Gama) were appointed as the EPC contractor.**
- **Bord Gáis appointed PB Power as the Owners Engineer.**
- **The EPC contract commenced in August 2007 and the Commercial Operation Date (COD) is July 2010. The Project is currently on schedule for COD July 2010.**

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Project Development

- **2005**
  - Bord Gáis and ConocoPhillips agreed to explore the potential for development of a power generation plant on 25 acres of land owned by the ConocoPhillips oil refinery in Whitegate, Co. Cork.

- **2006:**
  - Heads of Terms agreed for the long-term lease of 25 acres of land from ConocoPhillips
  - Bord Gáis appointed consultants
    - Arup's for planning and environmental
    - Mott McDonald for engineering and design
  - Submitted application to EirGrid for connection to the grid.
  - Motts developed original layout and design of plant.
  - Arup's developed planning application and EIS.
  - Planning permission for the project received in October 2006.
  - Developed Minimal Functional Specification (MFS) for EPC Tender
  - OJEC Notices:
    - Owners Engineer
    - Engineering, Procurement and Construction (EPC) for 450 MW CCGT Plant

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Project Development

- **2007**
  - Appoint Owners Engineer: PB Power
  - GE-Gama and Siemens tender for the EPC Contract
    - Tender evaluation process
    - Preferred bidder selection
  - GE-Gama selected as preferred bidder March 2007
    - Main contract based on Fidic Silver
    - Plant technical deliverables agreed within the MFS
  - EPC Contract signed with GE-Gama in August 2007
  - September 2007, GE-Gama mobilise to site
  - October 2007, site clearance works commence
  - November 2007, commence construction of site offices
  - December 2007, commence diversion of Glanagow Stream

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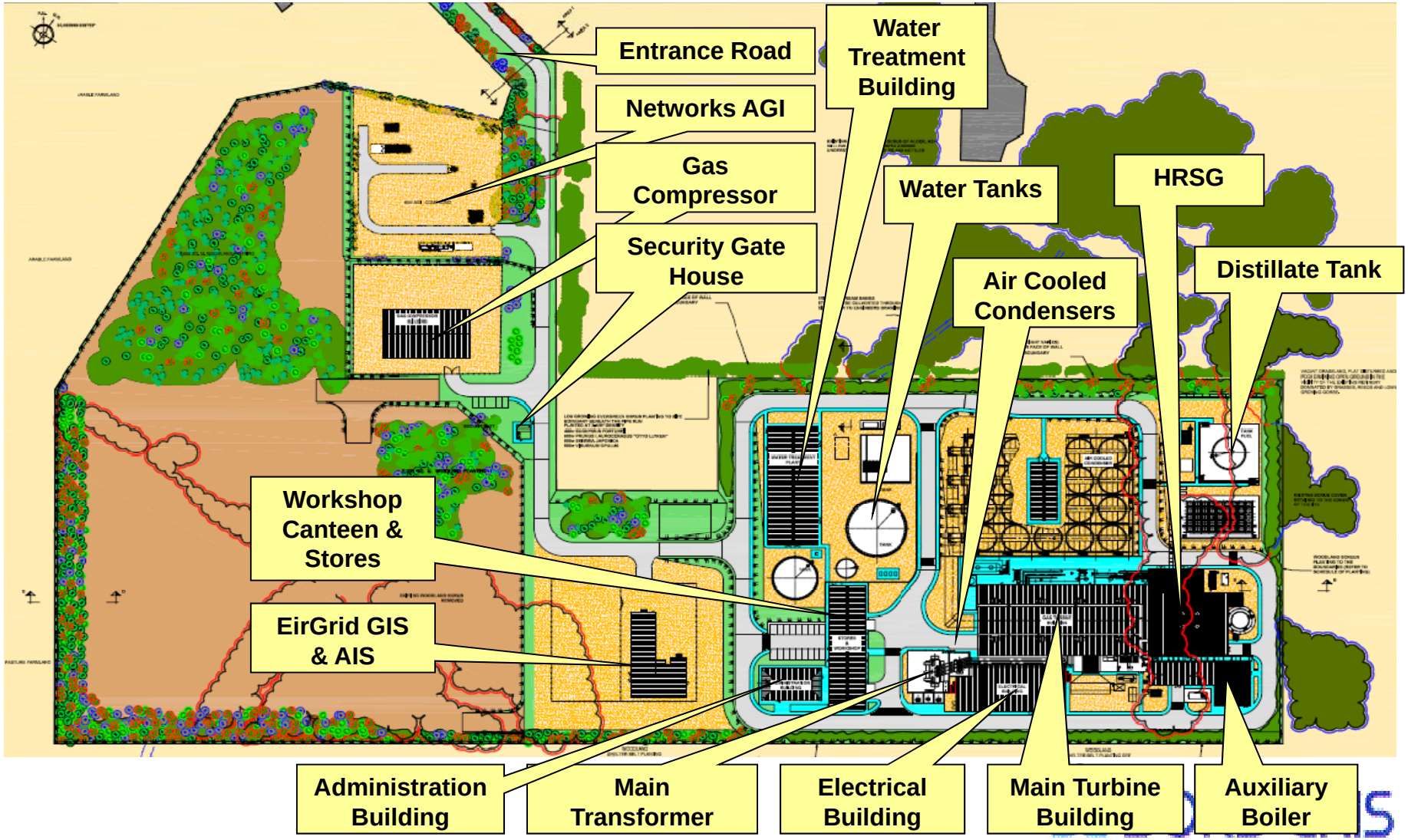
Landscape Plan & Site Layout



Key Project Milestones

• EPC Contract Award	Aug	2007
• Site Mobilisation	Oct	2007
• Civil Works	Mar	2008
• Structural Steel Erection	Sep	2008
• Mechanical Works Start	Nov	2008
• Electrical Works Start	Jan	2009
• Main Equipment Delivery	Jan	2009
• Main Equipment Installation	Feb	2009
• Electrical Back Feed	Sep	2009
• First Fire Gas Turbine	Feb	2010
• Base Load Operation	Apr	2010
• Grid Code Testing	May	2010
• Performance & Reliability Run	May	2010
• AIS Commissioning (3rd Circuit)	May	2010
• Commercial Operation Date	Jul	2010
• GIS Commissioning (4th Circuit)	Aug	2011

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BGE External Deliverables

• **Water Supply** • Cork County Council	Feb	2009
• **Effluent Discharge Line** – DAFF (Foreshore Licence)	Mar	2009
• **Gas Supply** – Bord Gáis Networks	Apr	2009
• **IPPC Licence** – EPA	Apr	2009
• **Electrical Back-feed** – EirGrid	Sep	2009
• **Emissions Trading Licence** – EPA	Feb	2010
• **Distillate Supply** – ConocoPhillips	Mar	2010
• **Telecommunications** – Eircom (Fibre Optic connection)	Apr	2010
• **Grid Connection** (3rd Circuit) – EirGrid	May	2010
• **Grid Connection** (4th Circuit) – EirGrid	Aug	2011

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EirGrid Circuit Routes

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EirGrid Deliverables

- **Back-Feed Cable**
  - Scheduled July 2009
  - Current network line capacity is ~860 MW
  - Installed base load capacity by January 2010= ~1140 MW (450 + 420 + 270)
    - WIPP + ESB CCGT + ESB Steam Plant (ESB OCGT's not included)

- **3rd Circuit**
  - Scheduled May 2010
  - 3rd circuit increases network line capacity to ~1290 MW.
  - N-1 requirements has set grid firm access at ~860 MW: to be shared by BGE and ESB.
  - Circuit operational May 2010

- **4th Circuit**
  - Scheduled August 2011
  - Submarine cable order July 2009
  - Submarine cable installation December 2010 to February 2011
  - Circuit Operational August 2011

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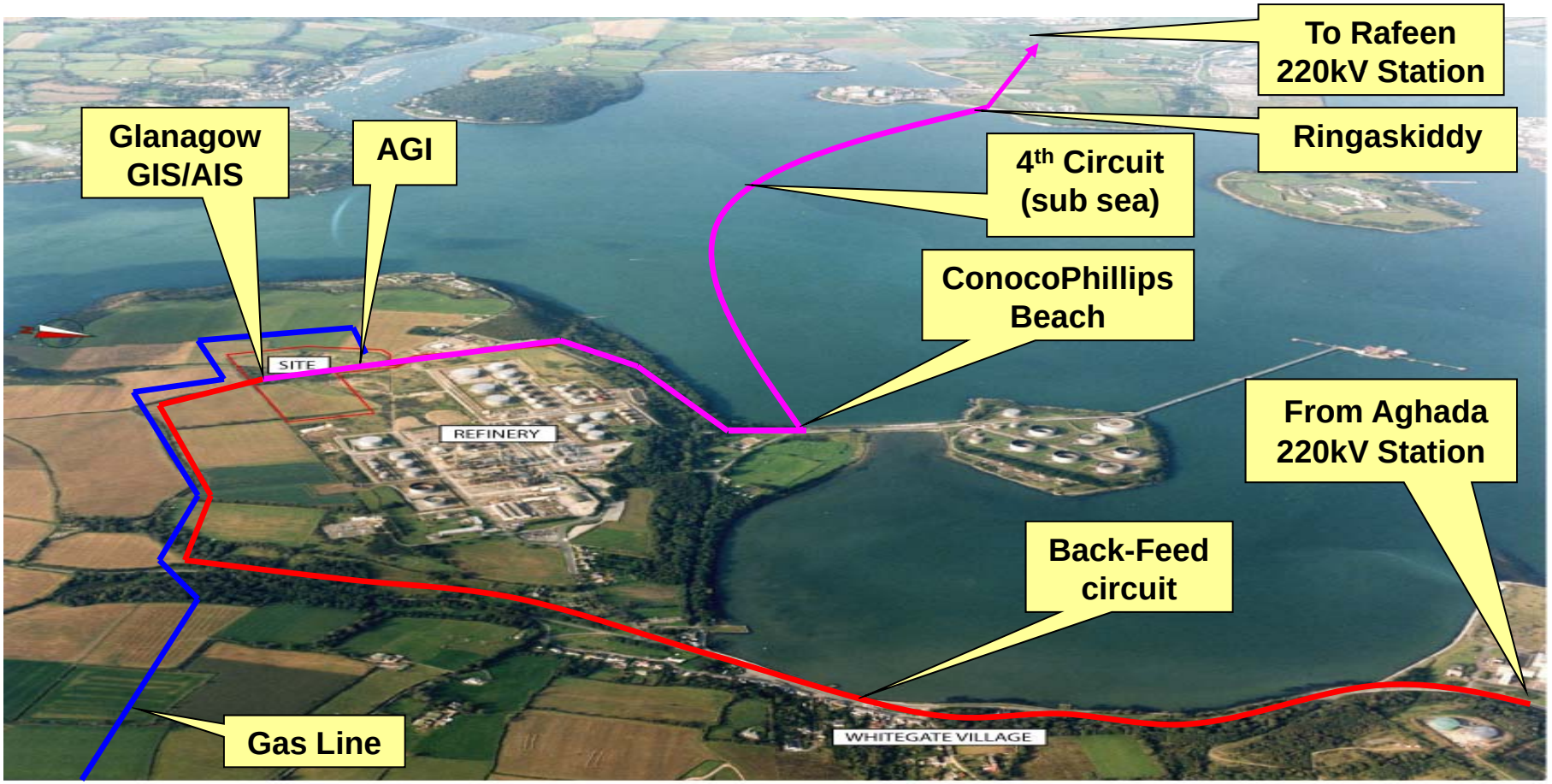
Gas Line & EirGrid Back-Feed and 4th Circuit Routes



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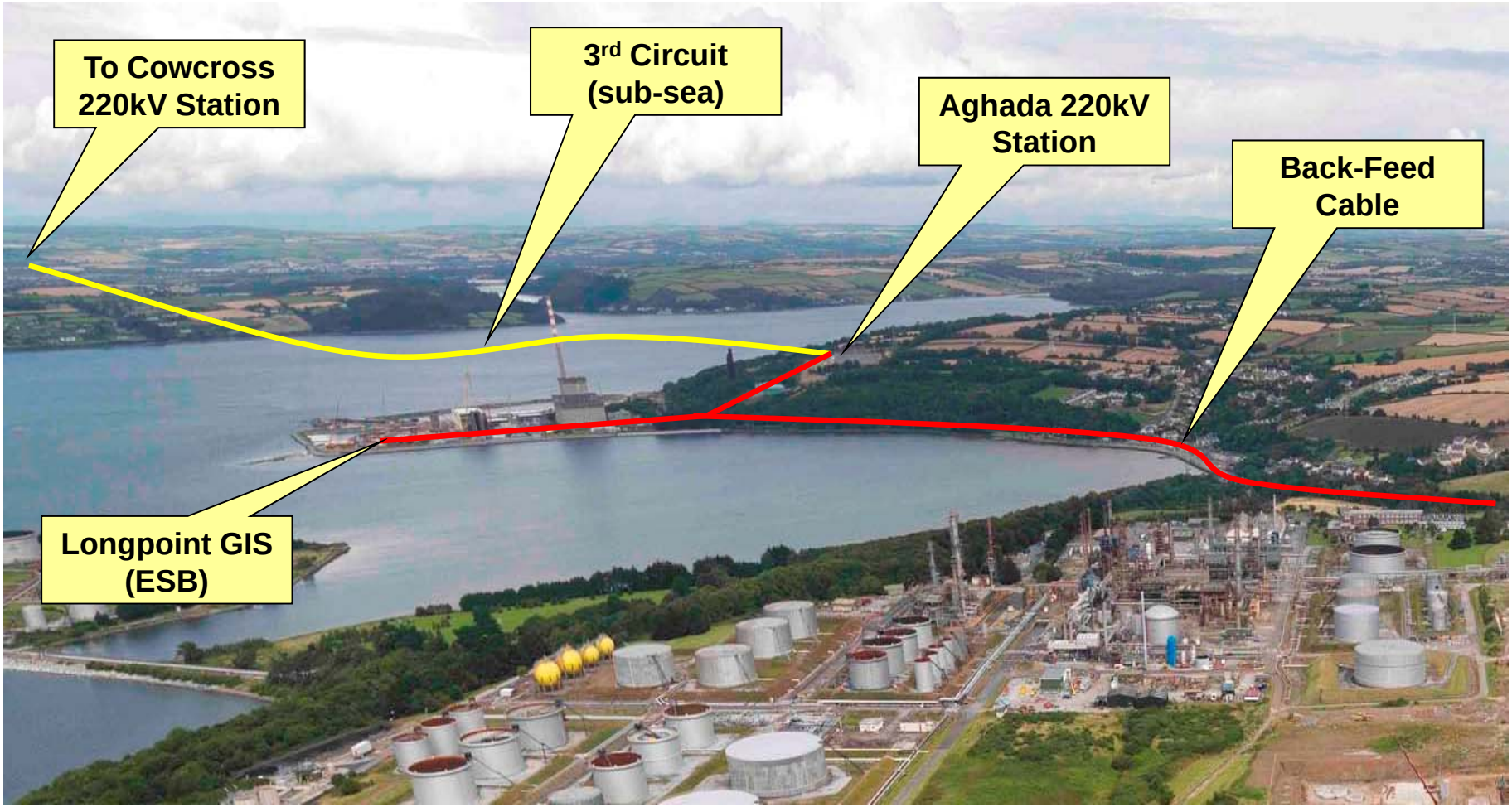
3rd Circuit Route



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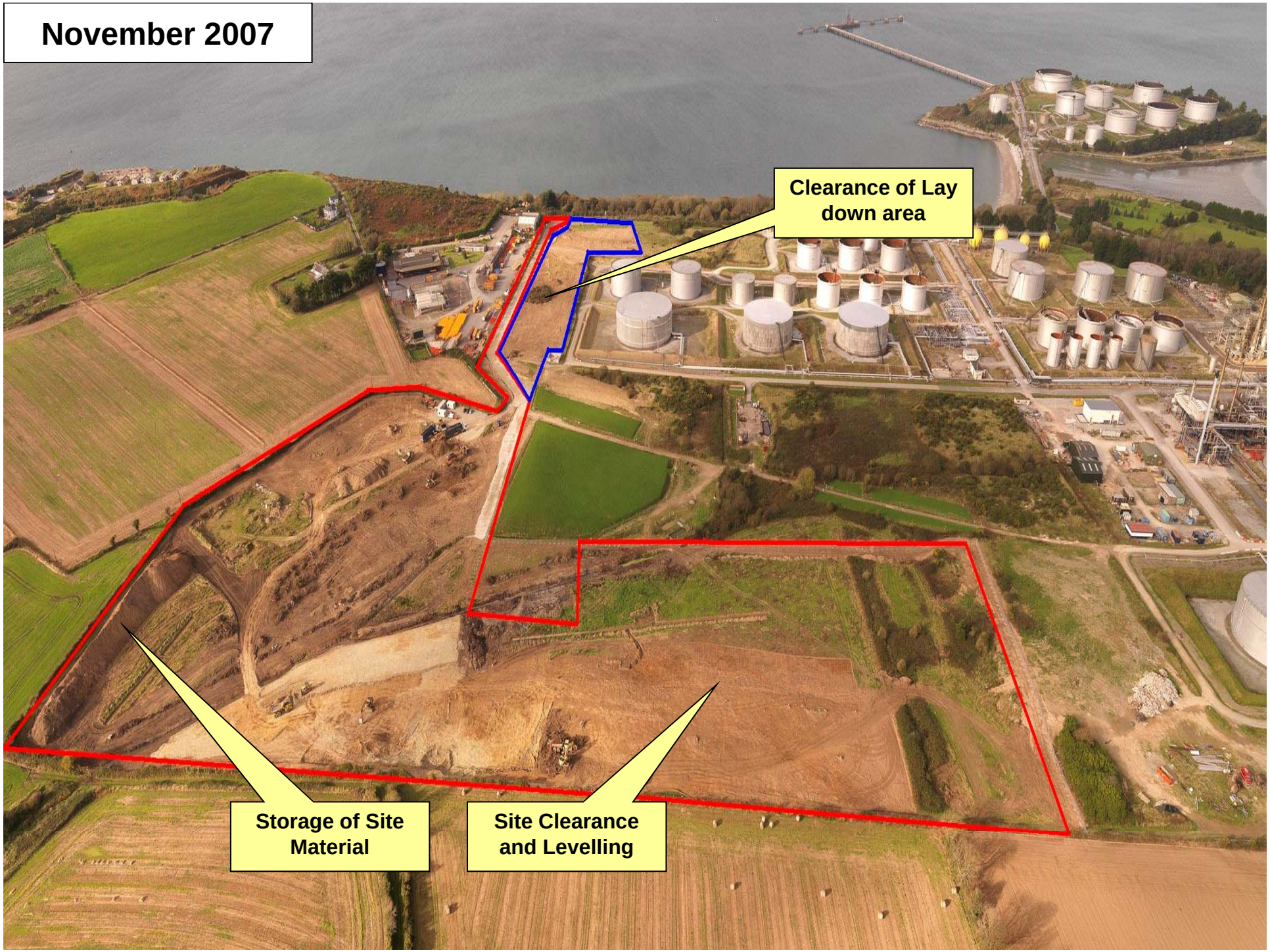
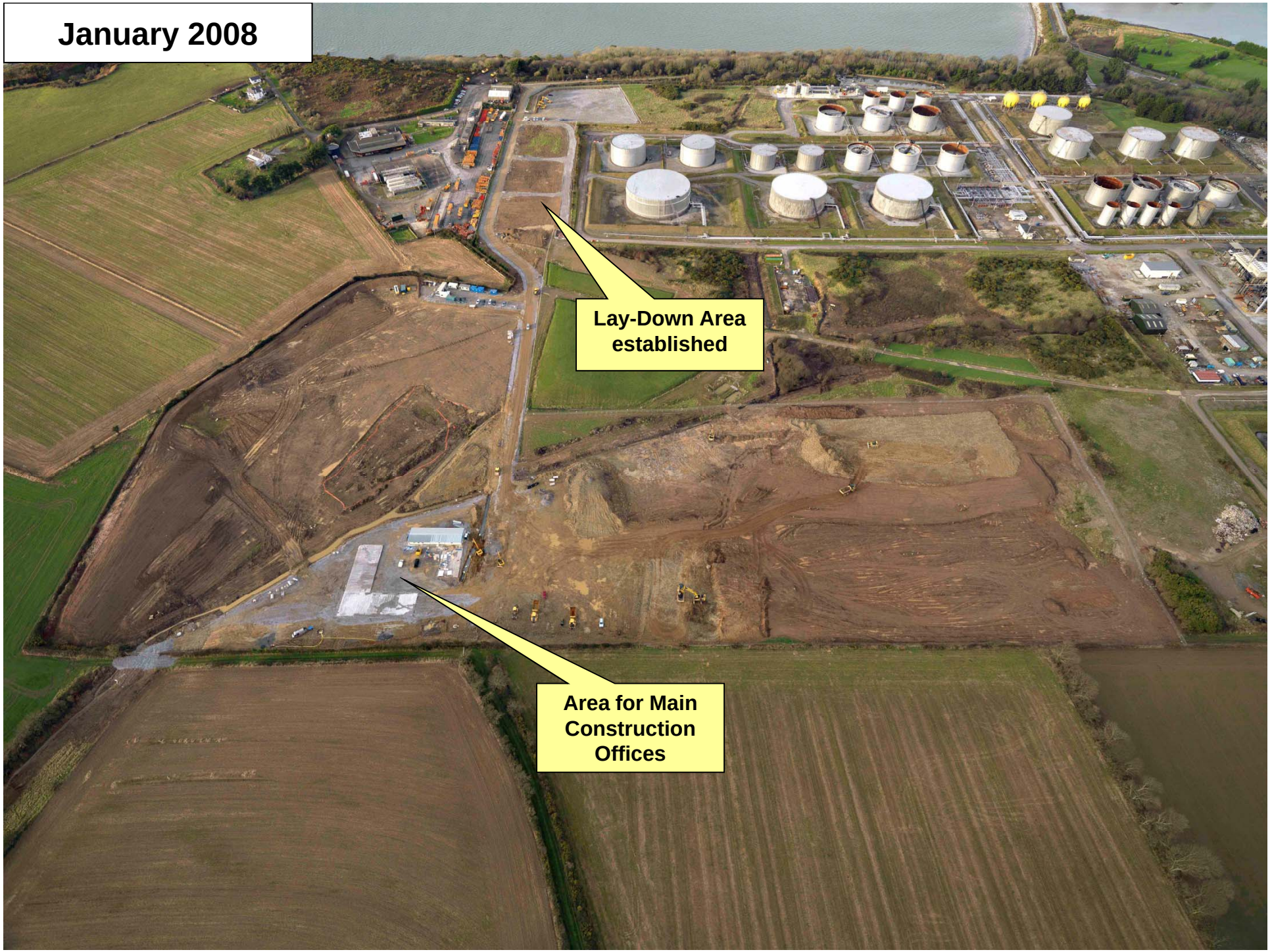
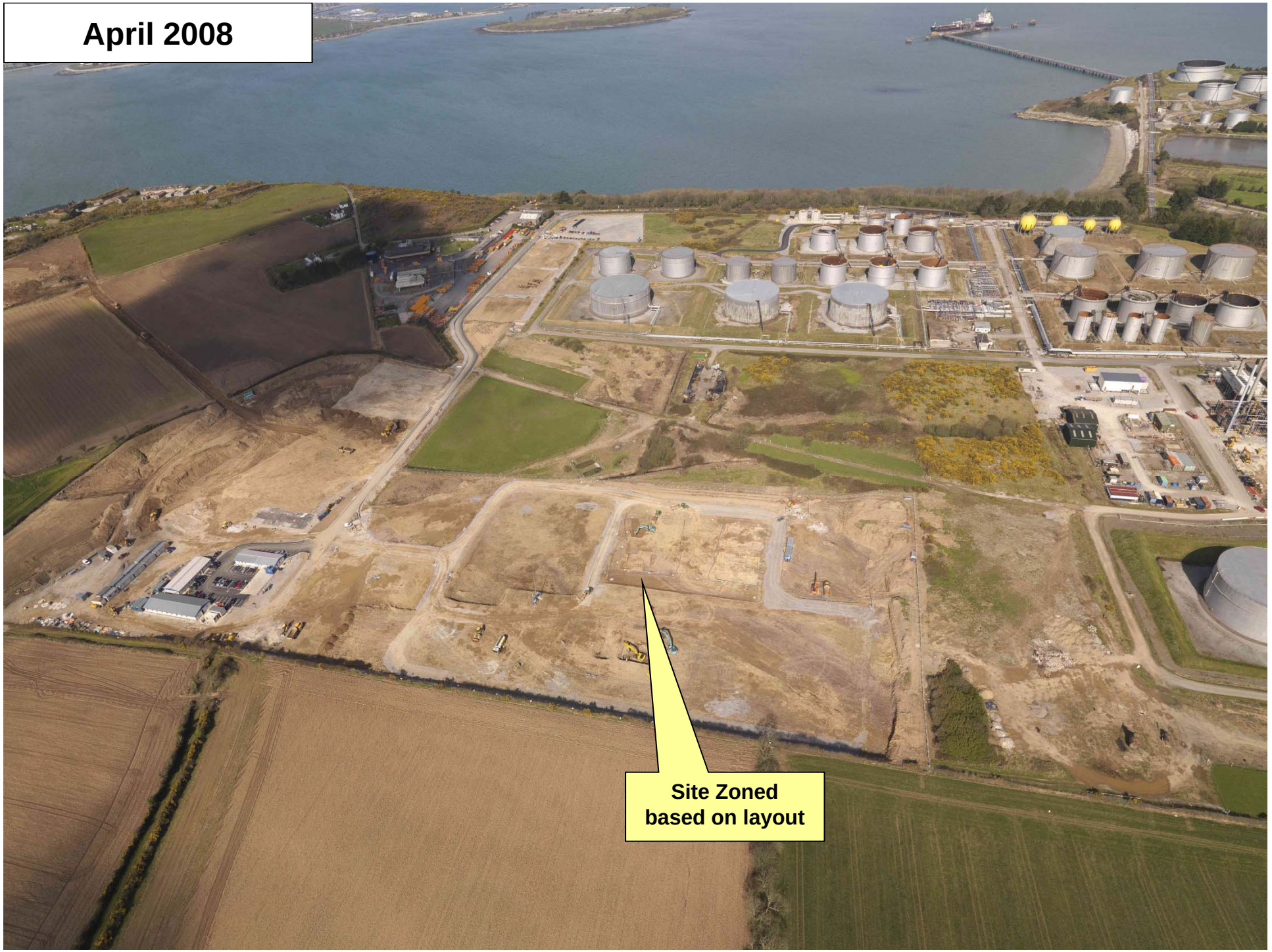
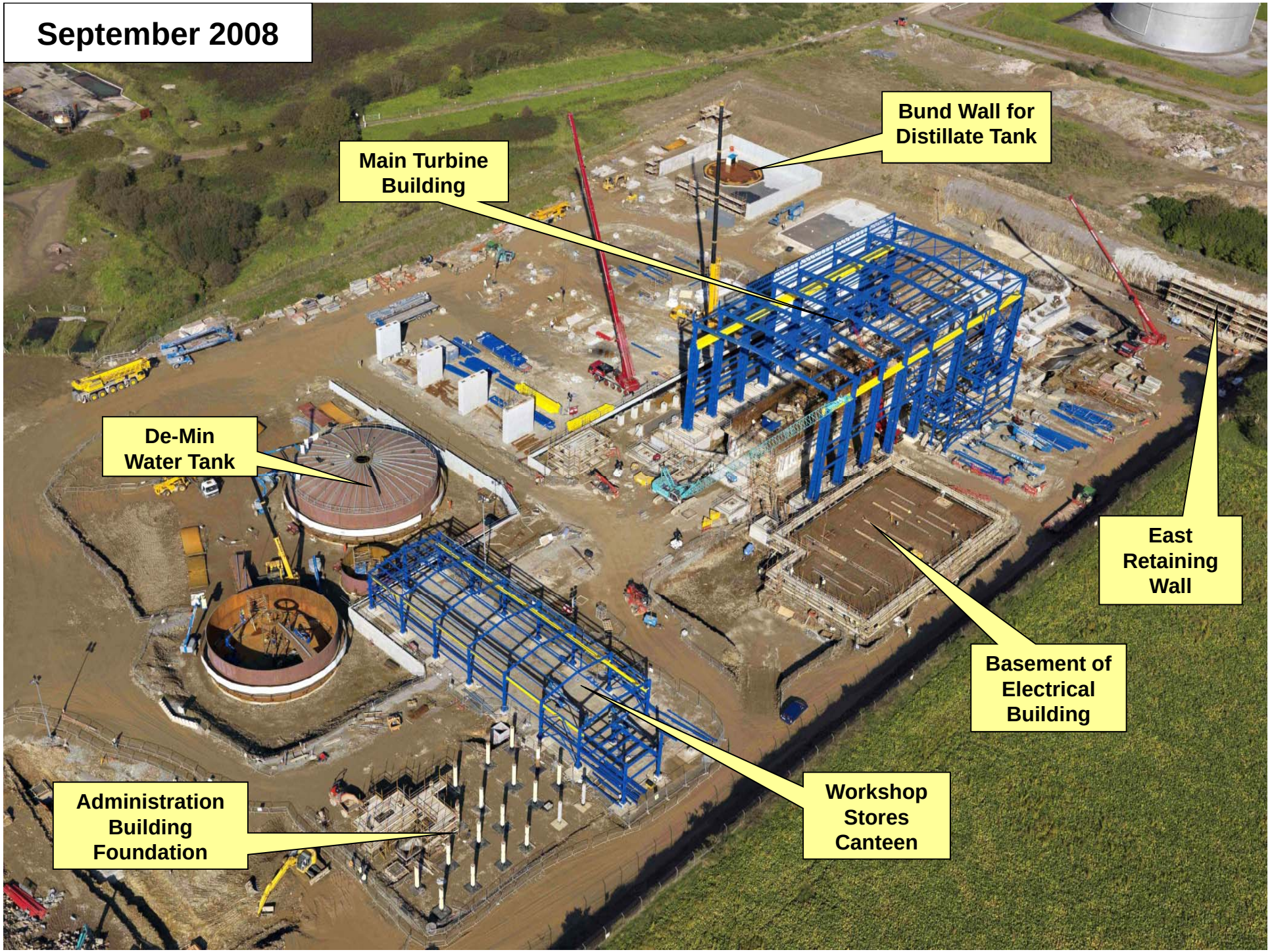

November 2007
Clearance of Lay down area
Storage of Site Material
Site Clearance and Levelling


January 2008
Lay-Down Area established
Area for Main Construction Offices


April 2008
Site Zoned
based on layout

August 2008


September 2008
Bund Wall for Distillate Tank
Main Turbine Building
De-Min Water Tank
East Retaining Wall
Basement of Electrical Building
Workshop Stores Canteen
Administration Building Foundation

450 MW CCGT Power Plant

- GE Single Shaft Configuration (58% efficiency)
  - 9FB Gas Turbine – 280 MW
  - A15 Steam Turbine – 150 MW
  - Supplementary Firing – 30 MW
  - 450H Class Generator – 19 kV
  - SPX- Air Cooled Condensers – 20 fan units
  - CMI Vertical Tube HRSG – 3 pressure, re-heat.

- Fuel
  - Natural Gas (primary)
    - Gas turbine, Supplementary Firing, Auxiliary Boiler
  - Distillate (secondary)
    - Gas Turbine, Auxiliary Boiler, Emergency Generator
  - Refinery Off Gas (ROG)
    - Supplementary Firing

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Natural Gas Fuel Cycle for CCGT

- **Natural Gas**

  - **Bord Gáis Networks AGI**
    - Supply pressure 60 bar
    - Filters and meters only; no pressure reduction
  - **Gas Reduction Station**
    - Reduced to 38 bar
    - Gas Compressors available if supplied below 38 bar
  - **Fuel Performance Skid**
    - Filtered
    - Heated to 108 degrees C
  - **Gas Turbine**
    - 35 bar inlet to gas turbine
    - 57 tons/hr at base load (432 MW)
  - **Supplementary firing**
    - Reduced to 3 bar
    - 4 burner units inside HRSG duct
    - 5 tons/hr giving approx 30 MWe
    - 50 tons steam to the Refinery

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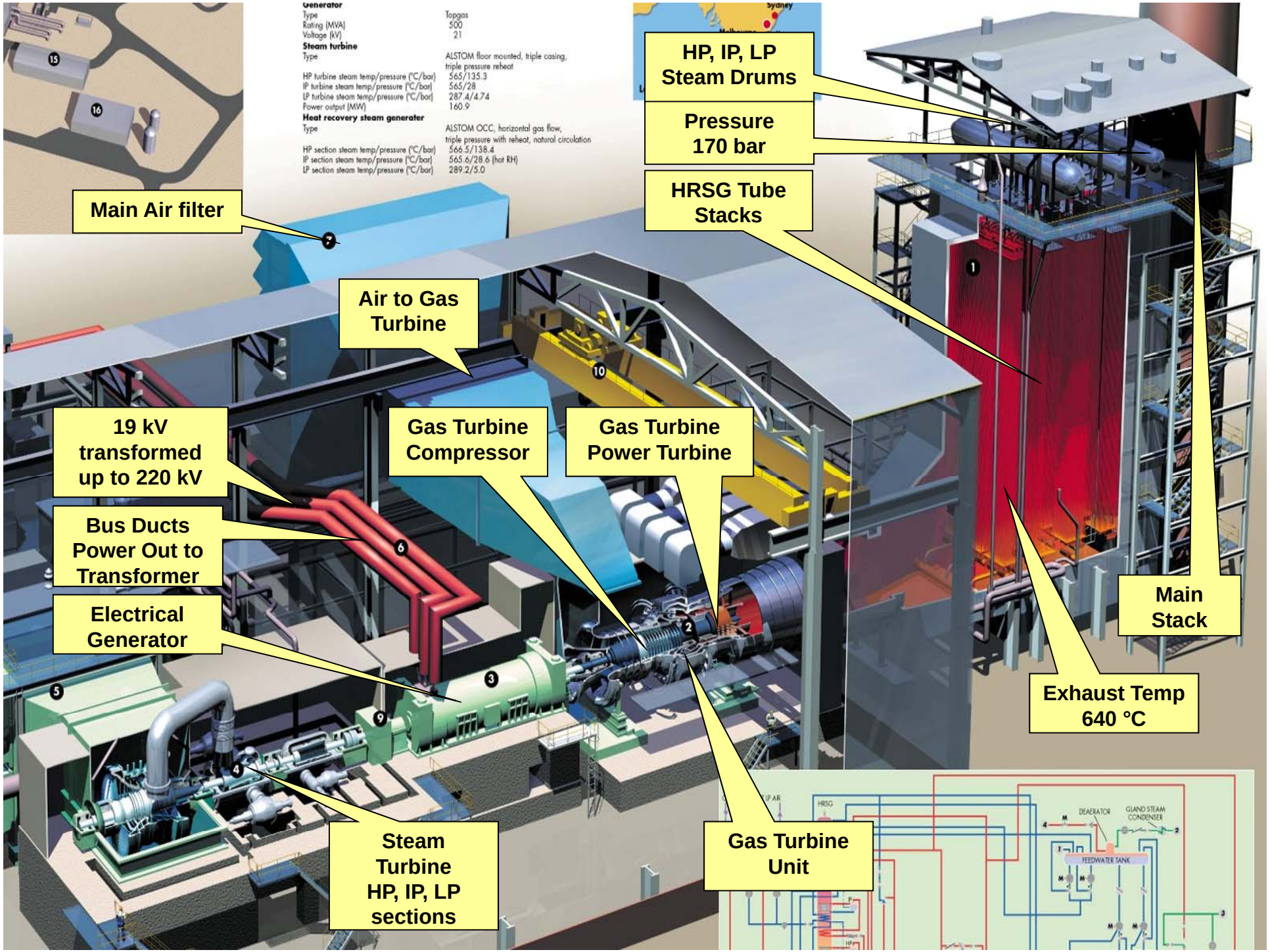
Generator
Type
Rating (MVA)
Voltage (kV)
Topgas
500
21
Steam turbine
Type
ALSTOM floor mounted, triple casing, triple pressure reheat
HP turbine steam temp/pressure (°C/bar) 565/135.3
IP turbine steam temp/pressure (°C/bar) 565/28
LP turbine steam temp/pressure (°C/bar) 287.4/4.74
Power output (MW) 160.9
Heat recovery steam generater
Type
ALSTOM OCC, horizontal gas flow, triple pressure with reheat, natural circulation
HP section steam temp/pressure (°C/bar) 566.5/138.4
IP section steam temp/pressure (°C/bar) 565.6/28.6 (hot RH)
LP section steam temp/pressure (°C/bar) 289.2/5.0
Sydney
HP, IP, LP Steam Drums
Pressure 170 bar
HRSG Tube Stacks
Main Air filter
Air to Gas Turbine
19 kV transformed up to 220 kV
Gas Turbine Compressor
Gas Turbine Power Turbine
Bus Ducts Power Out to Transformer
Electrical Generator
Main Stack
Exhaust Temp 640 °C
Steam Turbine HP, IP, LP sections
Gas Turbine Unit
HRSG
DEAERATOR
GLAND STEAM CONDENSER
FEEDWATER TANK

Energy Cycle

- **Gas Turbine (280 MW)**
  - 55 tons/hr natural gas at full load
  - Generates 2400 tons/hr exhaust gas @ 640 °C

- **HRSG**
  - Exhaust gas @ 640 °C inlet to HRSG
  - Exhaust gas @ 85 °C exit from HRSG at main stack (60 meters)
  - Generates approximately 360 tons/hr of steam in HRSG
  - Increase steam output to 400 tons/hr using supplementary firing

- **Steam to Turbines (150 to 180 MW)**
  - HP Turbine: 340 tons/hr steam @ 140 bar (560 °C)
    - Steam Exits @ 29 bar (333 °C) to Re-heater
  - Re-heater to IP Turbine: 340 tons/hr steam @ 26 bar (560 °C)
  - LP Turbine: 40 tons/hr steam @ 4 bar (300 °C)
    - 380 tons/hr Steam Exits to ACC @ 0.6 bar (38 °C).

- **Inlet Steam to Air Cooled Condensers** (ACC)
  - 20 Cooling Fans (18 operational at full load, with 2 spares)
  - Condensate exits ACC @ 34 °C
  - Returns to condensate system

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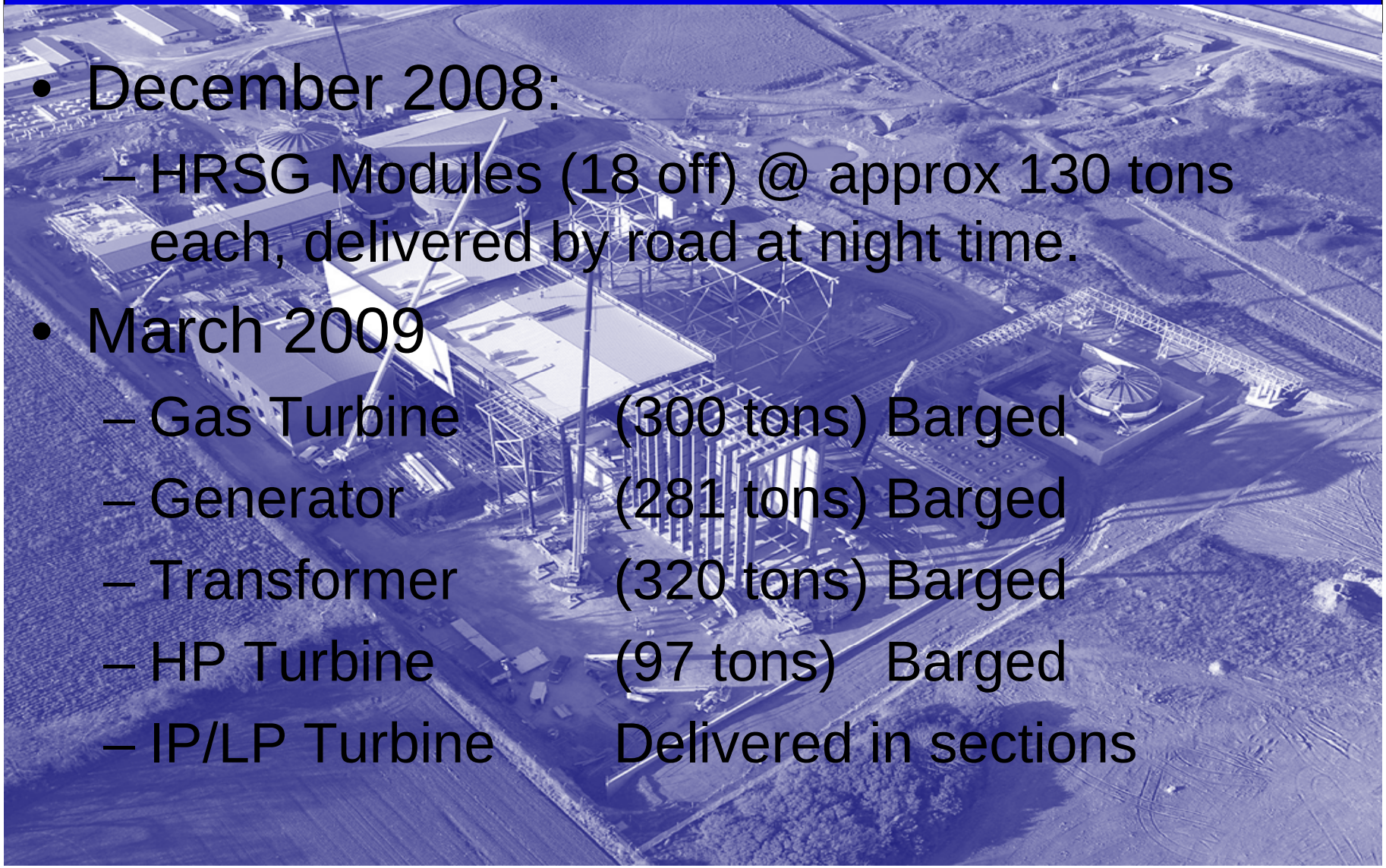
Major Equipment Deliveries



- December 2008:
  - HRSG Modules (18 off) @ approx 130 tons each, delivered by road at night time.
- March 2009
  - Gas Turbine (300 tons) Barged
  - Generator (281 tons) Barged
  - Transformer (320 tons) Barged
  - HP Turbine (97 tons) Barged
  - IP/LP Turbine Delivered in sections

HRSG Structural Steel Frame

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HRSG Module & Lifting Frame Attachment

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HRSG Module being lifting into position

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HRSG – 3 Modules in Position

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HRSG – Row 5 Modules being positioned

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HRSG Module Installation

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Major Equipment Off Loading at ESB Aghada

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Gas Turbine on Main Road through Village

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Passing Under ESB Aghada Bridge on main road

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Main Transformer transportation to site

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Gas Turbine Passing Corkbeg

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Gas Turbine Passing Corkbeg

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Gas Turbine on Gantry Crane

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Generator on Gantry Crane at Turbine Hall

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Main Transformer on Positioning Tracks

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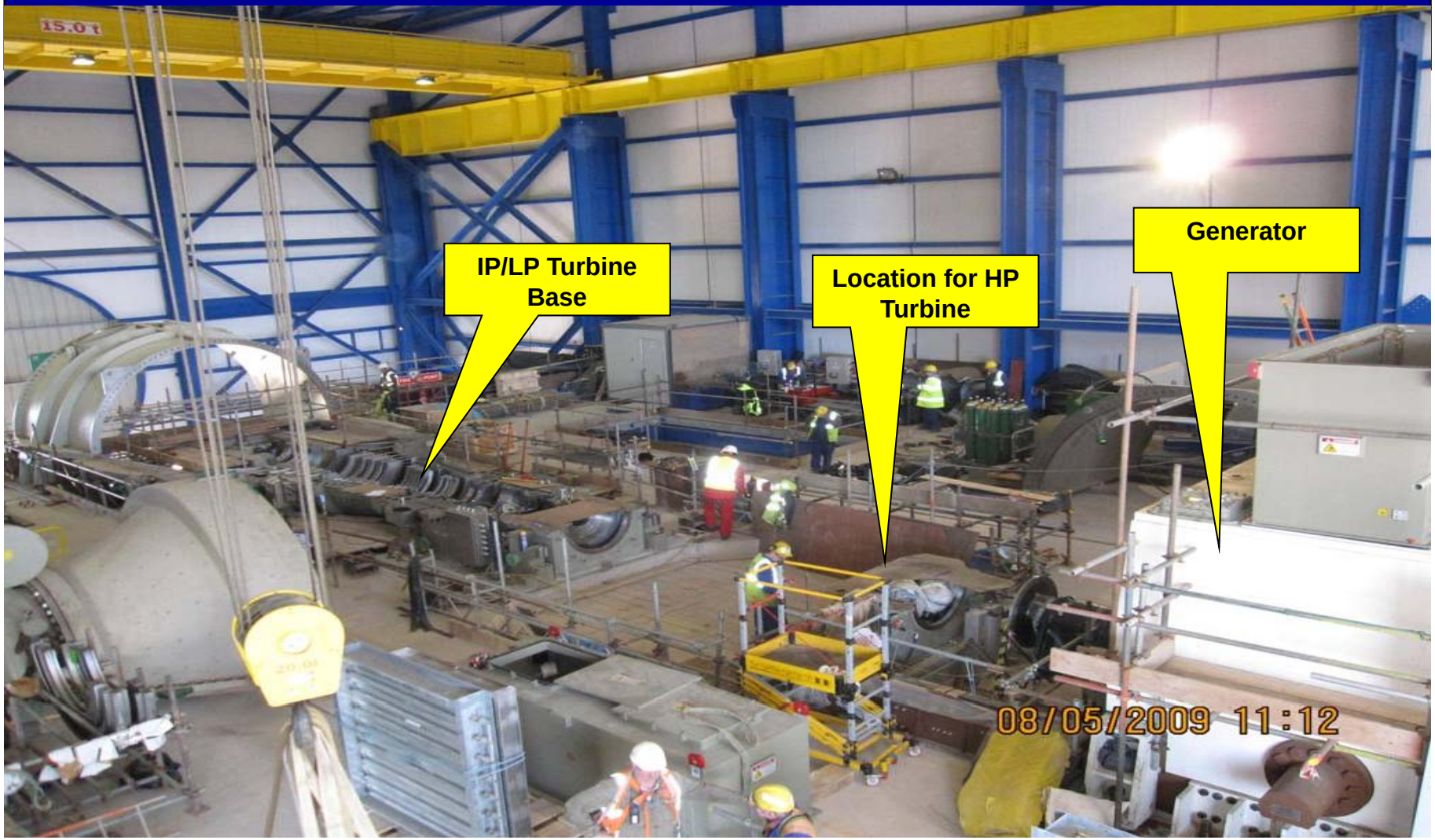
May 2005 - Centreline



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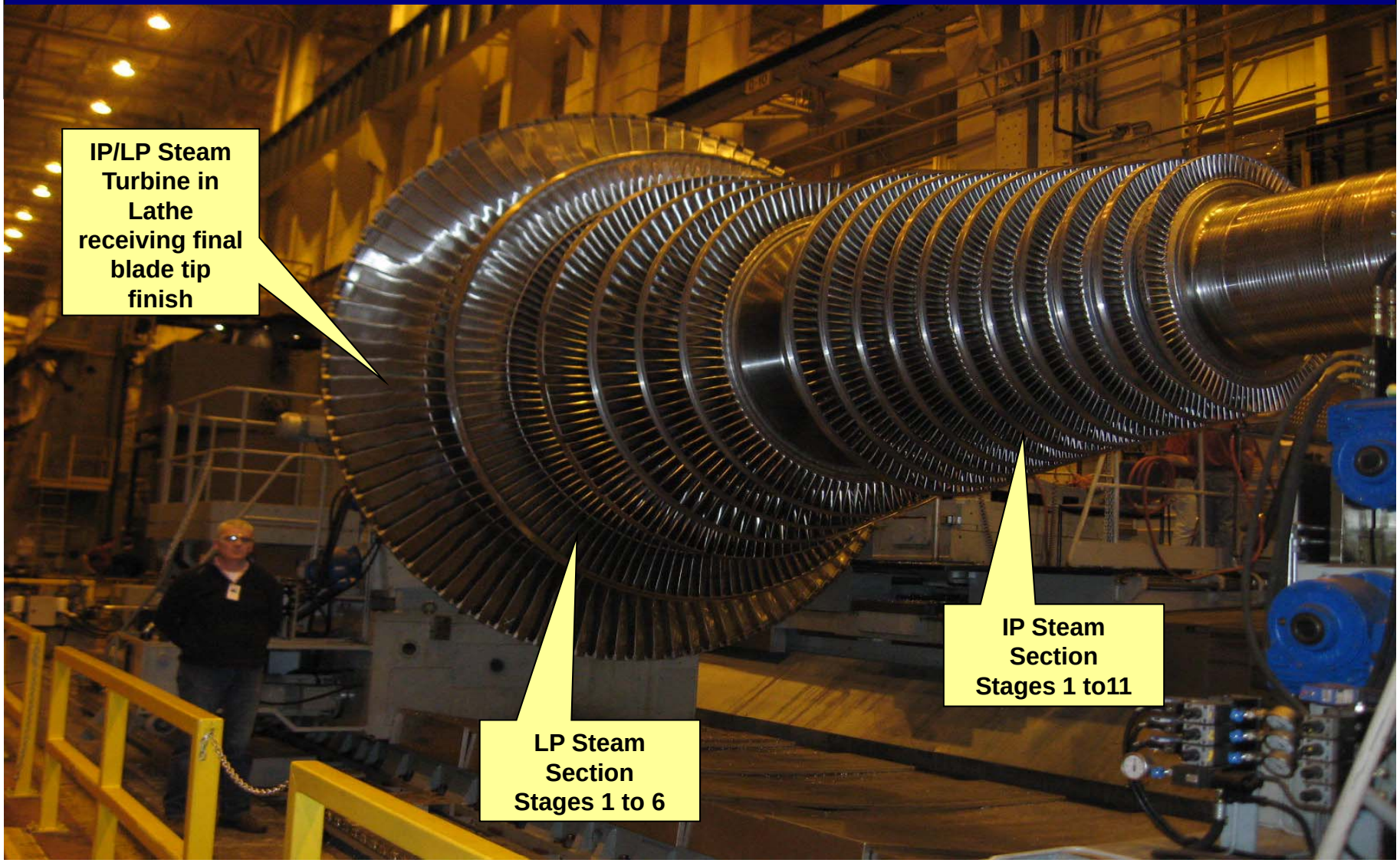
GE Facility, Albany, New York



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Gas Turbine on Centreline

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Centreline with IP/LP Rotor In Place

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HP Steam Turbine on Centreline

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IP/LP Steam Turbine Top Cover in Place

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Lagging of HP/IP/LP Steam Turbines

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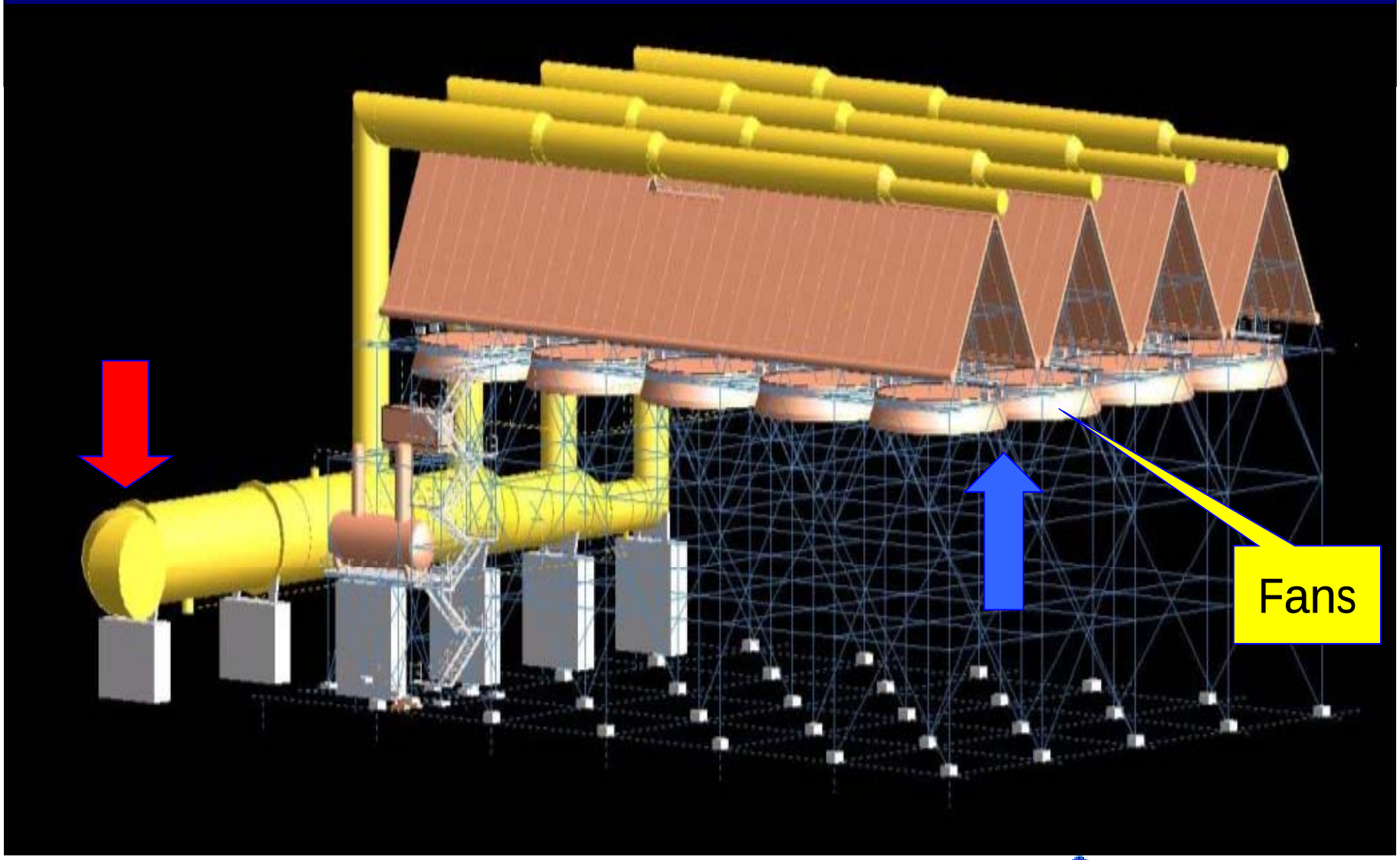
Model of Air Cooled Condenser (ACC)



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Example of an ACC Under Construction

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Construction Area for Air Cooled Condenser (ACC)

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ACC Frame Construction

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ACC Fan Installation

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ACC Condenser Units Streets 3 & 4

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ACC A Frames for Streets 1 & 2

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ACC Streets 1 to 4 Condensing Units Complete

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ACC Construction Continued

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ACC Side Cladding Installation

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ACC Construction Complete

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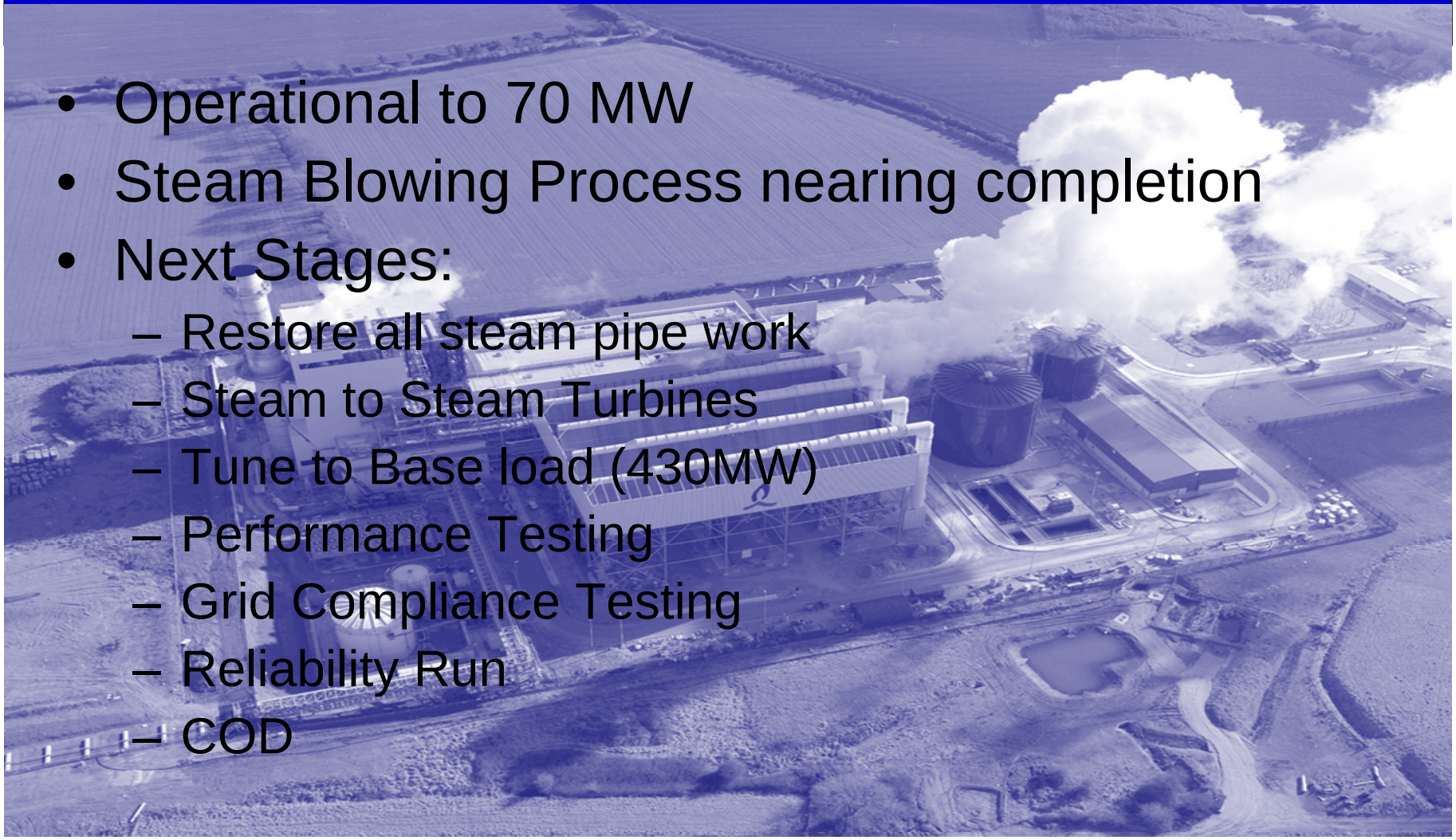
Current Status



- Operational to 70 MW
- Steam Blowing Process nearing completion
- Next Stages:
  - Restore all steam pipe work
  - Steam to Steam Turbines
  - Tune to Base load (430MW)
  - Performance Testing
  - Grid Compliance Testing
  - Reliability Run
  - COD

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Whitegate Independent Power Plant

Thank You For Your Attention

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