



COST ENGINEERING OF PIPELINES FOR FLUID TRANSPORT

by

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PIPELINES

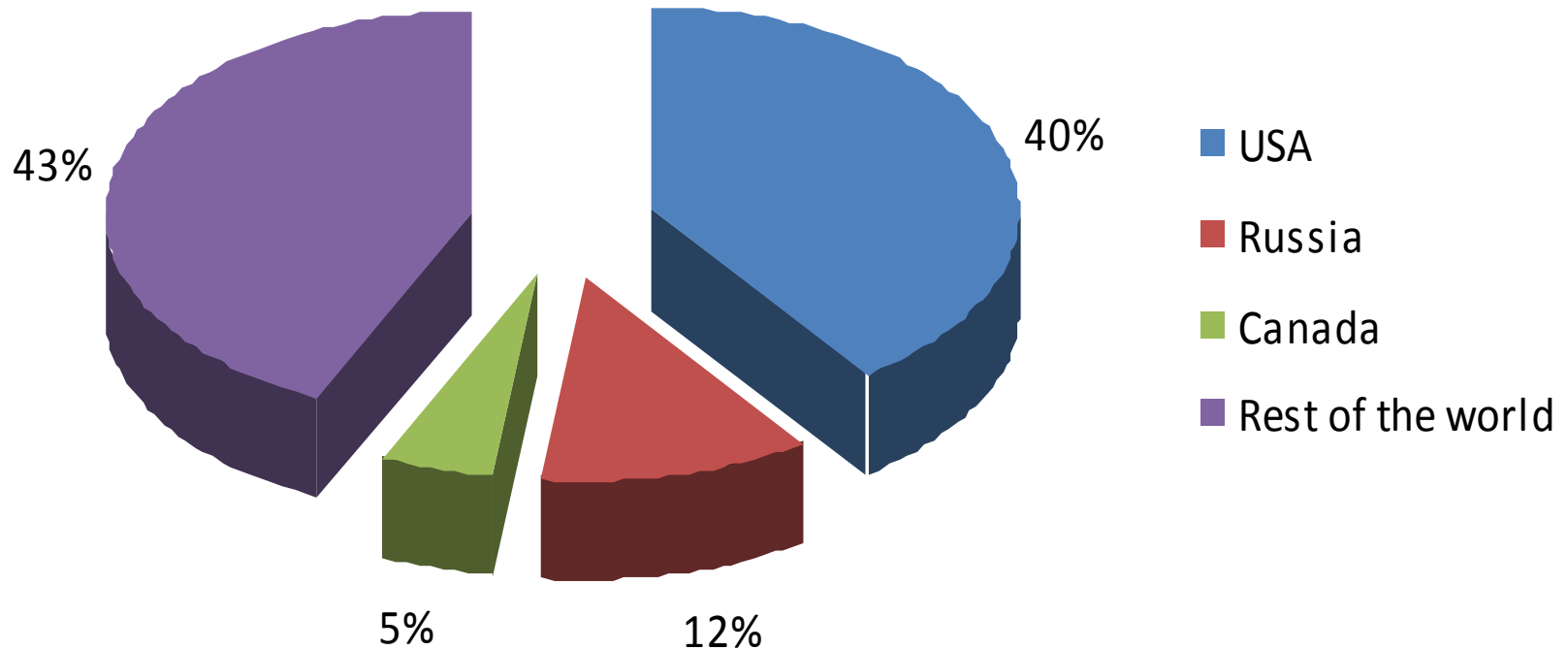
- Pipelines are made up of sections of line pipes welded together.
- They are generally the most economic way to transport large quantities of fluid and other products over land.
- Compared to other means of transportation, they have lower cost per unit and higher capacity.

TYPES OF PIPELINE - BY FUNCTION

- Flow Lines
 - Gathering Lines
 - Transmission Lines
 - Distribution Lines
 - Service Lines
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WORLD PIPELINE NETWORK BY COUNTRY

World Pipeline Network (Statistics from CIA world fact book 2008)



Nigerian pipelines accounts for 0.47% of the world's pipeline network

ALTERNATIVES TO PIPELINES

- Road Transportation
 - Rail Transportation
 - Sea Transportation
 - Air transportation
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FLUID PRODUCTS YOU CAN TRANSPORT USING PIPELINE.

- Crude Oil
 - Natural gas
 - Refined Hydrocarbon Products
 - Bio fuels
 - Hydrogen
 - Water
 - Beverages etc.
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COST ENGINEERING

- Cost engineering is concerned with the application of scientific principles and techniques to problems of cost estimating, cost control, business planning and management science.
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PIPELINE FLUID TRANSPORT COST ESTIMATION-CAPITAL EXPENDITURE (CAPEX)

- Cost estimating is a well-formulated prediction of the probable cost of a project, operation or any activity.
 - For a project, cost estimates are improved and updated as the project moves from feasibility studies to detailed engineering/design.
 - The key determinates of pipeline construction costs are:
 - Pipeline Diameter
 - Pipeline length
 - Operating pressure
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CAPEX

- Other factors are:
 - Terrain
 - Climate
 - Local Labour Cost
 - Safety/Environmental Regulations
 - Population Density and Right of Way (ROW)
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CAPEX-MAJOR COST COMPONENTS

ONSHORE CONSTRUCTION

- Linepipe
 - Freight (Ocean and Overland)
 - Miscellaneous materials (Valves, fittings, etc)
 - Cathodic Protection (CP)
 - Coatings (FBE,3-layer PE)
 - Compressor/Pump Stations
 - Metering Station
 - Communication Infrastructure/Equipment
 - Insurance
 - Construction (Survey & inspection, ROW, hauling & stringing, laying, special crossings, etc)
 - Project management
 - Engineering/Design
 - Expected completion time
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CAPEX-MAJOR COST COMPONENTS OFFSHORE CONSTRUCTION

- Linepipe
 - Freight (Ocean and overland)
 - Miscellaneous (buckle arrestors, tie-ins, anodes, valves etc)
 - Insurance
 - Construction (survey, trenching, installation, shore crossings etc)
 - Coating (concrete, corrosion)
 - Project management
 - Cathodic Protection
 - Engineering/Design
 - Expected completion time
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OPERATIONAL EXPENDITURE (OPEX)/ MAINTENANCE COST

OPEX

- Fuel cost (for Compressor/Pump and Metering Stations) and other consumables
- Other Utility cost
- Operating staff cost
- Land lease cost, if applicable
- Insurance and taxes

MAINTENANCE COST

- Inspection cost
 - Labour cost
 - Equipment/Material replacement and repair cost
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PIPELINE FLUID TRANSPORT- COST CONTROL

- Cost control involves the use of special techniques in controlling cost associated with a project, operation or any activity
 - Below are some cost controlling techniques during project construction phase:
 - Planning and budgeting
 - As a baseline guild.
 - Keeping track of cost
 - To monitor project cash flow
 - Effective time management
 - To keep project within budget
 - Project change control
 - To manage anticipated or possible changes to scope
 - Use of end value
 - For reliable evaluation of work progress
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PIPELINE FLUID TRANSPORT COST CONTROL

- Below are some cost controlling measures during operations and maintenance phase:
 - Use of energy efficient equipment
 - Efficient use of utilities and consumables
 - Preventive maintenance approach to facility/asset management
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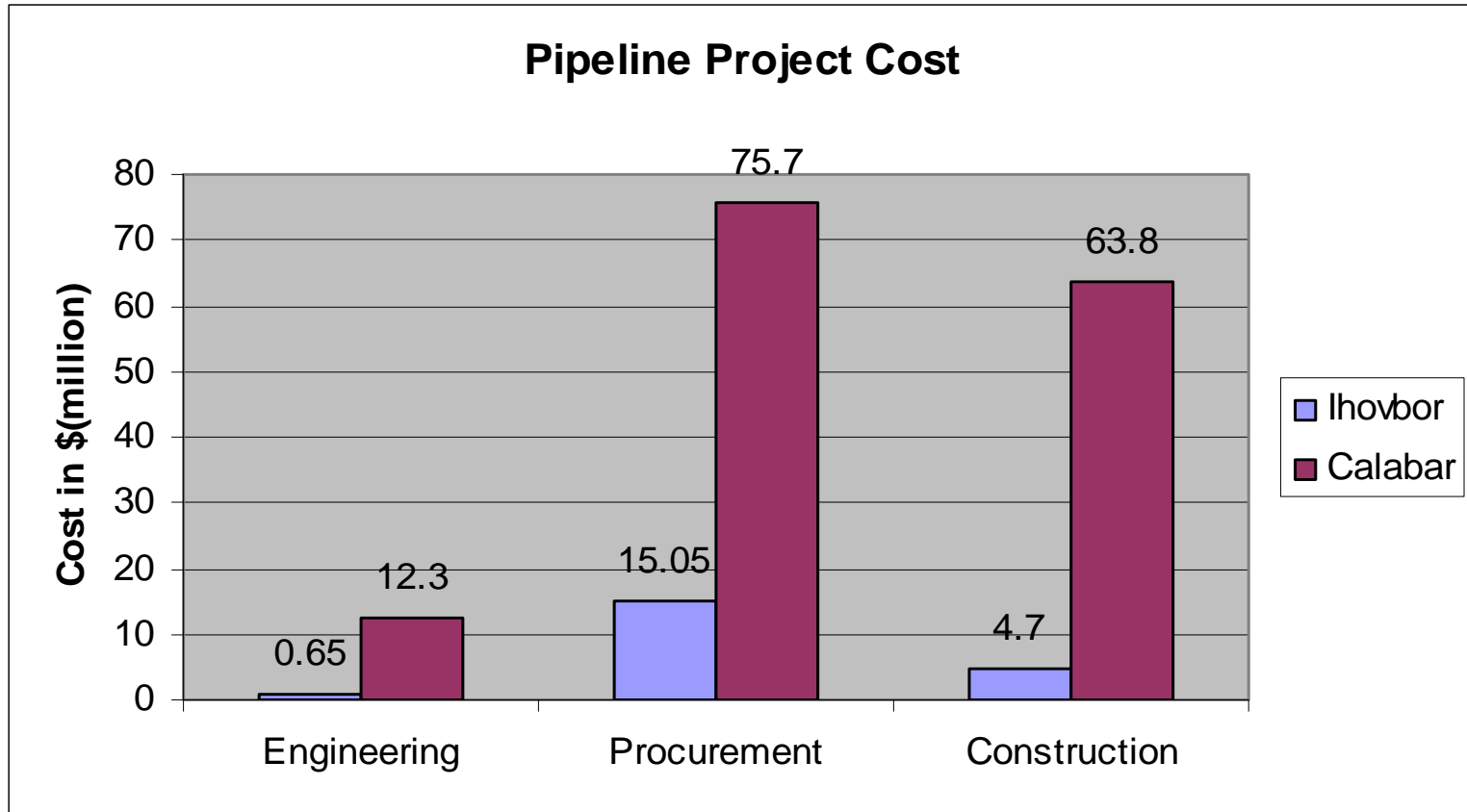
CASE STUDY ;COMPARING TWO NIPP PIPELINE PROJECTS;

- Two NIPP projects with different cost factors would be considered as a case study.
 - This case study considered only the CAPEX of the pipeline project.
 - Cost factors considered;
 - Diameter
 - Length
 - Onshore/offshore
 - ROW
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NIPP CASE STUDY

COST FACTOR	PROJECT	
	Ihovbor	Calabar
Diameter (inches)	18	24
Length (KM)	22	107
Operating pressure (Bar)	35	35
Terrain		
Onshore/Offshore	Onshore	Onshore/offshore
Climate	Same	
Local labour cost	Same	
Safety/Environmental laws	Same	
Population density	Medium	Low
ROW Issue	Difficult	Ok
Total Project Cost	\$20.4 million	\$151.8 million

NIPP CASE STUDY



NIPP CASE STUDY

- The CAPEX of Calabar project is higher than the Ihovbor project by 86.6%.
 - Cost factors – Diameter, Length, Onshore/Offshore and ROW;
 - Pipeline diameter of Calabar project is 24 inch while Ihovbor project is 18 Inch.
 - The length of Calabar project is greater by 74.4 %.
 - Calabar project has onshore and offshore elements.
 - Though ROW acquisition cost for Ihovbor was more because of higher population density, other factors (diameter, length & onshore/offshore) increased the total cost of Calabar project.
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SUMMARY

- The total cost of fluid transportation using a pipeline is the sum of CAPEX and OPEX/Maintenance cost, and this is calculated considering the entire life cycle of the pipeline.
 - The CAPEX of a pipeline project is a function of key cost factors.
 - The impact of key cost factors are less significant in OPEX/ Maintenance.
 - Cost estimations are important for economic and investment decision.
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