

The
NZ Road _{to}
Cleaner
Air

A Refinery Plans for the Future

The New Zealand Refining Company
Limited (NZRC)

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Presentation Structure

- NZRC Company Background
- NZRC's Response on Product Quality
- Key Product Qualities
- Refinery Wide Technical Study
- Conclusion - Business Impact

Company Background



- NZRC is an NZ Stock Exchange Listed Company
- 27% of Ownership Is With Independent Investors
 - Oil Companies Hold Remainder
- NZRC offers an oil refining service to its customers - “Toll Processor”
- NZRC is NZ’s only Oil Refinery
 - Initial operations in 1965 - Expanded in 1984
- NZRC supplies about 83% of NZ’s oil product requirements

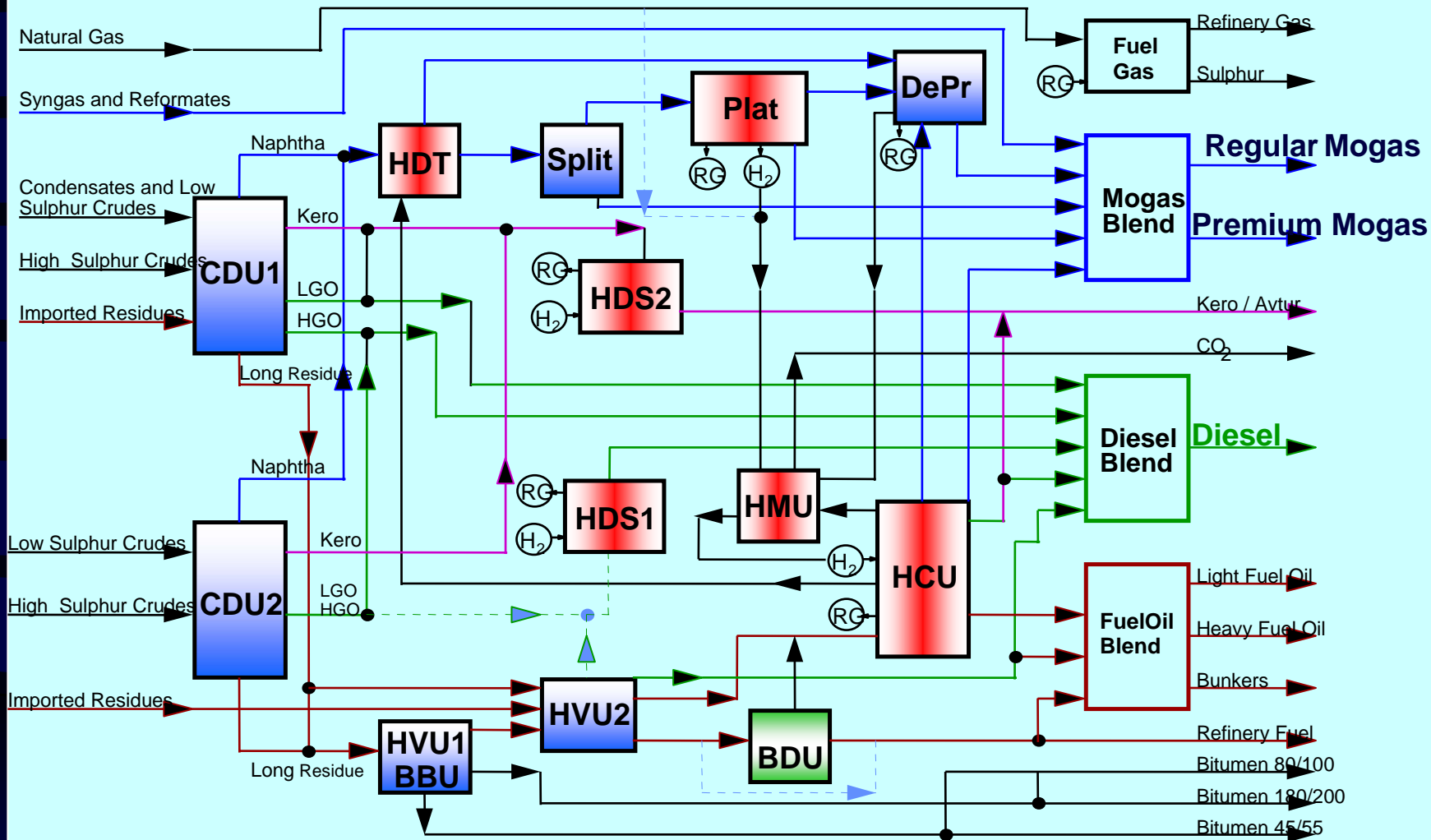
NZRC's Response on Product Quality

- Product Qualities will change
- NZRC has Taken a Proactive Approach
 - Meetings with Government
 - Meetings with Stakeholders
 - Technical Capability Studies
- With the Objective of
 - Orderly and Structured Transition
 - Minimum Supply/Distribution Impacts

Key Product Qualities

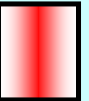
- Mogas
 - Benzene
 - Aromatics
 - Olefins
 - Sulphur
 - Vapour Pressure
- Diesel
 - Sulphur
 - Cetane
 - Density
 - Distillation

Marsden Point Refinery - Simplified Line-Up




Distillation


Liquid
Extraction


Catalytic
Reaction

Refinery Wide Technical Study

- Study carried out in 2000 at cost > \$1 mln
- Purpose of Study Was to Identify
 - Technical Feasibility of Meeting Future Specifications
 - Cost of Any Changes / Additions Required
 - Timing Constraints
 - Impacts on Income, Fuel Balance, CO₂.

But what specifications should be used?

Refinery Wide Technical Study

Scenario Approach

- Scenarios Were Developed
- Key Differences
 - Timing
 - Extent of convergence to Euro IV / WWFC specifications
- Options Were Assessed for Robustness Against These Scenarios

Refinery Wide Technical Study

Refinery Configuration Impacts

Refinery #'s and Status in Australasia	Hydrocracking Configuration		Cat Cracking Configuration	
	NZRC		1 refinery	6 refineries
	Stronger	Weaker	Stronger	Weaker
Mogas	Low Sulphur No Olefins	Aromatics Benzene Octane	Low Aromatics Octane Boosting Potential Benzene Dilution	Sulphur Olefins
Diesel	Low Sulphur Low Density High Cetane			Sulphur Density Cetane Distillation

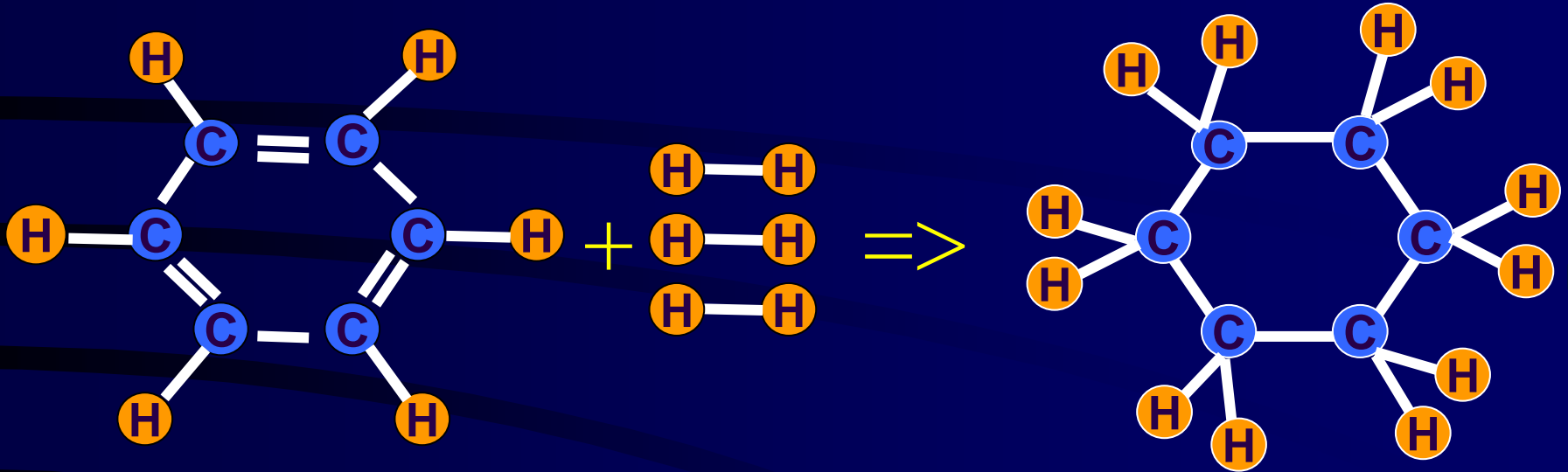
Key Issues 1 - Mogas Benzene

- Where does Benzene come from?
 - naturally occurring in crude oil
 - produced in Platforming[®] process
- Current and likely future specifications?
 - 5% wt (4.3% vol) => 3% vol => 1% vol

How to Reduce Benzene?

Refinery Wide Technical Study

Mogas Benzene Reduction



Benzene + 3*Hydrogen \Rightarrow CycloHexane

But how?

Refinery Wide Technical Study

Mogas Benzene Reduction



- NZRC cannot remove benzene now
- One Industrial Scale Option is Catalytic Distillation

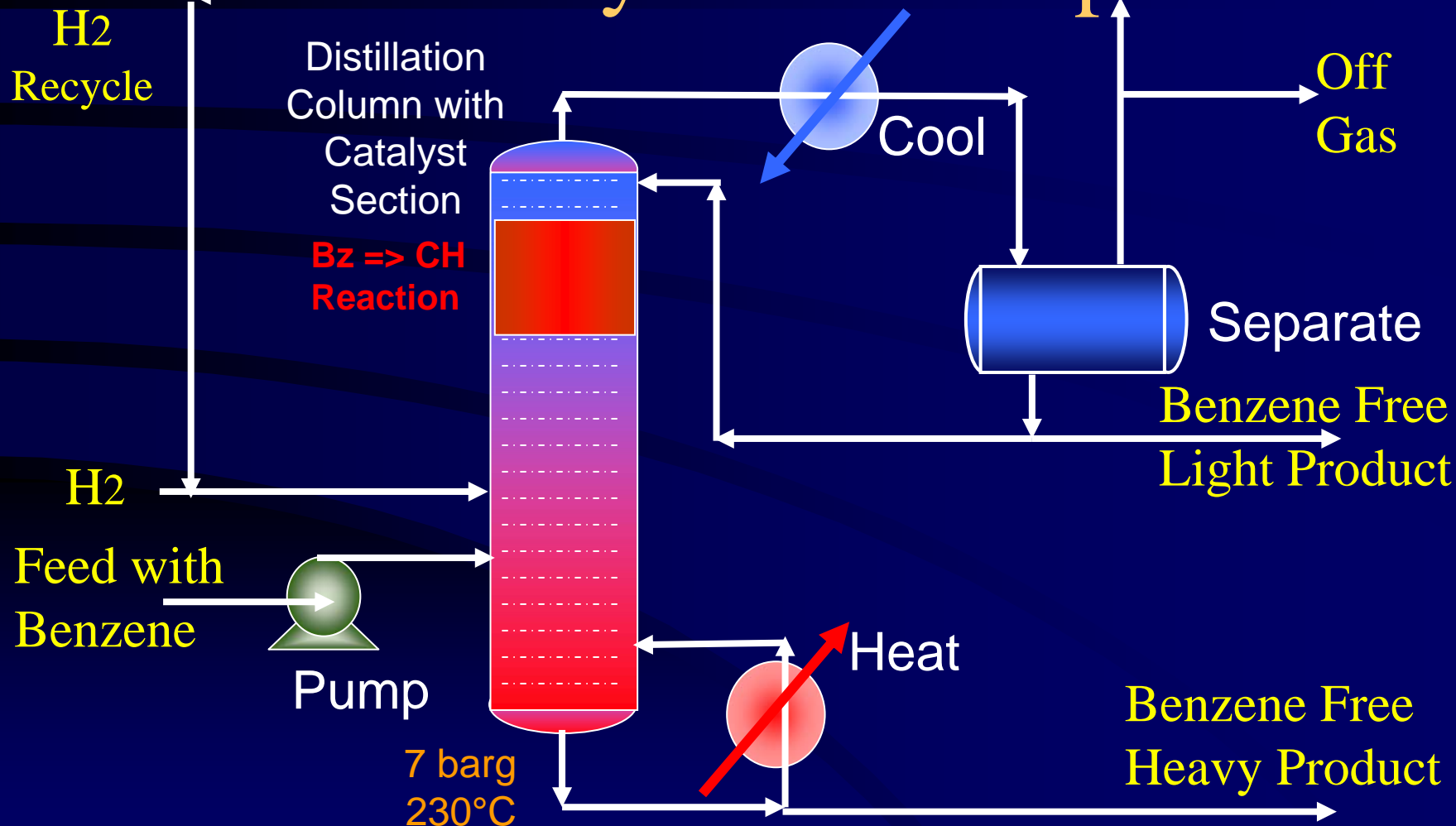
“CD-Hydro”



- Cost Estimate 12-16 US\$ million [derived from NPRA paper AM-97-27]
- Time to construct 3-4 years
- Octane loss resolved through imported blendstock

Refinery Wide Technical Study

CD-Hydro Line Up



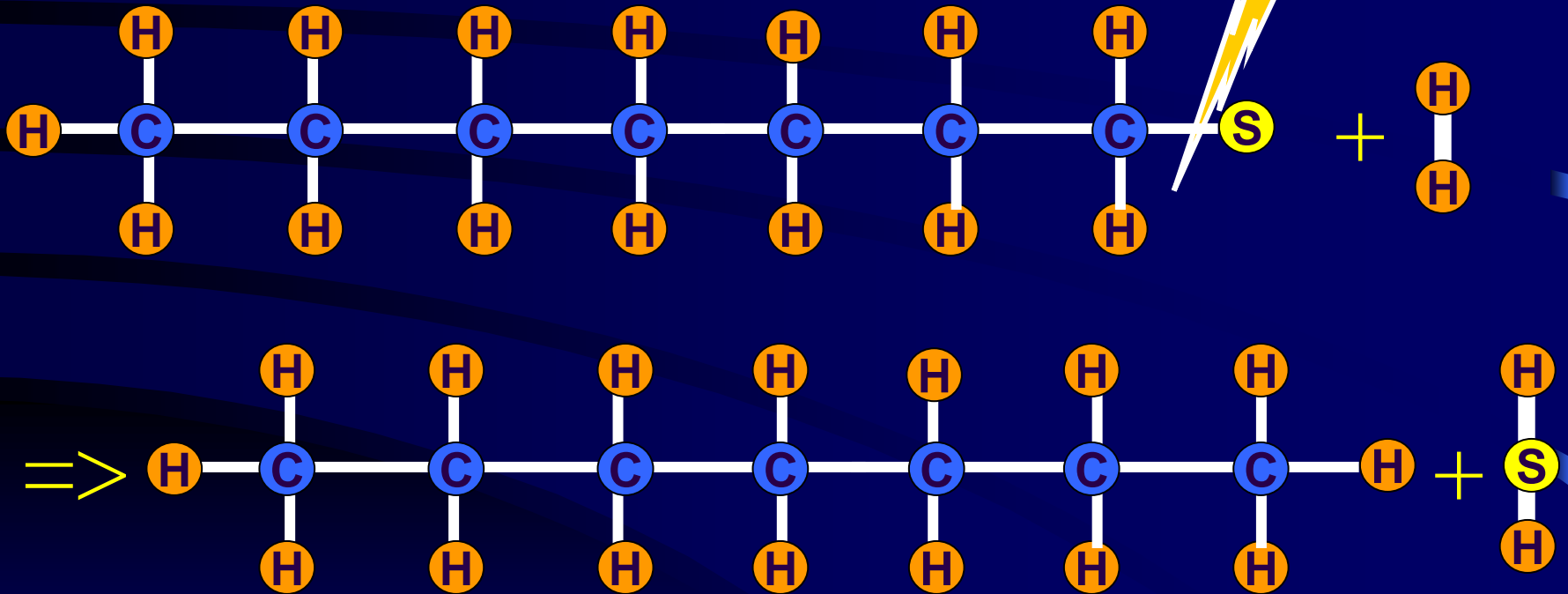
Key Issues 2 - Diesel Sulphur

- Where does Sulphur come from?
 - naturally occurring in crude oil
- Current and likely future specifications?
 - 0.3% wt => 0.05% wt => 0.005% wt => ??
 - (3000ppm => 500ppm => 50ppm => ??)

How to Reduce Sulphur?

Refinery Wide Technical Study

Diesel Sulphur Reduction



S contaminated HC + Hydrogen \Rightarrow HC + H₂S

But how?

Refinery Wide Technical Study

Diesel Sulphur Reduction



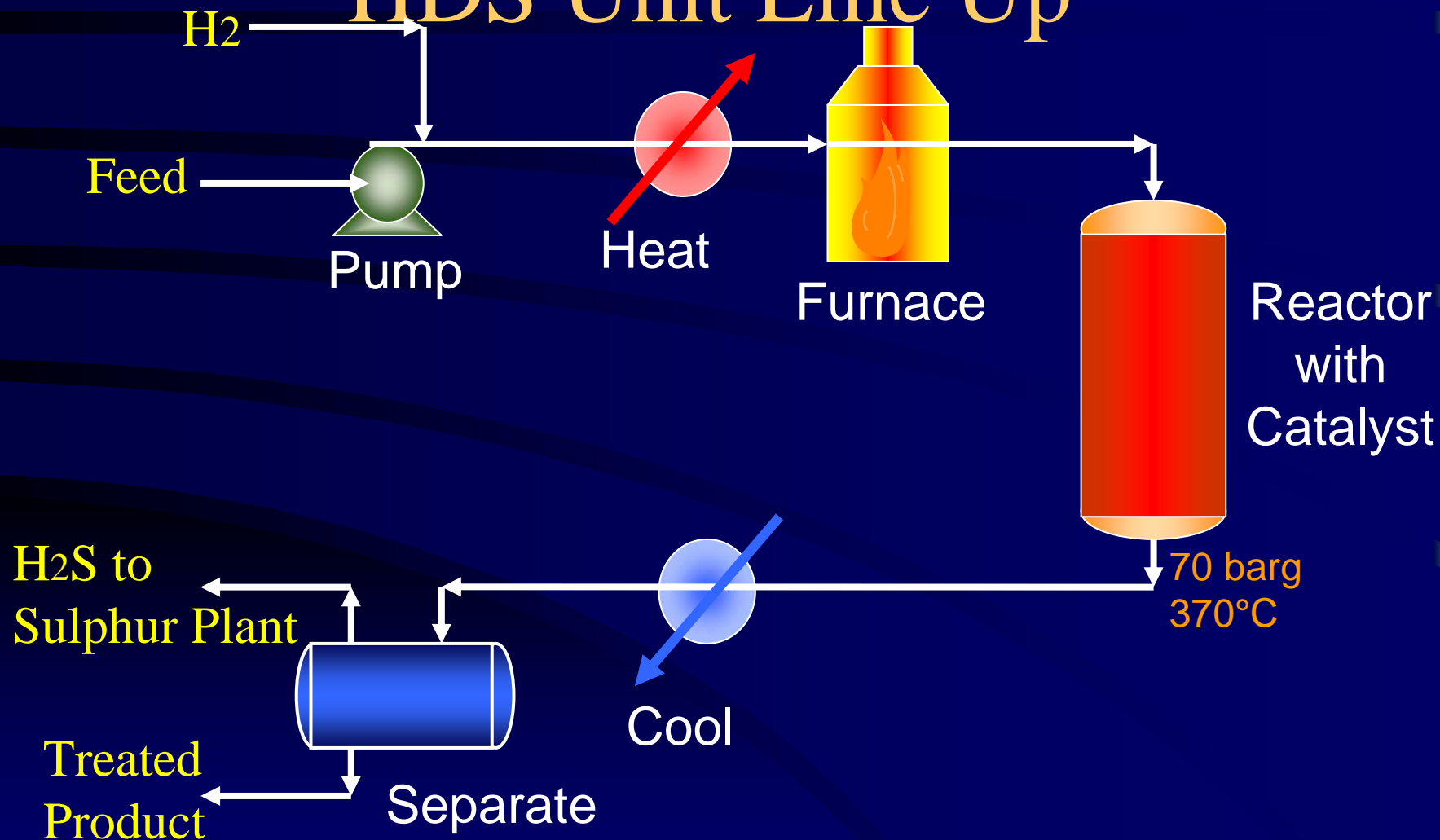
- NZRC has one small Hydrodesulphurisation Unit (HDS) unit for diesel



- A New much bigger HDS unit is required for future.
 - Cost Estimate 50-70US\$ million [Concawe Report 99/56]
 - Time to construct 3-4 years
- Hydrogen is needed
 - Cost Estimate for upgrade of H₂ plant ~10US\$ million

Refinery Wide Technical Study

HDS Unit Line Up



Refinery Wide Technical Study

Study Results

- Technical Options Have Been Identified
- Two Examples Shown - Many Many More Issues Surrounding Each Specification
- Scenario Approach Gave Robust Options
- NZRC Now Has Knowledge Needed for Their PQ Review Submission.
- NZRC Now Has Information to Evaluate Future Business Case for Investment.

Conclusion - Business Impact

Product Quality; a Cross Roads for NZRC

- Capital Expenditure Required
- Operating Costs Will Increase
- Energy and GHG Emissions Will Increase
- No Income (Margin) Increase Is Expected

International Competitiveness May Reduce

How Much Will Depend on the New Regulations