



SHELL COAL GASIFICATION

Delivering performance in
Chinese operations today,
Developing technology
and deployment solutions
for tomorrow



Jim Volk
Commercial General Manager for Gasification, Americas

DISCLAIMER

The companies in which Royal Dutch Shell plc directly or indirectly owns investments are separate entities. In this presentation the expressions "Shell", "Group" and "Shell Group" are sometimes used for convenience where references are made to Group companies in general. Likewise the words "we", "us" and "our" are also used to refer to Group companies in general or those who work for them. The expressions are also used where there is no purpose in identifying specific companies.

Shell Global Solutions is a network of independent technology companies in the Shell Group. In this presentation the expression 'Shell Global Solutions' is sometimes used for convenience where reference is made to these companies in general, or where no useful purpose is served by identifying a particular company.

The information contained in this presentation contains forward-looking statements, that are subject to risk factors which may affect the outcome of the matters covered. None of Shell International B.V., any other Shell company and their respective officers, employees and agents represents the accuracy or completeness of the information set forth in this presentation and none of the foregoing shall be liable for any loss, cost, expense or damage (whether arising from negligence or otherwise) relating to the use of such information.

The information contained in this presentation is intended to be general in nature and must not be relied on as specific advice in connection with any decisions you may make. Shell Global Solutions is not liable for any action you may take as a result of you relying on such material or for any loss or damage suffered by you as a result of you taking this action. Furthermore, these materials do not in any way constitute an offer to provide specific services. Some services may not be available in certain countries or political subdivisions thereof.

Copyright © 2010 Shell Global Solutions International B.V. All copyright and other (intellectual property) rights in all text, images and other information contained in this presentation are the property of Shell Global Solutions International B.V. or other Shell companies. Permission should be sought from Shell International B.V. before any part of this presentation is reproduced, stored or transmitted by any means, electronic or mechanical including by photocopy, recording or information storage and retrieval system.

TOPICS

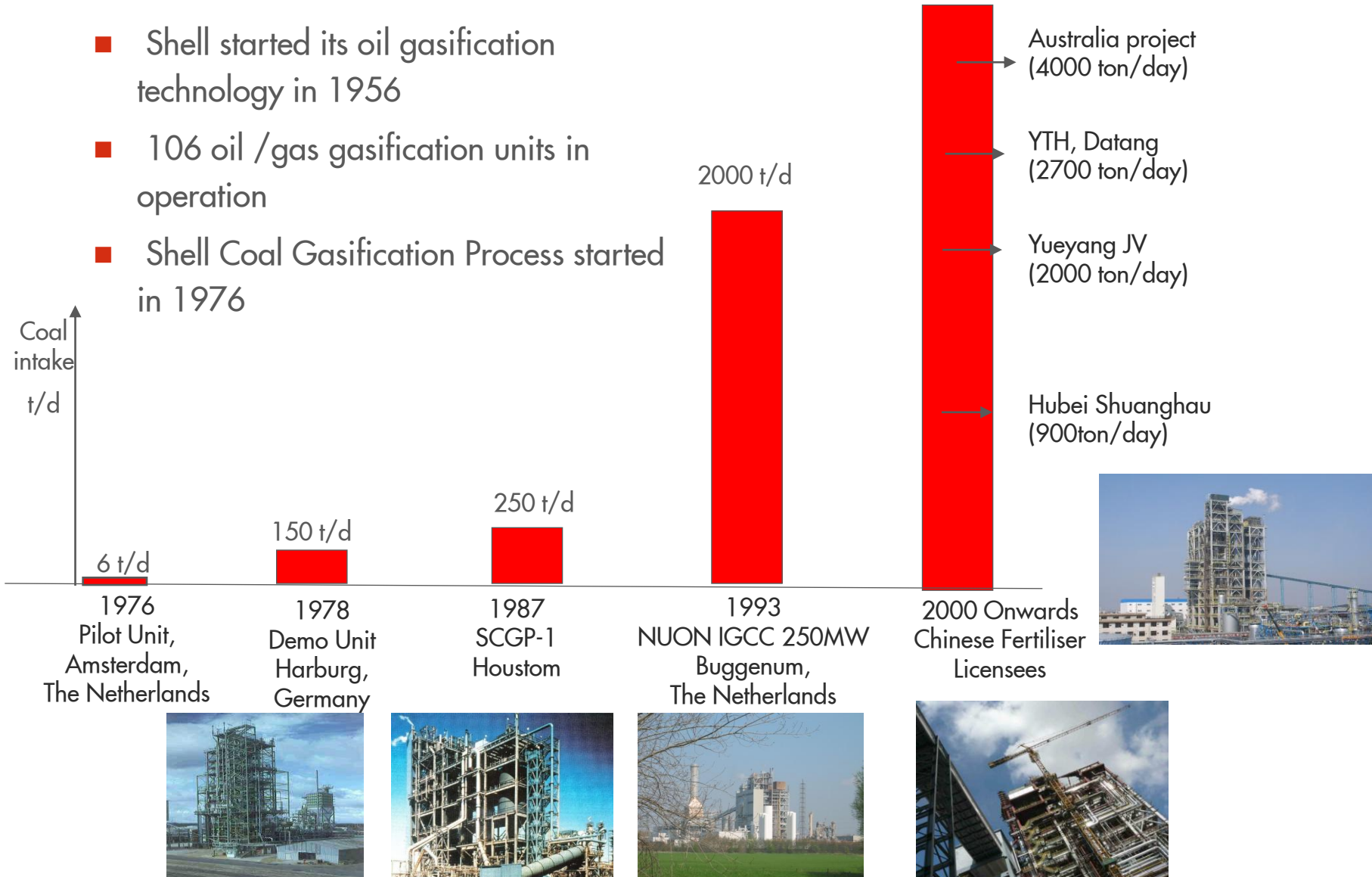
- Performance in Operations
- Technical Solutions
- Enhancing Technology

1.0

PERFORMANCE IN OPERATIONS

INCREASING CAPACITIES

- Shell started its oil gasification technology in 1956
- 106 oil /gas gasification units in operation
- Shell Coal Gasification Process started in 1976



SUCCESSFUL PERFORMANCE TEST RUNS IN CHINA

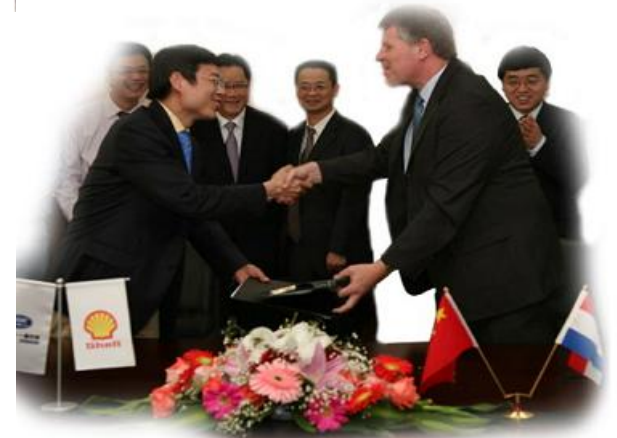
- 3 performance test runs successfully completed
- 4 sites accepted the plant performance without formal test run (either test done for similar design or plant operation satisfied owner)
- 1 underway, 3 in preparation



NEW AUTHORIZED VENDORS IN CHINA

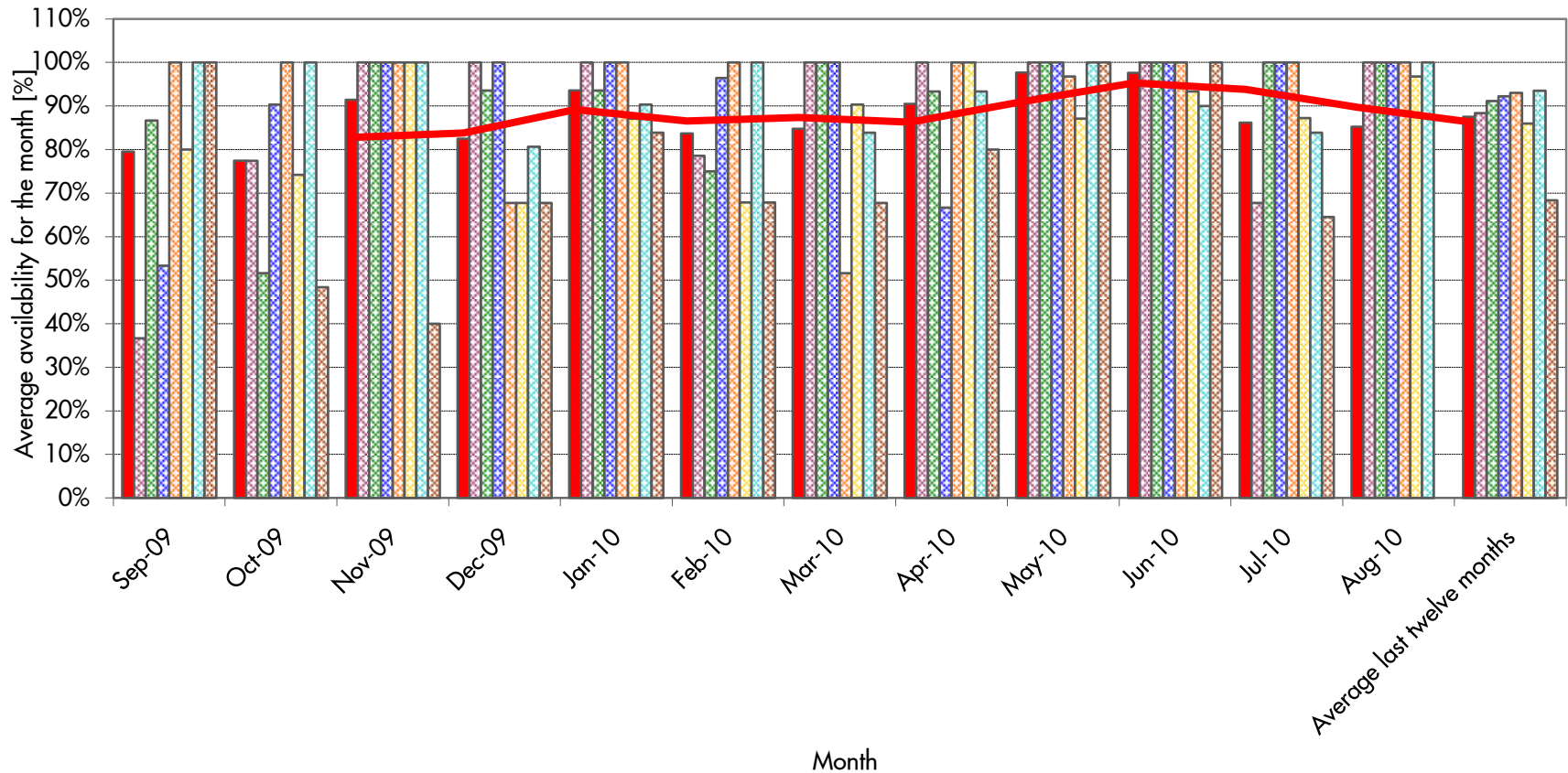
- 3 for gasifier and SGC (Dongfang Boiler (Group) Co. Ltd., Suzhou Hailu Heavy Industry Co., Ltd, Wuxi Huaguang Boiler Co., Ltd)
- 2 for aeration device (Xi'an Baode and Beijing A&M)
- 1 for coal flow diverter valve (Hefei General), ongoing work to authorize a second
- 1 for local coal burner repair (YueyangFCC)
- 1 for coal burner manufacturing (Shanghai 711)
- 3 for sluicing valves (SHK, Hongsheng and Antiware)

Apart from two critical equipment items (velocity and density meter), all other SCGP critical equipment can now be sourced in China.



RELIABILITY IN CHINA: OVERVIEW SECOND WAVE

Reliability trend second-wave Chinese clients for past twelve months



2.0

PROVIDING TECHNICAL SOLUTIONS

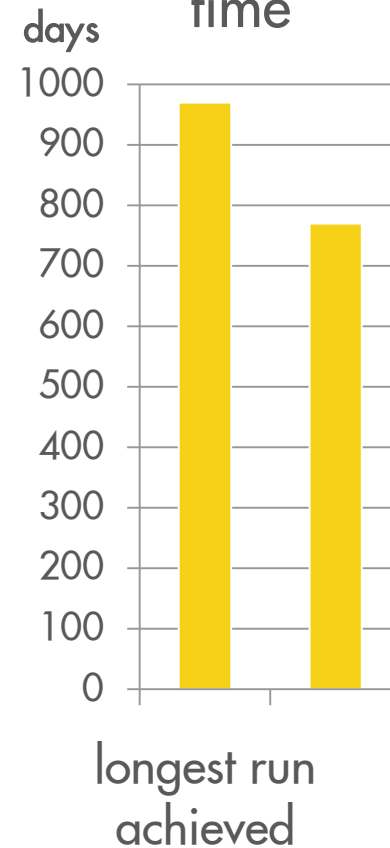
SUPPORT EXAMPLE: HPHT FILTER OPERATIONS

Filter candles that had been in operation until 2008.



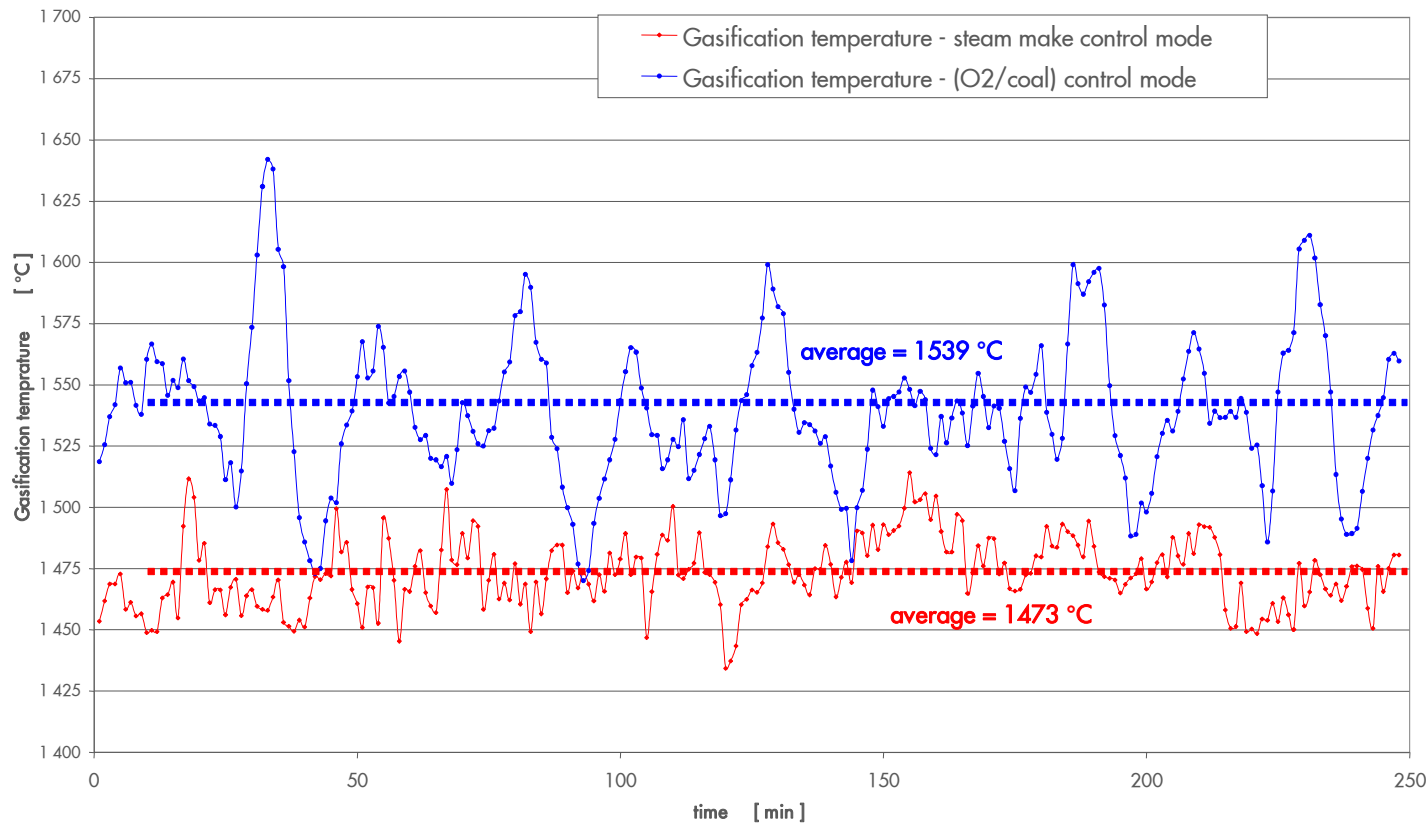
Life time of HPHT filters > 30 months

HPHT Life
time



SUPPORT EXAMPLE: IMPROVE GASIFIER OPERATIONS

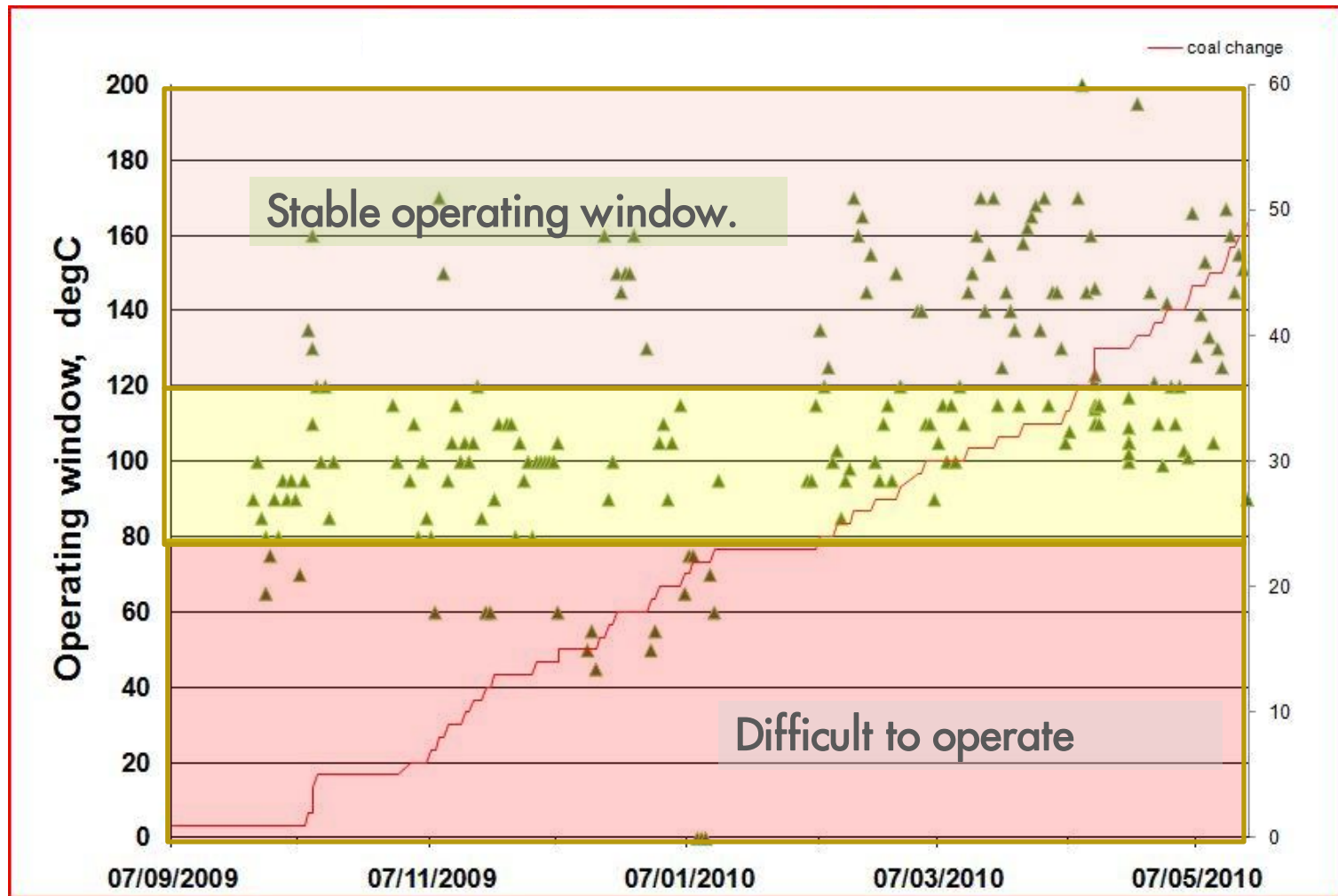
Steam make control can lower the gasification temperature fluctuation significantly, smoothing operation conditions.



- Operating on O₂/C control mode at 100% oxygen load:
 - Compared to Gasifier steam make control, amplitude of fluctuations in gasification temperature is more than factor 2.
- Operating on Gasifier steam make control mode at 100% oxygen load:
 - Mean amplitude of fluctuations around average value of gasification temperature is ± 25 °C.

FREQUENT COAL SWITCHES AND CHANGES IN QUALITY CAN BE HANDLED

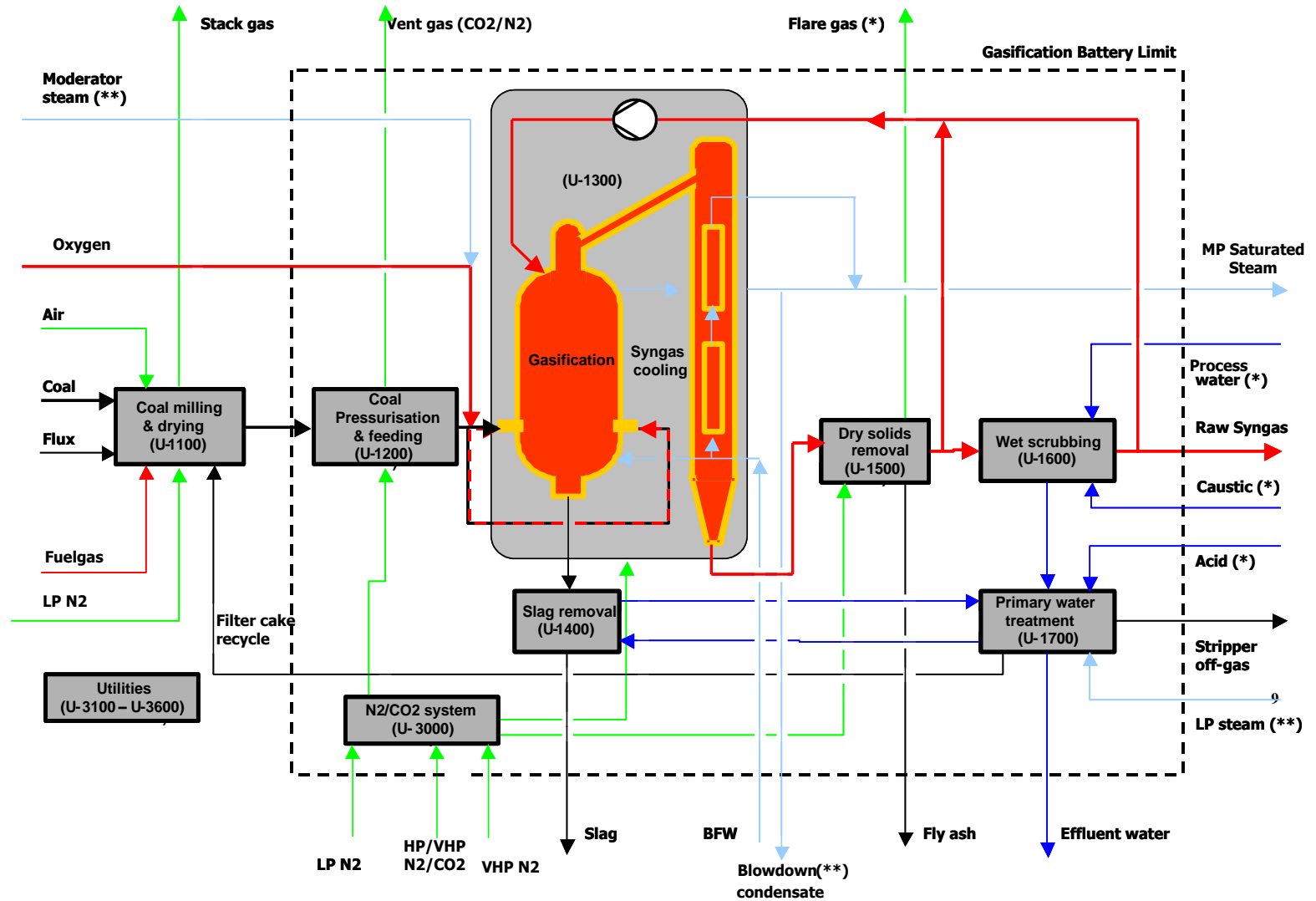
Coal and ash analysis are key to determine and manage the operating window.



3.0

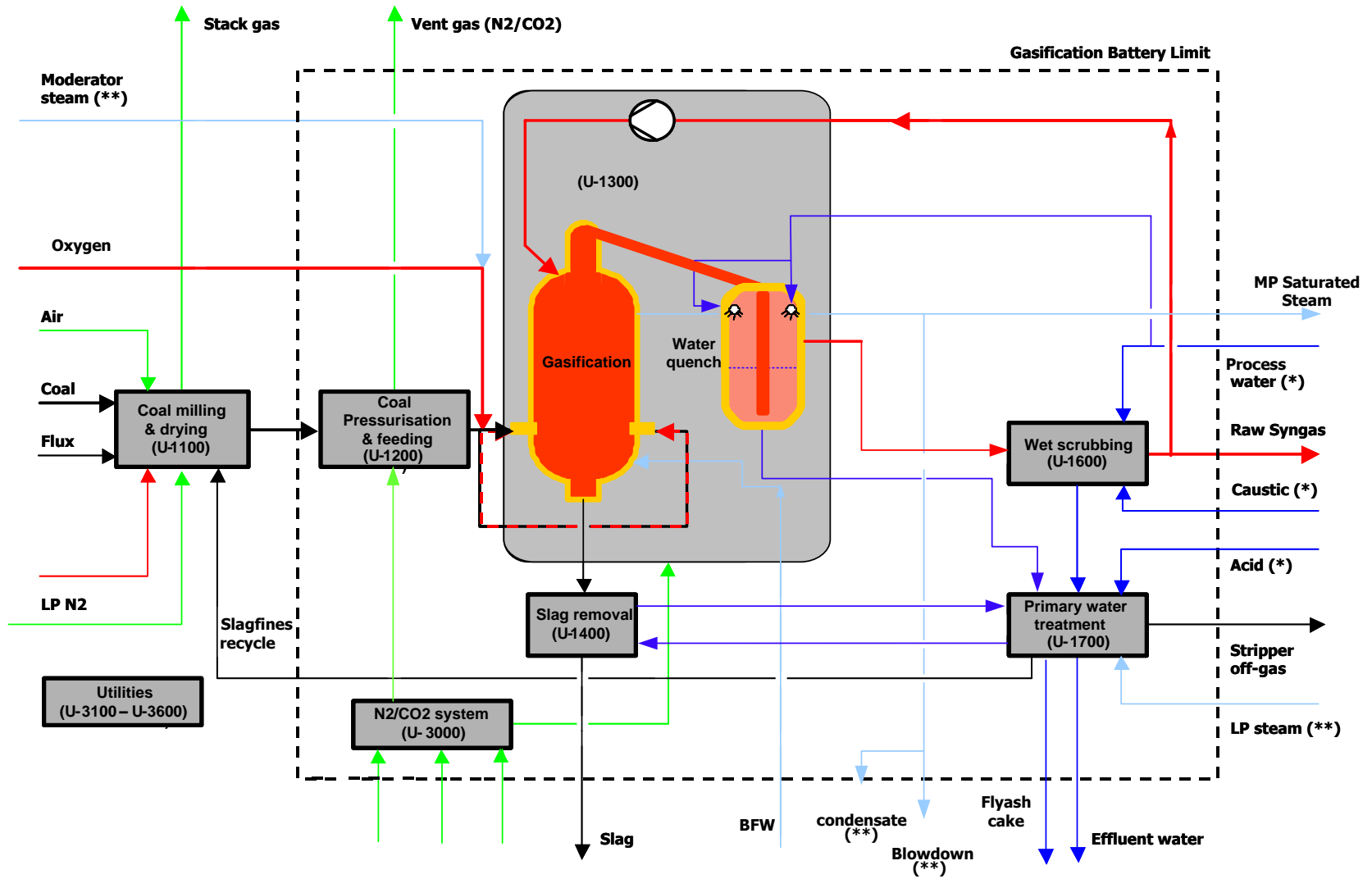
ENHANCING TECHNOLOGY

COMPARISON: SYNGAS COOLER LINE UP



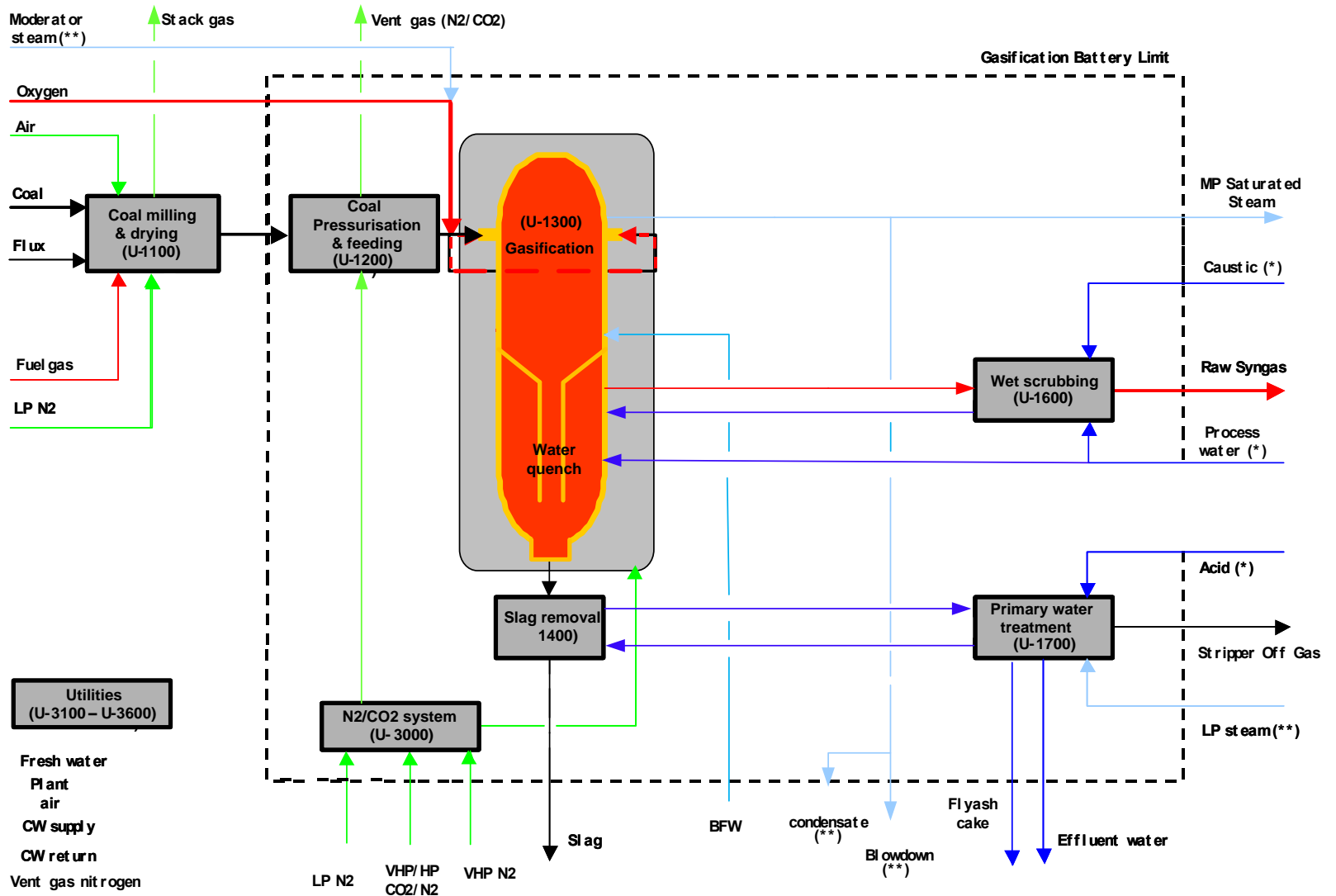
Note: (*) stream entering/leaving via utilities (**) internal stream, interfacing with utilities

COMPARISON: (TOP) WATER QUENCH



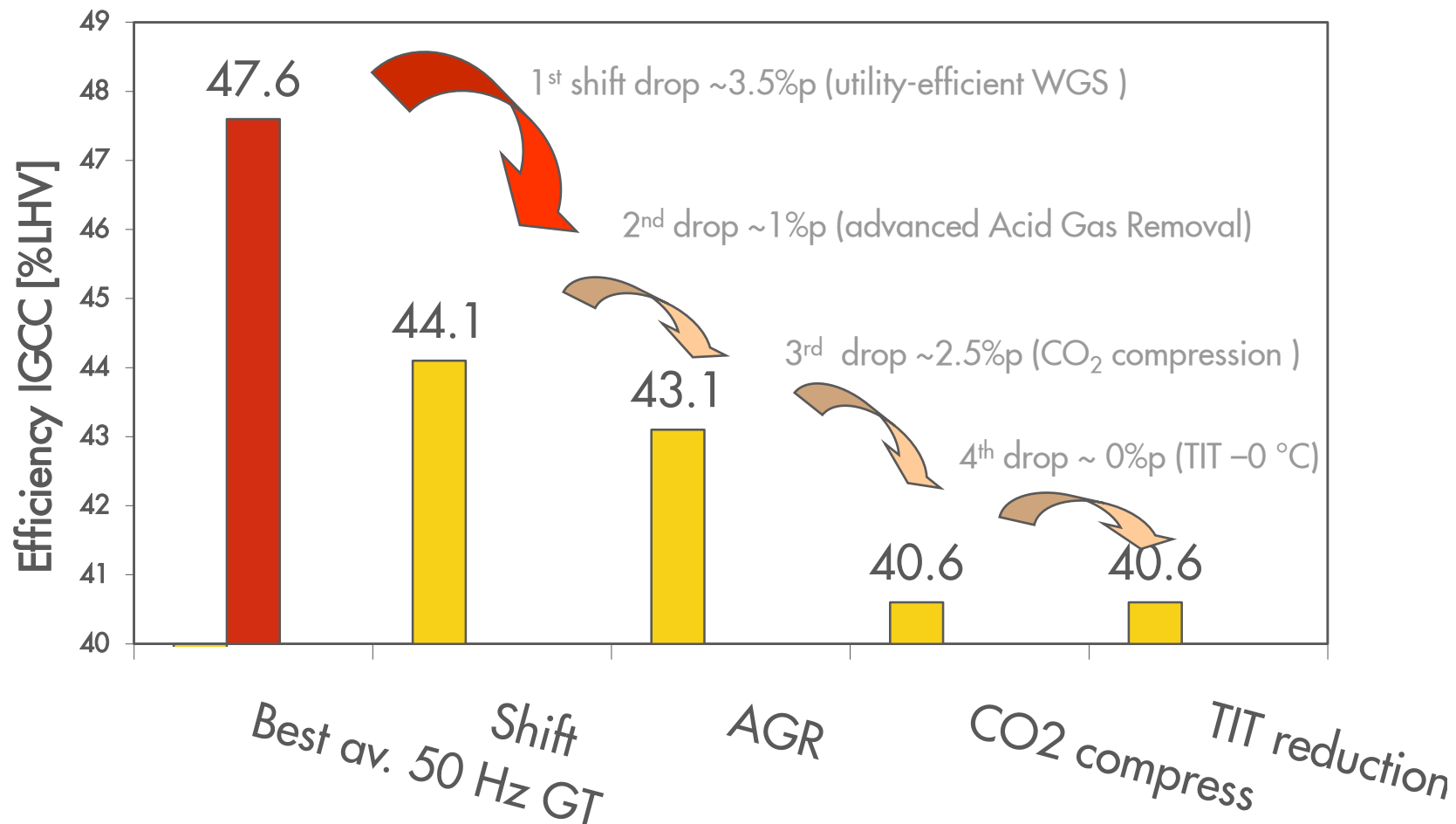
Note: (*) stream entering/leaving via utilities (**) internal stream, interfacing with utilities

COMPARISON: (BOTTOM) WATER QUENCH



Note: (*) stream entering/leaving via utilities (**) internal stream interfacing with utilities

IGCC + 90% CCS – USING TODAY’S TECHNOLOGY



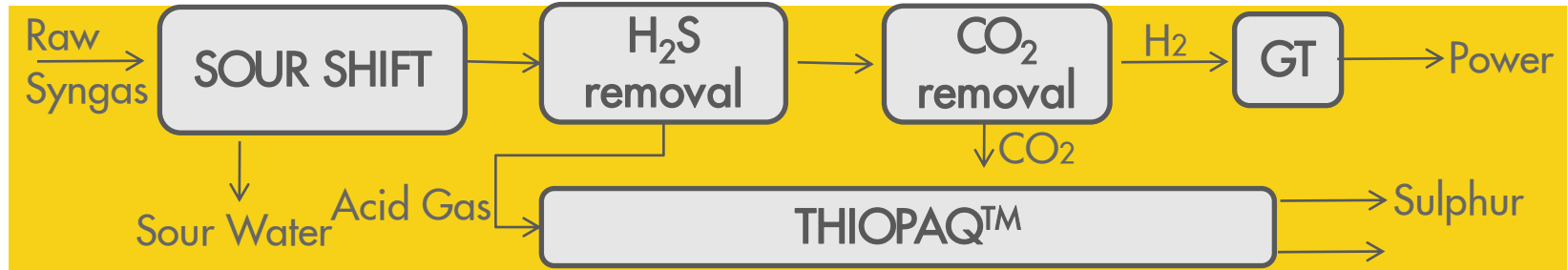
LHV Efficiency Drop < 7 %points; 40% barrier can be broken!

OPERATING MODE OF THE LIANXIN LOW-STEAM SHIFT CATALYST

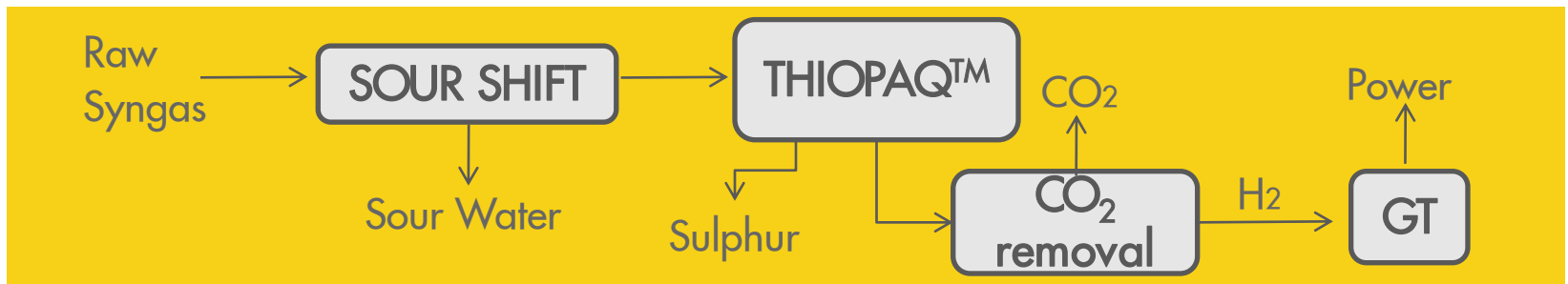
- Technology proven in operation in China in syngas application for 3 years+ (still on first catalyst fill), over 20 plants in operation in total
- The shift reaction is slightly exothermic. In standard sour shift catalysts, the heat generated is cooled away by excess steam.
- The Lianxin QDB-04 catalyst is operated under low-steam conditions, thus limiting the exotherm generated. The catalysts has special promoters which suppress coking.
- The highly exothermic methanation reaction is suppressed by applying a high space velocity

DIRECT THIOPAQ™ COMPARED TO INDIRECT THIOPAQ™

Today's technology: Indirect THIOPAQ™ syngas treating



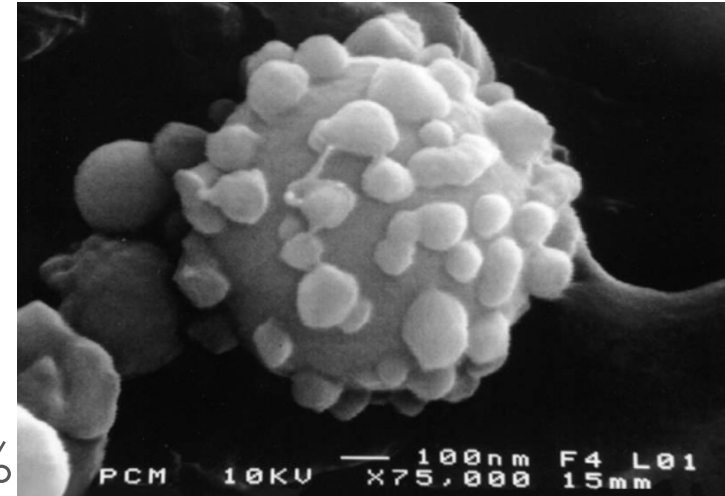
Today's +1 technology: Direct THIOPAQ™ syngas treating



THE THIOPAQ™ PROCESS FIGURES AND TIMELINE

Cost reductions potential:

- 5-6 % on total capex
- 25-30 % on treating line up capex
- Significant opex savings – case dependent
- Increase in IGCC plant efficiency of 0.5 – 1.5%
- **The optimal application for THIOPAQ™:**
Sulphur capacity range of 0 – 50 t/sd, to be extended to 150 t/sd in the future



Thiobacillus

Demonstration in syngas line up planned for 2011, prior to final market roll-out.

GASIFICATION

