Introduction to Virtual Metering

OGA Technology Leadership Board

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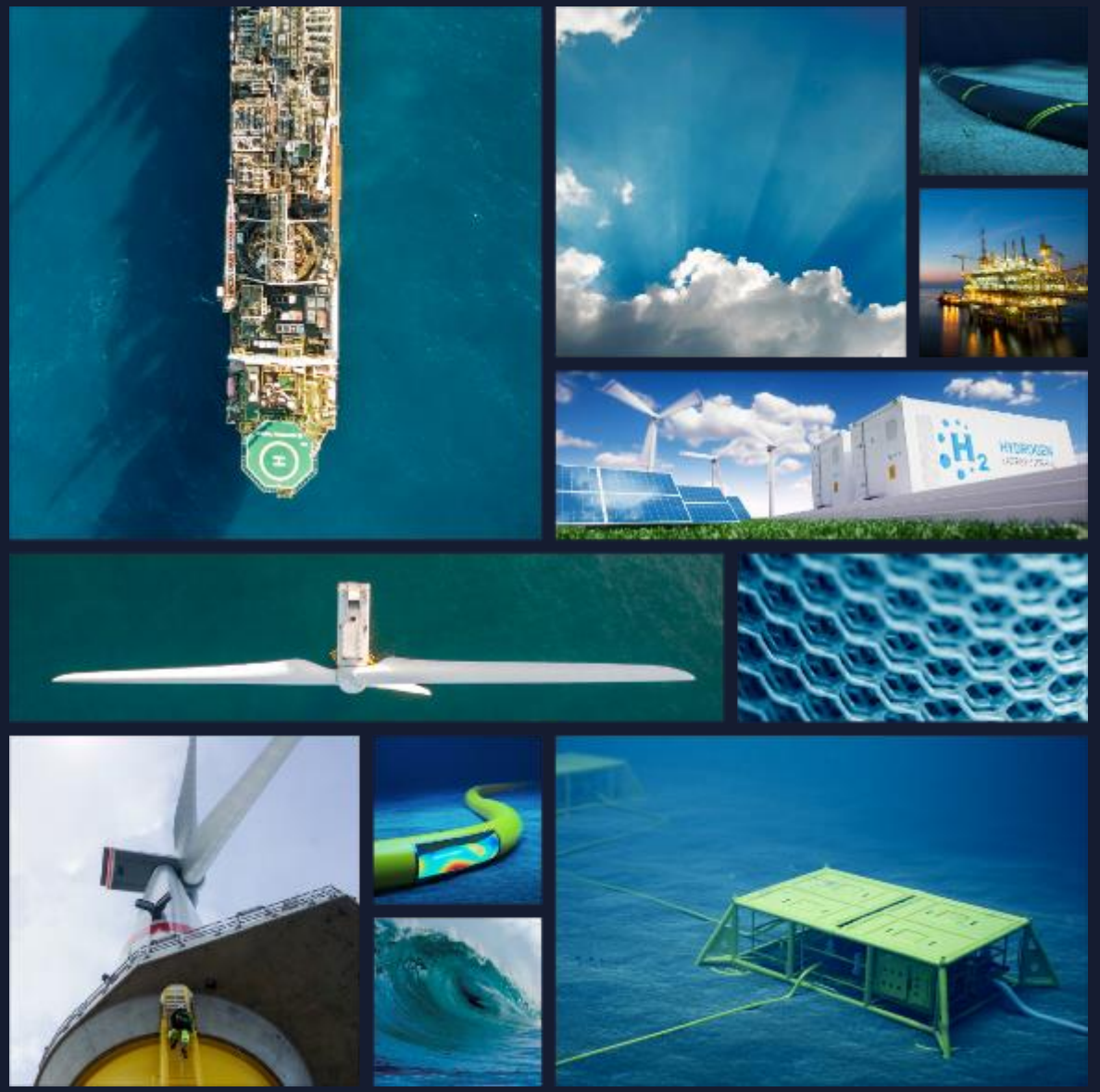
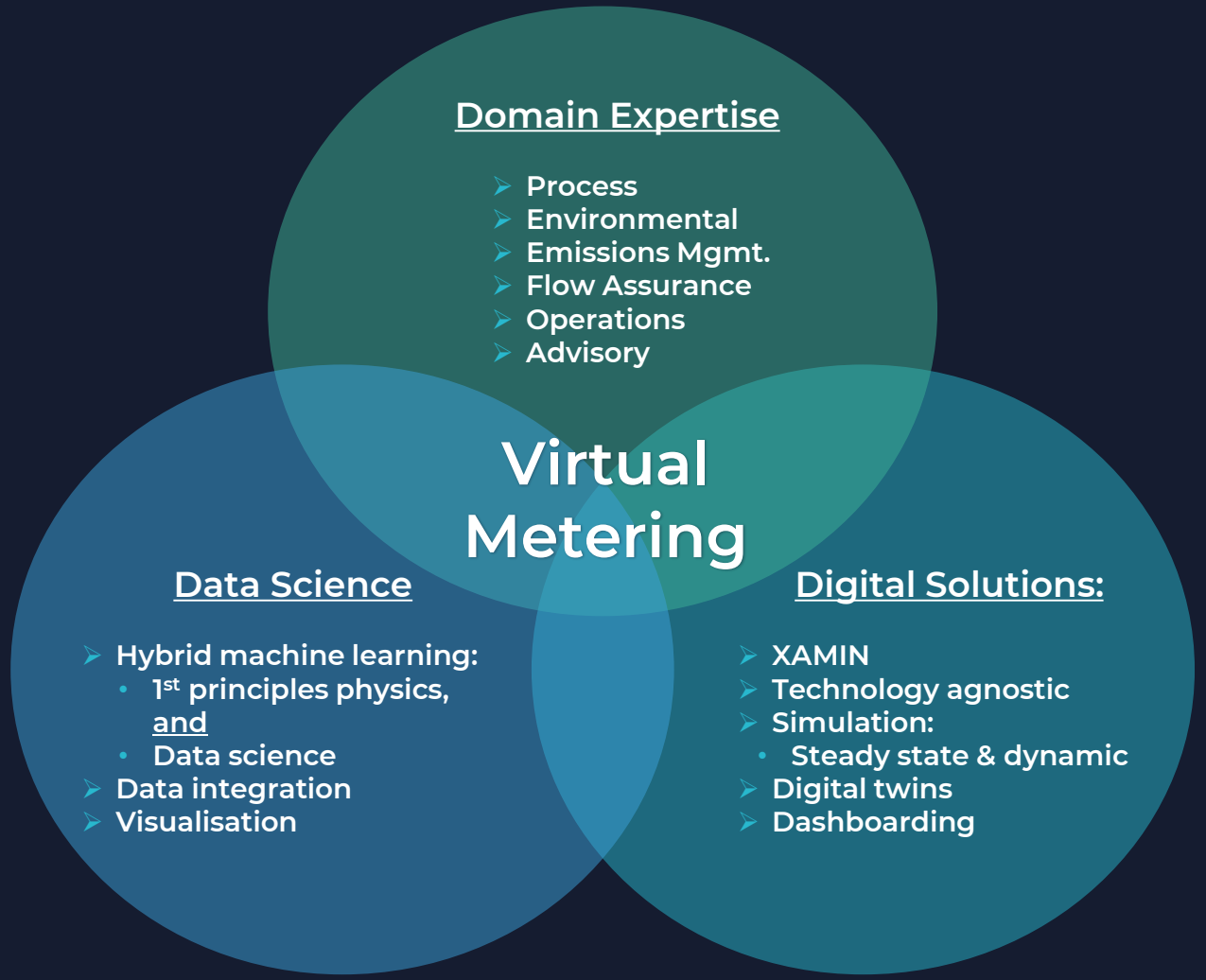
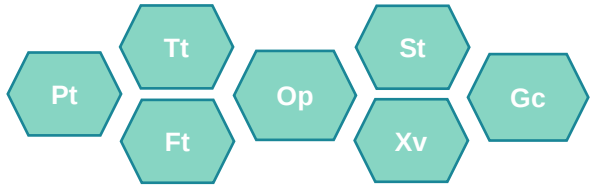


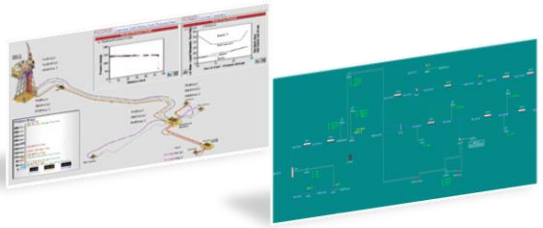
Combining Xodus Group's engineering domain expertise with digital capabilities to extract maximum value from your data.

- Integrated & multi-discipline
- Innovative solutions to modernise and optimise operations support
- Contextualise and visualise data, throughout the organisation
- Extensive experience
- Proven track record
- "Cradle to grave" capabilities



Virtual Metering: leveraging existing data to derive measurements which are not monitored by physical sensors or where an existing meter fails to operate reliably.





Instrumentation

Simulation

RO Size

Valve CV

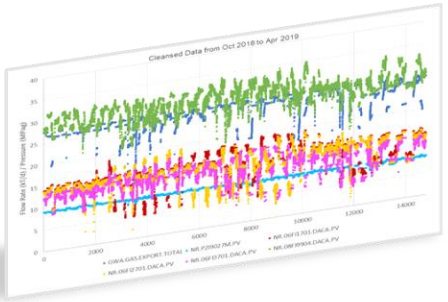
Composition

Valve Char. Curve

System Volumes

Configuration

Historical Data



Virtual Metering

- Virtual metering typically uses one, or a combination of methods:
  - First principles engineering calculations,
  - Data regression and correlation based on historical operating data,
  - Simulation based, either standalone or supported by historical operating data.
- "Hybrid" approach: guided but not limited to existing historical performance and is constrained by 1st principles physics
- Can be applied to any system where sufficient data is available to develop and drive the meter
- Xodus have developed a virtual flare meter for a major UK operator which was accepted by BEIS as a suitable replacement to the existing, faulty flare meter
- Vital to understand, monitor, optimise and report accurate emissions data

Flare and Vent Systems:

- Purge & pilot flows,
- Emergency blowdowns,
- Maintenance depressurisation,
- Pressure control to flare,
- Tank vapour outflow.

Fuel Gas Users:

- Individual turbines,
- Glycol regeneration,
- Seawater deaeration,
- Blanket gas,
- Fired heaters.

Other Applications:

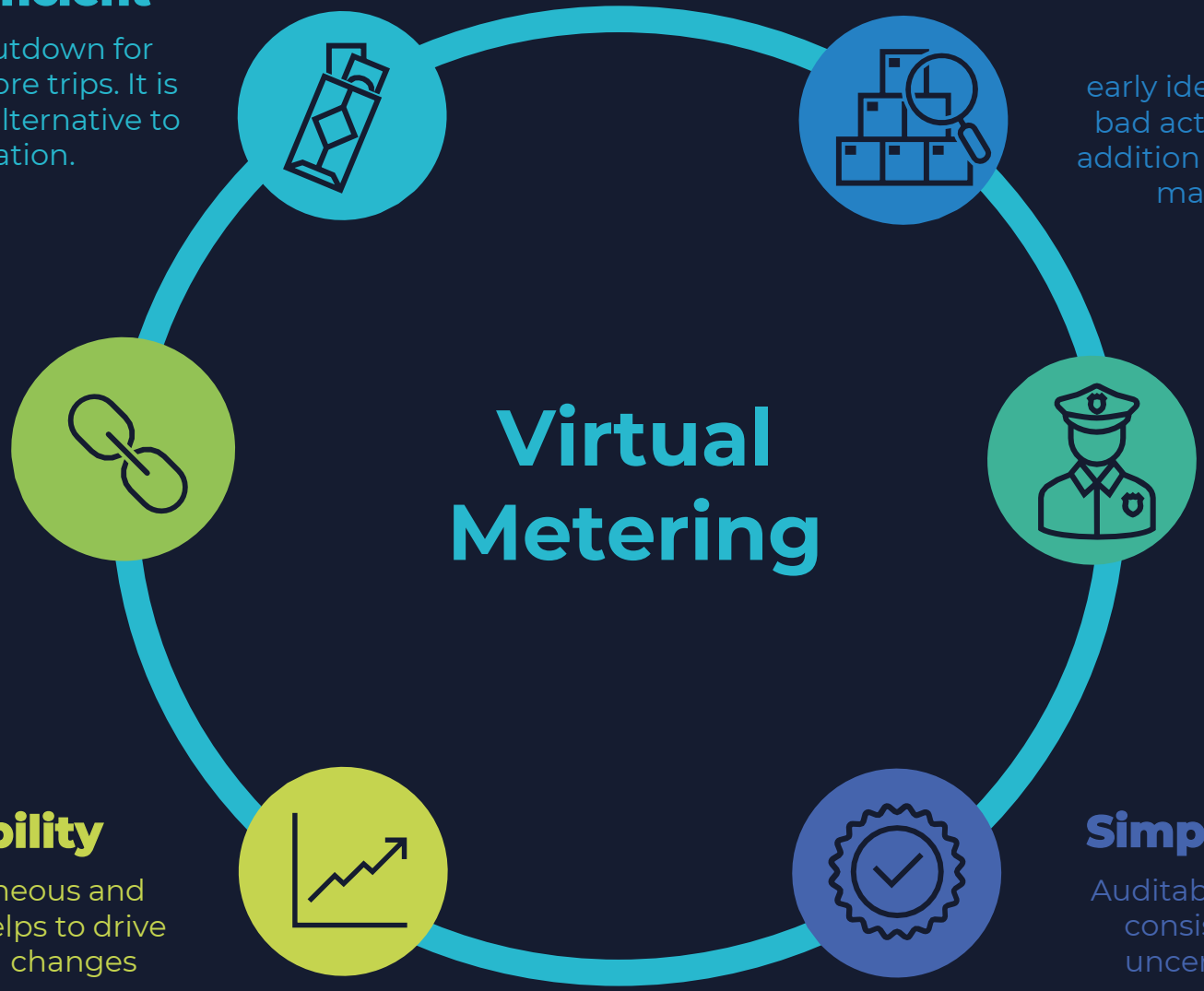
- Flare tip combustion efficiency,
- Turbine performance emissions,
- Well flows,
- Export system flows,
- LCV outflow calculation.

Economically Efficient

does not require plant shutdown for installation or regular offshore trips. It is a feasible and economical alternative to physical instrumentation.

Integrated Data Management

early identification of potential issues, bad actors or low / high flowrates, in addition to instrument calibration and maintenance requirements



Bespoke

Customisable to meet your specific facility needs and is not tied in
to specific software or providers

Removes Legacy Issues

which can result in costly fines, increased person hours and potential reputational damage from mismeasurement filing

Improved Visibility

Dashboards give instantaneous and cumulative values which helps to drive accountability for making changes

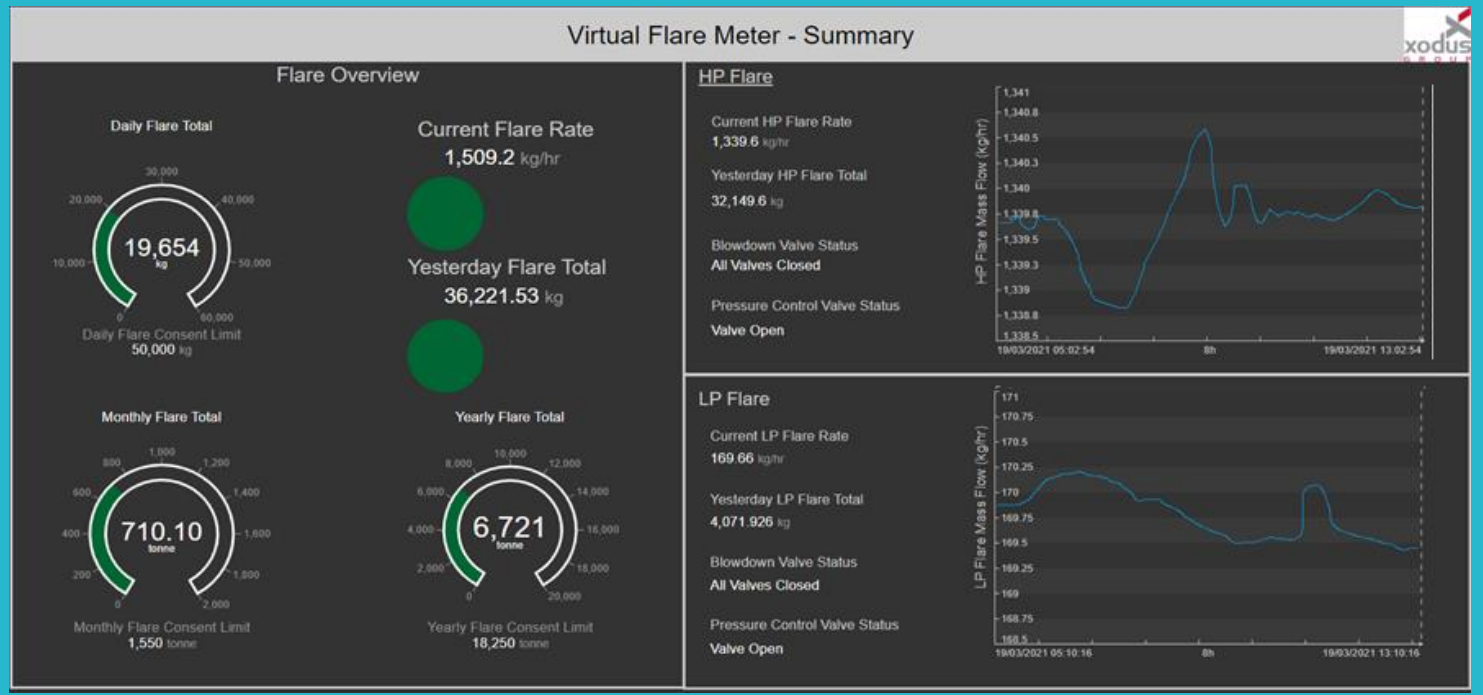
Simplified Verification

Auditable (internal or external) and consistent basis, removing the uncertainty and inefficiency of manual calculations

Case Study – Std. Calculation Basis

Problem: Asset had significant issues with their HP flare metering; at times of high flaring flowrate it would cut out or breakdown completely.

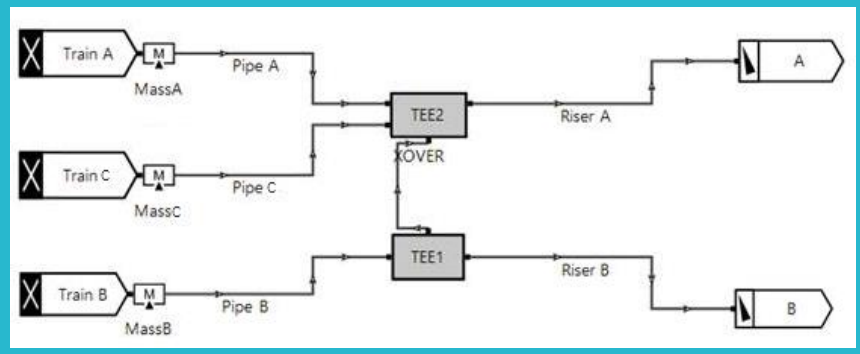
Solution: Xodus developed and deployed a virtual meter which continuously monitored and recorded the flaring from the HP flare. This resulted **in increased visibility of the real-time flare baseload**, allowing day to day **optimisation, identification of bad actors** and leading to a **standardised approach** and **significant reduction in person-hours** required to calculate and submit mismeasurement reports.

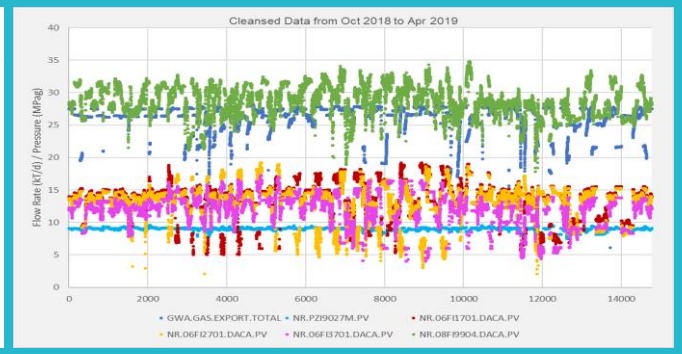


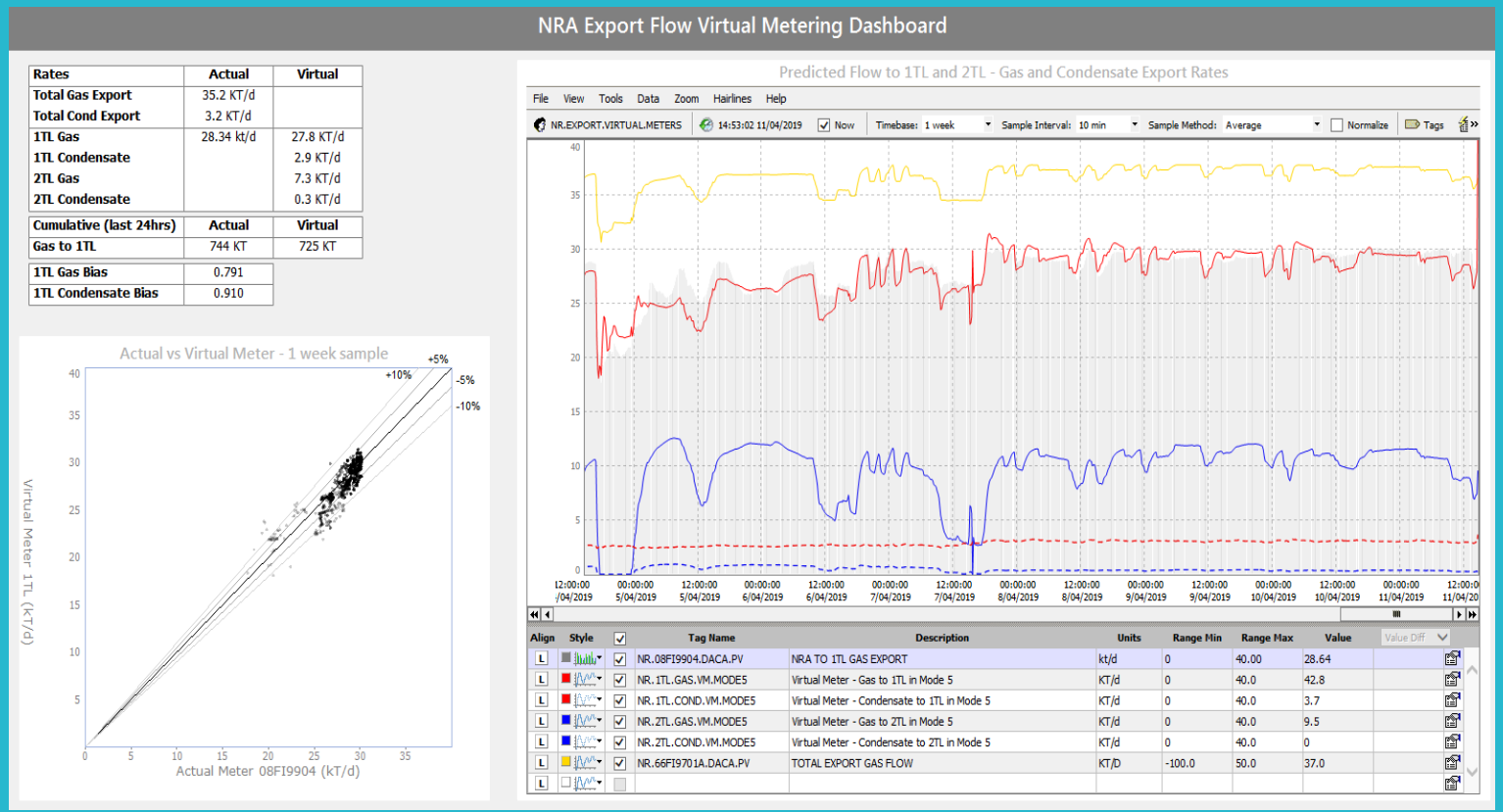
Case Study – Data Regression Basis

Problem: Export flow meter produced erratic readings at normal export rates, particularly during operation where the crossover is open and flow operates on a pressure balance

Solution: Xodus **extracted, analysed, cleansed and performed regression on thousands of data points** in order to be able to predict system performance. Historical data was **combined with thousands of simulations** to develop an **overall virtual metering solution** for gas and condensate flows.







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