

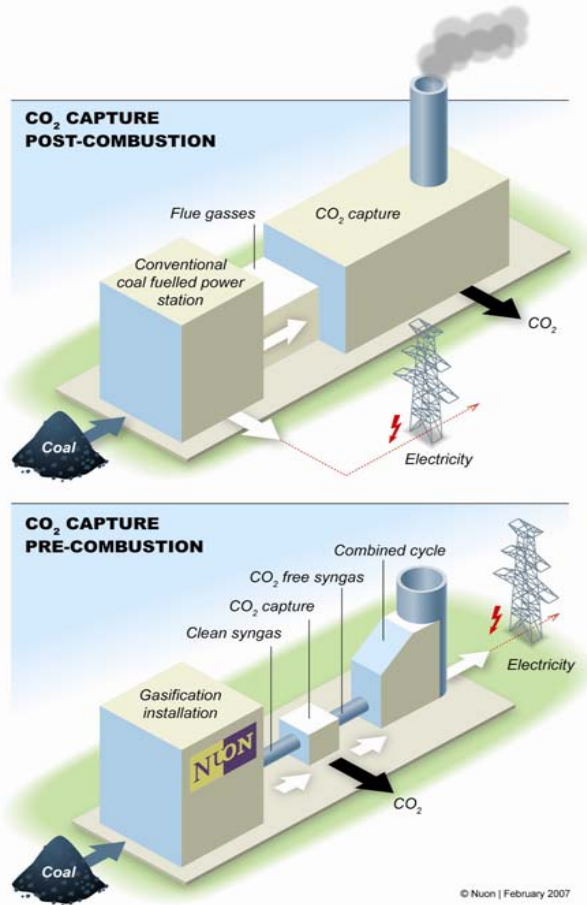


CO₂ capture in future IGCC plant

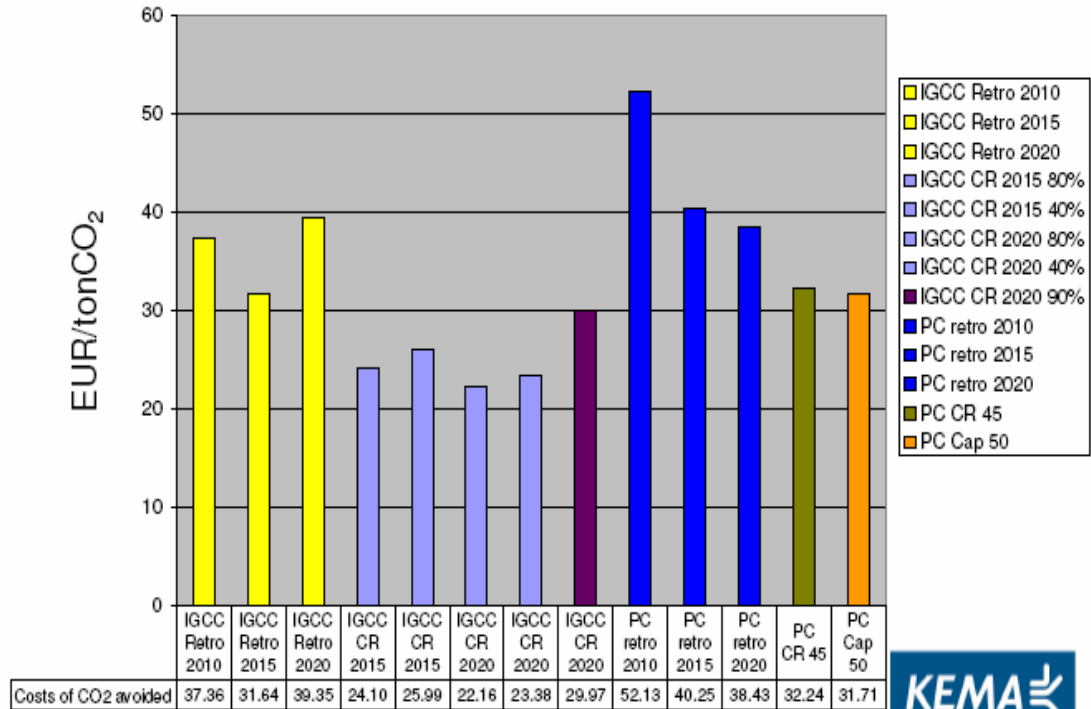
March 2007, Robert de Kler

Advantage of pre-combustion on CCS

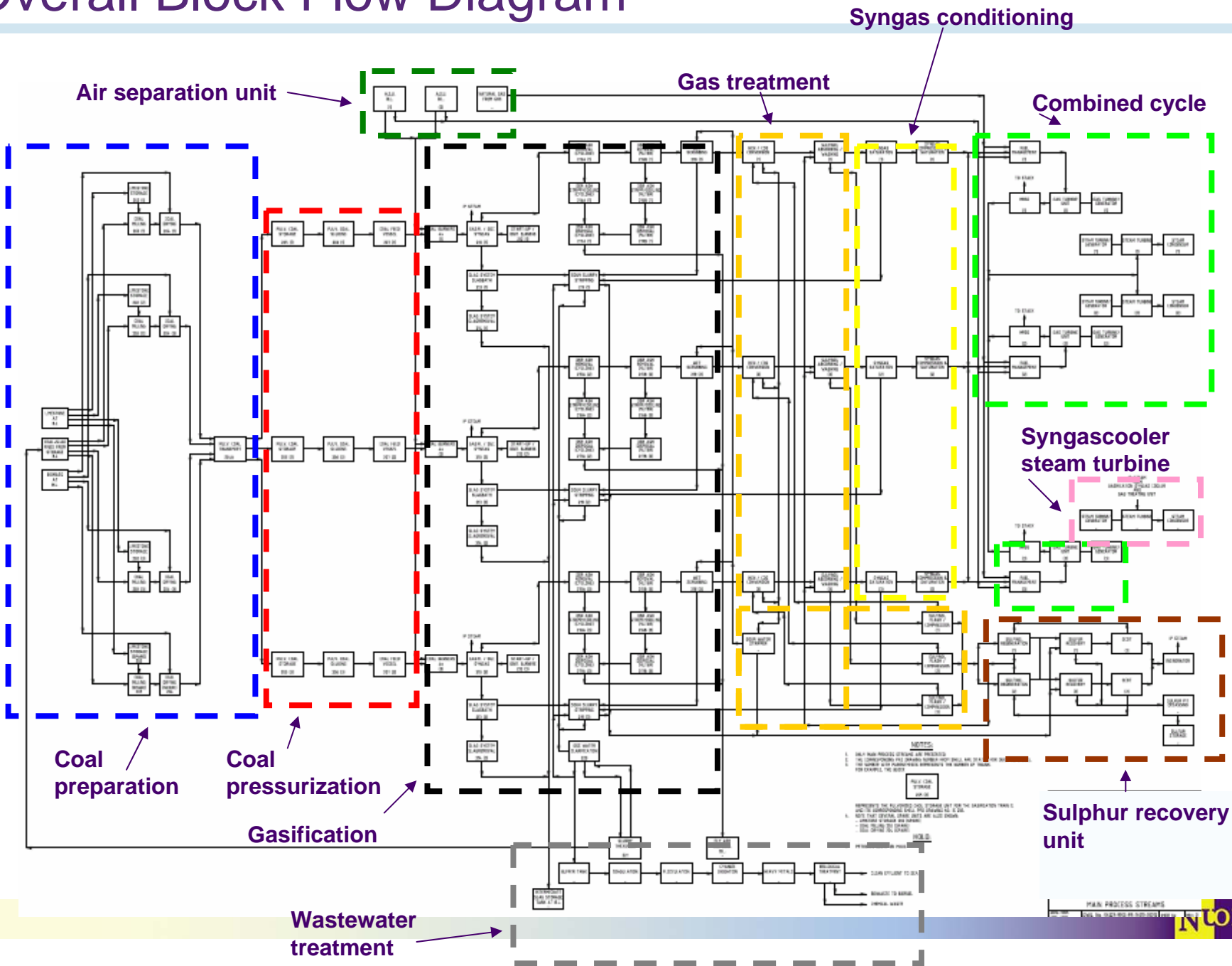
Pre-combustion has a competitive advantage in the energy market: IGCC (coal gasification) has the highest potential for economically feasible CO₂ capture applications (for both existing and new plants). The costs for CO₂ capture for a IGCC plant range from 20 to 25 €/tonne CO₂ for new build, while the costs for conventional coal plants range from 30 to 50 €/tonne CO₂.



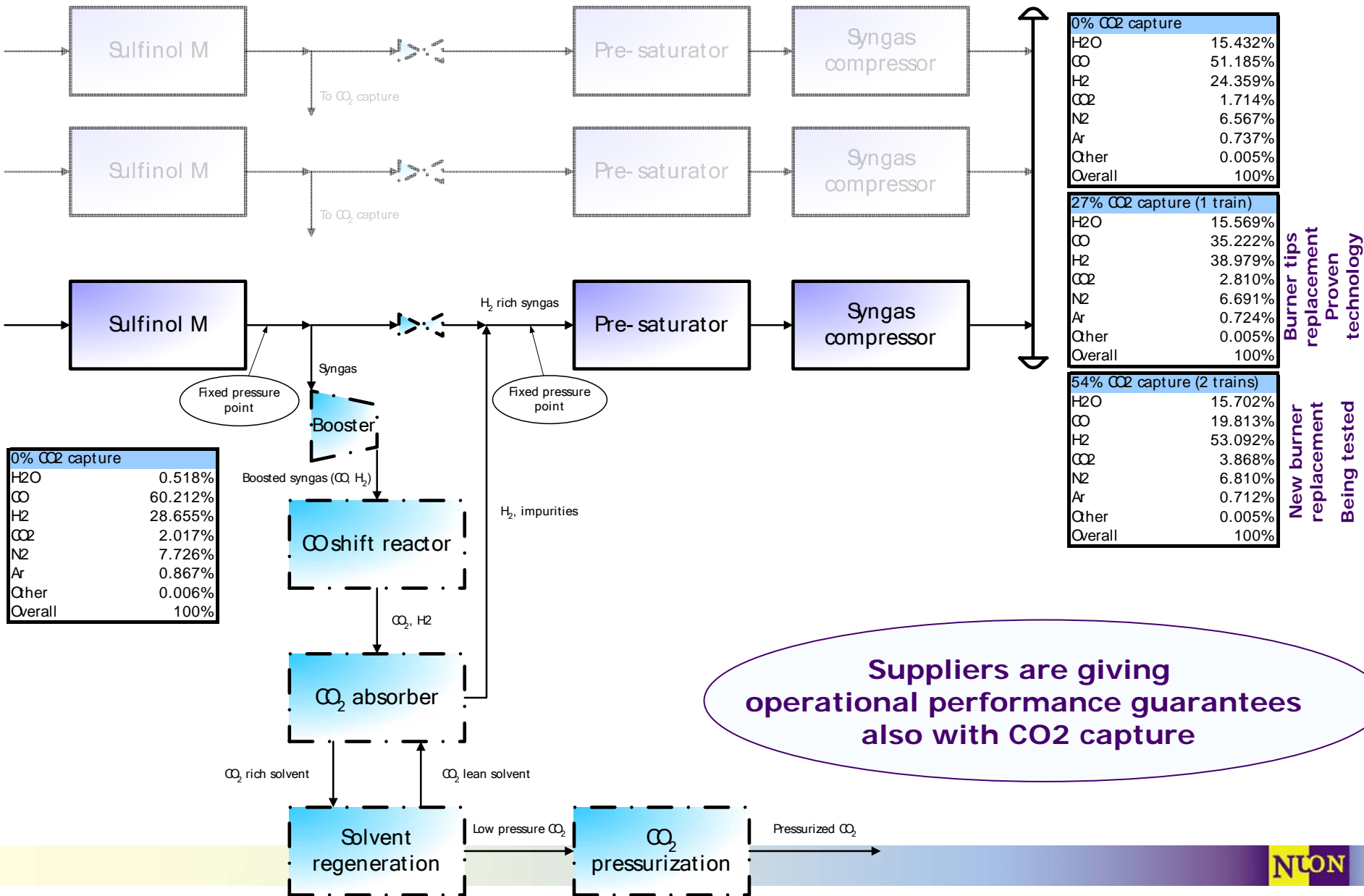
Costs of CO₂ avoided



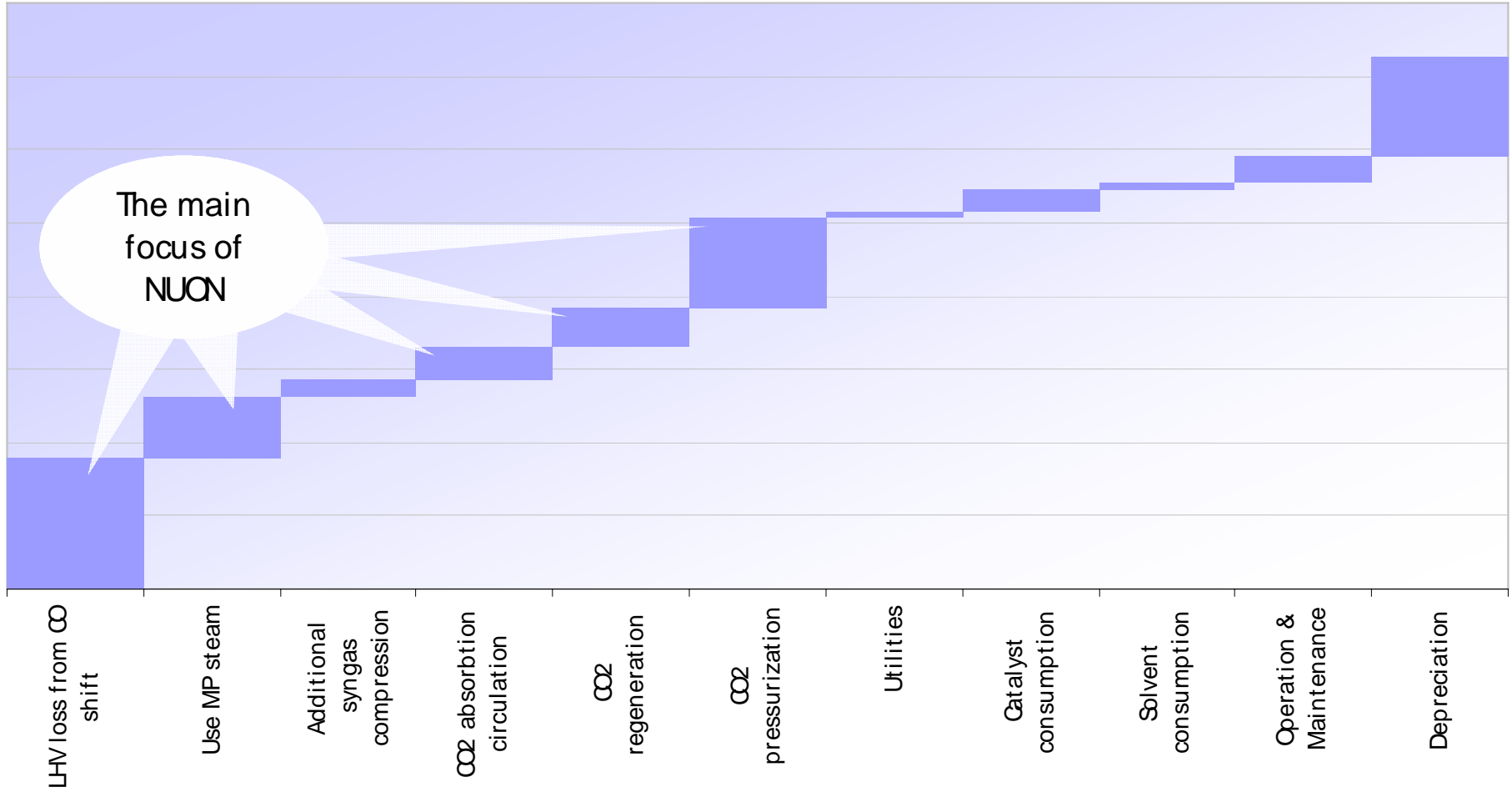
Overall Block Flow Diagram



CO₂ capture in IGCC



CO2 capture cost split-up



CO₂ capture ready design – design in which all the factors are eliminated which can prevent a retrofit taking place

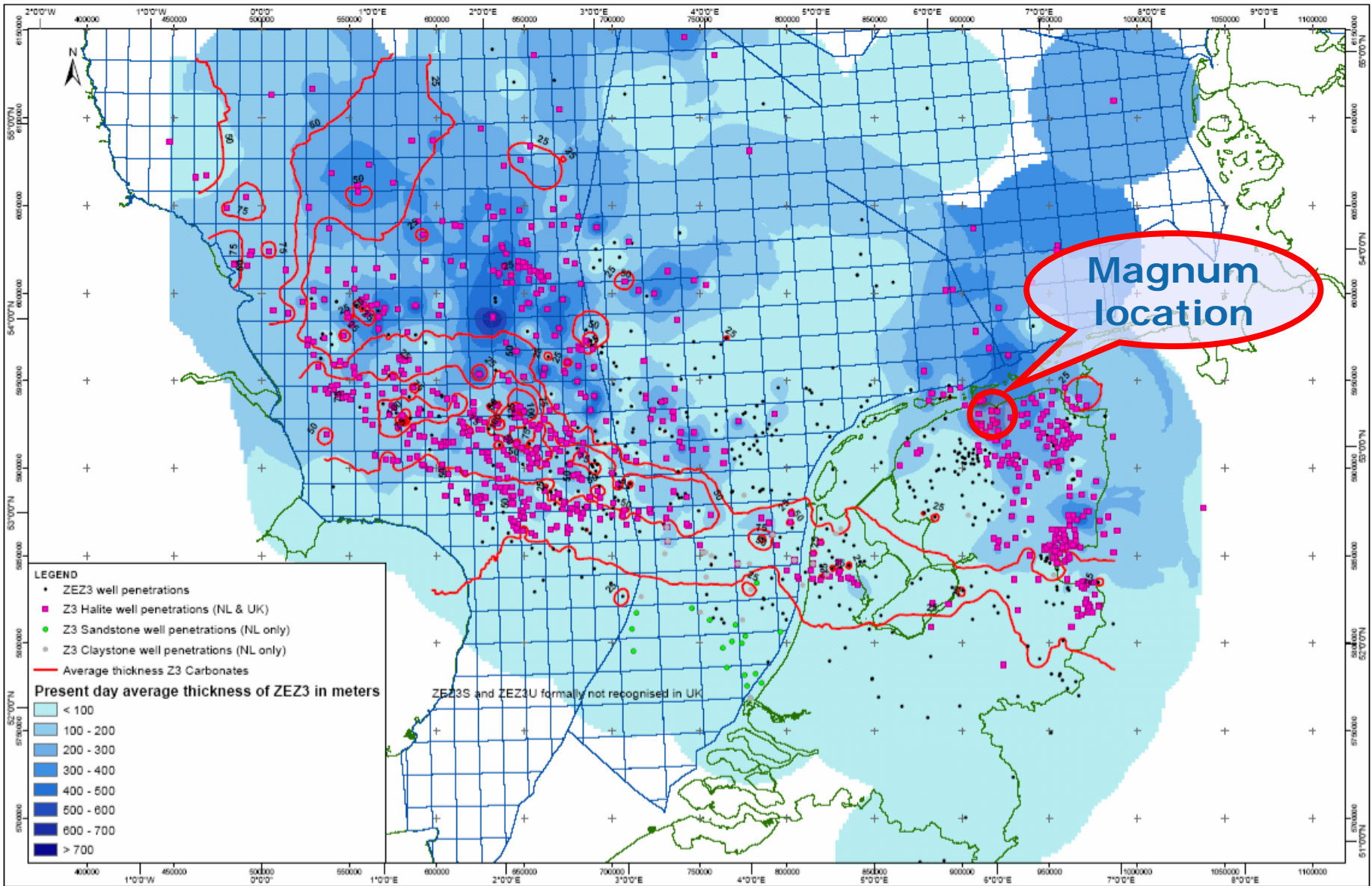
General Issues

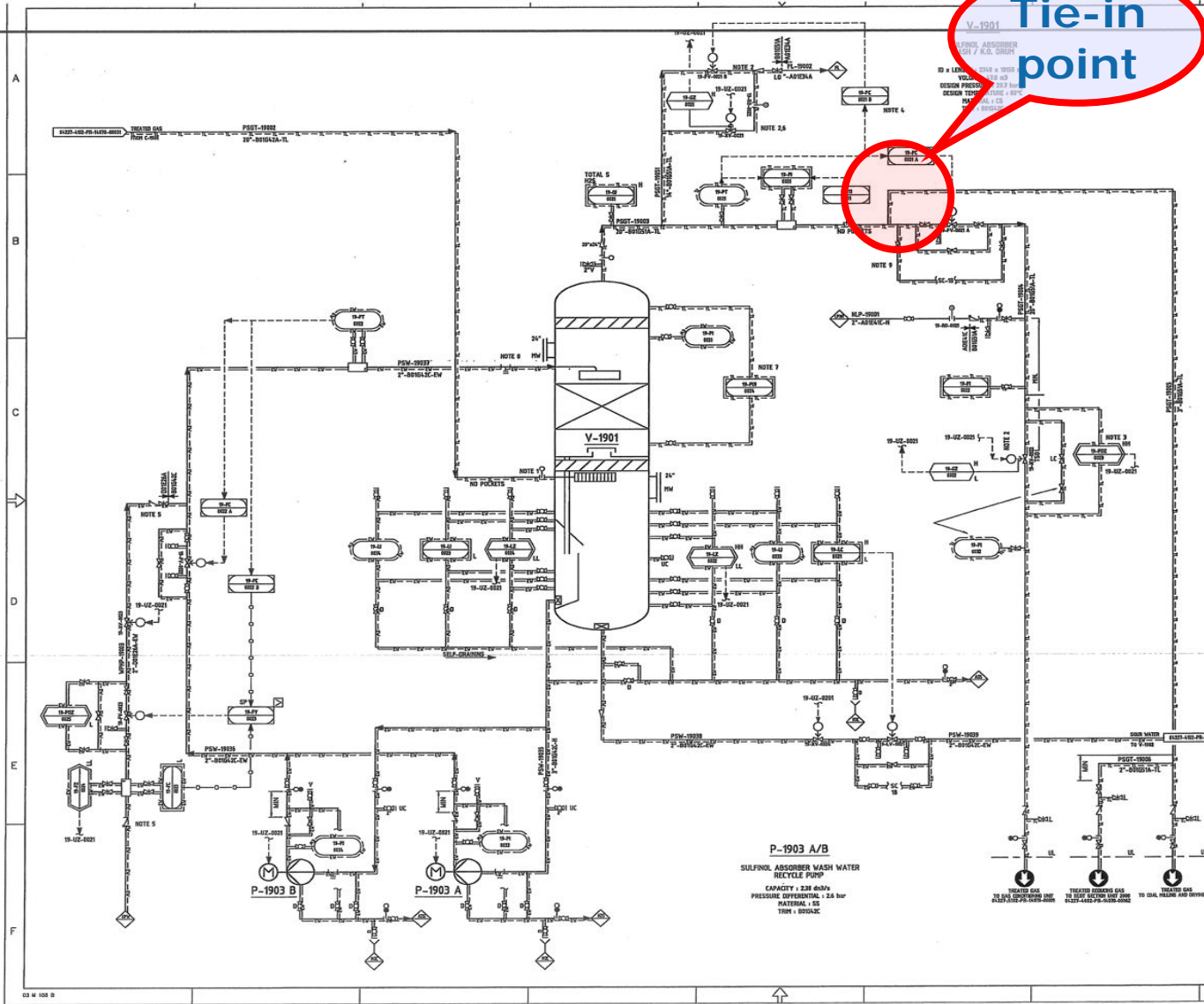
- Permittability
- Access (direct or indirect) to a low cost CO₂ storage
- Plot space – leave space for:
 - Water-gas shift reactor
 - CO₂ removal unit
 - Auxiliaries
 - Balance of Plant

Technical Issues

- Tie-ins
 - Syngas off-take
 - Steam
 - Cooling water/demi water
 - Water treatment
- Equipment Design
 - Prepare a design of the CO₂ capture unit including equipment sizing and plot space requirements
 - Assure design possibility to adapt changes to turbine combustors
 - Material selection
- Make-up power
 - Option for installing additional gasifier

CO2 storage options in the North of the Netherlands





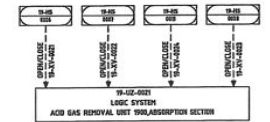
Tie-in point

GENERAL NOTES

A. FOR GENERAL NOTES SEE DRAWING: 64227-4002-PS-14070-00031

NOTES

1. NO BENDS, SWAGES OR VALVES ARE ALLOWED OUTSIDE THE VERTICAL PLANE THROUGH THE NOZZLE AND CENTRE LINE OF VESSEL FOR A HEIGHT OF 30 DIAMETERS FROM INLET NOZZLE.
2. VALVE MOUNTED ON HIGHEST POINT.
3. VALVE 19-XV-0022 OPENING PERMISSIVE ΔP LESS THAN 1.0 BAR.
4. DURING START-UP INTRODUCING OPERATIONS SET POINT OF 19-PC-0021 SHALL BE DEGRADED.
5. BOTH CHECK VALVES TO BE OF A DIFFERENT TYPE.
6. DEPRESSURING VALVE SIZE TO BE DETERMINED DURING DETAILED ENGINEERING.
7. TRANSMITTER TO BE LOCATED AT HIGHEST POINT SUCH THAT INSTRUMENT LINES ARE SELF DRAINING TOWARDS EQUIPMENT.
8. START-UP STRAINER
9. IN CASE OF INSUFFICIENT PRESSURE DROP OVER CONTROL VALVE DOWNSTREAM SIDE TO BE CONNECTED TO FLARE.



EQUIPMENT ON THIS DRAWING

V-1901
P-1903 A/B

JE JACOBS Project No. 64685-00

NO	DATE	FOR CHECK	BY
1	19-02-2001	FINAL ISSUE	BY
2	19-02-2001	FOR CORRECT	BY

DATE: 19-02-2001 REVISION DESCRIPTION: BY: [Signature]

REVISIONS HAVE BEEN MADE TO THIS DRAWING THE LETTER OF ISSUE SHALL BE INDICATED IN A TRIANGLE NEAR THE PART(S) CONCERNED

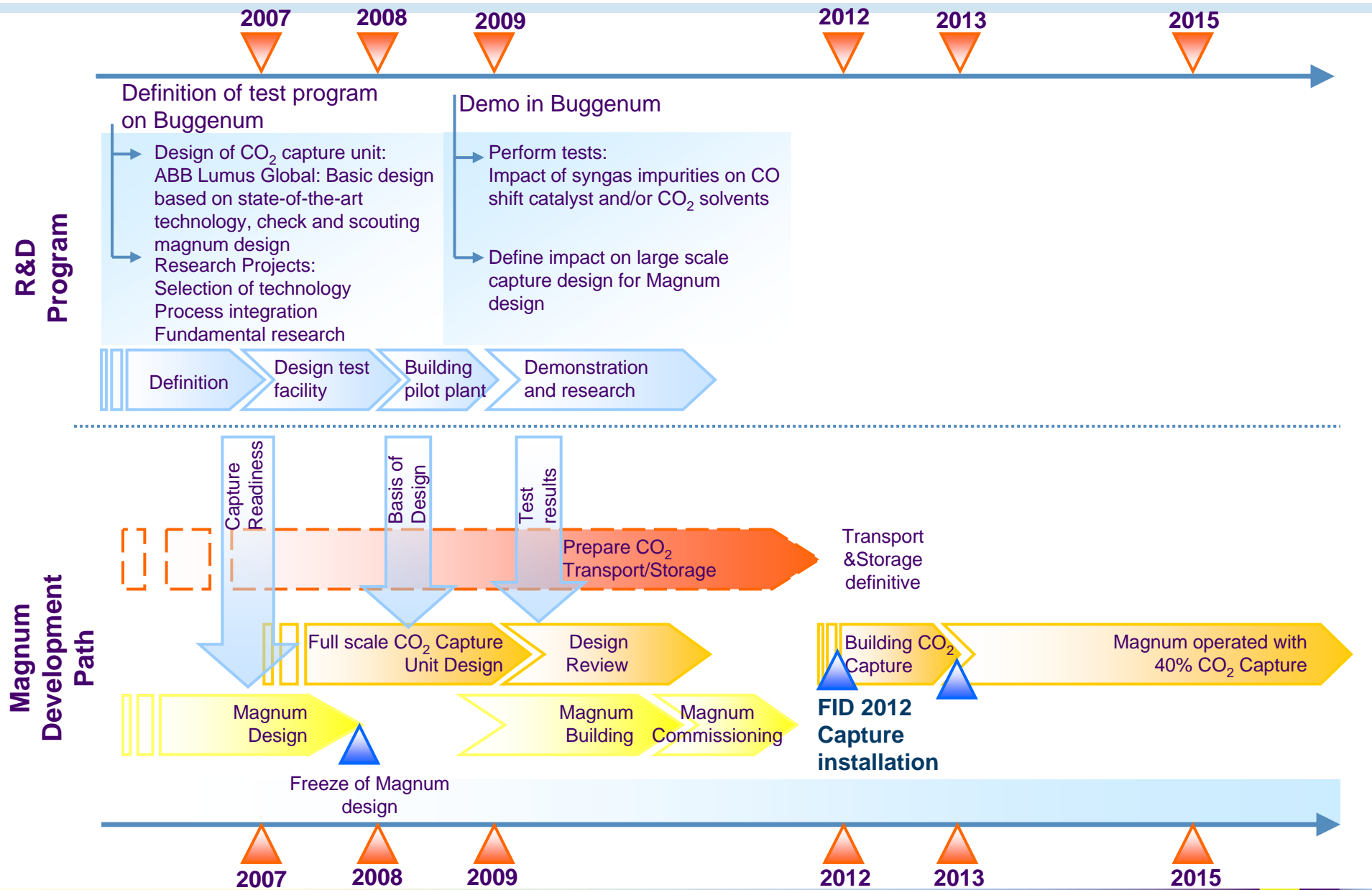
DRAWN BY: DATE: NONE

NAME: [Signature] SCALE: NONE

PIPING AND INSTRUMENTATION DIAGRAM
ACID GAS REMOVAL UNIT 1900, ABSORPTION SECTION
TREATED GAS K.O. SYSTEM

LOCATION: NETHERLANDS
FILANT: NUON-MAGNUM IGCC
SHELL GLOBAL SOLUTIONS INTERNATIONAL B.V. - HERTHOLDSMA
GSST DRG No: 64227-4002-PS-14070-00031

Nuon Carbon Capture Program (preliminary)



Thanks !