



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

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New Technology Manager

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Director of LNG



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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**

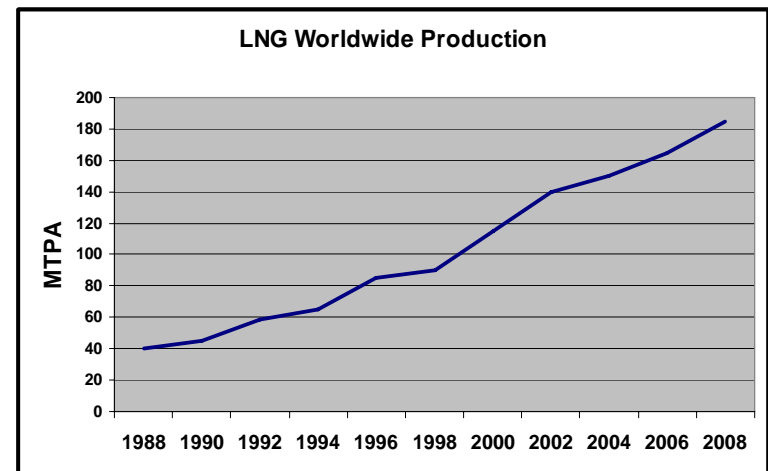
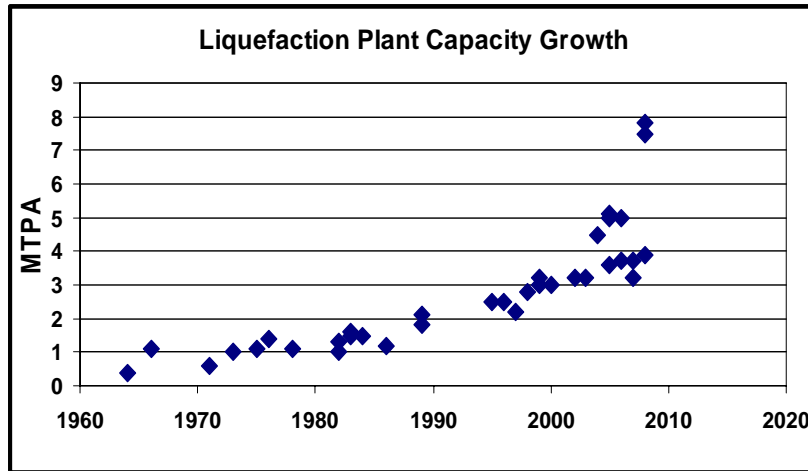


History of PROTEUS LNG

- **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

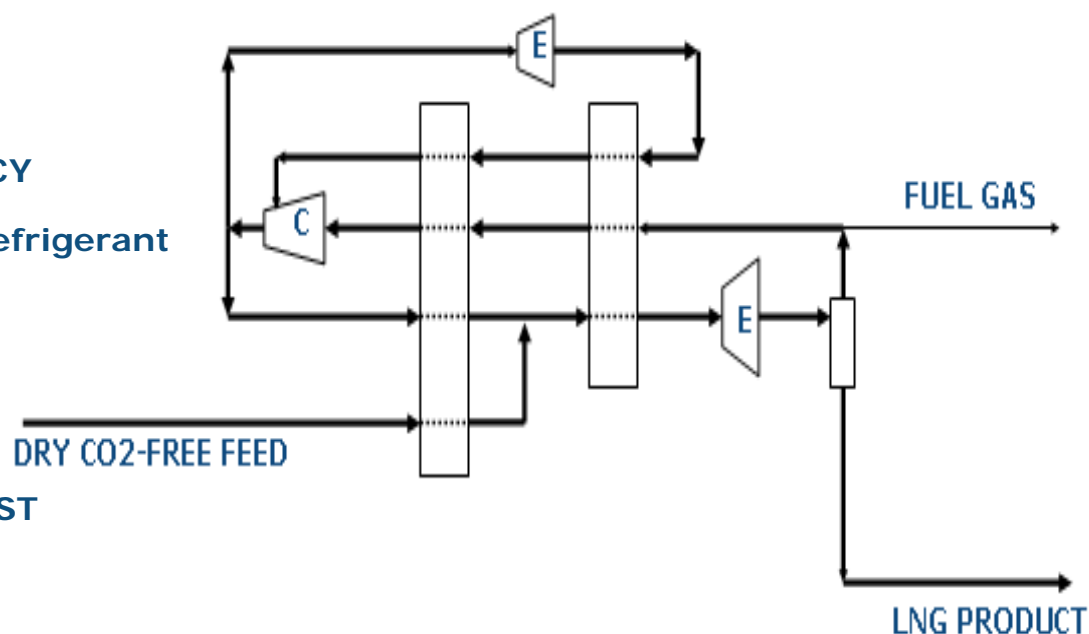


PROTEUS LNG Process

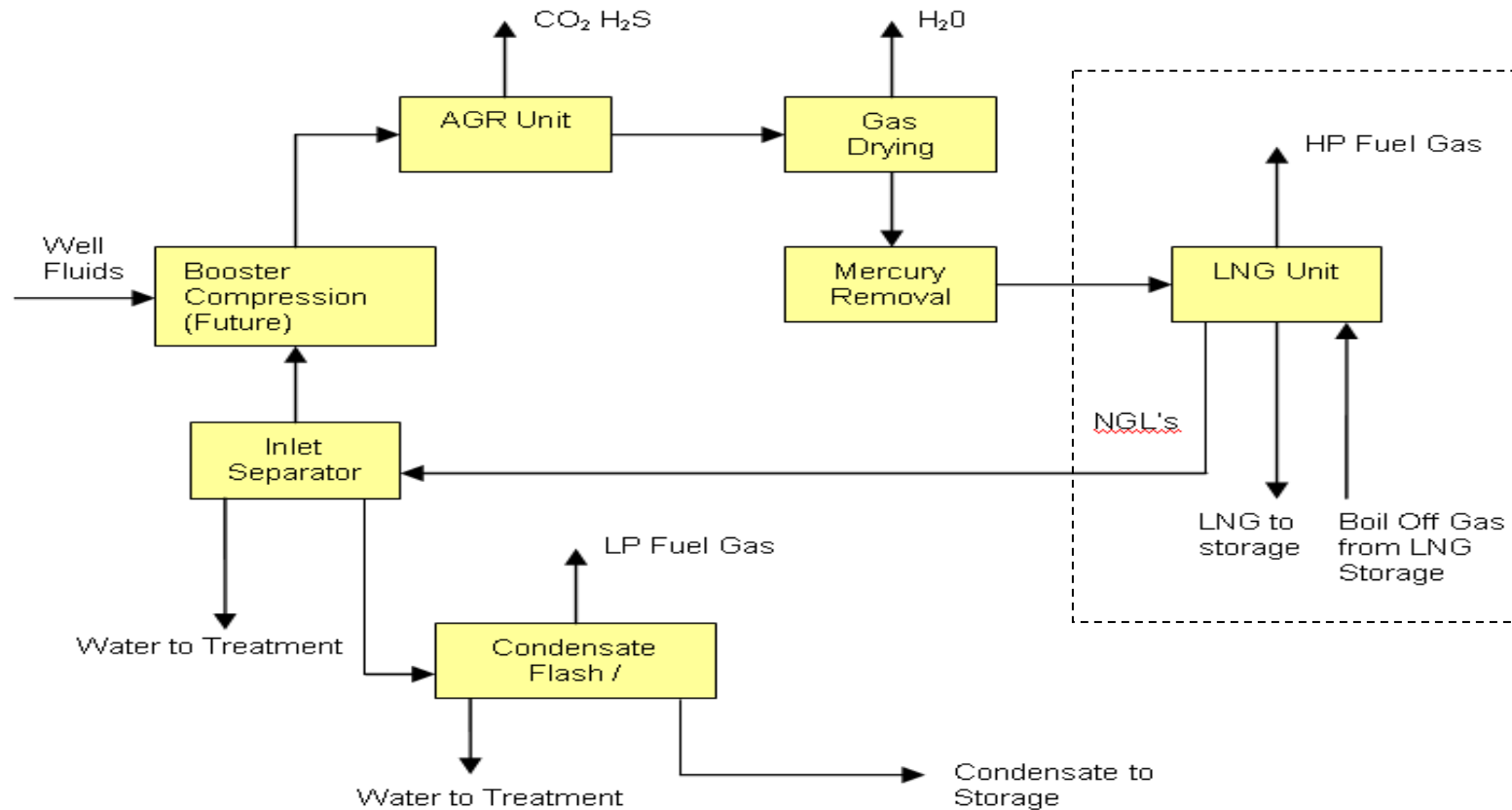
- **SIMPLE;**
 - Lower CAPEX due to low equipment count
 - Lower hydrocarbon inventory
 - Easier operation and maintenance
 - Improved Safety

- **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%
PROTEUS LNG	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

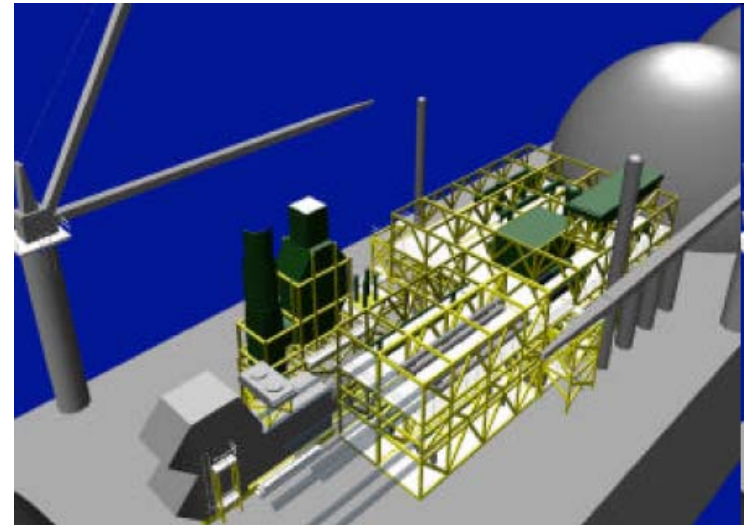
➤ OPEX

\$0.4 MMBTU based upon 1 million t/year

Liquefaction only

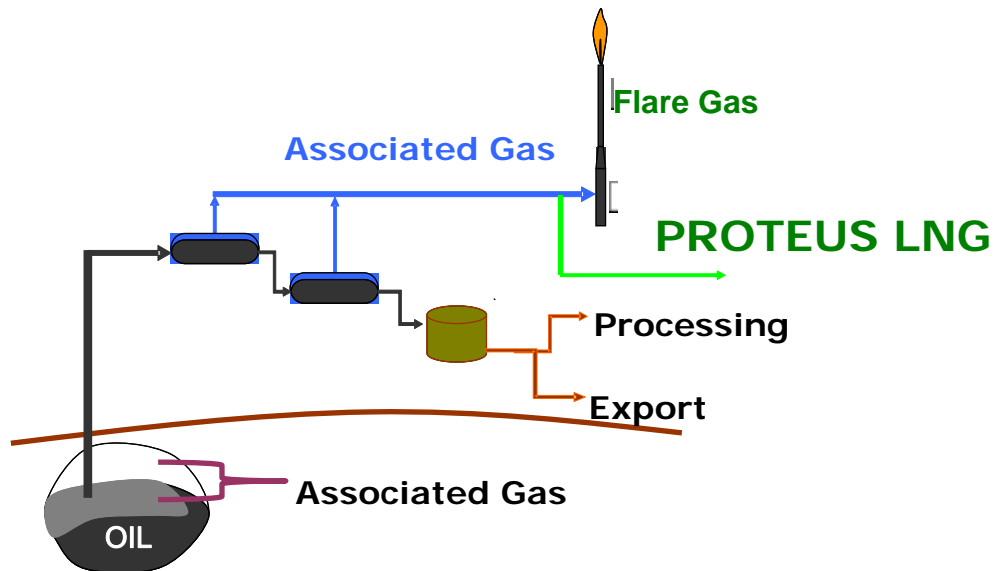
➤ PRODUCTION COST

\$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

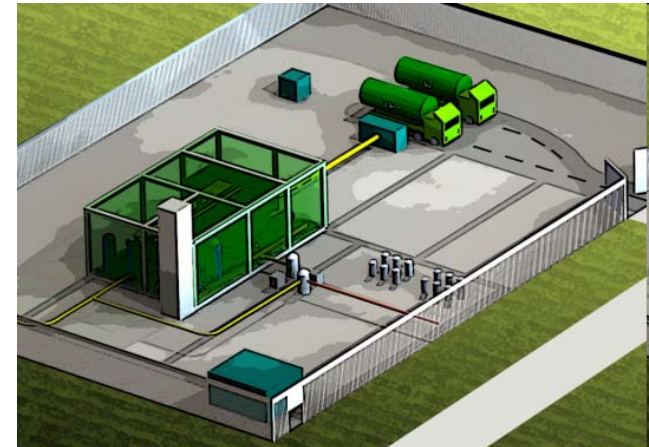


Next Steps

- **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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