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Developments in Natural Gas &LNG

Challenges for Sustainable Operations of Cross Country Pipeline

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Developments in Natural gas
Introduction

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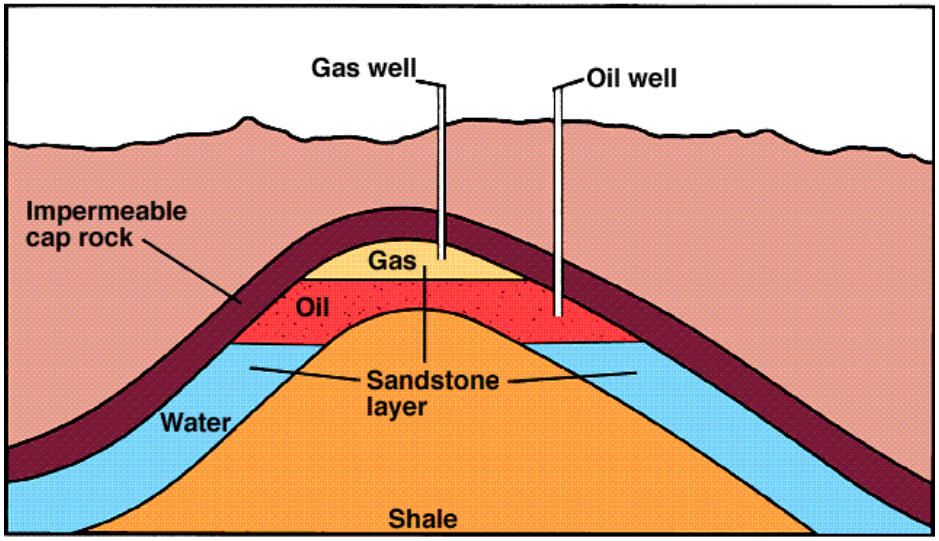
Crude Oil and Natural Gas Pool



- Accumulations of dead marine organisms on the ocean floor were covered by sediments.
- Muddy rock gradually formed rock (shale) containing dispersed oil.
- Sandstone formed on top of shale, thus oil pools began to form.
- Natural gas forms on top of oil.
- Primary component of natural gas is methane(CH4).
- Transportation in 3 forms

Liquid

Gas

Hydrate

Developments in Natural gas
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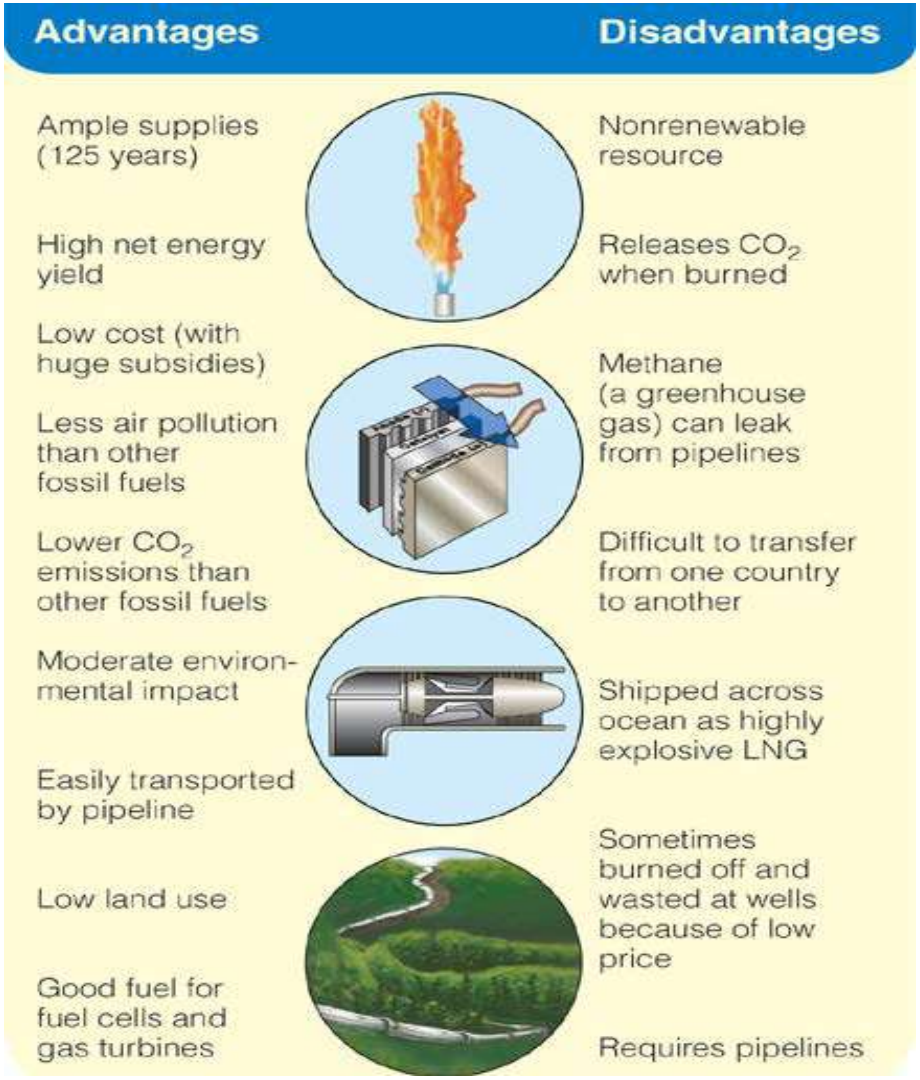
- Natural Gas was a nuisance initially when it is coming as a associate gas due to Hazardous in nature and transportation issues..
- Latter developed better utilization of natural gas as Fuel (Power / Steam generation) & Feed (Fertilizer / sponge Iron).
- Extraction of C2, C3, C4, C5, C6 for better value addition.
- Effective use of all modes of transportation;
  - Inter Continental - LNG/ Pipelines.
  - Intra State - Cross country pipelines
  - Intercity - CNG/PNG



Developments in Natural gas
Typical Gas Transportation

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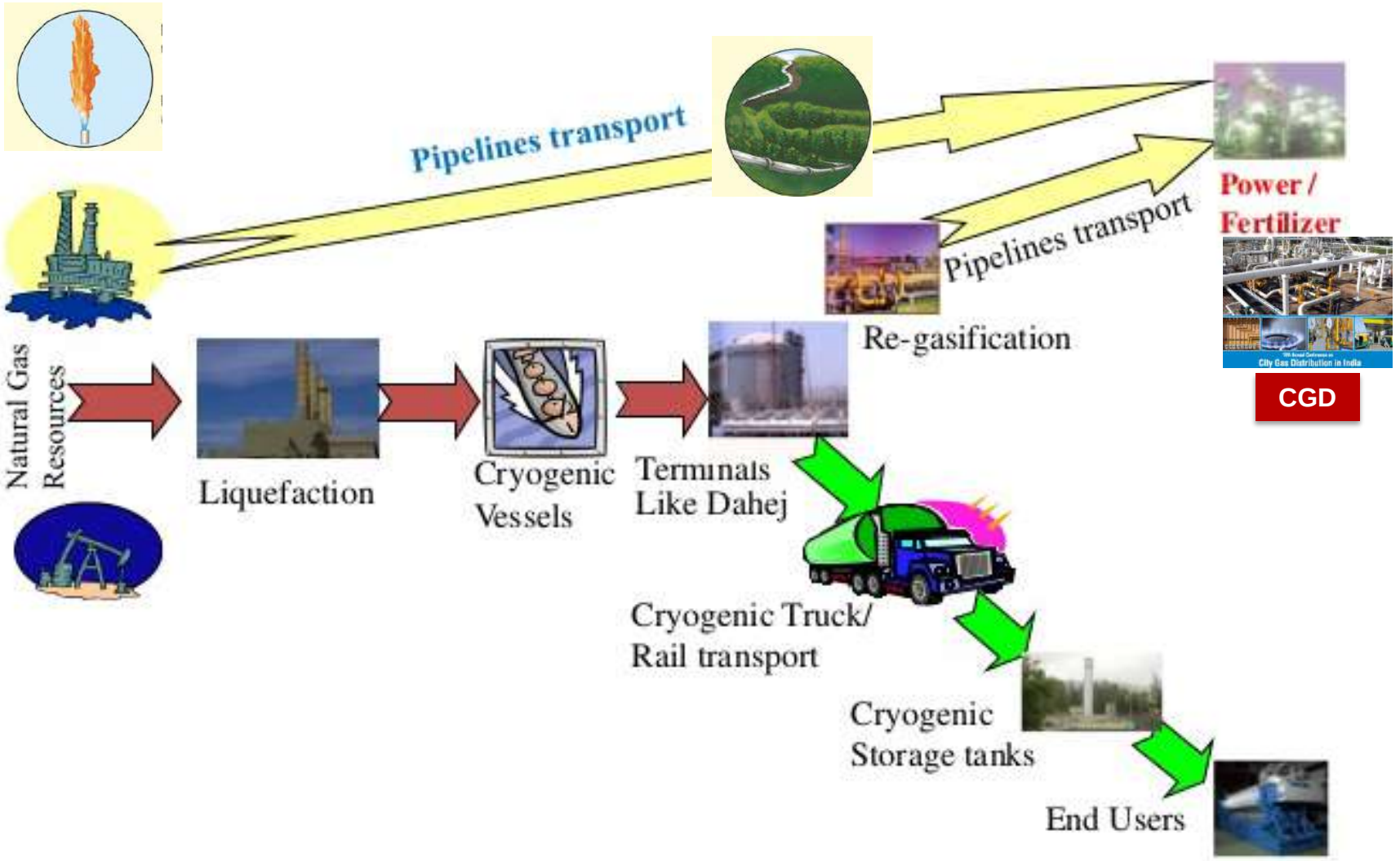

Typical Cross Country Configuration

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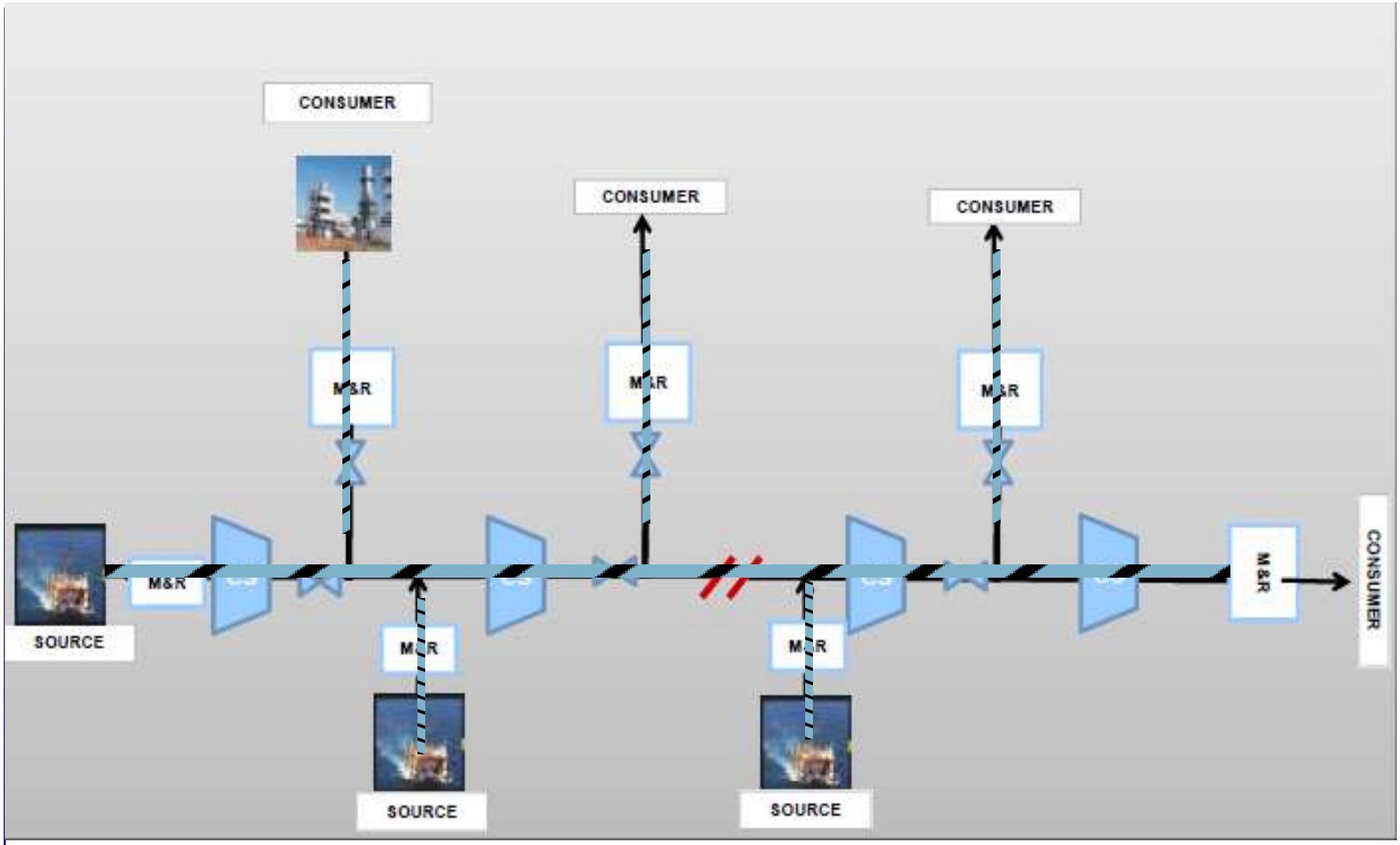

Gas Pipeline Network

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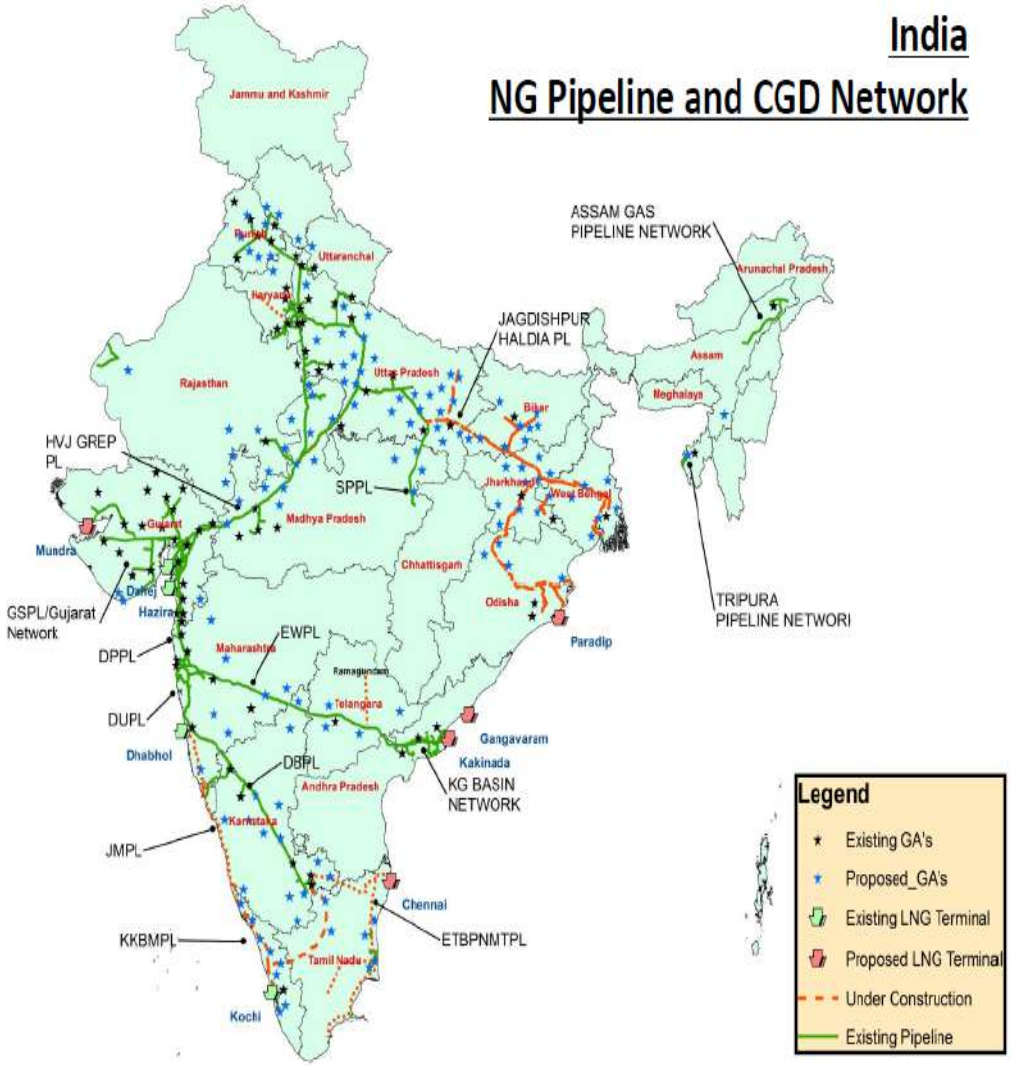

- Existing Natural Gas Pipelines 16,240 KM.
- FY 16-17, India's domestic gas consumption was ~156 MMSCMD.
- Up coming NG pipeline in next 3 years – 10258 KM.
- PNGRB's **"Vision 2030"**
  - ✓ the overall gas demand is expected to touch ~746 MMSCMD.
  - ✓ India will have 32,787 KM of pipeline network infrastructure with 815 MMSCMD capacity.
  - ✓ City Gas Distribution CGD expected to increase to 85 MMSCMD
- India is going to become Gas based economy..

Consolidated demand forecast for all Sectors

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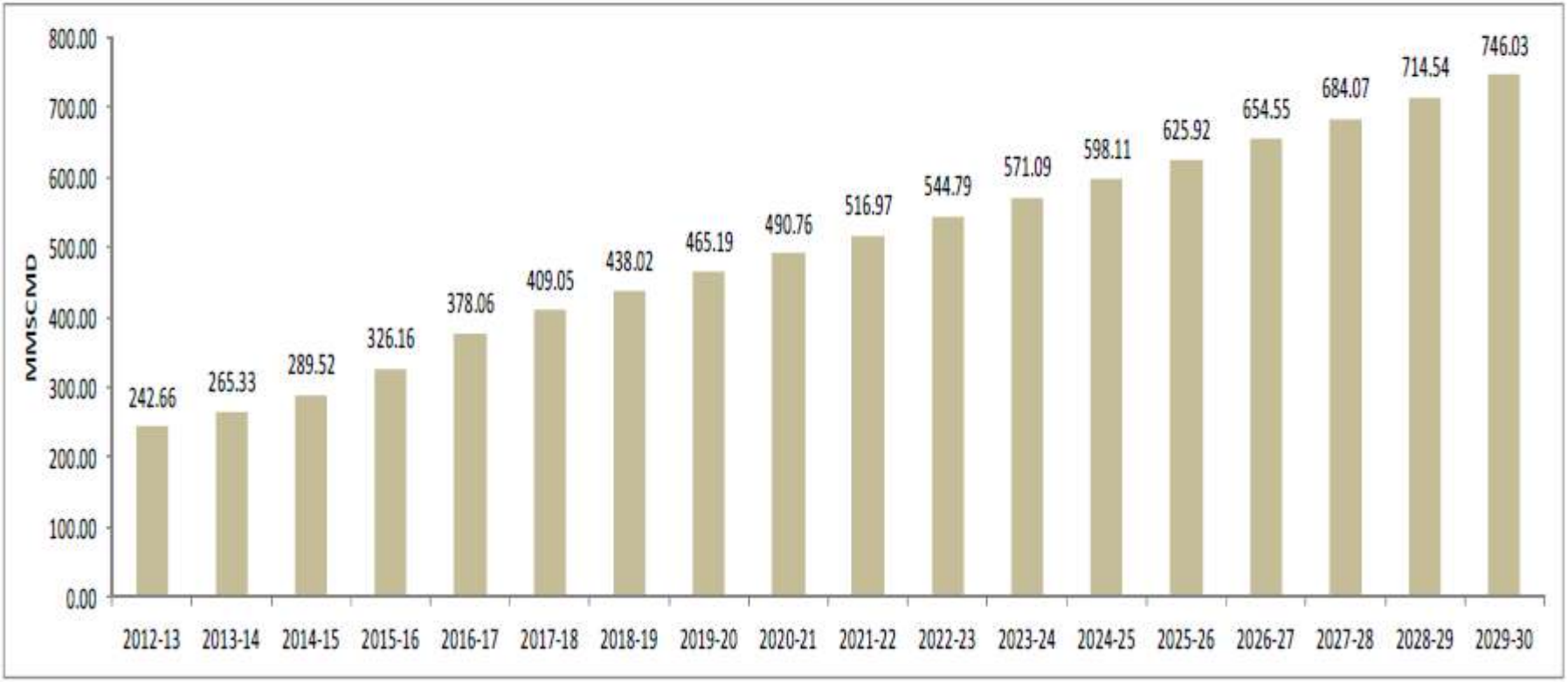
Figure 7 Consolidated demand growth trajectory



Gas demand forecast for City Gas Distribution (CGD)

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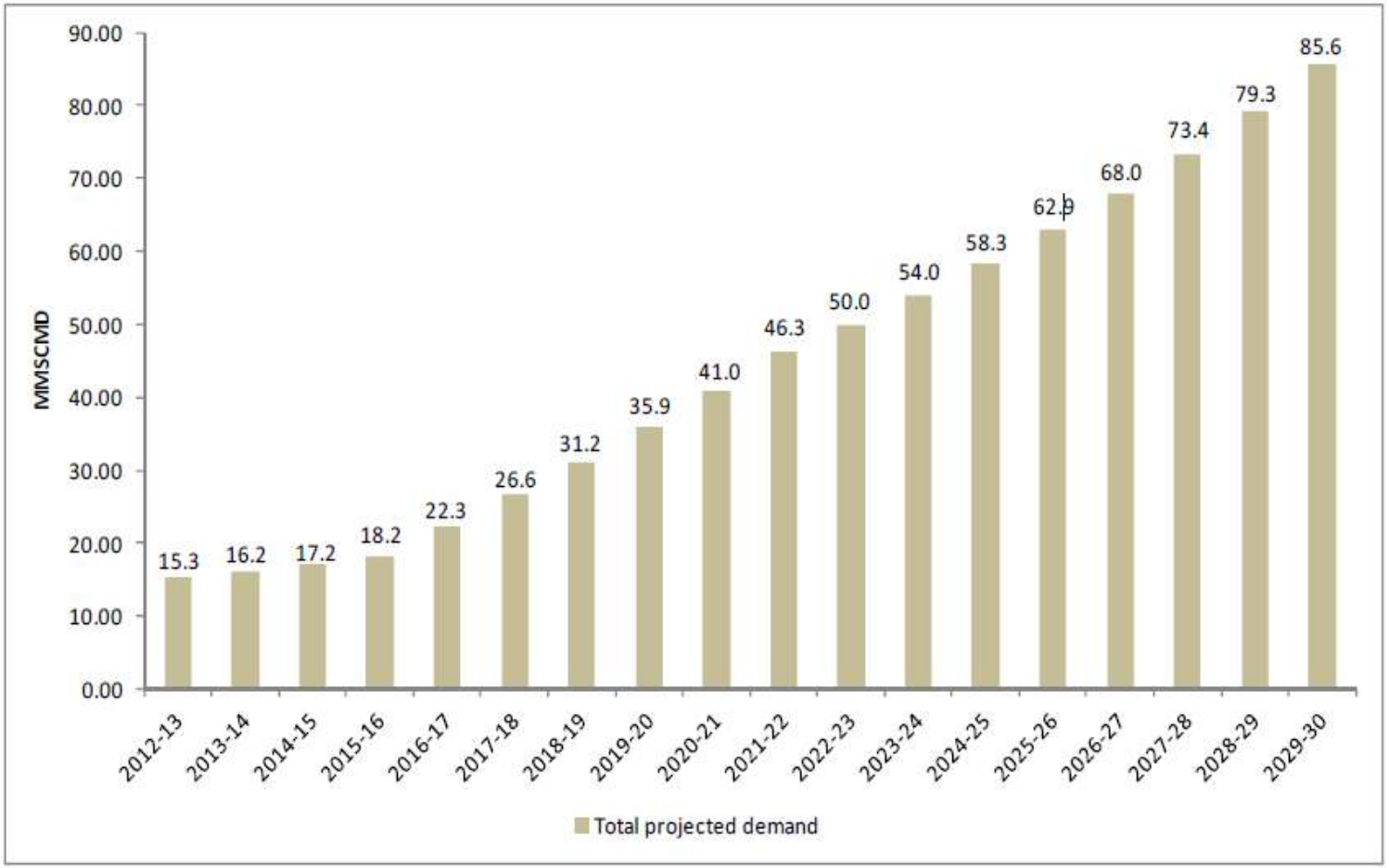
Figure 5 Gas demand from CGD sector: 2012-13 to 2029-30



Current Scenario

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India is going to become Gas based economy

- **Present scenario turned from Seller to Buyer's market**
- **High Competitiveness in Transportation needs focus on**
  - **Safety and Integrity**
  - **Gas Quality Assurance**
  - **Reliable supplies**

Table 1 Primary energy mix for India

Source	2010	2025
Coal	53%	50%
Oil	30%	25%
Gas	11%	20%
Hydro	5%	2%
Nuclear	1%	3%
	100%	100%

Major Challenges in Pipeline Operation

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- ✓ **Safety of Stakeholders, Team members, and General public**
- ✓ **Creating awareness among stakeholders**
- ✓ **Internal and External Corrosion of Pipelines**
- ✓ **Ensuring Statutory and Regulatory compliances**
- ✓ **Encroachment of Pipelines**
- ✓ **Uninterrupted gas deliveries**
- ✓ **Efficiency in Pipeline transportation**
  - **System Use Gas (SUG)**
  - **Transmission Losses**

Sustainable Operations - Life Cycle

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From Concept to Operations

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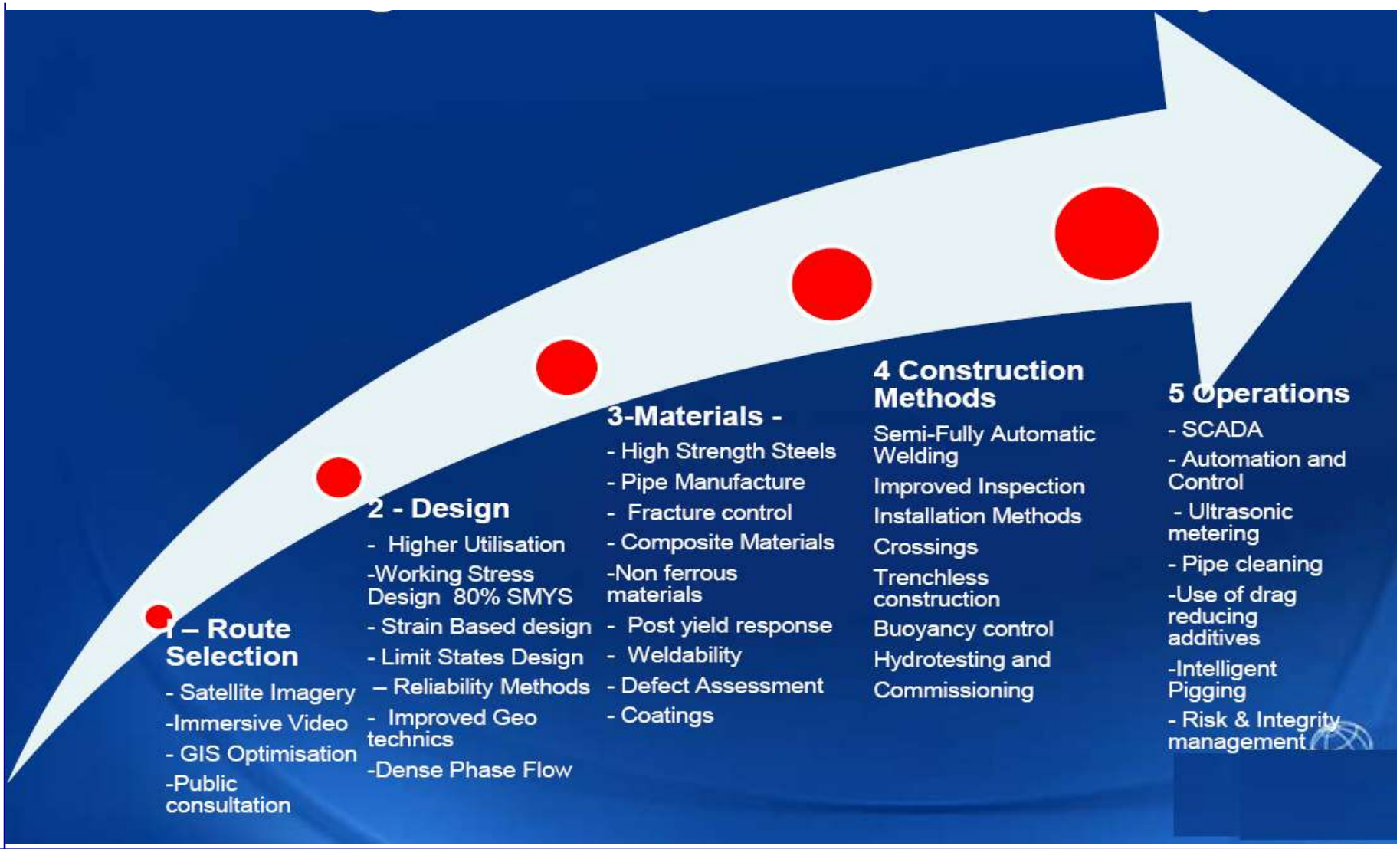

Pipeline Life Cycle
Slip Ups

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In spite of following all the Standards/Guidelines, there are always some slip ups during:

- Design
- Construction
- Commissioning
- Operation

⑩But consequential effect predominantly is visible during Operation Phase ,hence Effective Asset Integrity management shall be in place

Safety & Integrity

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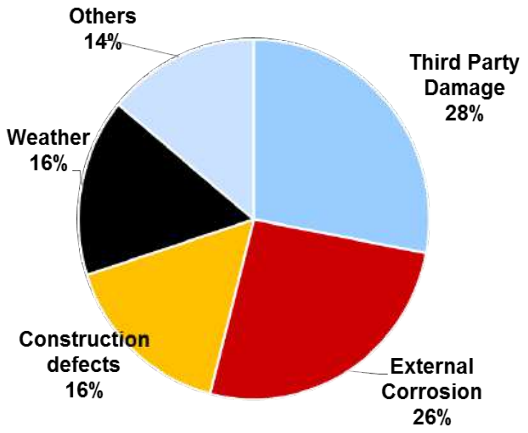
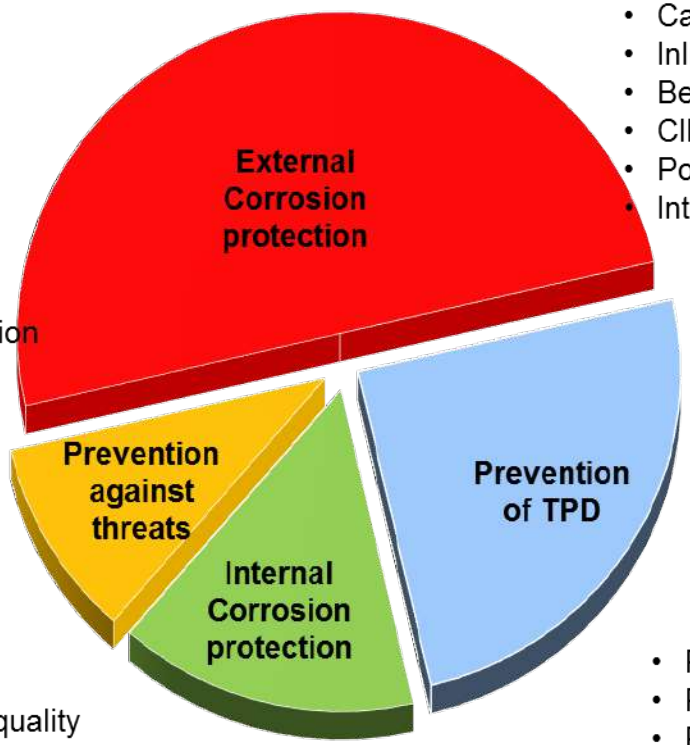
Typical Pipeline Failure statistics
Source: 9th EGIG report





- Cathodic Protection
- Inline Inspection
- Bell Hole inspection
- CIPL/DCVG surveys
- Polarisation cells and grounding anodes
- Interference survey

- River bank protection
- Bathymetry survey
- Maintenance of assets
- SOP/SMP
- Material Quality checks

- Cleaning Pigging
- Monitoring of gas quality
- Weight loss coupons

- PIDS
- Patrolling – Aerial / walk/ Road
- Public Awareness programme
- Prohibited area status

Efficiency (Accounting – SUG/ UFG)

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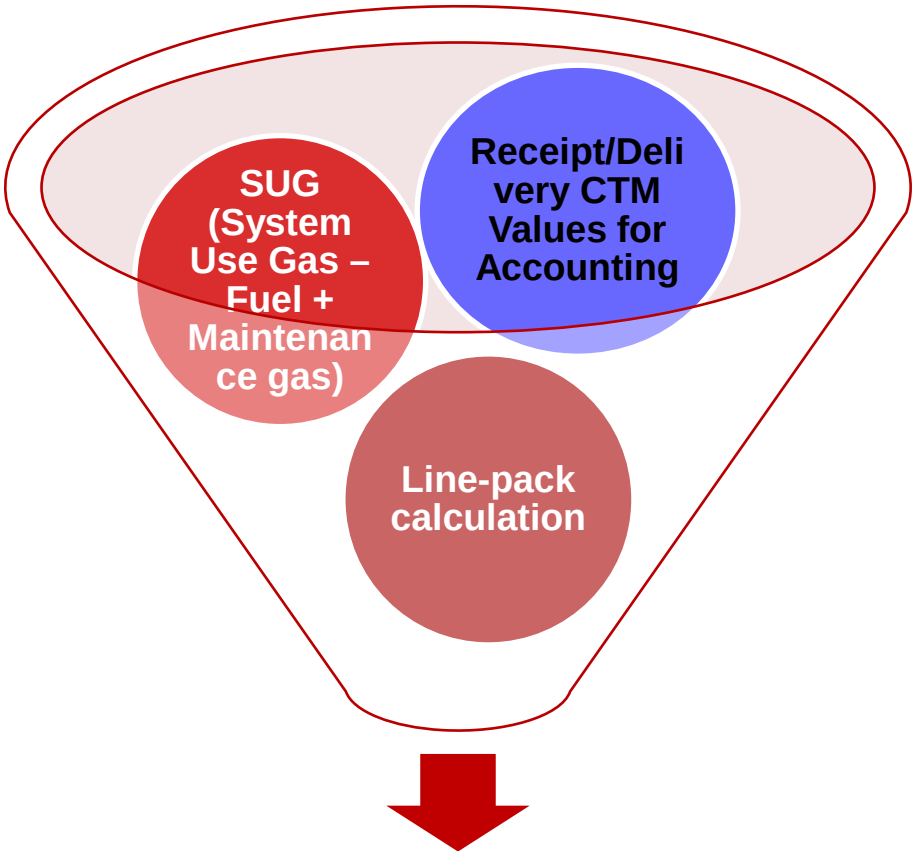
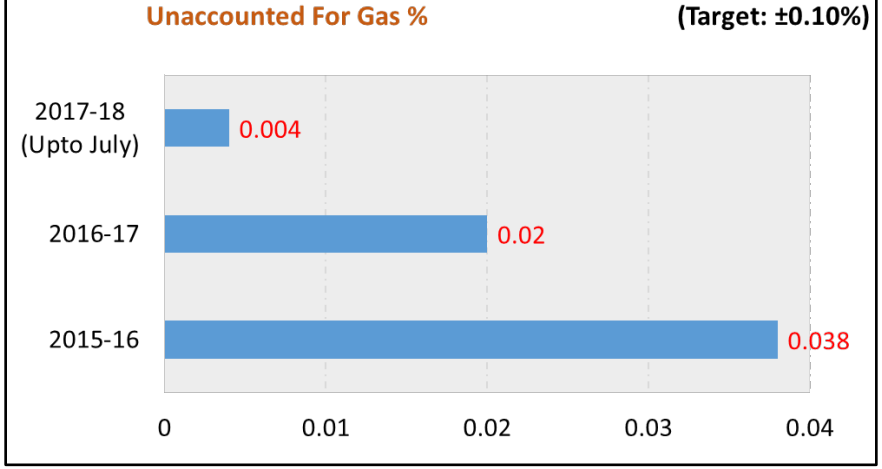


Unaccounted for Gas (UFG) / Fuel

- Major Opex of Pipeline is Fuel Consumption.
- UFG reflects leakage losses and Accuracy.
- For better efficiency, focus on Optimized Fuel Consumption / Control & Recirculation.
- Typical efficient operation figures represented below.



Way forward

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- Conducive atmosphere for Grid development
- Common corridor concept for utilities
- Safety awareness
- Cost competitiveness
- Periodic Interaction among pipeline operators
- Sharing of common assets

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Sustainable Operations
Resources (People & Competency)

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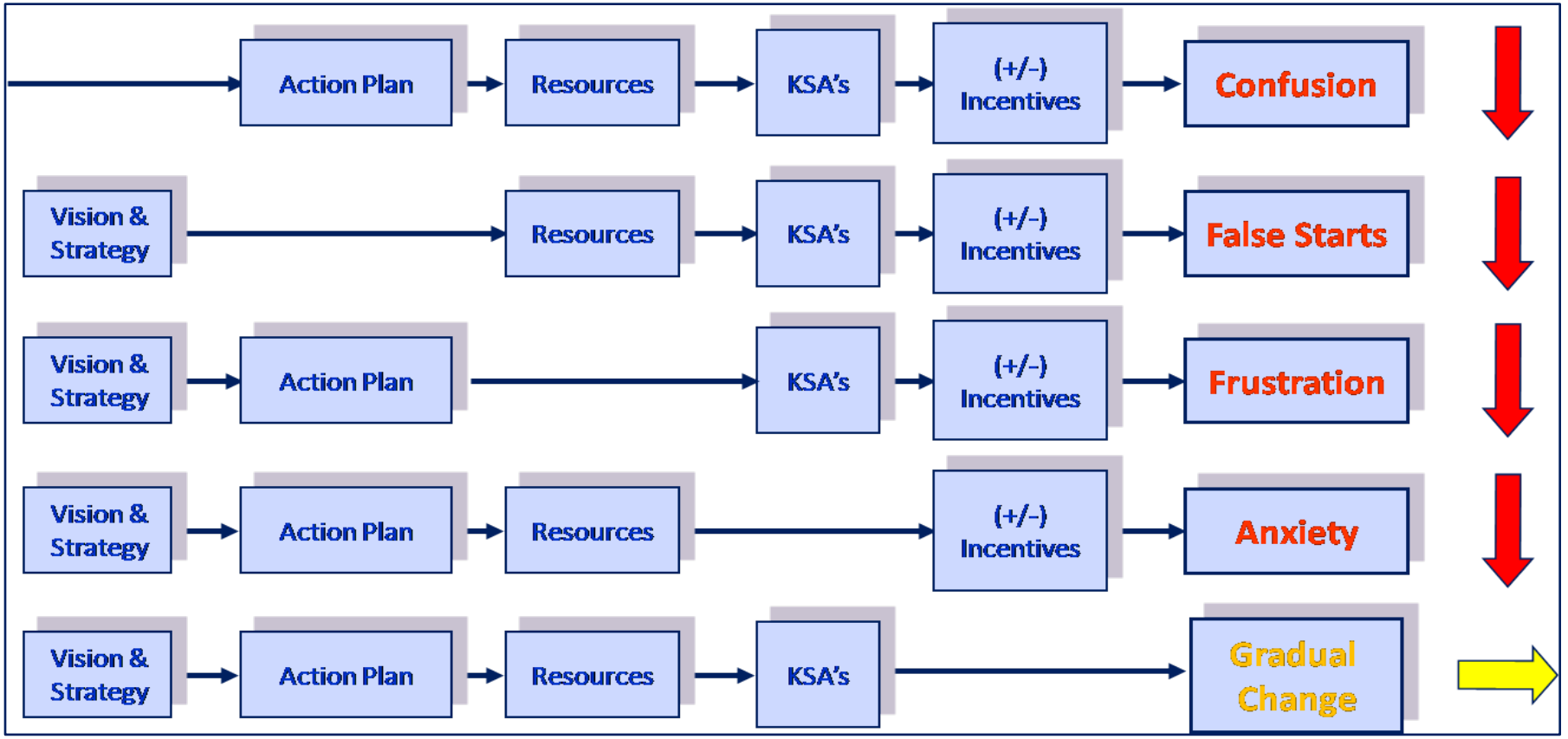

KSA = Knowledge, Skills, & Abilities