Investigation of an Expansion Factor for Gas Charging

Gas TCMF

5th April 2006

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Introduction

- Alternative Transport Models identified which depend on expansion Factor

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Potential Gas Expansion Factors

- The expansion factors could be expressed in £/peak dayGWhkm.
  - Represents the annuitised capital cost of the transmission infrastructure required to transport 1 peak day MWh over 1 km.
- A range of pipe diameters would need to be used
  - Derived from the projected cost of 85/75bar steel pipeline projects
  - Types could be weighted by usage on the transmission system to produce a single factor.
- Compression costs could also be used
    - Derived from the projected cost of additional compression

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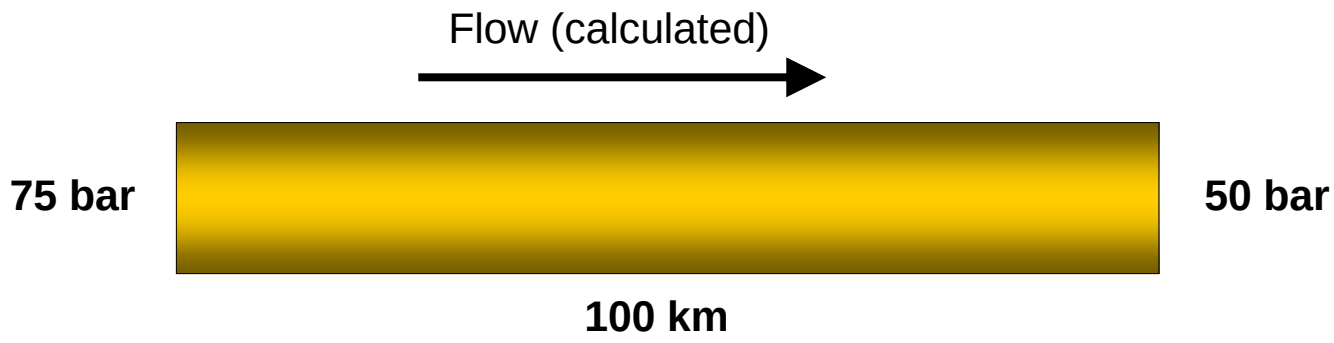
Pipe Costs



Consider effect on unit incremental flow costs arising from:

- Feeder duplication (parallel pipeline, same diameter)
- Feeder length
- Minimum/outlet pressure

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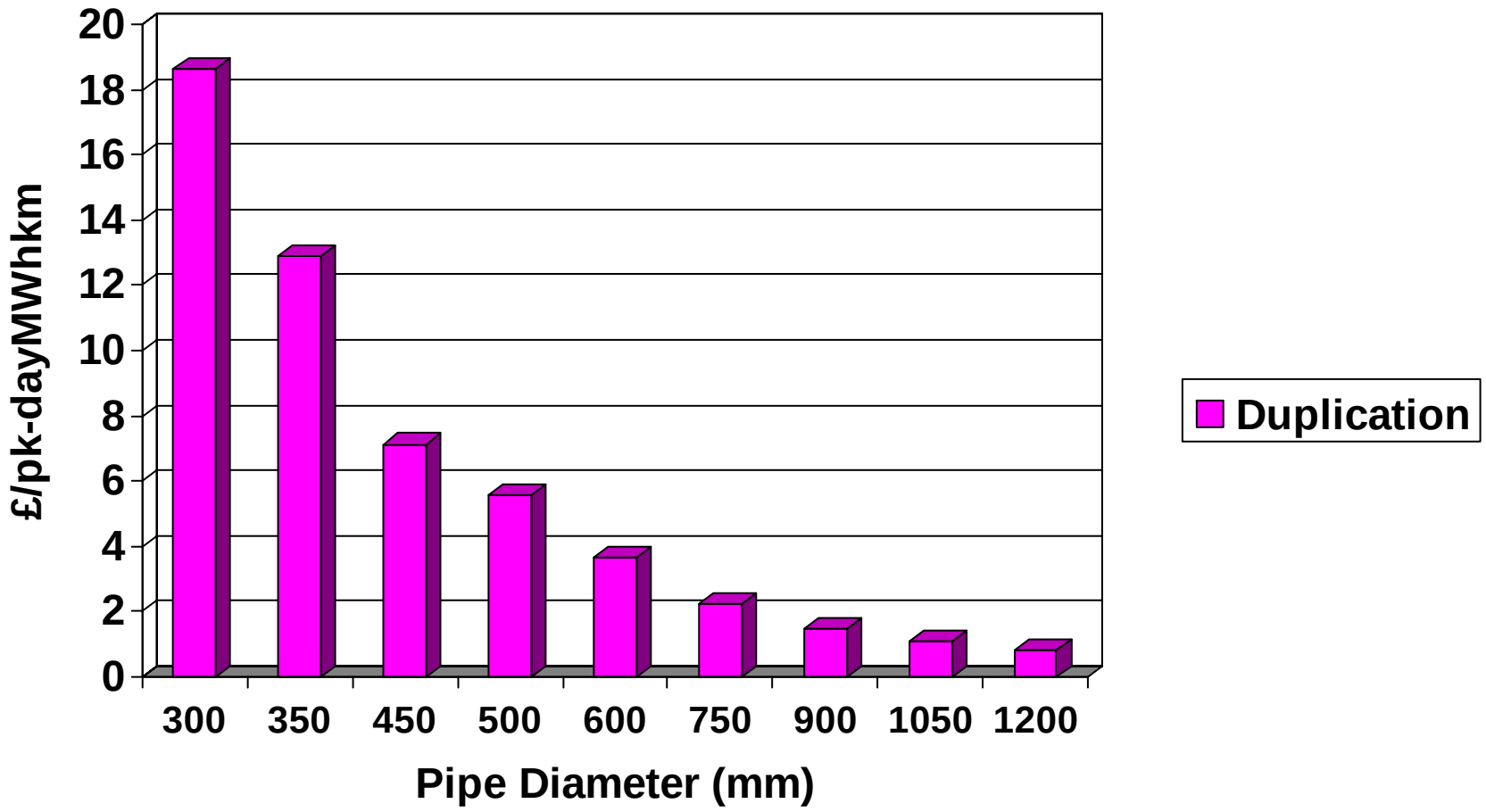
Effect of Pipe Duplication on Unit Costs

Incremental Cost per Unit of Incremental Flow (100km Feeder, 75bar max, 50 bar min)



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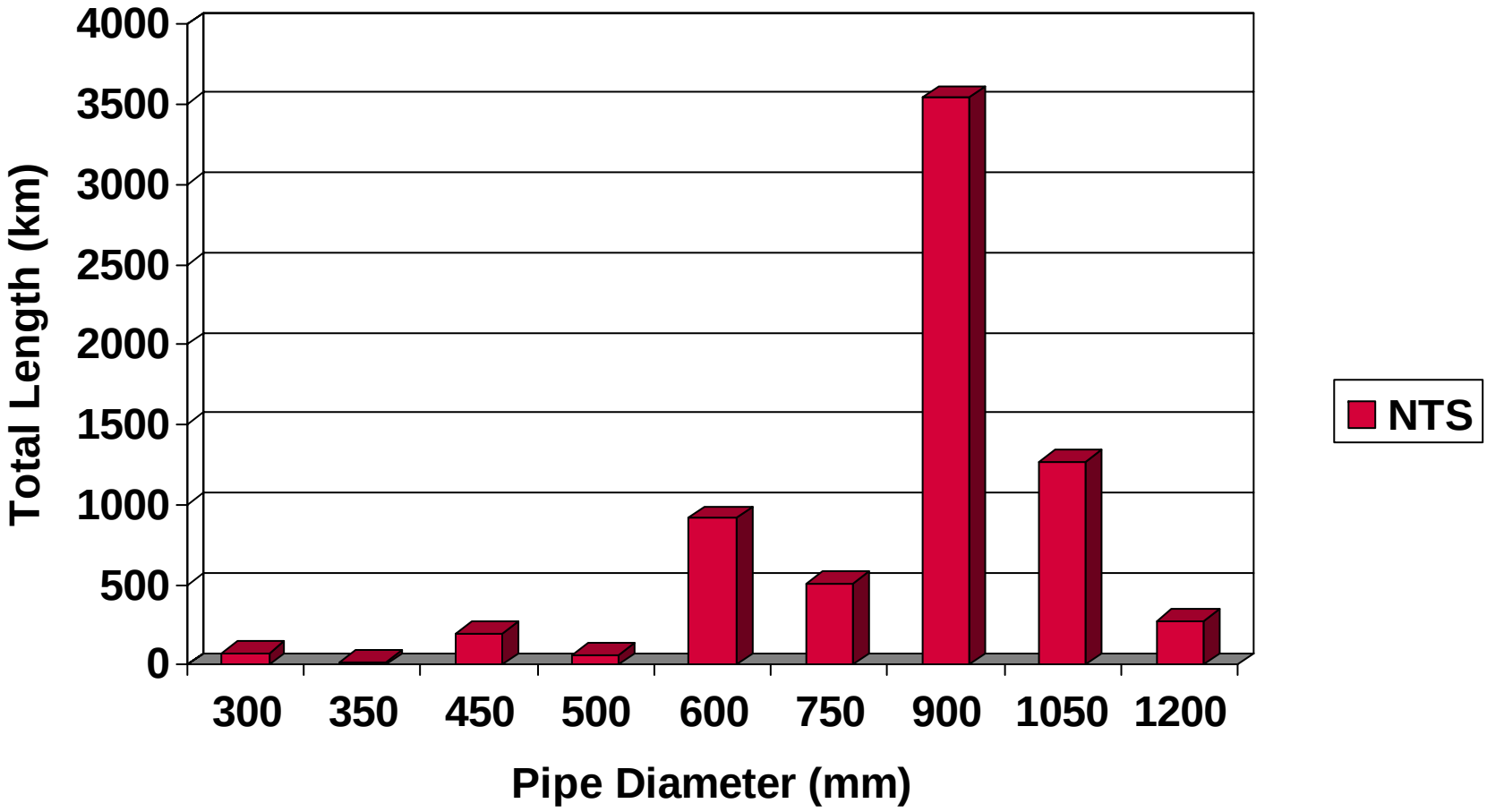
Existing NTS Pipe Diameters



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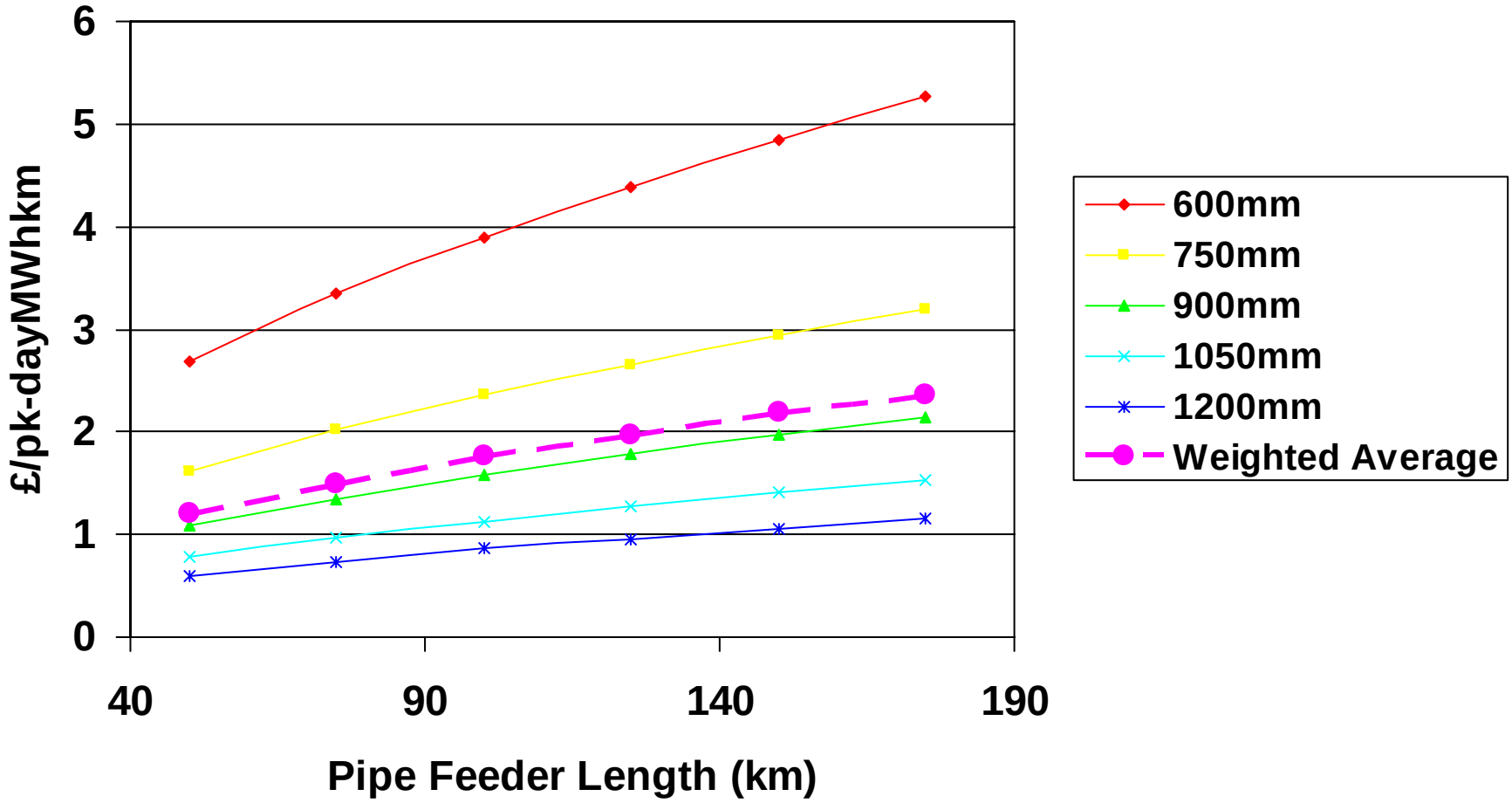
Effect of Pipe Length on Unit Costs

Incremental Unit Cost for Duplicating Pipe (varying Feeder sections, 75 bar to 50 bar)



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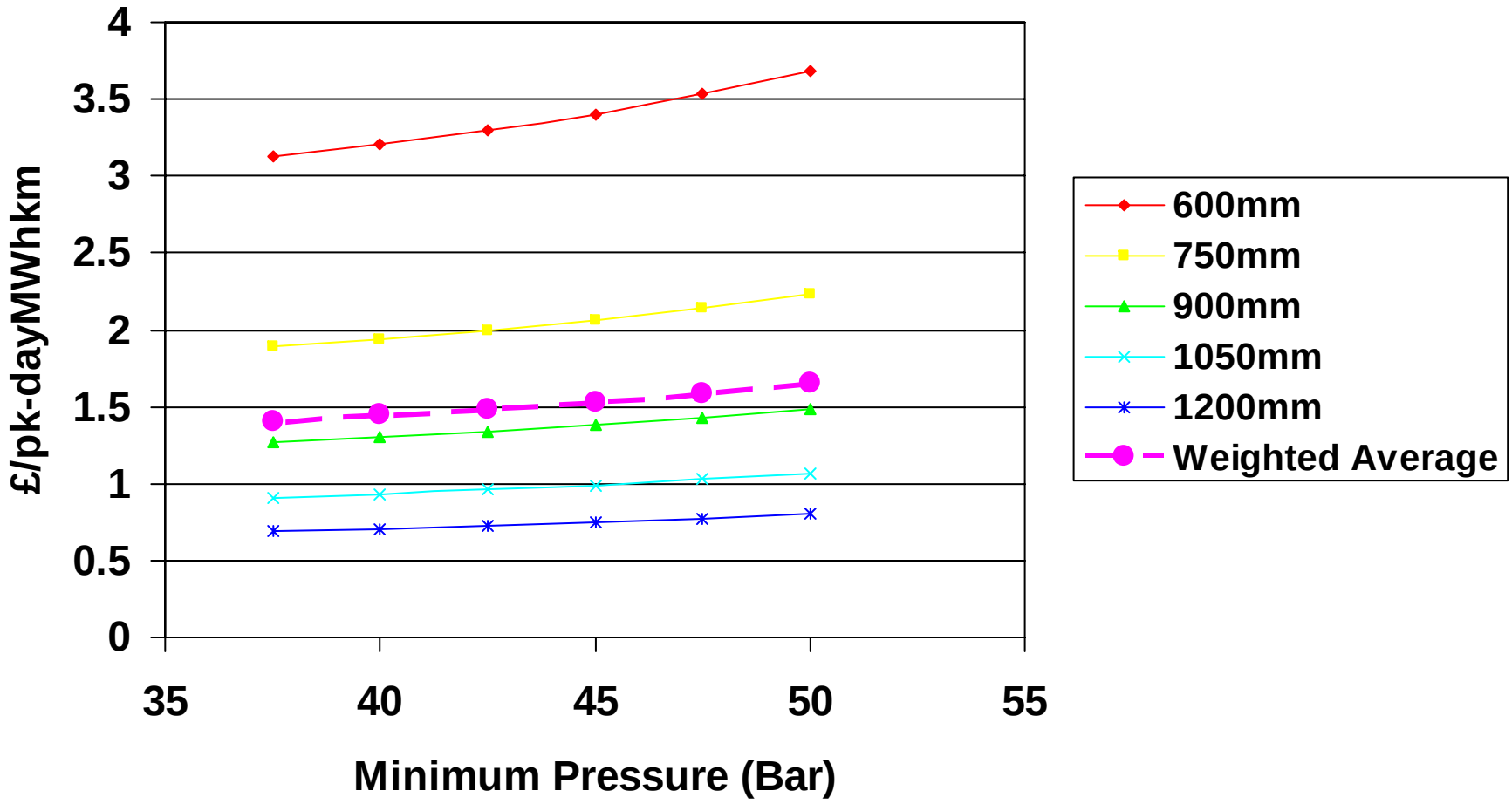
Effect of Outlet Pressure on Unit Costs

Incremental Unit Cost for Duplicating Pipe (varying Minimum Pressure, 100km, 75 bar)



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Compression Costs

- But……..
  - Additional Compressor power requirement will result from incremental flow
  - Additional Compressor power might be an alternative to pipe reinforcement/duplication if lower pressures are acceptable

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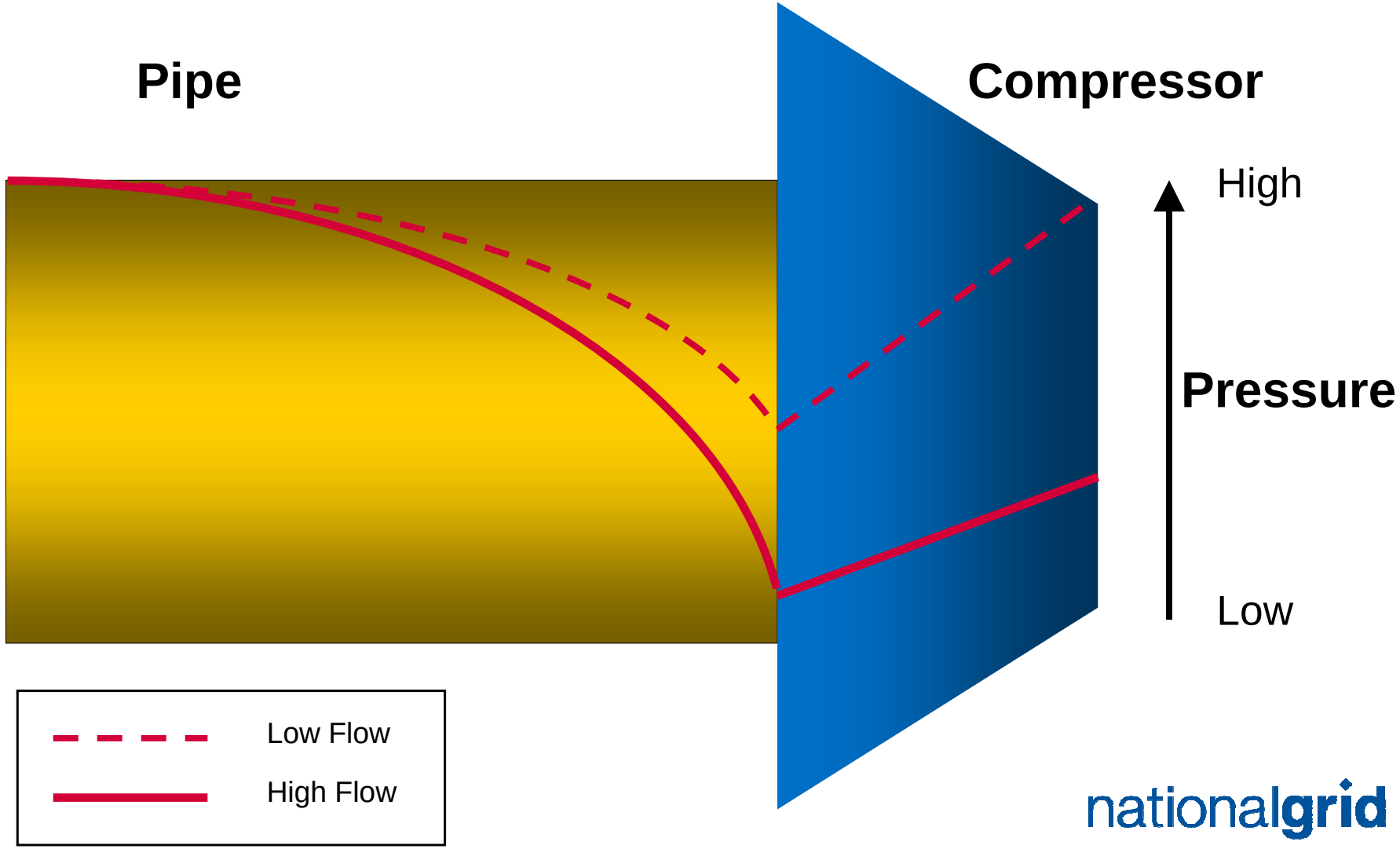
Pipe and Compressor Interaction



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Compressor spacing

- Compressor performance depends, in part, on the compressor inlet pressure
- The length of the upstream pipeline is a factor in the pressure decay along the pipeline (and therefore the compressor inlet pressure)
- The spacing of compressors along a feeder can therefore be optimised to maximise compressor performance

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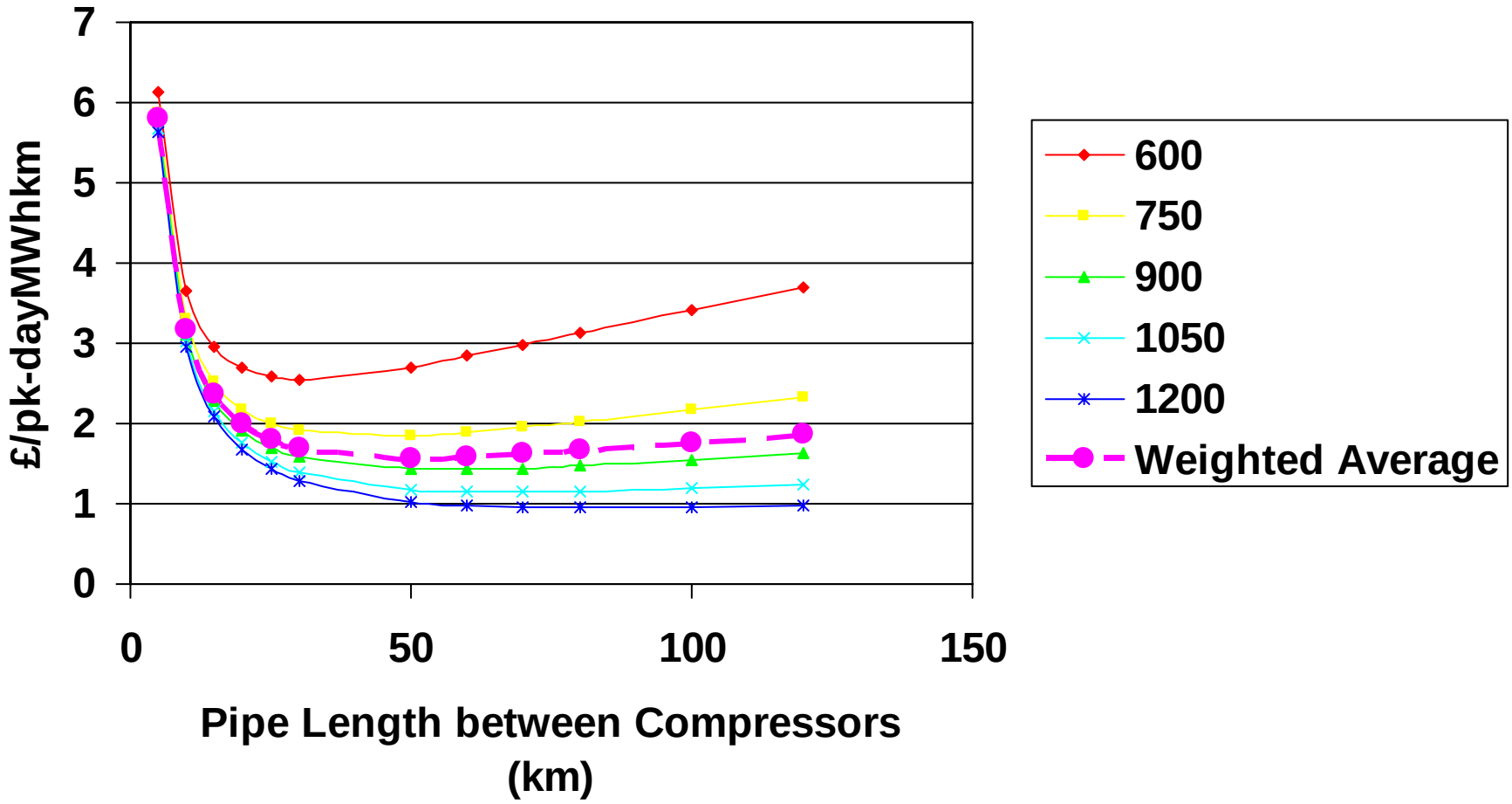
Effect of Compressor Spacing on Unit Costs

Pipe + Compressor Expansion Cost (75 to 50 bar, Full recompression back to 75 bar)



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Conclusion

- **A purely distance related Gas Expansion Factor might over simplify the costs associated with gas transmission**
  - Might not reflect economies of scale
  - Might not reflect varying pressure requirements
  - Might not reflect impact of existing assets such as compressor station/offtake spacing
- **A cost function could be generated with the following inputs**
  - Compressor/Offtake spacing
  - Pressure/Pressure Gradient
  - Diameter

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Gas Expansion Factors
Calculation Steps

- Could be……

  - Determined by National Grid each year, or

  - Calculated at the beginning of a price control period
    - This would set the expansion constant for the first year of the price control period, then increase by RPI or steel price index for each subsequent year within the price control period.

  - Include allowances for the cost of maintenance.

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Expansion Factors & Transport Models

- Transportation Model
- Flows allocated to cheapest routes
- Incremental flows allocated to cheapest routes
- Cheapest Incremental route selected

- Flow Model
- Flows allocated based on pressure loss equation
- Incremental flows allocated to minimise pressure loss

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Transport Model Selection

Model	Transcost	Flow Model	Transport Model
Flow allocation based on	Pressure loss equation	Pressure loss equation	Cheapest cost
Incremental flow path & cost	Cheapest route to reinforce	Flows allocated to minimise pressure loss then apply Expansion Factor	Cheapest incremental cost
Least Cost identified?	Yes	No	Yes

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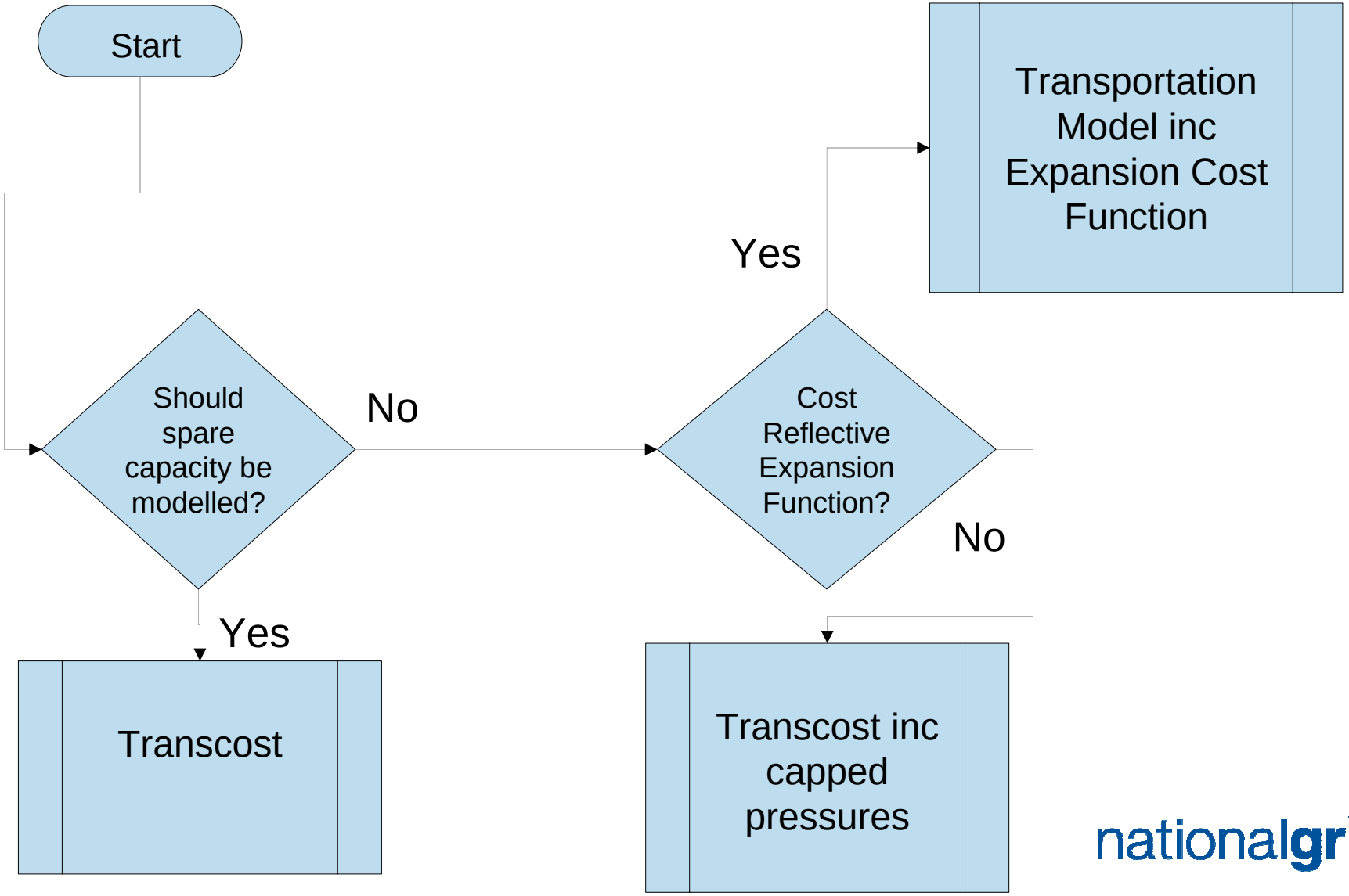
Transport Model Decision Route



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Way Forward

- 4th May 2006 gas TCMF
- Assess Options , key deciding factors:
  - Treatment of spare capacity
  - Expansion Constant Cost Reflectivity
- Undertake industry consultation (May/June 06)

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