

Demonstration Test Result for High Pressure Acid-gas Capture Technology (HiPACT)

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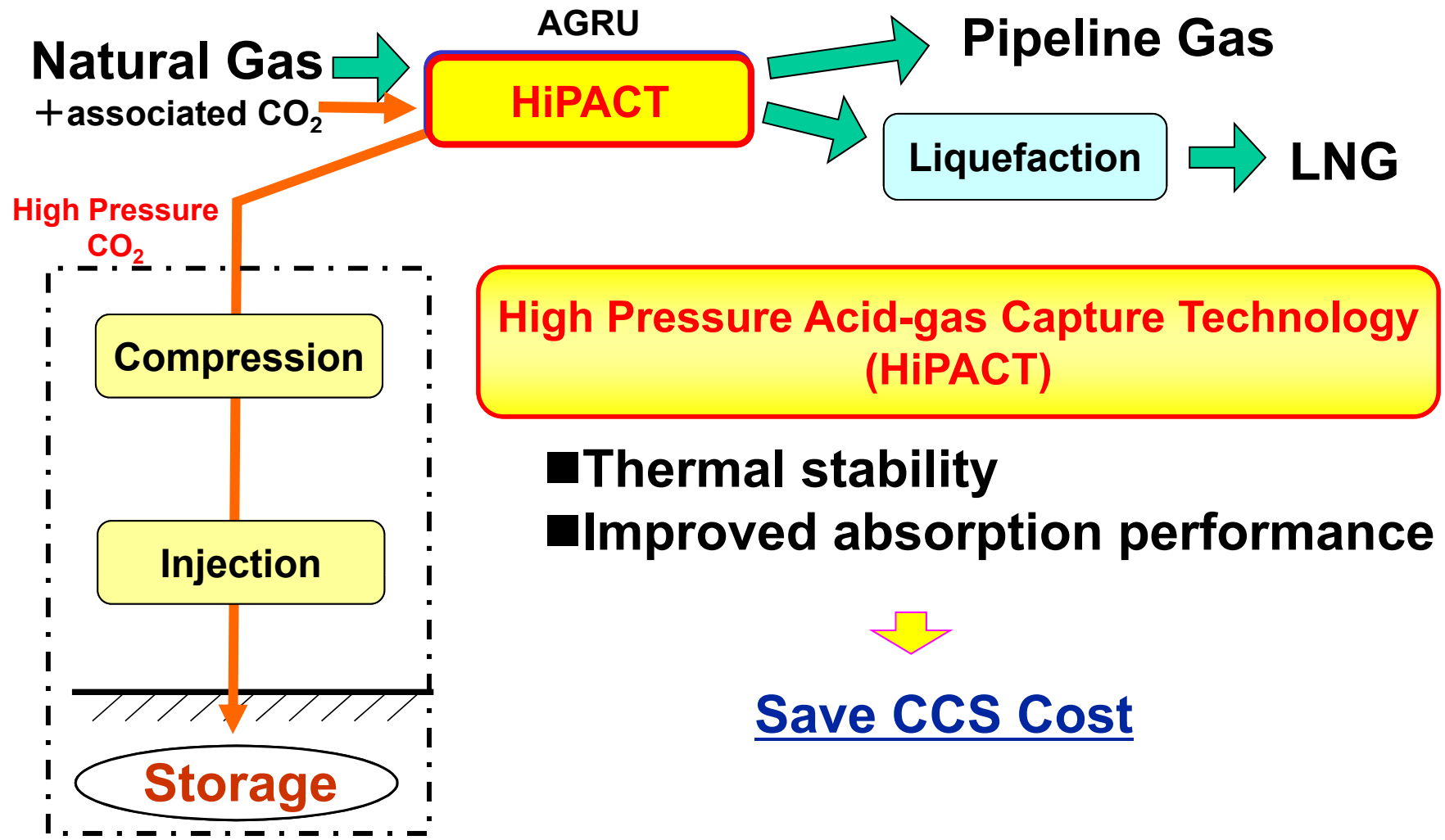
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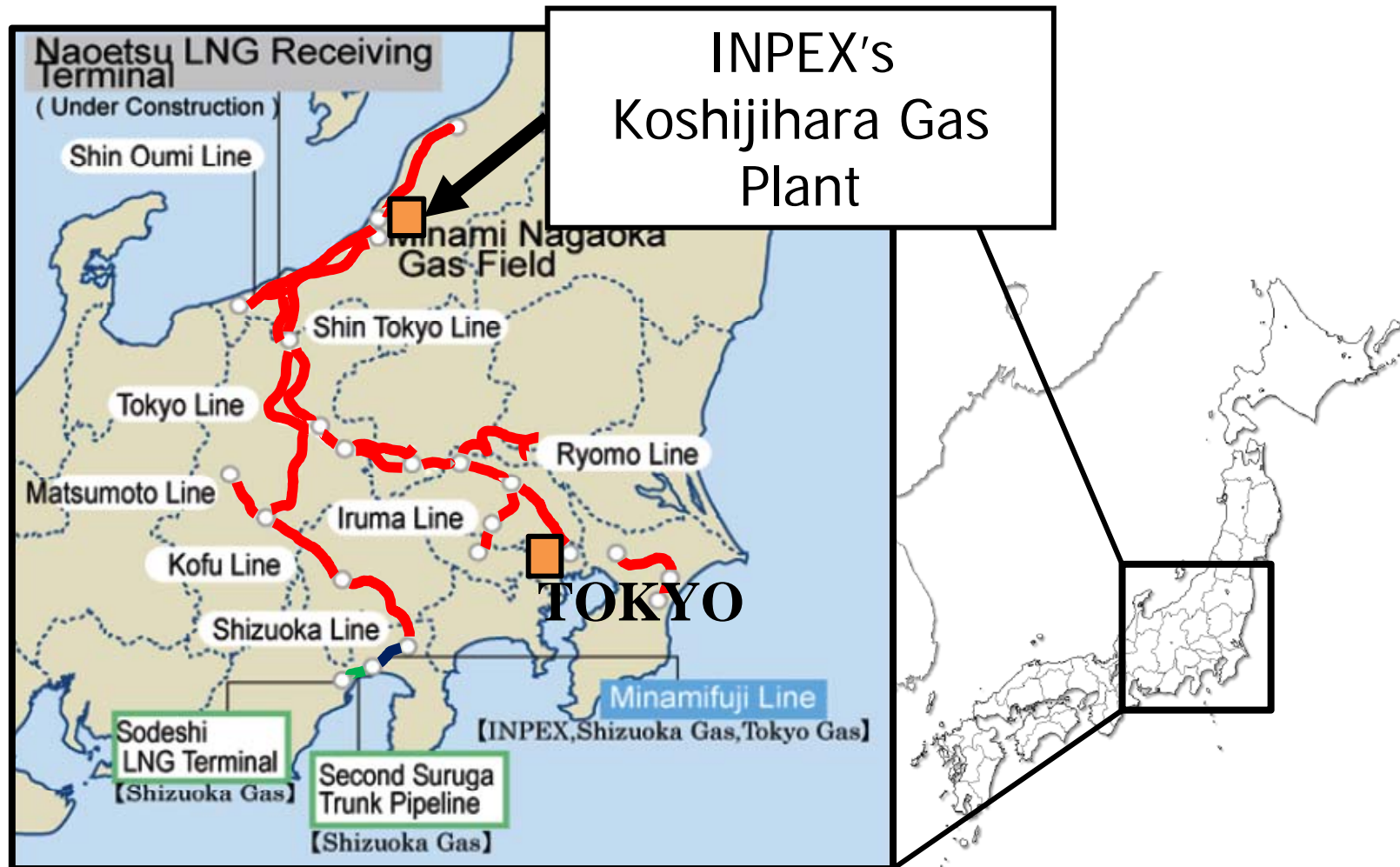
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Outline of HiPACT Concept

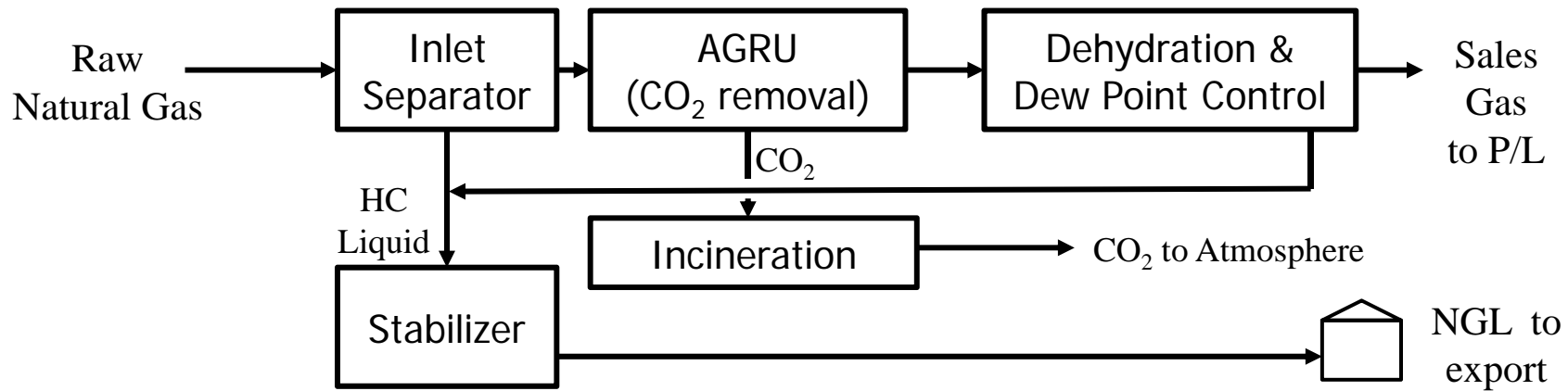


The Koshijihara Gas Plant (1/2)



The Koshijihara Gas Plant (2/2)

Operation with various solvents



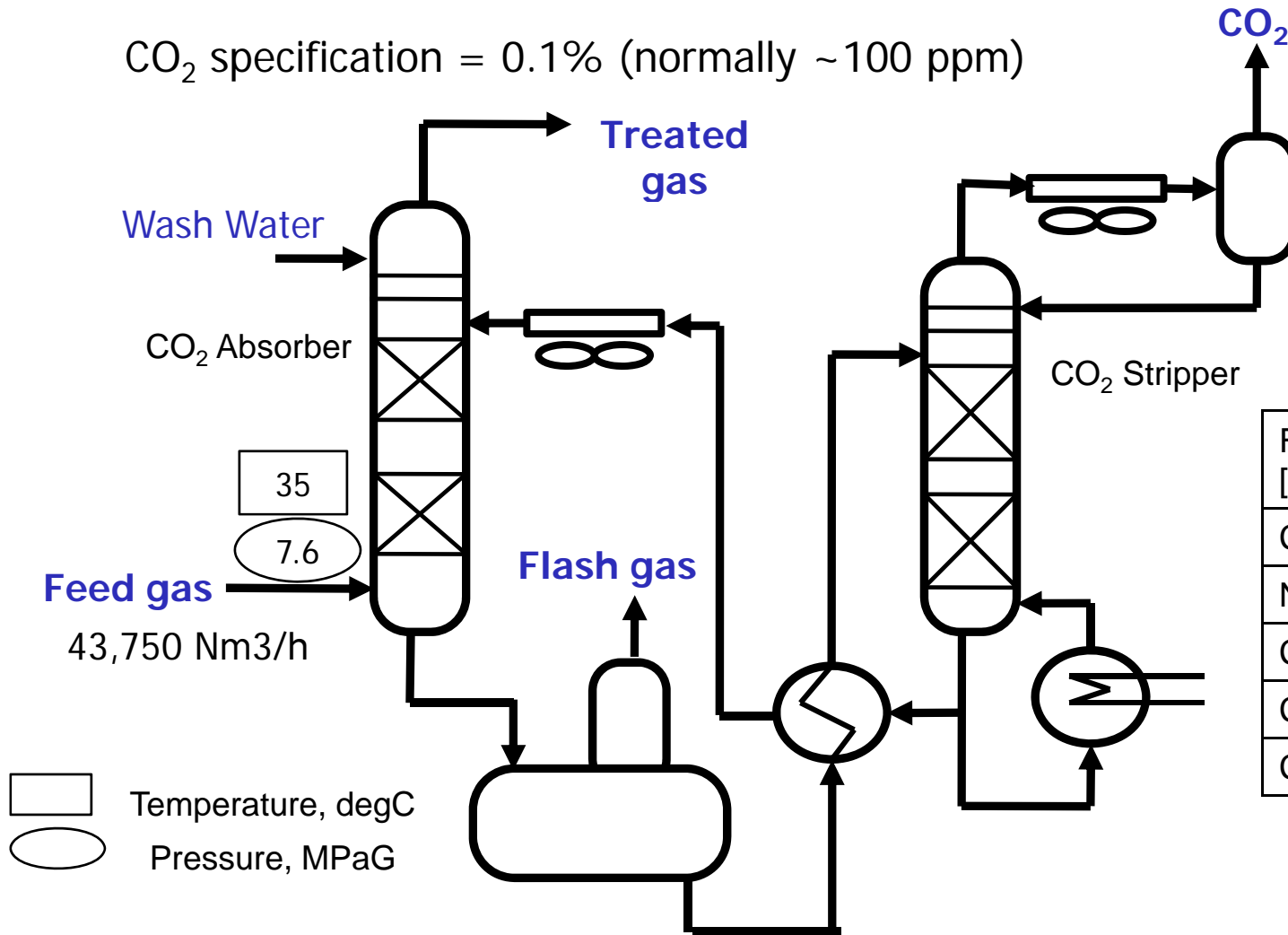
Natural Gas Production Capacity [Nm ³ /d]		
Koshijihara Plant	Train-A	950,000
	Train-B	950,000
	Train-C	1,900,000
Oyazawa Plant		1,500,000
Total (Minami Nagaoka Gas Field)		5,300,000

AGRU Solvent

15 years: DGA[®]
 10 years: OASE[®] purple
 2 months: HiPACT

Feed Gas Conditions and Set-up

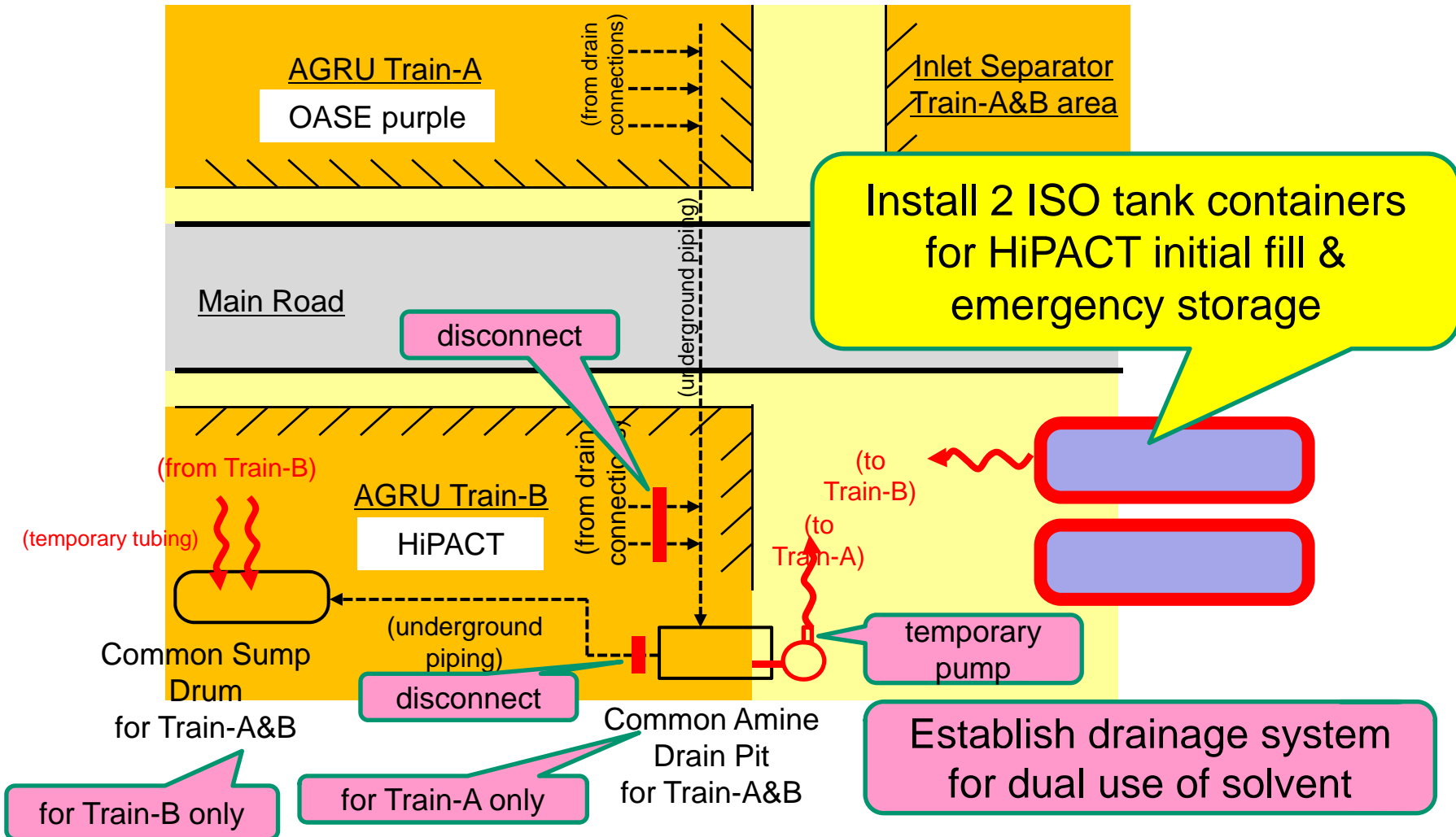
CO₂ specification = 0.1% (normally ~100 ppm)



Feed Gas Composition [mol%-dry]	
CO ₂	6.49
N ₂	2.03
C1	82.05
C2	5.25
C3+	4.18

Modifications in the Koshijihara Plant

for temporary use of HiPACT



Test Runs

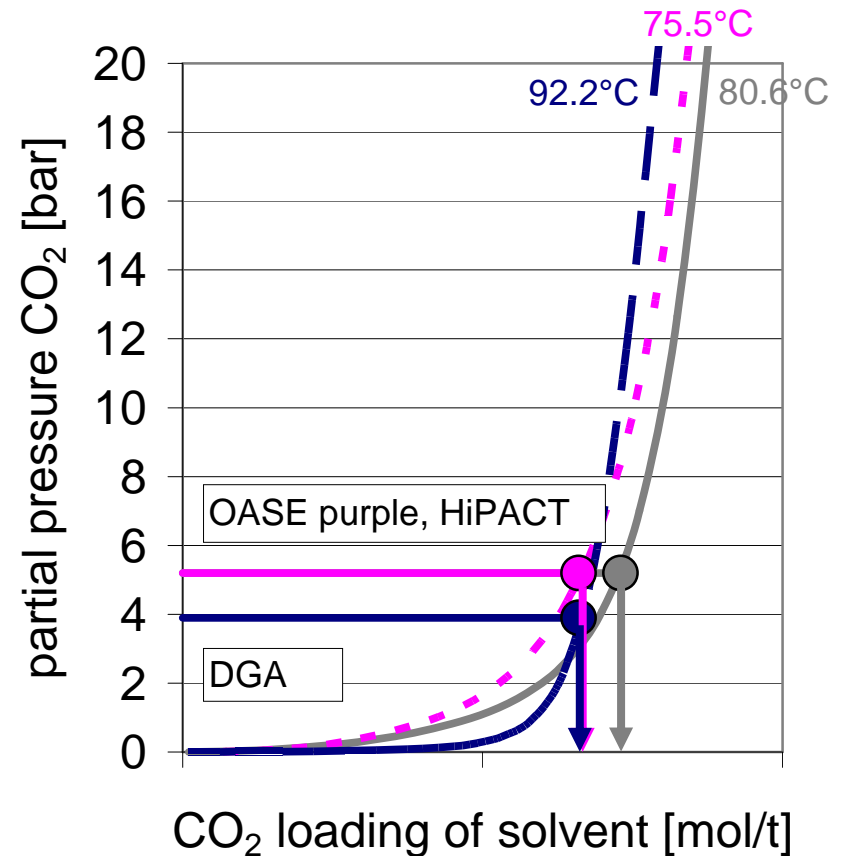
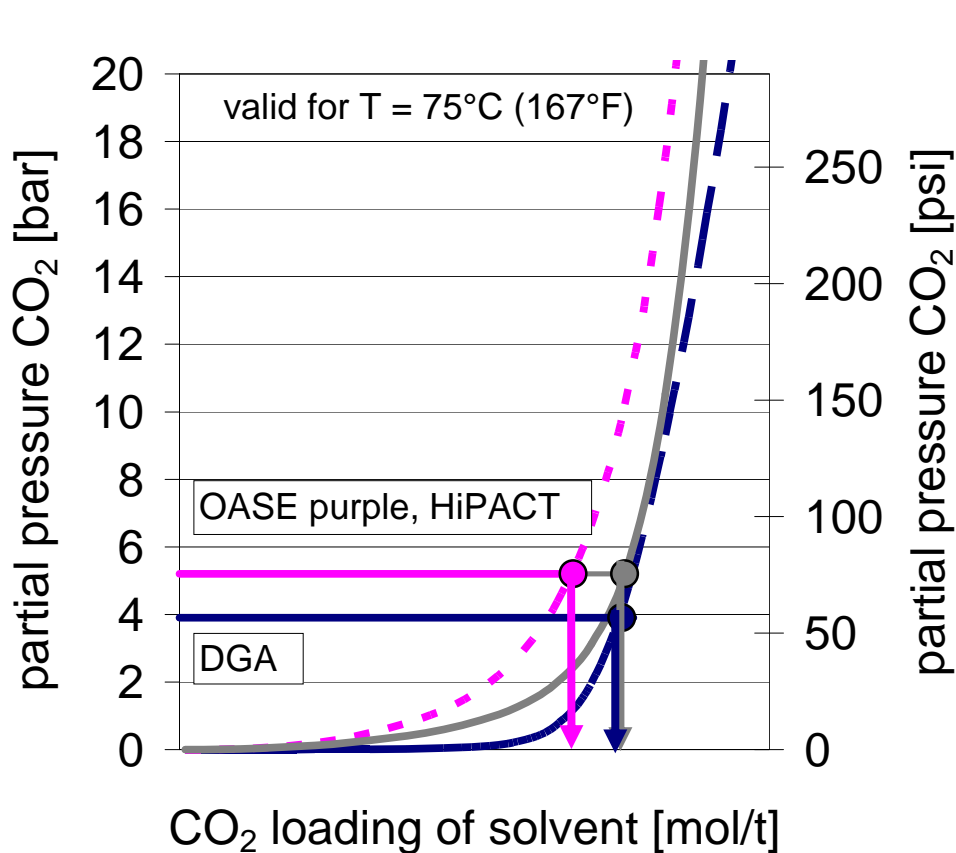
– HiPACT Demonstration Test Parameters



Run	Description	Solv. wt%	Reb. duty	Circ. rate	Lean temp	Regen. Press.
#1	Solvent strength	+10%	Adjusted			
#2	HiPACT Base		Base		Base (53°C)	
#3	Reboiler duty (reduced)		-13%			1.4bara
#4	Lean amine temp.	Base	Base	Base	50°C	
#5					45°C	
#6					55°C	
#7					Base (53°C)	
#8	Regenerator pressure					Base

CO₂ Equilibrium Capacity

DGA, OASE purple and HiPACT



Absorber Bottom Conditions

DGA, OASE purple and HiPACT

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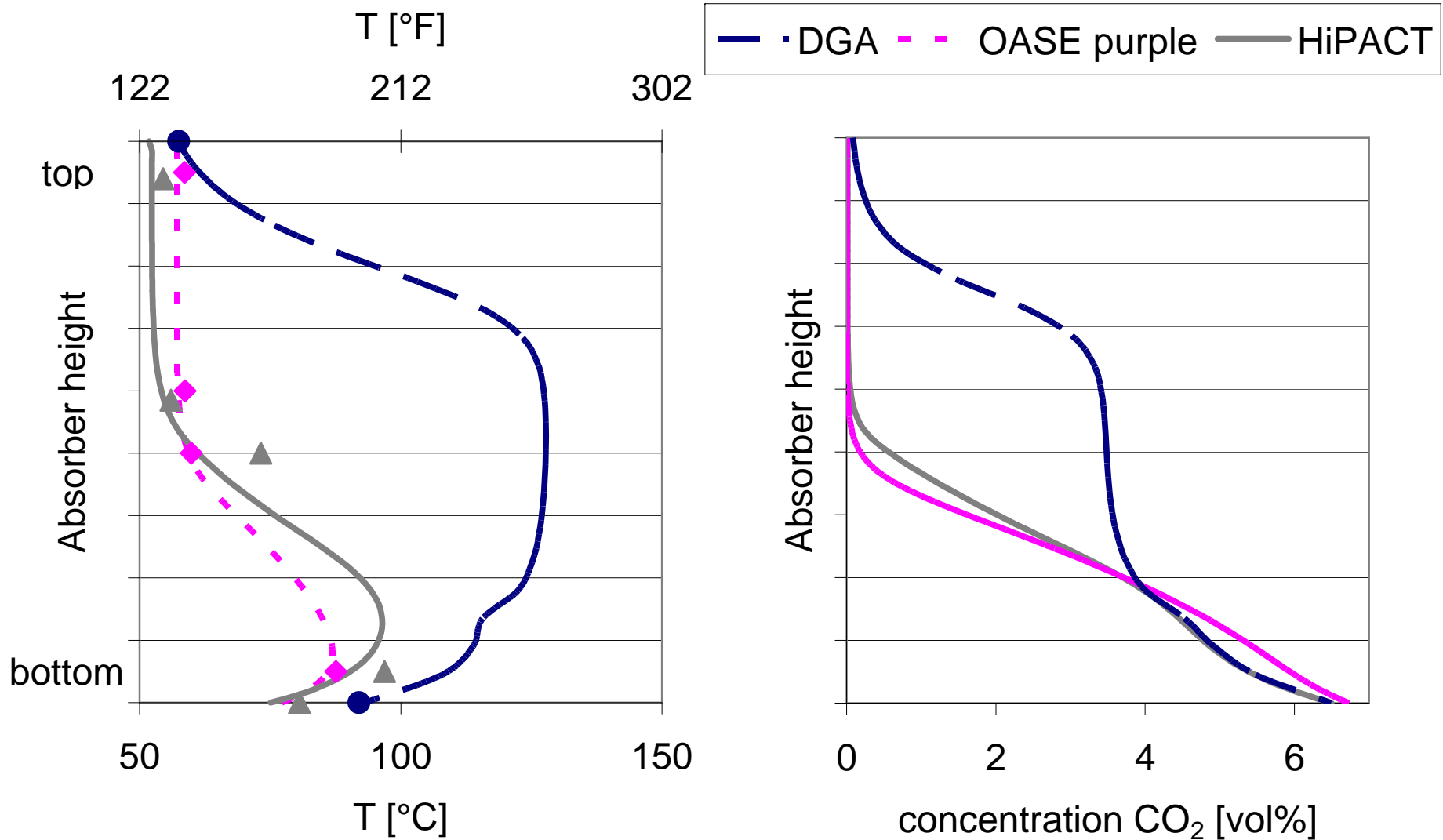
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		DGA	OASE purple	HiPACT
Temperature	[°C]	92	75.5	80.6
	[°F]	197	168	177
CO ₂ partial pressure	[bara]	3.9	5.2	5.2
	[psia]	57	75	75
Feed gas flow rate	[Nm ³ /day]	800,000	1,033,000	1,033,000
	[MMSCFD]	29.8	38.5	38.5
Specific lean solvent circulation rate*	[%]	100	135.8	108.1

$$* \text{ specific lean solvent circulation rate} = \frac{\left(\frac{\text{solvent flow [t/hr]}}{\text{captured CO}_2 \text{ [t/hr]}} \right)_{\text{solvent}}}{\left(\frac{\text{solvent flow [t/hr]}}{\text{captured CO}_2 \text{ [t/hr]}} \right)_{\text{DGA}}}$$

Absorber T and CO₂ Profile

DGA, OASE purple and HiPACT



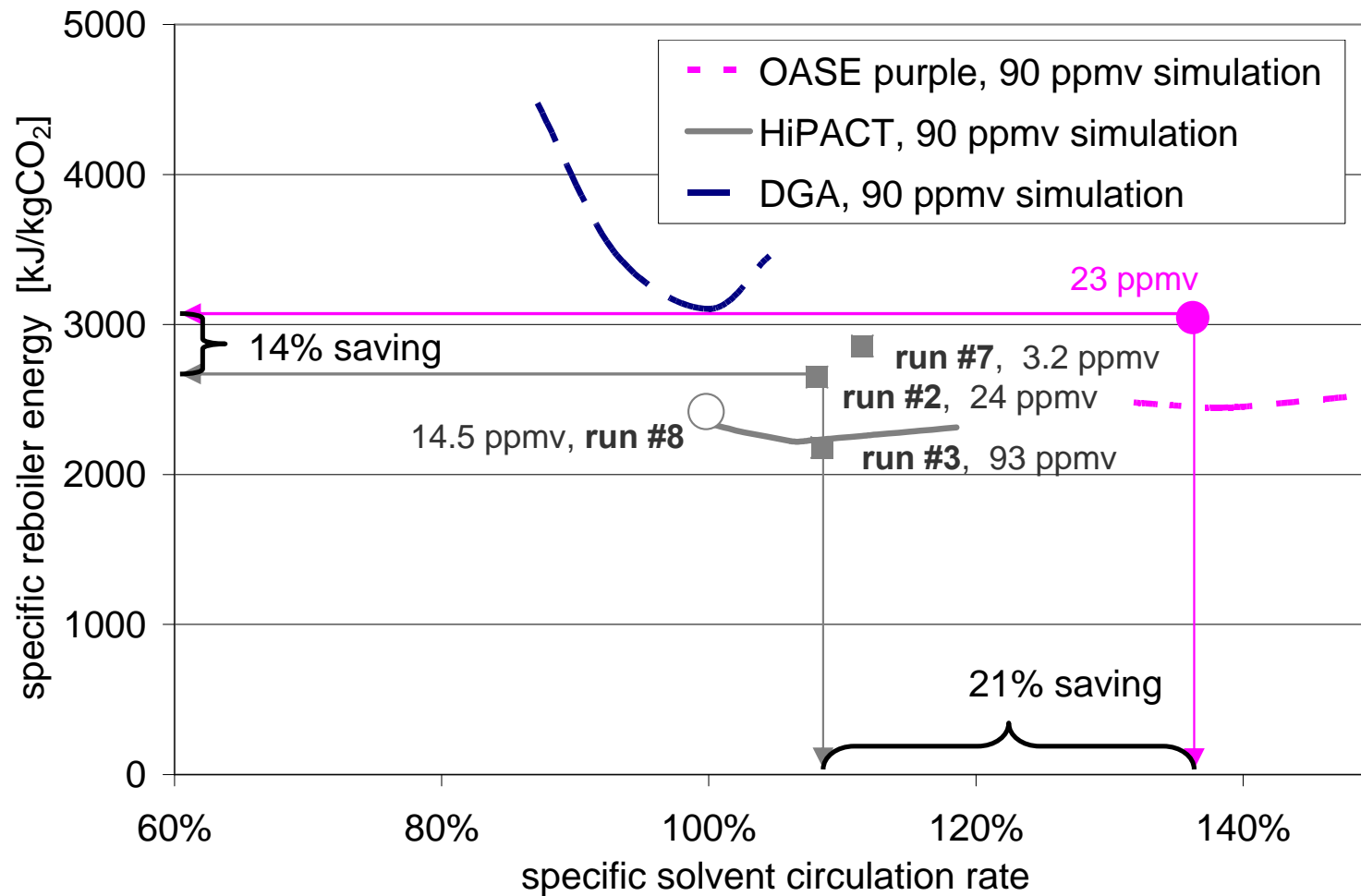
Reboiler Duties

DGA, OASE purple and HiPACT

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Solvent Losses at Absorber Overhead with standard design for backwash section

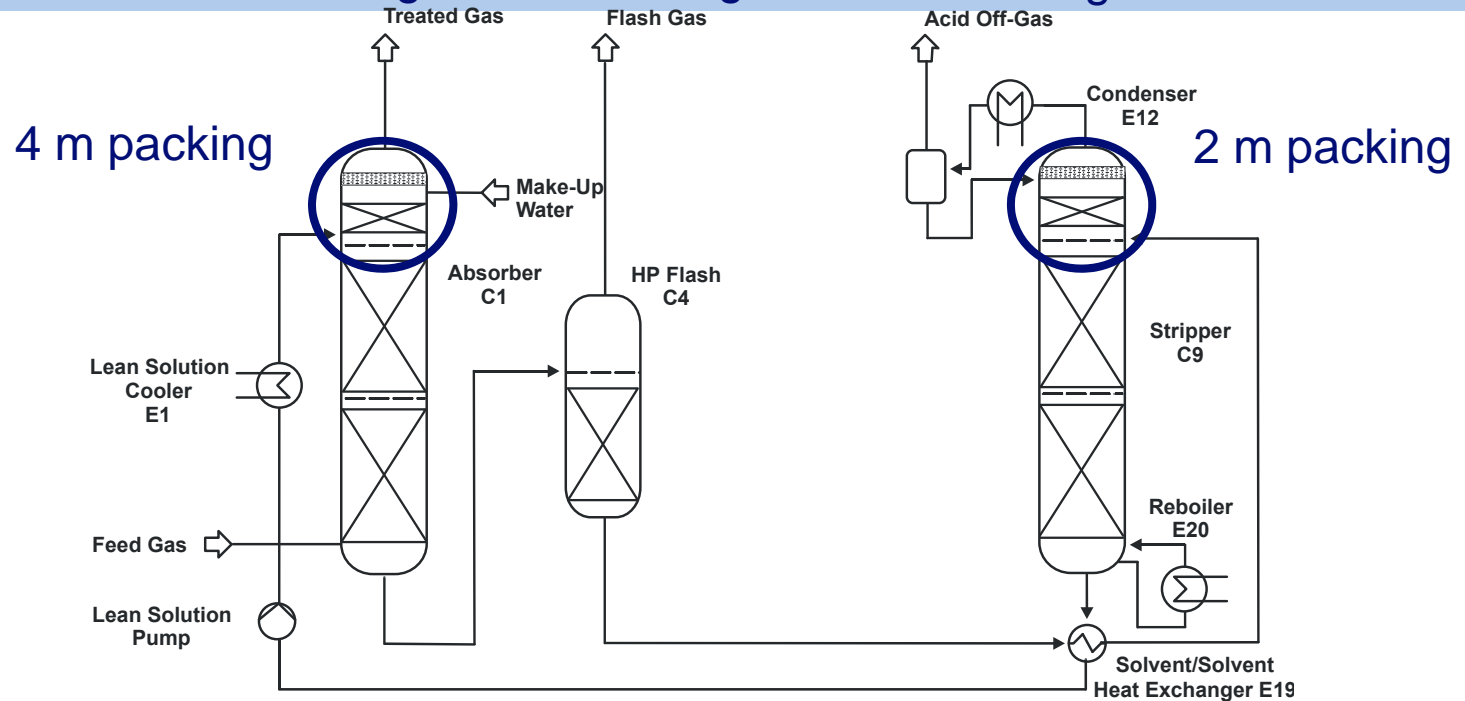


		Expected accuracy	Measured solvent loss [mg/m ³]
1.	On-line sampling of treated gas	-	10-25
2.	Solvent accumulation in the DEG unit + emissions solvent from the DEG unit	0	60-100
3.	Decrease of solvent inventory/solvent make-up rate	+	75
4.	Change in the ratio between base solvent and activator	0	70-140

→ Measured values (60-140 ppmv) ≈ simulated value of 91 mg/m³

Optimized Backwash Section Design

Solvent concentration	1.3 mg/Nm ³	33 mg/Nm ³	0.03 mg/Nm ³
Solvent loss	0.05 kg/hr	< 0.001 kg/hr	< 0.001 kg/hr



- Expected annual solvent loss: 0.4 mt \approx 1.6% of an initial solvent fill
- ➔ Improved design will bring losses down to acceptable level

HiPACT Advantages

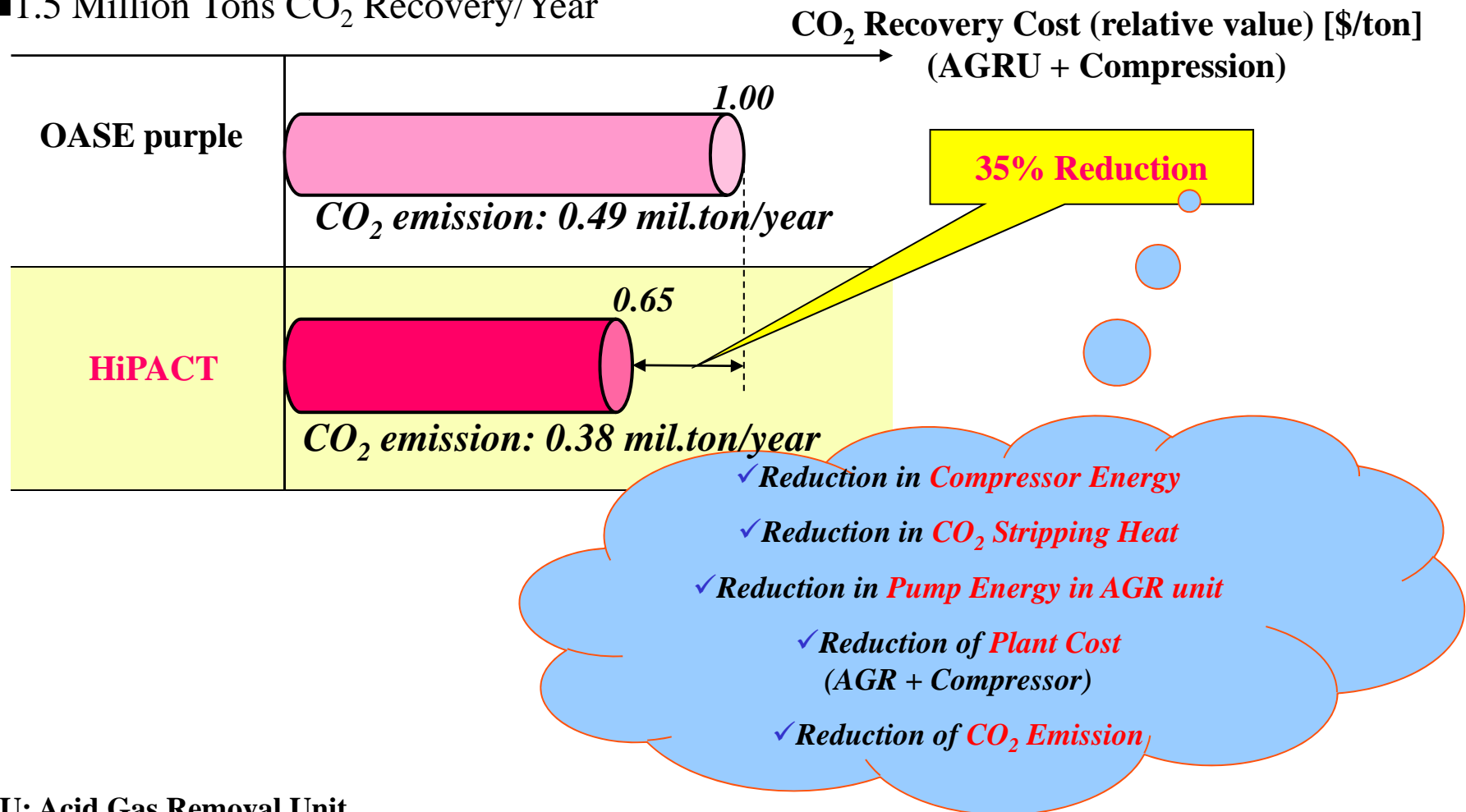
Case study - Grassroots

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- Grassroots Natural Gas Plant with CCS
- 1.5 Million Tons CO₂ Recovery/Year



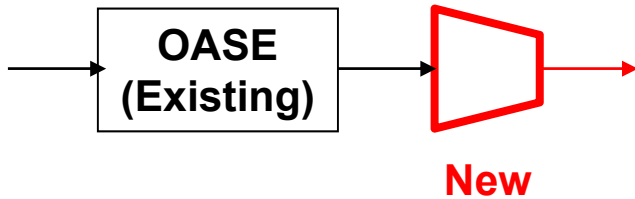
AGRU: Acid Gas Removal Unit

HiPACT Advantages

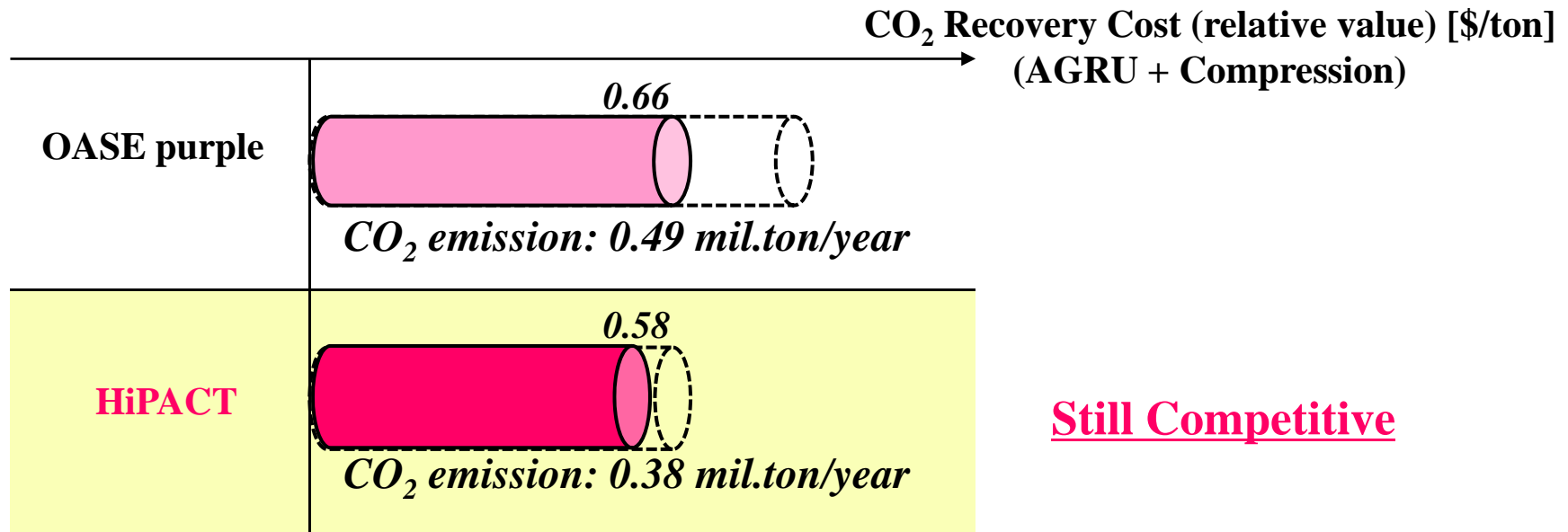
Case study – revamps of existing plant



<OASE purple case>



<HiPACT case>



Summary

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- The Koshijihara plant was successfully operated with DGA, OASE purple and HiPACT
- Compared to OASE purple, HiPACT
 - ➔ shows \approx 10-20% reboiler savings
 - ➔ needs 20-27% less solvent flow rate
- The HiPACT solvent
 - ➔ is non corrosive
 - ➔ shows no degradation
 - ➔ requires decent backwash section
- A case study suggests that swapping conventional technology to HiPACT offers an economical option when implementing CCS

