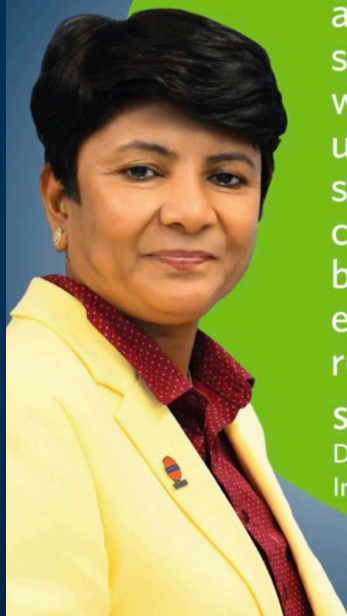


Digitalization, Innovation, and Energy

Digitalization will define the winners
and losers in the energy transition

Why?

Ron Beck, +1-978-771-5888



“The digitalization journey has opened amazing possibilities for innovation and change across a wide spectrum of the oil business, which were hitherto unexplored. The key for successful deployment is customized digital solutions based on the local environment and requirements.

Sukla Mistry

Director (Refineries)

Indian Oil Corporation Limited

GLOBAL ENERGY
DEMAND GROWTH

50%

by 2050⁴

GLOBAL ELECTRICITY
GENERATION GROWTH

75%

by 2050, 90% renewables⁸

METALS FOR
ELECTRIFICATION

600%

production growth
in lithium by 2035⁵

Global Population¹

2022

2050

8.0B

9.7B

Net-Zero Carbon Emissions by
2050

GLOBAL CHEMICALS
DEMAND GROWTH

300%

by 2050⁶

INFRASTRUCTURE
GROWTH

\$150T

Energy sector
investment by 2050⁷

¹ International Institute for Sustainable Development, SDG Knowledge Hub, Aug 2020

² IEA. For the first time in decades, the number of people without access to electricity is set to increase in 2022. Oct 22

³ Assessing the future of the Phoenix Market Visual Conference, Jan 2019

⁴ EIA projects nearly 50% increase in world energy usage by 2050. International Energy Outlook 2021, EIA, Oct 21

⁵ Lithium supply from mineral will lead the growth, Wood Mackenzie Mar 22

⁶ WFP — Global Chemical companies collaborate in pivotal move to net zero Oct 21

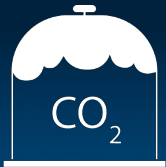
⁷ IEA — World Energy Transitions Outlook 2023 Preview

⁸ World Energy Outlook Report 2021 — IEA Rev Dec 21

⁹ When will the global consumer class recover?, K.Wu and M.Thomasberger, Brookings, Nov 2020

CCS, Green H₂, Bio-Feedstocks & Renewable Energy

! The needed pace of change is only possible with new ways of working !



Carbon Capture

202 global project
announcements since 2020
Total value of **\$128B**



Green Hydrogen

488 global project
announcements since 2020
Total value of **\$616B**



Bio-feedstocks

154 global project
announcements since 2020
Total value of **\$72B**



Renewable Energy

4,572 global project
announcements since 2020
Total value of **\$2.9T**

Digitalization in the Energy Transition



Digital Models



**Artificial Intelligence
(AI)**



Innovation



Usability



Architecture and Security



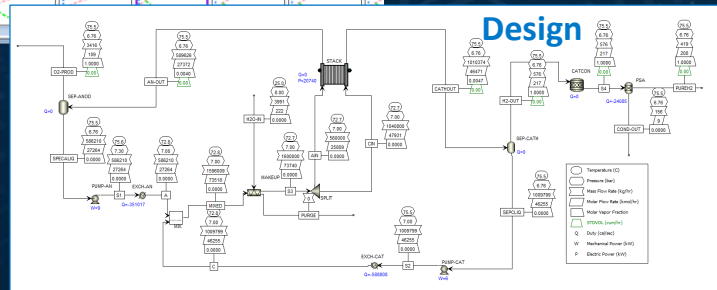
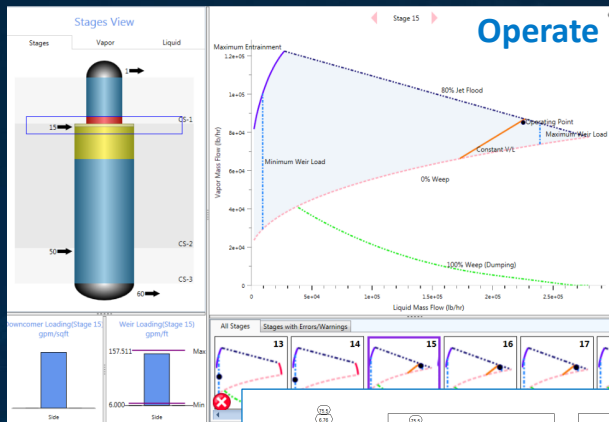
Vision

Digital Models

Digital models predict, analyze and represent a physical asset

Value

- Scale-up faster.
- Automate engineering.
- Optimize.



Artificial Intelligence (AI)

Use-cases for AI in energy are maturing.

Today AI can act as a value add to enhance “first-principles” models.

Value

- Speed and insight in navigating complexity.
- Expert advisor for better operating decisions.

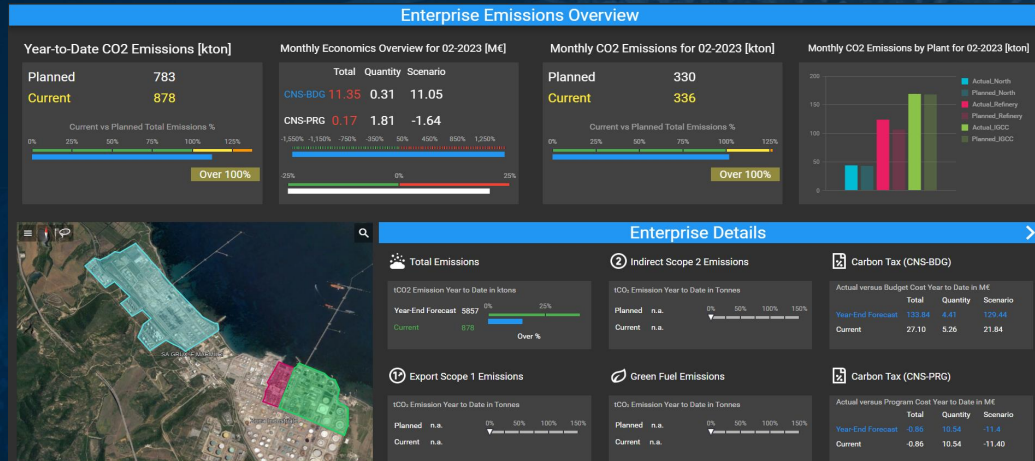


Innovation

Rapid digital innovation is required.

12 companies collaborated on this carbon emissions management solution.

Value
Collaboration between diverse people and companies will lead to more and better ideas.



Usability

Energy Systems are highly complex.

So is the digital software.

In the future it must be delightful to use.

Value

Empower the next generation of users to solve the hard energy challenges.



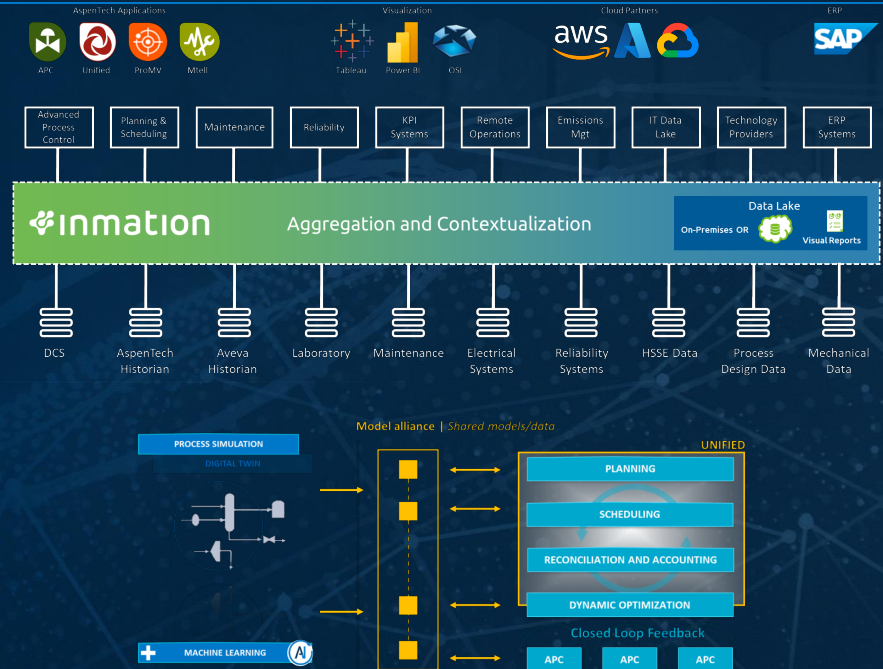
Architecture

Architectures can be technical but also conceptual.

They are important to make digitalization part of an evolving journey.

Value

- Adopt apps seamlessly.
- Ease of evolution.
- Constantly harden cybersecurity.



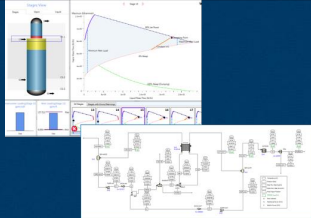
Vision

Digitalization must always focus on value created.

Rapid digital Innovation is most effective when driving towards a vision and target.



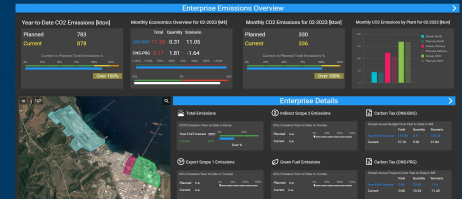
Digitalization in the Energy Transition



Digital Models



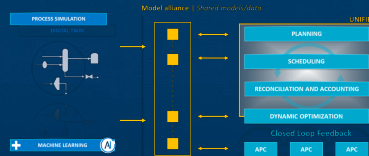
Artificial Intelligence
(AI)



Innovation



Usability



Architecture and Security



Vision

The Journey to Operational Excellence

1

MANUAL PROCESS
IMPROVEMENT

2

ISOLATED DIGITAL
IMPROVEMENT

3

MULTI-ASSET
OPTIMIZATION

4

**THE SMART
ENTERPRISE**

DIGITALIZATION JOURNEY



**NEW BUSINESS
MODEL**



“It is well recognized that ensuring a regular, stable and continuous supply of renewable energy involves intensive deployment of digital tools to achieve the necessary large-scale real-time integration of various systems.

T. Srinivas

COO - Supply & Trading
Reliance Industries Limited