

# **REPORT**



Peterborough Compressor Station Level 2 Schedules (Phase 2)

Prepared for: National Grid PLC

Prepared by:



Project Title: King's Lynn & Peterborough Compressor Station MCPD FEED Project

Document/Rev No: 203513C-002-PLG-0301/B

Date: August 2022

Rev	Date	Description	Issued by	Checked by	Approved by	Client Approval
Α	13/07/2022	Issued for Client Review				
В	12/08/2022	Issued for Approval				



Project Title: Document Title:

Project
Peterborough Compressor Station Level 2 Schedules (Phase 2)

Document/Rev No: 203513C-002-PLG-0301/B

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## **ABBREVIATIONS**

CSRP Control System Restricted Performance

DLE Dry Low Emissions

EPC Engineering, Procurement and Construction

ERP3 Emissions Reduction Phase 3

FEED Front End Engineering Design

HSSE Health, Safety, Security, and Environment

ITT Invitation To Tender

LER Local Equipment Room

MCPD Medium Combustion Plant Directive

NTS National Transmission System

PDS Process Duty Specification

SCR Selective Catalytic Reduction

SIMOPS Simultaneous Operations

UCP Unit Control Panel

VSD Variable Speed Drive

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# **HOLDS LIST**

HOLD	SECTION	DESCRIPTION
1	2.2	Location of SCR facilities needs to be confirmed following detailed site surveys including assessment to all existing underground pipes / channels plus potential clash with ERP3 project installed draw pits.

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## 1.0 INTRODUCTION

## 1.1 General Background

The Medium Combustion Plant Directive (MCPD) requires that existing plant between 1 MW and 50 MW net thermal input must not exceed specified operational emission limit values or be taken out of service before 1 January 2030. This legislation impacts the Rolls Royce Avon driven compressor units on the gas National Transmission System (NTS) including units at King's Lynn and Peterborough Compressor Stations. Investment is required to ensure the capability, that the network requires, can be maintained beyond 1 January 2030. Investment may include various combinations of the following options and the investment must be assessed against network capability requirements predicted under various future energy scenarios to ensure the most cost-effective solution for end consumers.

- Upgrading non-compliant units to bring emissions within acceptable legislative limits;
- Replacement of non-compliant units with new low emissions compressors;
- Taking non-compliant units out of service;
- Restrict the performance of non-compliant units through control system restriction such that operational emissions are limited to within legislative limits;
- Limit the use of non-compliant units to a maximum of 500 hours per year under an emergency use derogation as defined in the MCPD legislation.

National Grid submitted a compressor emissions compliance strategy paper to Ofgem in 2019 within which compliance options for each site impacted by the incoming MCPD legislation were presented. Due to the uncertainty around the optimum solution for King's Lynn and Peterborough Compressor Stations it was agreed that further review of options would be conducted with the optimum solution for each site presented to Ofgem in two separate Final Options Selection Reports. Agreement on the optimum solution would then allow the project(s) to progress to the next phase of development prior to final funding allowances being agreed via an uncertainty mechanism under the RIIO regulatory framework.

# 1.2 Site Background

Peterborough and King's Lynn Compressor Stations are located in the East of England and their location on the NTS is shown on the schematic below. A brief outline of each site is provided in the section below to put the project scope into context.

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Figure 1-1 Peterborough & King's Lynn Compressor Stations

# Peterborough Unit A, B, C Unit D, E Solar Titan 130 King's Lynn Unit A Unit B Compliance Key Derigated unit Leberic unit Concompliance (Key) Derigated (Key)

#### 1.2.1 Peterborough Compressor Station

The Peterborough Compression Station is used primarily for bulk transmission of gas to support demand and currently has:

- 3 off Rolls-Royce Avon gas driven compressors (A, B, C) existing that do not meet emissions limits:
- 2 off Solar Titan gas driven compressors (D, E) in process of being installed to become lead units;
- Part of ERP3 project due for commissioning Q4 2022. Other modifications also being undertaken.
- Installation of 3rd Solar Titan was originally planned: Limited Construction has been done

A, B and C compressors do not comply with MCPD (Medium Combustion Plant Directive). They will be used to provide resilience after commissioning of Units D, and E but need to be replaced/modified by 2030.

#### 1.2.2 King's Lynn Compressor Station

The King's Lynn is a bi-directional compression station which is used to resolve supply/demand imbalance for SE England and currently has:

- 2 off Siemens SGT400 driven compressors (C, D) which operate as lead units;
- 1 off Rolls-Royce Avon Gas driven compressor (B) which operates as partial backup to C and D
- 1 off Rolls-Royce Avon Gas driven compressor (A) which is disconnected and partially dismantled

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Unit B compressor does not comply with MCPD and does not provide sufficient back-up capacity. Design capacity cannot be achieved with C and D unavailable.

## 1.3 MCPD Legislation Compliance Options

The technical options being considered to meet MCPD legislation at the existing compression stations are as follows:

RR Avon Retrofit Options

- a) Change out of Avon engine to a Dry Low Emissions (DLE) unit;
- b) Use of Control System Restricted Performance (CSRP);
- c) Installation of a Selective Catalytic Reduction (SCR) unit.

New Build (Replacement of RR Avon) Options

- a) New Gas Turbine Driven Compressor;
- b) New Electric Variable Speed Drive (VSD) Compressor.

## 1.4 Document Objectives

Level 2 project execution schedules for the Peterborough Station new build and retrofit options have been developed. The intention of the Level 2 schedules is to highlight any differences in overall project execution duration for the alternative options for use in the cost benefit analysis of the options and thus allow selection of a preferred Peterborough Station MCPD option.

#### 1.5 Document Structure

This document is structured as follows:

Section 2.0 presents and summarises options being considered.

Section 3.0 summarises the main assumptions and basis used for development of the schedules.

Section 4.0 presents the overall estimated project execution duration for each option.

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#### **DEVELOPMENT OPTIONS** 2.0

## 2.1 New Build Options

For the new build options, two alternative compressor designs are being considered:

- a) New Gas Turbine Driven Compressor (Option A);
- b) New Electric Variable Speed Drive (VSD) Compressor (Option B);

The preferred option for the new build option is a gas turbine driven unit (Ref. 7). The electric VSD drive option has been screened out (Ref. 7) and therefore is not considered further in this report.

There is only one potential location for the new compressor, i.e. Plinth F. Some pre-investment for the new compressor has already been included as part of the currently ongoing ERP3 Project (Ref. 1 and 2).

The Figure 2-1 shows the location of Plinth F, together with the main civils works required for the new unit.



Figure 2-1 New Build Compressor Location

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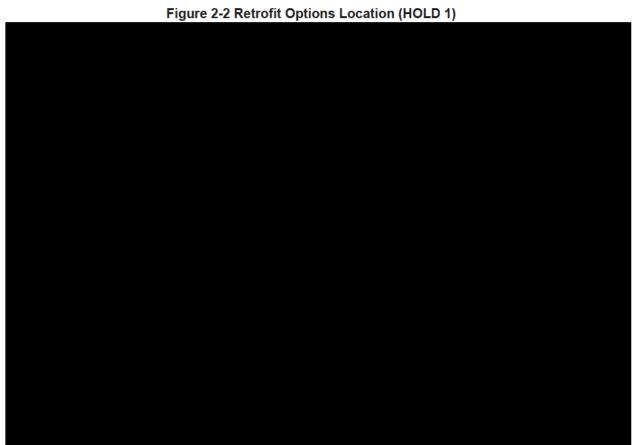
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## 2.2 Retrofit Options

For the retrofit options, the existing Avon Unit A is the preferred unit as it is the most reliable (Ref. 2). The retrofit options being considered are as follows:

- Change out of Avon engine to a DLE unit (Option C);
- Use of CSRP (Option D);
- Installation of a SCR unit (Option E).

Figure 2-2 (HOLD 1) shows the location of Avon Unit A, plus the plot space required by the SCR facilities. For the DLE and CSRP options, no additional equipment is installed outside of the Avon A Compressor Building or LER.



For the retrofit options, as well as the upgrades required to meet the MCPD requirements, additional 're-life' modifications / upgrades also need to be undertaken on the Avon A unit to ensure the requisite design life is achieved. These additional modifications include (Ref. 2):

- Overhaul of the Avon A Gas Compressor Section incl. installation of dry gas seals;
- Overhaul of the Lube Oil System (Electric Motors / Pumps);
- Replacement of Avon A Cab Lighting (ExD Rated LED);
- New Gas Turbine (Governor) & Compressor (UCP) Control System if not being performed as part of the MCPD option retrofit;
- New fuel gas heater package.

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## 3.0 BASIS FOR SCHEDULES

Refer to Reference 3 for a summary of the technical scope associated with each option.

The basis and the main assumptions used to develop the Level 2 schedules were as follows:

- The Peterborough Ofgem Re-Opener period is 31/12/2022 to 30/06/2023.
- A second Ofgem Re-Opener period of 2 months is required to agree funding allowances, This period will be after Execute (i.e. EPC) tenders have been received.
- At the conclusion of the Re-Opener period, an option will be selected for the Peterborough MCPD project.
- The project will be executed in the following project phases:
  - Pre-FEED;
  - ➤ FEED;
  - Detailed Design;
  - Construction;
- The Pre-FEED can start before option approval / selection, i.e. before Ofgem Re-Opener period closure, if it is required in order to achieve project completion before the MCPD target date of 2030.
- The following National Grid internal approvals / governance periods are required:
  - > 2 months between pre-FEED and FEED (F3 Sanction). This can occur in parallel to the FEED ITT period.
  - ➤ 2 month governance cycle (F4 sanction) immediately before the second Ofgem re-opener to confirm remaining funding allowances. This sanction process commences post receipt of Execute bids.
  - > 2 months governance cycle at the end of construction/commissioning (T6 Sanction).
- The tendering periods required plus durations of these project phases for the new build options will be longer than the retrofit options given the significantly greater scope.
- Pre-FEED ITT award activities are kicked off immediately following option selection being finalised, i.e. conclusion of Re-opener period.
- Activities that involve total shutdown of the compressor station can only occur during
  the period April September [Ref. 2]. For the retrofit options, it is currently assumed
  that Unit A is also only taken offline for upgrade / refurbishment in this period too, to
  ensure that it is available during winter months etc. It may not be necessary to limit the
  Unit A outage window, as Units B and C are still available to provide reliance during
  the winter periods.
- For both new build and retrofit options, the Avon units that are not MCPD compliant will need to be demolished. It is assumed that this demolition occurs after the MCPD project upgrades. Thus the demolition activities are not on the MCPD project critical path and demolition can occur any time after start-up of the MCPD project facilities.
- On site construction activities not requiring a total shutdown of the compressor station can occur all year round, i.e. constructions and operations SIMOPS is allowed.

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 The delivery time for the GT driven compressor package is 16 months (ex. Works) and this includes string test. The delivery time for the equipment required for the retrofit options will be significantly shorter. A duration of 6 months is assumed based on information provided by Reference 5 and previous project experience.

- Purchasing of equipment etc. will occur post FEED, i.e. no early investment. However, in order to reduce the overall procurement cycle for the new compression unit, it is assumed that the procurement specs / documents and compressor unit ITT technical bid evaluations will be performed during FEED. A period for vendor engagement will occur during FEED. Therefore, the purchase order can be placed soon after the Execute activities commence.
- For the retrofit options, the project execution activities for the MCPD facilities and 'relife' facilities can be done in parallel and managed by a single design and installation contractor.
- Adequate manpower is available to support the construction activities, i.e. there are no manpower restrictions. A 7 day working week / 12 hours a day is assumed for the preliminary schedules, This provides opportunity to increase site working hours if delays are experienced.
- Required permits and planning permissions are not on the critical path. It is assumed
  these activities will be performed in parallel to the engineering activities and will be
  managed such that they will not be on the critical path and thus will not impact the
  overall schedule. The environmental assessment and planning consents / approvals
  for the retrofit options are assumed to be of a shorter duration than the new build
  options.
- For the new build and SCR retrofit option, space outside the site fence is required for the temporary construction camp. It is assumed that the space will be the same as currently used for the ERP3 Project construction camp. The schedule currently includes a period for construction camp land lease agreements. However, there is a potential opportunity to re-use the existing land purchased for the ERP3 project construction camp, if it is not sold, which would mean a lease agreement for land is not required by the MCPD project. It is assumed that the negotiations, if required, will commence at the start of FEED, such that the land will be available for the start of the construction activities.
- National Grid's T2 Cyber delivery strategy does not permit compressor engine overhauls and cab refurbishments to be conducted at the same time as control system replacements due to overlap of working areas.

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#### 4.0 LEVEL 2 SCHEDULES

Representative Level 2 schedules are provided in Appendix A, and Table 4-1 provides a summary of the estimated project completion dates. The schedules indicate that the project completion by 2030 can be achieved and that there is also some schedule float. The retrofit options have more float and thus less schedule risk.

Table 4-1: Overall Execution Durations

Option	Project Completion Date	Comments
Α	1Q 2029	Note 1
С	4Q 2027	Note 2
D	4Q 2027	Note 3
E	4Q 2027	Note 4

#### Notes

- Only a single total site shutdown is considered to be required for hook-up of the new compressor into the general site facilities, as significant pre-investment is already included in ancillaries, electrical, control and support systems including cable ducting for the new unit.
- Two site shutdowns are required, one for the compressor overhaul and refurbishment activities and one
  for the DLE facilities installation and associated control system upgrades. It is assumed DLE technology
  will be tested / proven and commercially available by Q3 2023, before the commencement of pre-FEED /
  FEED project stages.
- 3. Two site shutdowns are required, one for the compressor overhaul and refurbishment activities and one for the CSRP facilities installation and associated control system upgrades.
- 4. Two site shutdowns are required, one for the compressor overhaul and refurbishment activities and one for the SCR facilities installation and associated control system upgrades. The project completion date is the same as Options C and D, even though this option requires on site civils works to be undertaken prior to the SCR facilities installation. This is because all options are reliant on the year April September window for all refurbishment and retrofit activities including the total site shutdown plus.

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# 5.0 REFERENCES

REFERENCES	
Ref 1	Peterborough Compressor Station Study Basis of Design, doc. no. 203513C-002-RT-0008-0002
Ref 2 Peterborough Compressor Station Site Visit Report, doc. no. 203513C-002-RT-0500	
Ref 3	Peterborough Compressor Station Cost Estimates (Phase 2 +/-30%), doc. no. 203513C-002-RT-0301.
Ref 4	Peterborough Compressor Station Process Description, doc. no 203513C-002-RT-0008-0001.
Ref 5	SCR Innovation Project Summary Report by , doc no. 7063-0870-075-07-0002-001 REV P1.
Ref 6	Avon DLE and Avon Control Systems Restricted Performance (CSRP) Provisional Innovation Study Outputs by National Grid, dated June 2021
Ref 7	Peterborough Compressor Station Option Review Report (Phase 1), doc. no. 203513C-002-RT-0503

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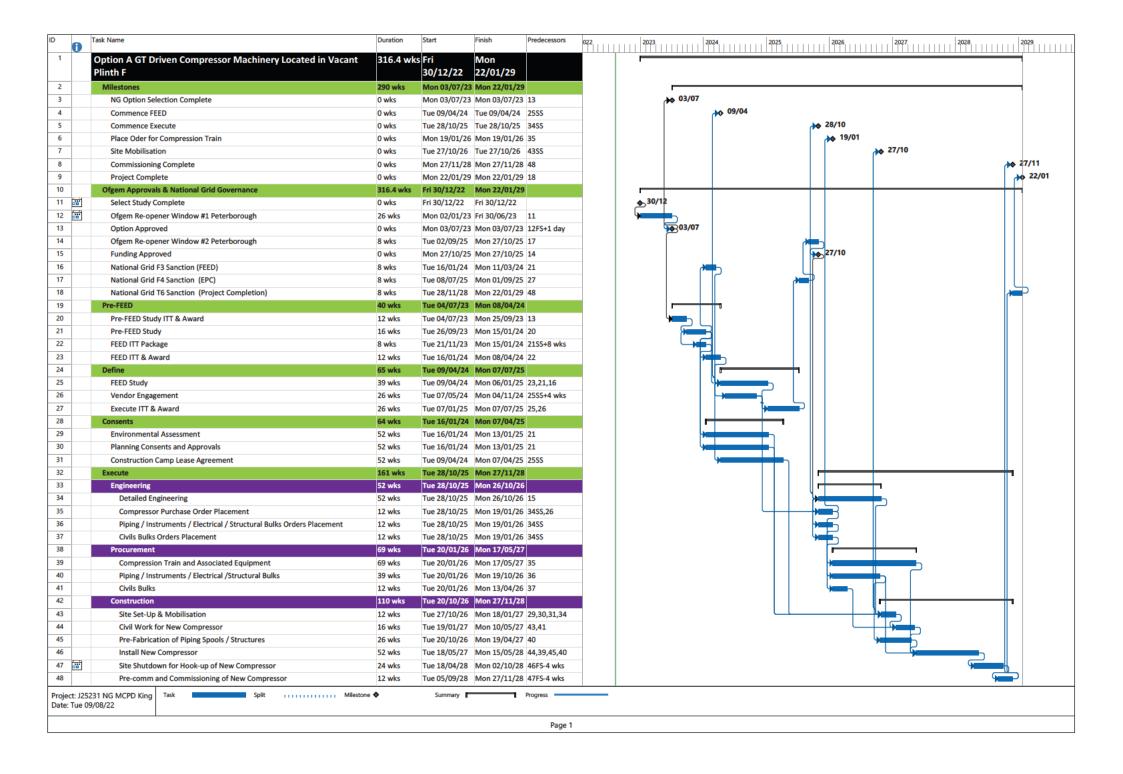
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# 6.0 APPENDIX A

# 6.1 Option A Level 2 Schedule



J25231 NG MCPD PB Option A Execution



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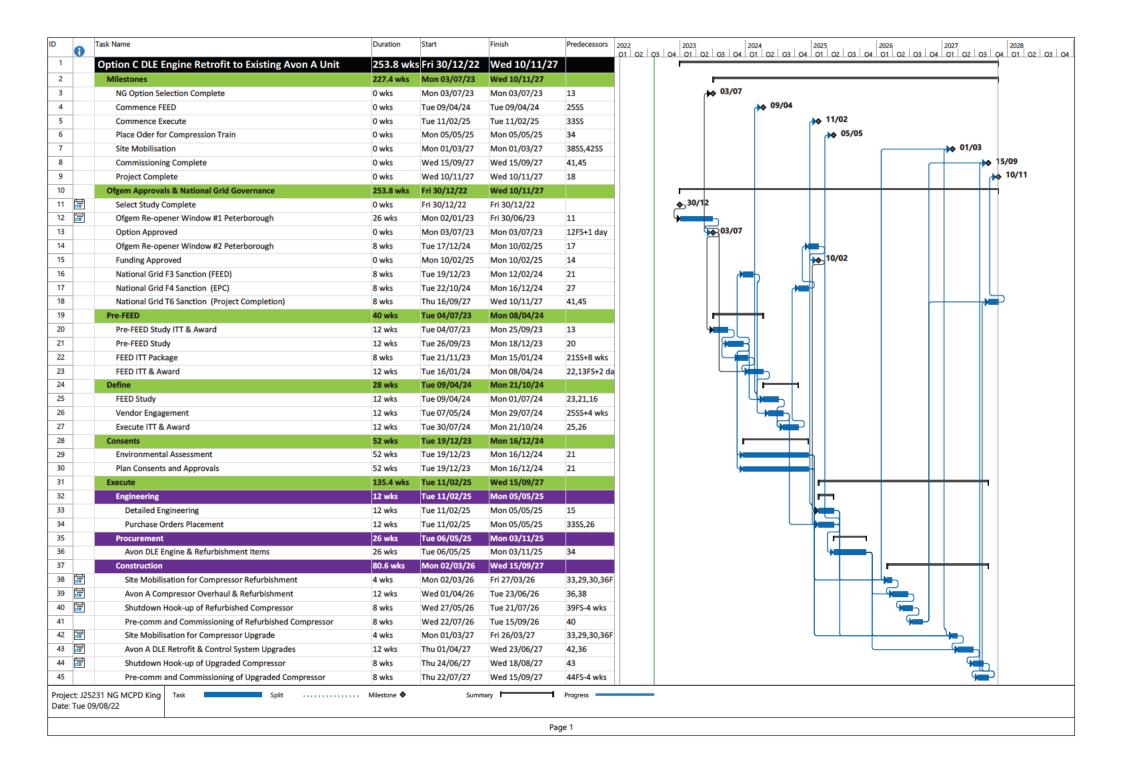
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# 6.2 Option C Level 2 Schedule



J25231 NG MCPD PB Option C Execution



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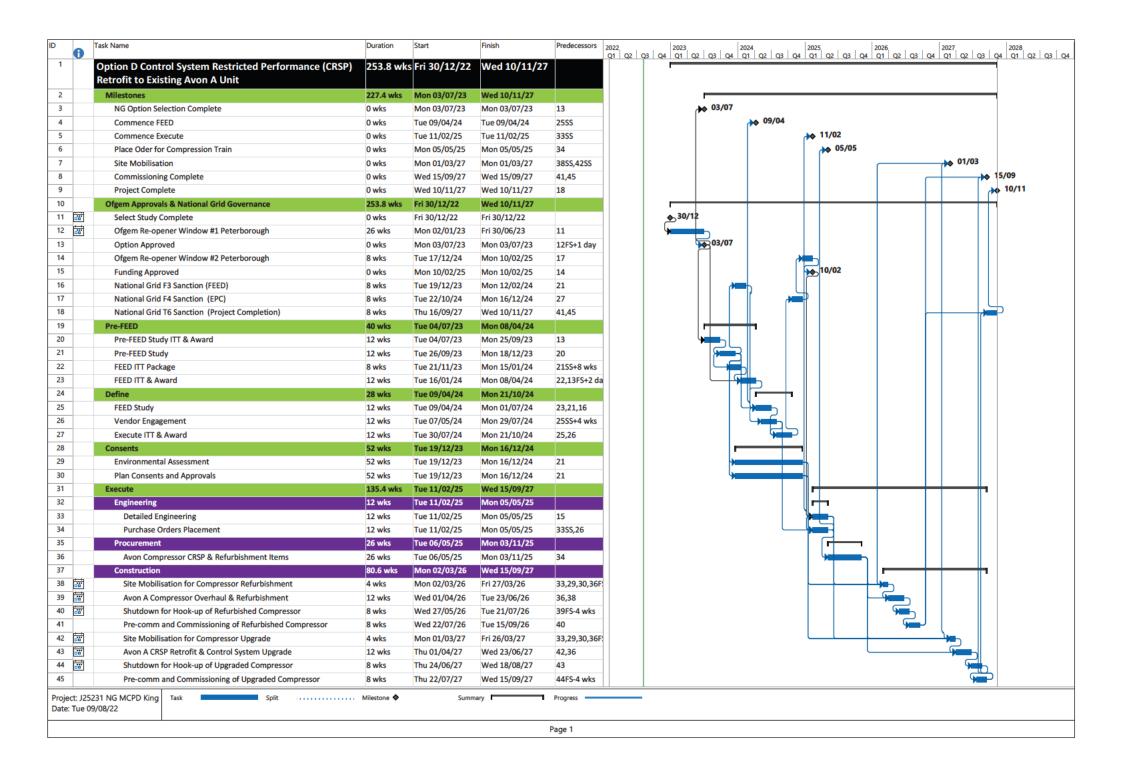
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# 6.3 Option D Level 2 Schedule



J25231 NG MCPD PB Option D Execution



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# 6.4 Option E Level 2 Schedule



J25231 NG MCPD PB Option E Execution

