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Gas Quality Harmonisation Cost Benefit Analysis

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Initial report to Madrid Forum

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PÖYRY MANAGEMENT CONSULTING AND GL NOBLE DENTON

Pöyry Management Consulting – energy market modelling

GL Noble Denton – gas, combustion and process engineering

- **Pöyry Management Consulting**
 - Specialists in Energy, Forestry, Process
 - Consultancy and advisory in strategies, markets and operations
 - 500 staff throughout Europe
- **Oxford office formerly ILEX**
 - Modelling Europe's energy markets since 1992 – prior to liberalisation
- **Part of Pöyry plc**
 - Global consulting and engineering
 - Energy, Paper & process, Urban & Mobility, Environment, Management Consulting
 - 7,000 staff in 50 countries
 - Listed on Helsinki stock exchange
- **GL Noble Denton**
 - Specialists in Oil & Gas
 - Assurance, consulting, marine operations and project execution services
 - 3000 staff in 80 countries
- **Loughborough formerly Advantica**
 - Formerly part of British Gas plc – providing cutting edge gas engineering technologies
- **Part of Germanisher Lloyd**
 - Global engineering, assurance, classification
 - Oil & Gas, Renewables, Maritime
 - 6,900 staff in 80 countries
 - Private Limited Company based in Hamburg

PRELIMINARY RESULTS – COSTS OUTWEIGH THE BENEFITS

The majority of gas flows are not impacted by gas quality constraints & implementation costs have massive one-off costs

BENEFITS

- Fully unconstrained flows and trading of gas throughout Europe
 - Before = quality constraints
 - After = **no** quality constraints

➤ Benefits = costs to serve I
less costs to serve II
- European gas fundamentals model
- Sophisticated iterative linear programming techniques

Economic fundamentals

< €0.2bn pa

COSTS

- 'Harmonisation' can be achieved through two primary means:
 - Replacement of appliances (to meet a harmonised specification)
 - Use of processing (to keep existing specifications and facilitate cross-border trade)

Appliance replacement

~ €178bn

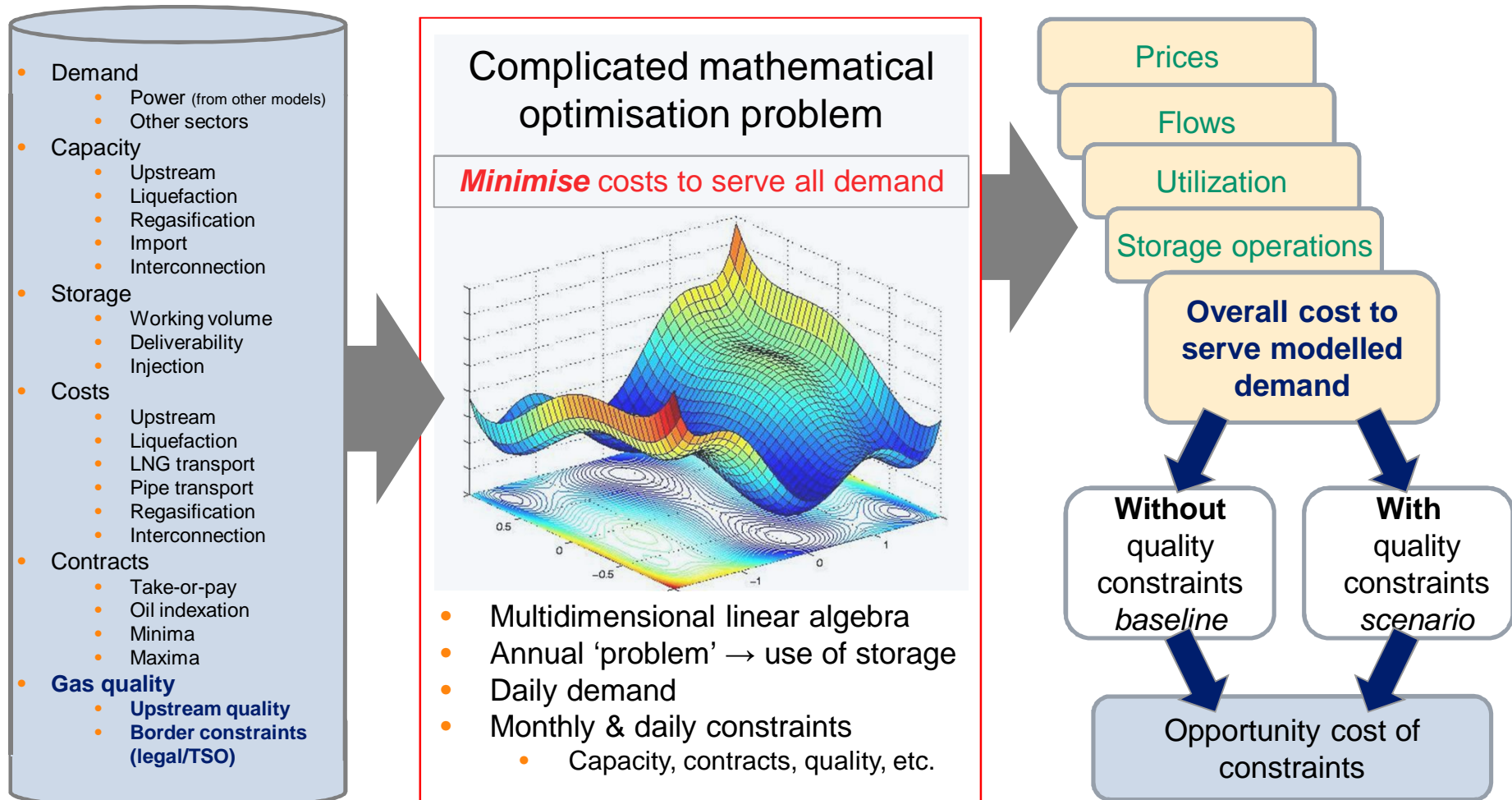
Processing

~ €6.5bn
+ ~ €0.5bn pa

* - assuming the 50% sensitivity

BENEFITS – METHODOLOGY

Benefits calculated through iterative linear programming techniques, using the sophisticated Pegasus gas market model



BENEFITS – SCENARIOS & ASSUMPTIONS

Flow/capacity assumptions are based on 2011 Q1 Pöyry Central scenario: similar patterns as other models, e.g. EU PRIMES

- Two upstream gas quality scenarios
 - ‘Narrow’ – there is a modest/realistic degree of variation of supply qualities
 - ‘Wide’ – there is a wide degree of variation of supply qualities
- Examined Wobbe, CO₂, O₂, N₂, H₂S

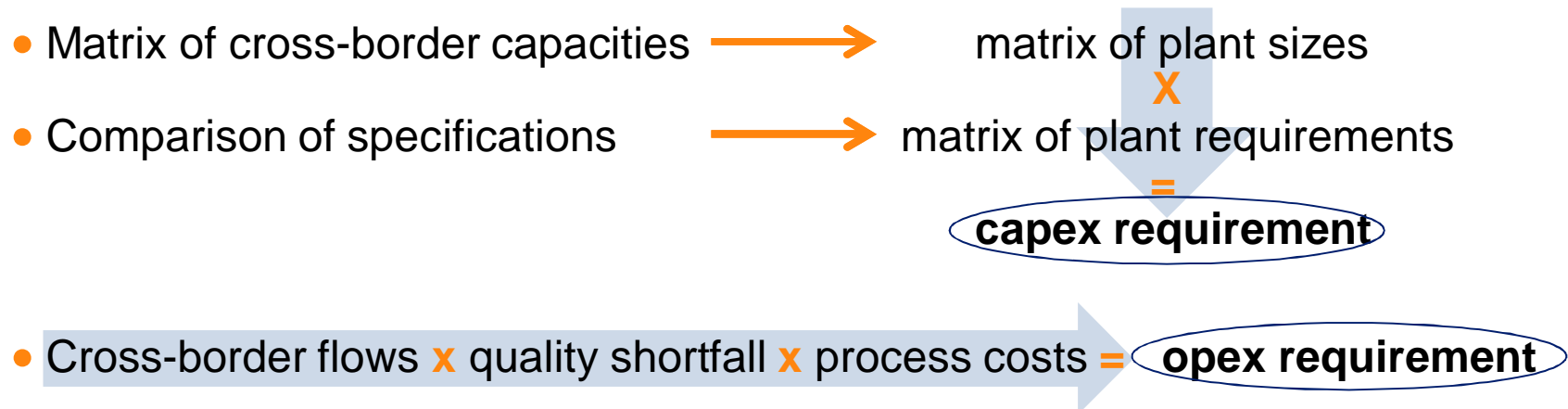
Constraint scenario examined	Upstream scenario	Opportunity cost (over baseline) €m	
		2020	2030
EASEE-gas Wobbe	Narrow	3.7	0
Existing Wobbe	Narrow	44	20
Existing Wobbe	Wide	99	62
Existing Wobbe + CO ₂ + O ₂ + N ₂ + H ₂ S	Narrow	139	20

Benefit < €0.2bn pa

PROCESSING COSTS – METHODOLOGY

Ensures that all cross-border flows are compatible with existing downstream specifications

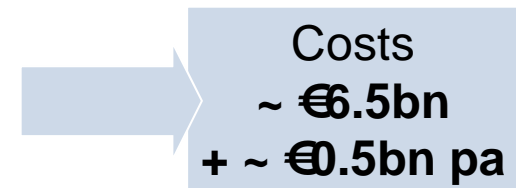
- TSOs are obliged to accept any gas that is within the upstream specification
- Free trade at each border point, no harmonised specification
- Each TSO invests in various processing equipment
 - Derichment (N_2 /Air) and enrichment (C_2 , C_3) – overcoming Wobbe constraints
 - S, H_2S , CO_x removal (liquid adsorption) + O_2 removal (solid bed)
 - Cross-border transportation capacities, assuming maximum processing requirement
 - Annual costs use results from the benefits modelling



PROCESSING COSTS – SENSITIVITY

Enabling free trade assumes TSOs burden all the gas quality risk: shippers are not exposed to gas quality concerns

- *TSOs are obliged to accept any gas that is within the upstream specification*
- Very low load factors – does this indicate overinvestment?
 - Lower levels of investment introduces risk
 - TSO risk => higher cost of capital?
 - Shippers' risk => lower benefits realised?
 - **Where should the risks lie?**
- Sensitivity: assumed investments for 50% of capacity
 - Unlikely reverse flow situations, efficiency/innovation, etc.
- Magnitude of processing requirements possibly needs new engineering



Costs
~ €6.5bn
+ ~ €0.5bn pa



REPLACEMENT COSTS – DATA SOURCES & ASSUMPTIONS

The study has used a wide variety of data sources

- Source of Data for Domestic and Commercial Appliances
 - GASQUAL study, Work Packages 1 to 4
 - Period 1993 to 2007 and covers sixteen of the EU countries. Represented 91% of the European Union's gas users
- Domestic Appliances
 - Option 1: - replace all units (€132b)
 - Option 2 – replace top 13 at risk appliance types (€117b)
- Commercial
 - Assume complete replacement
- Industrial
 - Number of appliances based on meter points – this is minimum number as sites will have multiple burners
- Gas Engines
 - Numbers based on figures supplied by EUROMOT (11,000 units) and detailed information from The Netherlands assumes 40% replacement
- Gas Turbines
 - 2500 units based figures from GE and Siemens. Control system at €300k per unit
- Study assumes one-off replacement, does not examine 'natural replacement'

REPLACEMENT COSTS – RESULTS

Costs estimated taking into account the difficulty in obtaining appliance population numbers and identifying those at risk

Domestic	165m appliances	€132bn		
Commercial	15m appliances	€32bn		
Industrial		€11bn		
Engines		€3bn		
Turbines		€0.75bn		

- Significant risk that units might be missed during checking, upgrade or replacement
 - 165m domestic appliances
 - > 15m commercial / industrial units
- Assumes technology is available or can be developed for appliances to operate over wider range

DATA QUALITY

Because of a lack of robust data, it has been necessary to make a large number of assumptions

- L-gas, biogas, dewpoints, impact on billing and odourisation out of scope
- Data quality issues:

Benefits modelling	Cost modelling	
	Appliances	Processing
Unknowns: upstream gas qualities (Russia, Africa, Mid. East, LNG, etc.)	GASQUAL project results not published I&C, gas engine and gas turbine populations unknown	Liquid absorption (acid gas removal) for removal of H ₂ S / COS, S, CO ₂ , Mercaptans Solid bed technology for removal of O ₂
Blending capabilities: granularity of upstream data	Historical appliance population performance unknown	Assume multiple gas treatment trains required depending on the flow, defined as high, medium or low

- Flame workshop attendance good, but...
- ...very poor questionnaire response
 - E.g. nine NRAs failed to respond!

CONSULTATION RESPONSES & NEXT STEPS

We will need to analyse the wide variety of consultation responses in detail, and issue a final report in December

- 38 responses: 16 agree with conclusions, 15 disagree, 7 neutral
 - Appliance manufacturers generally agree, **no consensus from other players**
 - Report does not consider regional harmonisation which may offer benefits
 - Individual situations might justify harmonisation/investment
 - Report does not consider particular parameters
 - Odour, bio-methane, rates of change
 - Misunderstandings and/or lack of clarity on methodologies
 - Offers to provide some data and/or bilateral meetings; some (minor) errors highlighted
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- | | |
|---|--|
| <ul style="list-style-type: none">• Correct errors• Conceptualise regional harmonisation• Receive/analyse new data• If useful forward looking data provided, reanalyse costs/benefits regionally | <ul style="list-style-type: none">• Reissue the report<ul style="list-style-type: none">• Include any refined results• Clarify methodologies• Address consultation responses |
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http://ec.europa.eu/energy/gas_electricity/consultations/20110916_gas_quality_en.htm

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