# The Value of Topsides Process Digital Twins with Activated Rigorous Separation Modelling

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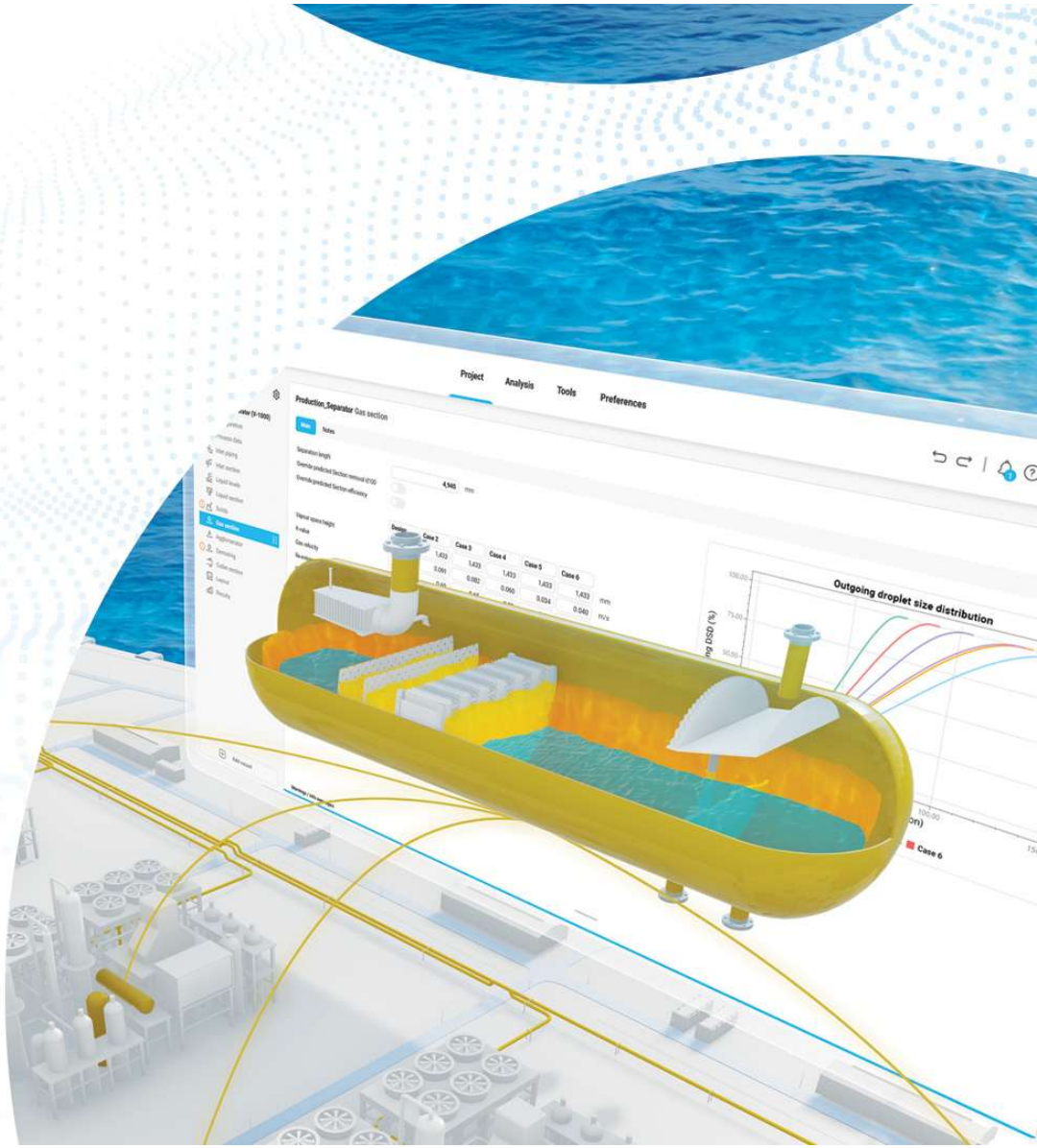

# Outline


- Separation: what's the problem
- Rigorous modelling in Digital Twins
  - How are separators currently modelled in simulation software
  - Embed software to predict separator performance
- Results
  - Rigorous modelling
  - Optimization
- Conclusions
- Questions



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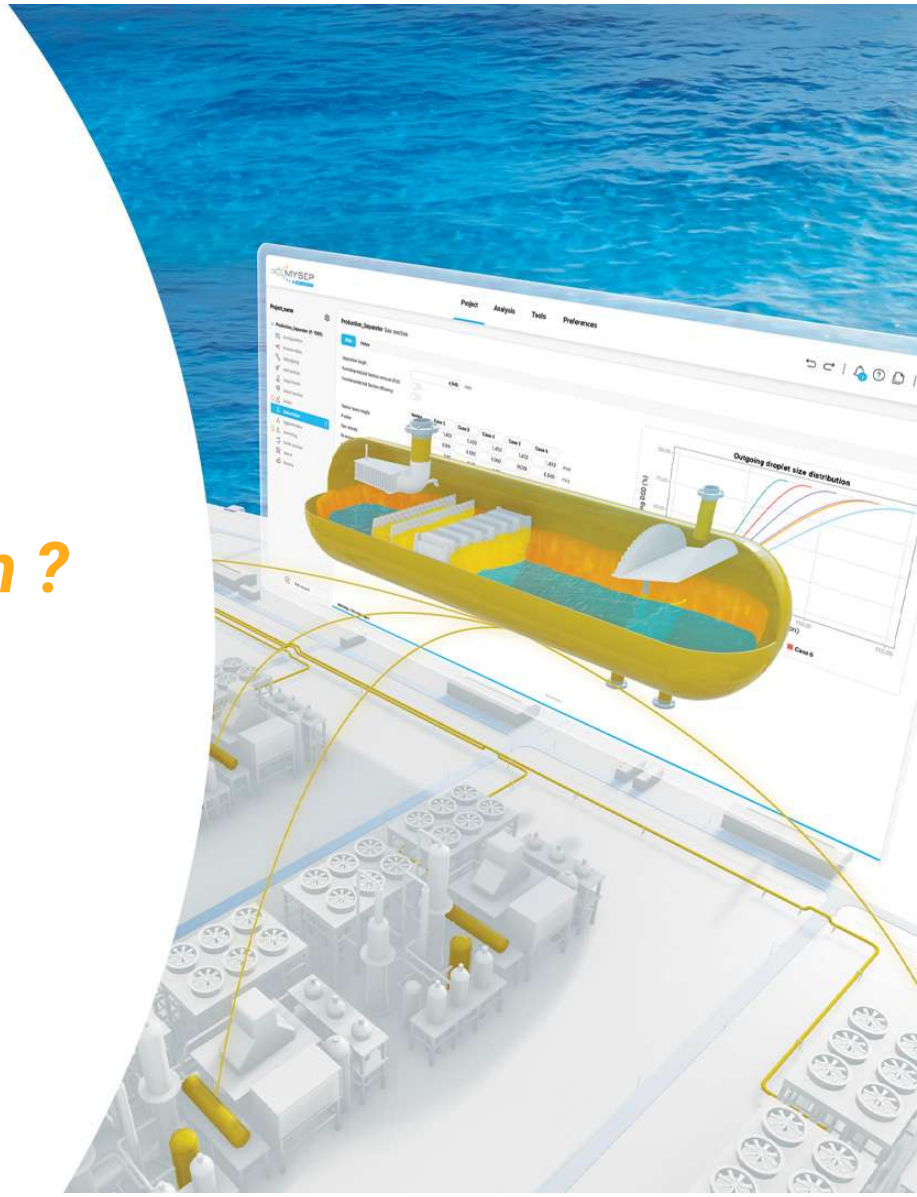
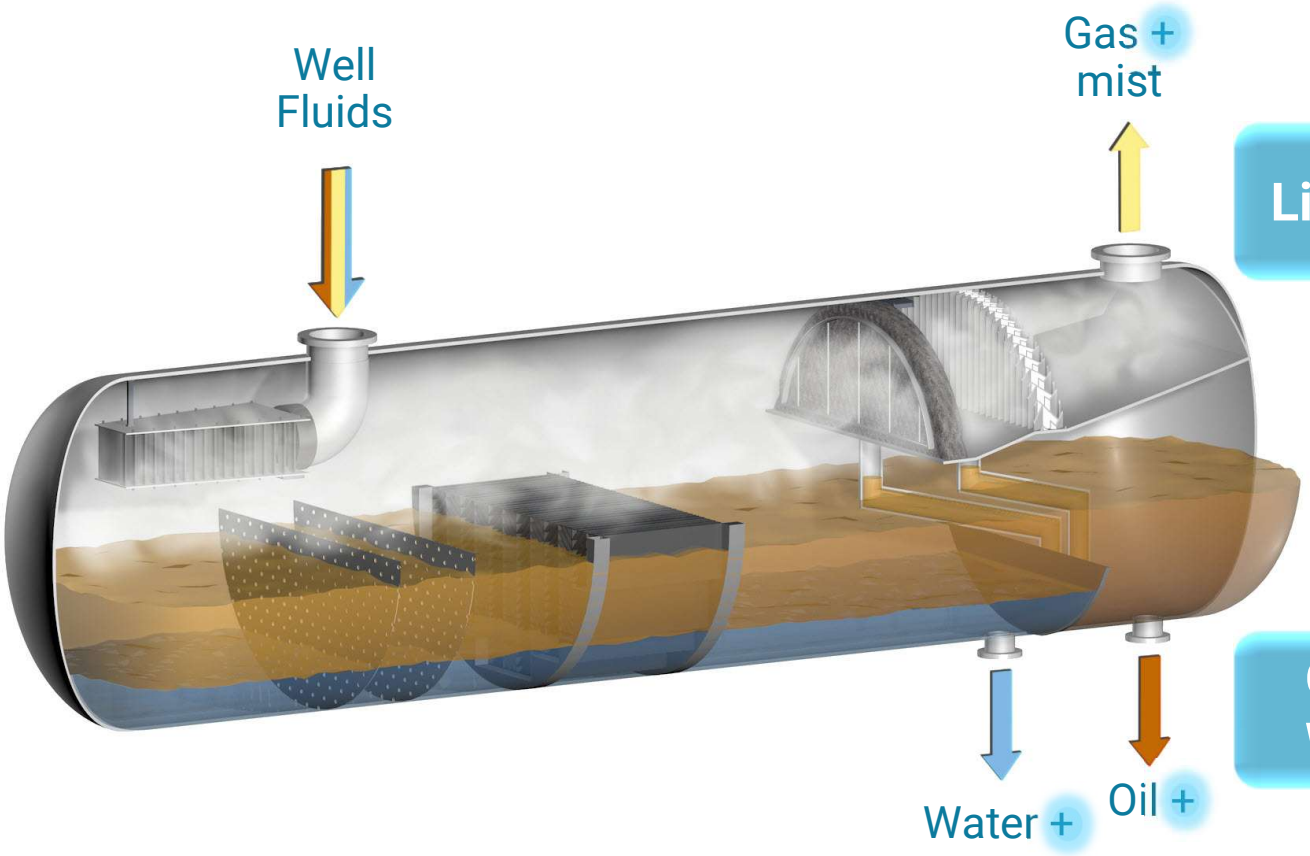
# Separation – *what's the problem ?*



# Separation, what's the problem ?




**Liquid carry-over !**

**Oil-in-Water !**
**Water-in-Oil !**



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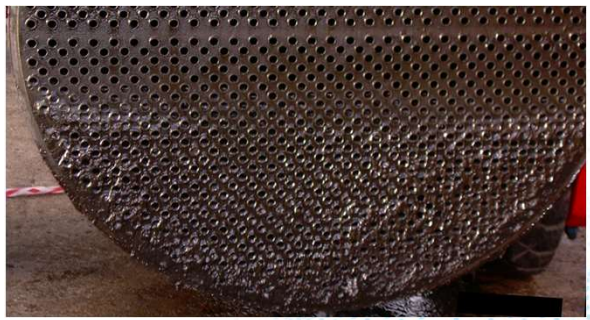
# Effect of liquid carry-over on downstream equipment and on products

- Product quality (e.g. dew point)
- Compressors
  - increasing compression energy demand
  - fouling
  - damage
- Heat exchangers
  - increasing compression energy demand
  - fouling
- Foaming in amine contactors
- Mol-sieves degradation



Picture at courtesy of Calgavin Ltd

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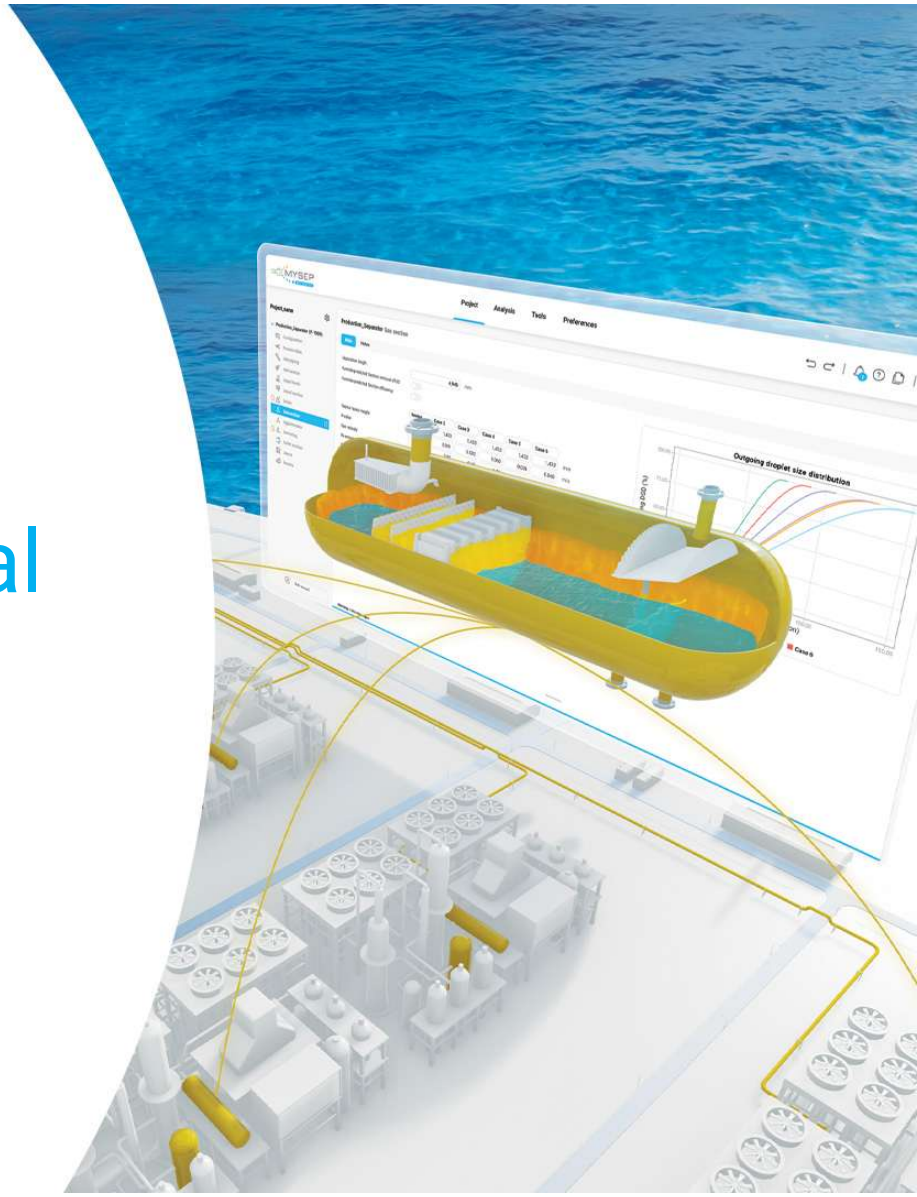
# Rigorous modelling in Digital Twins

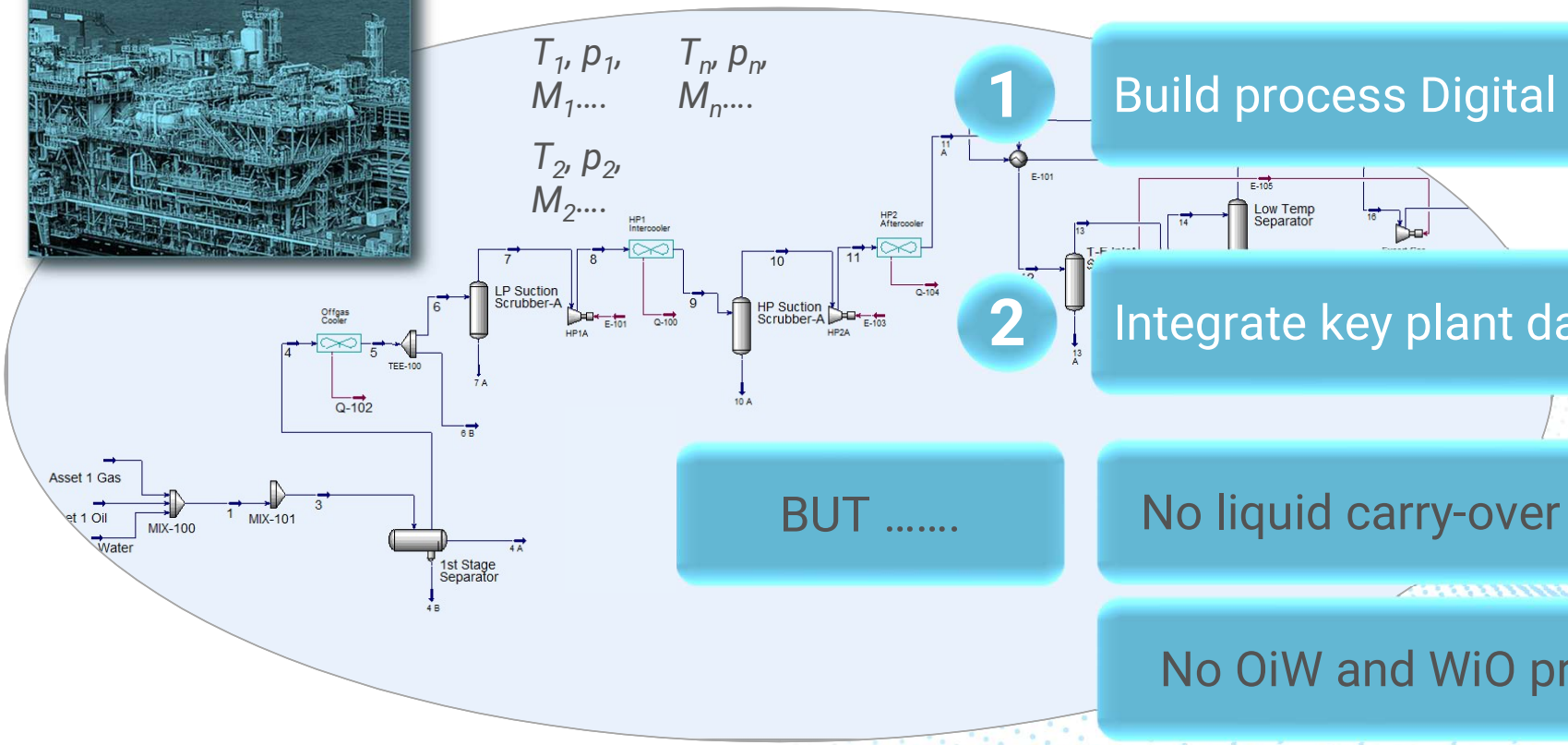


# Let’s Consider A Facility

An FPSO

The separation modules

# How to optimise for more production ?




1 Build process Digital Twin

2 Integrate key plant data

BUT .....

No liquid carry-over prediction

No OiW and WiO predictions

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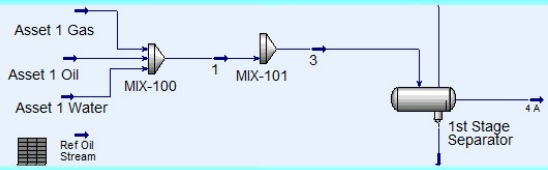
# Facility Process Digital Twin

74,000 bbl/day Oil & 79 MMSCF/day Gas

Revenue ≈ $6.5 MM/day



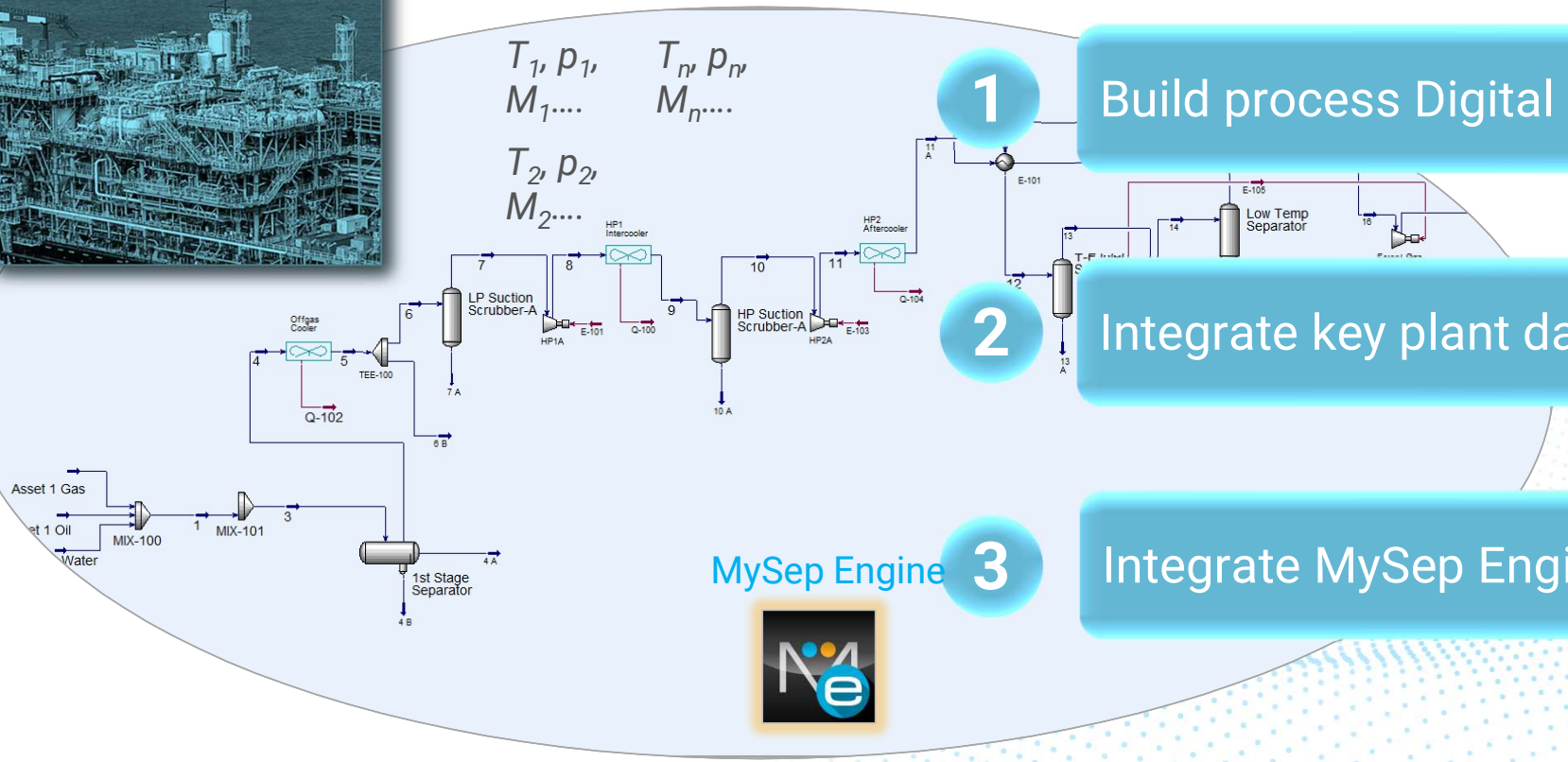

Constraint – Hydrocarbon dew point

Implemented on commercial simulator platform

# Embed separator modelling software into digital twin

$T_1, p_1, M_1 \ldots$ $T_n, p_n, M_n \ldots$

$T_2, p_2, M_2 \ldots$




MySep Engine

1. Build process Digital Twin
2. Integrate key plant data
3. Integrate MySep Engine modelling

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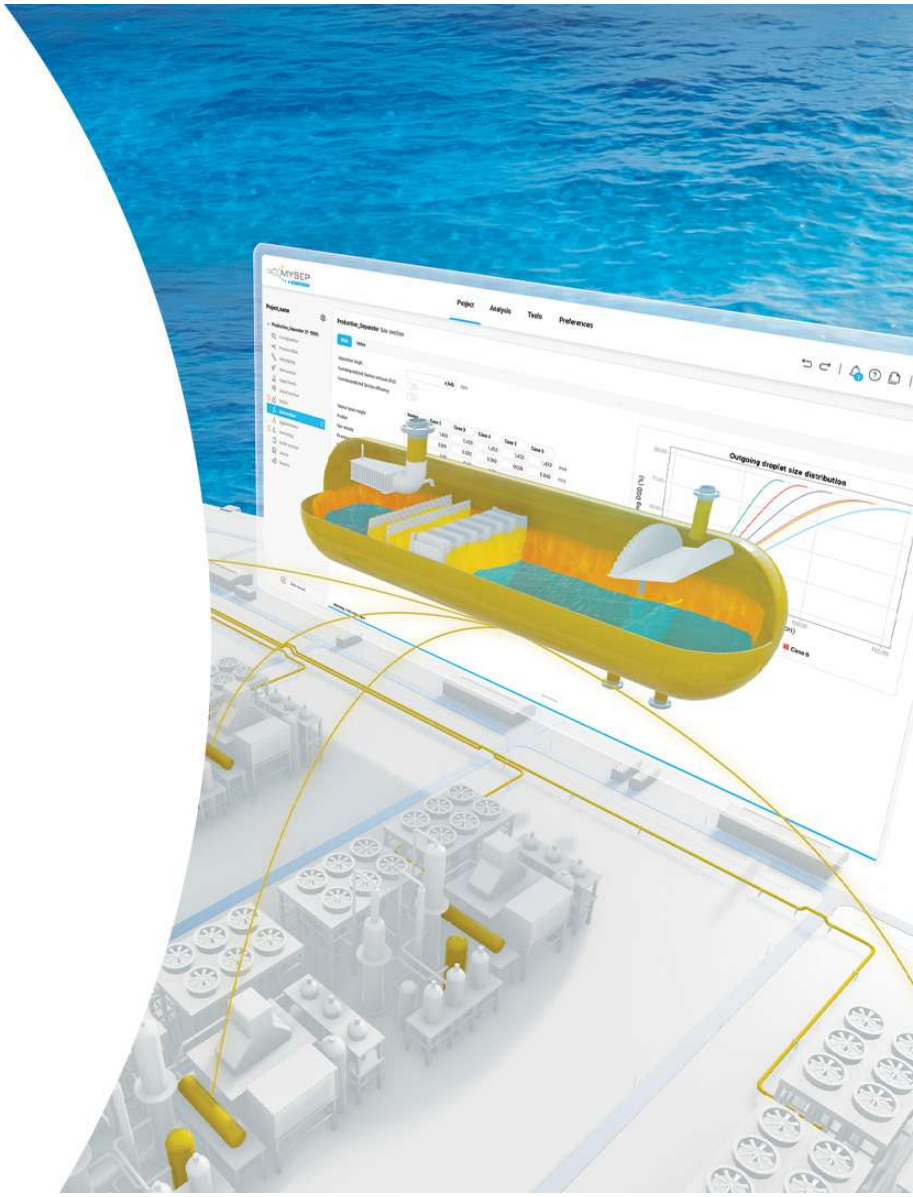
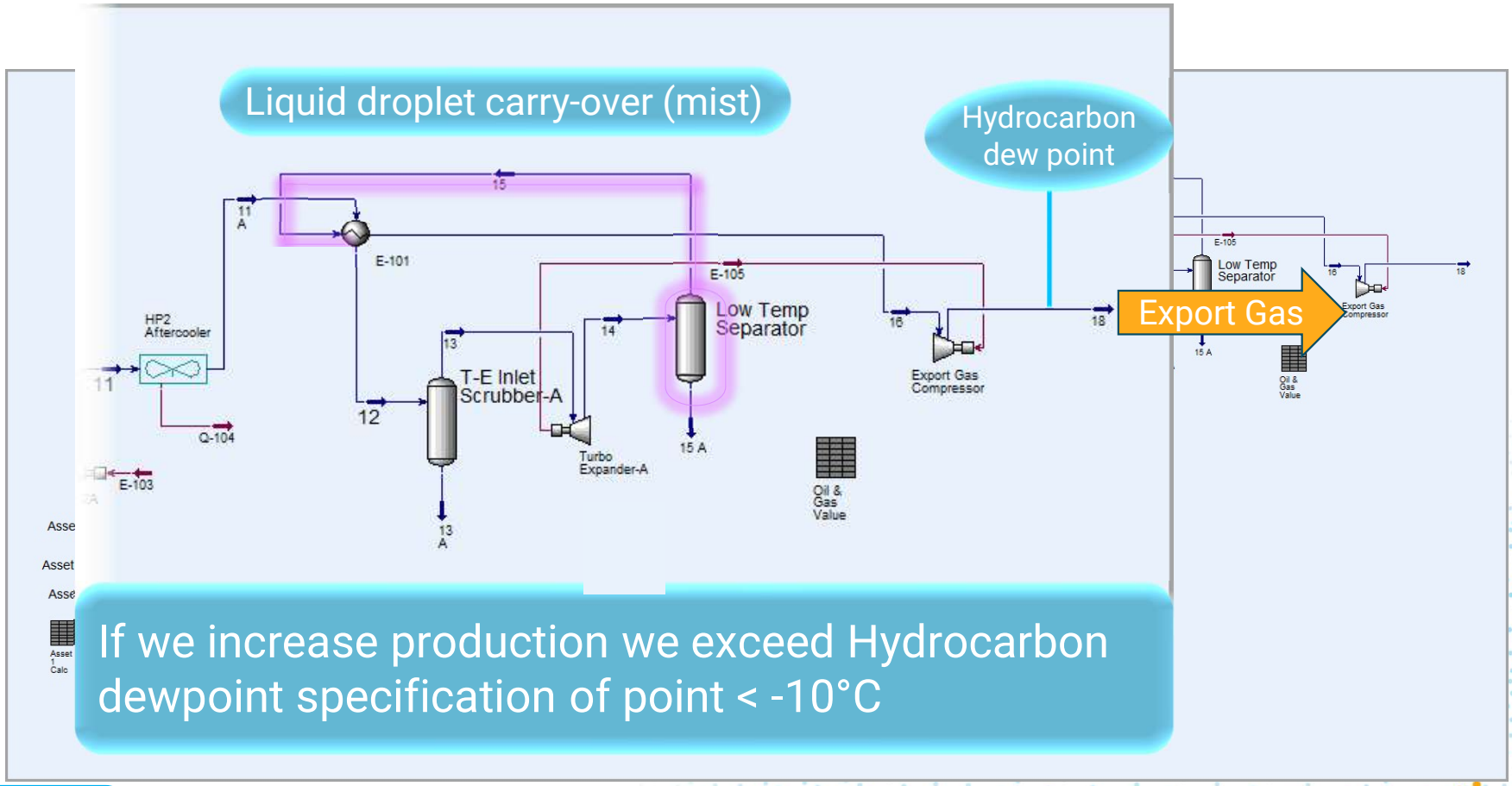
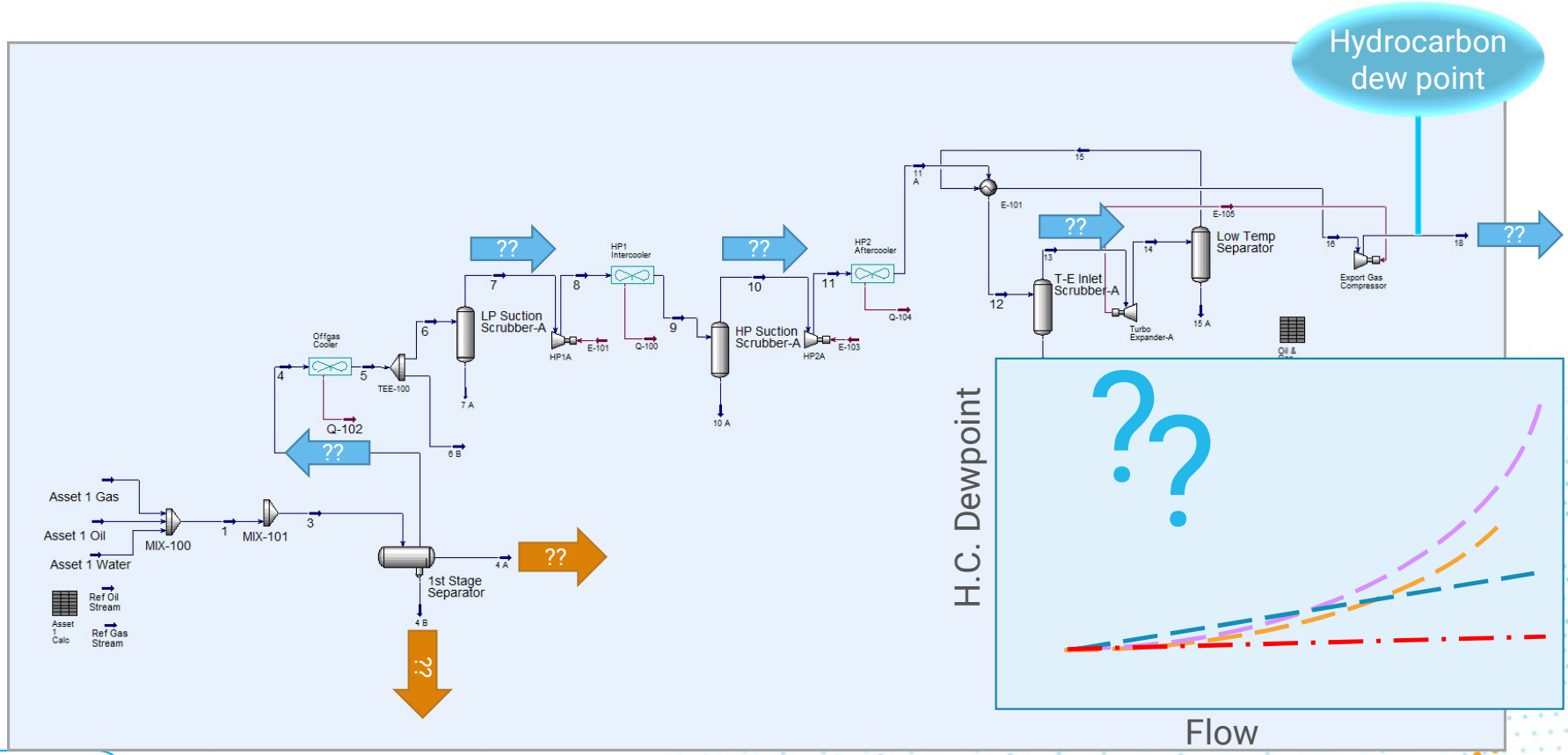
# Results



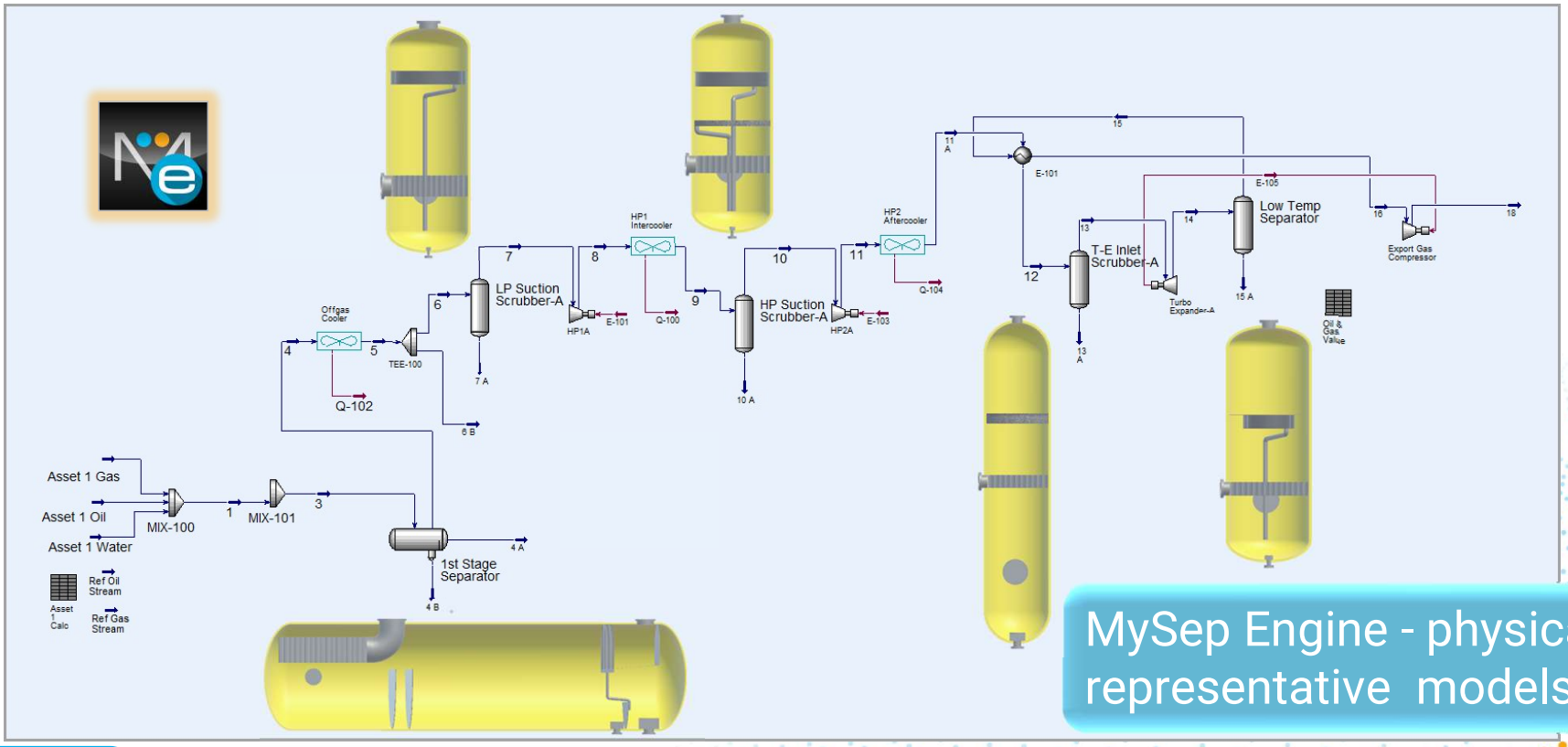
# Understand Production Constraint



# No Rigorous Separator Models in Our Digital Twin



# Let’s Put Rigorous Separator Models in Our Digital Twin




MySep Engine - physically representative models

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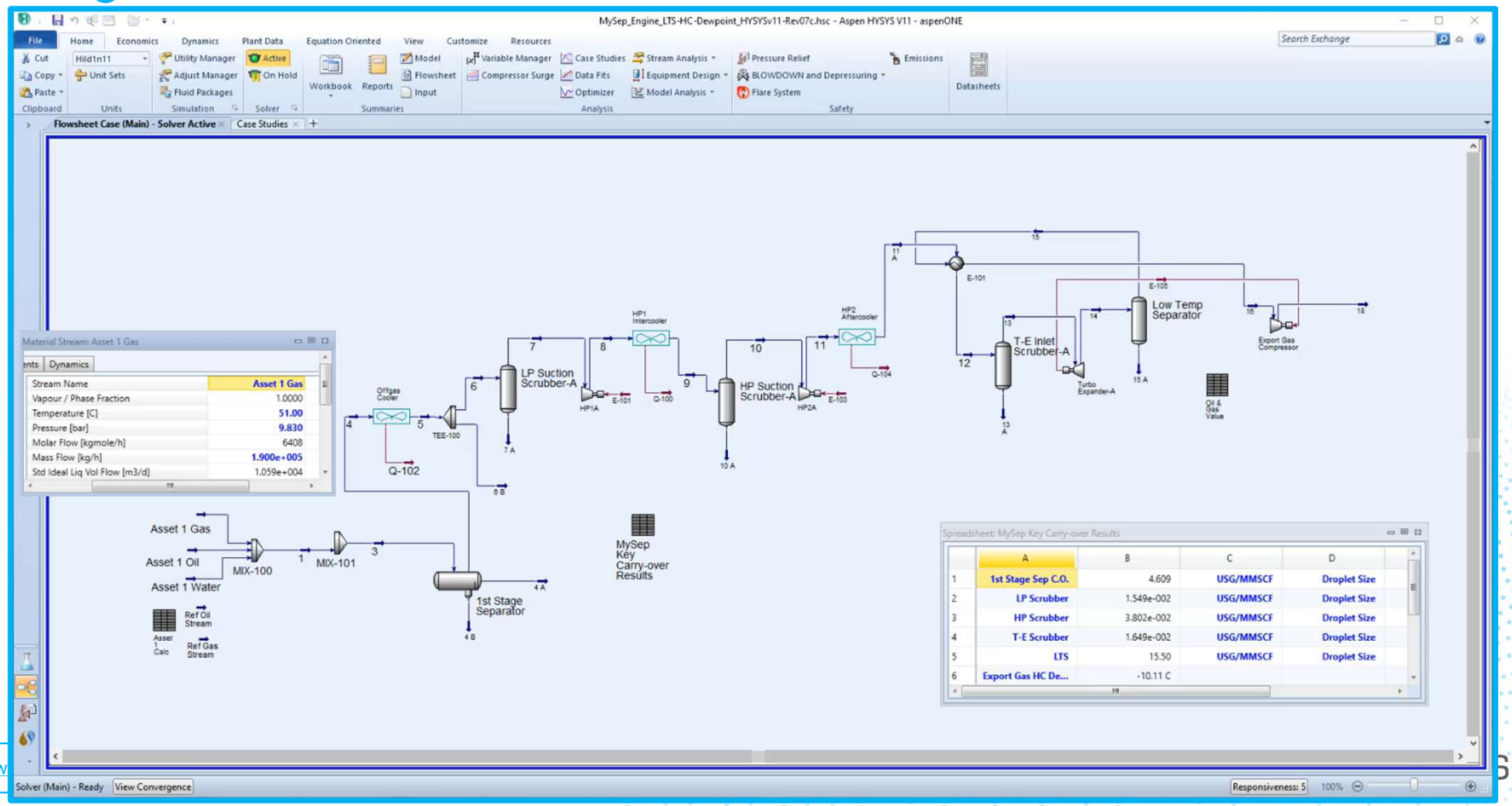
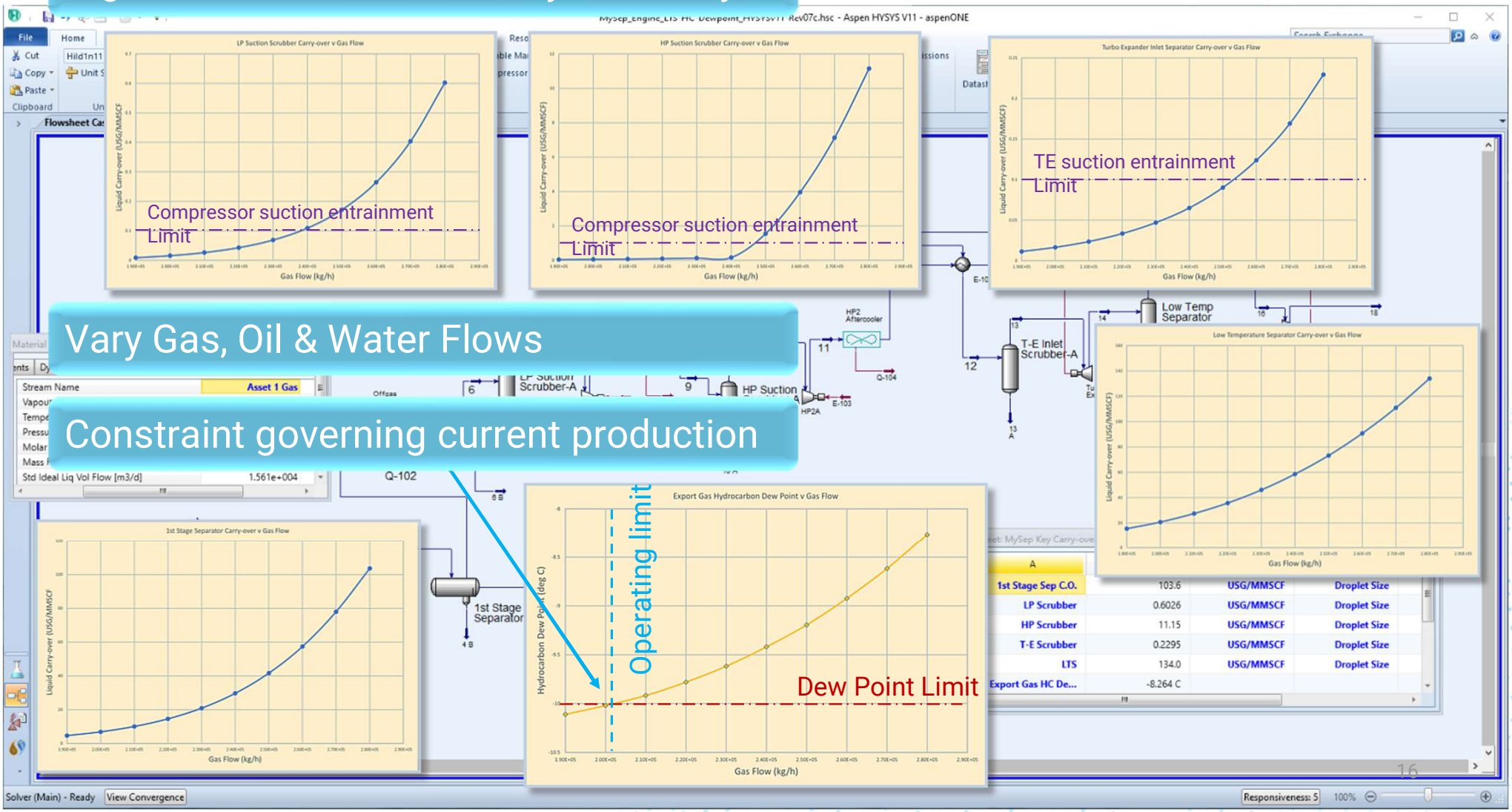
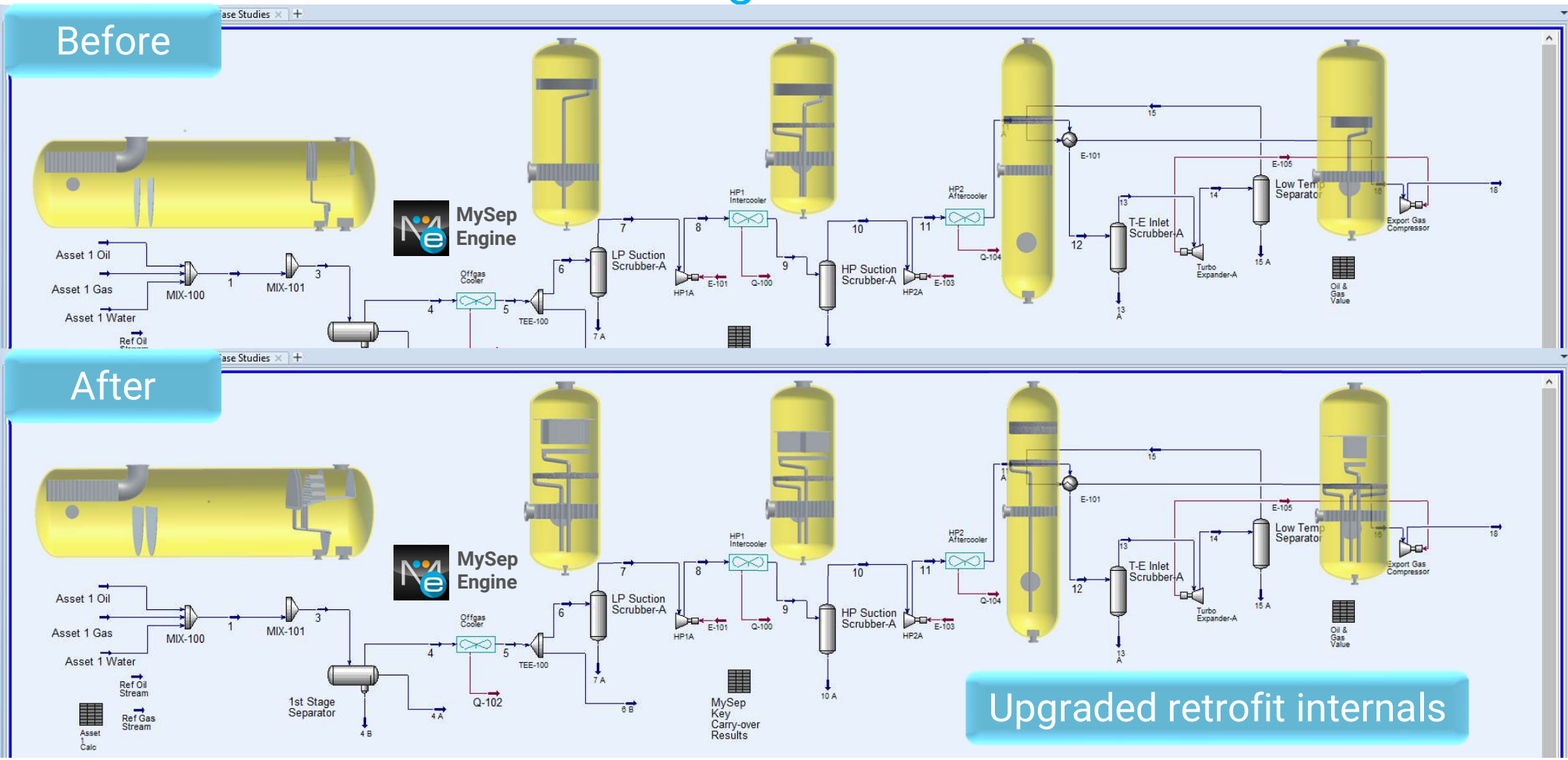
# Digital Twin Predictions



# Digital Twin – “what if” study summary



# Can we de-bottleneck – Digital Twin?



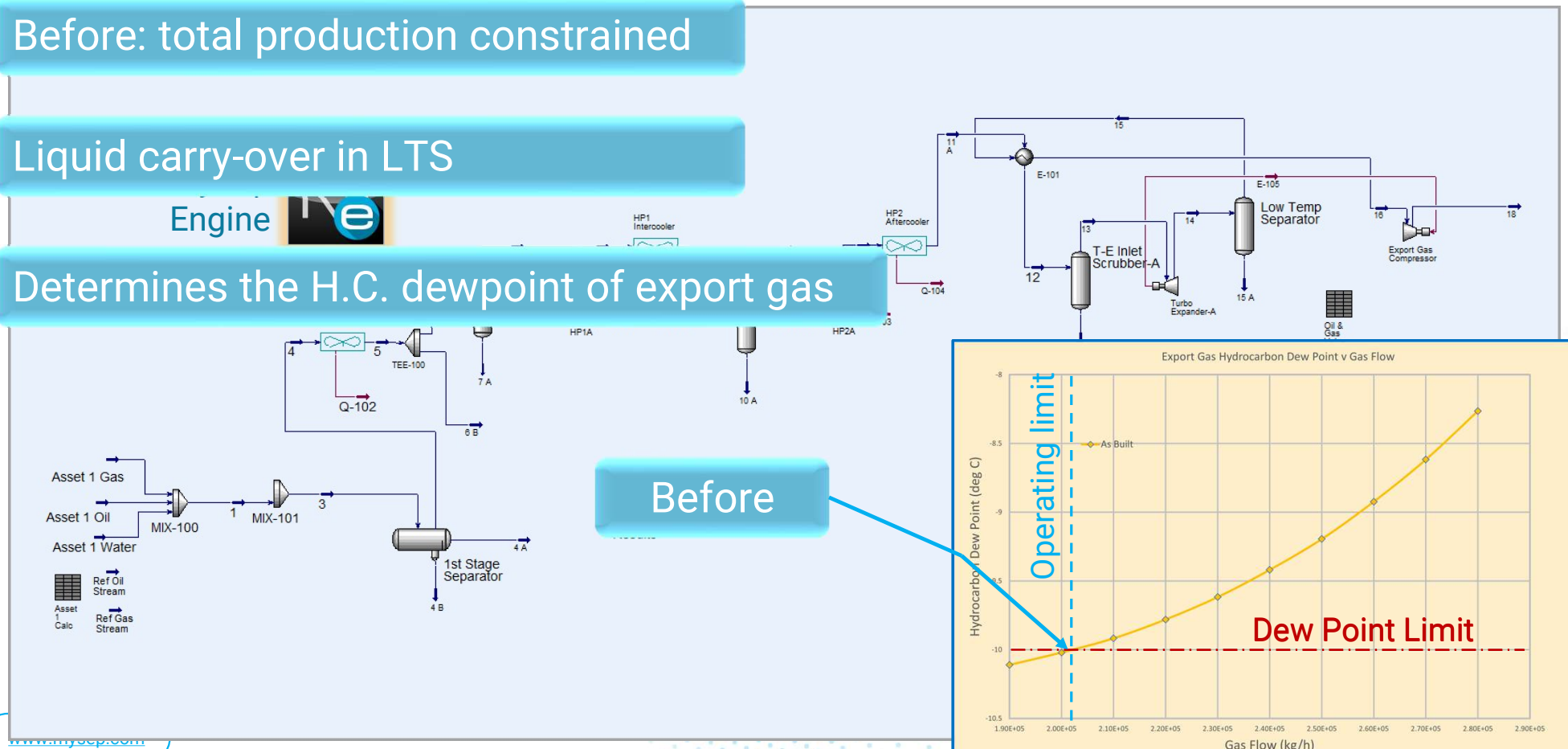
# Digital Twin Study with Revamps

Before: total production constrained

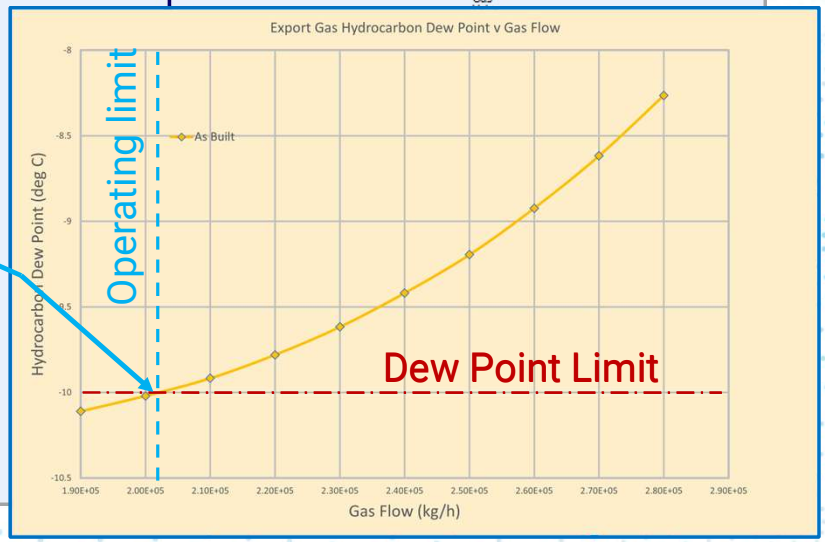
Liquid carry-over in LTS

Engine

Determines the H.C. dewpoint of export gas




Before



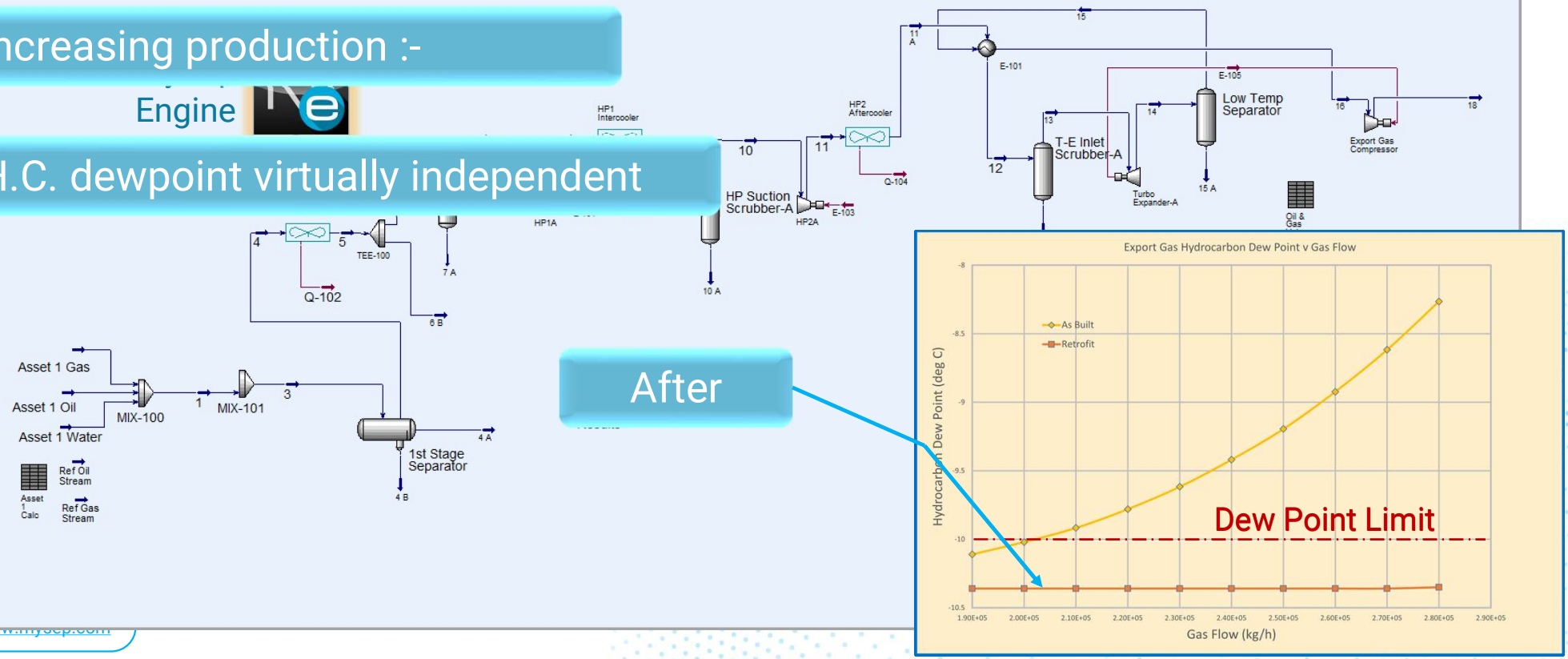
# Evaluating our Optimised Process

## After: Low Temperature Separator constraint **mitigated**

## Increasing production :-

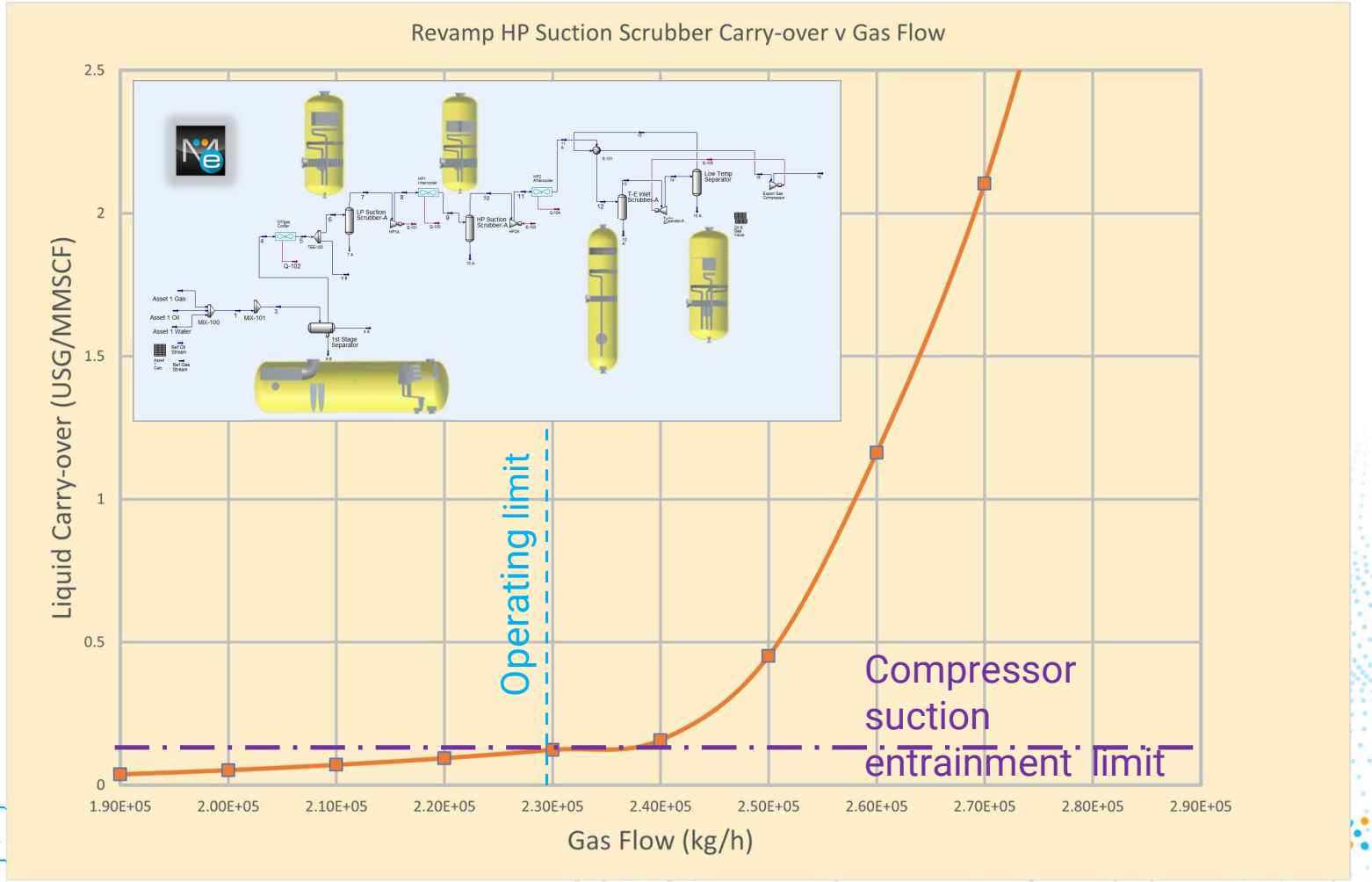
Engine

## H.C. dewpoint virtually independent

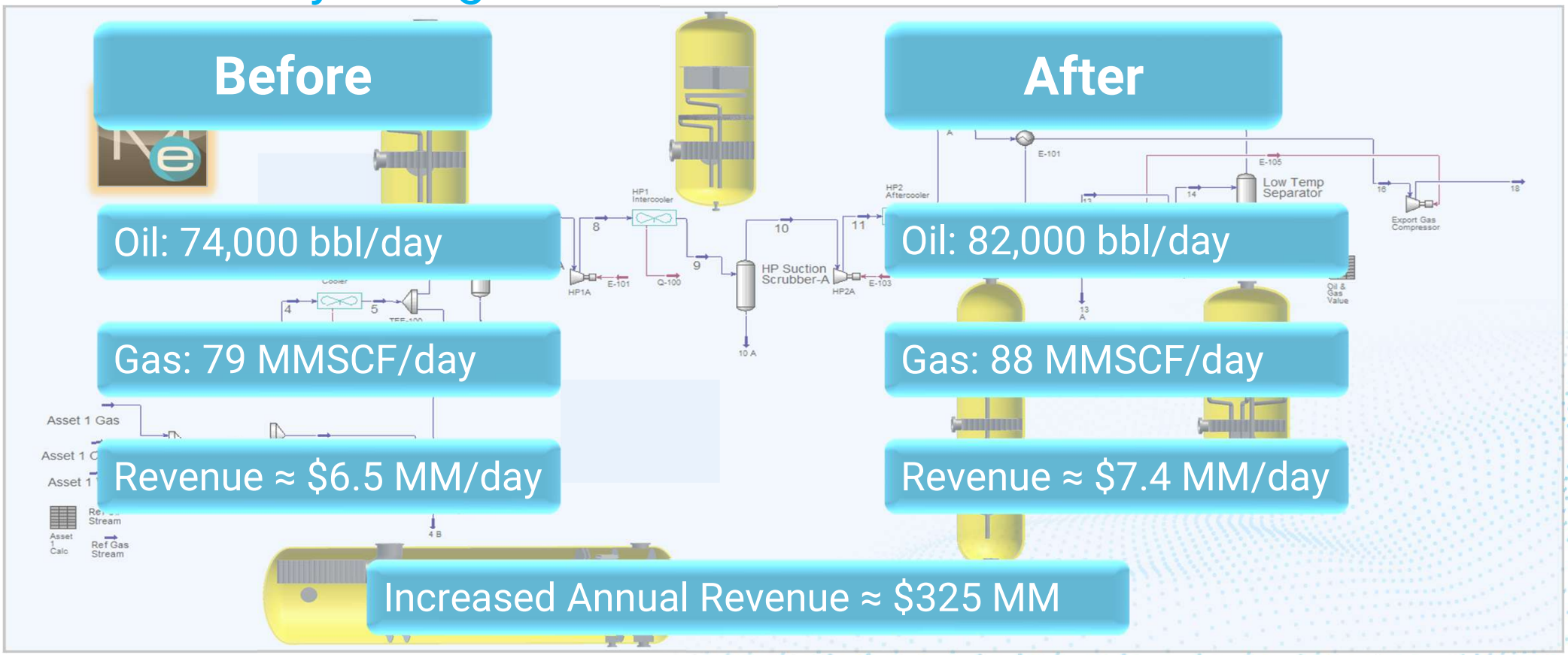



After

# The New Process Constraint



# Summary of Digital Twin Result



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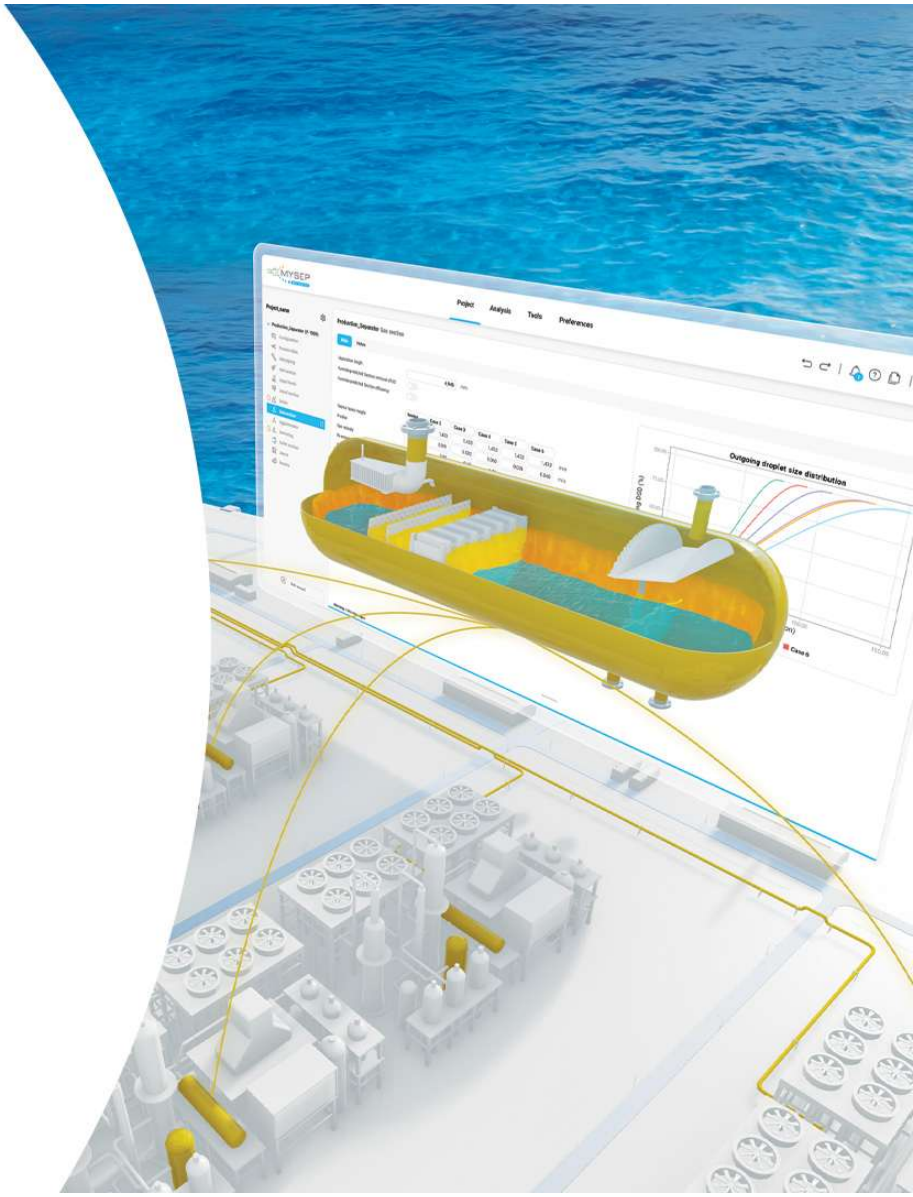
# Conclusions



# Conclusions 1

- Process Digital Twins – becoming an essential tool
  - Monitor parameters that cannot be measured
  - Log these along with direct process measurements
  - Apply experience and AI to diagnose real failure causes
  - Conduct “what-if” studies to optimise operations
- Separation is crucial in Topsides processing
  - Rigorous separator modelling is an essential component

# Conclusions 2

- Currently MySep is closely supporting 2 leading international operators:
  - Dynamic real-time digital twin (RTS)
  - Steady-state online digital twins for all facilities operated in a basin


- Almost all our Operating Customers are exploring



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# Q & A

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