COST ENGINEERING OF PIPELINES FOR FLUID TRANSPORT

by

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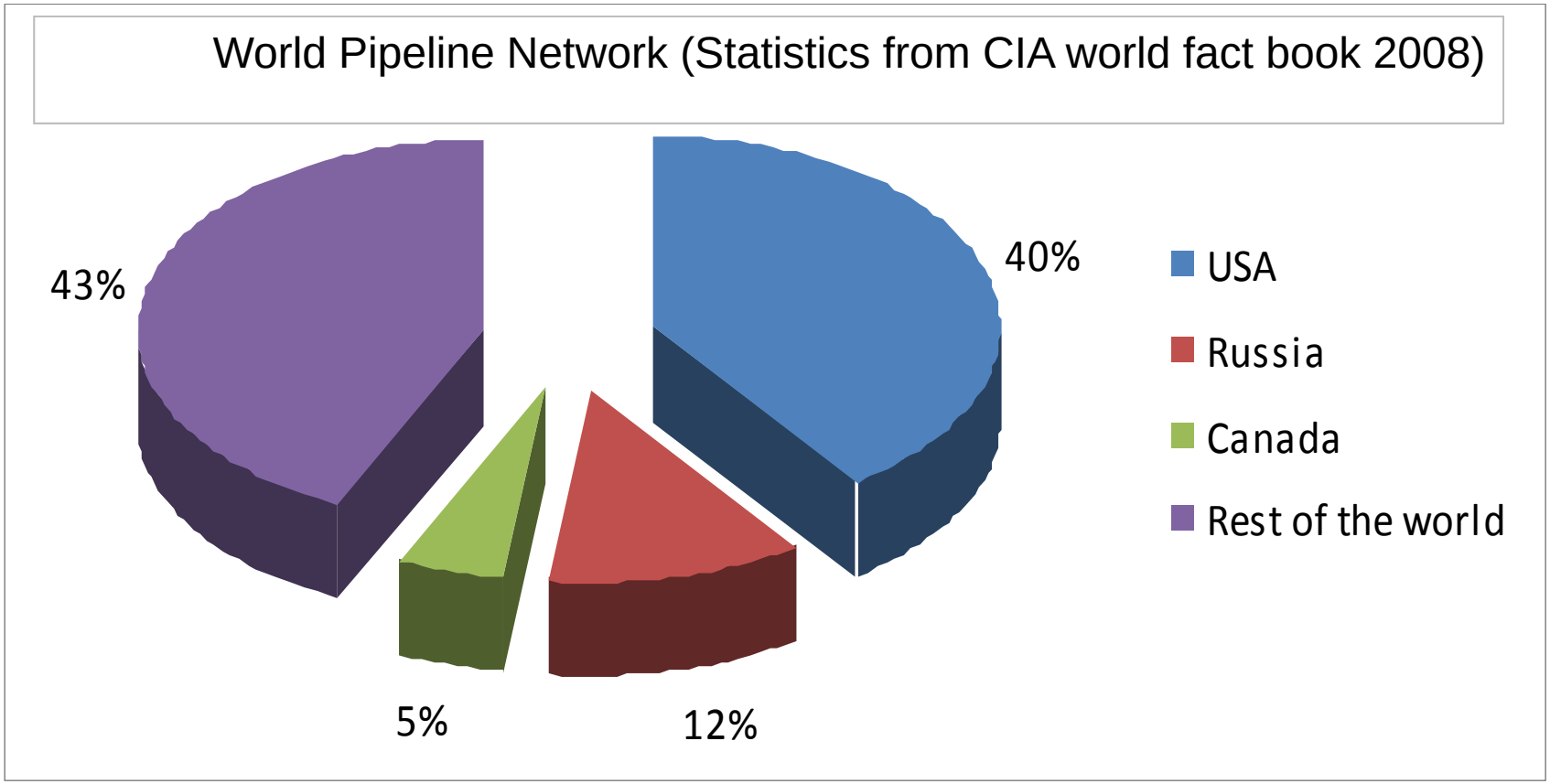
PIPELINES

- 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

WORLD PIPELINE NETWORK BY COUNTRY



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

ALTERNATIVES TO PIPELINES

- Road Transportation
- Rail Transportation
- Sea Transportation
- Air transportation

FLUID PRODUCTS YOU CAN TRANSPORT USING PIPELINE.

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

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.

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

CAPEX

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

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

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

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

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

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

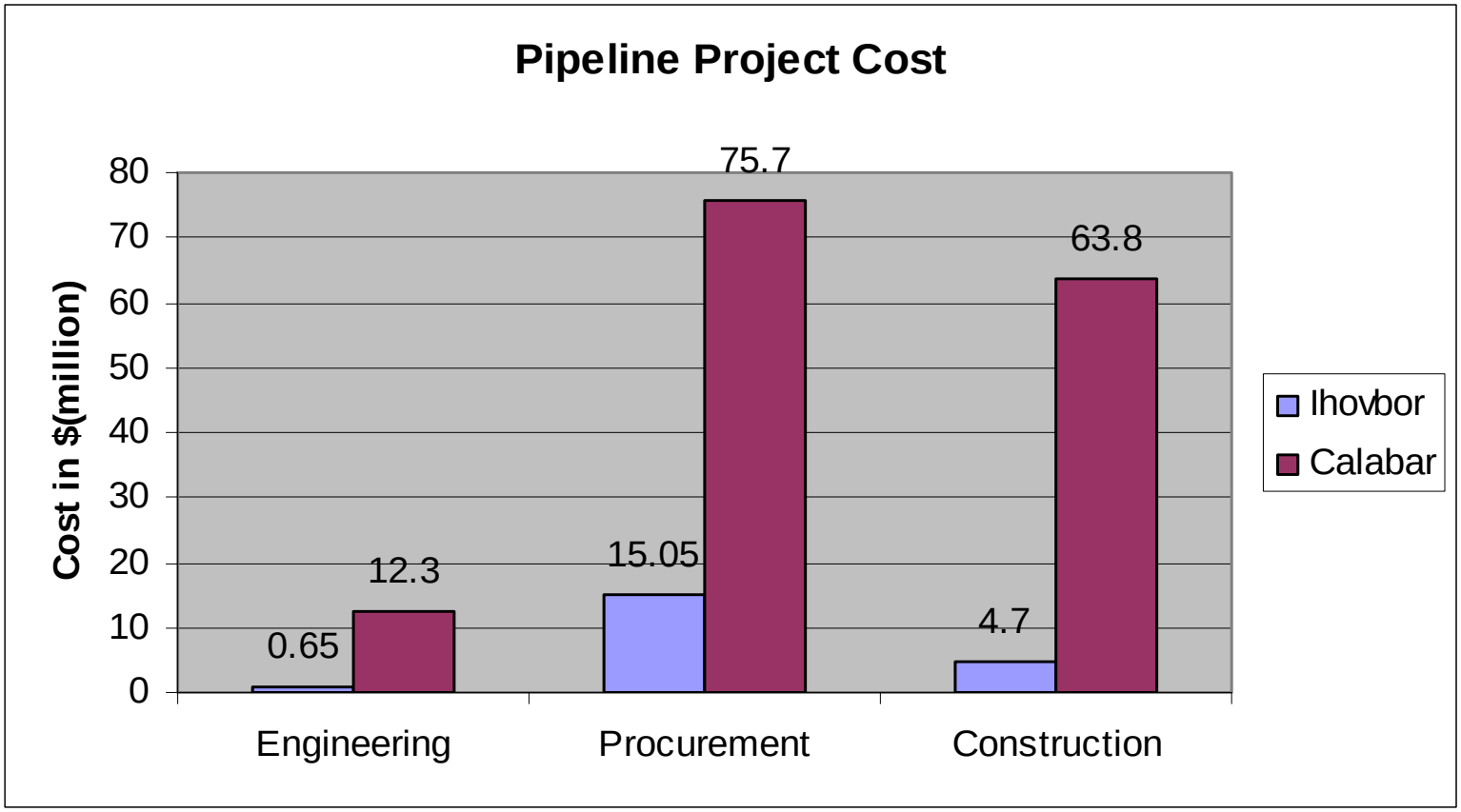
CASE STUDY ;COMPARING TWO NIPP PIPELINE PROJECTS;

- 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

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.

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.