

The background features a large, solid yellow circle in the upper left quadrant. To its right and extending across the lower right is a complex, abstract grey line drawing that resembles a stylized profile of a face or a map. The lines are thick and irregular, creating a sense of movement and depth.

# Meet the Specifier

## Deep Dive Session #3. Static Equipment

*The Heath, Conference Centre, Runcorn, UK  
8<sup>th</sup> June 2022*

- *The meeting is being recorded;*
- *Phones off or on silent – kindly leave room if required;*
- *Presentation will be limited solely on technical requirements – commercial requirements are outside the scope;*
- *Welcome questions – please raise your hand, or wait until the Q&A session;*
- *A scribe is available;*
- *Provide your details on the register in circulation – clear handwriting please;*
- *Fire exits – no drills planned.*

***Thank you***

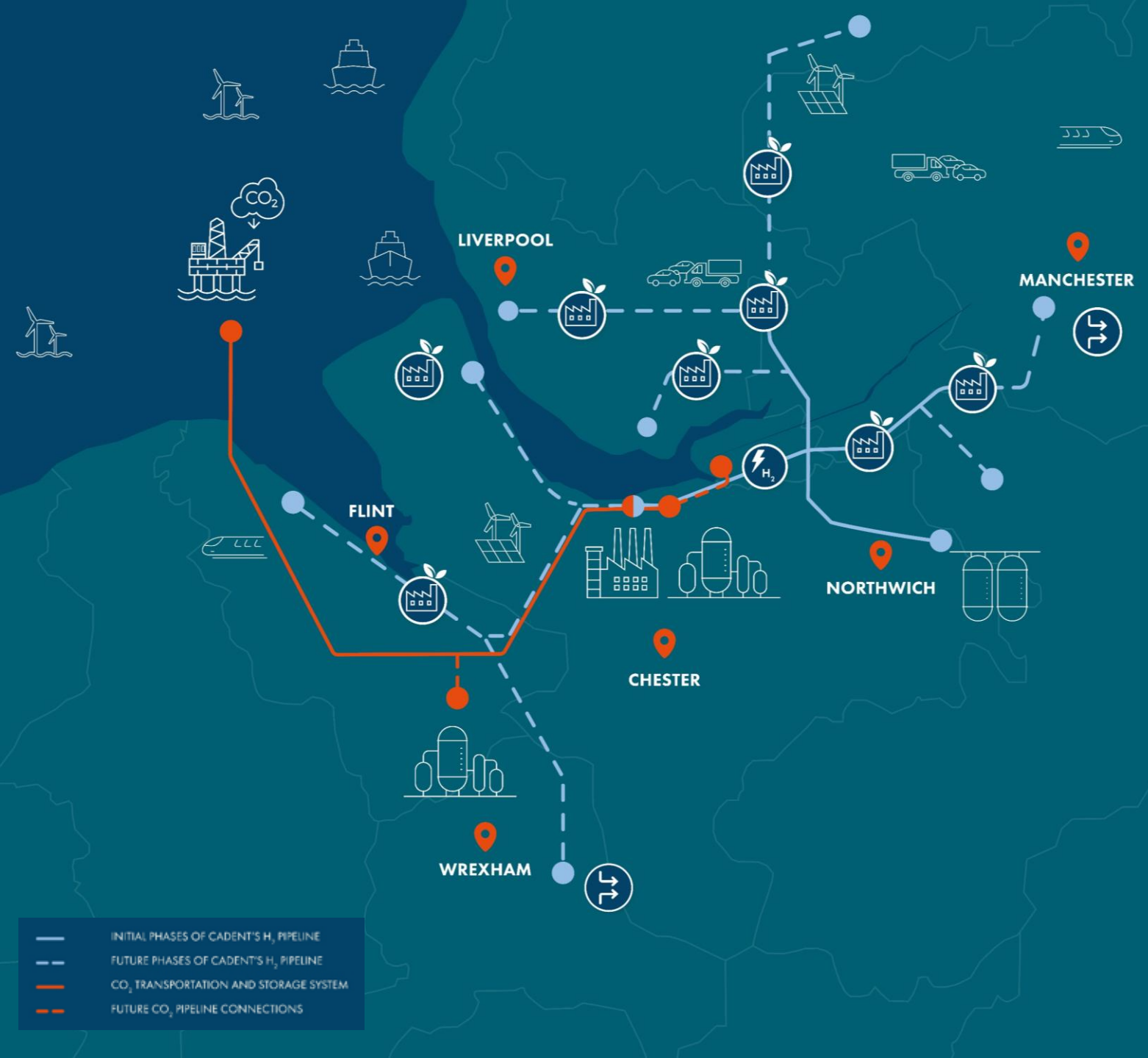
- *Project Overview*
- *Static Equipment*
- *CO2 & Materials of Construction*
- *Selection of Static Equipment for CO2 Transportation & Storage*
- *Legislation, Codes & Standards*
- *Q&A session*

# HyNet North West

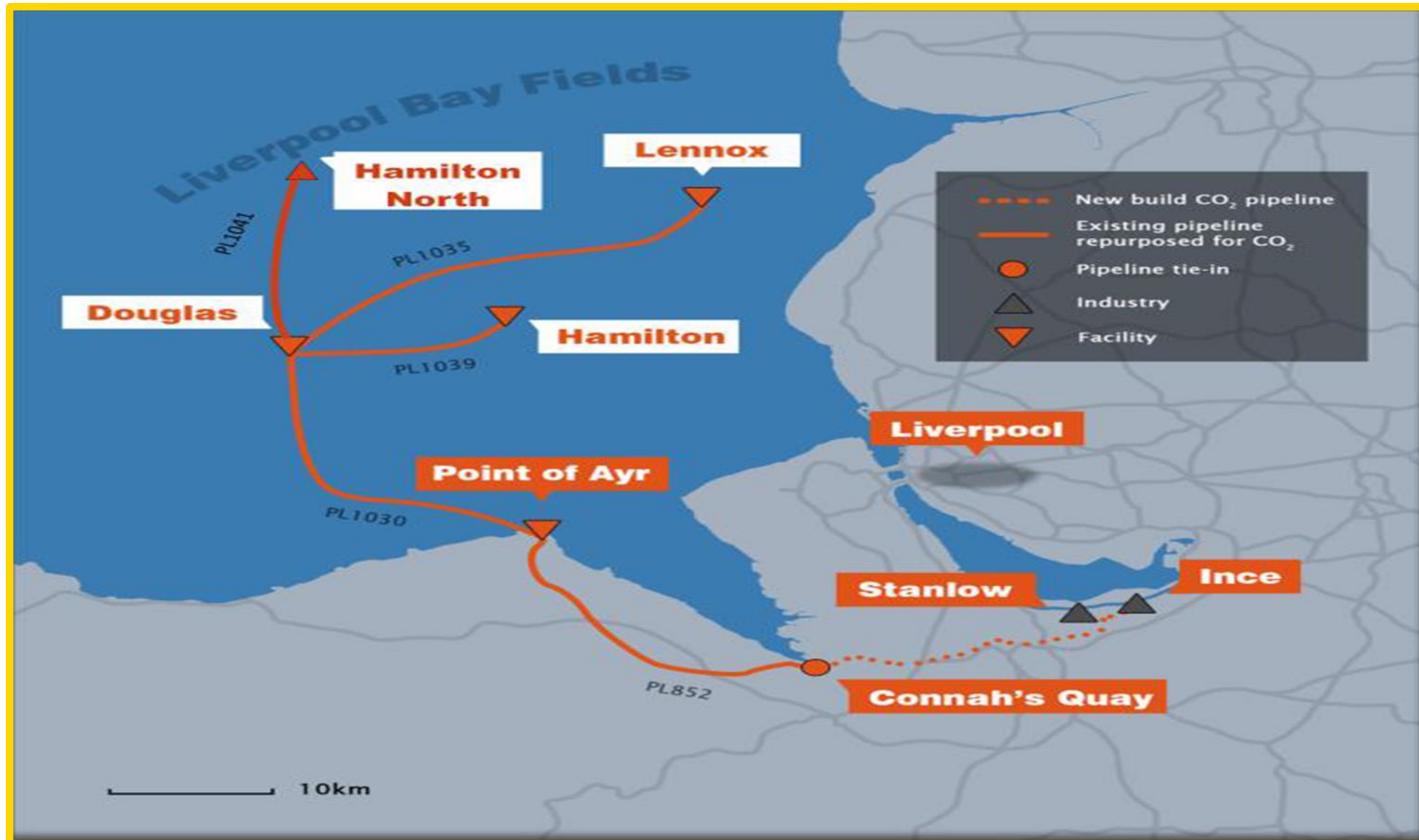
*The HyNet North West cluster will deliver:*

- Facilities to capture CO<sub>2</sub> emissions*
- Underground pipelines to transport CO<sub>2</sub> emissions to permanent safe storage*
- Low-carbon hydrogen production plants*
- A hydrogen pipeline network and salt caverns in which hydrogen can be stored ready for use*

Eni's scope is shown by the red line.



# Eni's Liverpool Bay Transport & Storage Project





# Eni's Liverpool Bay Transport & Storage Project – Point of Ayr



# Eni's Liverpool Bay Transport & Storage Project – Offshore



**Douglas Process  
Platform**

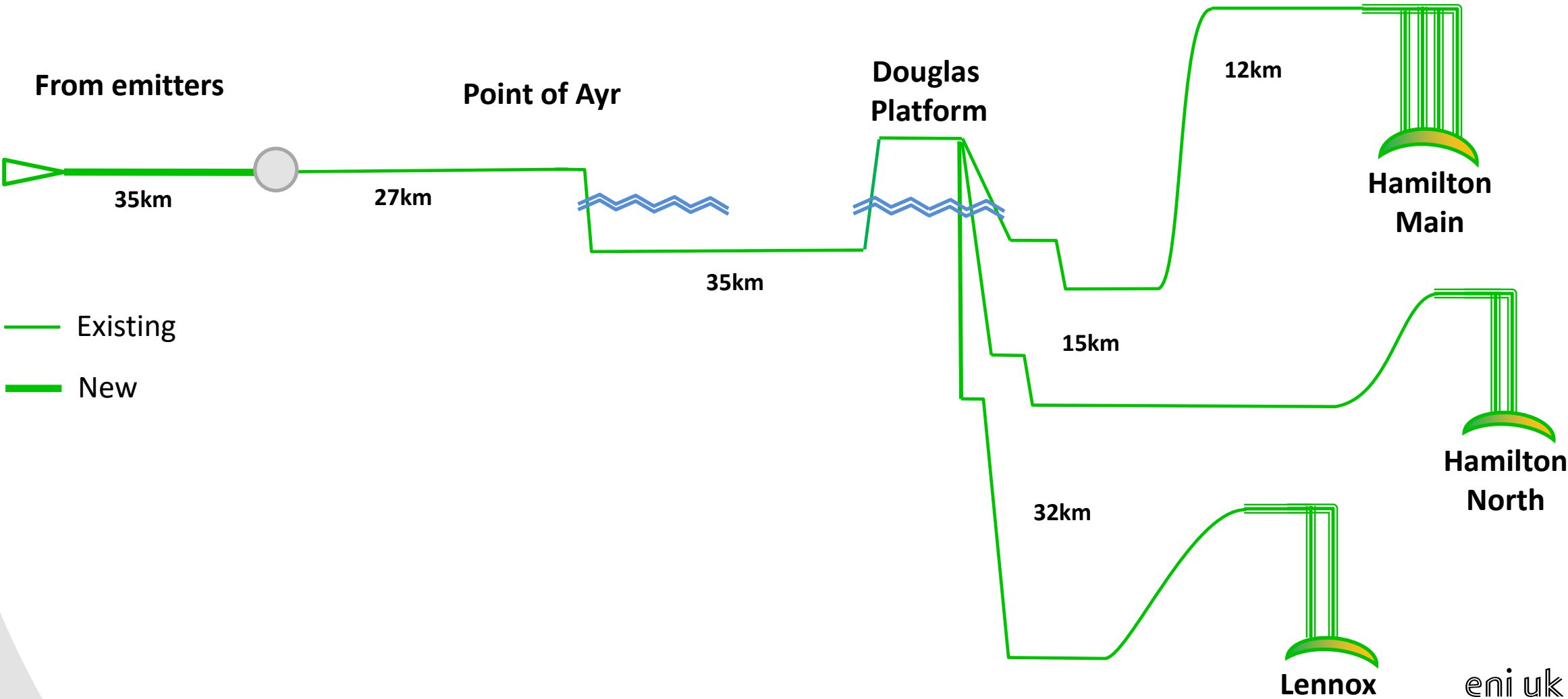
**Hamilton Main  
Wellhead Platform**

**Hamilton North  
Wellhead Platform**

**Lennox Wellhead  
Platform**

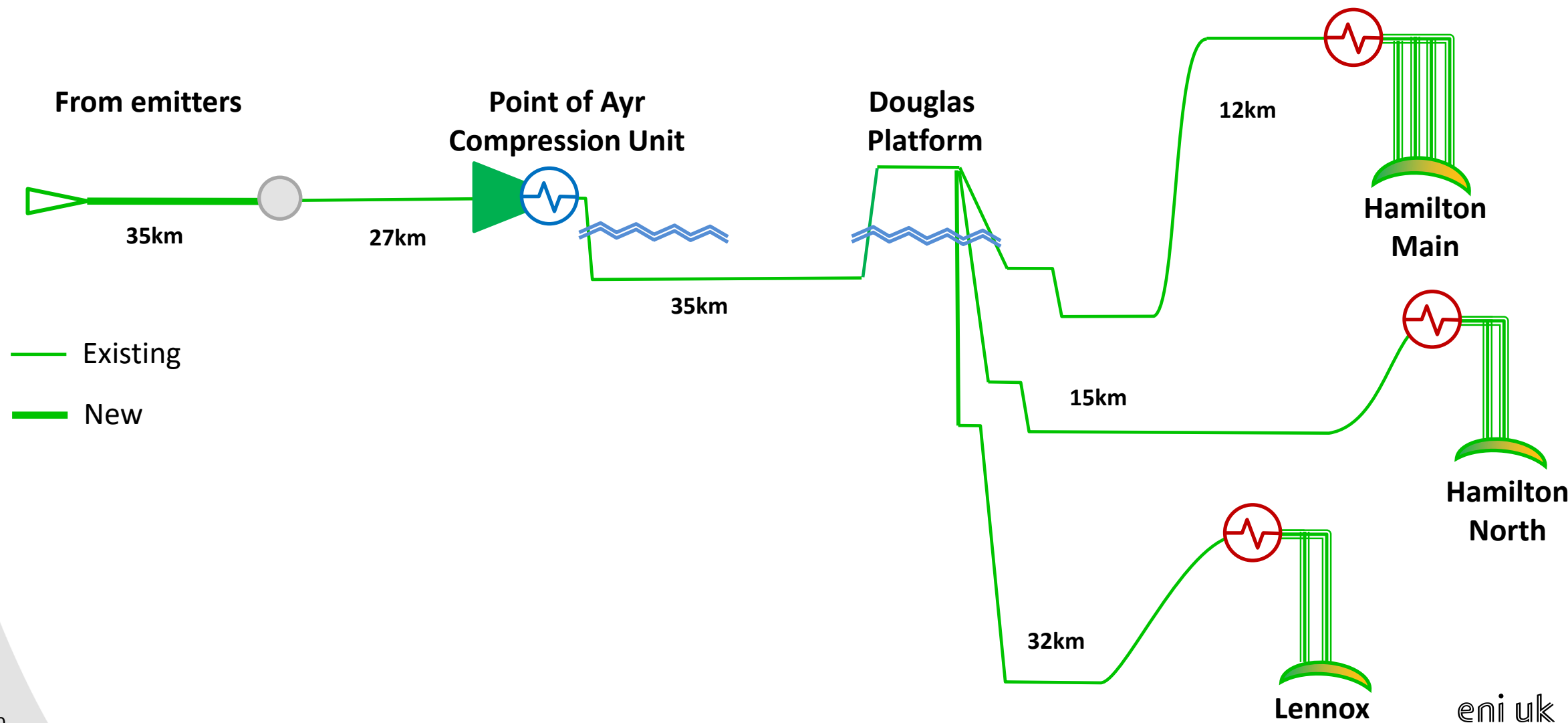


# Stage 1. Free-Flow

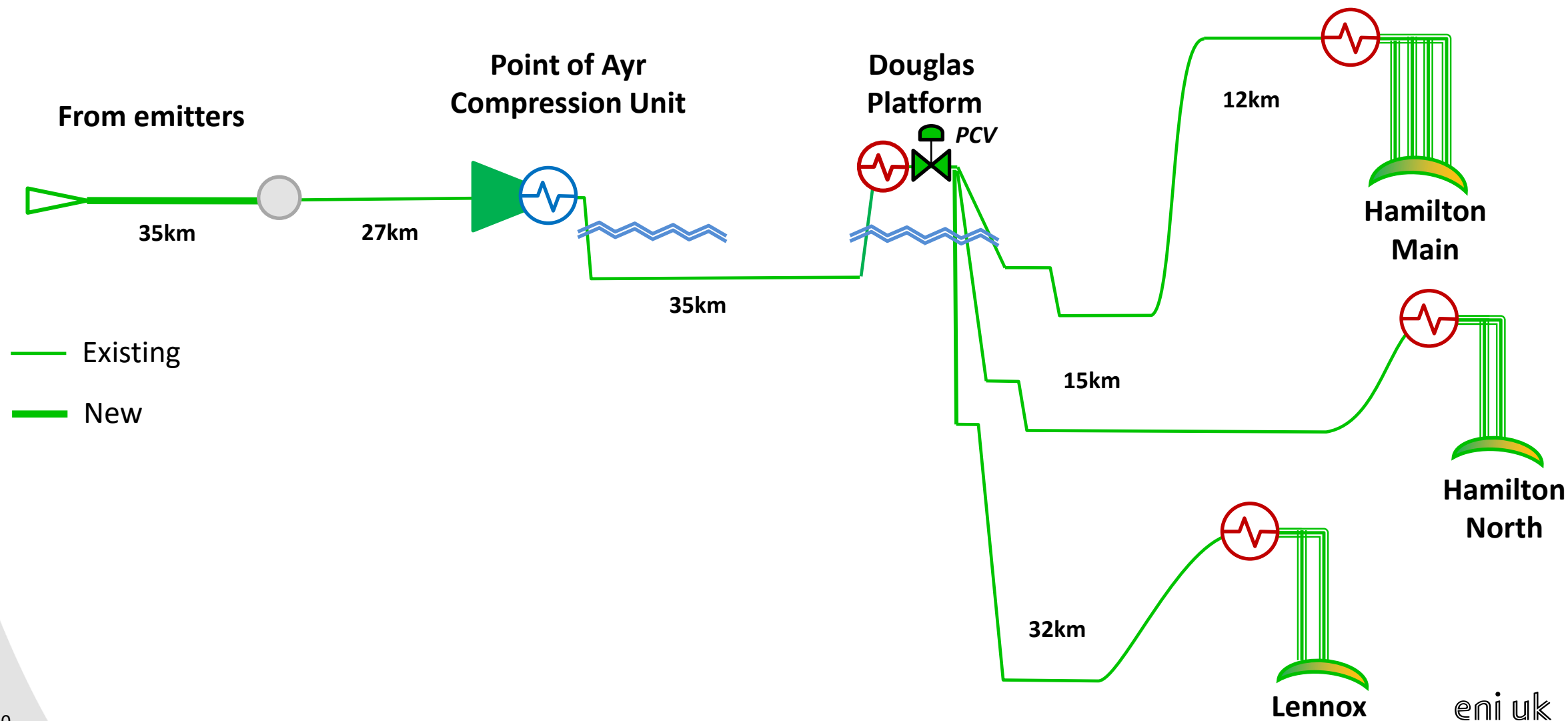




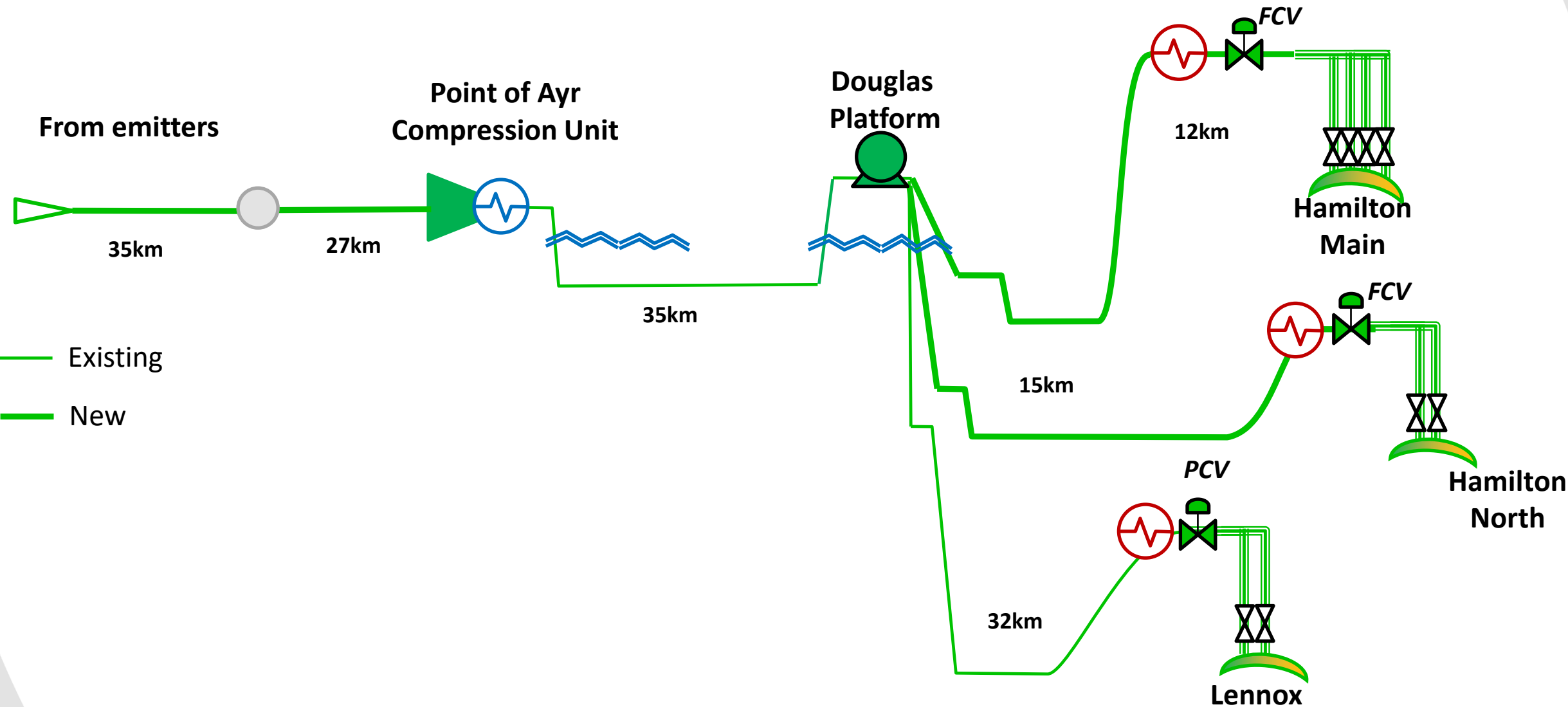
# Stage 2. Compression at Point of Ayr



# Stage 3. Pressure Control at Douglas



# Stage 4. Dense Phase



Existing  
New

# Static Equipment



# Static Equipment – Pressure Vessels



## *Pressure Vessel – Types:*

- *Configurations – Vertical and Horizontal;*
- *Process Vessels – Reactors, Columns, Bullets, Separators, Blowdown Drums;*
- *Utility Vessels – Instrument Air/Nitrogen Receivers, Fuel Gas, Drains Drums.*

## *Horizontal Vessels – are generally used:*

- *for the treatment of streams characterised by a low gas/liquid ratio;*
- *in the case of long hold-up times of the liquid phase.*

## *Vertical Vessels – are generally used:*

- *for the treatment of streams characterised by a high gas/liquid ratio;*
- *where space restrictions are imposed in the plot plan;*
- *if greater sensitivity is required for controlling the liquid level in relation to variations in the liquid flowrate.*





# Static Equipment – Heat Exchangers



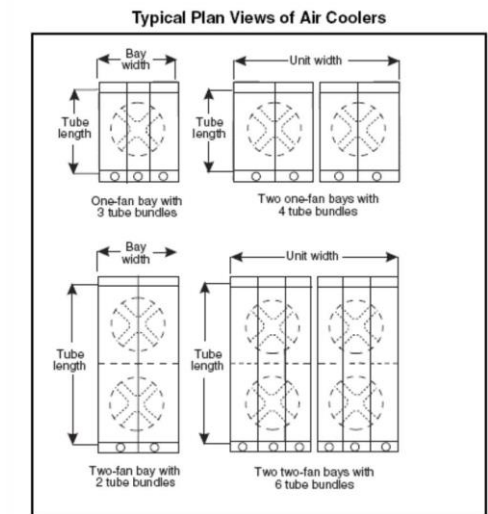
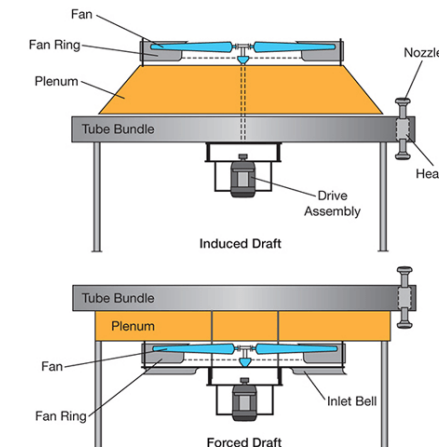
## Heat Exchanger – Types:

- Shell & Tube Heat Exchangers (STHE);
- Air Cooled Heat Exchangers (ACHE);
- Compact Heat Exchangers:
  - Plate & Frame (PFHE);
  - Plate & Shell (PSHE);
  - Printed Circuit (PCHE).
- Electric Heaters.



## Heat Exchangers are a vital part of process plants:

- Heating/Cooling/Boiling/Condensing Process Fluids;
- Each design is unique for the required process:
  - Heat Exchanger Duty;
  - Process Stream Flow Rates;
  - Process Stream Properties;
  - Component Material Properties.



# Static Equipment – Electric Heaters



## ***Electric Heaters:***

- *Used where no heating stream is available;*
- *Compact design;*
- *Stab-in bundle or standalone vessel;*
- *Requires power supply.*

## ***Electric Heaters – are generally used for:***

- *Gas Heating (Fuel Gas, Nitrogen, CO<sub>2</sub>);*
- *Oil Heating (Viscosity Reduction);*
- *Liquid Vaporizer;*
- *Freeze Protection;*
- *Tank Heating.*



## ***Pressure Vessels (Point of Ayr – Onshore)***

### ■ *Compressor Suction Knock Out Drums:*

- *4.5 MTPA Gas Phase ..... 3 Trains (3 x 50%)*
- *10 MTPA Dense Phase (Future) ..... 5 Trains (5 x 25%)*
- *First Stage – Gas & Dense Phase ..... 125 barg @ 70°C / MDMT = -35°C / 2,150mm I/D x 4,300mm T-T;*
- *Second Stage – Gas & Dense Phase ... 125 barg @ 135°C / MDMT = -35°C / 1,850mm I/D x 3,700mm T-T;*
- *Third Stage – Dense Phase (Future) ... 125 barg @ 125°C / MDMT = -35°C / 2,200mm I/D x 4,000mm T-T;*

### ■ *Nitrogen Receiver:*

- *12 barg @ 70°C / MDMT = -10°C / 2,000mm I/D x 6,500mm T-T.*

## ***Heat Exchangers (Point of Ayr – Onshore)***

### ■ *Air Cooled Heat Exchangers*

- *No cooling water available;*
- *Design Air Temperature = 30.6°C ..... 10°C approach temperature;*
- *4.5 MTPA Gas Phase ..... 3 Trains (3 x 50%);*
- *10 MTPA Dense Phase (Future) ..... 5 Trains (5 x 25%);*
- *First Stage – Gas & Dense Phase ..... 2.5 MW / 40 barg @ 105°C / MDMT = -35°C;*
- *Second Stage – Gas & Dense Phase ..... 12.5 MW / 80 barg @ 155°C / MDMT = -35°C;*
- *Third Stage – Dense Phase (Future) ..... 20.0 MW / 145 barg @ 135°C / MDMT = -35°C.*

## *Heaters (Offshore)*

### ■ *Electric Heaters*

- *No heating stream available;*
- *Weight & Space – Electric Heater(s) + Control Panel(s);*
- *Intermittent use: based on ambient temperature / operational requirements;*
- *Douglas – Gas Phase only ..... 3.0 MW / 90 barg @ 35°C / MDMT = -35°C;*
- *Hamilton Main – Gas & Dense Phase .... 3.0 MW / 145 barg @ 60°C / MDMT = -35°C;*
- *Hamilton North – Gas & Dense Phase ... 1.3 MW / 145 barg @ 60°C / MDMT = -35°C;*
- *Lennox – Gas & Dense Phase ..... 5.3 MW / 145 barg @ 60°C / MDMT = -35°C.*



## ■ **UK Legislation**

- *The Pressure Equipment (Safety) Regulations 2016*
- *The Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019*
- *UKCA – UK Conformity Assessment*

## ■ **Design Code**

- *ASME VIII Div 1 / ASME VIII Div 2 / EN 13445 / PD 5500*
- *Selection based on a techno-economic basis*

## ■ **Product Standards**

- *Pressure Vessels – IOGP S-619*
- *Air Coolers – API 661 + IOGP S-710*
- *Electric Heaters – IOGP S-723*

## ■ **Project Requirements**

- *Supply Specifications*

**Eni = Minimum Requirements**

# IOGP – The International Association of Oil & Gas Producers



***“The IOGP is the voice of the global upstream industry.”***

***Formed in 1974 - as of April 2020 it has 77 members, including...***

## **Upstream Members**

BP  
Chevron  
ConocoPhillips  
Eni  
Equinor  
ExxonMobil  
Petrobras  
Petronas  
Saudi Aramco  
Shell  
Total  
Woodside

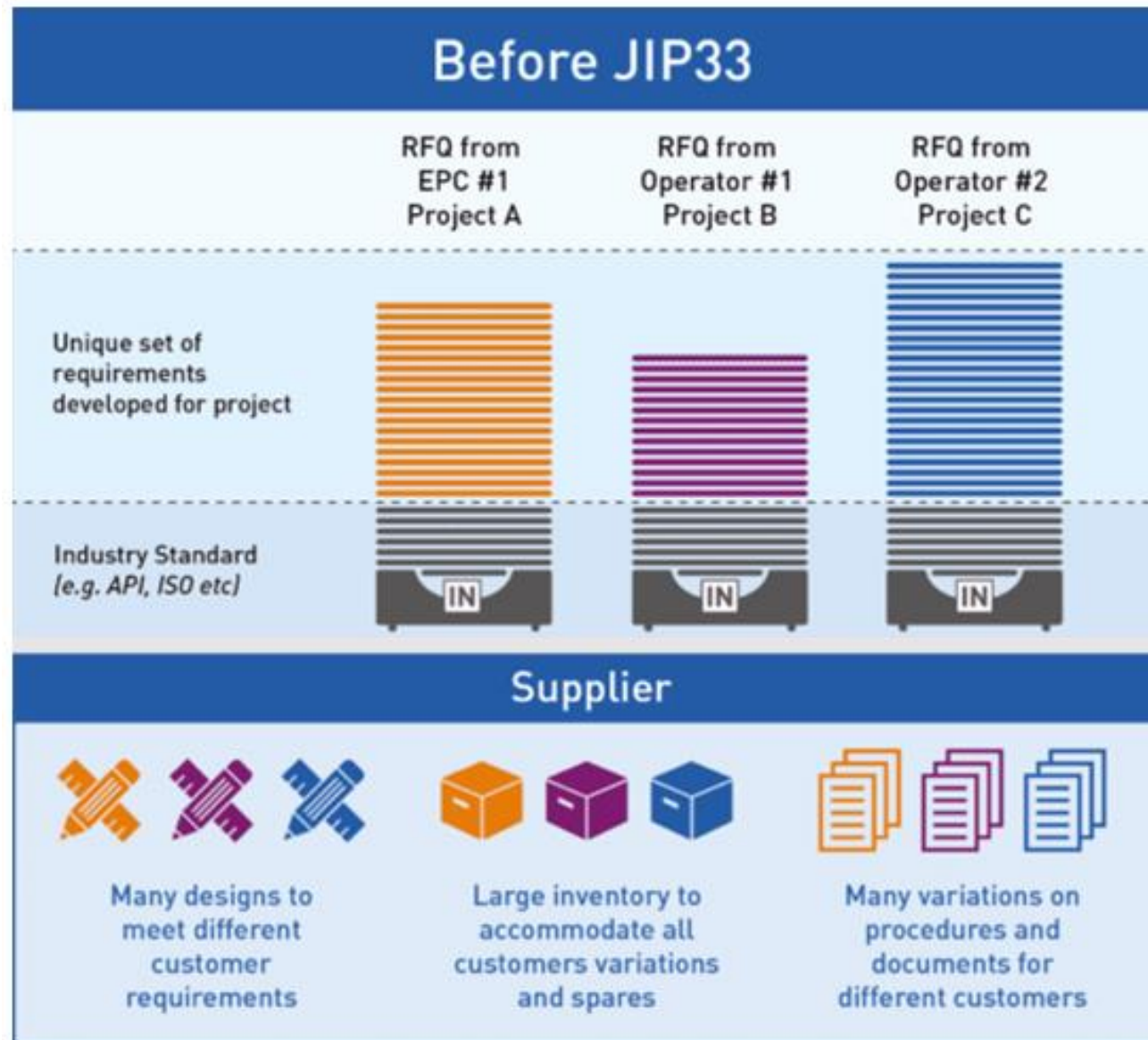
## **National and other associations**

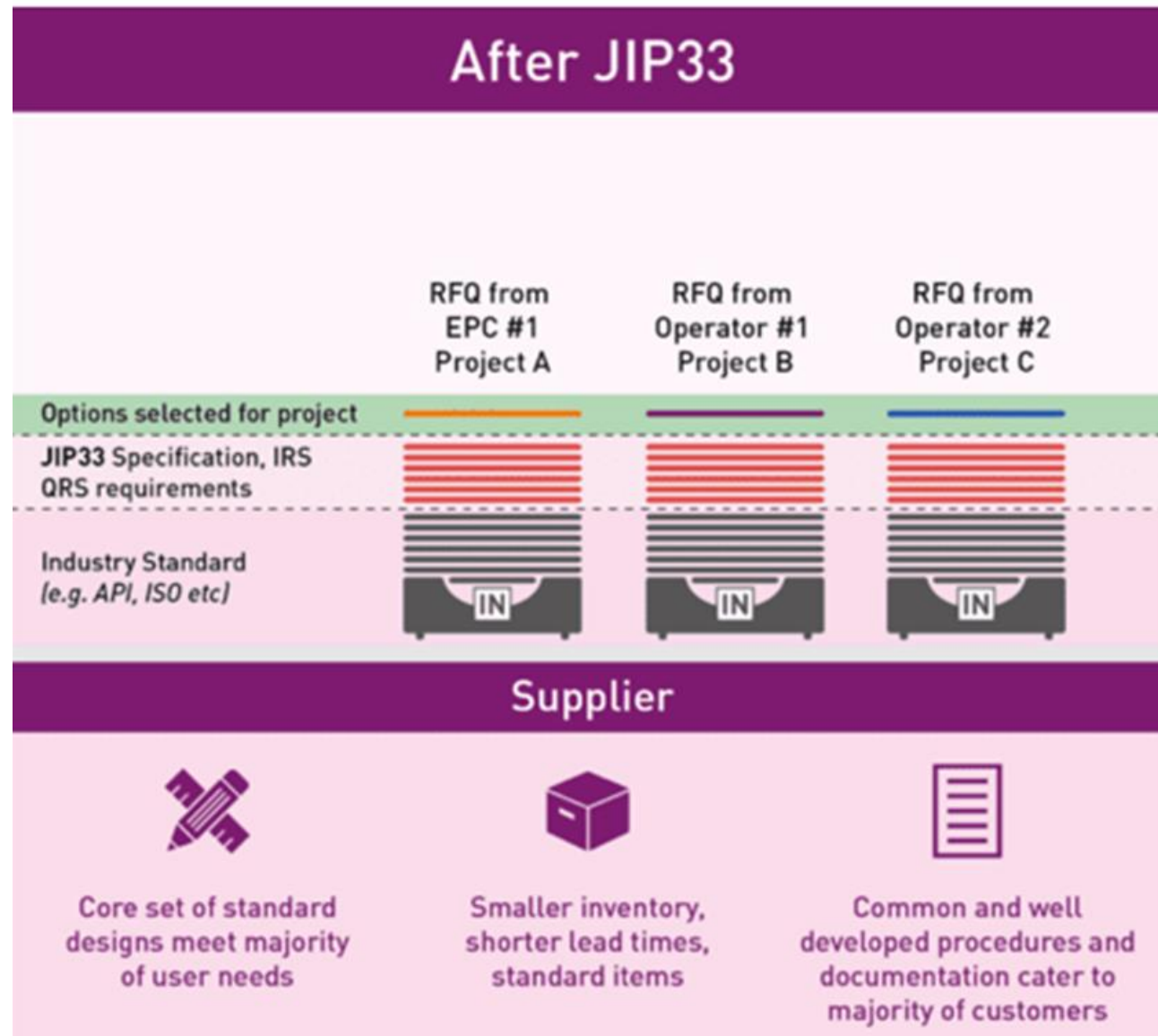
American Petroleum Institute (API)  
Energy Institute (EI)  
OGUK  
Norwegian Oil & Gas Association

## **IOGP Associate Members**

Aker Solutions  
Baker Hughes  
OPITO  
Schlumberger  
TechnipFMC plc

***Offices in London, Brussels and in Houston***





- **2016** JIP33 initiated with support from the World Economic Forum Capital Project Complexity Initiative;
- **2017** Started [4] Subsea Xmas Trees [API]; LV Switchgear [IEC]; Piping Material [API]; Ball Valves [API];
- **2018** Published [9] **Shell & Tube Heat Exchangers [API 660]; Pressure Vessels [None];**
- **2019** Published [4]
- **2020** Published [21] **Air-Cooled Heat Exchangers [API 661]; Welding [API 582]; Painting [NORSOK]; Insulation (NORSOK);**
- **2021** Published [7] **Electric Heaters [None]; Packages: Diesel Generator (S-714); Firewater Pump (S-721);**
- **2022** Published [5] **Pressure Vessels – 2<sup>nd</sup> Issue [None];**

**As of May 2022** : Total: 50 specifications published covering....

- *Electrical Equipment / Instruments / Packages / Mechanical / Safety / Components / Subsea*





- *Design Code ..... ASME VIII Div 1 / EN 13445 / PD 5500*
- *Equipment Standard ..... API 661*
- *Supplementary Specification ..... IOGP S-710*
- *Quality Control Requirements (QRS) ..... IOGP S-710Q*
- *Information Requirements (IRS) ..... IOGP S-710L*
- *Equipment Data Sheet ..... IOGP S-710D*

- *Long-term:*
  - *CEOs committed to JIP 33 – top down objective.*
- *Fresh Start:*
  - *A chance to question the value/application of existing requirements.*
- *Personal Development:*
  - *Bringing in new engineers working alongside established engineers (> 300 Engineers involved);*
  - *New tools/skills/methods for requirements definition.*
- *Challenge:*
  - *50 specifications published therefore 50 specifications to be maintained and developed.*
- *Boost to existing Standard's Bodies:*
  - *API, BSI, CEN, ISO, IEC, IEEE, ISO.*

- *Onshore - KO Drums, ACHE*
  - *Design Pressure > 100 barg;*
- *Offshore - Electric Heaters & Control Panels*
  - *Fixed Structure – deck mounted;*
  - *Weight & Space limitations;*
  - *CO2: Gas & Dense Phase Operation;*
  - *Design Pressure > 100 barg;*
  - *Intermittent use: based on ambient temperature / operational requirements;*
  - *Maintenance.*
- *Common:*
  - *IOGP Specifications.*