Gas Handling Options for Associated Gas in Deepwater Developments in the Gulf of Mexico

Project for the

Minerals Management Service

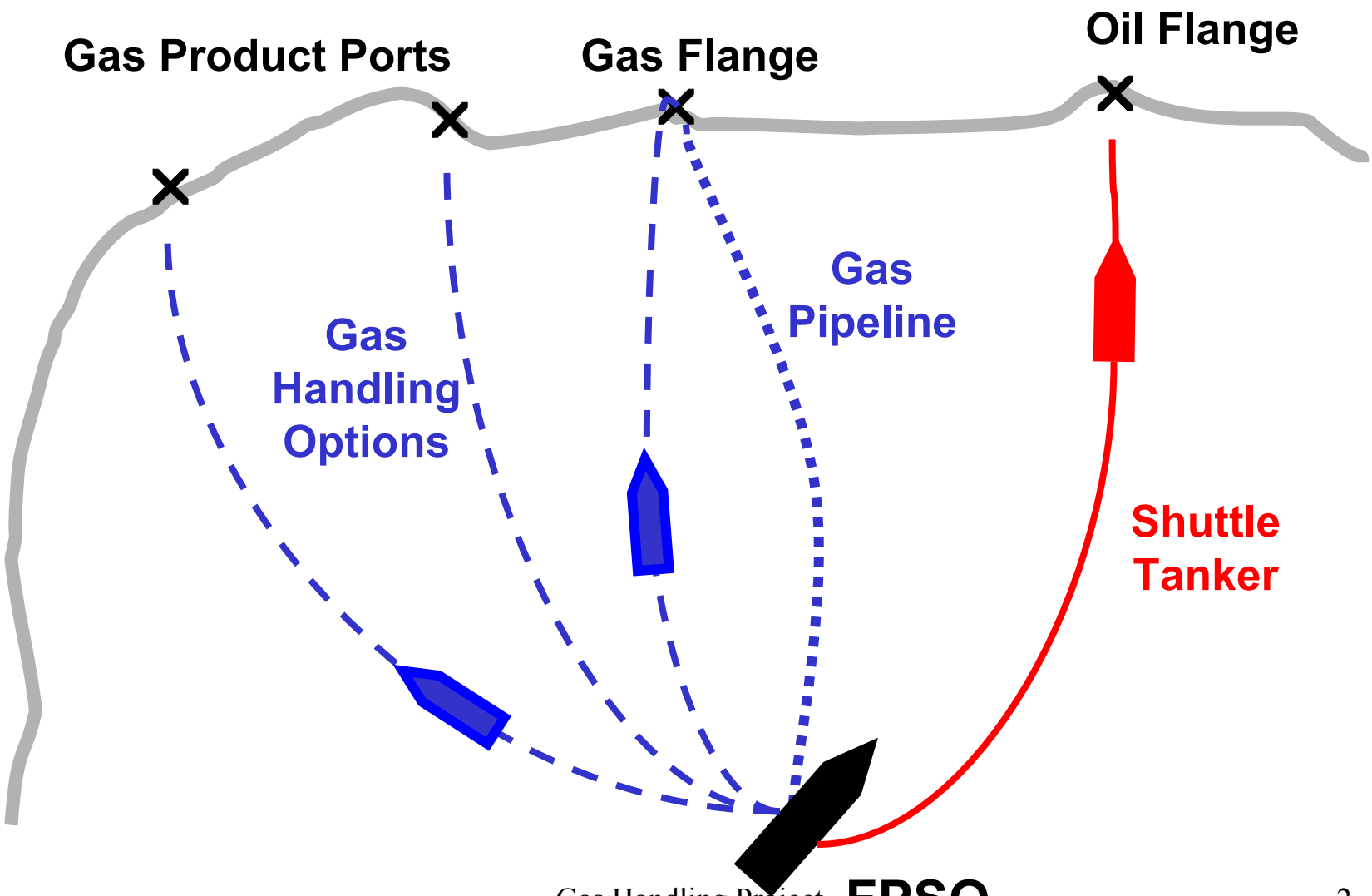
by

Offshore Technology Research Center

with assistance of

Offshore Operators Committee

Gas Handling Option Study



Agenda

Time	Subject	Topic	Presenter
12:30	Registration		
1:00 – 1:15	Introduction	Welcome & Background	Skip Ward - OTRC
		MMS Objectives & Perspective	Paul Martin - MMS
		OOC Perspective & Role	Allen Verret - OOC
1:15 – 1:40	Summary of Overall Study Plan		Skip Ward
1:40 – 2:00	Overview of Gas Handling Technologies in Study		Skip Mick - Paragon
2:00 – 2:35	Study Plan	Technology Assessment Goals & Metrics	Paul Martin Skip Ward
2:35 – 3:05		Break	
3:05 – 3:25		Study Scenarios	Dave Saylor - Unocal
3:25 – 3:55		Workshops – Format & Processes	Andy Wolford - AJW+
3:55 – 4:05		Project Schedule & Final Report	Skip Ward
4:05 – 4:20	Industry Participants	Participant Needs, Roles, Opportunities	Allen Verret
4:20 – 4:30	Closure		Skip Ward
4:30	Adjourn		

Steering Committee

- Offshore Technology Research Center/TAMU
  - Skip Ward
  - Stuart Scott
- A.J. Wolford Associates
  - Andy Wolford
- Paragon Engineering
  - Skip Mick
- Minerals Management Service
  - Bill Hauser
  - Russell Hoshman
  - B.J. Kruse
- Offshore Operators Committee
  - Allen Verret
  - Larry Golson (ChevronTexaco)
  - Rick Meyer (Shell)
  - Eric Nelson (ExxonMobil)
  - Larry Yoho (Marathon)
  - Joe Fontenot (Ocean Energy)
  - David Saylor (Unocal)

MMS Objectives

- Complete objective technical assessment of technology options for handling gas associated with for deepwater oil & gas developments in the GOM
- Assessment to focus on oil developments with associated gas
- Assessment results to be used by MMS
  - Reviews readiness & safety of gas handing options proposed for deepwater development projects
  - Studies pertaining to deepwater oil & gas developments

MMS Objectives

Provide study information & results to –

- the MMS, USCG & other government agencies
- public (awareness of alternative technologies for deepwater GOM gas development)
- oil & gas industry and technology partners

GAS HANDLING KICK OFF MEETING 3-25-03

CHALLENGES FOR INDUSTRY

- **Accelerate Field Developments**
- **Lower Lifting Costs**
- **Continue to Lower Incident and Accident Rates**
- **Improve Communication**
- **Deploy Enabling Technology Solutions**
- **Enhance Existing Tools and Processes**
- **Cope with a Shrinking Resource Base**
- **Compete in a Global Effort to Supply Energy to a Changing World**

GAS HANDLING KICK OFF MEETING 3-25-03

Industry Perspective and Role

- **Industry has been studying alternative gas handing processes for quite some time.**
- **Infrastructure is a key element of successful gas distribution systems.**
- **Deepwater environment provides substantial challenges to operating gas transmission systems.**
- **Industry can and should provide feedback to MMS and OTRC on the study being undertaken.**

GAS HANDLING KICK OFF MEETING 3-25-03

Industry Perspective and Role Continued

- **Participation by operators in the OTRC organized and managed workshops will help facilitate meeting study goals and objectives and accelerating roll out of available information concerning those options.**
- **A proactive industry response to study goals has been endorsed by the Offshore Operators Committee.**
- **Interaction by operator representatives in the early stages of the study planning has been encouraged and supported.**

Summary of Study Plan

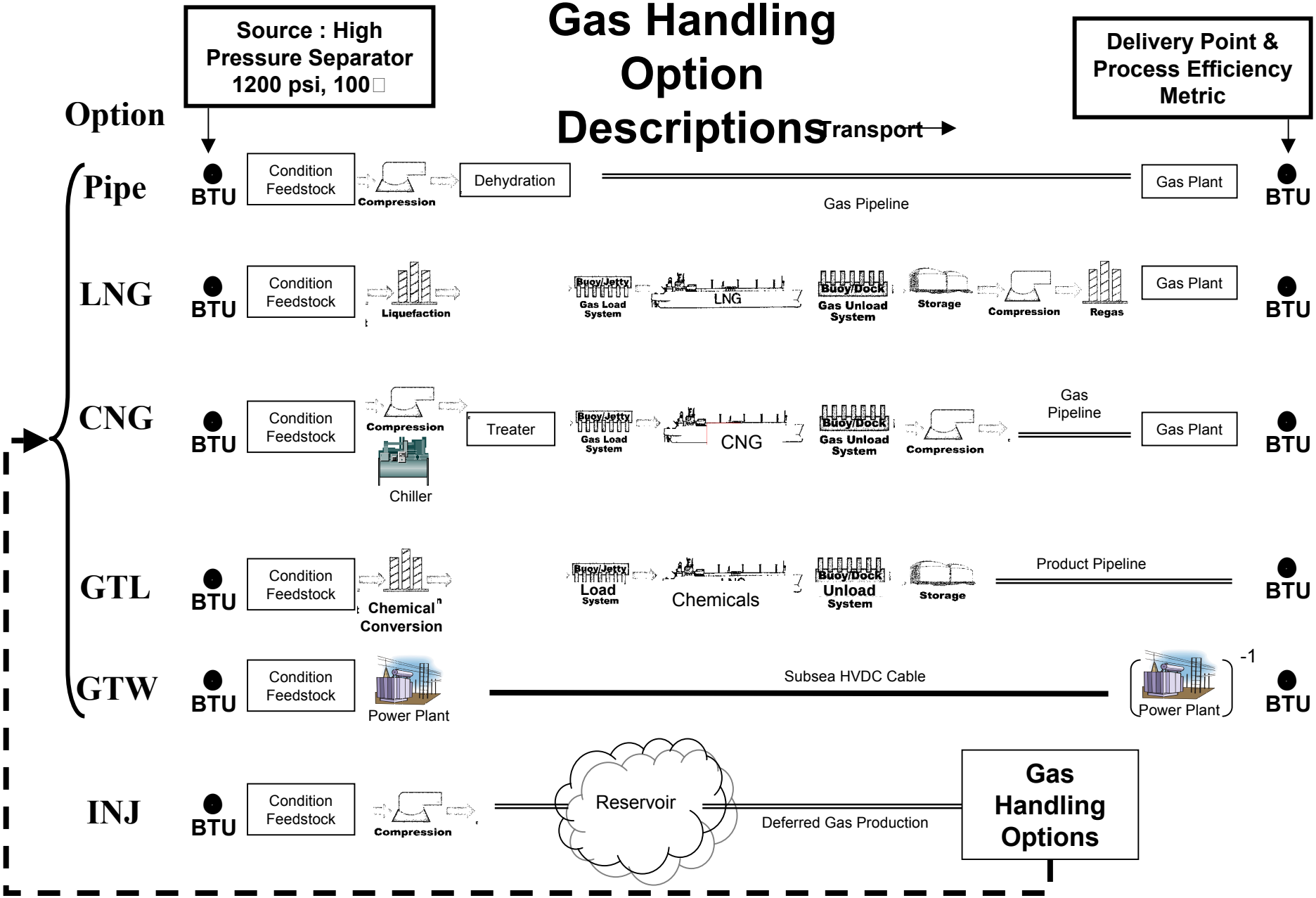
Skip Ward

OTRC

Gas Handling Options

- Study to consider
  - Pipelines
  - LNG – Liquefied Natural Gas
  - CNG – Compressed Natural Gas
  - GTL – Gas-to-Liquid Products
  - Injection
  - GTW – Gas to Wire (offshore power generation)
  - Gas to Solids (hydrates)
  - Others
- Pipelines to be considered as the *baseline* in assessing options

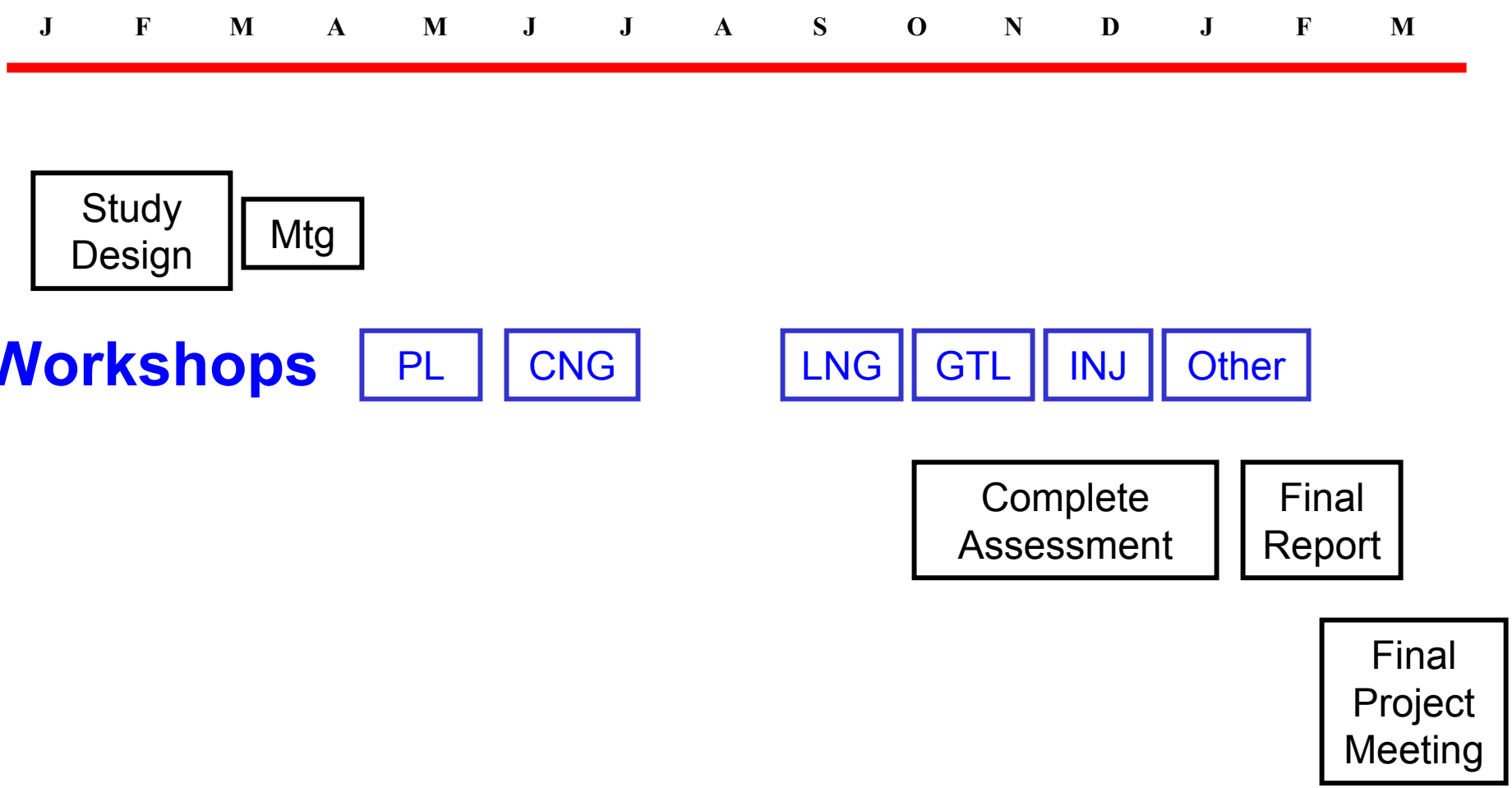
Gas Handling Option Descriptions



Technical Assessment Metrics

- Technical, Commercial, & Regulatory Feasibility & Readiness
- HSE
- Costs (CAPEX, OPEX)
- Process Efficiency

Study Process



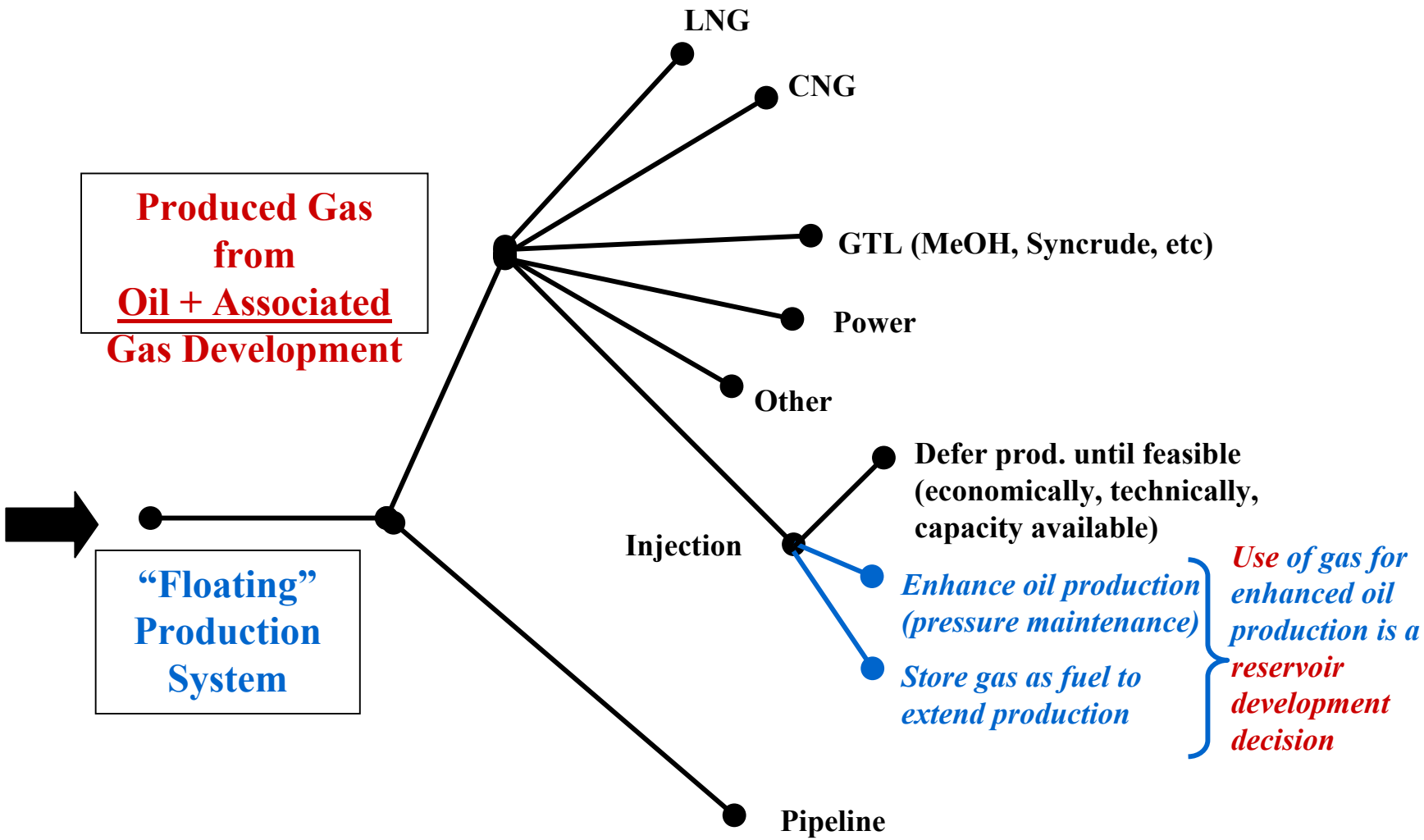
Overview
Gas Handling Technologies

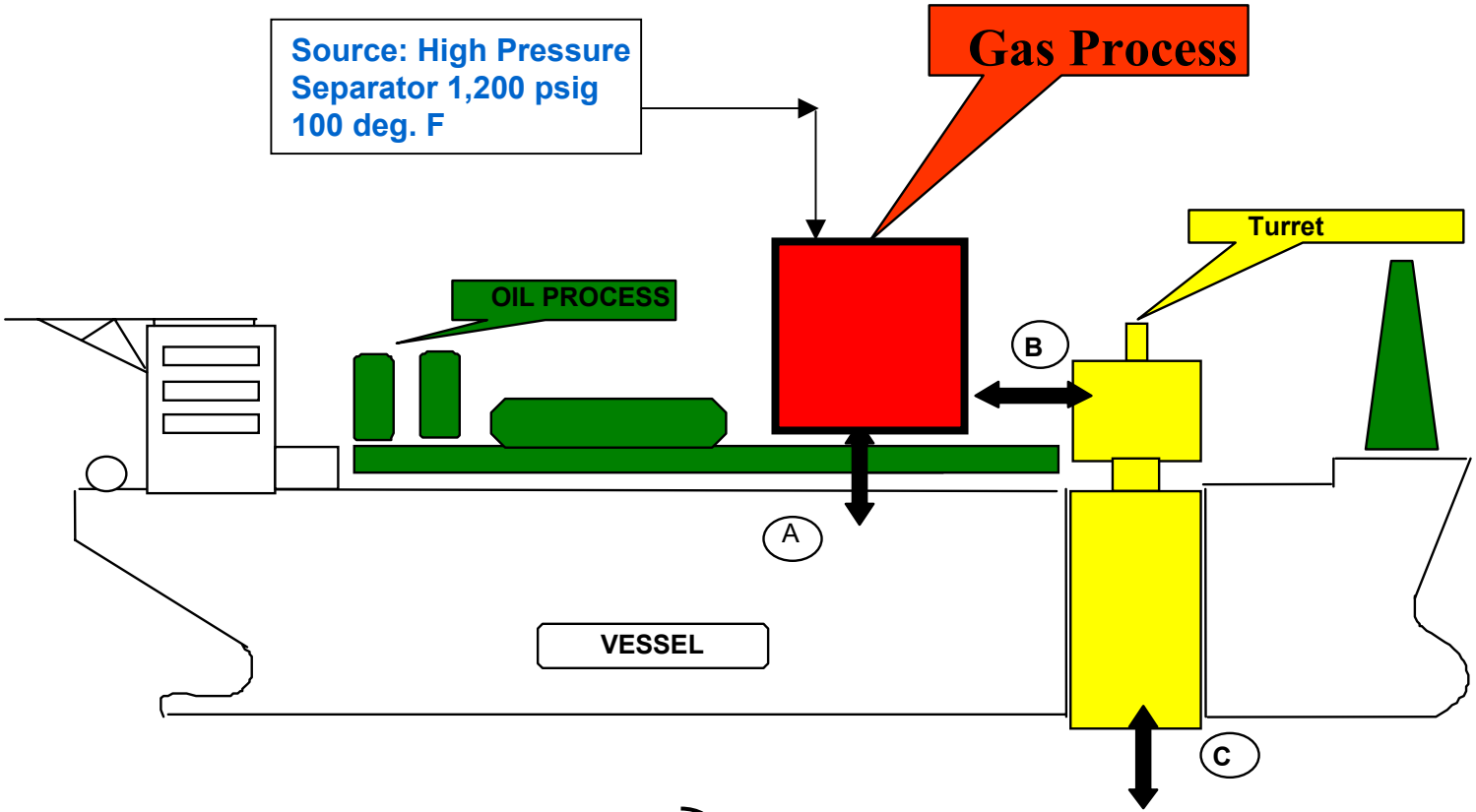
Skip Mick
Paragon

Gas Handling Options

- **Alternatives to consider**
  - **Pipeline**
  - **Injection**
  - **LNG – Liquefied Natural Gas**
  - **CNG – Compressed Natural Gas**
  - **GTL – Gas-to-Liquids**
  - **GTW – Gas to Wire (offshore power generation)**
  - **Gas to Solids (hydrates, e.g.)**
  - **Others**
- **Pipeline to be considered as the *baseline* in assessing options**

Gas Handling Options





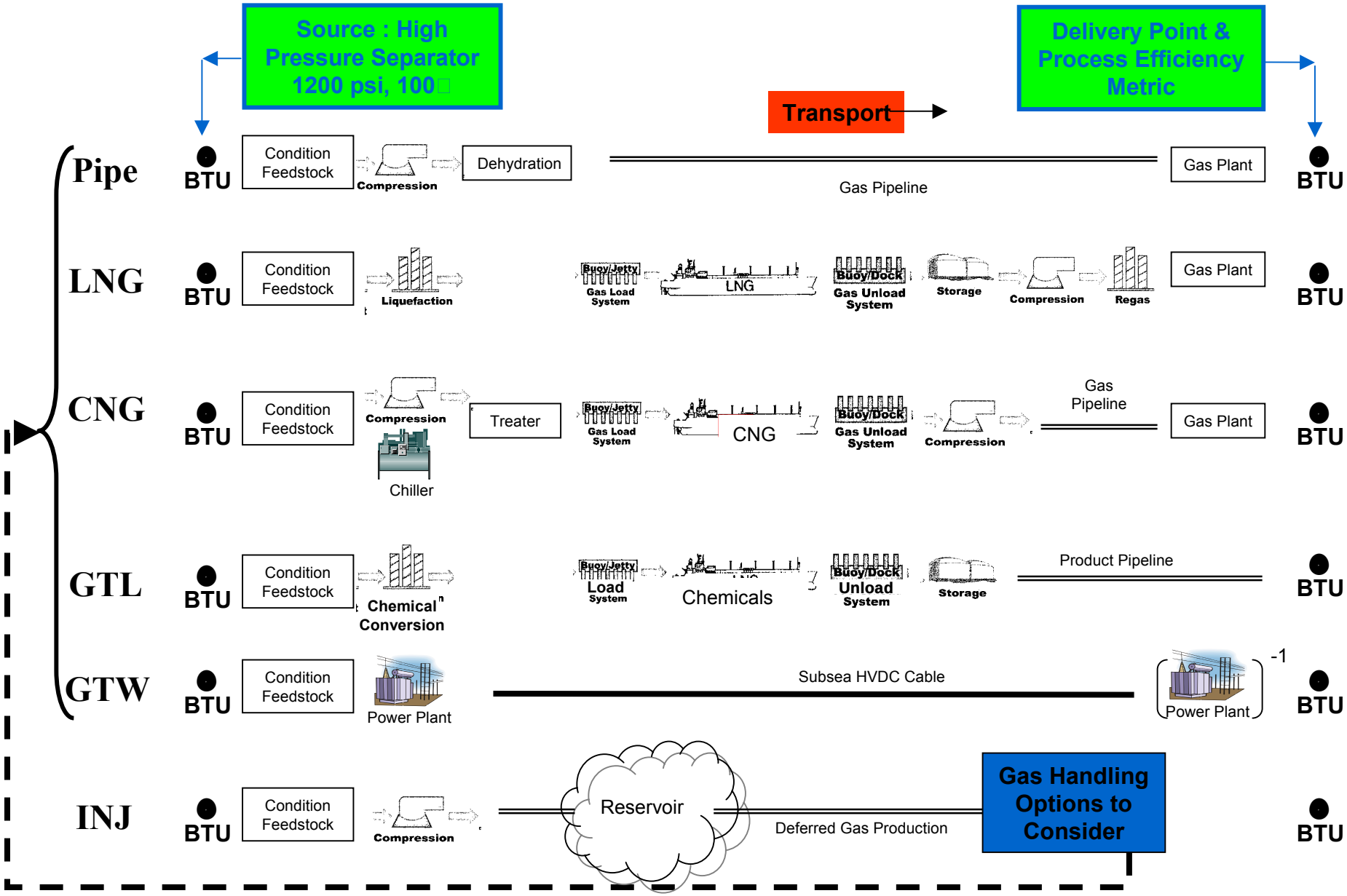
POINTS	INTERFACE
A	Vessel / Gas Process
B	Gas Process / gas product offtake (via Turret or alternate method)
C	Mooring / Vessel

Study Participants to establish Key System Interfaces & Requirements

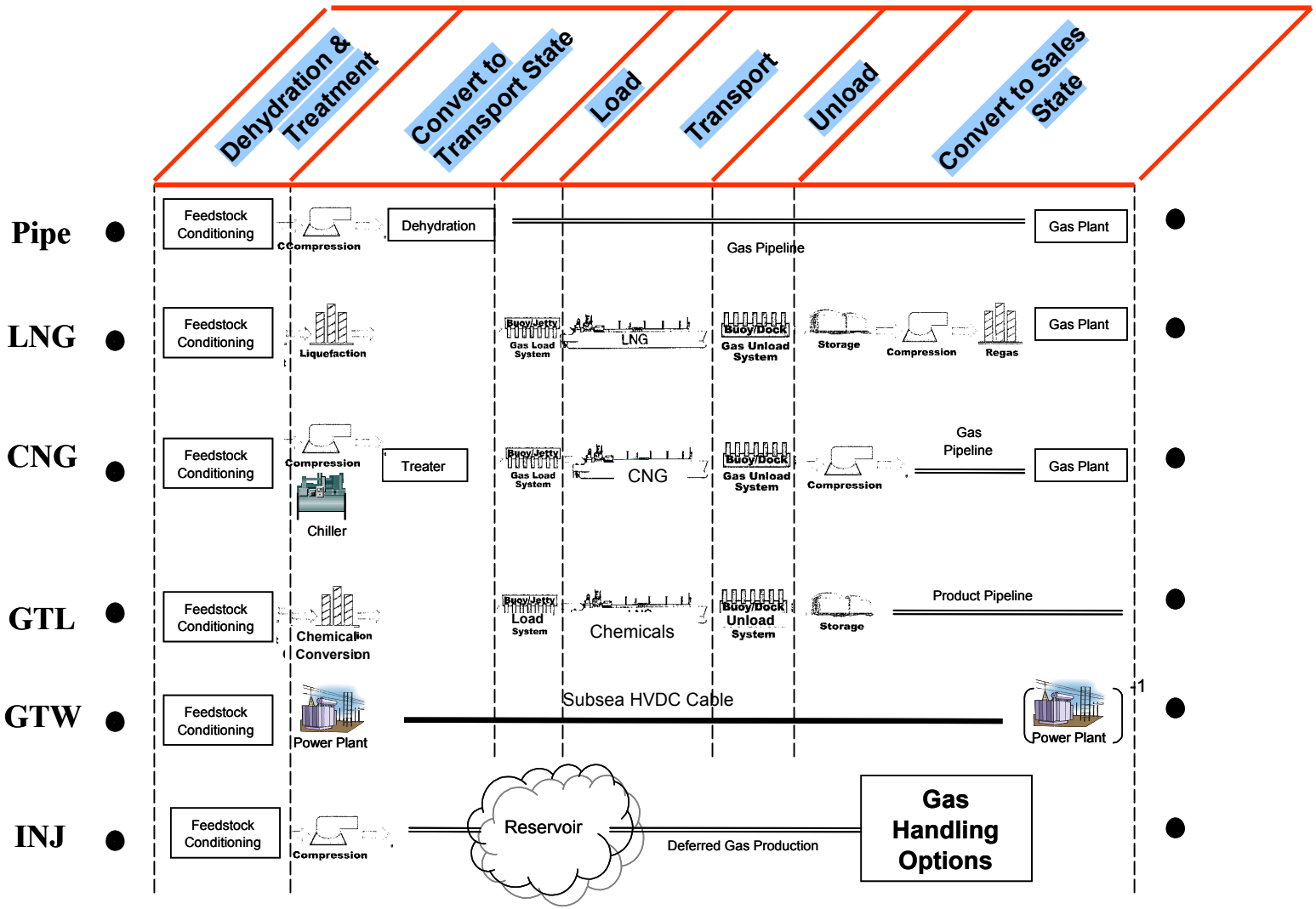
Assume an FPSO development, using parameters from EIS/CRA

Technical Assessment Metrics

- **Technical, Commercial, and Regulatory Feasibility & Readiness**
- **HSE**
- **Costs (CAPEX, OPEX)**
- **Process Efficiency**


Source : High Pressure Separator 1200 psi, 100
Transport
Delivery Point & Process Efficiency Metric
Pipe
BTU
Condition Feedstock
Compression
Dehydration
Gas Pipeline
Gas Plant
BTU
LNG
BTU
Condition Feedstock
Liquefaction
Buoy/Jetty
Gas Load System
LNG
Buoy/Dock
Gas Unload System
Storage
Compression
Regas
Gas Plant
BTU
CNG
BTU
Condition Feedstock
Compression
Chiller
Treater
Buoy/Jetty
Gas Load System
CNG
Buoy/Dock
Gas Unload System
Compression
Gas Pipeline
Gas Plant
BTU
GTL
BTU
Condition Feedstock
Chemical Conversion
Buoy/Jetty
Load System
Chemicals
Buoy/Dock
Unload System
Storage
Product Pipeline
BTU
GTW
BTU
Condition Feedstock
Power Plant
Subsea HVDC Cable
Power Plant
-1
BTU
INJ
BTU
Condition Feedstock
Compression
Reservoir
Deferred Gas Production
Gas Handling Options to Consider
BTU

Technology ("Process") Steps



Pipeline Process

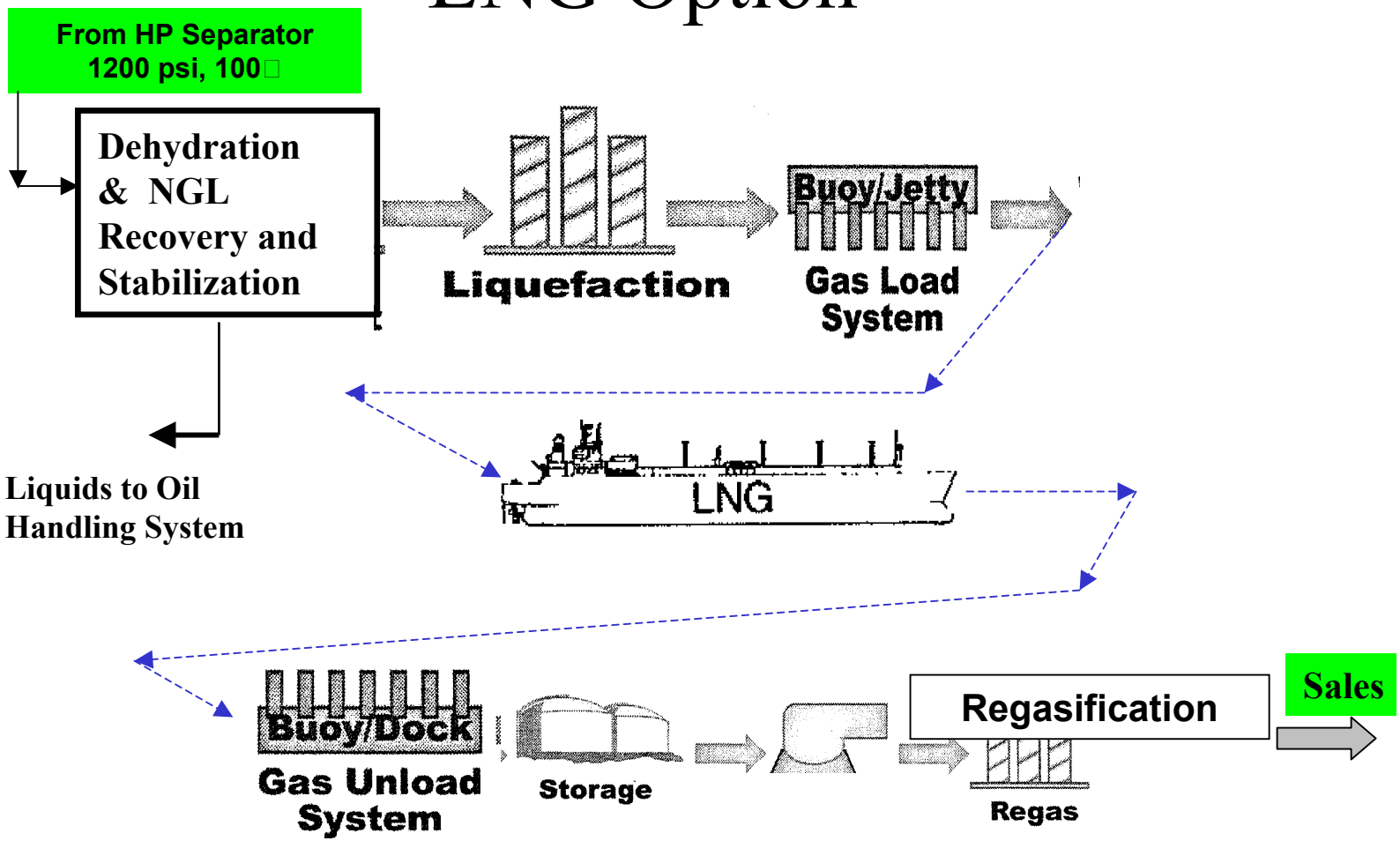
- **Compression**
- **Dehydration**
  - **Treating**
- **Compression**
  - **Raw Gas Liquids Product**
- **Pipeline for Transportation**
- **Gas Processing Plant**
  - **NGL Recovery & Fractionated Liquid Products**
- **Gas Delivered to Existing Infrastructure**

Source: High Pressure Separator 1200 psi, 100 F

LNG Processes

- **Gas Conditioning**
  - **Raw Gas Liquids Product**
- **Dehydration**
  - **Treating**
- **Liquefaction Processes**
- **Tanker for Transport**
  - **LNG Storage and Loading Terminal**
  - **LNG Receiving and Storage Terminal**
- **Regasification**
- **Gas Delivered to Existing Infrastructure**

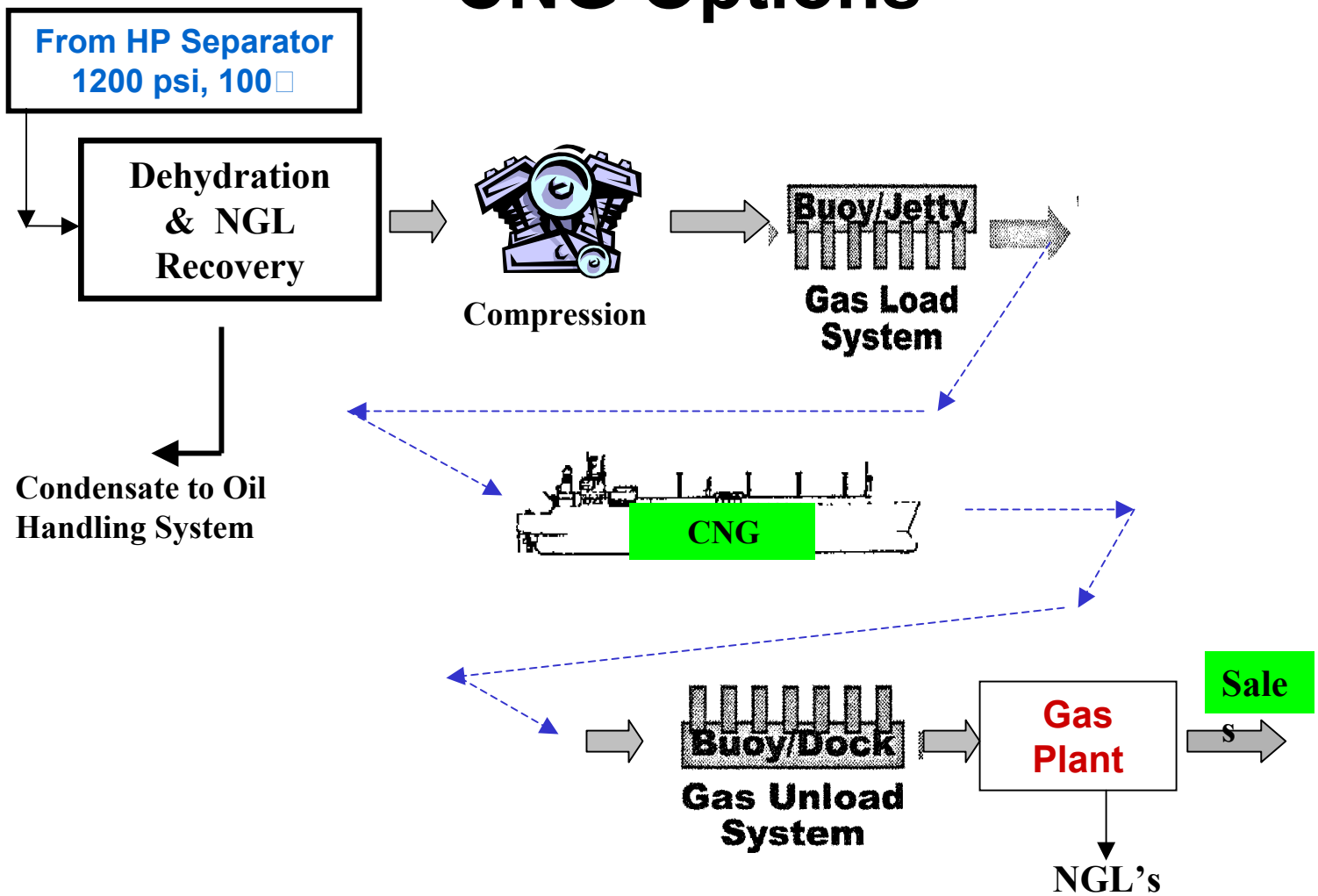
LNG Option


From HP Separator
1200 psi, 100□
Dehydration
& NGL
Recovery and
Stabilization
Liquefaction
Buoy/Jetty
Gas Load
System
Liquids to Oil
Handling System
LNG
Buoy/Dock
Gas Unload
System
Storage
Regasification
Regas
Sales

CNG "Processes"

- **Gas Conditioning**
  - **Raw Gas Liquids Product**
- **Dehydration**
- **Compression**
- **Gas Chilling**
  - **Raw Gas Liquids Handling**
- **Tankers for Storage and Transportation**
  - **Loading Terminal**
  - **Receiving Terminal**
- **Compression**
- **Gas Processing Plant**
  - **Fractionated Liquid Products**
- **Gas Delivered to Existing Infrastructure**

CNG Options


From HP Separator
1200 psi, 100□
Dehydration
& NGL
Recovery
Compression
Buoy/Jetty
Gas Load
System
Condensate to Oil
Handling System
CNG
Buoy/Dock
Gas Unload
System
Gas
Plant
Sale
s
NGL's

GTL Process

- **Gas Conditioning**
  - **Raw Gas Liquids Product**
- **Chemical Conversion Processes**
  - **MeOH, Syncrude**
- **Tanker for Transport**
  - **Storage and Loading Terminal**
  - **Receiving and Storage Terminal**
- **Liquids Delivered to Refinery for Additional Processing**

GTW Process

- **Gas Conditioning**
  - **Raw Gas Liquids Product**
- **Power Plant Offshore**
- **Electrical Wire for Transportation**
- **Power Conversion Plant / "Transforming"**
- **Power Delivered to Existing Infrastructure**

Gas Injection Process

- **Gas Conditioning**
  - **Raw Gas Liquids Product**
- **Compression**
- **Dehydration**
- **Gas Injected into Reservoir**
- **Gas Produced at a Later Date**
- **→ → → → Gas Handling Options to Consider**

Gas Handling Options

- **Alternatives to consider**
  - **Pipeline**
  - **Injection**
  - **LNG – Liquefied Natural Gas**
  - **CNG – Compressed Natural Gas**
  - **GTL – Gas-to-Liquids**
  - **GTW – Gas to Wire (offshore power generation)**
  - **Gas to Solids (hydrates, e.g.)**
  - **Others**
- **Pipeline to be considered as the *baseline* in assessing options**
- **Standard Gas Composition**

Gas Handling Options

Questions ?

Study Plan
Technical Assessment
Goals & Metrics

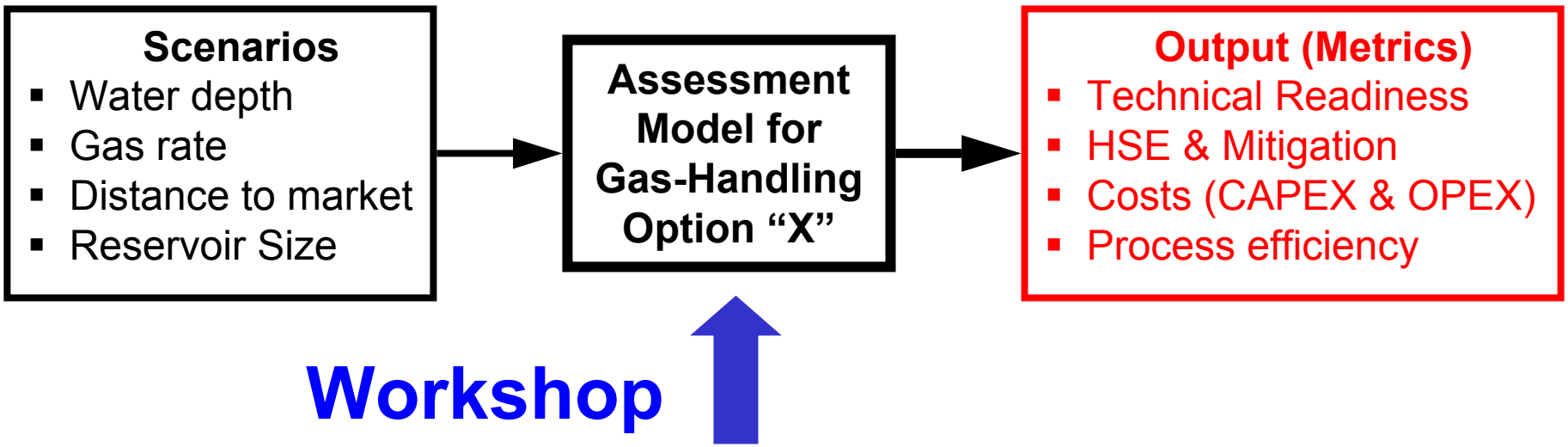
Paul Martin (MMS)

Skip Ward (OTRC)

Technical Assessment Metrics

- Technical, Commercial, & Regulatory Feasibility & Readiness
- HSE
- Costs (CAPEX, OPEX)
- Process Efficiency

Assessment "Model"



Technical Readiness Metric

Question - When will technology be "project ready"?

- Examine stage of development of present technology, e.g.,
  - Concept
  - Bench test
  - Pilot test
  - Field test of similar application of key component(s)
  - Onshore or similar applications of key components/systems
- Examine barriers to technical, commercial, & regulatory readiness of present technology
  - Identify key needs
  - Assess probabilities of success

Technical Readiness Metric (*continued*)

- **Metric**
  - Years to "project ready"
    - Now (2004)
    - +3 years (2007)
    - + 6 years (2011)
    - + 9 years (2014)
    - + 12 years (>2017)
  - Describe uncertainties in readiness in +/- years

HSE Metric

- Risks to human safety
- Risks to environment
- Identify
  - Hazards & risks Mitigation options
  - Costs to achieve acceptable risks
- Build on CRA of Deepwater Production Systems Study

Cost Metric

- CAPEX ($/MCF-delivered)
- OPEX ($/MCF-delivered)
- Include costs to mitigate HSE risks to acceptable level
- Project economics (e.g., economic feasibility, profitability) will not be assessed - ∴ will not consider value of
  - Produced gas or product
  - Enabled oil production
- "Value" of produced gas directly used in process will be included in process efficiency metric, not OPEX

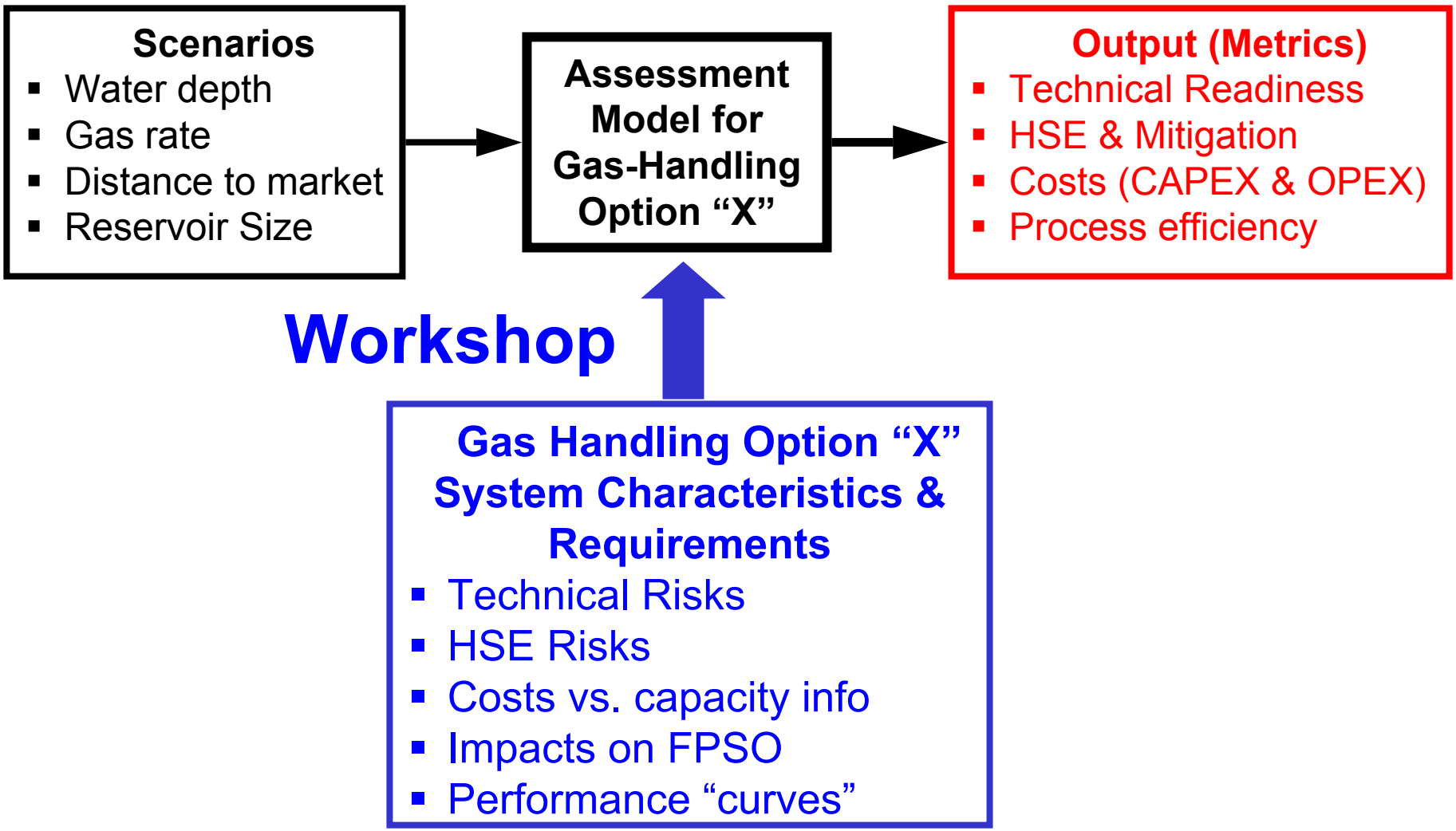
Process Efficiency Metric

- Thermal efficiency of gas utilization -

$$\frac{\textit{BTU's delivered to transfer or sales point}}{\textit{Recoverable BTU's}}$$

- Gas used in process and losses will be deducted from BTU's & volume delivered

Assessment "Model"

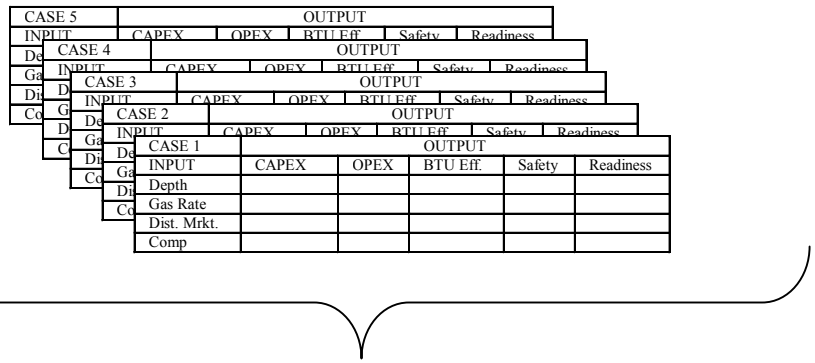


Assessment Metrics

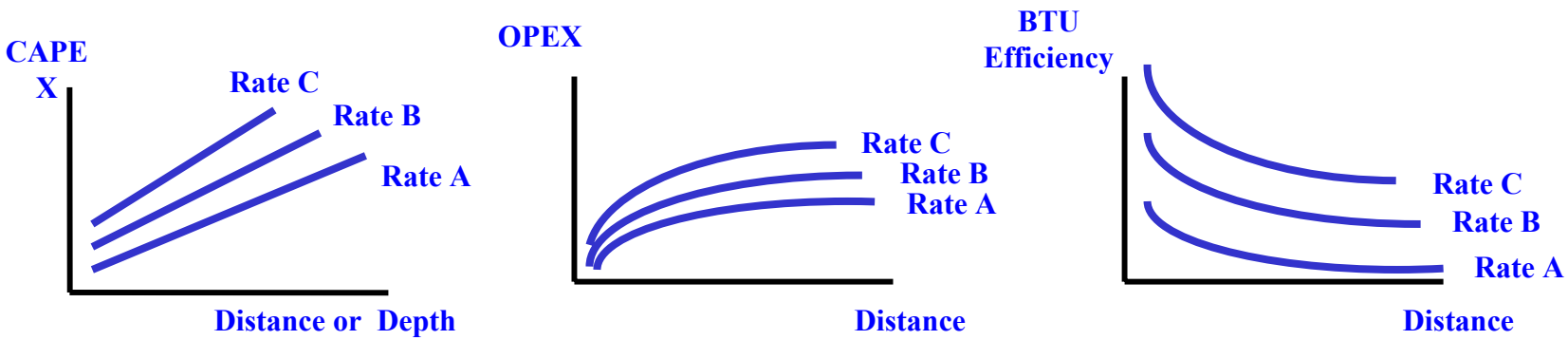
We know where we are going, but we don’t know what it will look like, yet!

Assessment Metrics

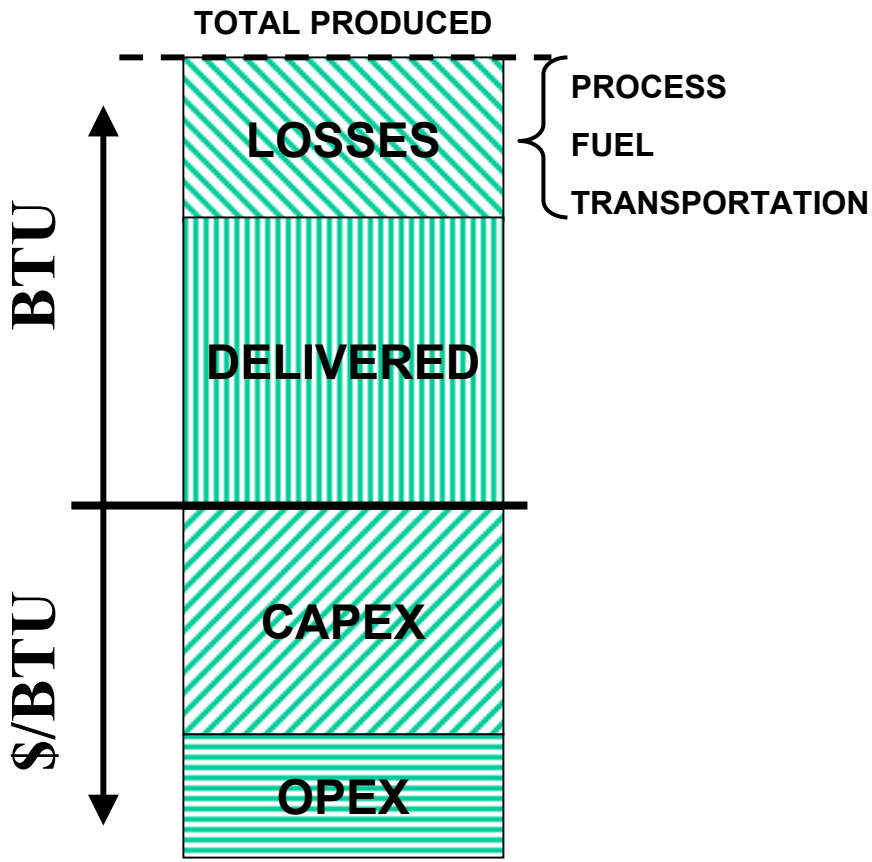
For Each Gas-Handling Option (e.g., CNG) compute assessment metrics for specific Scenario Cases



Plot Curves

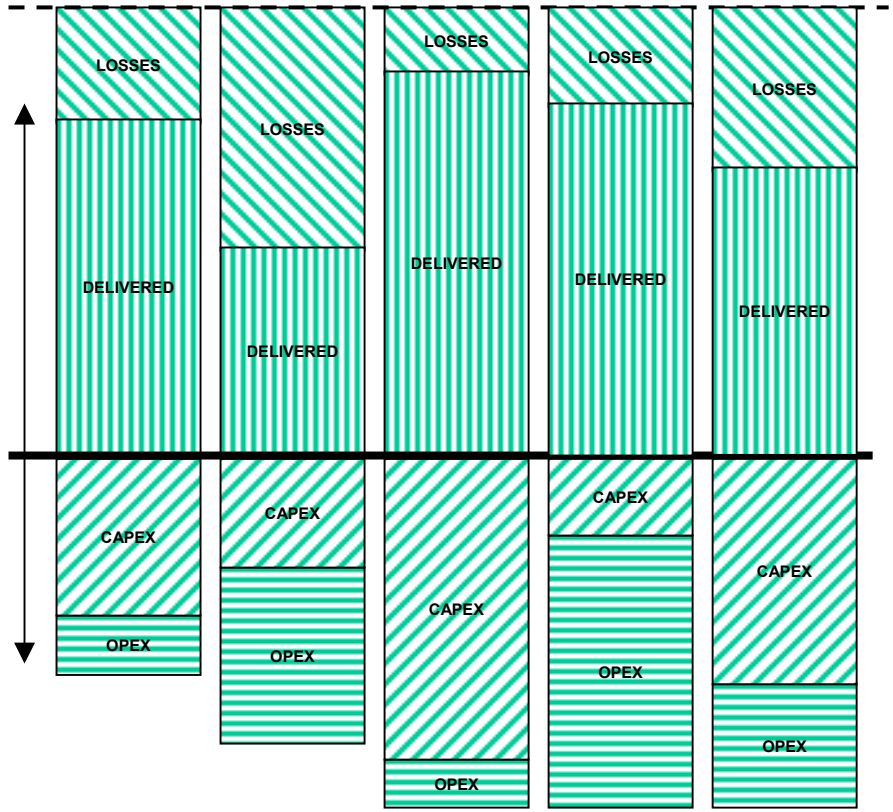


Assessments Metrics



Option A

(for given Scenario)



Study Plan
Scenarios

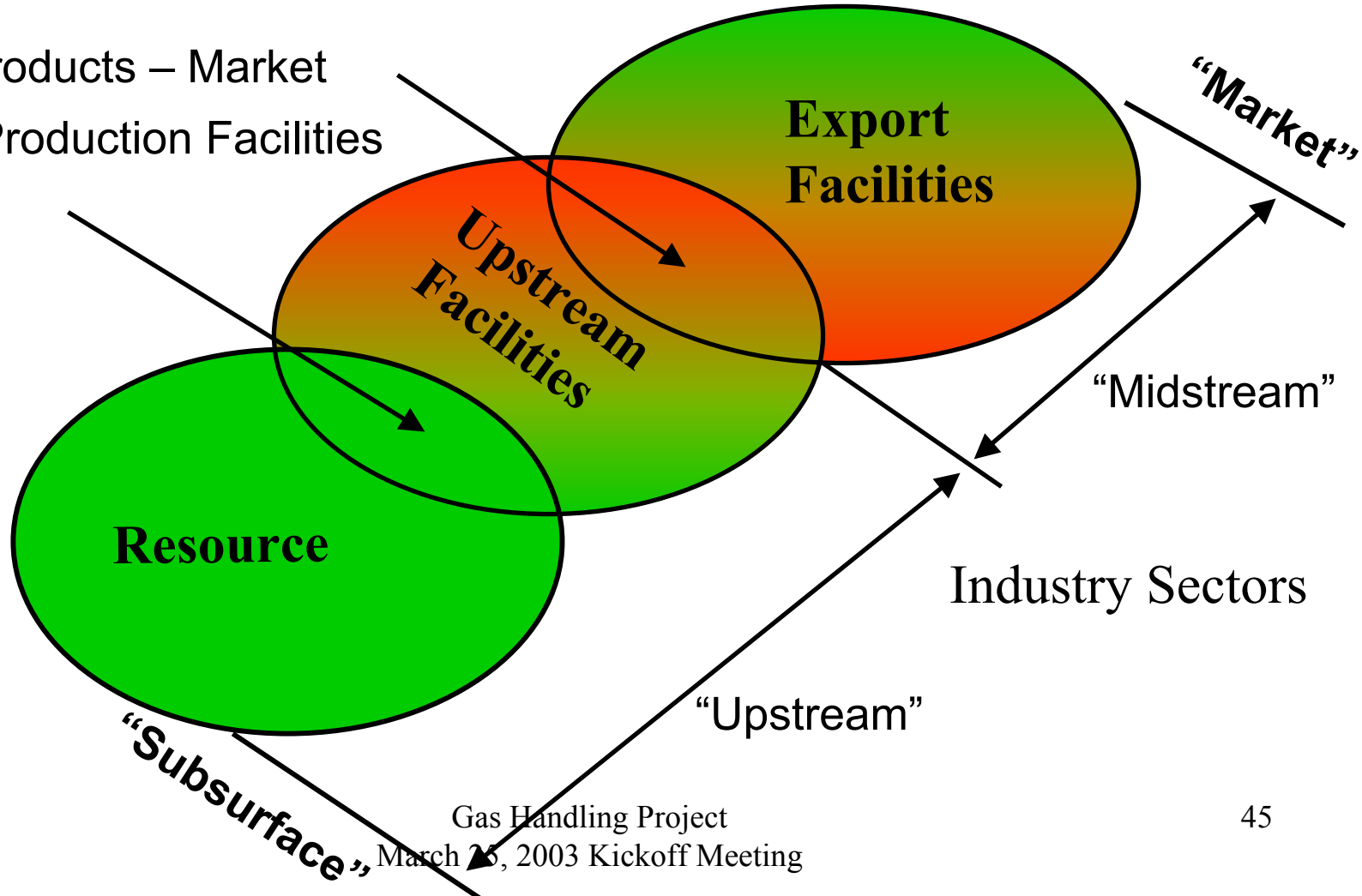
David Saylor
Unocal

Background: DW Development – Big Picture

David Saylor's View

Key Interface Requirements Influence Development Concept and Project Value:

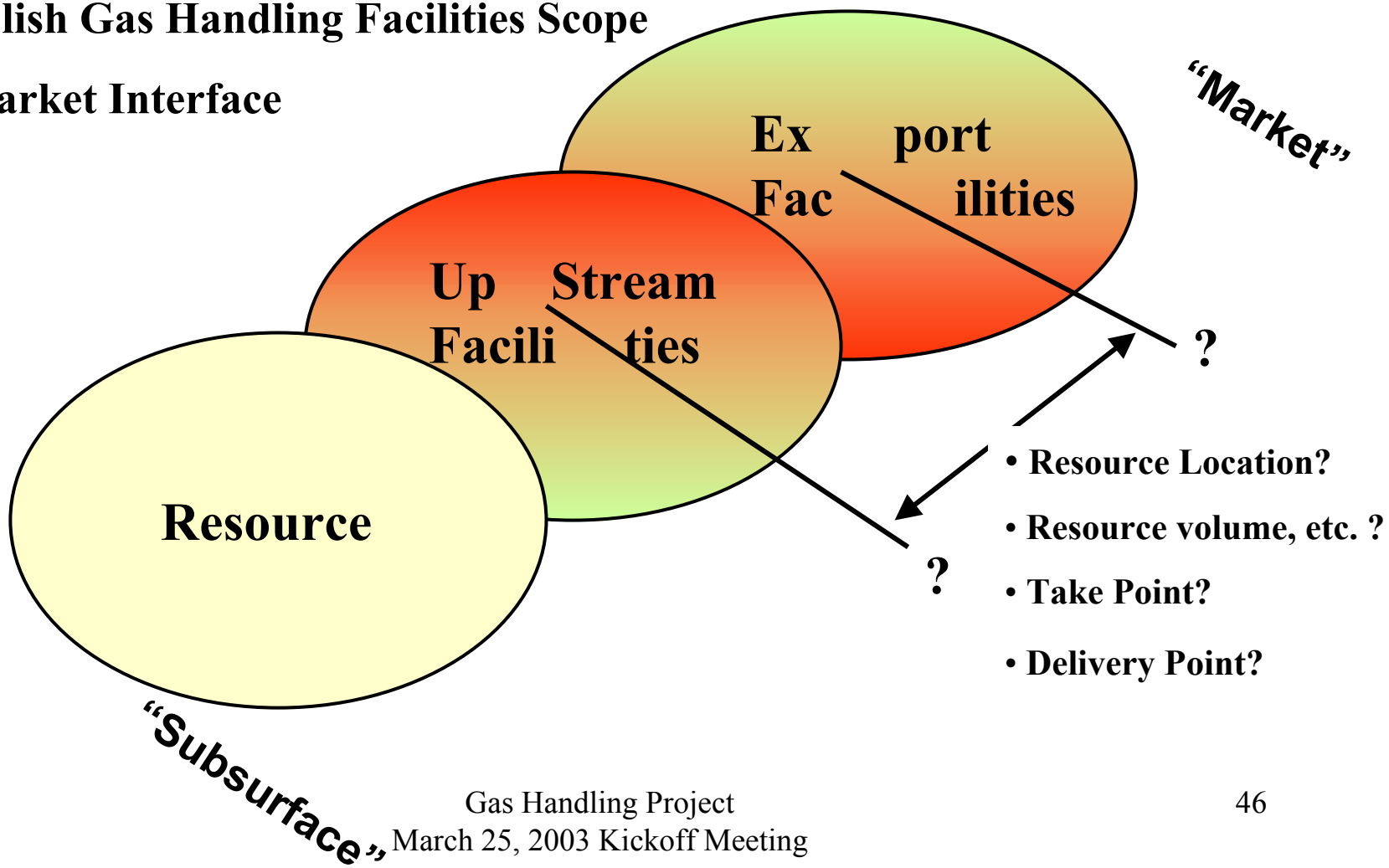
- Export Products – Market
- Wells – Production Facilities



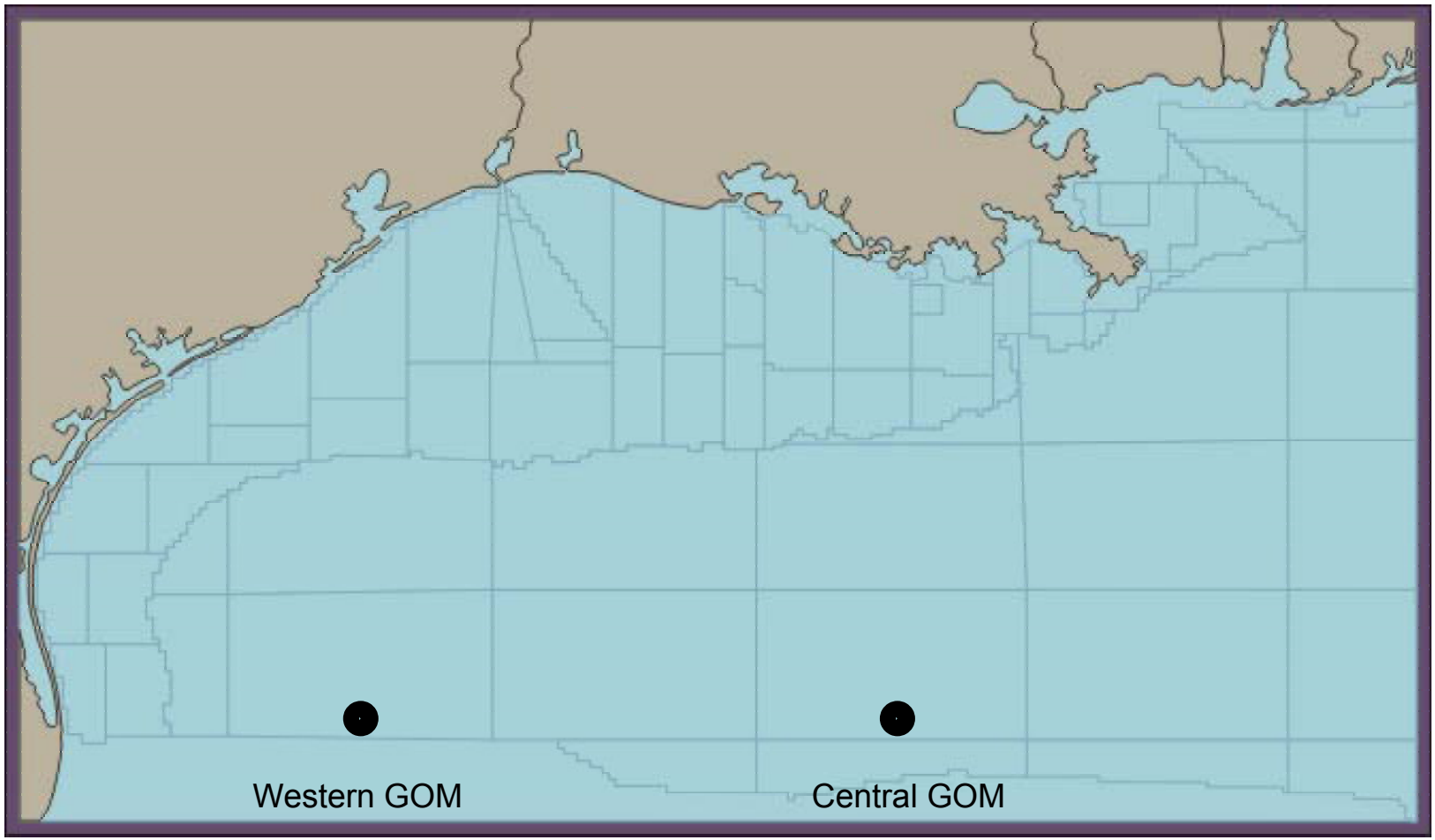
Study Scope & Scenarios

Objective for this section:

- **ID Resource parameters**
- **Establish Gas Handling Facilities Scope**
- **ID Market Interface**

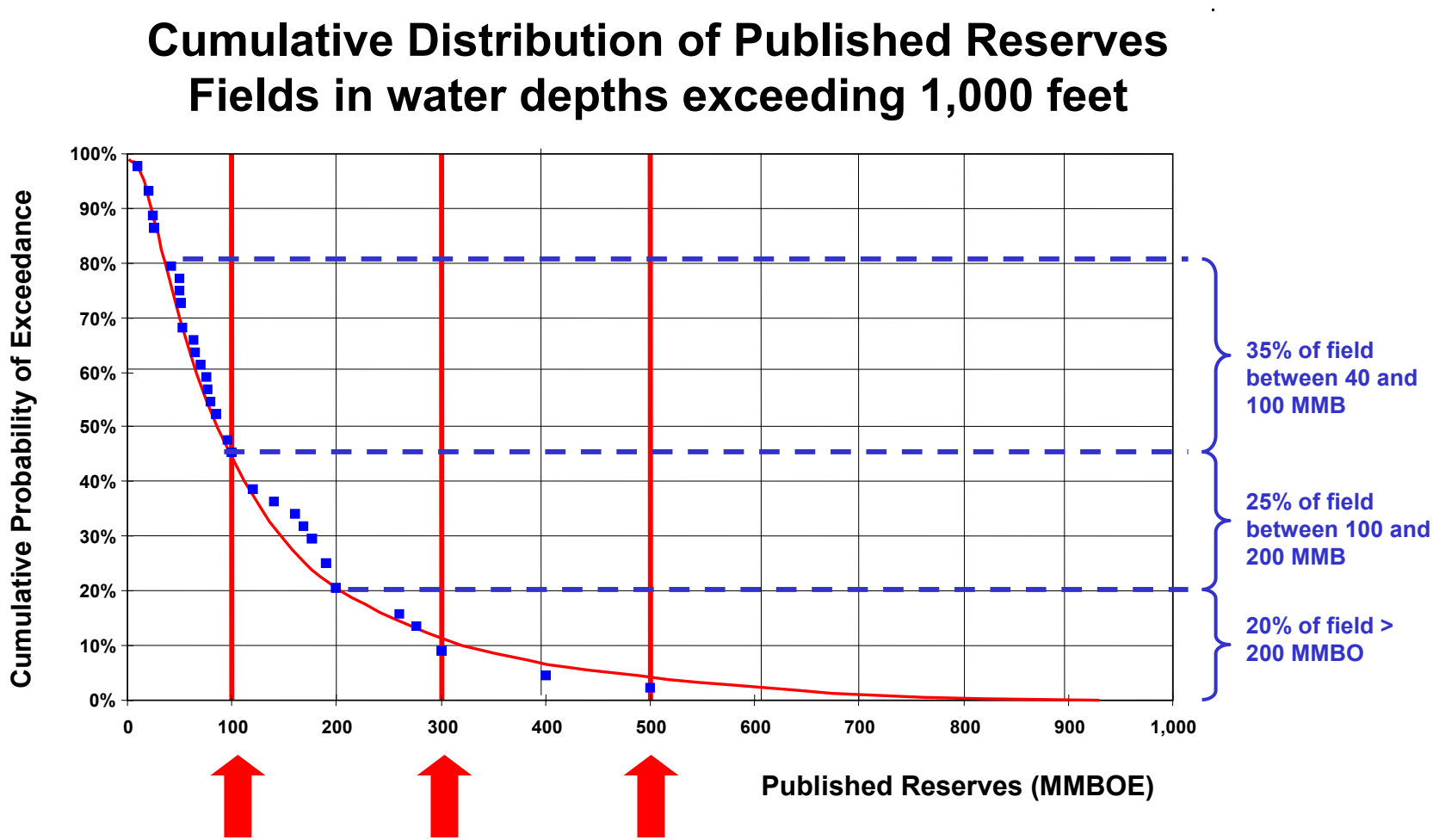


Where: Study Resource Locations



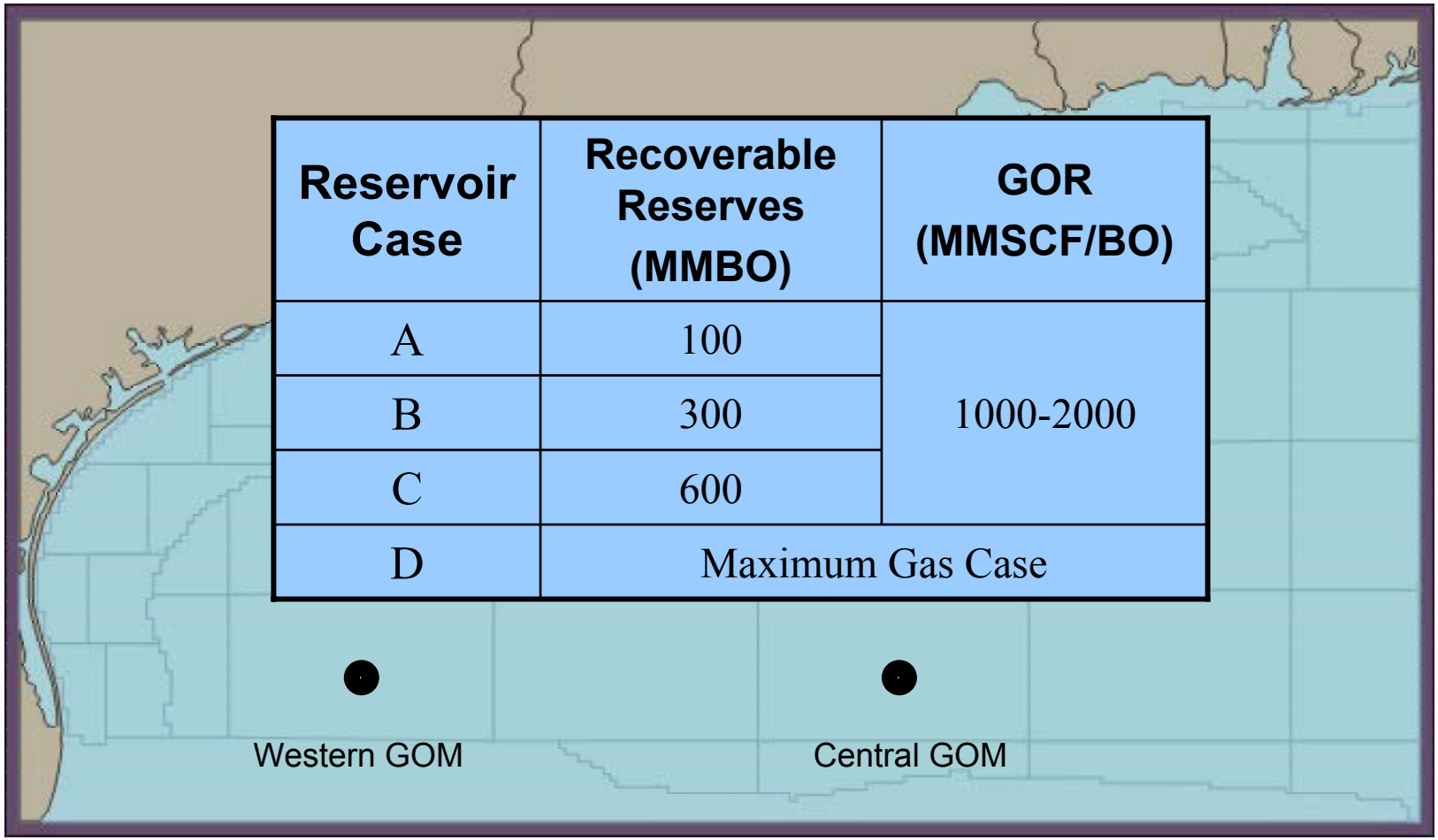
Water Depth Cases of 6,000 and 10,000 Ft.

GOM Field Size Distribution



Source: PFC GoM Field Size Distribution Report Feb 2001 as reported by ABB at SNAME (Anderson, Jan.2003)

What: Subsurface Parameters



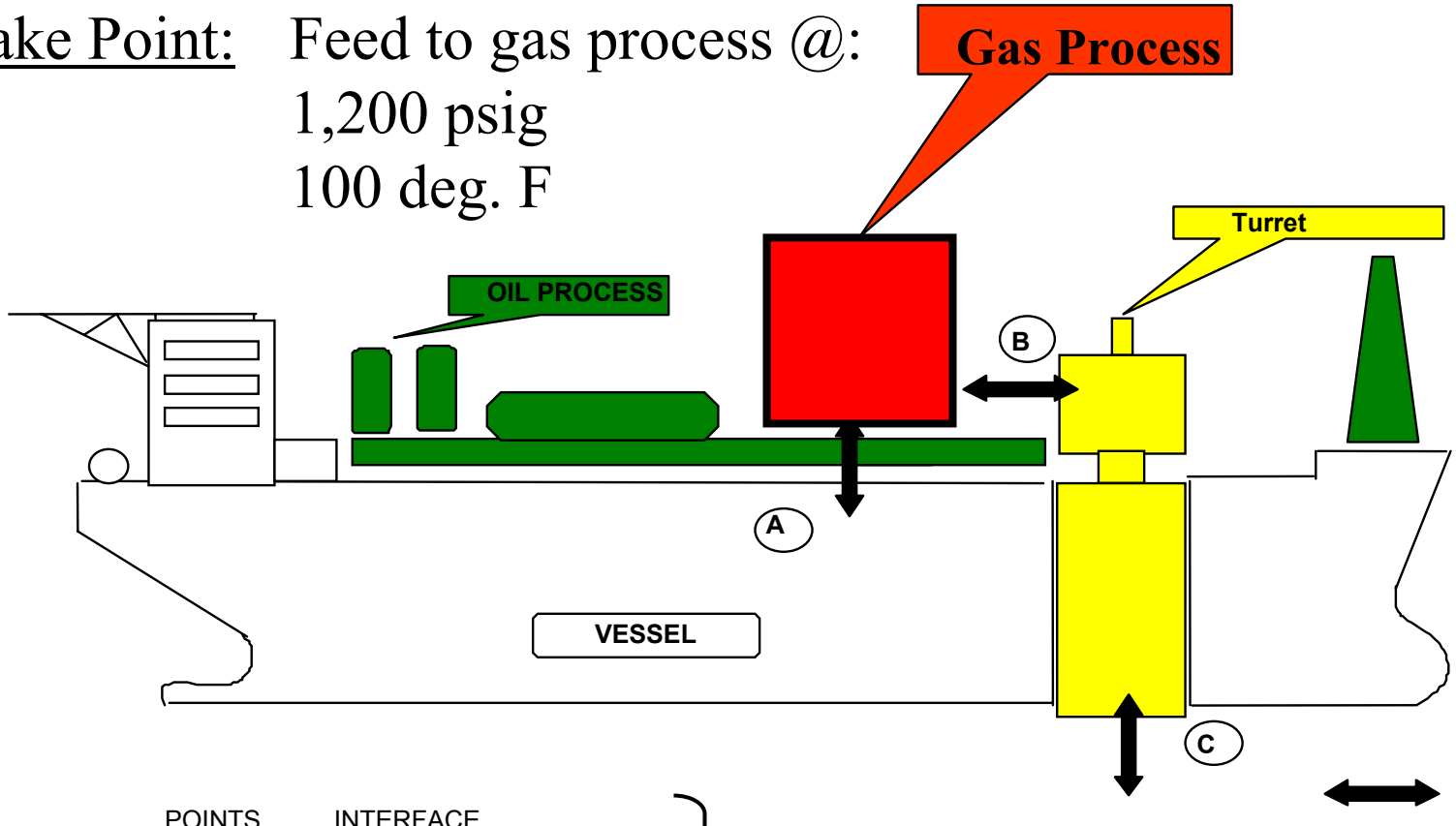
Reservoir Case	Recoverable Reserves (MMBO)	GOR (MMSCF/BO)
A	100	1000-2000
B	300	
C	600	
D	Maximum Gas Case	

How: Study Development Characteristics

Reservoir Case	Oil		Gas			Est. Field Life (years)
	Recoverable Reserves (MMBO)	Production Rate (MBOD)	GOR	Recoverable Reserves (BCF)	Production Rate (MMCFD)	
A	100	25	1000	100	25	11.0
			2000	200	50	
		50	1000	100	50	5.5
			2000	200	100	
B	300	50	1000	300	50	16.4
			2000	600	100	
		100	1000	300	100	8.2
			2000	600	200	
C	600	75	1000	600	75	21.9
			2000	1200	150	
		150	1000	600	150	11.0
			2000	1200	300	
D				*1825*	500	*10.0*

Case D assumes a 10 year life as basis for est. Recoverable Gas Reserves

Take Point: Feed to gas process @:
1,200 psig
100 deg. F

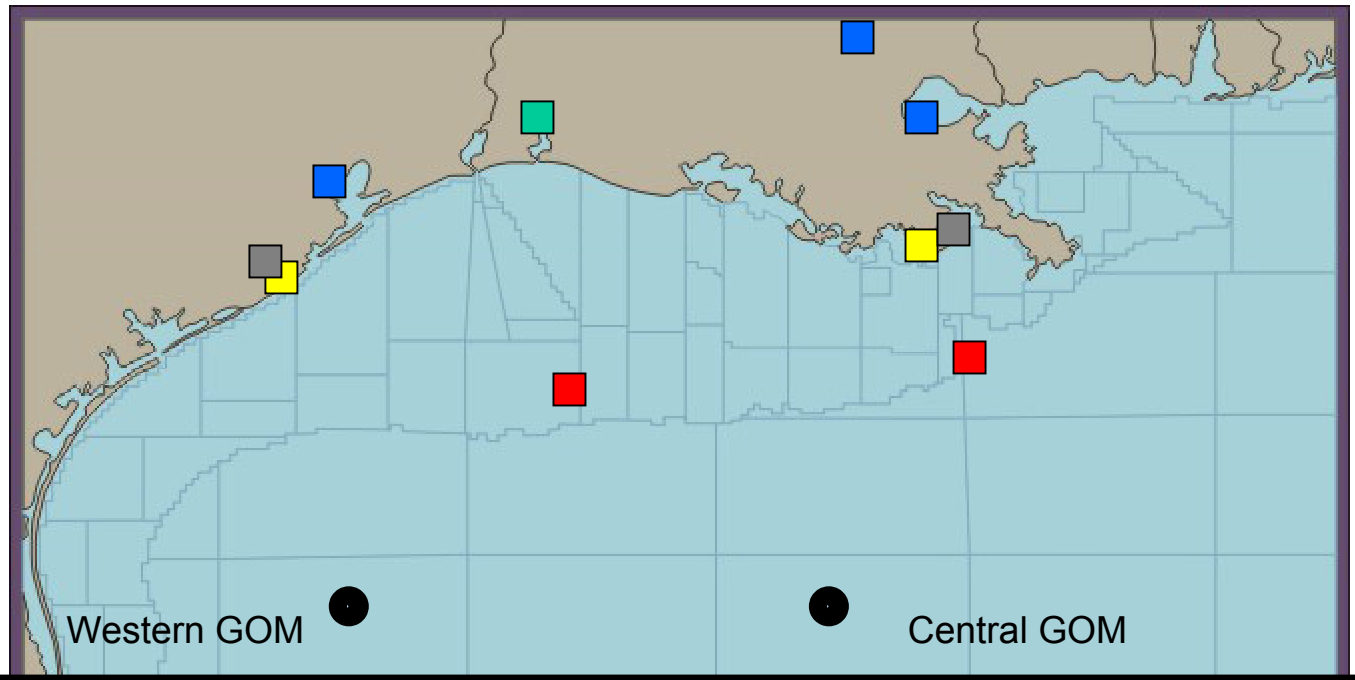


POINTS	INTERFACE
A	Vessel / Gas Process
B	Gas Process / gas product offtake (via Turret or alternate method)
C	Mooring / Risers/ Vessel
D	Gas product to delivery point

Study Participants to establish Key System Interfaces & Requirements

Study assumes FPSO based development using parameters from EIS/CRA

Where: Delivery Point Locations



Products	Destination
Gas	Pipeline to tie in to existing infrastructure (e.g. Transco, Seahawk, or Sting Ray from Eastern Gulf; or Tenn. TGT,El Paso, or Tenn. Trunk from Western Gulf)
CNG	Ship to new build facility offloading/storage facility (w/ gas plant?) located offshore Grand Isle or Freeport in depths > 50 ft.
LNG	Ship to existing LNG facility Lake Charles or Elba Is., S.Car.
GTL	Ship to existing refinery near Houston/Galveston or New Orleans
Power	Cable to Freeport or Grand Isle to tie into existing power grids

Transportation Distances for Gas/Gas Products

Transport Mode	Field Location	Destination	Distance (miles)	Study Distances (miles)
Pipeline	Eastern GOM	Transco, Seahawk, Sting Ray	150	**150 -300**
	Western GOM	Tenn. TGT,El Paso, Tenn. Trunk	150	
CNG	Eastern GOM	Grand Isle	225	**150-300**
	Western GOM	Freeport	175	
LNG	Eastern GOM	Elba Is., S.Car.	1200	**300-1200**
	Western GOM	Lake Charles	300	
GTL	Eastern GOM	New Orleans	275	**300**
	Western GOM	Houston, Galveston	250	
Power	Eastern GOM	Grand Isle	225	**150-300**
	Western GOM	Freeport	175	

Study Plan
Workshops
Format & Processes

Andy Wolford

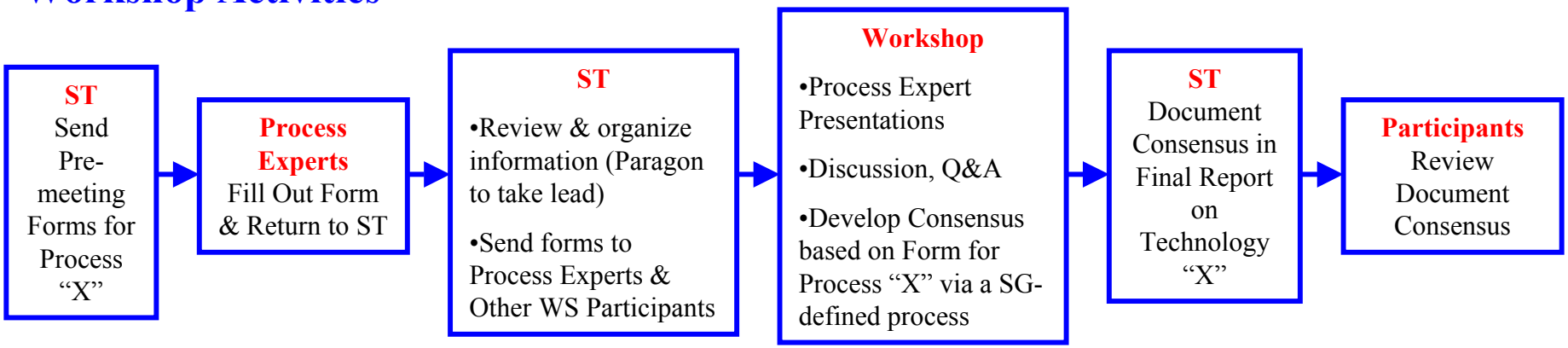
A.J. Wolford Associates

Technical Assessment Metrics

- Technical, Commercial, & Regulatory Feasibility & Readiness
- HSE
- Costs (CAPEX, OPEX)
- Process Efficiency

Workshop Process

Workshop Activities



Offline Activities

ST
Develop Pre-Meeting Form for Process "X"

ST
Develop process for reaching consensus at Workshops

SG

•Select Process "X" Workshop Participants

•Invitation Only

WS Participants

•Process Experts/Vendors (oil companies, engineering companies,consultants)

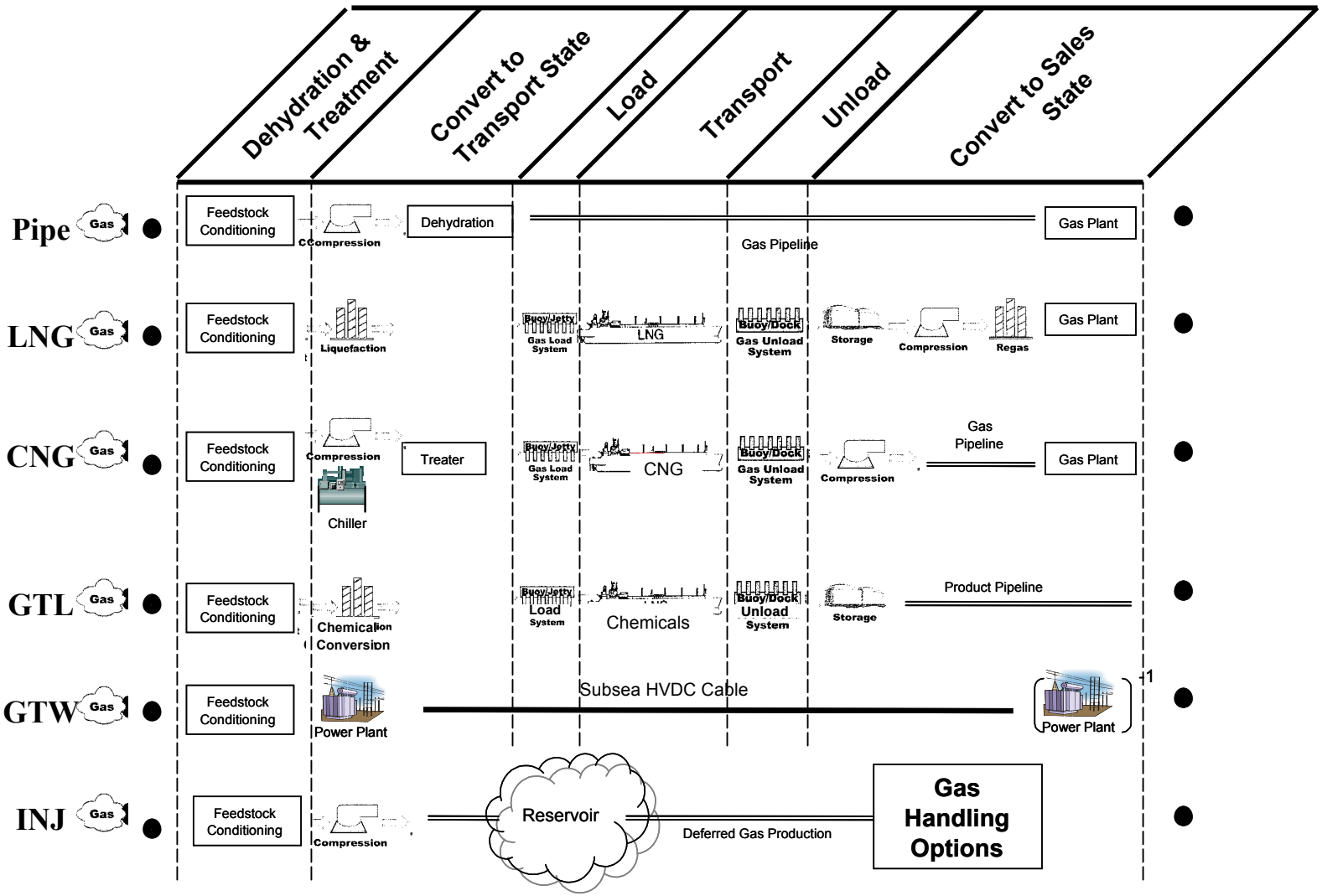
•Other WS Participants (oil companies, engineering companies,consultants, class societies)

•MMS & other Agencies

ST - Study Team

SG - Steering Group

Process Steps



Gas Handling Process Steps & Metrics

Metric	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Adjust for Equivalencies
Technical Readiness							
HSE							
CAPEX							
OPEX							
Efficiency							

Modeling Roadmap – Pipelines

Dependence of Metrics on Variables

Input	Output Metrics				
	TRL	HSE	CAPEX	OPEX	Efficiency
Water depth	Export riser fatigue	X	Mooring payload	IMR*	X
	Pipe wall		Riser payload		
			Installation		
Gas rate	X	X	Cost of plant	Utilities	Process losses
			Pipeline diameter		
Reservoir size	X	X	X	X	X
Distance to market	X	X	Pipeline length	Logistics	Pipeline loss
				IMR*	
Other			Permit		Fuel gas

X = no dependence

* = Inspection, Maintenance & Repair

Modeling Roadmap – CNG

Dependence of Metrics on Variables

Inputs	Output Metrics				
	TRL	HSE	CAPEX	OPEX	Efficiency
Water depth	**X**	**X**	Mooring payload	**X**	**X**
			Riser payload		
			Installation		
Gas rate	**X**		Cost of plant	Utilities	**X**
		Number loading/unloading operations	Cost of tanker (number, size)	IMR*	
			Equipment weight/area		
Reservoir size	**X**	**X**	**X**	**X**	**X**
Distance to market	**X**	Tanker transit (exposure time)	Cost of tanker (number, size)	Logistics (resupply crew) / Transportation cost	**X**
				Tanker (fuel, crew, etc)	
Other	Metallurgy	Consequence hazard	Permit	Port charges	
	Motions				

X = no dependence

* = Inspection, Maintenance & Repair

Technical Readiness

Technical Readiness (years)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Probability that Process ready in X years
0							
1- 3							
3 - 7							
7 - 10							
> 10							

Technical Readiness(continued)

Barriers to Technical Success of Present Technology

	Key Technical Needs for Option "X"	Probability of Success in Y Years
1		
2		
3		
4		
5		
6		

Commercial Readiness

Commercial Readiness (years)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Probability that Process ready in X years
0							
1- 3							
3 - 7							
7 - 10							
> 10							

Commercial Readiness

Barriers to Commercial Success of Present Technology

	Key needs for Option "X"	Probability of Success in Y Years
1		
2		
3		
4		
5		
6		

Regulatory Approval

Regulatory Approvals* (years)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Probability that Approval Complete in X years
0							
1- 3							
3 - 7							
7 - 10							
> 10							

*** Approvals by MMS & USCG**

Regulatory Approval

List of Regulatory Barriers

	Regulatory Barriers for Option "X"
1	
2	
3	
4	
5	
6	

Pipelines - Health, Safety & Environment

Hazards & Consequences

Process Step	Hazard	Consequence		
		Fatalities	Oil Spill	Product / Gas Spill
Offshore Plant	Gas leak from additional gas handling facilities	Fire / explosion, increase in fatality rate	Fire / explosion leading to breech of FPSO oil system containment	Gas release disperses without environmental impact
Offshore Transfer	Gas leak from additional gas handling facilities	Incremental risks introduced by transfer operations - exposure of all POB FPSO	Fire / explosion leading to breech of oil system containment	Gas release disperses without environmental impact
Transit	Pipeline leak	No personell exposure	No oil exposure	Gas pipeline leak disperses without environmental impact
Offshore Unload	NA	NA	NA	NA
Onshore Unload	Piping leak from offshore teminal receiving facilities	Fire / explosion & direct incremental fatality (terminal & neighboring facility personnel)	No oil exposure	Gas release disperses without environmental impact

	Include in model
	Seek guidance
	Exclude from model

CNG - Health, Safety & Environment

Hazards & Consequences

Process Step	Hazard	Consequence		
		Fatalities	Oil Spill	Product / Gas Spill
Dehydration, Treatment, Convert to Transport State	External Leaks / Failures (from gas process equipment)	Fire / explosion leading to fatalities. Exposure of all POB FPSO.	Fire / explosion leading to breech of oil system containment	Any gas released as a result of leak/fire/explosiondisperses without environmental impact.
Load	External Leaks Collision Structural Failure	Fire / explosion leading to fatalities. Exposure of all POB FPSO + Shuttle Vessel	Fire / explosion leading to or direct breech of bunker containment	Any gas released as a result of leak/fire/explosion disperses without environmental impact.
Transport	External Leaks Collision Structural Failure Overpressurization Loss of Propulsion / Steering: Foundering	Fire / explosion/impact leading to fatalities. Exposure of all POB Shuttle Vessel	Fire / explosion/impact leading to or direct breech of bunker containment	Any gas released as a result of leak/fire/explosiondisperses without environmental impact.
Unload Offshore	External Leaks Collision Structural Failure	Incremental risks introduced by loading operations - exposure of all POB (Shuttle Vessel + Terminal)	Fire / explosion leading to or direct breech of bunker containment	Any gas released as a result of leak/fire/explosiondisperses without environmental impact.
Unload Inshore	External Leaks Collision Structural Failure Grounding	Incremental risks introduced by loading operations - exposure of all POB (Shuttle Crew + Terminal & Neighboring Facility)	Fire / explosion leading to or direct breech of bunker containment	Any gas released as a result of leak/fire/explosiondisperses without environmental impact.
Convert to Sales State	External Leaks / Failures (from gas process equipment)	Fire / explosion leading to fatalities. Exposure of all POB Conversion Facility	NA	Any gas released as a result of leak/fire/explosiondisperses without environmental impact.

	Include in model
	Seek guidance
	Exclude from model

HSE – Human Safety

HSE - Human Safety (Fatalities/Year)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Total Fatalities/year
P10							
Expected							
P90							

HSE – Oil Spilled

HSE - Oil Spilled (Bbl/20 years)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Total Oil Spilled (bbl/20 years)
P10							
Expected							
P90							

HSE – Liquid Gas Product Spilled

HSE - Gas Product Spilled (Bbl/20 years)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Total Gas Product Spilled (bbl/20 years)
P10							
Expected							
P90							

HSE (continued)

Mitigation Measures for Option "X"

	Hazard/Risk	Mitigation Measure
1		
2		
3		
4		
5		
6		

CAPEX

CAPEX ($M)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Total CAPEX ($M)
P10							
Expected							
P90							

CAPEX			
	P10(CAPEX)	**E(CAPEX)**	**P90(CAPEX)**
Mooring payload	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Installation cost	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Cost of plant	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Cost of tanker (number, size)	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Equipment weight/area	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Ammortization timeline/payback	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Number of Wells	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Cost of tanker (number, size)	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Permit	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
TOTAL CAPEX	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz

OPEX

OPEX ($M/Year)	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Total OPEX ($M/year)
P10							
Expected							
P90							

OPEX			
	P10(OPEX)	**E(OPEX)**	**P90(OPEX)**
Utilities	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Manpower	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Well Oerations	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Logistics (resupply crew)/Transportation cost	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Tanker (fuel, crew, etc)			
Port charges	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
Maintenance	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz
TOTAL OPEX	xxxxxx.xx	yyyyyy,yy	zzzzzz.zz

Process Efficiency

Process Efficiency	Dehydration & Treatment	Convert to Transport State	Load	Transport	Unload	Convert to Sales State	Overall Process Efficiency (%)
P10							
Expected							
P90							

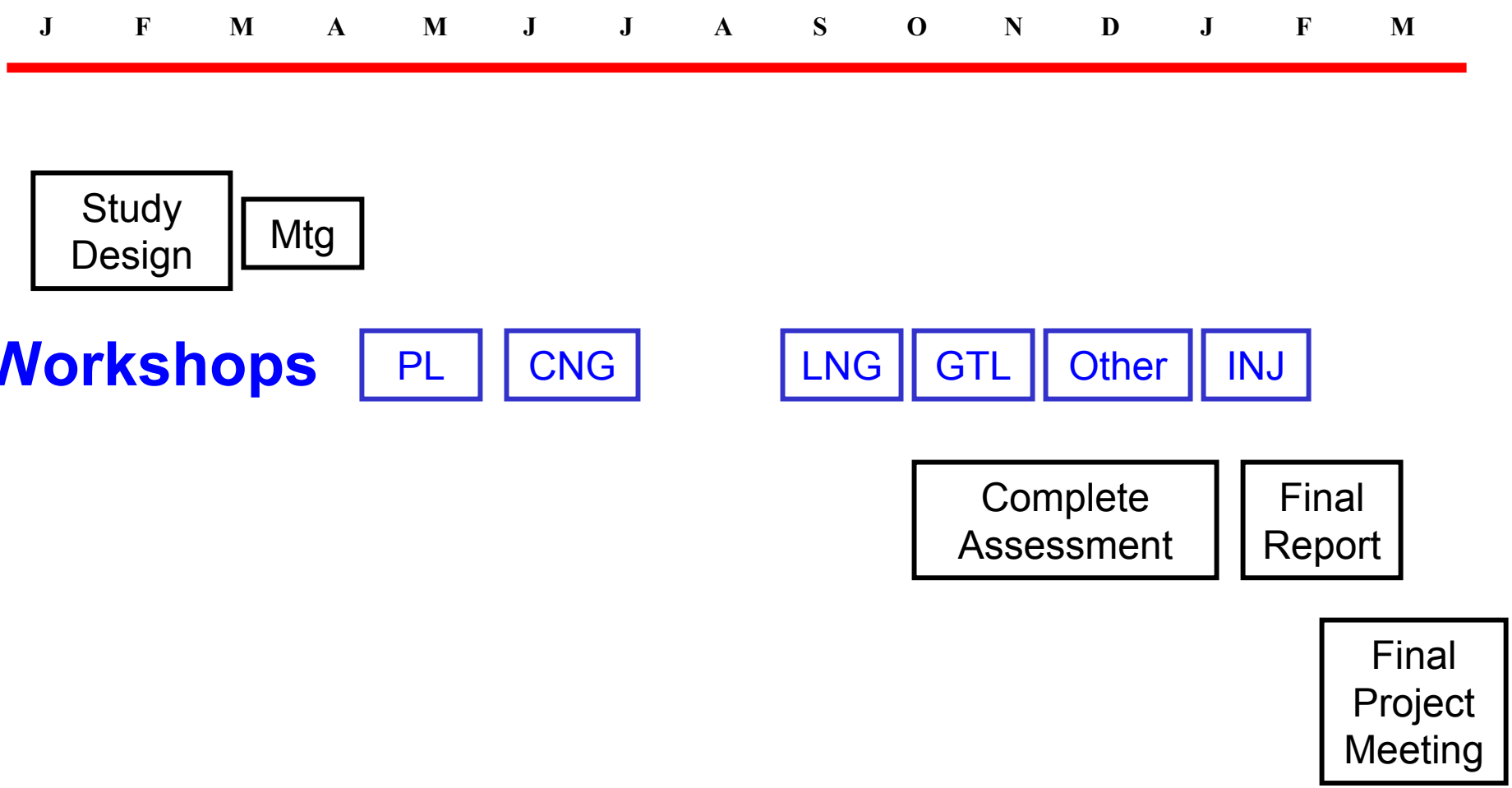
Order of Assessment Workshops

Gas Handling Option	
1	Pipeline
2	CNG
3	LNG
4	GTL
5	Other (Power, Gas-to-Solids)
6	Reinjection

Study Plan
Project Schedule & Final Report

Skip Ward
OTRC

Study Process



Schedule

Workshop		Month
1	Pipeline	April
2	CNG	June
3	LNG	September
4	GTL	October
5	Other (Power, Gas-to-Solids)	November
6	Reinjection	December
Final Report		
Issue Draft		February
Final Project Meeting		March

Study Plan
Industry Participation

Allen Verret

OOC

Workshop Participants

- Invited Participation in Workshop on Specific Gas Handling Option
- Review pre-Workshop Strawman
- Active Participation in Workshop
  - Presentations on Technologies
  - Share Technical Knowledge & Experience
  - Clarifications & Deliberations
  - Develop Consensus View of Option
- Review Draft Report on Option
- Review/Comment on Final Report (covering all Options)

Workshop Participants

- Invited Participants to Workshop on Specific Gas Handling Option Will Include
  - Process Experts (Advocates, Vendors)
  - Stakeholders & Others with Relevant Expertise
- Opportunity to Volunteer and/or Nominate Others
  - Complete Form Today
  - Email Others Later

Final Stretch!!

Websites

OTRC

(http://otrc.tamu.edu)

- Announcements & Calendar Links
  - Project Information & Schedule
- Technology Transfer Link
  - Comparative Risks Analysis for Deepwater Production Systems

MMS

(http://www.gomr.mms.gov/homepg/offshore/fpso/fpso.html)

- FPSO EIS
- Comparative Risks Analysis for Deepwater Production Systems

Thanks for Your Interest

Please Register your Interest in Participating in Workshops

Please Nominate Others That Could Contribute to Workshops