



# DIGITAL DECARB

LIFECYCLE CARBON ASSESSMENT AND REDUCTION

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TNChE Asia 2023



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TNChE Asia 2023



# LUMMUS DIGITAL



**110+**  
Years Legacy



**143+**  
Technologies



**2,400+**  
License Units



**Technology  
know-how**

**Domain  
Expertise**

**Lifecycle Services**



**AI Platform**



**20**  
Years of Digital  
Transformation



**End to End  
Data Insight**

**Low code AI**

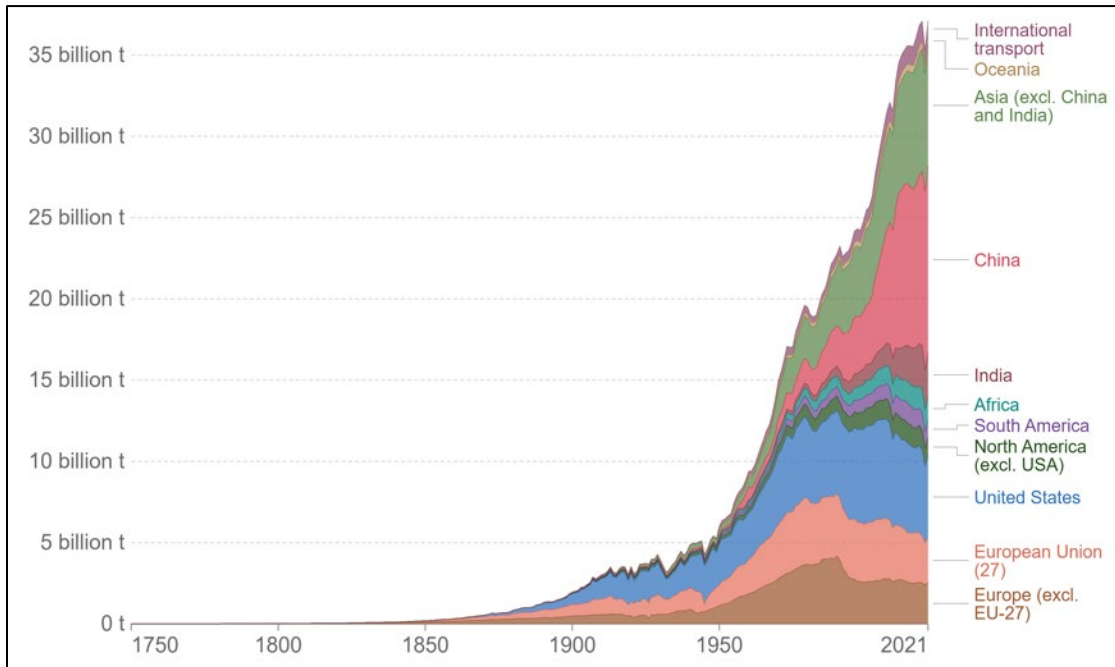
**50**  
Global Clients



**Real-time  
data ingestion**

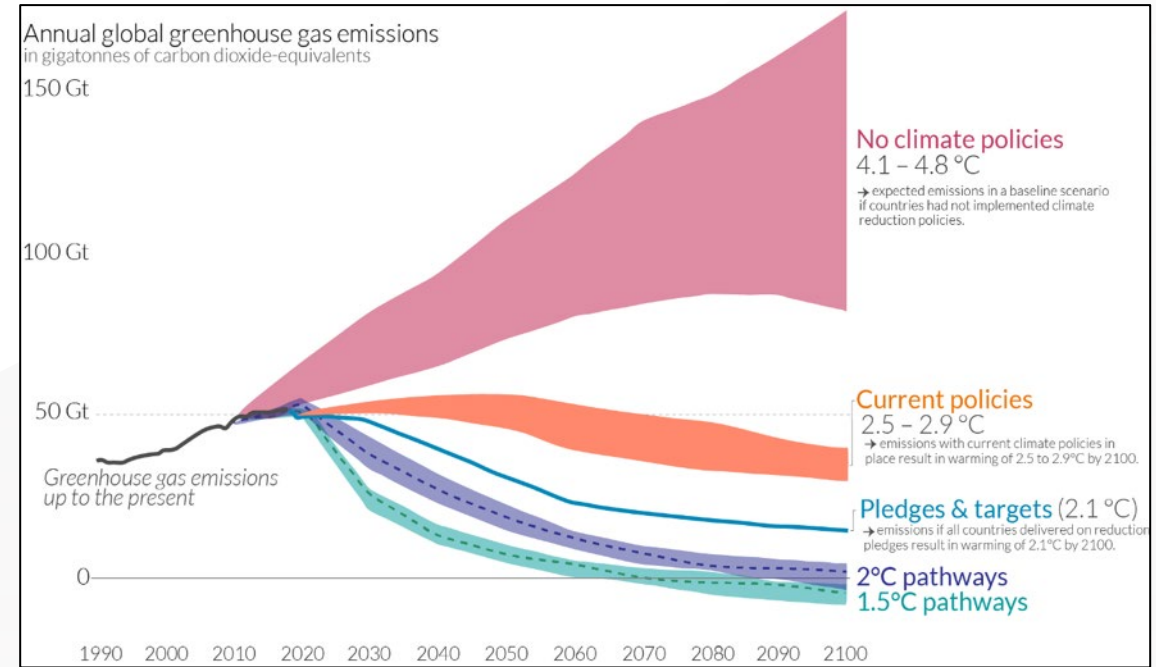
**Industry specific**

# GLOBAL EMISSIONS & WARMING SCENARIOS



Source: Our World in Data based on the Global Carbon Project (2023)

Hannah Ritchie, Max Roser and Pablo Rosado (2020) - "CO<sub>2</sub> and Greenhouse Gas Emissions". Published online at [OurWorldInData.org](https://ourworldindata.org/co2-and-greenhouse-gas-emissions). Retrieved from: '<https://ourworldindata.org/co2-and-greenhouse-gas-emissions>' [Online Resource]



Data source: Climate Action Tracker (based on national policies and pledges as of November 2021).  
[OurWorldInData.org](https://ourworldindata.org) – Research and data to make progress against the world’s largest problems.

The world needs to move to “Net Zero” emissions ...

# VARIOUS PATHS TO GHG REDUCTION



“ Companies need to choose one or more of these options to achieve their ESG goals.”

ESG – Environmental, Social. and Governance

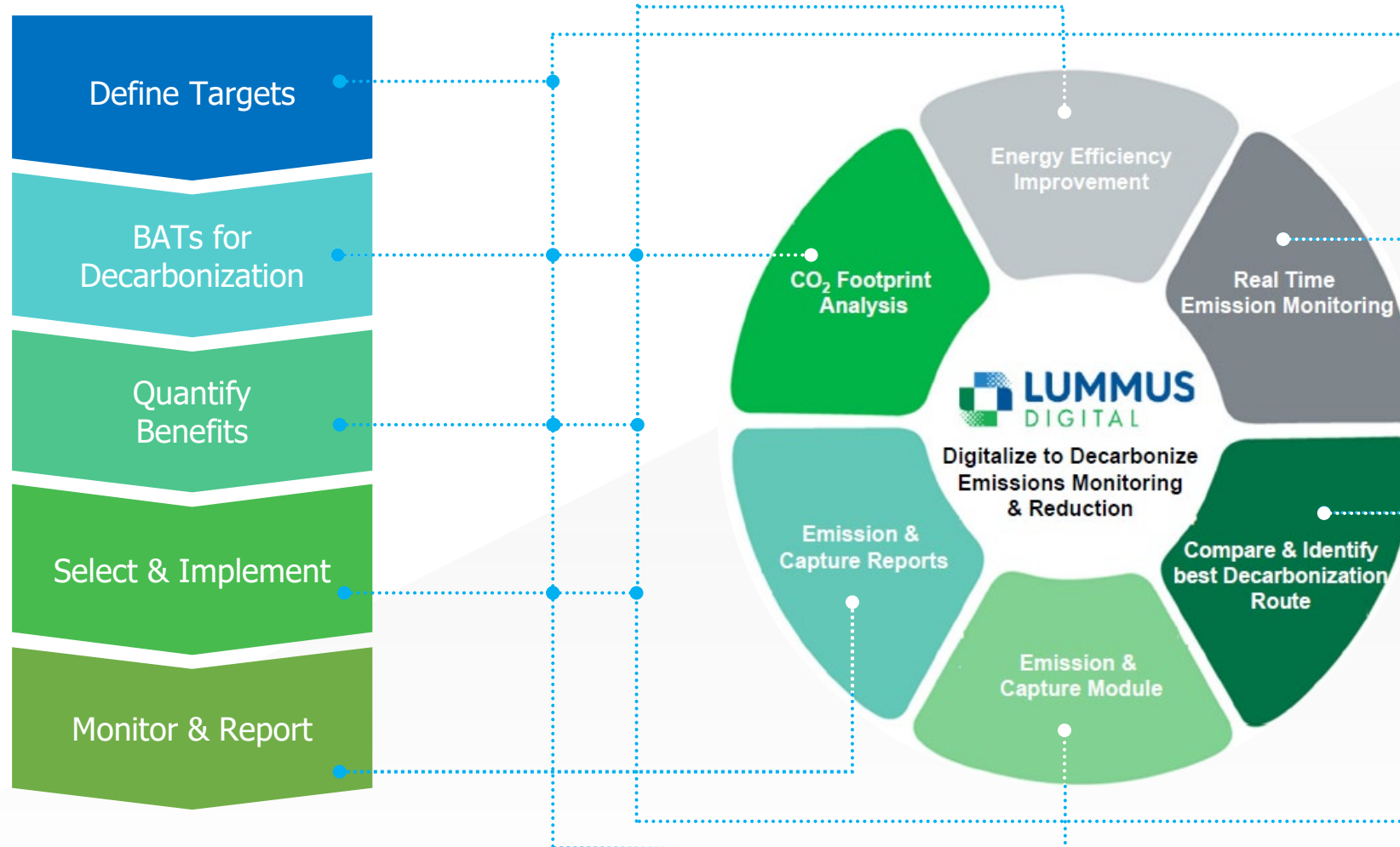
# NO ONE SOLUTION FITS ALL

All Carbon reduction and capture technologies are dependent of various factors –

- **Existing Energy & Emission Scenario**  
(Total Emissions per unit Energy/Feed/Product)
- **Source and Availability of Renewable Energy**  
(Low carbon H<sub>2</sub>, green electricity etc.)
- **Energy Penalty and Impact of new reduction & capture technology**  
(Net Emissions Reduction)
- **Alternate Feedstock availability and its net impact**  
(Bio Feedstock, Plastic Recycle Feedstock)
- **Geographical Location / Local Regulations**
- **CAPEX for grass root & retrofit technologies**

“ BUT...  
WHICH ROAD  
TO WALK?

# EMISSION REDUCTION FRAMEWORK



**A**  
**complementary**  
**solution that can**  
**further enhance**  
**your current**  
**process**

\*BAT – Best Available Technologies

# INTRODUCING DIGITAL DECARB

## A Low-Cost Decarbonization Assessment Tool

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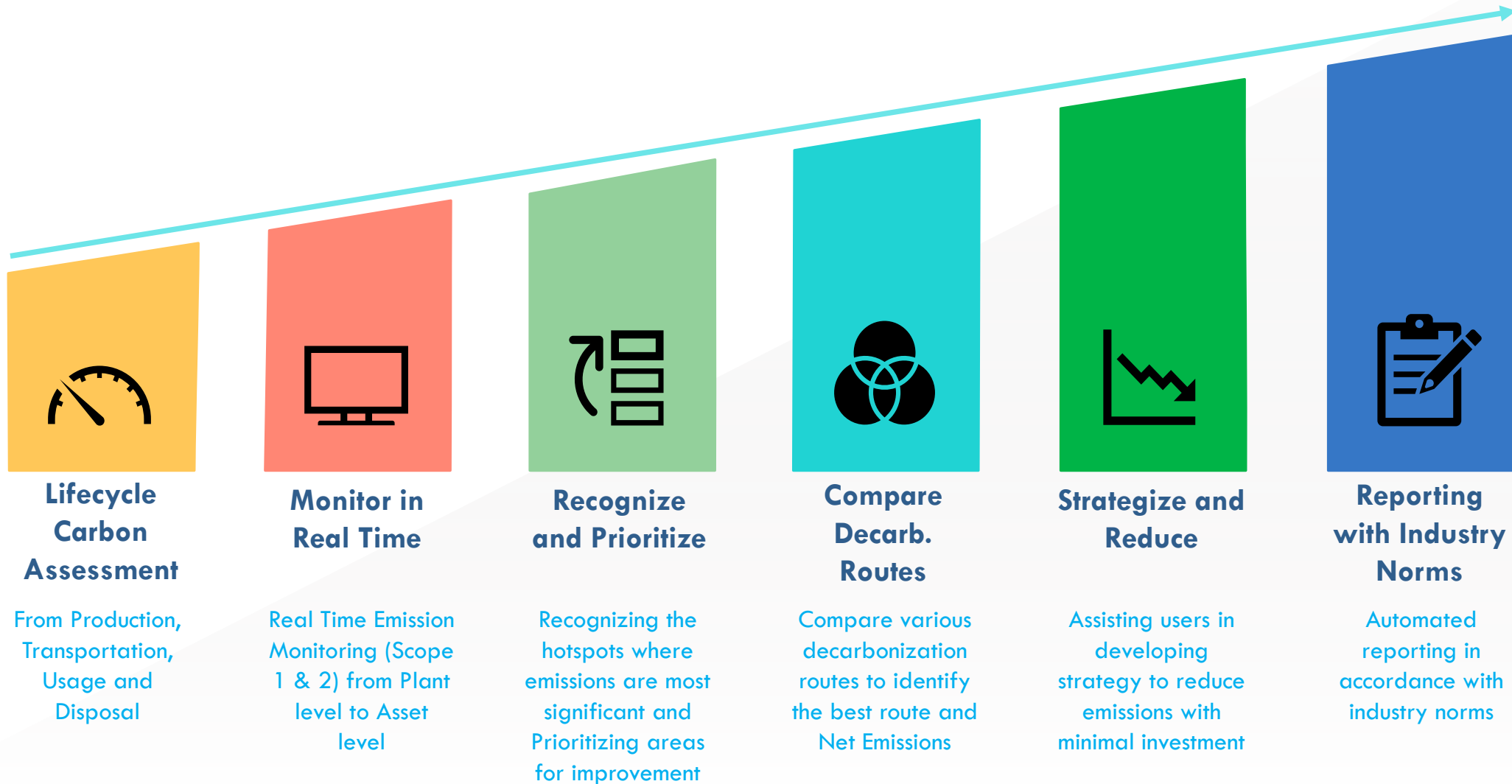
Utilizing Lummus  
Extensive Technology  
know-how

**Digital Decarb**

Tailor-made  
Solution for  
Client Needs

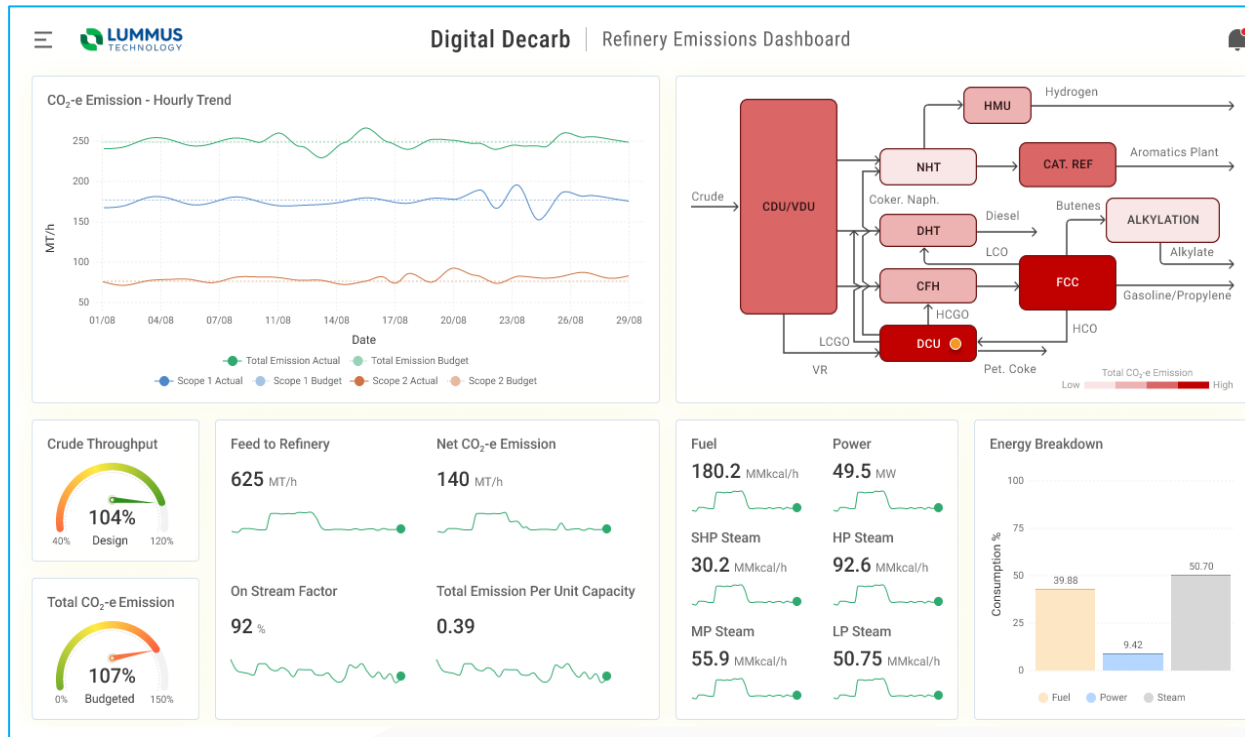
Backed by TCG's proven  
mcube™ platform

# DIGITAL DECARB - ONE STOP SOLUTION





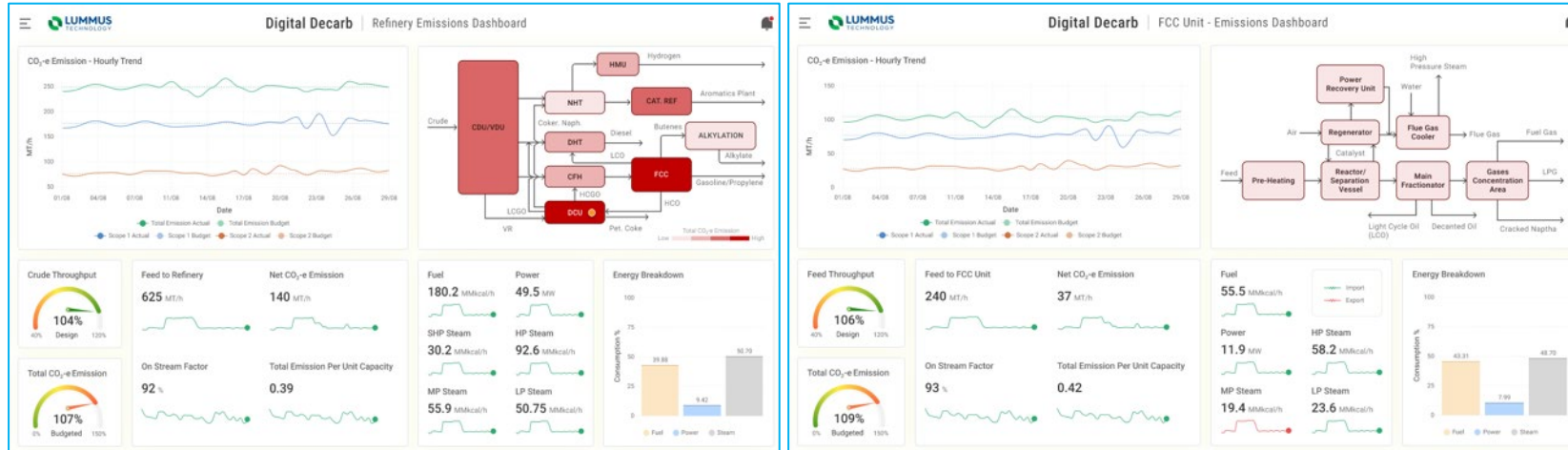
# ENERGY AND EMISSION ANALYSIS



What we can do :

- ✓ Real-time monitoring and heat-map analysis of Scope 1 & 2 emissions / energy consumption
- ✓ Identify opportunities for reducing emission and energy optimizations
- ✓ Prioritizing areas for improvement and hotspots notification alarms
- ✓ Emission and energy breakdowns analysis
- ✓ Assisting users in doing Benchmarking analysis
- ✓ Automated reporting system

# DRILL DOWN EMISSION ANALYSIS



**Hot Spot Analysis - Emission analysis from complex to unit to asset and breakdown emission sources**

# AUTOMATED REPORTING SYSTEM

## Summary for preparing AUDITABLE EMISSION REPORTS

Emission Summary Report

Select View

Hourly Emissions

Emissions & Capture Summary	Without Export Credit	With Export Credit	UoM
<b>Total Emissions in CO<sub>2</sub>-e (AR4 GWPs, excluding Biogenic CO<sub>2</sub>)</b>	<b>101,851.0</b>	<b>92,674.2</b>	<b>kg CO<sub>2</sub>-e/hr</b>
+ Scope 1 CO <sub>2</sub> -e Emissions	70,001.8	70,001.8	kg CO <sub>2</sub> -e/hr
+ Scope 2 CO <sub>2</sub> -e Emissions	31,849.2	22,672.5	kg CO <sub>2</sub> -e/hr
<b>Emission by Gas in CO<sub>2</sub>-e (AR4 GWPs)</b>			
+ Carbon Dioxide (CO <sub>2</sub> )	101,833.2	92,660.7	kg CO <sub>2</sub> -e/hr
+ Biogenic CO <sub>2</sub>	--	--	kg CO <sub>2</sub> -e/hr
+ Methane (CH <sub>4</sub> )	8.1	6.2	kg CO <sub>2</sub> -e/hr
+ Nitrous Oxide (N <sub>2</sub> O)	9.7	7.4	kg CO <sub>2</sub> -e/hr
<b>Annual CO<sub>2</sub>-e Emissions (excluding biogenic CO<sub>2</sub>)</b>	<b>814,800.6</b>	<b>741,387.1</b>	<b>MTPA CO<sub>2</sub>-e</b>
<b>Total Emission per unit Capacity (excluding biogenic CO<sub>2</sub>)</b>	<b>0.4</b>	<b>0.4</b>	<b>MTPA CO<sub>2</sub>-e/MTA</b>
<b>Total CO<sub>2</sub> Capture</b>	<b>59,536.4</b>	<b>59,536.4</b>	<b>kg CO<sub>2</sub>-e/hr</b>
CO <sub>2</sub> Capture	59,536.4	59,536.4	kg CO <sub>2</sub> -e/hr
Biogenic CO <sub>2</sub> Capture	--	--	kg CO <sub>2</sub> -e/hr
<b>Net CO<sub>2</sub>-e Emissions</b>	<b>42,314.6</b>	<b>33,137.9</b>	<b>kg CO<sub>2</sub>-e/hr</b>

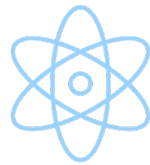
Consolidate emission data from multiple sources across the plant/unit for all Scope 1 and Scope 2 Emissions.

On-demand Automated Reporting for Total and Net Emissions for preparing auditable emission reports.

# IMPROVING CARBON INTENSITY

REDUCE SCOPE 1 AND SCOPE 2 EMISSIONS BY 10-15%

## KEY TAKEAWAYS



### Visualize Emissions

- Monitor and visualize Scope 1 and Scope 2 Emissions
- Alert and Identify potential emissions sources and areas for improvement



### Optimize Operations

- Leverage AI-ML for efficiency at system level.
- AI-ML based insights from APM and RTO model



### Digital Decarb coupled with APM and RTO deliver additional value

- Improved process performance.
- End-to-End optimized process
- Increase asset reliability and productivity

# DIGITAL DECARB



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