



ISAB ENERGY IGCC NEW HYDROGEN PLANT



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AGENDA

- Scope of the Project
- Comparison of Options
- Existing IGCC plant
- New Gasifier
- Revamping of Existing Facilities
- New IGCC Performances
- Plot Plan
- Project Execution Plan

Scope of the Project

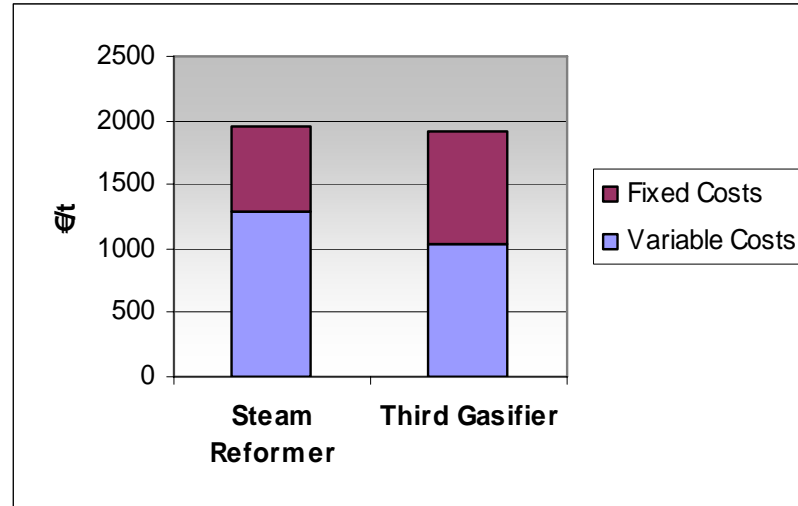
Production of 20,000 Nm³/h for Euro-grade automotive fuels

Three options for ERG:

- | | | | |
|--|---|---------------------------------------|--------------|
| 1. Refinery revamping | → | new steam reformer | } ONE OPTION |
| 2. Purchase H ₂ from external suppliers | → | new steam reformer | |
| 3. ISAB Energy IGCC revamping | → | third gasifier + H ₂ plant | |

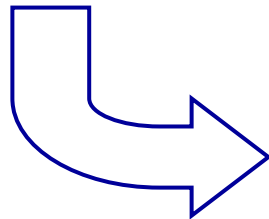
Option Comparison

Bases: ERG Financial/
economic parameters
and natural gas/
hydrocarbon products
price forecast

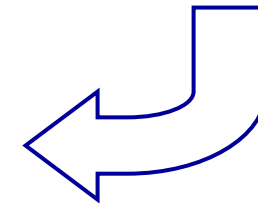


Higher capex for IGCC: +30%

Lower opex for IGCC: -20%

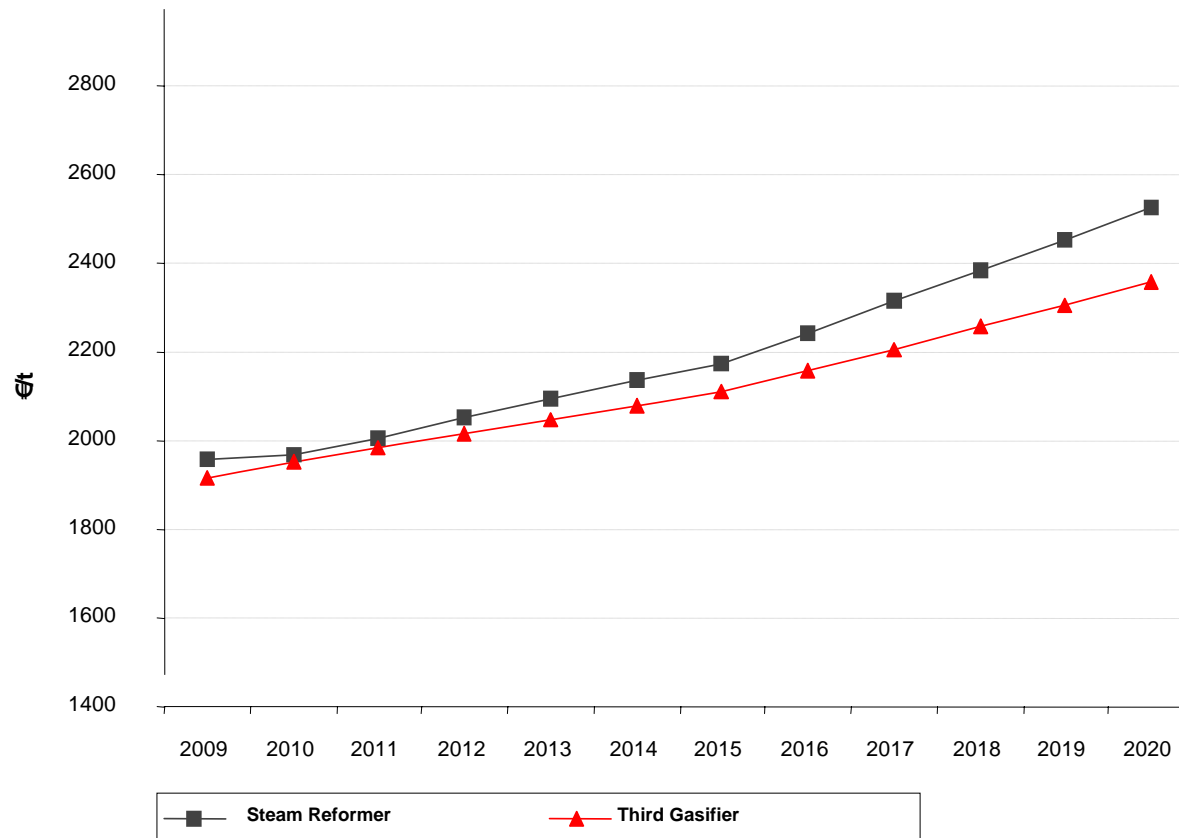


Marginally lower H₂ price
for third gasifier option
1900 €/t (0.17 €/Nm³)



Option Comparison

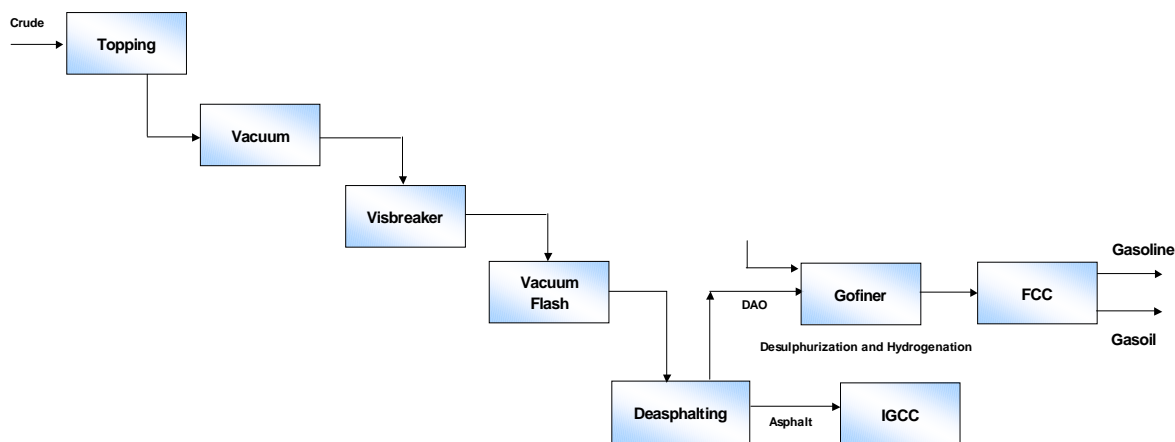
Forecast to 2020: the third gasifier advantages become higher



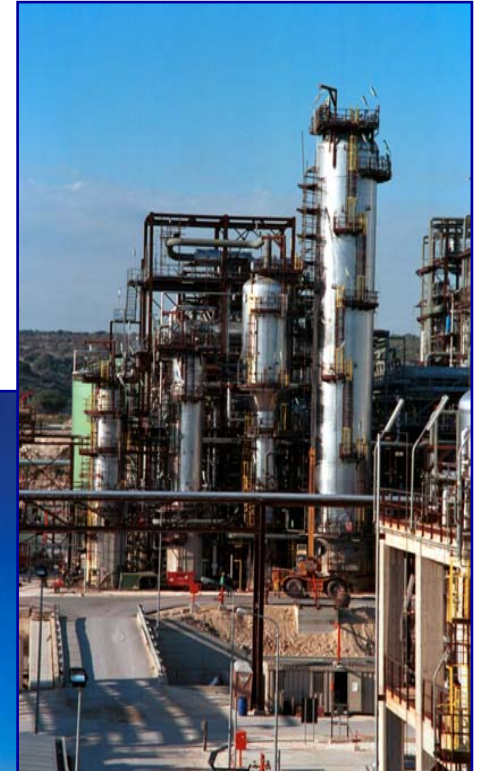
Option Comparison

Additional benefits for IGCC/refinery:

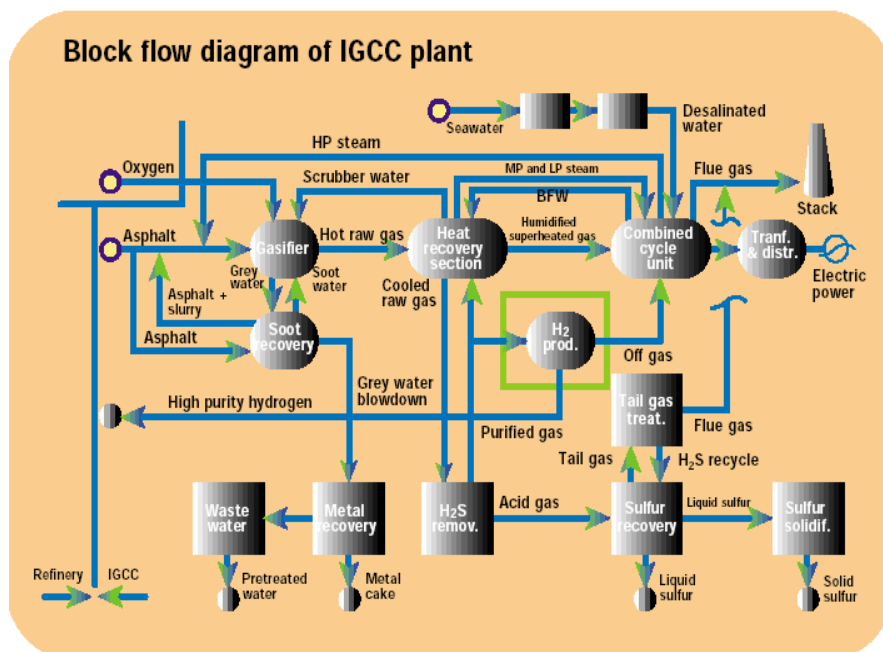
- Reduction of fuel oil production
- Increase of deasphalted oil production **➔** With consequent increase of light products
- Increase of IGCC overall availability **➔** 30,000 MWh per year



Existing IGCC plant

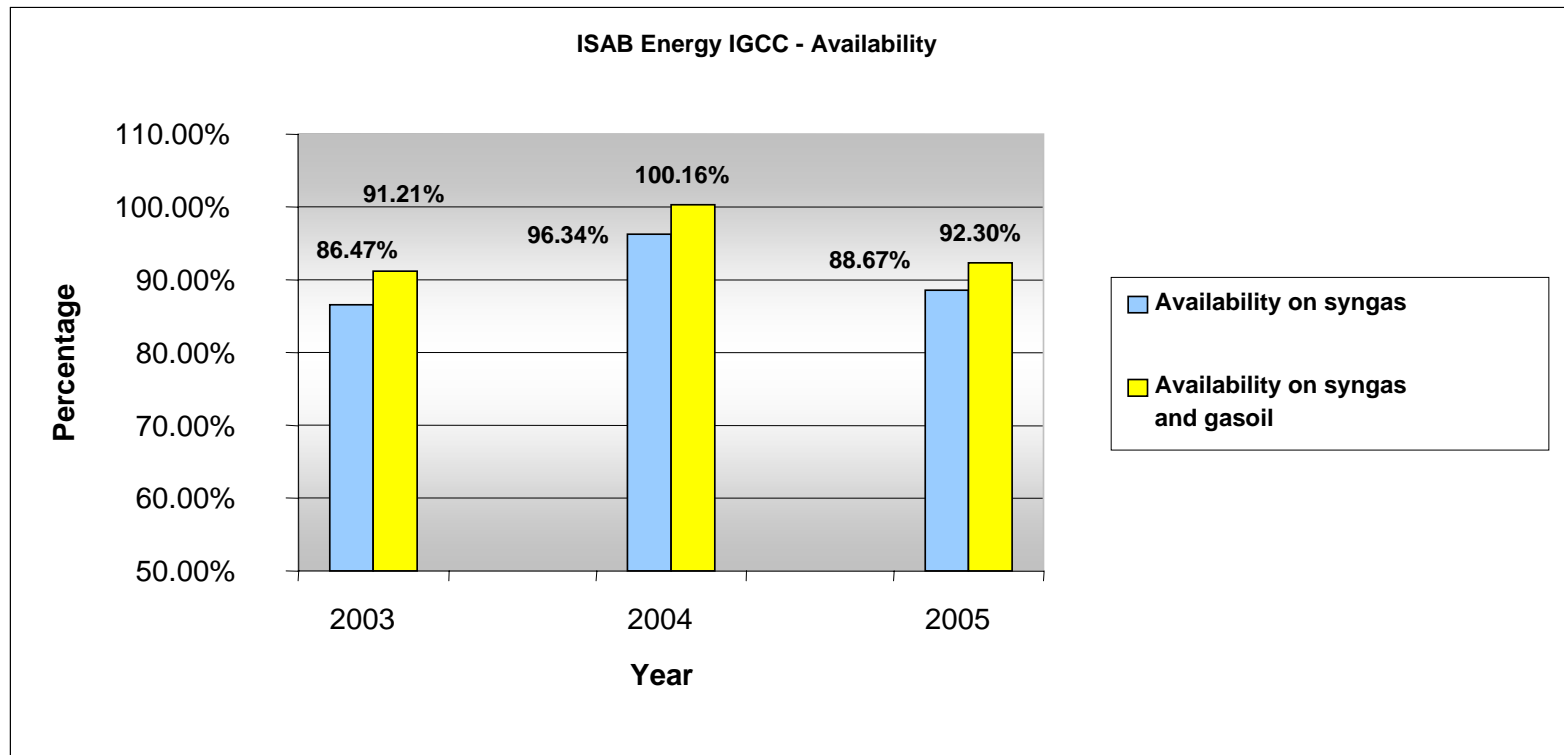


Existing IGCC plant



- Kellogg deasphalting unit
- Feed: asphalt 132 t/h
sulphur 6%wt
- Two quench-type GE gasifiers
- MDEA based AGR for H₂S removal
- Oxygen Claus SRU + TGT
- Two power train (GT+HRSG+ST)
based on GT Ansaldo/Siemens V94.2K
- IGCC power output: 560 MWe

Existing IGCC plant - Availability



Excellent operating results from the first year of commercial operation

New Gasifier

Target: 20,000 Nm³/h of H₂ at constant IGCC power output: 560 MWe

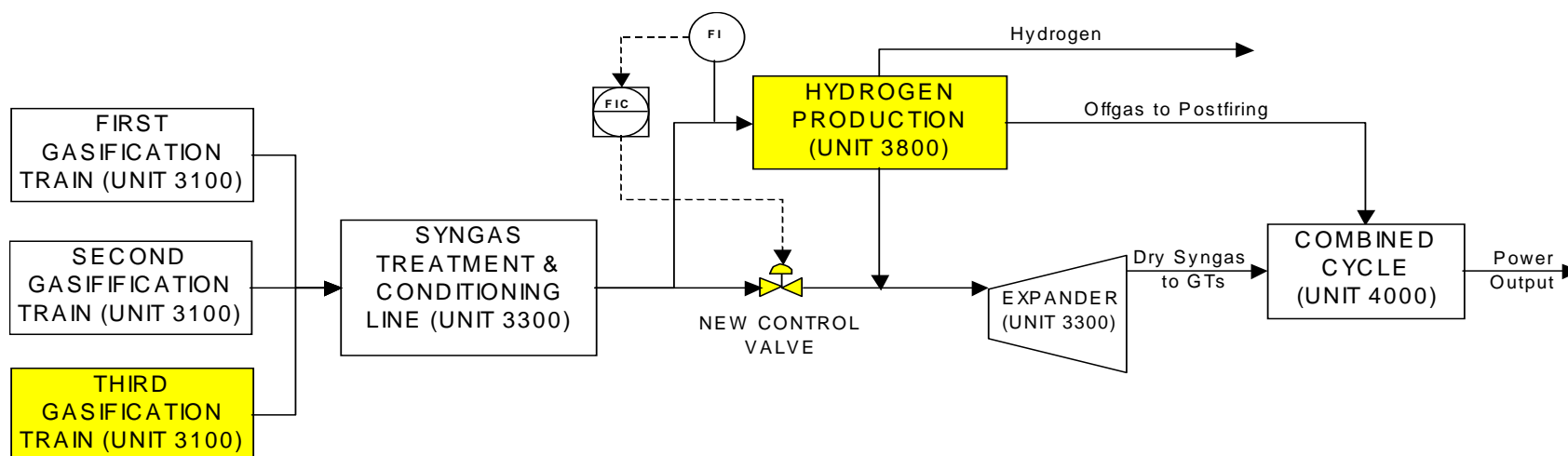


Gasification capacity increase +5.4% i.e. +7.5 t/h of asphalt

Two alternatives:

1. New gasifier same size as the existing ones
2. New gasifier sized for 18 t/h of asphalt

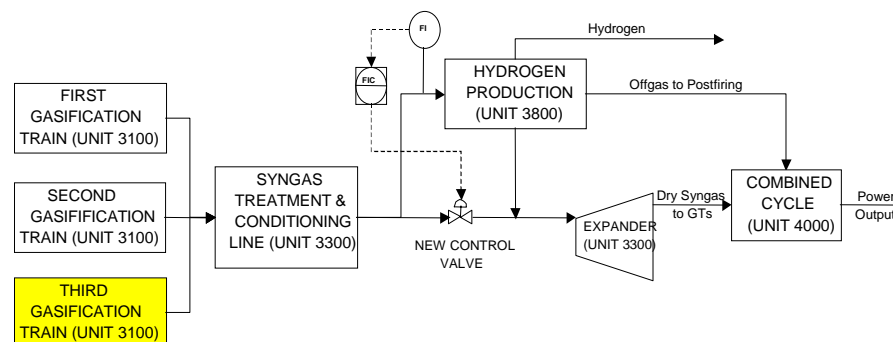
Revamping of Existing Facilities



- Existing gasification feed storage is adequate for the future operating conditions
- Utilities and infrastructure are able to operate in the future configuration
- Flare system is adequate
- Control and safety shutdown systems with the same philosophy and integrated with the existing facilities

Revamping of Existing Facilities

Third Gasification Train

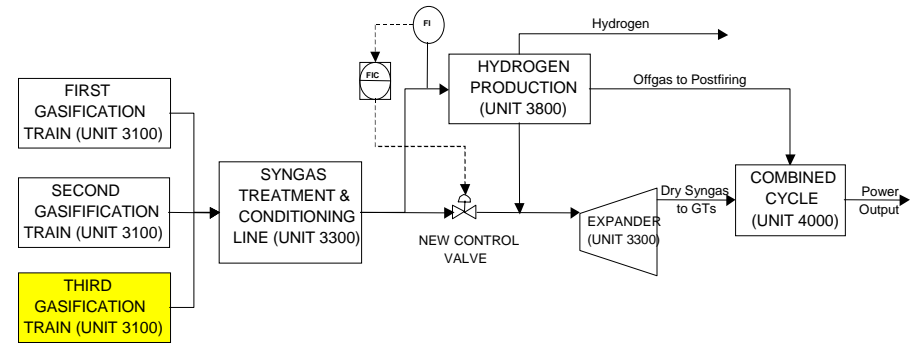


New facilities:

- Gasifier sized for 18 t/h
- Charge oil pump
- Syngas scrubber
- Start-up quench water pumps and sump for start-up/shutdown
- Grey water/soot water exchanger
- Ancillaries dedicated to third gasification line

Revamping of Existing Facilities

Third Gasification Train

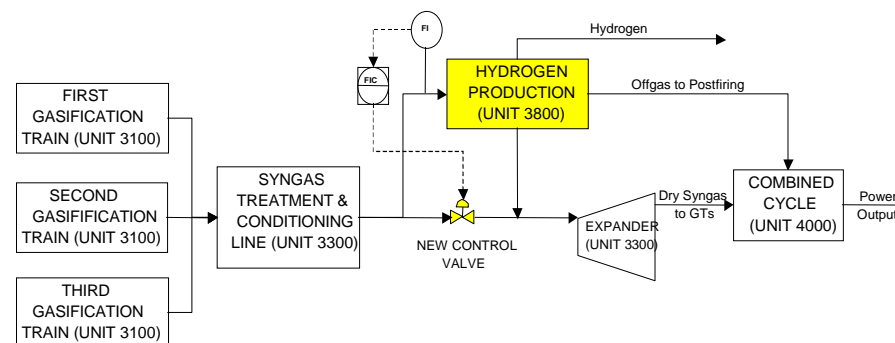


Impact on existing facilities:

- Revamping of the burner cooling water pumps to assure proper cooling of the three gasifiers burners
- New high pressure naphtha pump
- New emergency demineralized water diesel pump to cool the quench ring of the new gasifier in case of electric power failure

Revamping of Existing Facilities

Hydrogen Plant

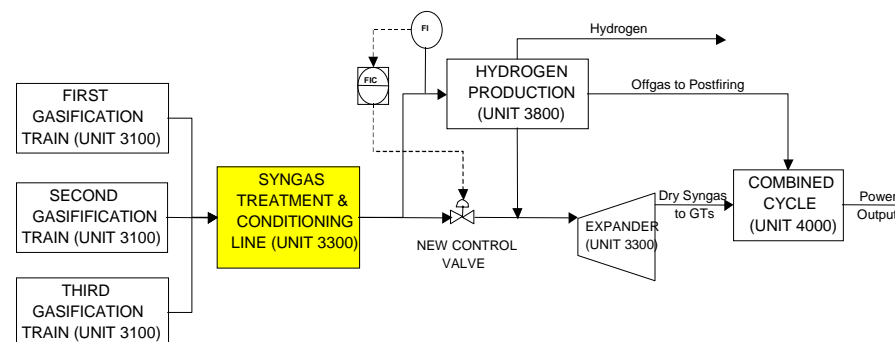


New facilities:

- Clean syngas scrubber for MDEA solvent entertainment abatement
- Membrane section for hydrogen enrichment (approx. 50% syngas)
- PSA section for 20,000 Nm³/h hydrogen production
- Control valve to regulate the syngas fed to hydrogen plant

Revamping of Existing Facilities

Syngas treatment



New facilities:

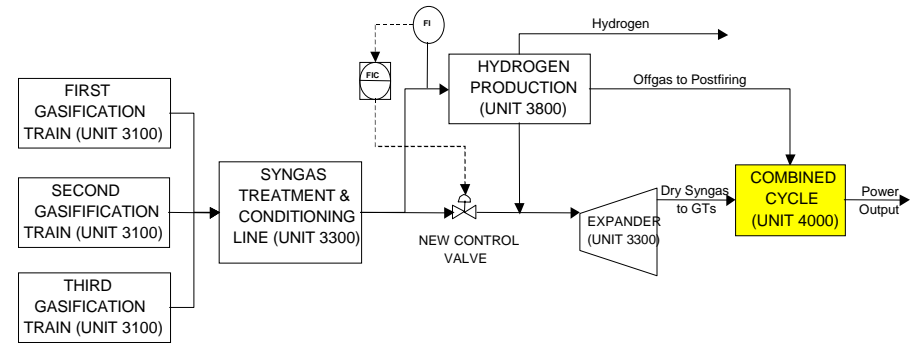
- Condensate return pump dedicated to the new scrubber; existing pumps acting as spare also for third gasifier

Existing facilities:

- The existing facilities for syngas cooling, COS hydrolysis, syngas saturation and expansion are suitable

Revamping Existing Facilities

Combined Cycle



Impact on existing facilities:

- Different H_2/CO ratio of syngas fed to GTs. Ansaldo Energia confirmed existing burners suitability with minor impacts on performance and emissions

New facilities:

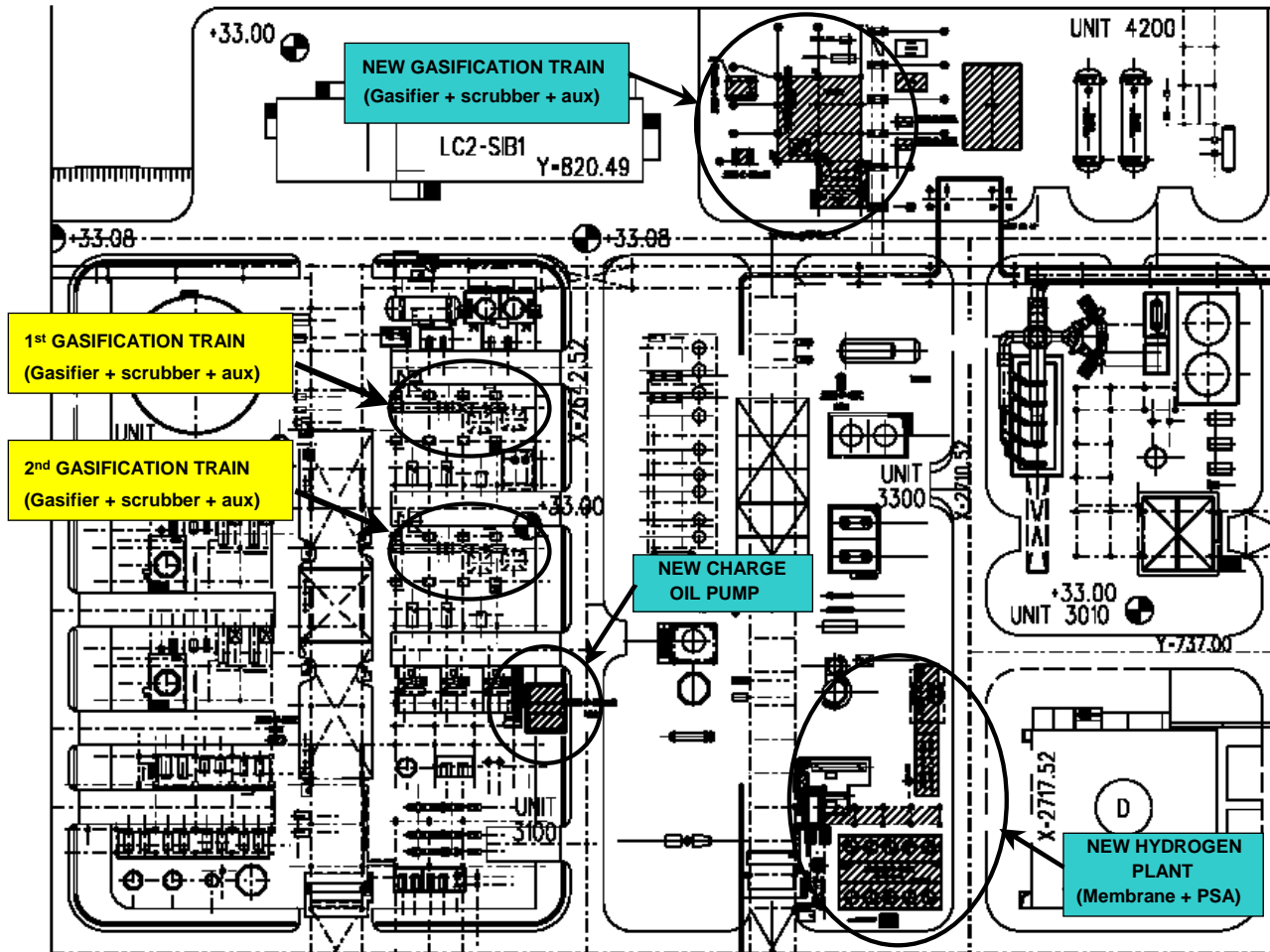
- Two new post-firing burners able to burn either syngas or PSA offgas

New IGCC performances

EXPECTED PERFORMANCES OF THE IGCC PLANT			
		Existing IGCC	Revamped IGCC
Feedstock	t/h	139.0	146.5
Oxygen consumption	Nm ³ /h	102,000	107,800
Gross power output	MW	570	570
Combined cycle consumption	MW	10	10
Net power output	MW	560	560
Process and utility consumption	MW	30	30.5
Net IGCC power	MW	530	529.5
Hydrogen production	Nm ³ /h	0	20,000

- New solvent proposed in the AGR maintains constant SO₂ emissions
- NO_x, CO and particulate emissions are not expected to increase in future operating conditions (GTs and post-firing systems at constant loads)

Plot Plan



- Third gasifier located in a new area far from the existing gasifier due to constructability reasons
- Charge oil pump located close to the existing ones
- Hydrogen plant located within the syngas cooling, saturation and expansion area

Project Execution Plan

'Fast track' strategy with overlap of the permitting, basic design and detailed engineering phases to optimise the overall project schedule

Mechanical, instrument and electrical modifications designed and implemented in the general IGCC complex turnaround previously planned in May 2007

Construction phase is planned to start in early 2008

Hydrogen unit is planned to be mechanically complete by the end of 2008

Gasification unit is planned to be ready for commissioning activities in 4Q/2009

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