

Viraj Desai

Process Engineer | Process Modelling Engineer | P&ID Solutions Engineer

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Professional Experience

Cerebre. P&ID Solutions Engineer

Dallas, Texas, U.S.A (WFH)
Jan 2026 - Present

Supported Cerebre's P&ID digitization operations, leading triage, diagram solving in Studio Pro, quality assurance, and regex development across multiple client sites (ExxonMobil, Chevron, Shell), while contributing ML domain expertise for object detection algorithm development.

- Conducted triage of **P&ID** drawings (.dwg files) to verify proper rendering in Studio Pro and **reported technical issues** to the development team for resolution.
- Converted engineering drawings into **structured knowledge graphs** by identifying and mapping equipment, pipelines, and instrumentation as nodes and relationships (edges) using Studio Pro.
- Performed **quality assurance checks** on solved diagrams through cross-review with implementation engineers prior to ingestion into the Plant Graph platform.
- Developed **regex rules** for multiple client sites including **ExxonMobil, Chevron, and Shell** to standardize tag recognition and improve data extraction accuracy.
- Assisted in **feature ideation and improvement proposals** for Studio Pro and Plant Graph to enhance platform capabilities.
- **Collaborated** with **developers and cross-functional teams** by raising and tracking technical issues through JIRA and maintaining communication via Slack.
- Supported **client onboarding** and **technical understanding** of Studio Pro workflows and digital P&ID concepts.

ExxonMobil Sustainment — Sarnia (Canada), Nanticoke (Canada), Rotterdam (Netherlands), Baton Rouge (United States), Antwerp (Belgium)

Sustainment Solver/Engineer | Team Sizes: 10 / 15 / 18 | Projects Completed

- Analysed client-side **revision changes** (additions/deletions) to P&ID drawings across multiple sustainment cycles, ensuring updates were accurately reflected in Plant Graph without breaking existing data.
- **Flagged rendering, drafting, and data anomalies** to the triage lead prior to team execution, improving downstream solving accuracy.
- Performed **UUID mapping of data enrichments** post-diagram-solving to prevent Plant Graph integration issues.
- Generated final **Health Check reports** (asset connections, symbol type, line type) and raised JIRA tickets for rectification, closing the loop on quality issues across all three sites.

Phillips66 – Humber Refinery (England)

P&ID Solution Engineer | Team Size: 20 | Project Completed

- Supported **digitization of 450+ P&ID** diagrams for Phillips66's Humber Refinery, from project kick-off and scope alignment through triage, solving, QA, and final ingestion into Plant Graph.
- **Led triage activities** and **tracked issues** via JIRA to ensure diagrams were review-ready before solving began.
- Identified and tagged **equipment symbols per taxonomy standards**, then mapped lines, asset connections, and flow relationships to construct accurate knowledge graphs.
- Performed **QA** reviews on **solved diagrams** followed by **Health Checks** prior to Plant Graph ingestion.
- Applied **diagram interpretation guidance and client-specific solving conventions**, incorporating client feedback to maintain consistency across the full diagram set.

Cerebre – Internal Developments (StuioPro Performance Center)

SME/Reviewer | Team Size: 3 | Project Completed

- Led **Solving Guidance cleanup** for **ExxonMobil** to improve the accuracy of data captured and fed into the **RAG pipeline**.
- **Ran validation tests and checks on cleaned data** to confirm outputs retrieved from the original source were accurate and consistent.
- Contributed to **query engine optimization** by benchmarking results against ground truth data.
- Provided **UI feedback** to the development team, supporting several platform **usability enhancements**.

Cerebre – Internal Developments (ML Team Object Detection and Agentic AI model development)

SME/Reviewer | Team Size: 5 | Project Completed

- Collaborated with the ML team to **train and fine-tune models** for identifying P&ID symbols and lines, adapting **LLM prompts** per client site.
- Refined a **text-association algorithm** that captured text based on both asset location and regex-based pattern matching, improving association accuracy.
- Built **Train/Test/Validation data splits for every ExxonMobil site** by referencing site-specific complexity reports, generating Python dictionaries used for LLM training.

Cerebre – Internal Developments (Development of Training Materials for 3rd Party Onboarding)

Content Creator | Team Size: 5 | Project Completed

- Collaborated with team to discuss about the platform to host the training material for new participants
- Video lectures creation using OBS-Studio Recorder
- Video editing and guiding team members to meet the quality output
- Contributions in declaring the final structure of the guides

Aleph Technologies Pte Ltd.
Process Modelling Engineer

Singapore (WFH)
Feb 2023 - Jan 2026

Executing multiple client projects across global locations (Saudi Arabia, India, Taiwan, Singapore) to deliver process optimization, energy efficiency improvements, and digital modelling solutions as part of Aleph's consulting and technology offerings.

Evonik - Methionine Crystallization Process Optimization (Germany/Singapore)

AI/ML Predictive Modelling & Process Optimization | Team Size: 4 | Project Completed

- Engaged by **Evonik** to address **recurring solid accumulation and vacuum loss** in the crystallization section of their Methionine production plant, which led to **frequent unplanned shutdowns** and cleaning.
- Developed a **predictive AI/ML model** to monitor **crystallization processes in near-real time**, estimating solid buildup and **forecasting vacuum failure risks** using historical **DCS/SCADA data**.
- Conducted exploratory **data analysis and event labelling** to identify 11 incidents and 6 shutdowns linked to carry-over over an 8-month period, establishing a **clear baseline for model training**.
- Built a **dual-rate accumulation model** to distinguish between **baseline and aggravated accumulation regimes**, integrating key process variables such as **pressure spikes, enthalpy changes, and flow parameters**.
- Designed an **Accumulation Index (AI)** to quantify buildup trends and trigger proactive online flushing alerts, enabling operators to intervene before vacuum degradation occurs.
- **Collaborated** closely with **Evonik's operations team** to validate **model predictions**, refine **alert thresholds**, and **ensure alignment** with plant operational protocols.

- Prepared **project deliverables** including **model documentation**, **training materials for engineers**, and a **roadmap for commercial-scale** rollout across multiple crystallizer units.

ACWA Power (Shuaibah-3 Expansion II, IWP Project)

Proof of Concept & Optimization Project | Team Size: 4 | Ongoing Project

- **Aleph tech** was declared as the **winner** for the **open-ended problem statement solver** by **ACWA Power** for their **desalination plants** which was **located at Saudi Arabia**
- **ACWA Power** was looking to **optimize** their **desalination facility** in **Saudi Arabia** in terms of **reduced power consumption**. To understand the facility and the capacity of plant a preliminary data analysis was done on their **DCS Data Dump** to check and identify the potential opportunities for optimization by reducing the **specific energy consumption**.
- The **KPI** for this project was declared as **kWh/m³ of permeate** for all trains.
- Several **case studies** were done across the all the trains **with potential savings** of **\$68,000/year (0.5% SEC reduction)**, **\$136,000/year (1%)**, and **\$407,000/year (3%)**.
- **Drafted a** techno-commercial proposal for plant optimization by analysing **plant layouts, PFDs, H&MBs, P&IDs, and control system data** with **Overview, Proposed Solution, Expected Project Outcome, Need-list, Prerequisites and Dependences Methodology, Timeline and project budget and cost**.
- Built **digital process models** and **energy optimization frameworks** to support implementation and monitoring.

Vedanta Alumina Smelter - Fuel Optimization (Odisha, India)

Proof of Concept & Optimization Project | Team Size: 4 | Project Completed

- **Vedanta's Jharsuguda facility** was looking to **optimize** potential areas to **reduce the consumption of fuel oil and cooling water consumption**
- **Performed a** preliminary energy assessment to **optimize** fuel oil and cooling water consumption.
- **Analysed DCS data and calculated** specific energy consumption (SEC).
- **Recommended optimal set points** for air-to-hydrate and air-to-fuel ratios, **achieving** daily savings of **\$7,000 (fuel)** and **\$700 (cooling water)**.
- **Later, techno-commercial proposal** was sent with the detail list of **Overview, Proposed Solution, Expected Project Outcome, Need-list, Prerequisites and Dependences Methodology, Timeline and project budget and cost**

SWANCOR - Condenser Feasibility Checks (Taiwan)

Feasibility Check | Team Size: 2 | Project Completed

- **Developed and refined** digital twin models to **resolve** solvent loss issues in condensers.
- **Recommended optimized** DCS set points, **reducing vapor losses and improving condenser efficiency**.
- Collaborated with SWANCOR, a leading manufacturer of specialty chemicals, to conduct a test case scenario for **optimizing** their existing **condensers** and addressing operational inefficiencies.
- Conducted trials to identify the root cause of the facility's challenges, leveraging **digital twin models** based on plant topology assumptions and customer consultations.
- Analysed **TEMA sheets, P&IDs, and control system** data to pinpoint solvent loss issues in the condensers.
- Refined digital twin models to align with plant data and **identified key operational handles** for improvement.
- Recommended and implemented optimized set points in the DCS, incorporating operator insights, resulting in reduced **solvent vapor losses** and **enhanced condenser efficiency**.

ABG Hindalco - Fuel Optimization (Jharkhand, India)

Proof of Concept & Optimization Project | Team Size: 4 | Project Completed

- **Hindalco Industries Limited** was looking to **optimize its calcination plant** operation to **reduce energy usage while maintaining desired product quality**
- The primary goal of the project was to **minimize fuel (HFO) consumption in calcination plant** while satisfying the desired product quality
- **KPI** for optimization was set as the **Specific Thermal Energy of Calcination (kJ/kg of alumina)**
- Conducted **process studies** for **alumina hydrate calcination**.
- **Performed** particle size distribution analysis **and built** custom process models **using PFD and DCS data**.
- **DCS** snapshots were studied to retrieve necessary process parameters for custom model building.
- And a **techno-commercial proposal** was sent with the detail list of **Overview, Proposed Solution, Expected Project Outcome, Need-list, Prerequisites and Dependences Methodology, Timeline and project budget and cost**

TES-AMM - Energy Monitoring & Optimization of MVR Process (Singapore)

Proof of Concept (POC) and Optimization | Team Size: 4 | Project Completed

- **Analysed** SCADA data **and developed** DWSim models **to evaluate energy performance**.
- **Established** KPIs for energy efficiency **and delivered actionable recommendations to reduce** energy waste during startups.
- Conducted **SCADA Data Analysis** to pinpoint critical process parameters contributing to energy waste during startup.
- Developed a **process model in DWSim** based on the SCADA System information and process data.
- Identified **energy-intensive equipment**, including the forced circulation pump, steam compressor, and centrifuge.
- Established **Key Performance Indicators (KPIs)** and presented them to customers and stakeholders, recommending changes to standard operating procedures for improved operational efficiency.
- Translated **Vendor P&ID from Chinese to English** for clear communication.
- Necessary **pump curves** were also investigated from the vendor's side.

GODREJ - Distillation Column Optimization Project (Ambernath, Maharashtra, India)

Proof of Concept (POC) and Optimization | Team Size: 4 | Project Completed

- **Developed** retrofit optimization models **for distillation units, enhancing** throughput and profitability.
- Enhancing **process performance and profitability** through retrofit and process twins.
- Process models were prepared by looking into key engineering deliverables received from GODREJ (**P&ID's Datasheets, Process Data**) in DWSim.
- The problem statement was that the customer could not operate the column at max capacity. By utilizing the inputs received from customer and from the process model the optimization was done.
 - Identification of key factors in **low feed-rate/throughput**.
 - Determine optimal operational process variable and then retrofit to enhance the feed-rate at the **least cost/energy**.
 - Increase **overall profit margin of distillation**.
- Site visit was also done to get the necessary process inputs from operators and to get more key insight of process. As well as **product demo** in beta stage.

Aleph Tech Stack Product Development & Digital Solutions (Singapore)

Product Development and Features | Team Size: 10 | Ongoing In-house Project

- **Designed and implemented** process models (**mixers, separators, columns, reactors**) **and back-end calculations**.
- Contributed to the setup of a **comprehensive compounds database** using open-source resources; developed custom **Python scripts for various process equipment**.

- Actively participated in **troubleshooting sessions** to refine and **converge process models**.
- Performed **diagnostics and analyses** to deliver solutions aligned with defined **objective statements**.
- **Performed model scaling and fine-tuning** to resolve infeasible solution occurrences and ensure **model stability**.
- **Authored** white papers on **optimization of chillers, distillation columns, and gas-fired boilers** using ALEPH CO-PILOT.
- **Wrote** custom Python scripts **for unit operations (RO membranes, pump curves at different impeller speeds)**.
- **Supported** Jupyter Notebook integration and **demonstrated product capabilities** at Chem Expo 2023.

Carbon Emission & Modelling Initiatives (Singapore)

Basic and Feasibility Check | Team Size: 3 | Project Completed

- Developed a **customized carbon emission and footprint calculator** tailored to **Singapore's context** using the **McKay methodology**.
- Supported strategic planning initiatives for **NUS Singapore** and **potential investors** exploring pathways to reduce **Singapore's carbon footprint**.
- **Conducted R&D** to adapt and **enhance the original McKay Carbon Calculator** by incorporating region-specific factors and Singapore's **global positioning**.

Automation & Tool Development

- **Built a** Python–DWSim connector **to enable** batch simulations and automated data extraction.
- **Developed scalable** process automation workflows **to support optimization studies across multiple clients**.

Larsen & Toubro Technology Services.
Process Engineer

Vadodara (WFO)
Apr 2022 - Jan 2023

Delivered engineering design and safety validation projects for refining and energy sectors, including ESD migration and SIL verification, ensuring compliance with global standards.

Exxon Mobil Baton Rouge Refinery - ESD Migration Project (LA, USA)

Detailed Engineering Design (DED) | Team Size: 4 | Project Completed

- Executed **ESD migration for 39 fire heaters** to replace decade-old pneumatic relay systems, reducing frequent trip incidents.
- Updated **200+ P&IDs, 39 Safety Critical Device (SCD) lists, Cause & Effect (C&E) diagrams, and Process Control Narratives** for construction phase.
- Collaborated on documentation for IO lists, FLDs, and trip-point settings.
- Coordinated **workflow through WRENCH** for IDC, ITR, and final approval stages.
- Prepared **Global Management of Change (GMOC) packages** for each furnace, ensuring compliance.
- Facilitated **SIL vendor meetings** and utilized exSILentia reports for SIS validation as per **API 560** standards.

AFZAR Consultants LLC.
Process Engineer

Vadodara (WFH)
Jan 2021 - Apr 2022

Provided front-end engineering and detailed design support for gas processing and offshore facilities, updating P&IDs, instrumentation lists, and conducting feasibility studies for process upgrades.

ADNOC Gas Processing Facility (Abu Dhabi, UAE)

Front End Engineering (FEED) & Detailed Engineering Design (DED) | Team Size: 10 | Completed

- Delivered **25 updated FEED P&IDs** and defined **key philosophies** (Isolation, Vent & Drain, ESD & Depressurization) for Habshan-3 NGI Compressor conversion project.
- Provided process support for **instrumentation upgrades** under ADNOC's DEFINE Stage, updating P&IDs using Bluebeam Revu, referencing **obsolescence reports, I/O lists, and datasheets**.
- Participated in **Alarm Rationalization** workshops for ADNOC Offshore facilities (NGTP, UZ, GPF).

BSS Technologies - Electro-Chlorination Project (Abu Dhabi, UAE)

Basic Engineering and Feasibility Checks | Team Size: 3 | Project Completed

- Designed and delivered **basic engineering package**, including **PFD, P&IDs, line sizing, heat and mass balance, and equipment datasheets**.
- Conducted **line hydraulics calculations**, prepared vendor documentation, and coordinated 3D modelling in AutoCAD 2020.

Additional Contributions

- Supported **techno-commercial proposals**, including CFD software quotations for Molten Sulphur pipeline (ANSYS, OLGA).
- Developed **design calculation templates** (PSV sizing per API 520, shell & tube exchangers, line sizing) using SMath Studio/Excel.
- Participated in **HAZOP and safety workshops** for ADNOC projects.

Achievements & Skills

- **Carbon Emissions Analysis:** Developed and delivered **Singapore-specific McKay Carbon Calculator** for forecasting emission reductions.
- **Process Modelling & Cloud Deployment:** Built and deployed a **digital process model for Godrej FADP Column** on a cloud-based platform.
- **Major EPC Deliverables:**
 - Delivered **200+ P&IDs, 39 SCD lists, 39 C&E diagrams, and 39 Process Control Narratives** for **ExxonMobil (USA)** fire heater ESD migration project.
 - Successfully issued **2 GMOC packages** to ExxonMobil for compliance and implementation.
 - Delivered **250+ revised P&IDs** for **ADNOC Gas Processing (FEED/DED)** to WOOD PLC within stipulated timelines.
- **Process Philosophy Development:** Defined **three critical process philosophies** (Isolation, Vent & Drain, ESD & Depressurization) for ADNOC's Habshan-3 NGI Compressor conversion project.
- **Technology Development:** Designed a **seawater desalination technology** for Sodium Hypochlorite production (Electro-chlorination) for **BSS Technologies**, including basic engineering and equipment sizing.
- **Innovation & Recognition:**
 - Developed **waste management technology**; awarded **2nd prize** statewide by Gujarat Cleaner Production Centre with a cash award of ₹5,000.
 - Article published in **Industry-Academia-Government Interlinking magazine**.
- **Certifications & Academic Achievements:**
 - **CII Industrial Proficiency Test** – Qualified (2020).
 - **Certified Excel User** – UpGrad.
 - **Topper in Polymer Technology (2020)** – Chemical Engineering Department, MSU Baroda.

Education

Maharaja Sayajirao University of Baroda (F.T.E)
Master of Engineering (Polymer Technology)

Vadodara
June 2018 - Oct 2020

- Graduated with **First Class Distinction (70.1%)**
- **Topper in Polymer Technology (2020)**

Gujarat Technological University (GTU)
Bachelor of Engineering (Chemical Engineering)

Ahmedabad
June 2014 - Aug 2018

- Secured **CGPA: 8.86/10**

Baroda Public School
Higher Secondary Certificate (H.S.C.)

Vadodara
June 2012 - May 2014

- Percentage: **64.8%**

Shree Ambe Vidhyalaya,
Secondary School Certificate (S.S.C.)

Vadodara
June 2011 – May 2012

- Percentage: **88.4%**

Skills

Core Skills

Process Engineering Side

- **Process Design & Engineering:**
Development and review of Process Flow Diagrams (PFDs) and Piping & Instrumentation Diagrams (P&IDs); execution of line sizing and hydraulic calculations; pump, vessel, valve, and PSV sizing in accordance with industry standards. Preparation of instrument process datasheets, equipment/line/tie-in lists, and design deliverables for greenfield and brownfield projects.
- **Process Safety & Control Engineering:**
Experience in SIL verification studies, preparation of Cause & Effect (C&E) diagrams, Functional Logic Diagrams (FLDs), and process control narratives. Development and maintenance of instrument indices and I/O lists to support control system design and integration with DCS/PLC platforms.
- **Engineering Documentation & Design Philosophy:**
Authoring and reviewing Isolation & Drain philosophies, Emergency Shutdown (ESD) and depressurization philosophies, and development of Heat & Material Balances (H&MBs) to support design validation, safety reviews, and operability studies.

Simulation & Modelling

- **Process Simulation & Analysis Tools:**
Proficient in DWSIM (advanced) for steady-state and parametric studies; working knowledge of Aspen HYSYS, PRO-II, HTRI, PIPE-NET, gPROMS-PSE, gPROMS Formulated Products, IDEAS-PSE, Korf Hydraulics, and AFT products for thermodynamic analysis, hydraulic modelling, heat exchanger evaluation, and network simulations.
- **Digital Twin & Model-Based Engineering:**
Development of static digital twin models for process analysis, performance benchmarking, and scenario evaluation, with exposure to cloud-based deployment of process models for scalable simulation and optimization workflows.

Programming & Automation

- **Python for Engineering Applications (Basic to Intermediate):**
Applied Python for data analysis, engineering calculations, and automation of simulation workflows, including batch execution and result post-processing.

- **Simulation Automation & Integration:**
Designed and implemented a DWSIM–Python connector to enable automated batch simulations and parametric studies, improving efficiency and reproducibility of engineering analyses.
- **Software Engineering Practices:**
Familiar with version control systems (Git, GitHub, GitLab), code documentation, refactoring, and modular programming principles for maintainable and scalable engineering codebases.

Collaboration & Personal Productivity

- Effective in cross-functional and remote team environments using MS Teams, Outlook, Slack, Discord, Jira, and Notion for communication, task tracking, and technical documentation.

Software Proficiency

- **Productivity & Documentation:**
MS Office Suite (Excel - Advanced data analysis & reporting, PowerPoint, Word), **OneNote**
- **Engineering & Drafting Tools:**
AutoCAD 2020, Bluebeam Revu Extreme
- **Engineering Calculation Tools:**
SMath Studio