



Large Scale Synthesis Gas Production

Recent Experience and Developments

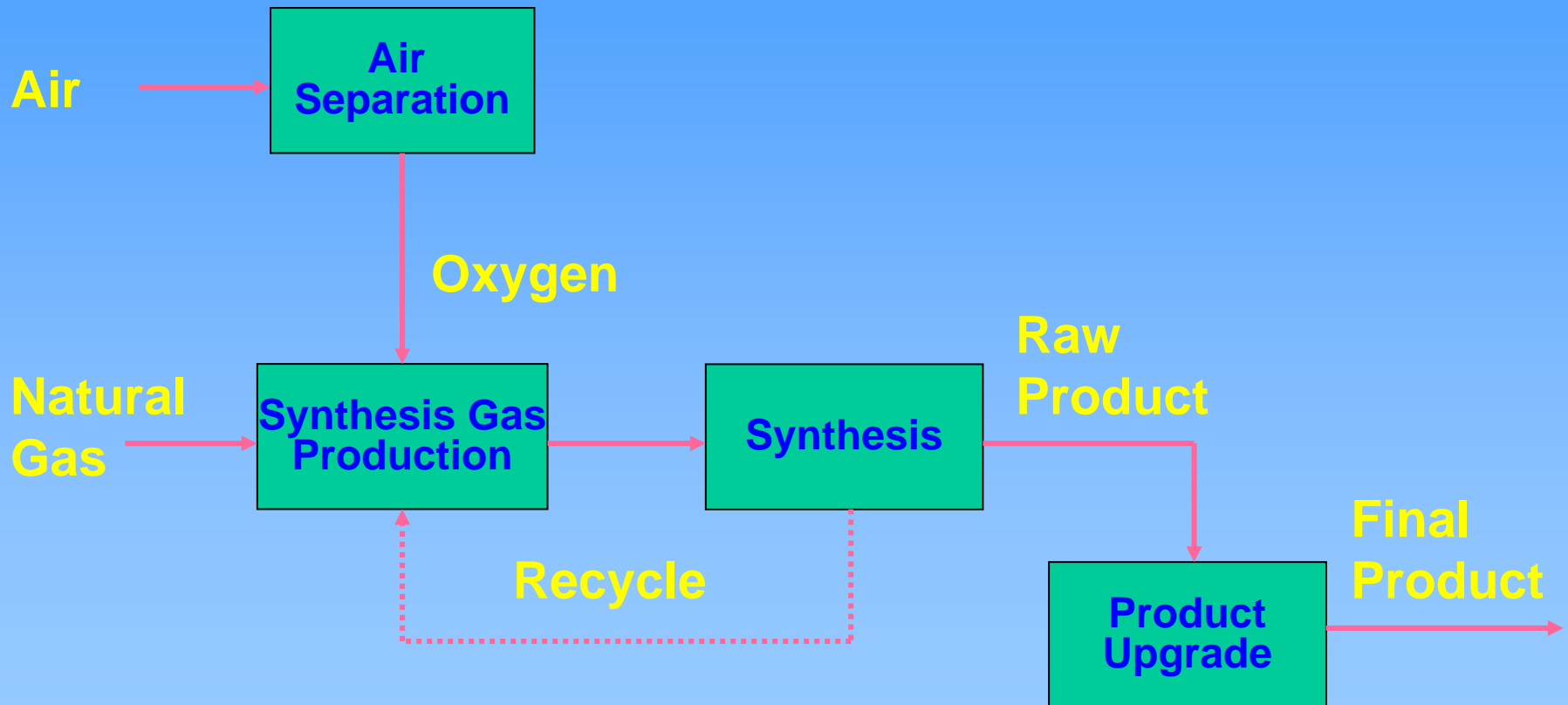
May 2007



Presentation Outline

- **Introduction**
- **The ATR**
- **Combinations with Heat Exchange Reforming**
- **Production of Multiple Products**
- **Conclusions**

Large Scale Gas to Liquids/Chemicals Plant



Large Scale Plant Design Targets

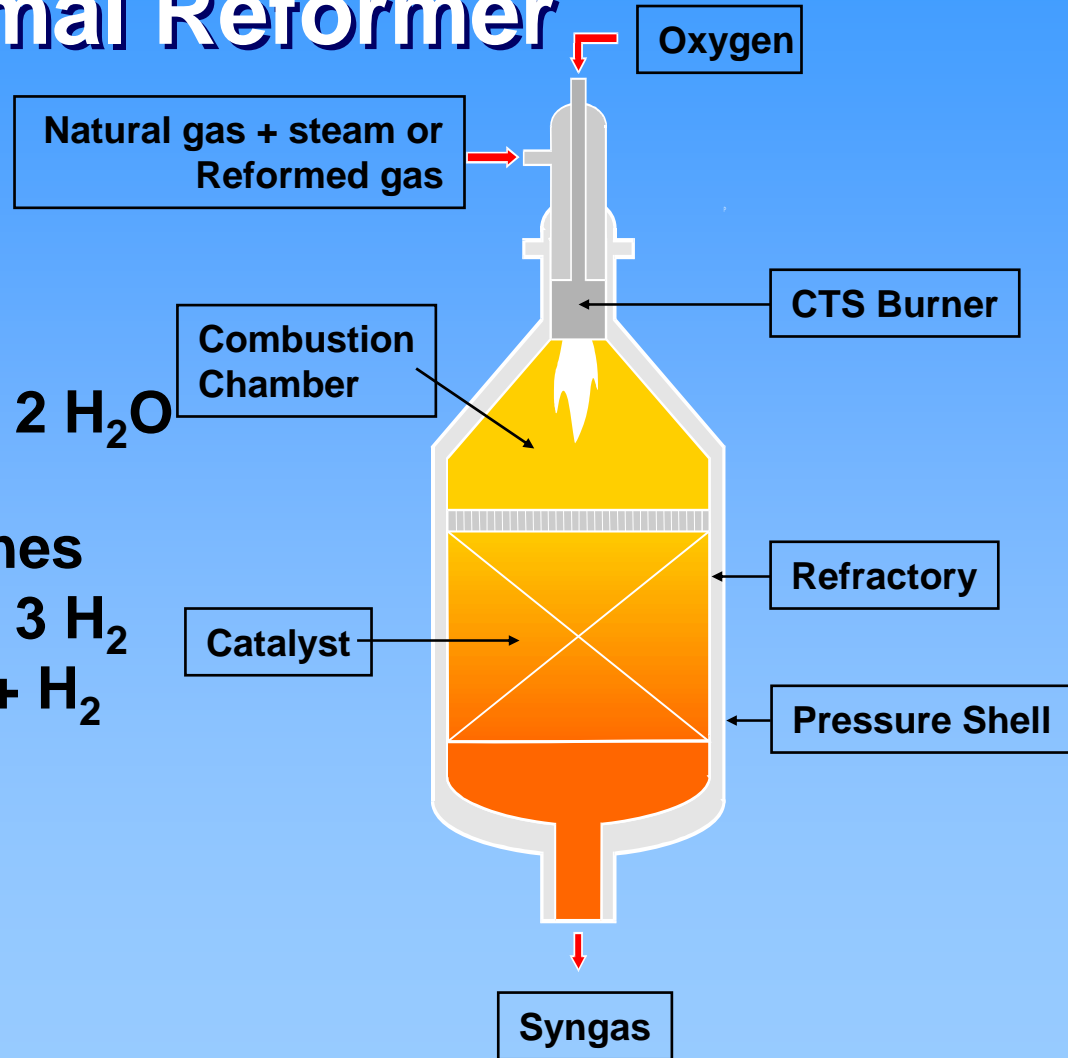
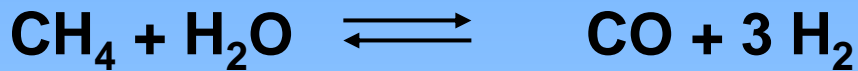
- **Large (single line) capacity**
- **Minimum investment per unit of product**
- **Efficiency often of secondary importance**

Autothermal Reformer

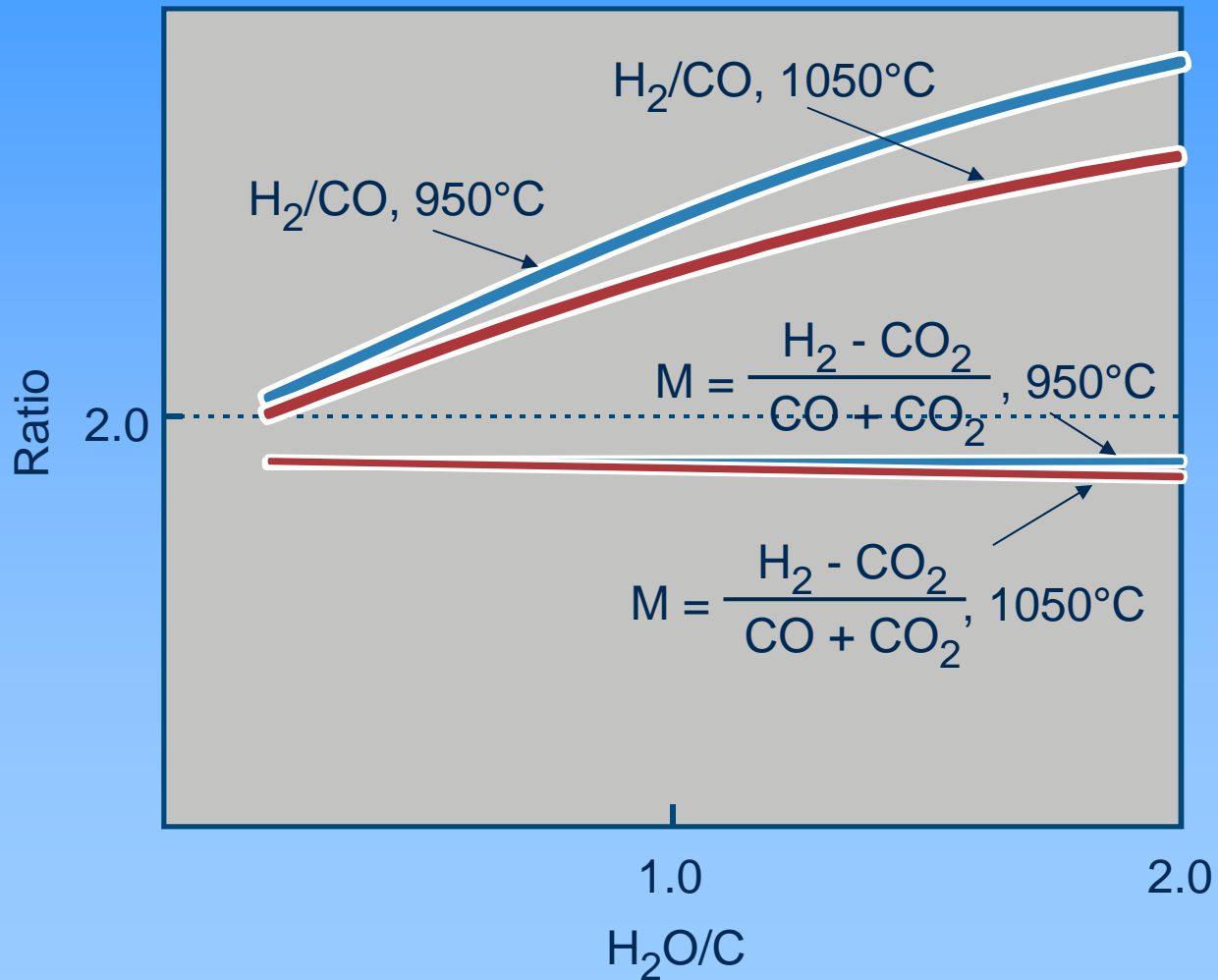
Combustion Zone



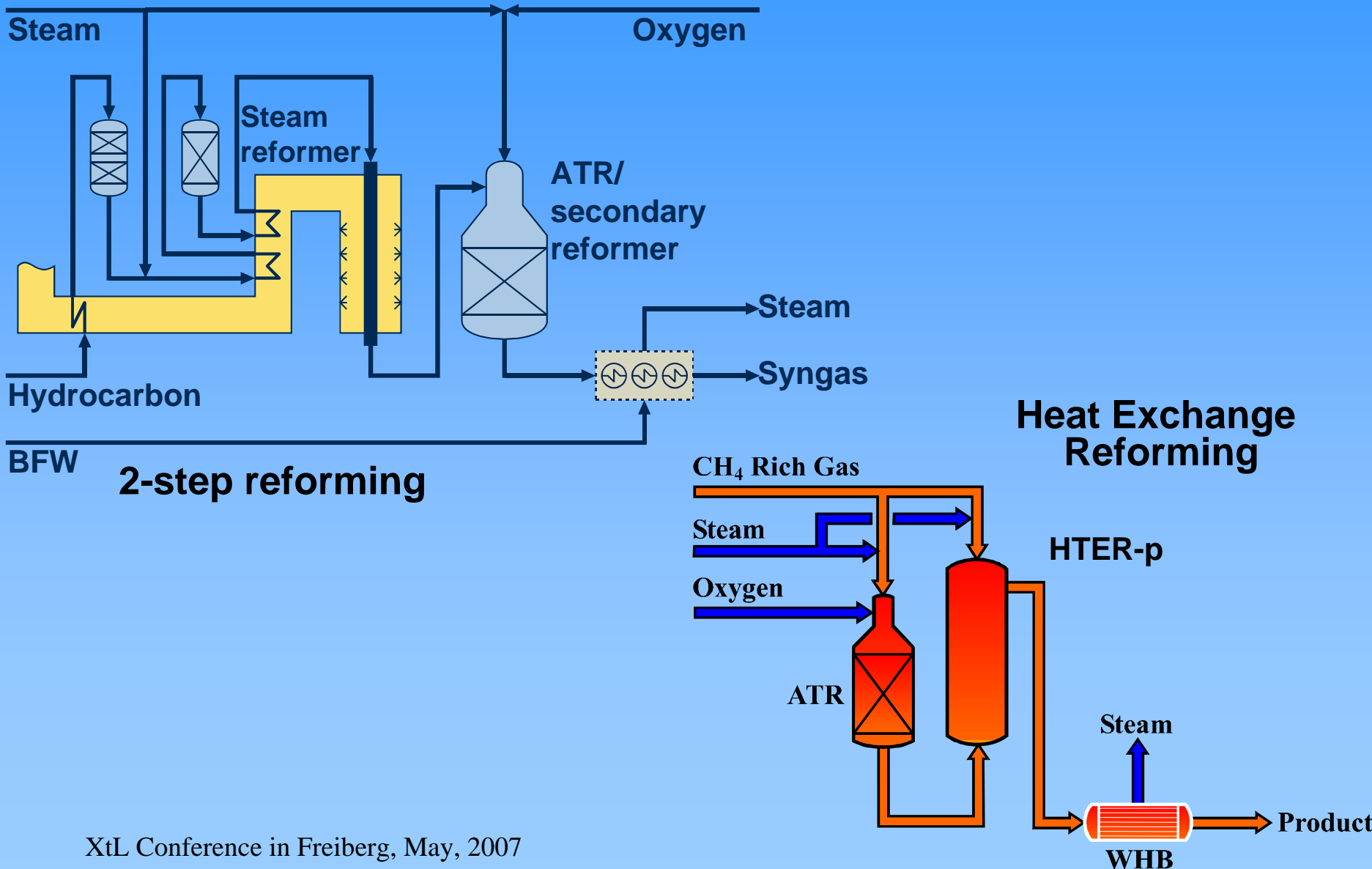
Thermal and Catalytic Zones



ATR synthesis gas properties

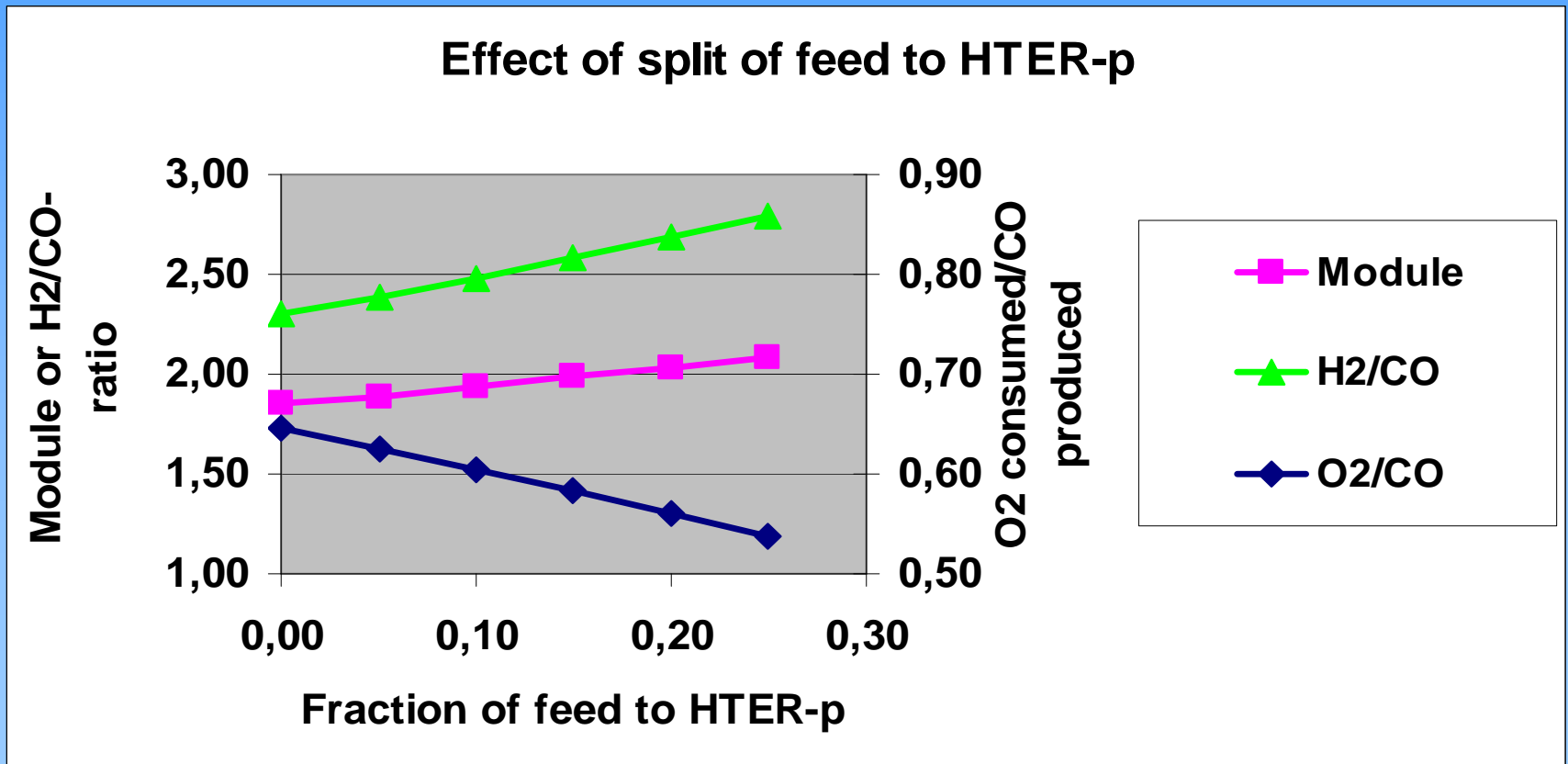


ATR and Steam Reforming Combinations



Split of Feed to HTER-p

ATR/HTER-p combination



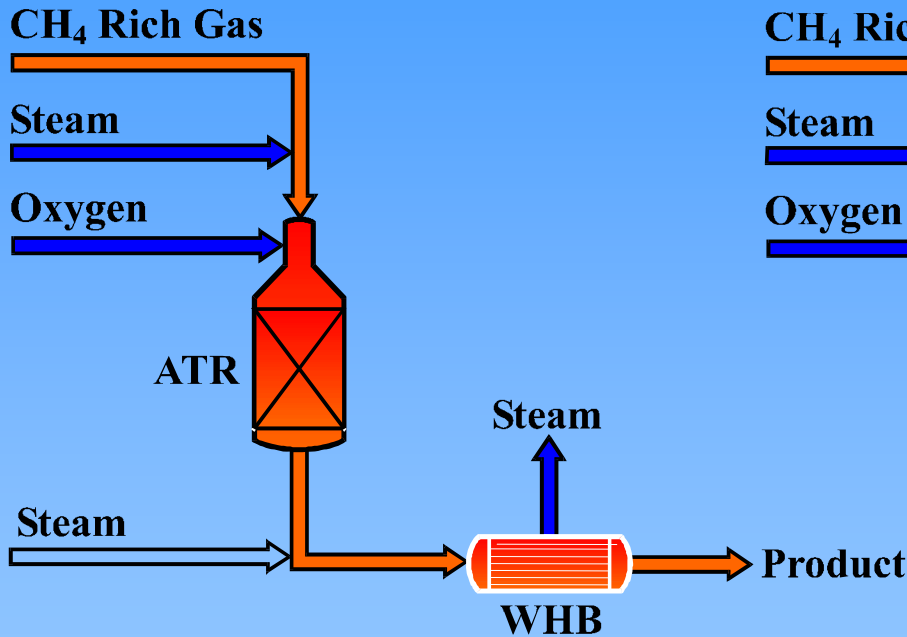
The HTER-p



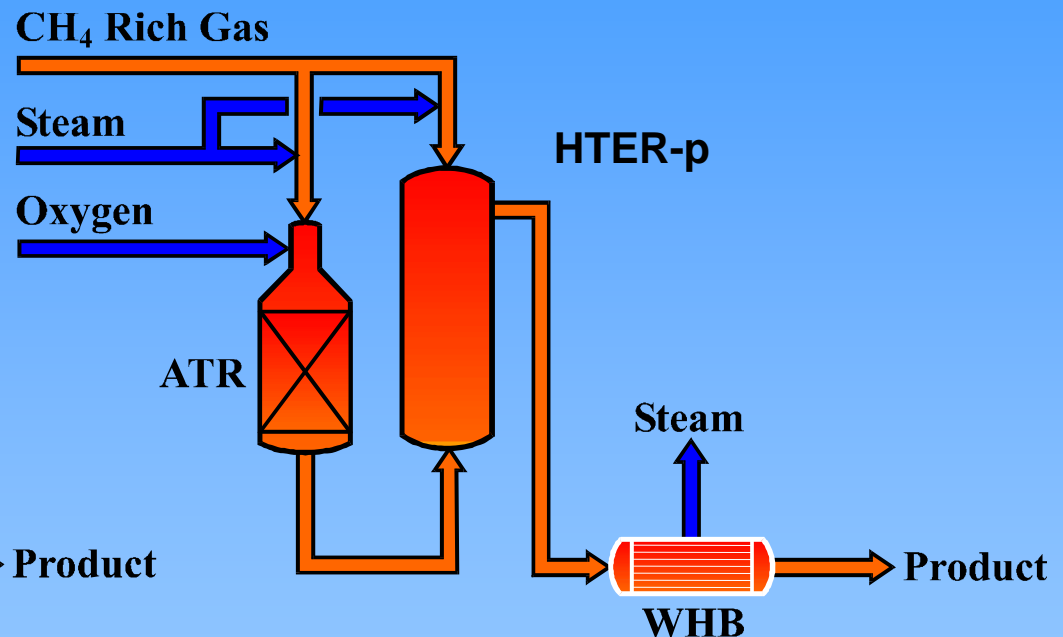
- **Compact**
- **Reduces oxygen consumption**
- **Increases efficiency**
- **Increases H₂/CO-ratio and methanol module**
- **Capacity increase of existing plant**
- **Industrial operation in South Africa**

Heat Exchange Reforming in South Africa

Before



After



CH₄ Rich Gas: 100
Product Gas: 100 (dry)
O₂-consumption: 100
Steam Production: 100

CH₄ Rich Gas: 133
Product Gas: 134 (dry)
O₂-consumption: 80
Steam Production: 54



Production of Methanol and Ammonia

5000 MTPD Grade AA MeOH & 2000 MTPD NH₃

Process Scheme	Separate Plants	Combined Synthesis Gas Unit
Synthesis Gas Technology	2 x 2 step Reforming	2 step Reforming
Methanol Synthesis	BWR Reactor	BWR Reactor
Ammonia Synthesis	S-300 Converter	S-300 Converter
Energy Consumption	100	101
Investment Index	100	87

Conclusions

- ATR at low S/C is the most attractive technology for large single line capacity production of synthesis gas
- The combination of ATR and heat exchange reforming reduces oxygen consumption and increases energy efficiency and single line capacity
- A combination of ATR and Heat Exchange Reforming is in commercial operation and several further units are in various phases of design or construction
- Plants for multiple products have lowest investment with a large and common synthesis gas unit