

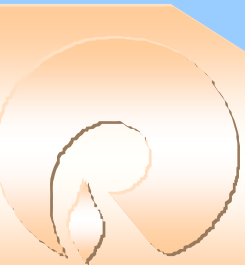
Reliance Jamnagar

ICC SEMINAR

on

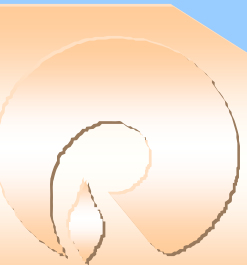
“Energy conservation & Carbon Trading”

3rd-4th Nov 2006

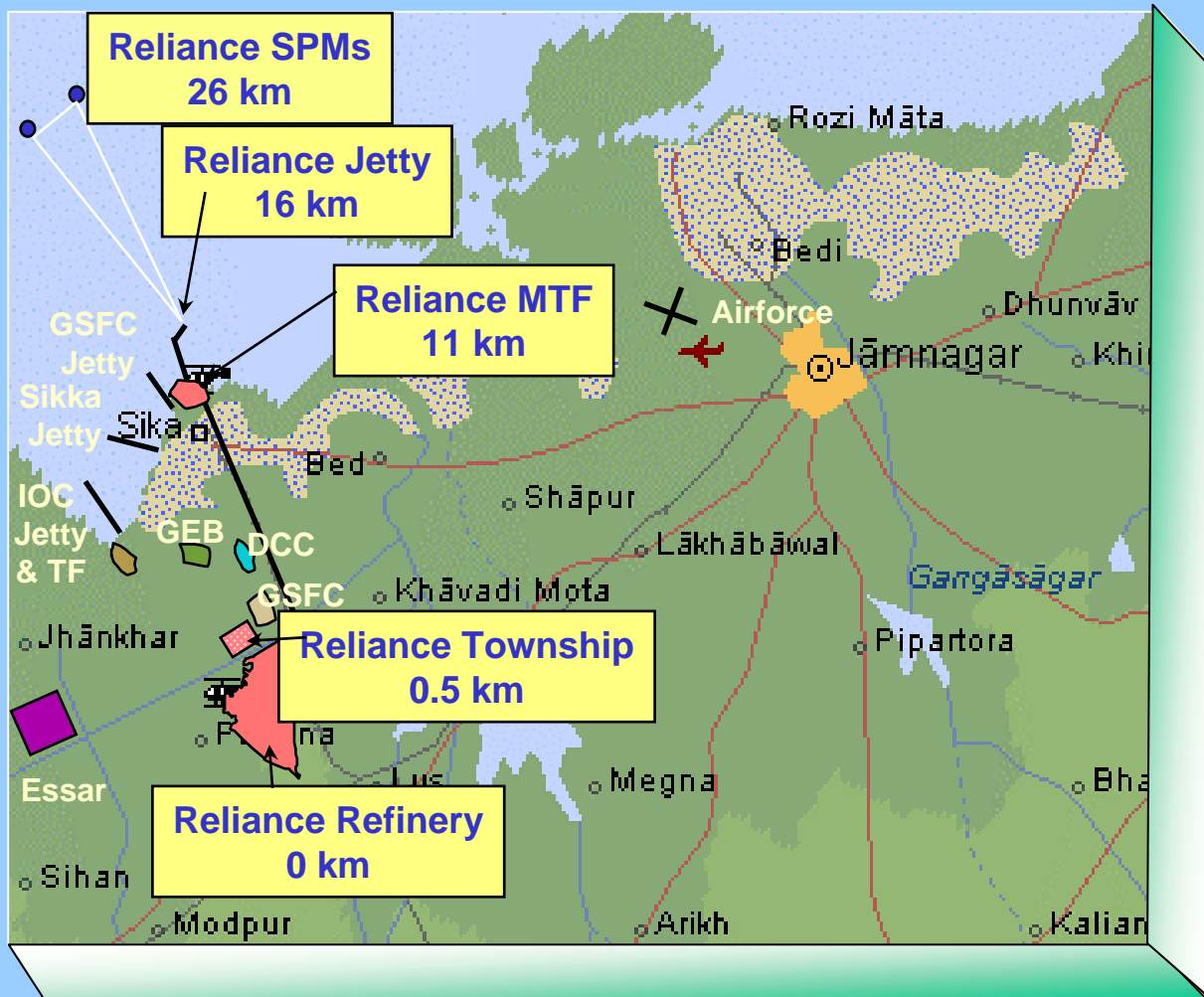


Content

- ✓ **Overview of Jamnagar Refinery**
- ✓ **Energy Management at RIL**
- ✓ **Best Practices**
- ✓ **ENCON & CDM Projects**



Overview - Jamnagar Refinery



**All weather -- deep sea port
enabling round the clock,
round the year operation**

**Rail, Road, Airways linkage
& Major oil pipeline linkage**

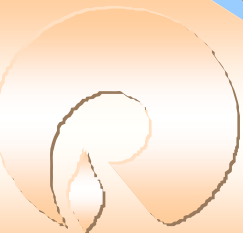
**Proximity to large crude
oil source -- Arabian gulf**

Overview - Jamnagar Refinery

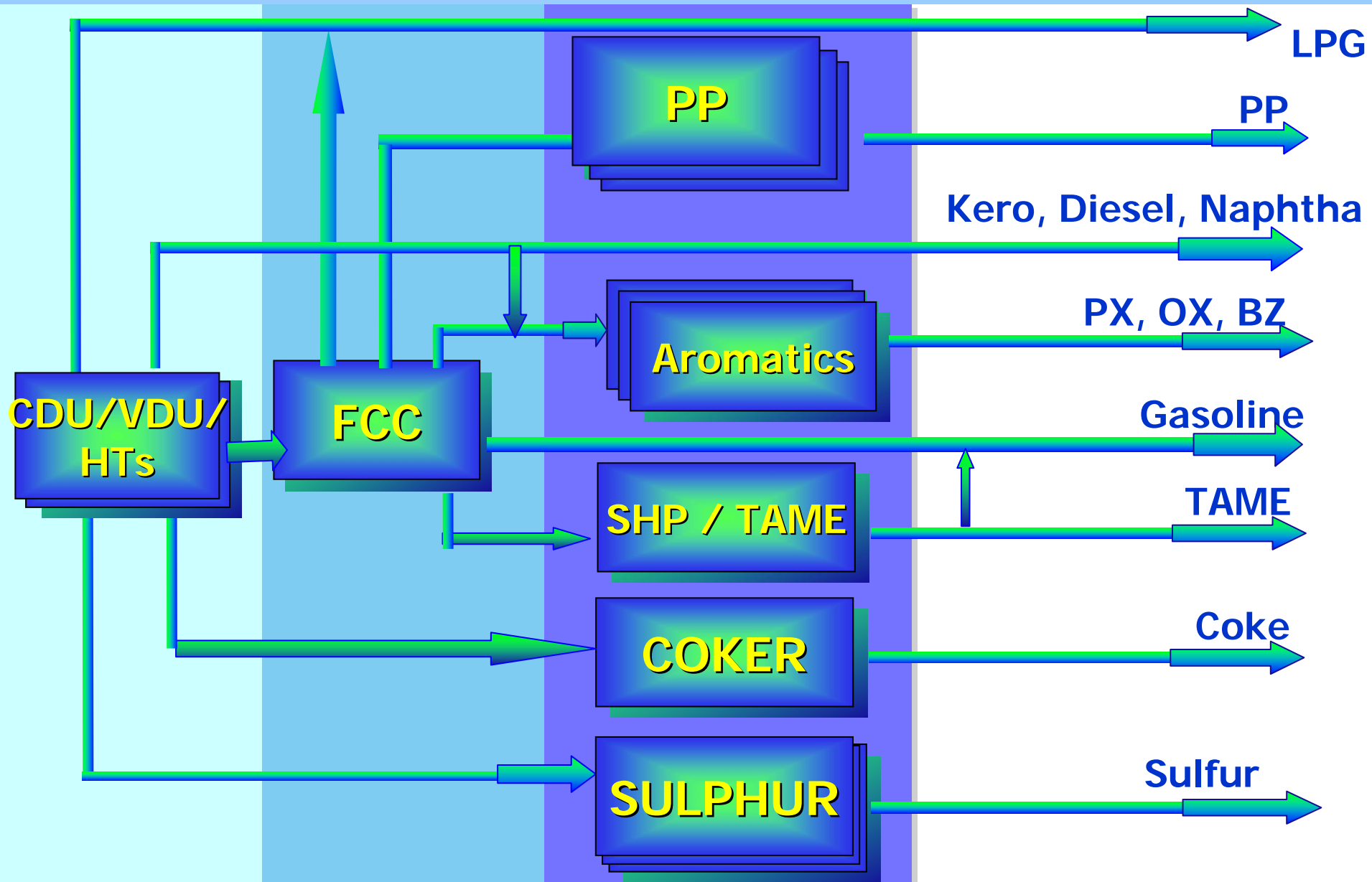
- **3rd Largest Refinery in the World - 33 MMTPA**
- **World's largest FCC, Coker & Aromatics complex**
- **India's largest Polypropylene unit, Captive Power Plant and Crude & Petroleum terminals**
- **Highly energy efficient & flexible in operation.**
- **Eco-friendly**
- **Producing superior quality products**
- **State of the art facilities for highest order of Reliability**

Process know-how from World Leaders

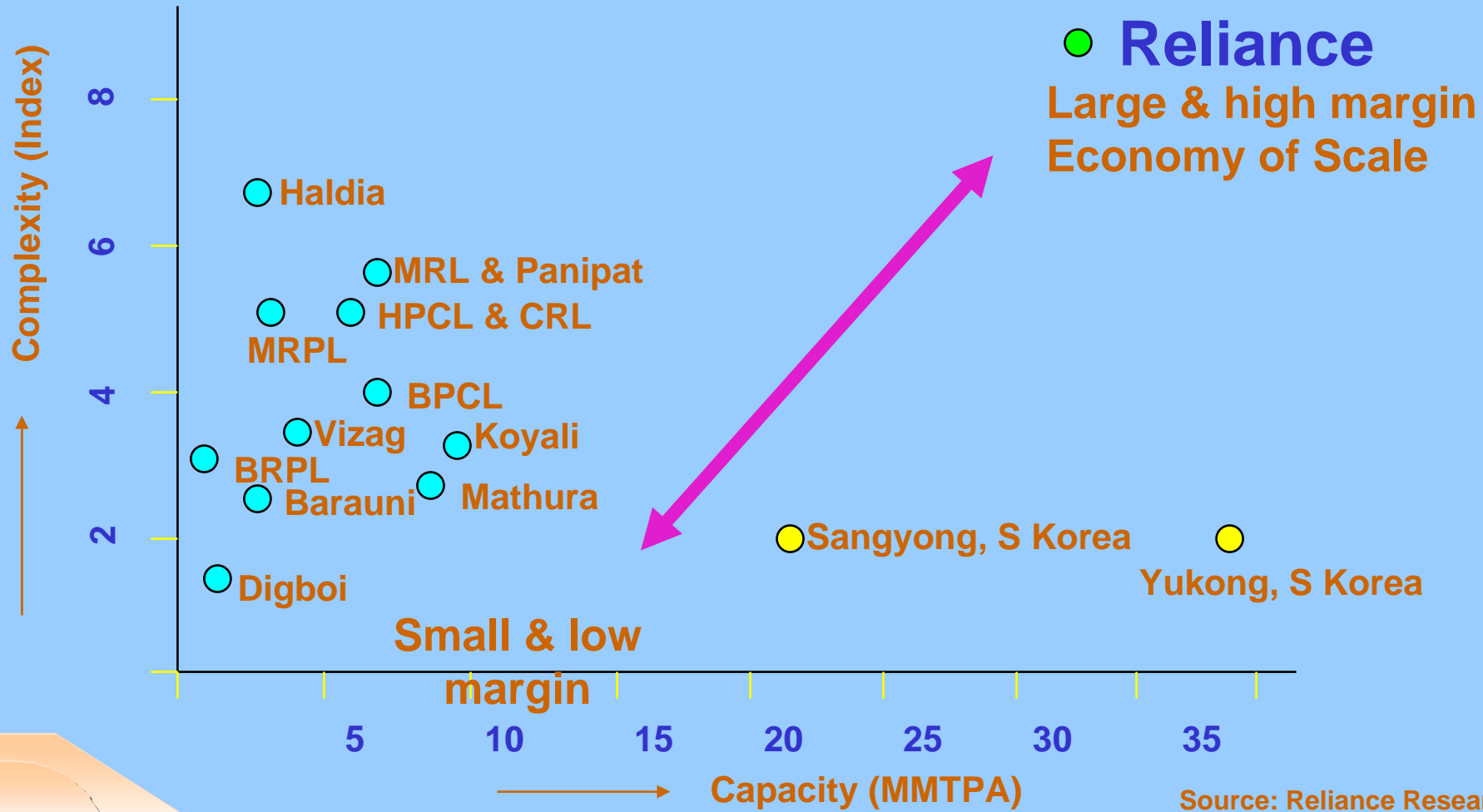
<u>Unit</u>	<u>Licensor</u>
• CDU/VDU (2 trains)	UOP, USA
• Diesel & VGO HTs (2 trains)	- do -
• SHP / TAME	- do -
• Gas conc. Units (4 nos.)	- do -
• Hy./Lt. Naphtha HTs (2 nos.)	- do -
• Meroxes (5 nos.)	- do -
• Platformer	- do -
• Aromatics (PX) (3 trains)	- do -
• Delayed Coker (8 drums)	Foster Wheeler, USA
• HMUs (2 trains)	Linde, Germany
• Polypropylene (3 lines)	Dow (earlier UCC), USA
• CBA units (3 trains)	Pritchard, USA



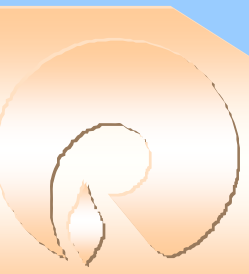
Process Block Flow Diagram



Way Ahead of Competition



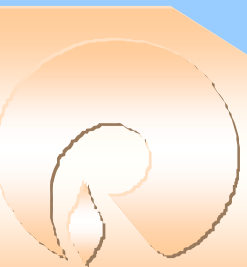
Source: Reliance Research



Most complex refinery in the region

Reliance Jamnagar

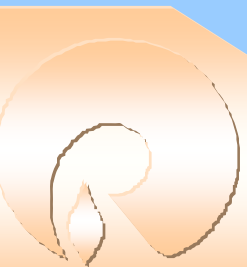
Energy Management



ENERGY MANAGEMENT- OVERVIEW

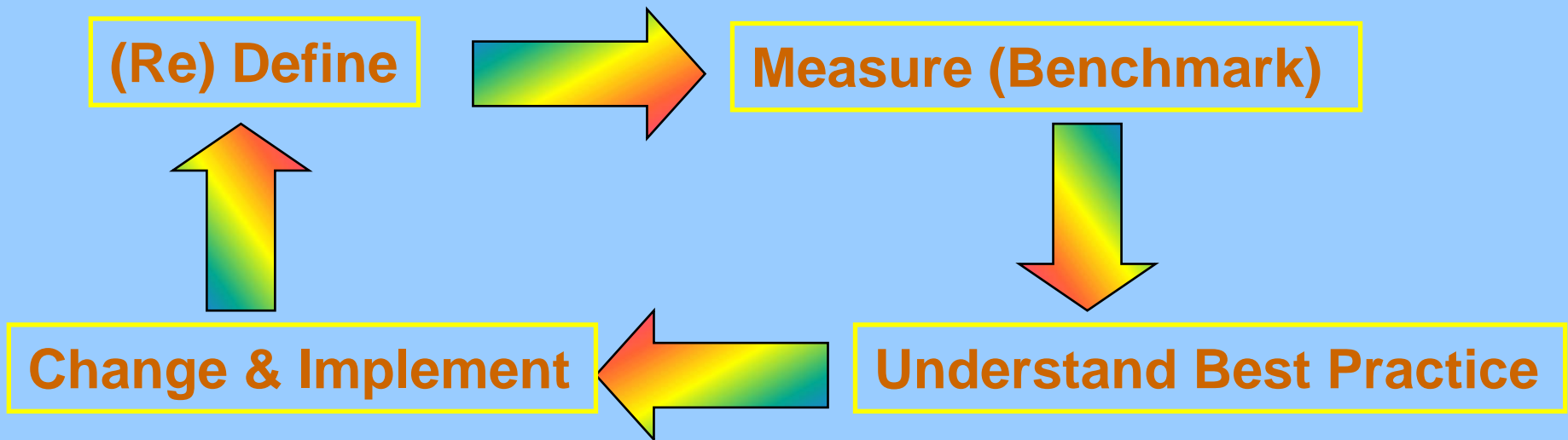
Jamnagar Complex: Details

- **34 Heaters, 9 GTs/HRSGs & 5 Aux. Boilers/STGs**
- **Fuel Requirement : ~ 3.0 Million MT/ Yr.**
- **Annual Fuel Bill : ~ Rs. 3200 CRORES**
- **75% of the Operating cost**
- **Reduction of 0.1 % Fuel amounts to Rs 3.0 Cr/Annum**



Energy Performance Improvement Cycle

1. First step – Define
2. Measure & Benchmark
3. Best practice sharing & highlight performance gaps
4. Change and Implement



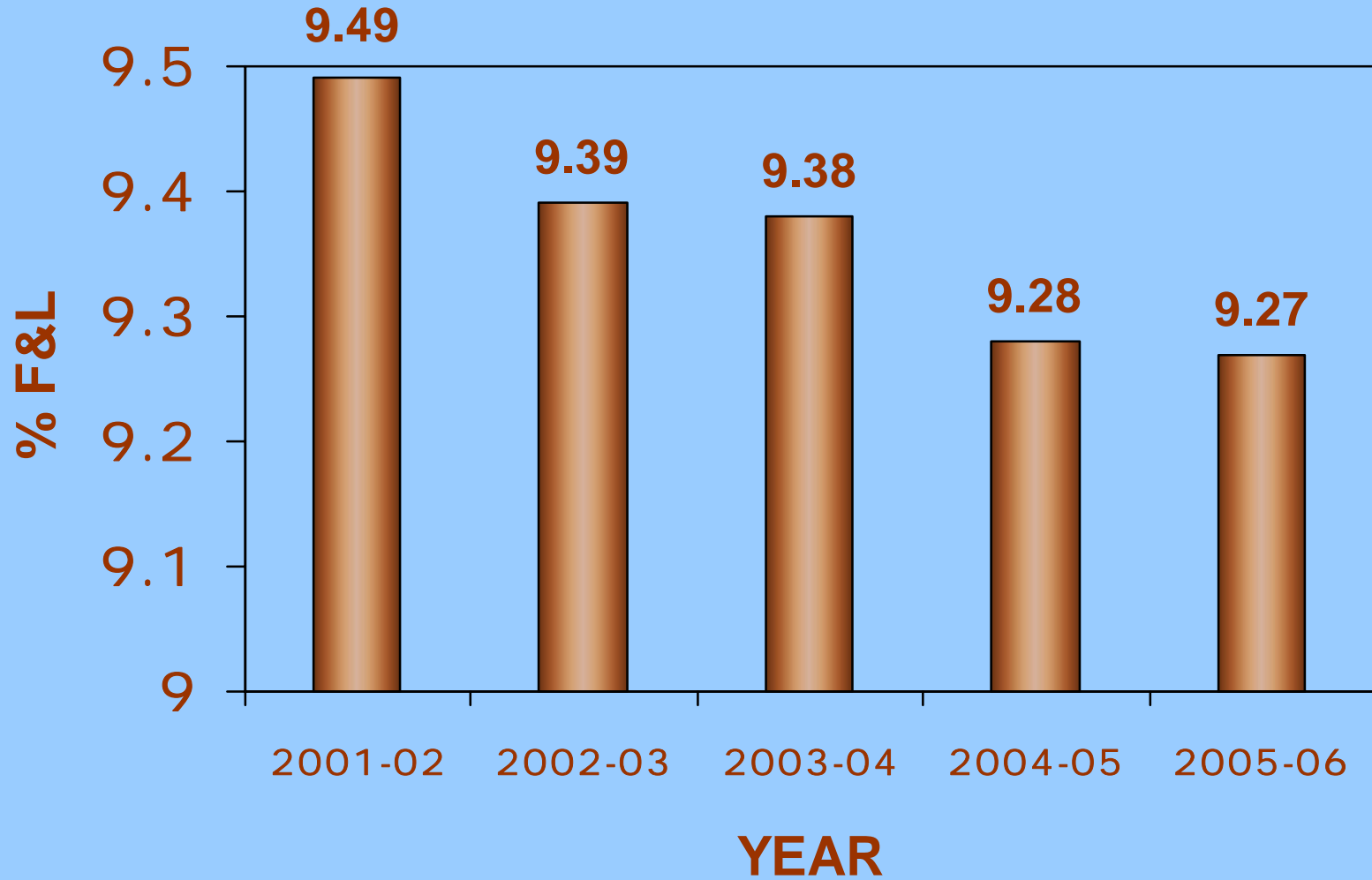
Business Process Management for Sustain / Continuous improvement



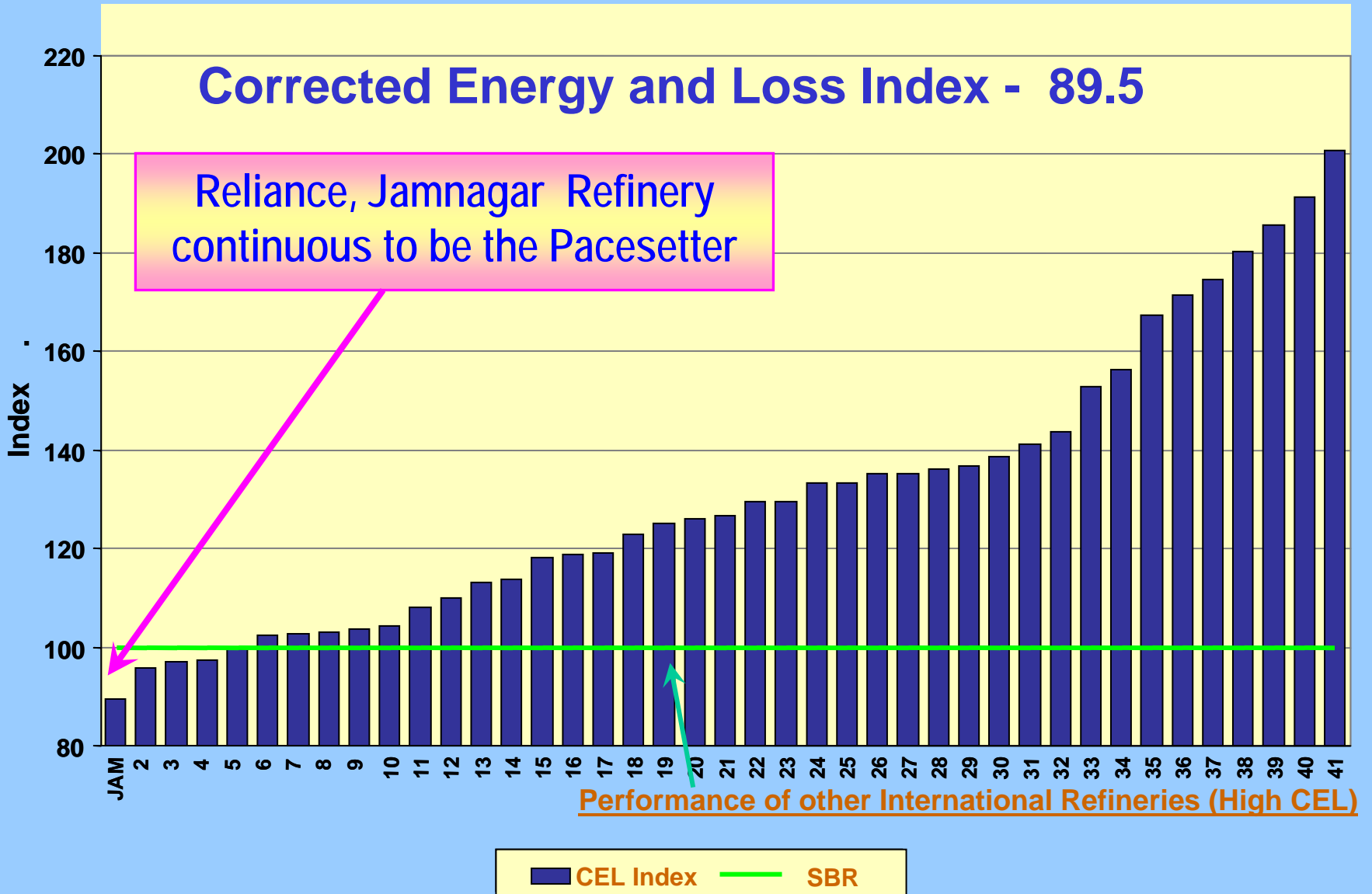
Specific Energy Consumption

Year	Total Fuel & Loss (KT)	Total Intake (KT)	% Fuel & Loss on Intake
2002-03	2867.8	30532	9.39 %
2003-04	2938.0	31330	9.38 %
2004-05	3076.0	33165	9.28%
2005-06	2975.6	32087	9.27%

Site Fuel & Loss (% on Intake) - Trend



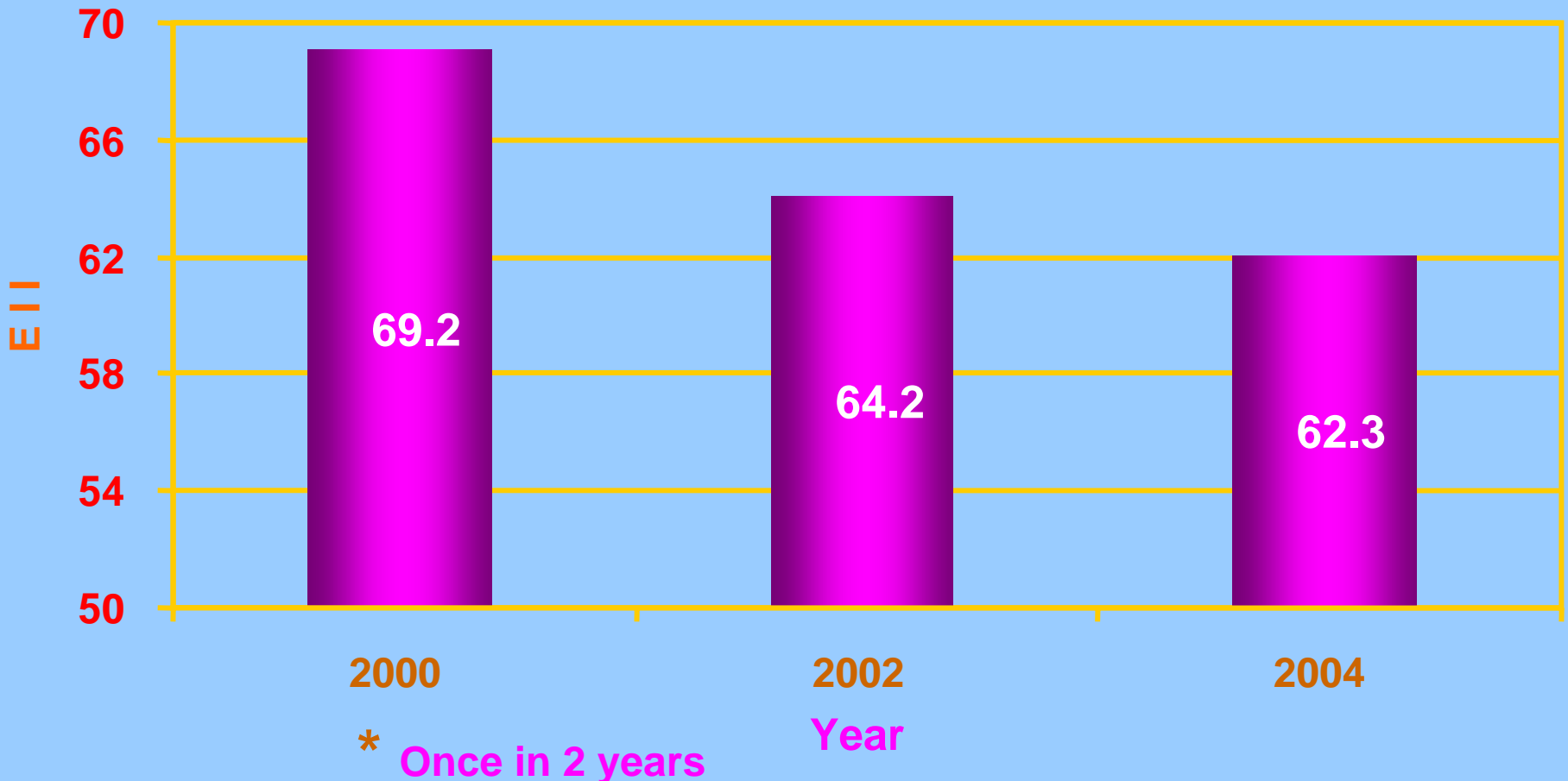
Global Benchmarking - Shell



Global Benchmarking - Solomon

Continuous Improvement - Solomon Energy Benchmarking

Energy Intensity Index (EII – Solomon *) - Trend

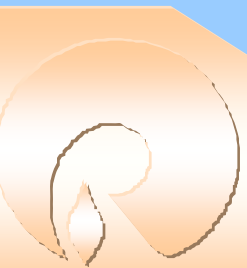


ENCON Awards

- ✓ **CII award for excellence in Energy Management : 2003,04 & 05**
- ✓ **ICMA award for excellence in Energy Management : 2003 & 05**
- ✓ **Federation of Gujarat Industries Award for Excellence in Energy Conservation : 2004**
- ✓ **National Energy Conservation award (Ministry of Power) : 2004 & 05**
- ✓ **Energy Conservation Award – PCRA (MoP&NG): 2004 & 05**

Reliance Jamnagar

Best Practices



Best Practices

ENERGY CONSERVATION EFFORTS AT RIL

- Energy Efficient Designs
 - Heat Pump Compressor in PRU
 - PRT to recover Power from FCC Flue gas
 - Pinch Technology used for Heat Integration
 - CPP running in Co-Gen mode with high Efficiency
- Energy Efficient Operations
 - Online Monitoring of Critical parameters
 - Optimisation of Fuel & Loss

Best Practices

ENERGY CONSERVATION EFFORTS AT RIL

- Online Furnace Monitoring Web page
 - All critical parameters like are monitored online & optimized
 - Furnace Efficiency
 - Excess O₂ in Stack
 - Loss from Stack in terms in MMUS\$
 - % Stack damper opening
- Monthly Calculation of Unit wise Energy Index
- Online Suggestion portal - Website for improving Energy Efficiency/ profit improvement

Best Practices

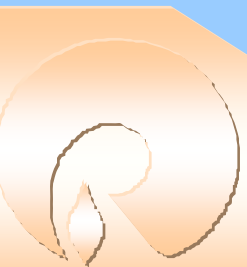
MAJOR ACTIVITIES COMPLETED IN PAST 3 YEARS

- 19 Engineers qualified as Energy Managers/Auditors
- A Study on Energy & Loss by KBC (Benefits identified : 17.9 MMUS\$/Annum)
- PINCH Study on Crude Preheat train completed (Benefits : 3.65 MMUS\$/Annum/train)
- Steam Trap Audit : Savings Rs 36 Lacs /annum
- Steam Leak Audit by CHT/In-house.(Steam loss : 0.044 Tons / Ton of Steam Gen)
- 75% of Engineers trained in Energy Conservation awareness program.
- Data reconciliation model implemented for Steam system

Reliance Jamnagar

ENCON

Innovative Projects



ENCON Efforts – Last 4 years

Year	No. of Projects	Benefit (Rs Cr/Yr)	Capex (Rs Cr)	Payback period (months)
2002-03	10	26.9	13.7	6.1
2003-04	12	87.1	55.4	7.6
2004-05	7	9.7	2.9	3.6
2005-06	4	17.8	8.6	5.8
4 Years span	33	141.5	80.6	6.8

Encon – Jamnagar : Most Successful Project

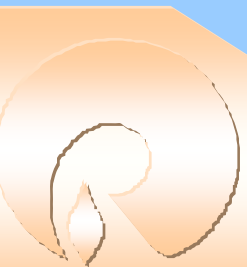
FLARE GAS RECOVERY

- **Objective: Recover the Flare gas to use it as Fuel gas.**
- **Project Study completed by Shell Global Solutions.**
- **Liquid Ring Compressor suggested.**
- **Accordingly Liquid Ring Compressor from GARO selected.**
- **In-house activities for the project includes:**
 - **Detailed engineering of the project,**
 - **Costing estimation,**
 - **Selection of Vendor of the Compressor,**
 - **Seal Drum modifications,**
 - **Erection and Commissioning of the System.**



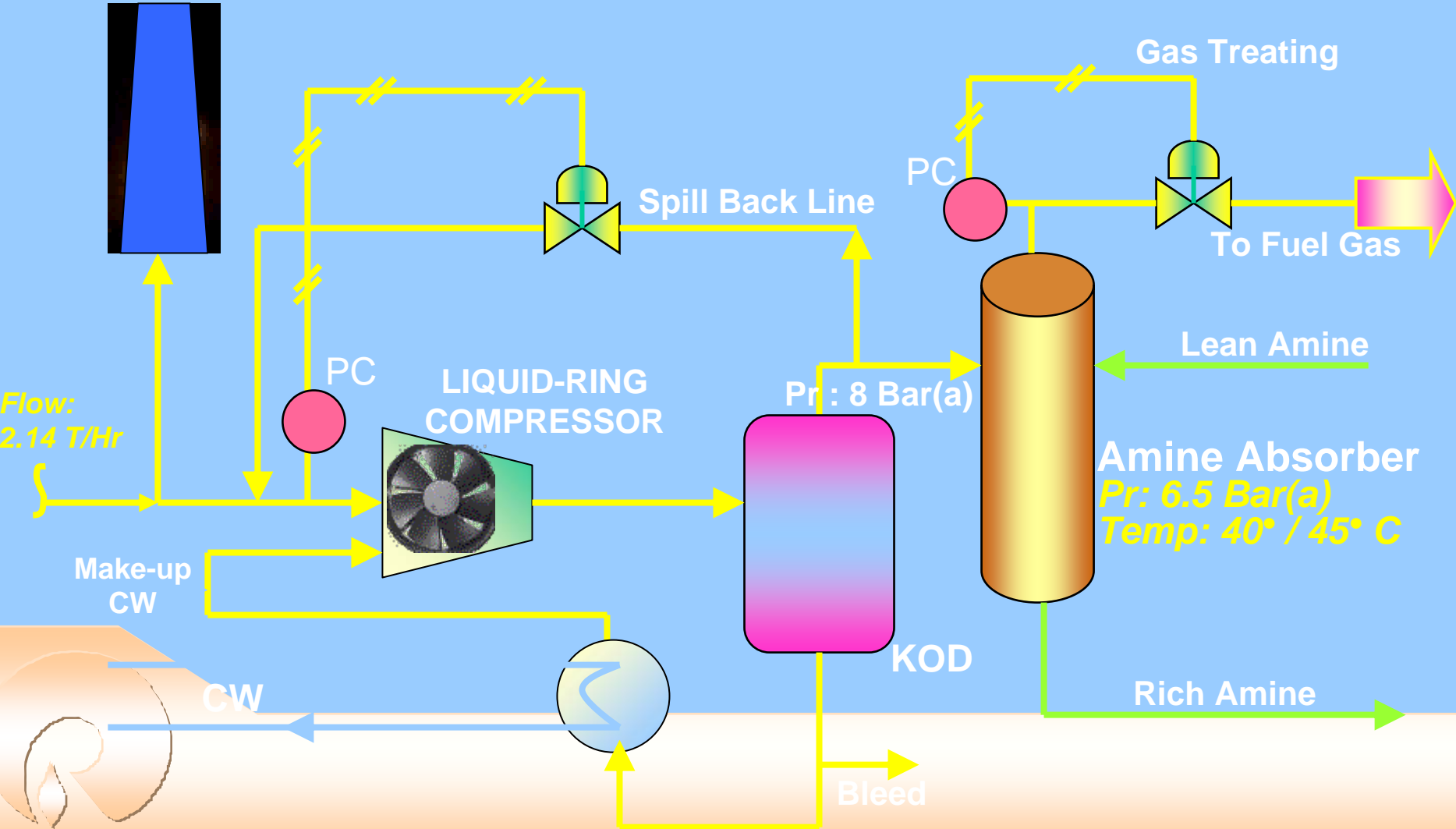
Encon – Jamnagar : Most Successful Project

- **Modifications carried out:**
- **Flare Gas:**
 - **Low Volumetric Flow Rates**
 - **Impurities / H₂S Presence (0.63 to 1.81 Mol %)**
- **Provision of Liquid Ring PD Type Compressor.**
- **Provision of Amine Wash Tower before reuse of Gases in Fuel Gas.**
- **Modification in Seal Drum to raise Water Level from Existing 127 mm to 1000 mm.**



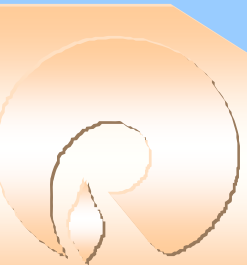
Encon – Jamnagar : Most Successful Project

➤ FLARE GAS RECOVERY (Diagram):



Encon – Jamnagar : Most Successful Project

- **Economics:**
- **Savings:**
 - **Rs. 11.53 Crores / Annum**
- **Investment:**
 - **Rs. 10 Crores**



Encon – Jamnagar : Most Successful Project

COKER BLOWDOWN RECOVERY

- DCU at Reliance is an Eight-drum (29 ft dia) coker with two separate blowdown systems catering for four drums each.
- Coking operation is a semi batch process, which involves various sequential activities between coking and decoking cycle.
- One such activity is steaming & water quenching of hydrocarbons from the coke drum to the blowdown drum for recovery of heavier ends.
- Low pressure operation @ 0.1 Kg/cm²g forces the lighter fractions of hydrocarbons from the blowdown system to be flared .



Encon – Jamnagar : Most Successful Project

➤ COKER BLOWDOWN RECOVERY

➤ Objective:

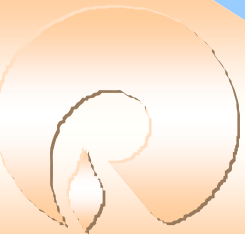
- To Recover the blow-down vent low pressure (0.1-0.15 Kg/cm²g) gas as Fuel

➤ Innovative:

- First time in the history of DCU

➤ Various Options evaluated

- Operate blow-down system at a higher pressure
- Compress blow-down gases using a compressor
- Compress blow-down gases using a Ejector system



Encon – Jamnagar : Most Successful Project

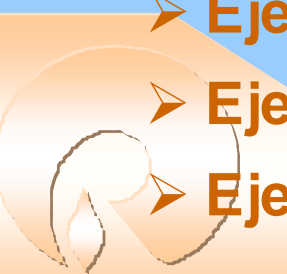
- Operate blow-down system at a higher pressure
 - Would have required modification of operating conditions of blow-down & coke drum section High Capital Investment costs with lower yields
- Compress blow-down gases using a compressor
 - Requires re-circulation line due to wide variation in flow rate of blow-down gases (0 to 6500 Nm³/hr) High Capital & Variable costs
- Compress blow-down gases using a Ejector system
 - A parallel set of four ejectors are used to overcome variation in flow rate of blow-down gases
 - Involves very low capital investment & Operating cost



Encon – Jamnagar : Most Successful Project

- Total package designed in-house by Coker Operations & FDC
- Compress blow-down gases using a Ejector system
 - There are four numbers of ejectors (371J01A/B/C/D). The operating philosophy is to keep one ejector four in manual to continuously suck the off gases into the suction of wet gas compressor.
 - Rest three ejectors are kept on auto at different set pressures to get on & off depending upon the off gas generation from the Blow-down system. Set points are as followed

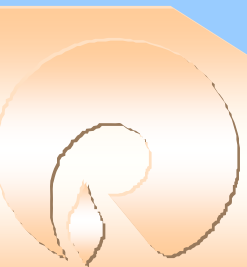
➤	On, Kg/cm2a	Off, Kg/cm2a
➤ Ejector-2 ,	1.085	1.045
➤ Ejector-3	1.1	1.056
➤ Ejector-4	1.2	1.06



Encon – Jamnagar : Most Successful Project

➤ COKER BLOWDOWN RECOVERY:

- Flaring From Coker Reduced by 95.4%.
- Benefit = Rs 15.75 Crores per Annum
- Investment = Rs 0.90 Crores per Annum
- Payback = Less than one month



Environmental Projects

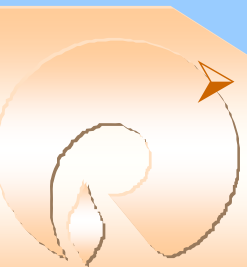
CDM – A new business initiative

Sr. No.	Project Activity Description	Annual CER (MT of CO2)	Benefit Rs Lacs/annum
1	Rerouting of Sat Gas Con Stripper off gases directly to Primary absorber feed, by passing HP receiver in CDU .	28,000	62
2	Fuel Gas firing in Gas Turbines	70,000	154
3	Main Flare Gas Recovery	49,000	108
4	Blow-down Gas recovery from Coker	45,000	99
5	Routing of rich amine flash gases in VGO HT to ATU sat gas absorbers	17,000	37
6	Re-routing of LPG Merox gases to combustion air in CDU-2 (to enable disposal of VDU off gases in furnaces)	18,000	40
7	Inlet air fogging in Gas Turbines in CPP	94,000	207
	Total	321,000	706

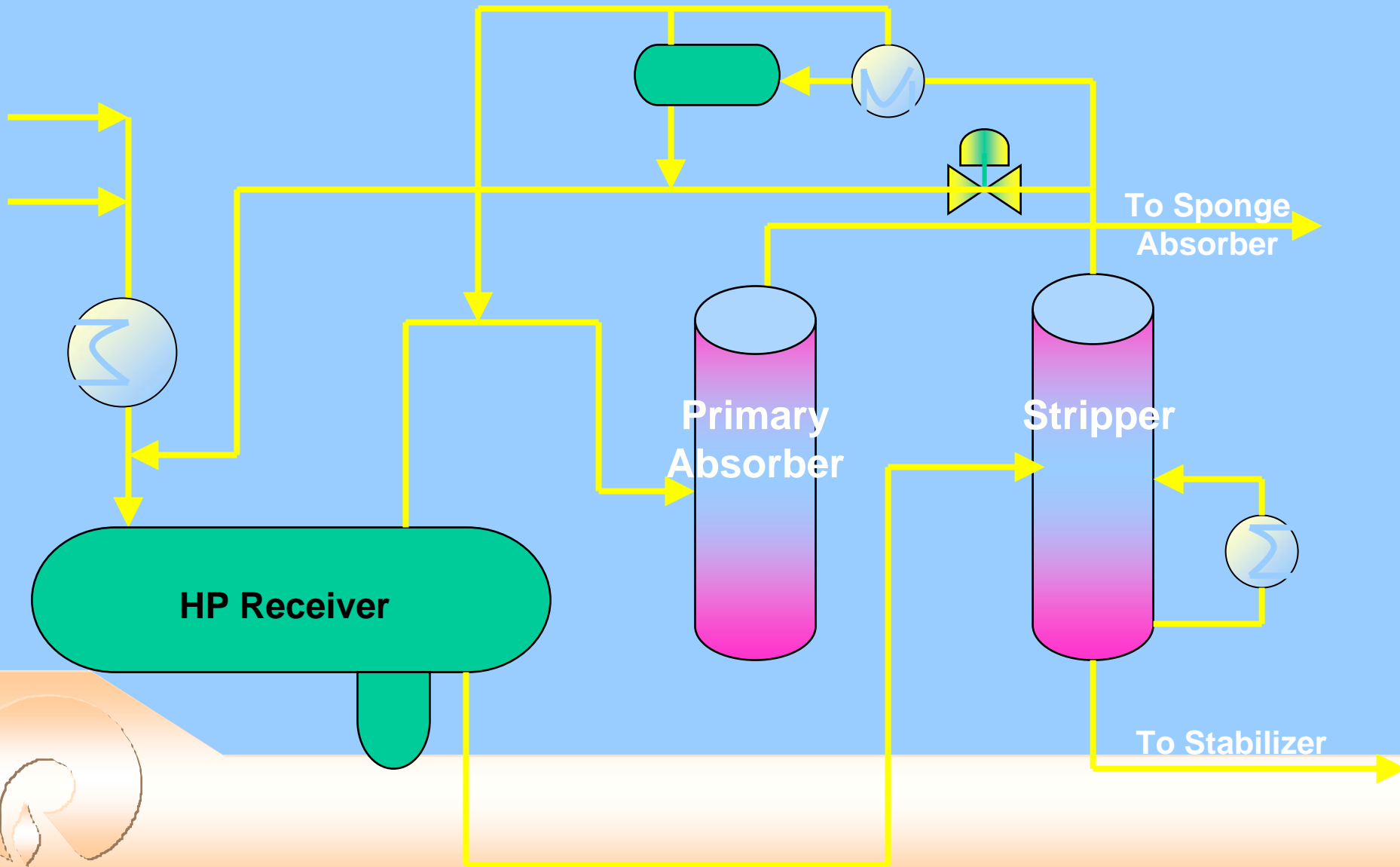
Sr. 1 is registered with UNFCCC

REGISTERED CDM PROJECT

- STRIPPER OFF GASES TO PRIMARY ABSORBER (BYPASS HP RECIEVER) IN CRUDE UNIT.
- Earlier Scheme:
 - The Overhead vapour from the Stripper Column (mainly C1,C2,H2S with small qty of C3/C4's) was recycled back to the HP receiver. These gases get reabsorbed in HP receiver liquid and get recycled again to stripper increasing the Stripper Reboiler load.
 - Revised Scheme:
 - To reduce the recycled load to the Stripper, the ovhd vapour was directly routed to the Primary Absorber via a new condenser.
 - Cooling is required to reduce the water content of the Vapours going to the Primary Absorber (prevent condensation of water in Absorber)



- **Stripper gases bypassed HP receiver and routed to Primary Absorber in Crude unit**



Thank You

