

Model Based Energy Optimization

: Decarbonization
of Existing Assets

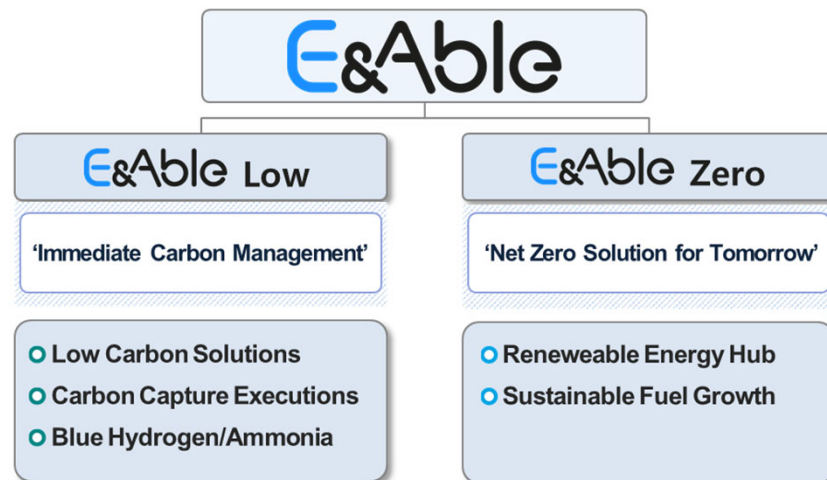
SAMSUNG E&A



Introduction to Samsung E&A Decarbonization Service Offerings (E&Able)

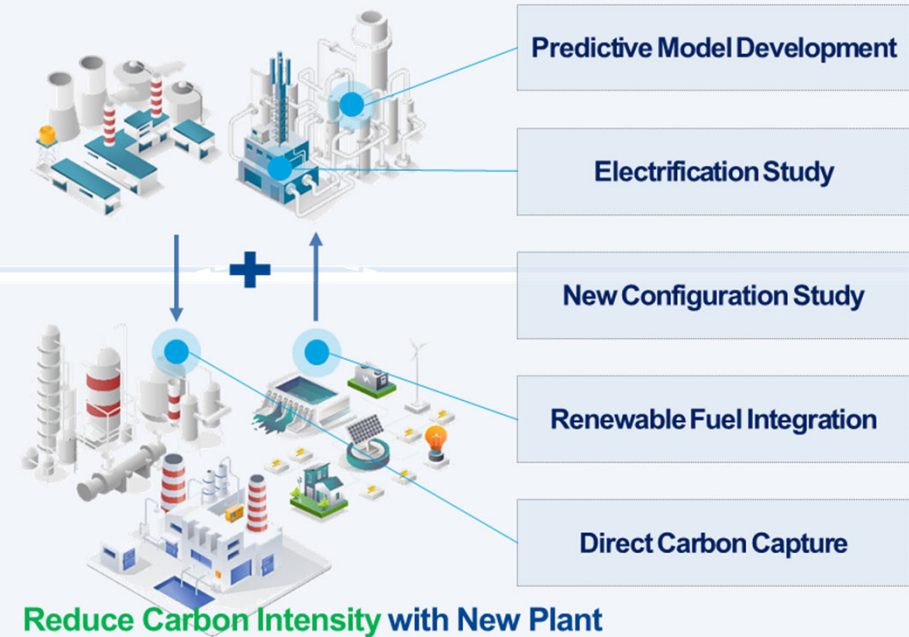
E&Able helps accelerate business in carbon neutral fields in Energy Transition Era

Deliver Bespoke Carbon Neutral Master Plan



Enabling a Sustainable **FUTURE AHEAD**

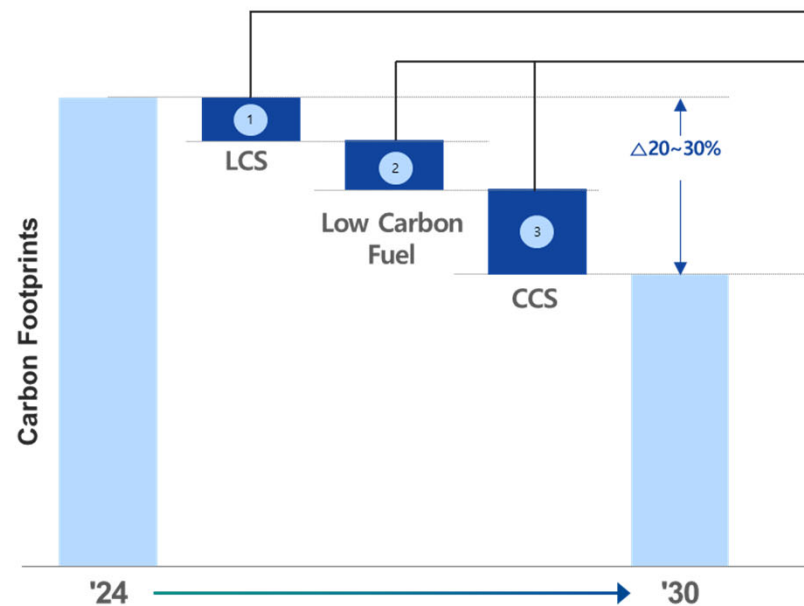
Reduce Energy Intensity for Existing Plants



Understand: Business Target & Operating Assets

First, we find the gap between current operations and future decarbonization targets

Review the Client's Decarbonization Plan



"1 or 2 Major Turn Arounds Remained"

Propose the Integrated Low Carbon Solution Study Plan

Materialize Items Each Category

- Categorize individual units based on the tiers of energy intensity
- Prioritize the energy saving potentials

Process	Energy Cost ^a	Saving Potential	
	10 ⁶ KRW/yr	%	10 ⁶ KRW/yr
A	3500	8.0%	280
B	300	10.1%	30
C	300	6.2%	19
D	200	9.9%	20
E	150	10.5%	16
F	100	6.3%	6
G	50	7.9%	4
Total	4850	8.2%	380

NO.	EMISSION SOURCE	TEMP. (°C)	Mass % CO ₂	CO ₂ (MTPA)	Priority
1	CDU FURNACE	300	9.1	0.1	3
2	HVU FURNACE	300	9.1	0.1	3
3	1ST A FURNACE	300	9.1	0.1	3
4	1ST B FURNACE	300	9.1	0.1	3
5	2ND FEED FURNACE	300	9.1	0.1	3
6	FRAC. FEED FURNACE	300	9.1	0.1	3
7	REACTOR FURNACE	300	9.1	0.1	3
8	CAD FEED FURNACE	300	9.1	0.1	3
9	VACUUM FURNACE	300	9.1	0.1	3
10	HDS CHARGE HEATER	300	9.1	0.1	3
11	HDT CHARGE HEATER	300	9.1	0.1	3
12	HMU SMR	300	9.1	0.1	3
13	HMU SMR	300	9.1	0.1	3

- Plan based on Priority which accounts for Upcoming Turn Around

Developing/Investing in Emerging Technologies

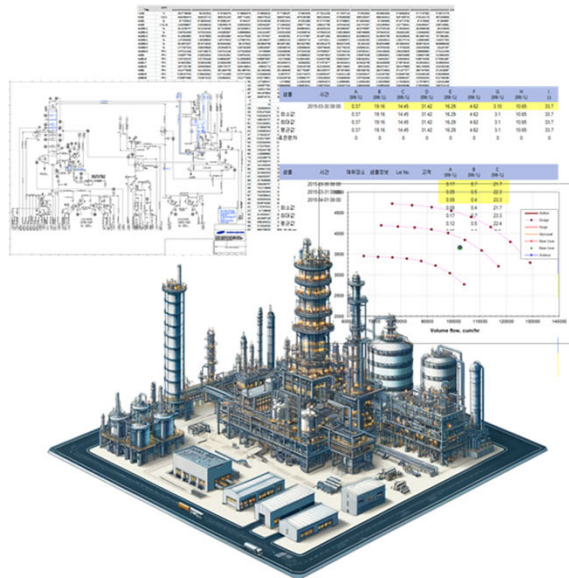
- Pursue partnership and joint development with CCS operator & low carbon fuel producers

Optimize Local: Model-Based Energy Optimization

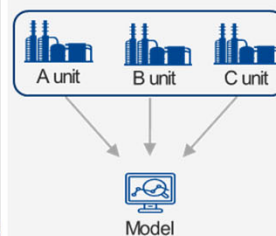
Predictive Simulation Model is the key kickoff to investigate conceptual ideas

Predictive Model Creation Work Flow

Actual Operating Data Collection

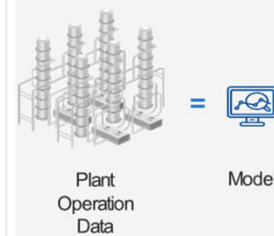


Plant-Wise Modeling



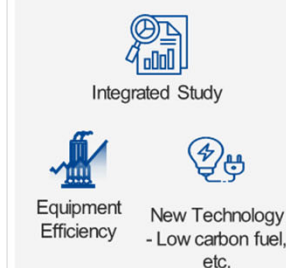
- Site-wise Analysis to Prevent the Balloon Effect
- Skills and Knowledge of Process Simulation

Accurate Simulation



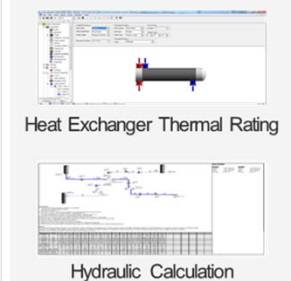
- 1st principle model accounting for complex process interactions
- Tuned to Actual Operation Data

Prudent Analysis



- Specialist with more than 30 years of Experience
- Ideation based on Track Records

Competent Engineering



- Seamless Engineering Capability
- Successful Precedents of Brownfield Project Execution

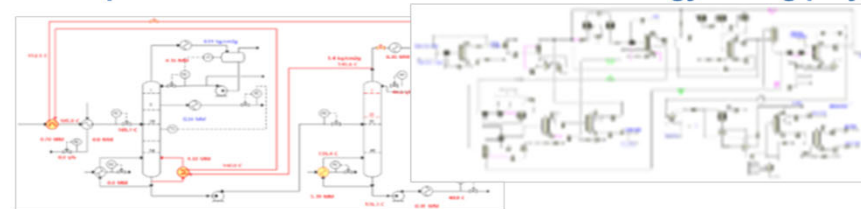
Optimize Local: Model-Based Energy Optimization

Energy Saving Ideas derive from Pinch Analysis

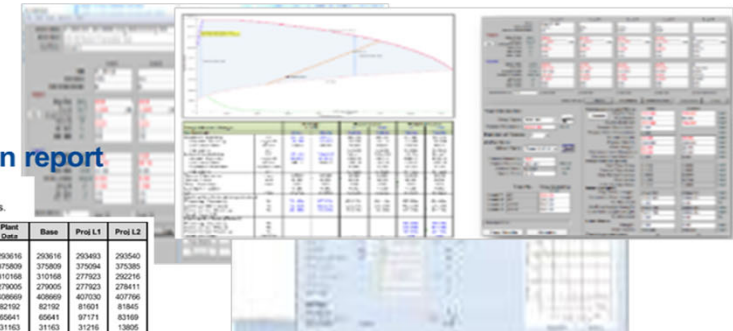
Review the Client's Decarbonization Plan

- 1 Optimization Operation Condition
- 2 Maximize Internal Process Heat Recovery
- 3 Distillation Optimization
- 4 Inter Unit Heat Integration
- 5 Optimize Closed Refrigeration Loop
- 6 Low Carbon Emission (Optimize Global)

Develop simulation model for each identified energy saving project



Check equipment performances



Numerate ideas in report

1.2.3 Benefit Assessment

Table below summarizes the expected benefits.

DCS	Description	Unit	Plant Data	Base	Prod L1	Prod L2
FC503	GB501 1ST SUCTION	kg/hr	293616	293616	293493	293540
	GB501 2ND SUCTION	kg/hr	375809	375809	375094	375385
	GB501 3RD SUCTION	kg/hr	310168	310168	277923	292216
	GB501 4TH SUCTION	kg/hr	279005	279005	277923	279111
	GB501 5TH SUCTION	kg/hr	409669	409669	407320	407766
F1505	GB501 2ND DIS.	kg/hr	82192	82192	81601	81845
F1502	GB501 2ND DIS.	kg/hr	65641	65641	67171	63169
F1508	GB501 3RD DIS.	kg/hr	31163	31163	31216	13805
GBT501 Steam						
F1716	H.P. ST.M. GBT501	kg/hr	170193	170193	169277	169679
F1717	M.P. ST.M. GBT501	kg/hr	100648	100648	100648	100648
F1719	COND. GBT501	kg/hr	69545	69545	69629	69631
GBT501 Power - Total						
S1501	GBT501	RPM	3400	3392	3395	
P15C Turbine HR Saving						
		kg/hr			916	314

More than 400,000 tons of CO₂ reduction achieved through successfully executing more than 10 projects