

# Flaring and Venting – A CNG Solution?

Darrell HAWKINS

## "Flaring and Venting – A CNG Solution?"



- Company and Technology
- Flaring and Venting
- A CNG Solution?
- Way Ahead

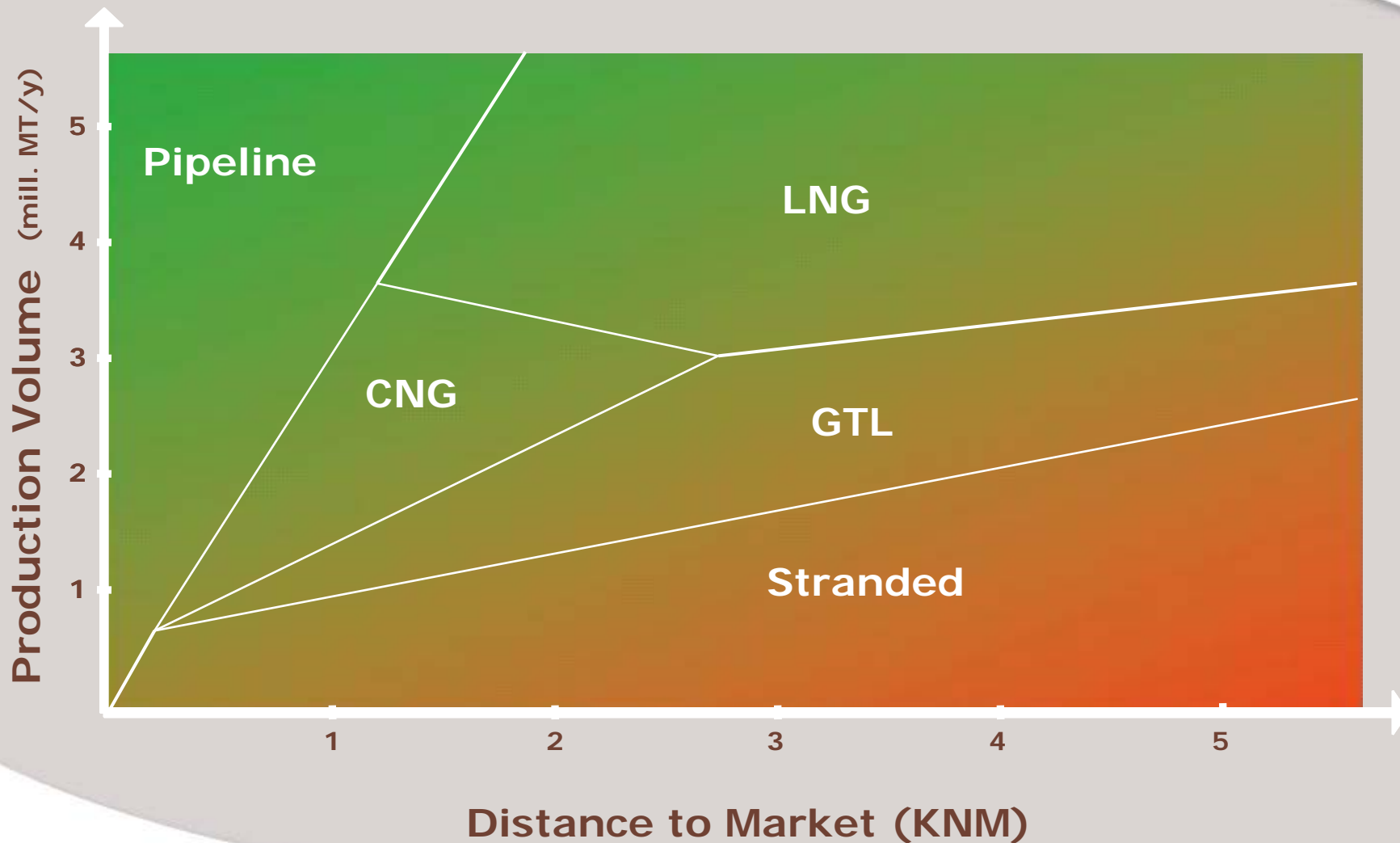
# INTRODUCTION

- Atlantic Canadian Compressed Natural Gas (CNG) technology company
- TOG owns CNG patent rights using Fiber Reinforced Plastic (FRP) technology
- Joint Industry Project (JIP) to verify design & obtain classification society certification
- Marine certification in Q1/07
- Road and rail certification in Q4/07

## What is CNG?

- Natural gas compressed to 3600 psi
- Low infrastructure cost
- Mobile infrastructure
- Minimal processing required for transportation

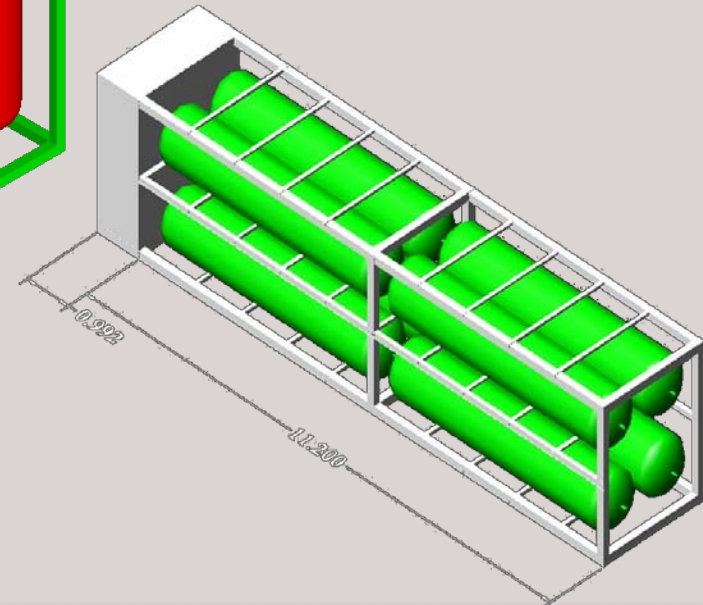
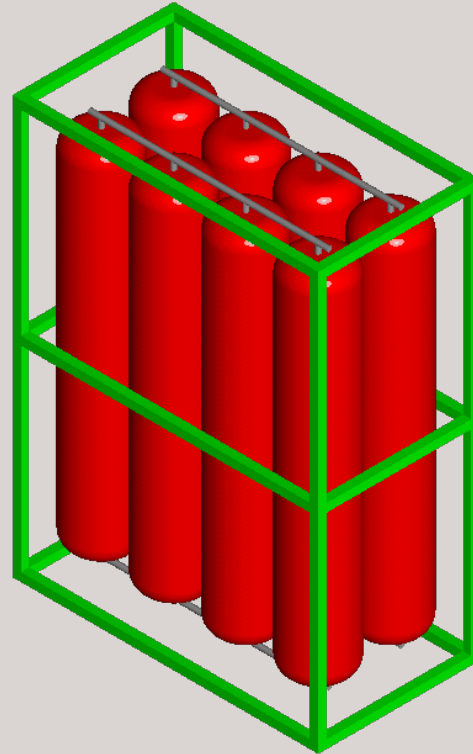
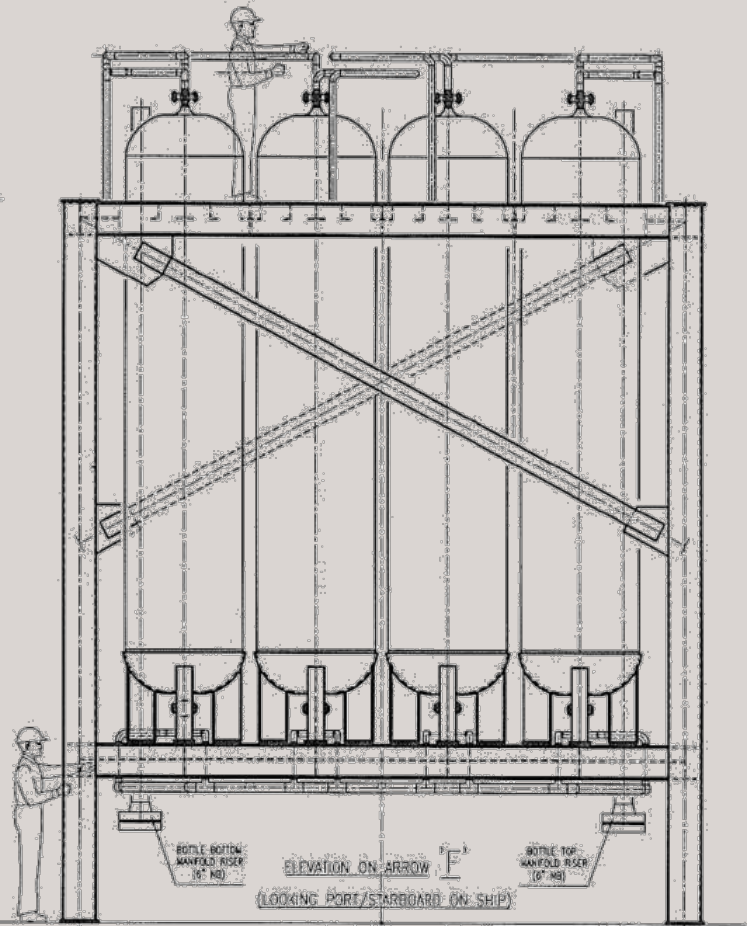
# Economics of Transporting Gas



# FRP Technology



# Flexible - Modular Cassette



# FLARING AND VENTING

# The Gas Flaring Issue



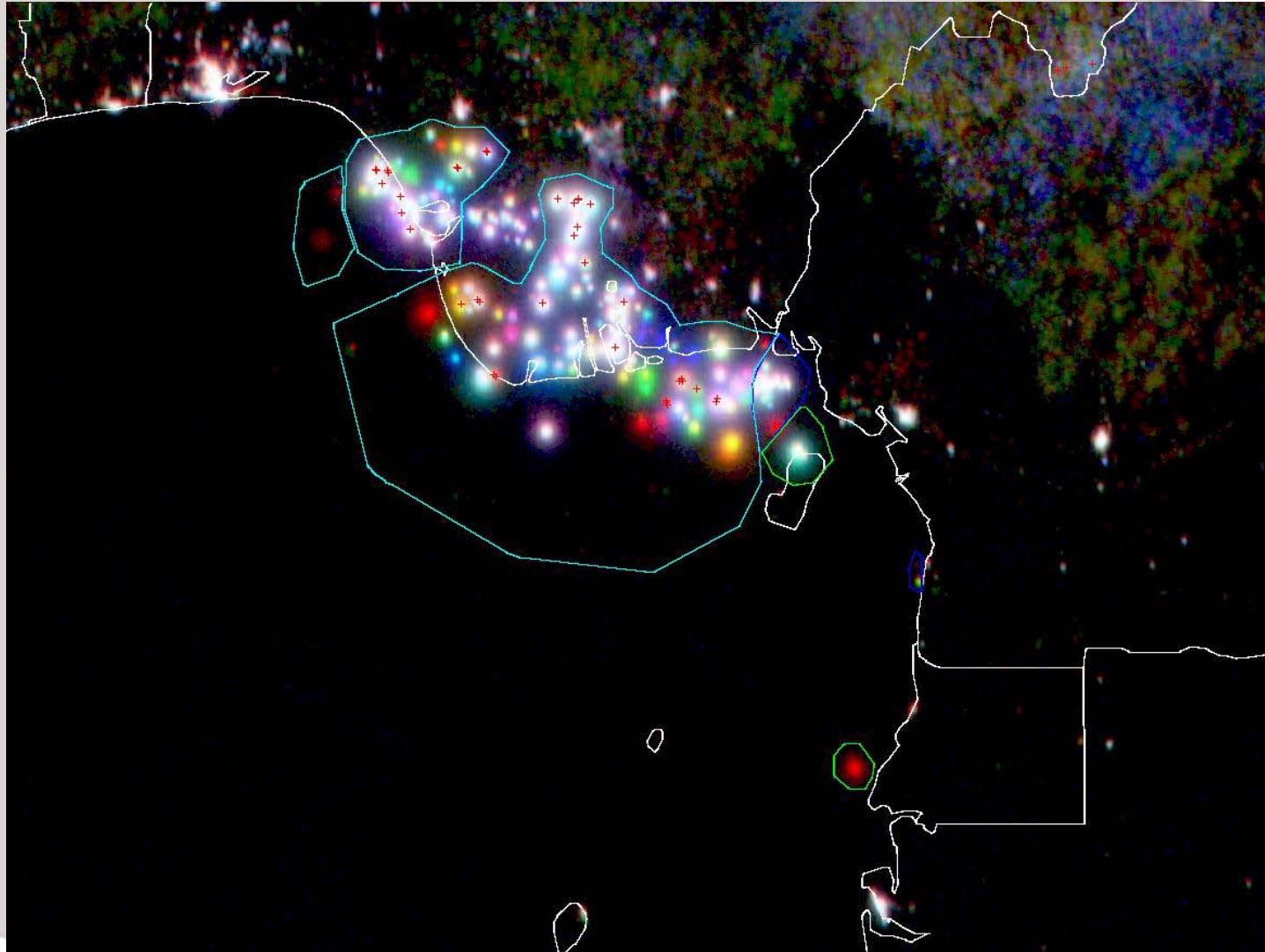
Exxon-Mobil Amenam Platform, Nigeria

- Crude oil contains associated hydrocarbon gases.
- When brought to surface the gases are released.
- Where there is no market for the gas the industry standard for disposal is flaring.
- Venting also occurs: releasing un-burnt gases directly into the atmosphere.
- Alternatives include re-injection, on-site power generation, and transport to markets.

# Why Flare Natural Gas?

- Flare
  - As an Emergency Safety Precaution
  - As part of Operations
  - Well Productivity Evaluations
- Vent
  - Reduce back pressure on oil wells
  - When low volumes make flaring impractical
  - When volumes are insufficient to make conservation economic
  - Rates vary by year, month, day and hour

# Satellite Image - Nigeria



# Flaring - Why is it an Issue?

- Technical reports question flare efficiency and potential animal health impacts
  - Combustion efficiency: assumed ~99%; 1996 research of two gas flares estimated to be ~62% and ~84%.
  - Incomplete combustion can produce:
    - Carbon monoxide and unburnt hydrocarbons
    - Volatile organic compounds (vocs) such as benzene
    - Polycyclic aromatic hydrocarbons (pahs)
    - Small quantities of sulphur compounds such as CS<sub>2</sub> and COS.
- Public concerns (health risks, odour, visibility, greenhouse gas, and resource conservation)
- Industry need for regulatory certainty

# Barriers to gas sector development



- Underdeveloped domestic market for gas and gas products (LPG, CNG, fuel methanol, power etc)
- Absence of / limited gas policies
- Limited institutional, legal and regulatory framework for gas, including associated gas
- Gas terms (or absence thereof) in existing oil development agreements
- Fiscal system
- Domestic gas and gas product pricing
- Infrastructure constraints and access
- Funding constraints

# A CNG SOLUTION?

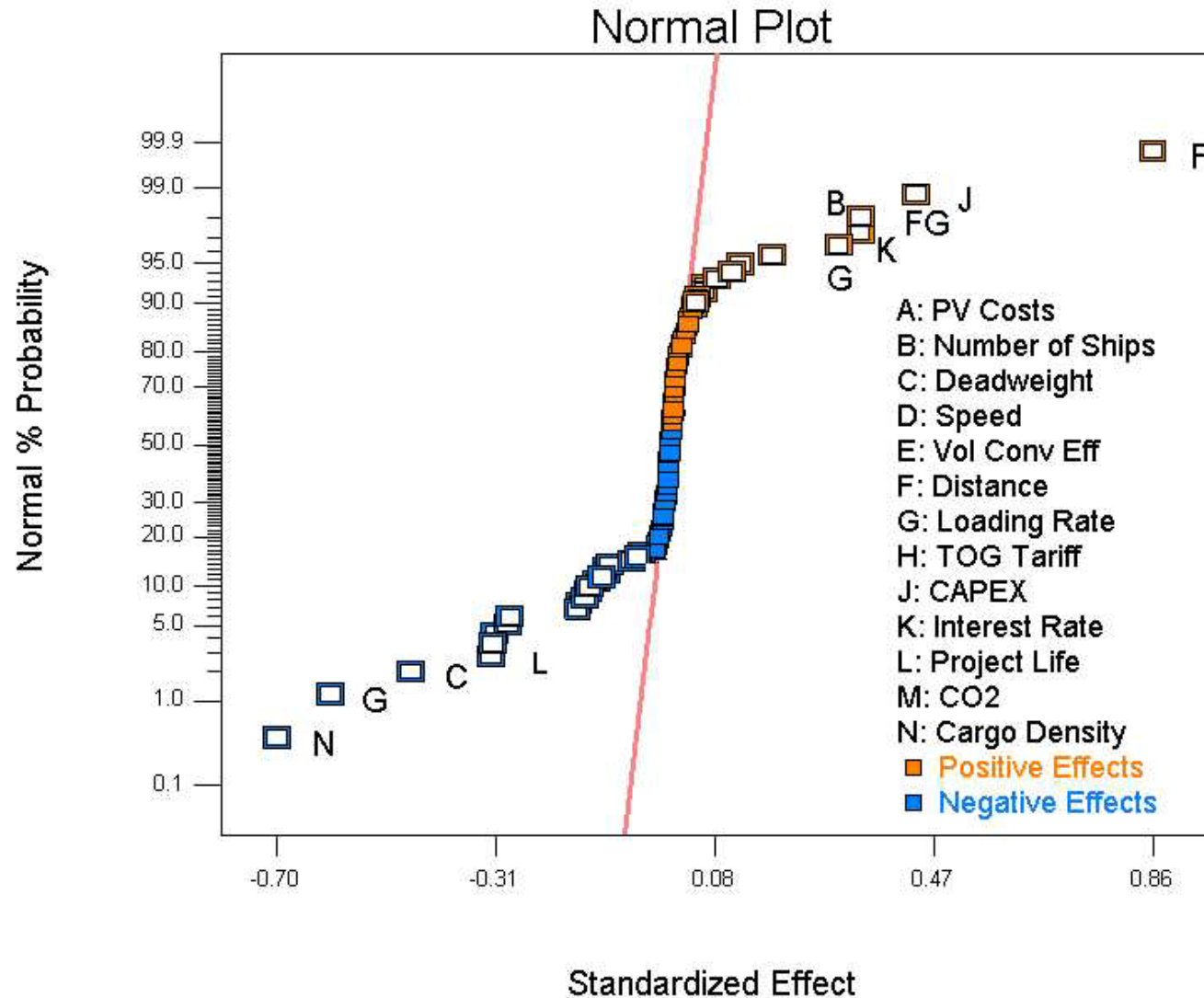
# CNG Solutions



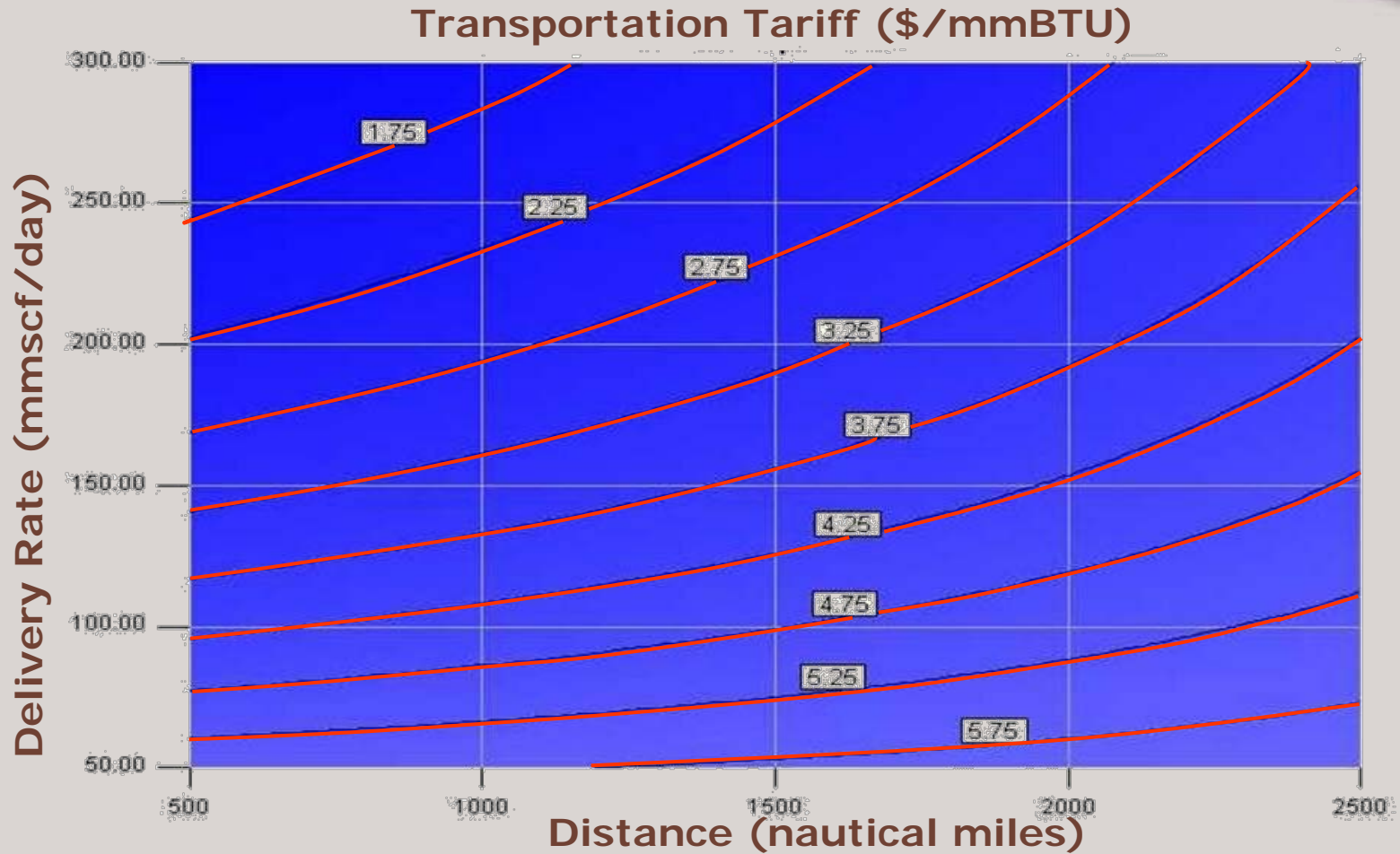
# Factors for CNG Project Economics

- Volume utilization %
- Cost of PV
- Transport Distance
- Ship Speed
- Ship Size
- Number of Ships
- Gas Throughput
- IP Tariff
- CAPEX
- Project Life
- Interest rate
- CO<sub>2</sub> %
- Gas Density

# Effects on Transportation Tariff




# Medium Projects – Sample Output



# Scenario – 6 TCF Gas – High Arctic

**Sample Results of DCF Analysis**



NPV at 15% (2005 Million Canadian Dollars)

	LNG	LNG Transshipment	CNG	GTL
Price Forecast B				
Start 2009	(270)	(300)	(150)	(40)
Start 2014	(240)	(260)	(100)	(60)
Start 2019	(90)	(120)	20	(30)
Price Forecast B'				
Start 2009	410	370	500	380
Start 2014	300	270	410	260
Start 2019	300	270	420	200

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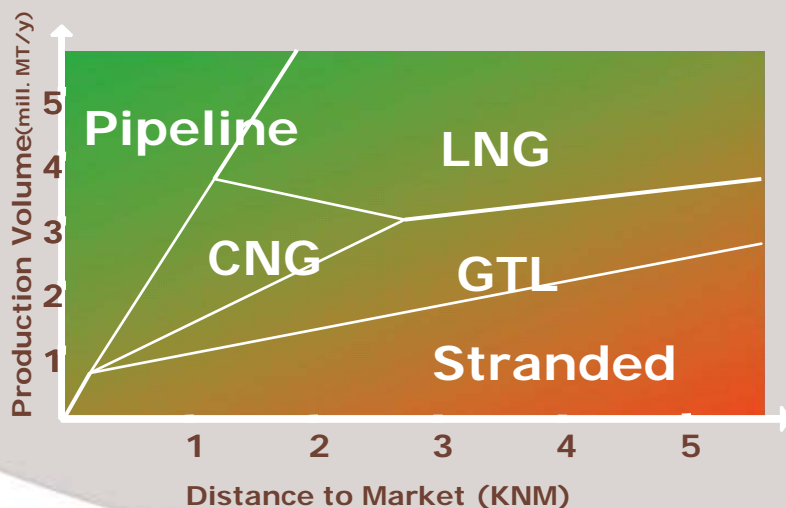
WWW.CERILCA

Source: "The Economics of High Arctic Gas Development: Expanded Sensitivity Analysis"  
Canadian Energy Research Institute, January 2005

While the CNG project provides the greatest economic value when point estimates are used, the results of the sensitivity analysis suggest that parameter uncertainty of as little as 25 percent can change the NPV such that another project may appear more favourable.

# Barriers to CNG Solutions

- Uncertainty of project implementation
- Technical and Financial risk issues with existing operations
- Complex economic modeling of project
- More attractive greenfield and downstream opportunities



- Outside pipeline feasibility
- Low daily volumes
- Relatively long distances

# WAY AHEAD

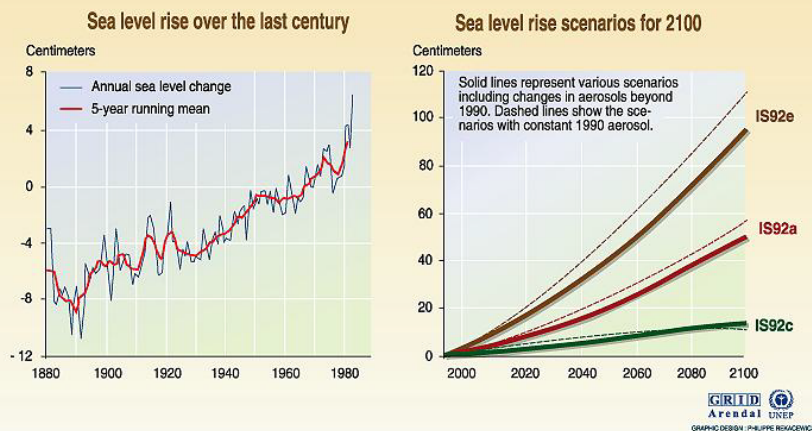
# Environmental Imperative

Table 3.1 Estimated Annual CO<sub>2</sub> Emissions from Flared Gas (2002 & 2001 figures)

Region	Gas Flared or Vented (Bm <sup>3</sup> )	Gas Flared or Vented (10 <sup>9</sup> MJ)	CO <sub>2</sub> Emission from Flaring (million tons)
Africa	37	1221	72
Asia-Oceania	7-20	231-660	14-39
Europe	3	99	6
Former Soviet Union	17-32	561-1056	33-62
Central and South America	17	561	33
Middle East	16	528	31
North America	5-10	165-330	10-19
World total	102-135	3366-4455	199-262

Source: Report on Consultations with Stakeholders plus COWI calculations (1 m<sup>3</sup> = 33.0 MJ and 0.059 kg of CO<sub>2</sub> per MJ).

## Sea level rise due to global warming



Source: Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996; Sea level rise over the last century, adapted from Gornitz and Lebedeff, 1987.



## Way Ahead



- World Bank Report – "Flared Gas Utilization Strategy" – 2002 – Include CNG option?
- CDM Baseline Methodologies – Needs to be analyzed
- Role of CNG in Downstream Market Development
- Recent development
  - 20 MMMSCF/D flare gas to power in SE Asia

## Contact Information



- Darrell Hawkins
  - Vice President – Business Development
  - Trans Ocean Gas Incorporated
  - Tel # 709-726-7050
- Email: [Darrell.Hawkins@transoceangas.com](mailto:Darrell.Hawkins@transoceangas.com)