



G L O B A L F O R U M

**On Flaring and Venting Reduction
and Natural Gas Utilisation**

PROTEUS LNG

An Economic Solution to Small – Mid Scale Liquefaction

Paul Emmitt

New Technology Manager

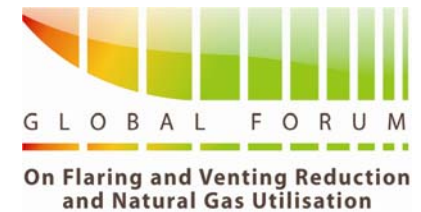
Brian Songhurst

Director of LNG



4th December 2008

Energy & Power



- Formed 2000, Independent (Privately Owned)
- 120 Personnel Based in London, Wales & Hong Kong
- Consultants to the Oil & Gas Industry (Oil Companies & Contractors)
- Due Diligence/Design Audits/Owner's Engineer (Client Support Teams)
- Feasibility Studies/Conceptual Design/FEED/Detailed Engineering
- Extensive Expertise in LNG Projects Worldwide (Onshore and Offshore)

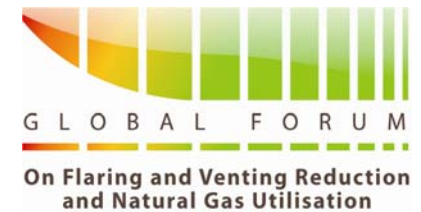


Contents

- **INCREASING NEED FOR MID RANGE LNG PLANTS:**
 - Why – to monetise stranded gas (flared gas, CBM)
 - Why stranded – focus has been on expensive large scale plants
- **PROTEUS LNG TECHNOLOGY:**
 - An innovative solution for small to mid range plants
 - Description
 - Comparison with other processes
 - Costs
 - Benefits
- **BUSINESS OPPORTUNITIES**
 - Energy companies
 - Suppliers & Contractors
- **NEXT STEPS & CONCLUSIONS**



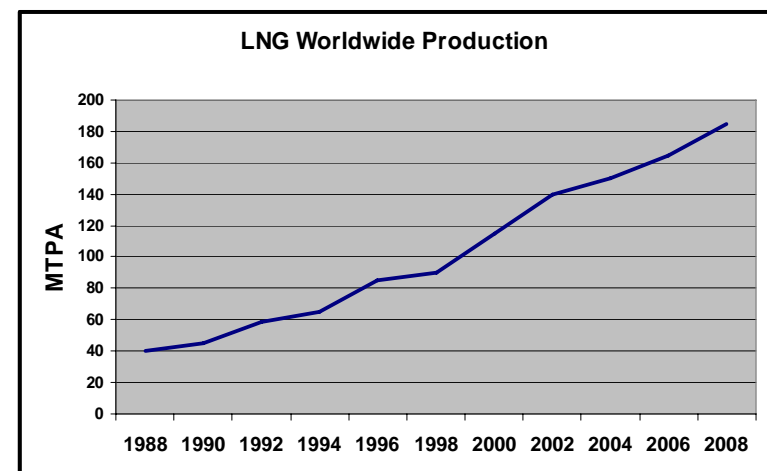
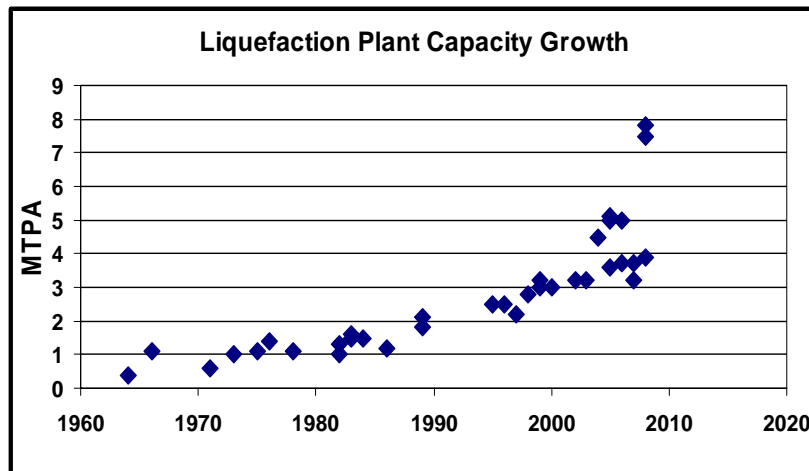
History of PROTEUS LNG



- Invented by GasConsult
- Energy & Power undertook partnership with inventors
- Process IP protected by Patent
- Process systems developed using Energy & Power' multidiscipline expertise
- Due Diligence of PROTEUS LNG completed by DNV in 2007
- Rigorous modelling of process undertaken
- Pilot plant Design, FEED, HAZOP, QRA completed
- Full economic model developed
- Market review highlighted need for a more flexible process
- Modular PROTEUS LNG concept developed e.g. remote locations / FLNG

Emerging Mid Scale LNG Market

- Rapid growth has led to “Stranded Gas” and flare gas opportunities
- Small scale LNG market is expanding
- Production 30 – 3,000 t/day (10,000 – 1,000,000 t/year)
- PROTEUS LNG offers low (lifecycle) cost solution
- Opportunities for new energy companies and suppliers

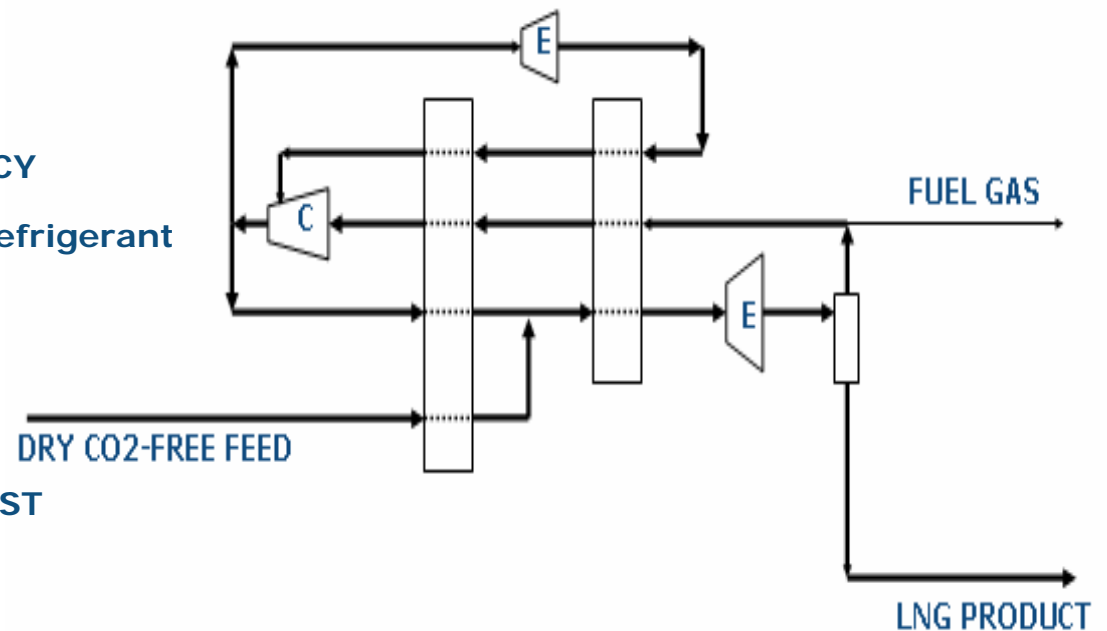


PROTEUS LNG Process

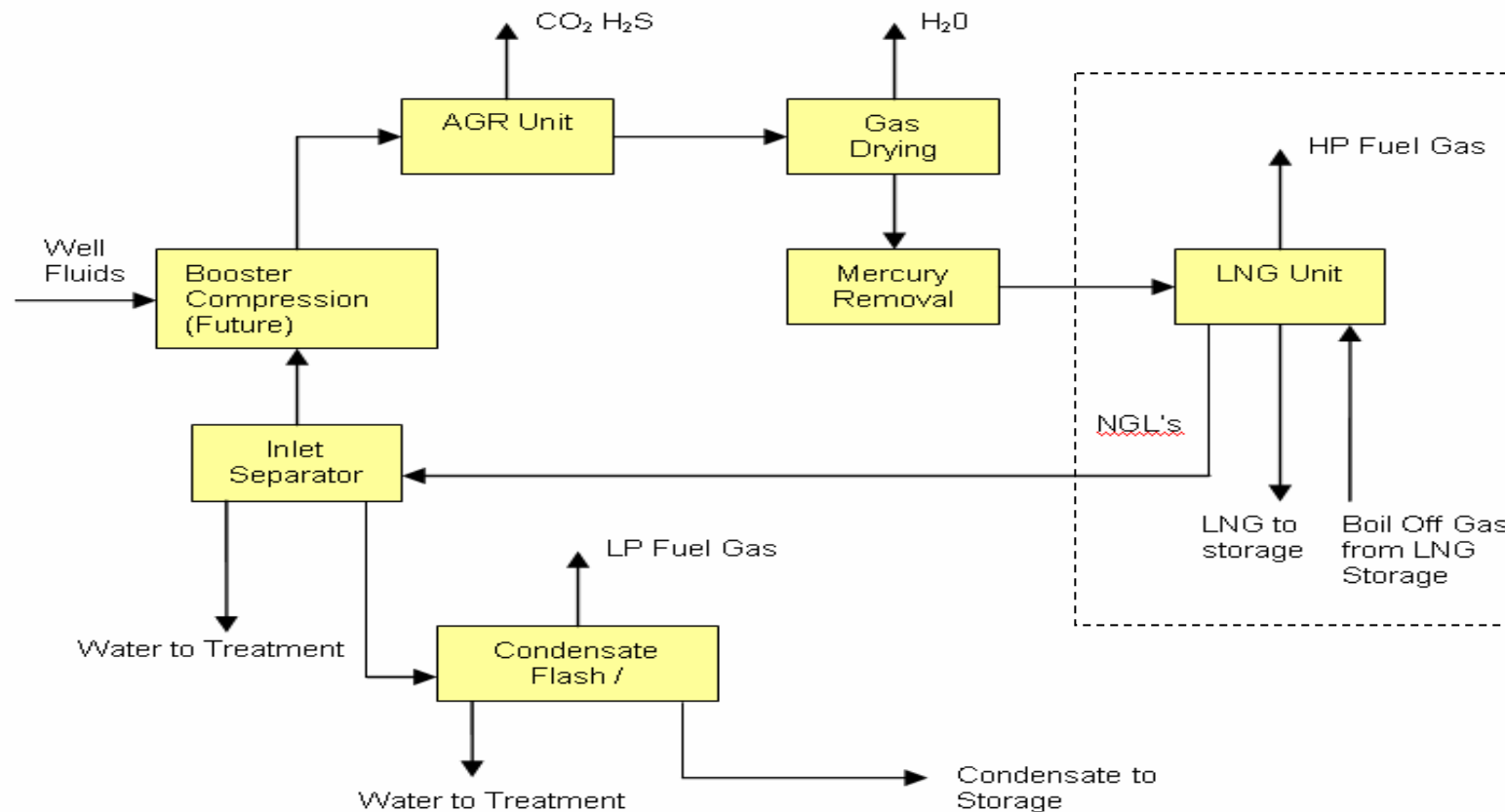
- **SIMPLE;**
 - Lower CAPEX due to low equipment count
 - Lower hydrocarbon inventory
 - Easier operation and maintenance
 - Improved Safety

- **HIGH THERMODYNAMIC EFFICIENCY**
 - Approaching complex mixed refrigerant processes
 - Lower OPEX

- **OVERALL LOWER PRODUCTION COST**
 - Increased profit



Overall Production Scheme



- STILL NEED CONVENTIONAL GAS PRE-TREATMENT (PURIFICATION);
- AMINE WASH, MOLECULAR SIEVE DRYING – ALL INDUSTRY STANDARD;

Specific Power (kW/TPD LNG)

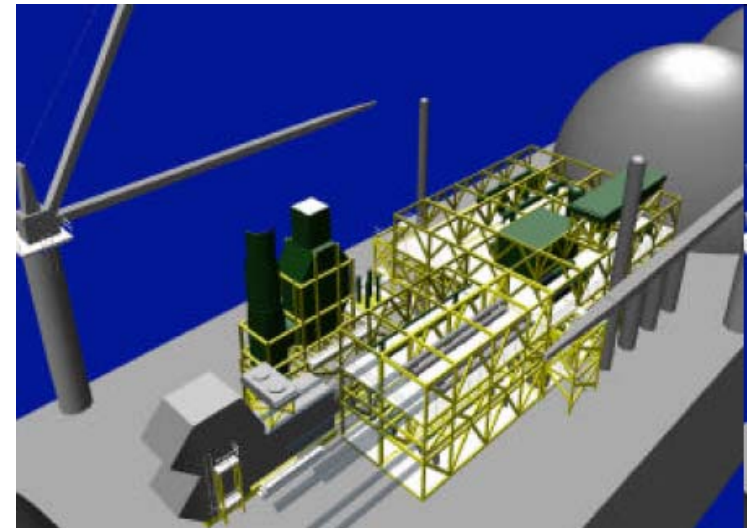
LIQUEFACTION PROCESS	SPECIFIC POWER KW/TON PER DAY	INCREASED LNG PRODUCTION PER UNIT OF FEED GAS
Single Expander Cycle	25-35	Base line 0%
Double Expander Cycles	20-25	+7%
PROTEUSLNG	13-20	+ 10%
Cascade Cycle	13-14	+11%
Mixed Refrigerant Cycle	12-13	+12%

Production Costs (Liquefaction Only)

- **CAPEX**
 - \$US 220 – 250 per ton/year
 - \$US 220 – 250 million for 1 million t/year (3000tpd) plant
 - \$0.3 MMBTU based upon 1 million t/year plant
 - FOB Basis
 - Modular Construction
 - Liquefaction Unit Only, excludes gas treatment, storage, export and utility systems

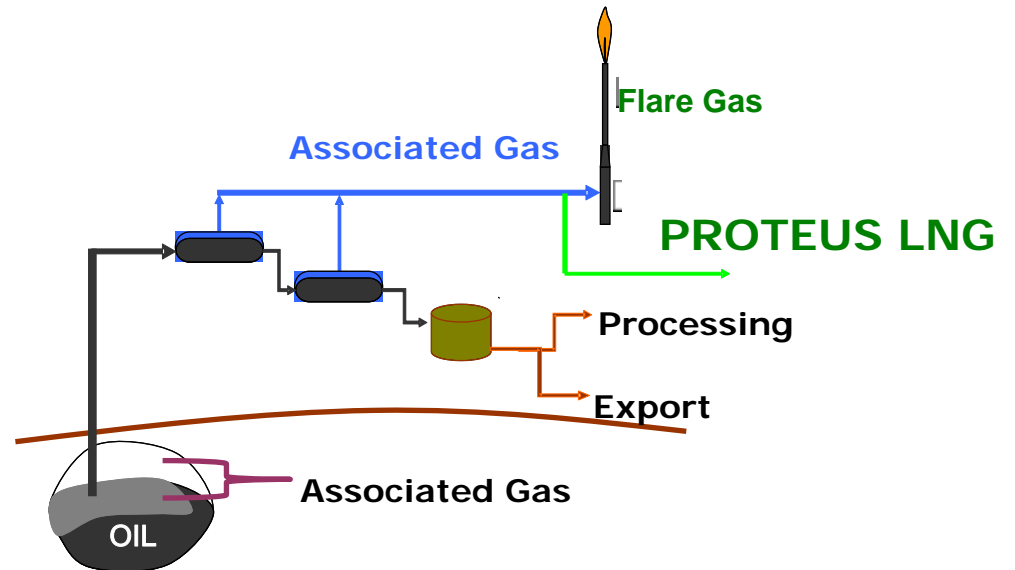
- **OPEX**
 - \$0.4 MMBTU based upon 1 million t/year
 - Liquefaction only

- **PRODUCTION COST**
 - \$0.8 MMBTU based upon 1 million t/year



Opportunity to Monetise Gas

- Flared Associated Gas From Oil Production;
- Small Offshore Gas Fields;
- Coal Bed Methane or Coal Seam Gas;
- Waste Site Methane and Biomass;
- End of Pipeline (Pipeline 'Extension');
- Sustainability (Diesel Displacement)
- Transport fuel solutions
- Off Grid supply opportunities

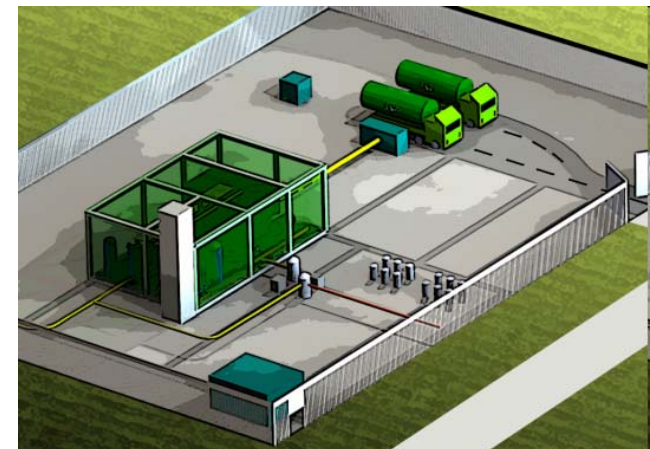


Next Steps

- **Build and Operate Demonstration Plant**
 - 10 tpd (12000 Nm³/d feed gas), ½ Road Tanker/d
 - Budget \$US 5 million
 - Currently Seeking Participants;

- **Seeking Potential Investors**
 - For IP
 - For Execution

- **First Commercial Plant Scheduled for 2012**



Conclusions

➤ PROTEUS LNG OFFERS

- A simple liquefaction process leading to:
- Lower costs – Capital & Operating
- High Efficiency – more production per unit of feed gas
- Shorter Schedule – earlier production, improved cash flow
- Improved Safety – if used with no external refrigerants
- Uses Proven Equipment

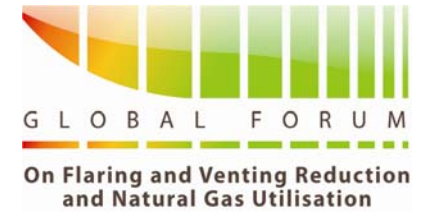
➤ CREATES OPORTUNITIES

- Enabling technology for monetising small gas reserves or flared gas
- New entrants into LNG production and supply business

➤ PROPOSALS

- We offer conceptual designs and cost studies for development of your gas reserves

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