European gas market: according to Anglo-Saxon pattern or based on Groningen formula

Dr. Andrey A.Konoplyanik,
Consultant to the Board, Gazprombank, and
Professor, Russian State Oil & Gas University

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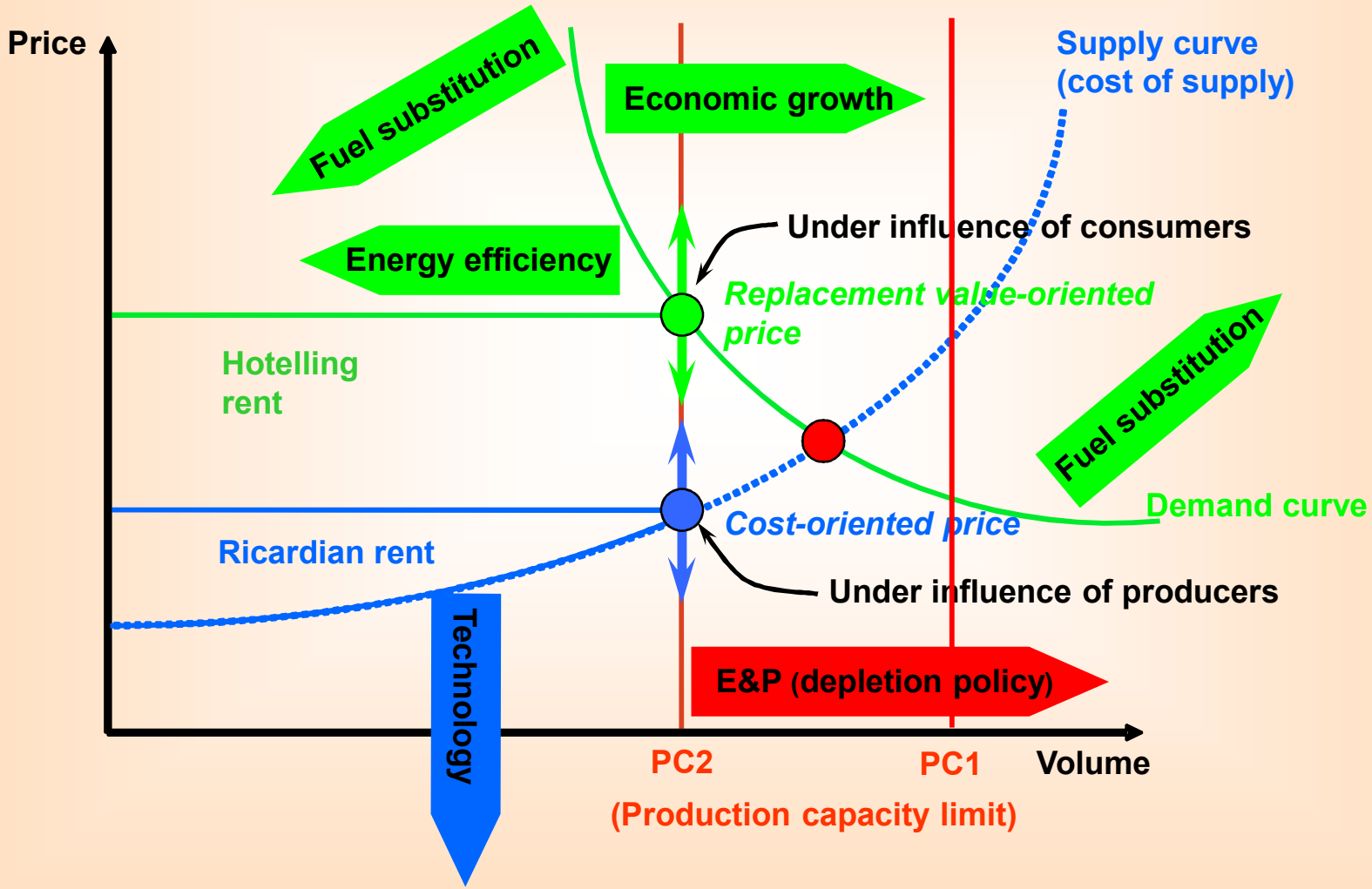
Pricing of Non-Renewable Energy Resources: Ricardian vs. Hotelling rent

Ricardian rent + Hotelling rent = Resource rent



Three key gas pricing mechanisms

- **Cost-plus (net-forward) pricing:**
  - Ricardian rent (long-term difference between costs & marginal costs => utilized at physical market)
- **(Net-back) replacement-value-based pricing:**
  - Ricardian rent *plus*
  - Hotelling rent (long-term difference between marginal cost & replacement value of competing fuel(s) => utilized at physical market)
- **Exchange (commodities) pricing (futures / options):**
  - Ricardian rent *plus*
  - Hotelling rent *plus/minus*
  - Windfall profits/losses (to cover short-term supply/demand imbalances; difference between supply/demand "equilibrium" price & replacement value => utilized at paper market)
    - UK 2007: while contractual price at physical gas market in Cont.Europe 350 USD/mcm, UK spot price fluctuate in between 1000+USD/mcm & negative prices (less 0 USD/mcm)

Non-renewable energy pricing: economic & legal background

- Resource owning state: to maximize long-term resource rent => Sovereign right of exporter/resource-owning state to sell gas to export market with highest replacement value (USSR/Russia => EU)
  - Economic basis: Groningen concept of LTGEC (1962) = long-term contract + pricing formula linked to gas replacement values (prices of replacing fuels within competitive energy market) + price review (+ net-back to delivery point) => to market gas within evolving market structure & competitive pricing environment to the mutual benefit of both producer & consumer
  - Legal basis: UNGA Res.1803 (1962) + ECT Art.18 (1994/98) = (permanent) state sovereignty on natural/energy resources

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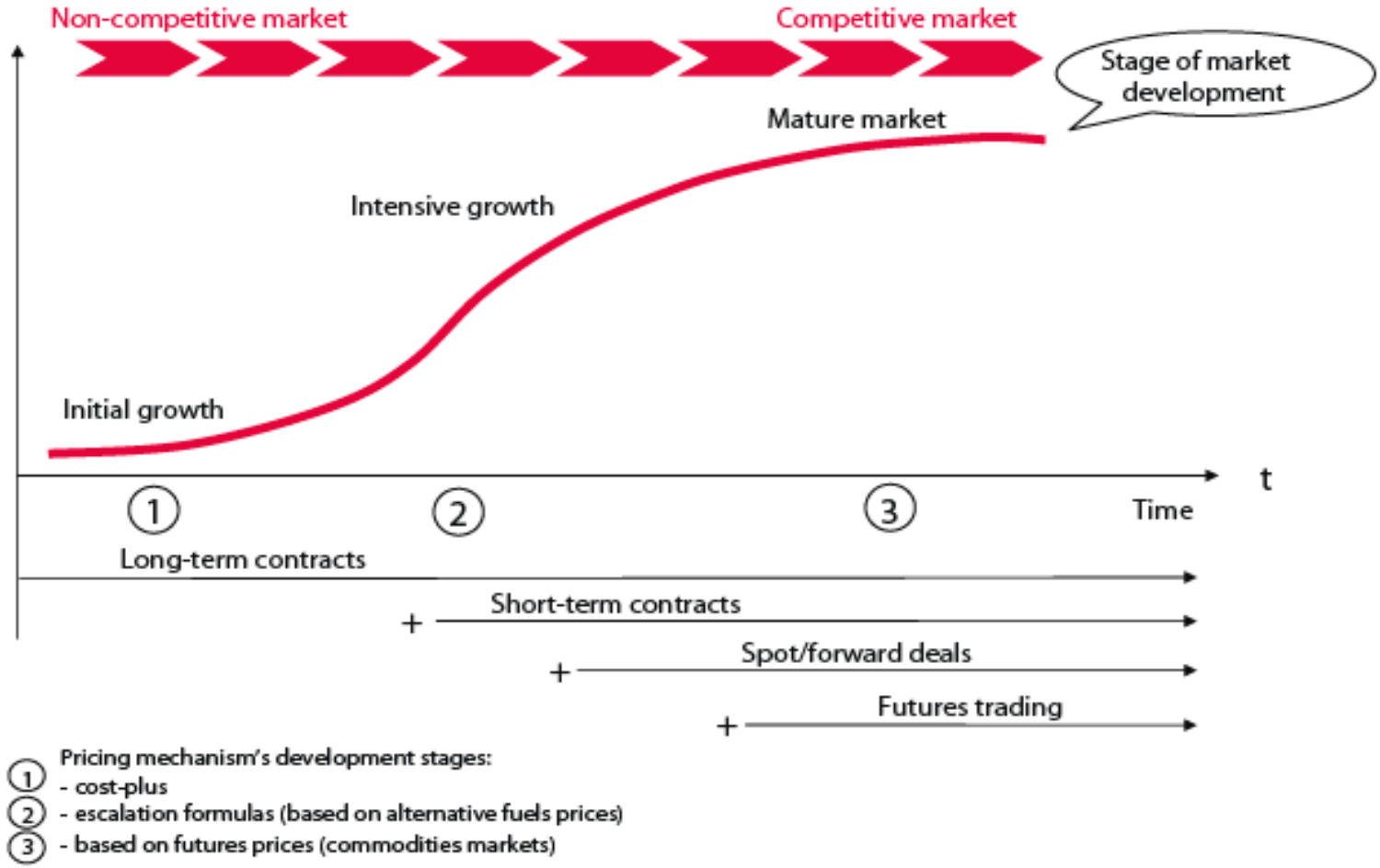
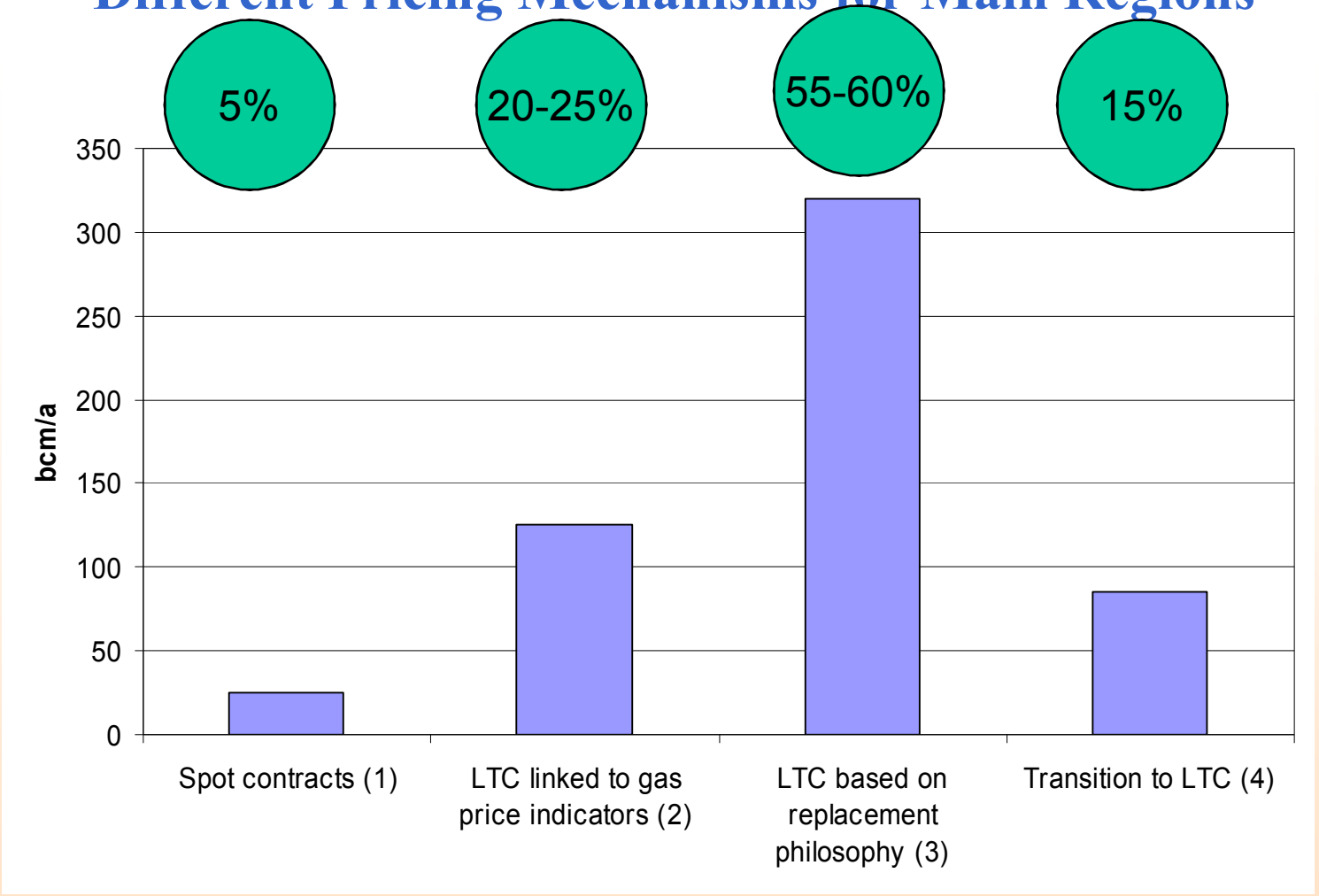
Evolution of Gas Markets: Correlation of Development Stages, Contractual Structures and Pricing Mechanisms



Source: "Putting a Price on Energy: International Pricing Mechanisms for Oil & Gas", Energy Charter Secretariat, 2007

Estimated International Gas Trade (2005): Different Pricing Mechanisms for Main Regions

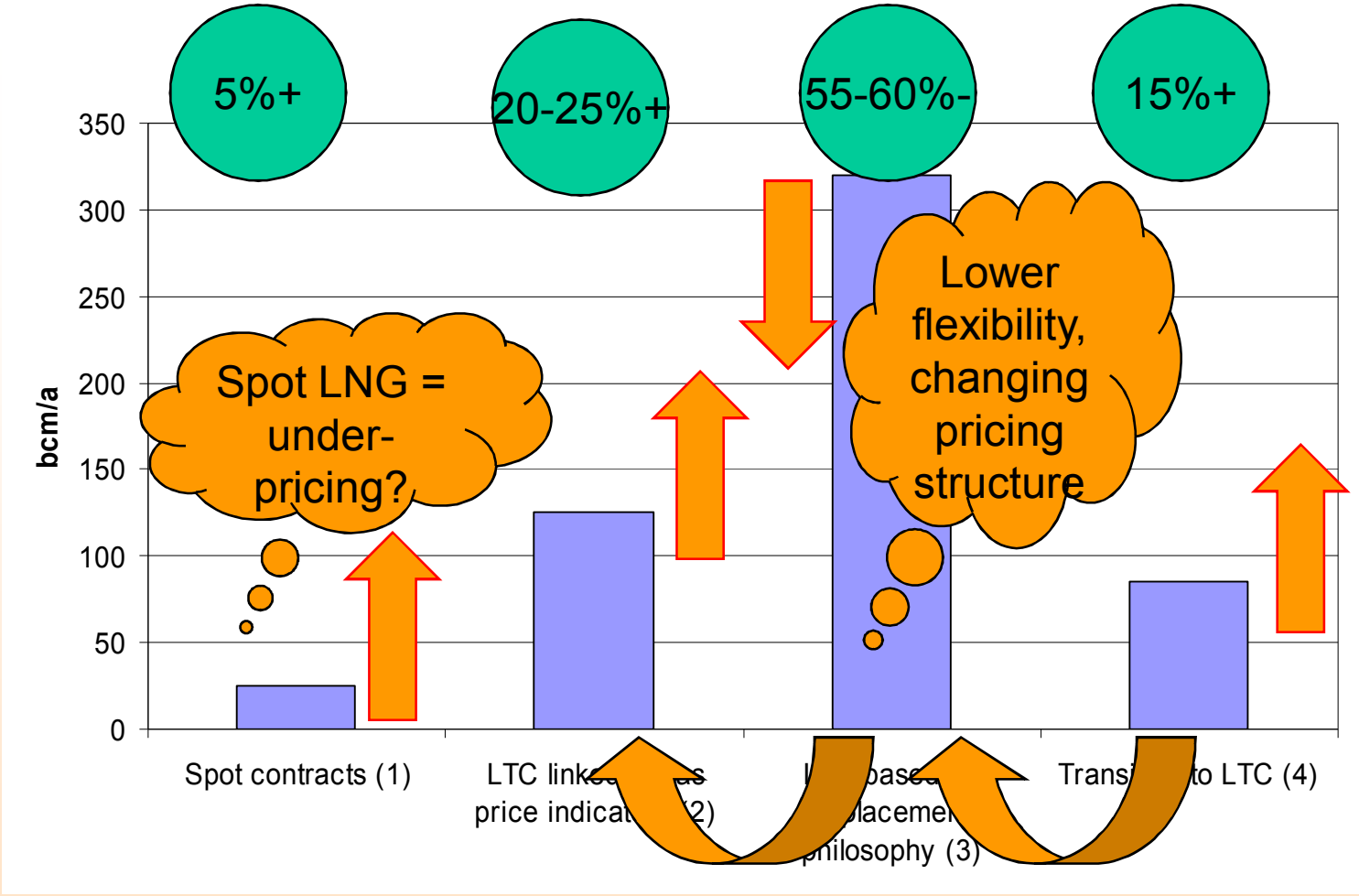


Source: BP (2006)

(1) LNG to USA, UK and other spot LNG; arbitrage on the UK-Belgium Interconnector
(2) Pipeline Canada-USA, pipelines to UK (BBL, Langeled) and new Dutch exports
(3) All imports by Continental Europe (incl. accession countries) less spot LNG under (1
(4) Trade with FSU now in transition from quasi-barter deals to LTCs, 2004 figures

Source: Energy Charter Secretariat calculations

Estimated International Gas Trade: Different Pricing Mechanisms for Main Regions & most recent trends



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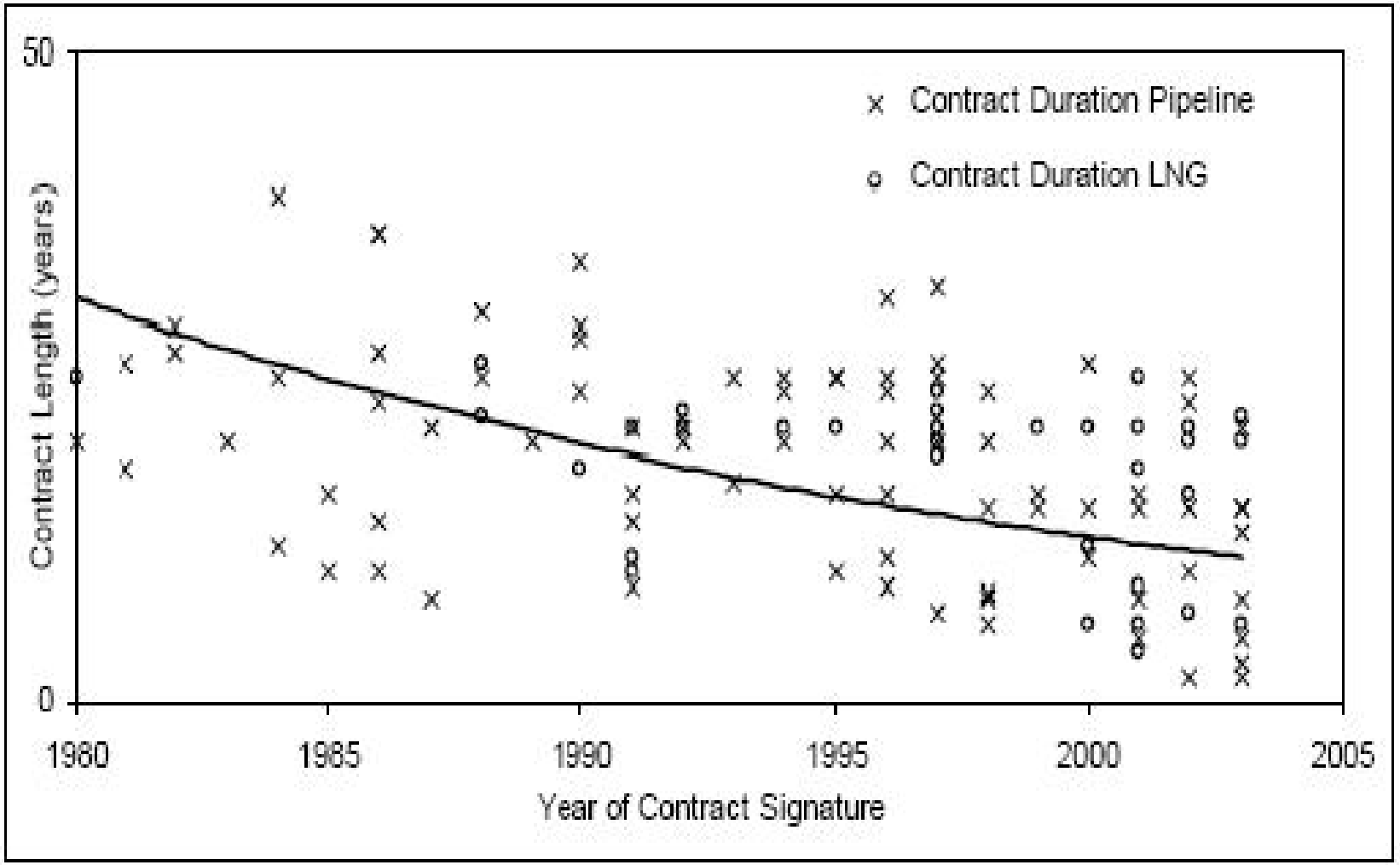
- Gas pricing: economic theory (Ricardian & Hotelling rent)
- Historical evolution of gas markets
- Contractual practice & pricing mechanisms in the EU: Groningen model of long-term gas export contract
- Contractual practice & pricing mechanisms in COMECON/CIS: from political pricing to Groningen model
- Formation of liquid gas marketplaces in Europe: current situation and future prospects
- Conclusions

Groningen (Dutch) & Russian/Soviet LTGEC Models: Differences & Similarities

	Groningen LTGEC model (since 1962)	Russian / Soviet LTGEC model (since 1968)	Russian / Soviet specifics (why Russian /Soviet LTGEC model differs from Groningen LTGEC model)
Contract duration	Long-term	Longer-term	Larger West Siberian fields & unit CAPEX, longer transportation distances & pay-back periods
Delivery point	Upstream to end-user	Upstream to end-user - on EU-15 border; one delivery point served for few final consumers	Historically: on political border between East & West
Pricing	Replacement value (RFO + LFO) + net-back to delivery point + regular price review + minimum pay obligation (take-and/or-pay)		West: both for export & domestic sales; East: only for export sales
Protection from price arbitrage	Destination clauses		More important since in one delivery point - few contracts with much more differing export prices destined for different markets
Role of transit	None (minimal)	Significant – especially after dissolution of COMECON & USSR & after EU expansion	New sovereign states appeared upstream to historical delivery points + new rules discriminating transit

Distribution of Contracts struck in OECD Europe since 1980



Source: C.Hirschhausen & A.Newmann. Less Long-Term Gas to Europe? A Quantitative Analysis of European Long-Term Gas Supply Contracts. – "ZfE – Zeitschrift fur Energiewirtschaft" 28 (2004) 3, p.181 (reproduced in: OGEL, March 2005, vol.3, issue 1).

A Typical Net Back Replacement Value Based Gas Price Formula & its Review

Pm = [Po]

+ [0.60] x [0.80] x 0.0078 x (LFOm - LFOo) *{**up**/down}*

+ [0.40] x [0.90] x 0.0076 x (HFOm -HFOo) *{up/**down**}*

+ [… (coal)] *{**up**/down}*

+ [… (electricity)] *{**up**/down}*

+ [… (gas-to-gas competition] *{**up**/down}*

NB: […] – parameters in brackets usually subject of renegotiation; elements in bold reflect historically original Groningen (Dutch) pricing formula

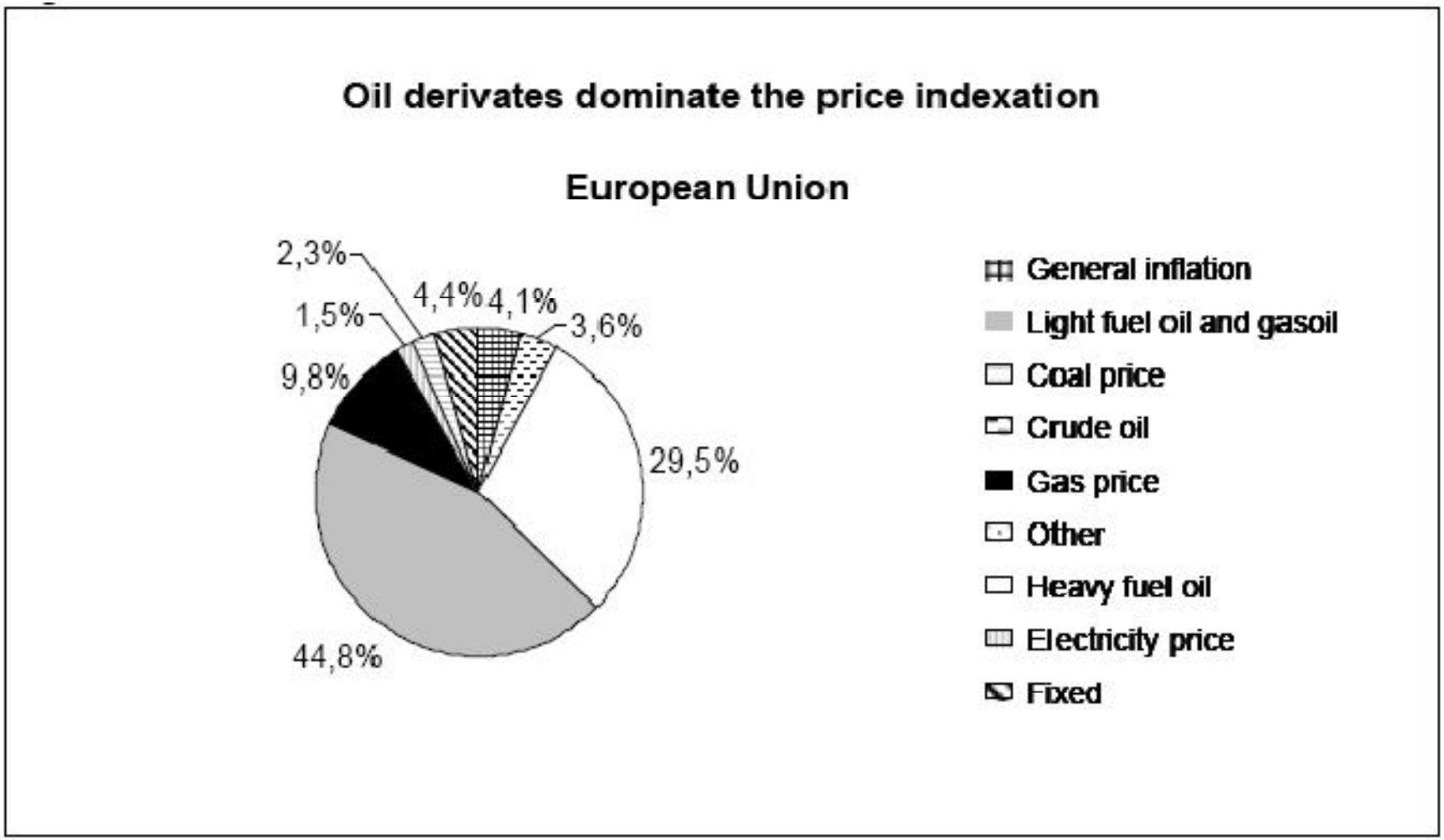
Long-term evolution of price review mechanism:

- reflect its adaptation to the new state of development of energy markets,
- changing shares of existing competing fuels (LFO/HFO ratio in favour of LFO) *and* incorporation of new competing fuels *and* gas to gas competition,

but

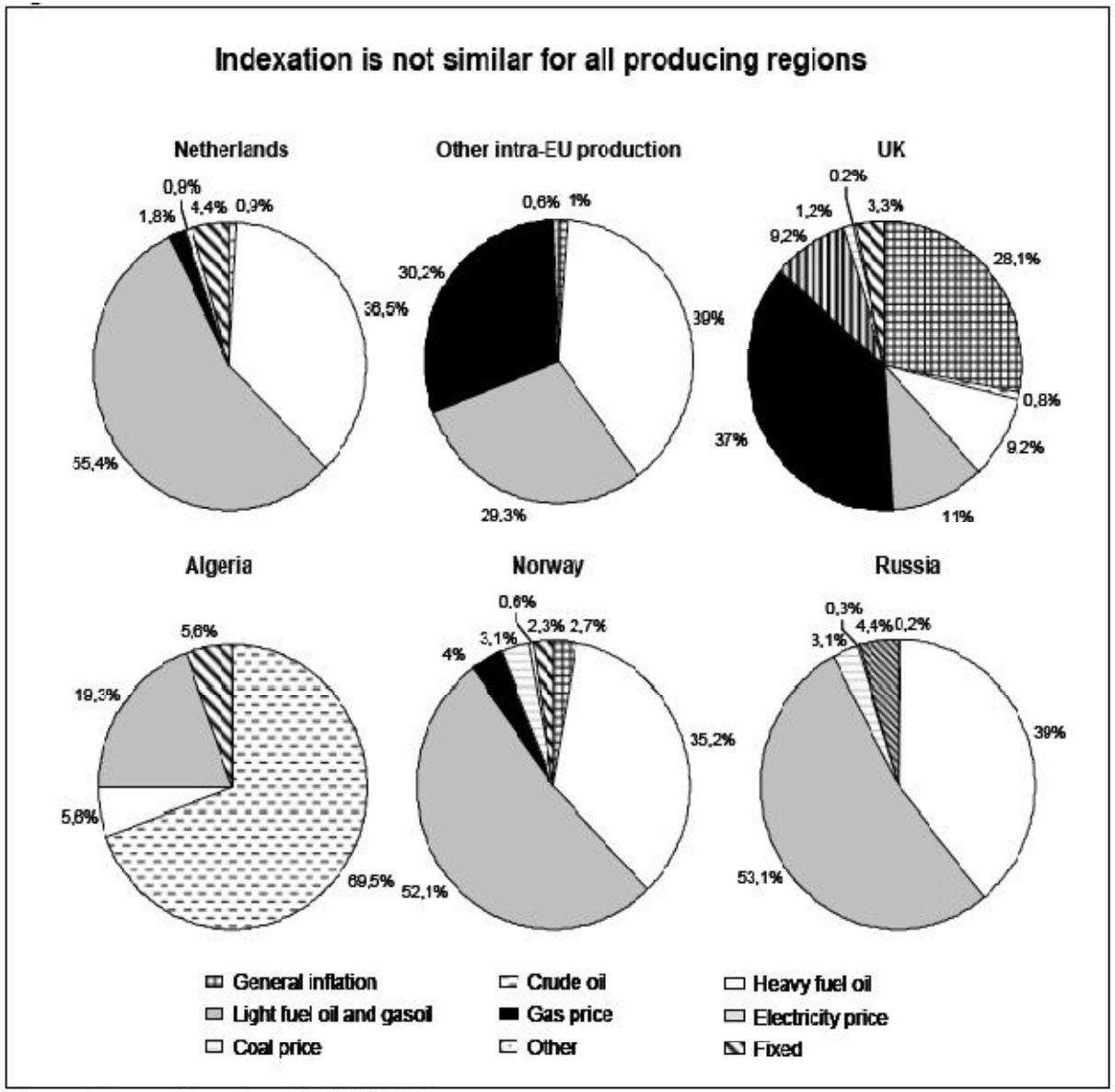
LFO & HFO are still dominant replacement fuels in gas pricing within long-term gas export contracts

Price indexation structure in the EU



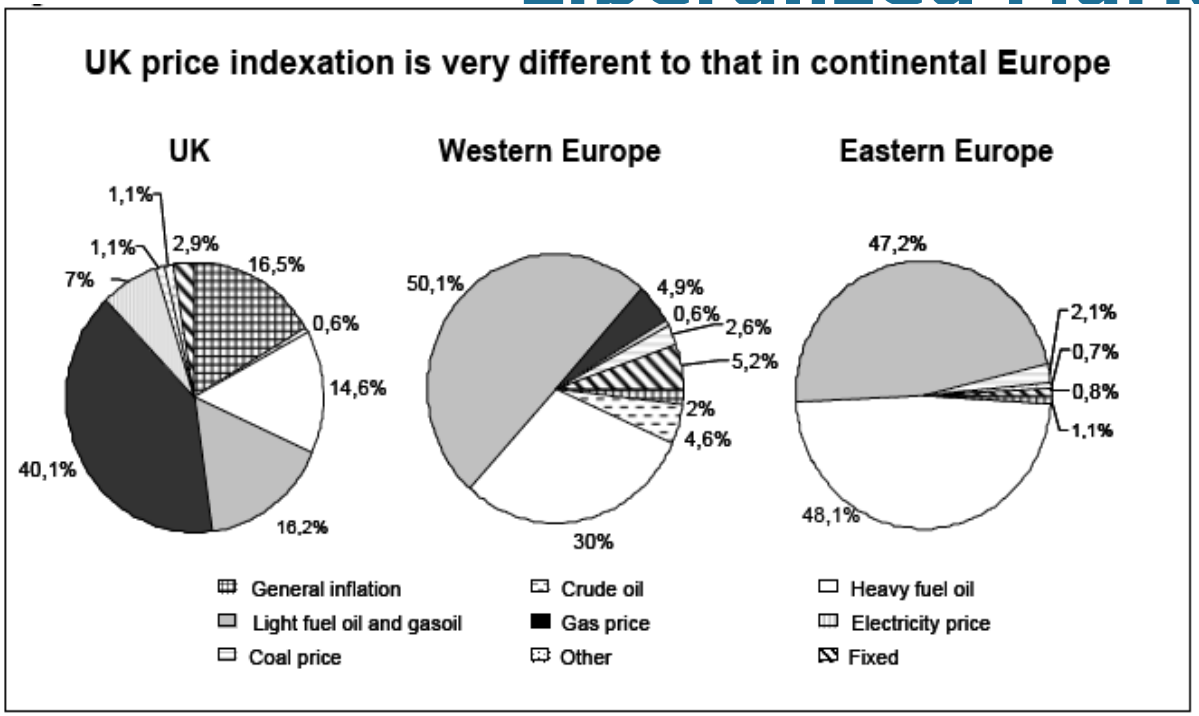
Source: Energy Sector Inquiry 2005/2006

LTGEC in the EU: Indexation by Producer



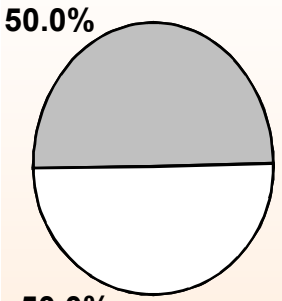
Source: Energy Sector Inquiry 2005/2006

LTGEC in Europe: Indexation by Region - Historical Evolution from Less to More Liberalized Markets

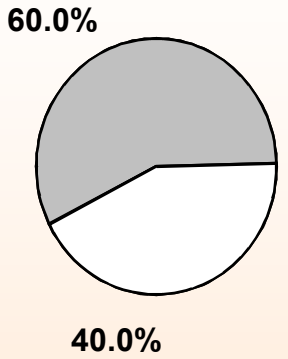


Source: Energy Sector Inquiry 2005/2006

Russia-Ukraine LTGEC (2009-2019)



Basic Groningen LTGEC model (since 1962)



Evolution of LTGEC pricing formula structure: from more simple to more complicated

Russia-Ukraine 2009 LTGEC structure rationale: more practical (understandable & sustainable) to start with less sophisticated pricing formula => similar to basic Groningen formula

Further development (most likely): towards EE-type => WE-type => UK-type price indexation

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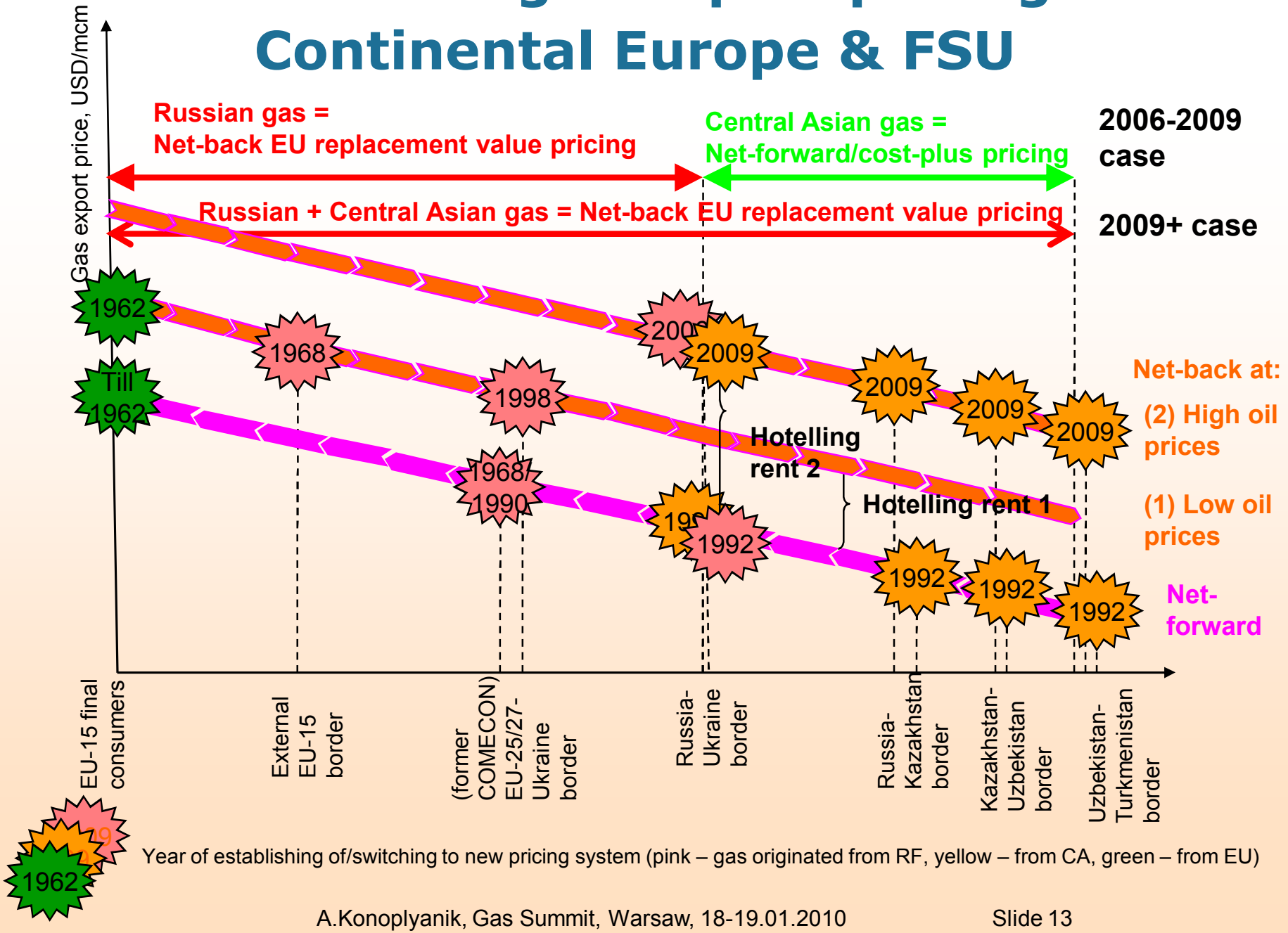
Evolution of gas export pricing in Continental Europe & FSU



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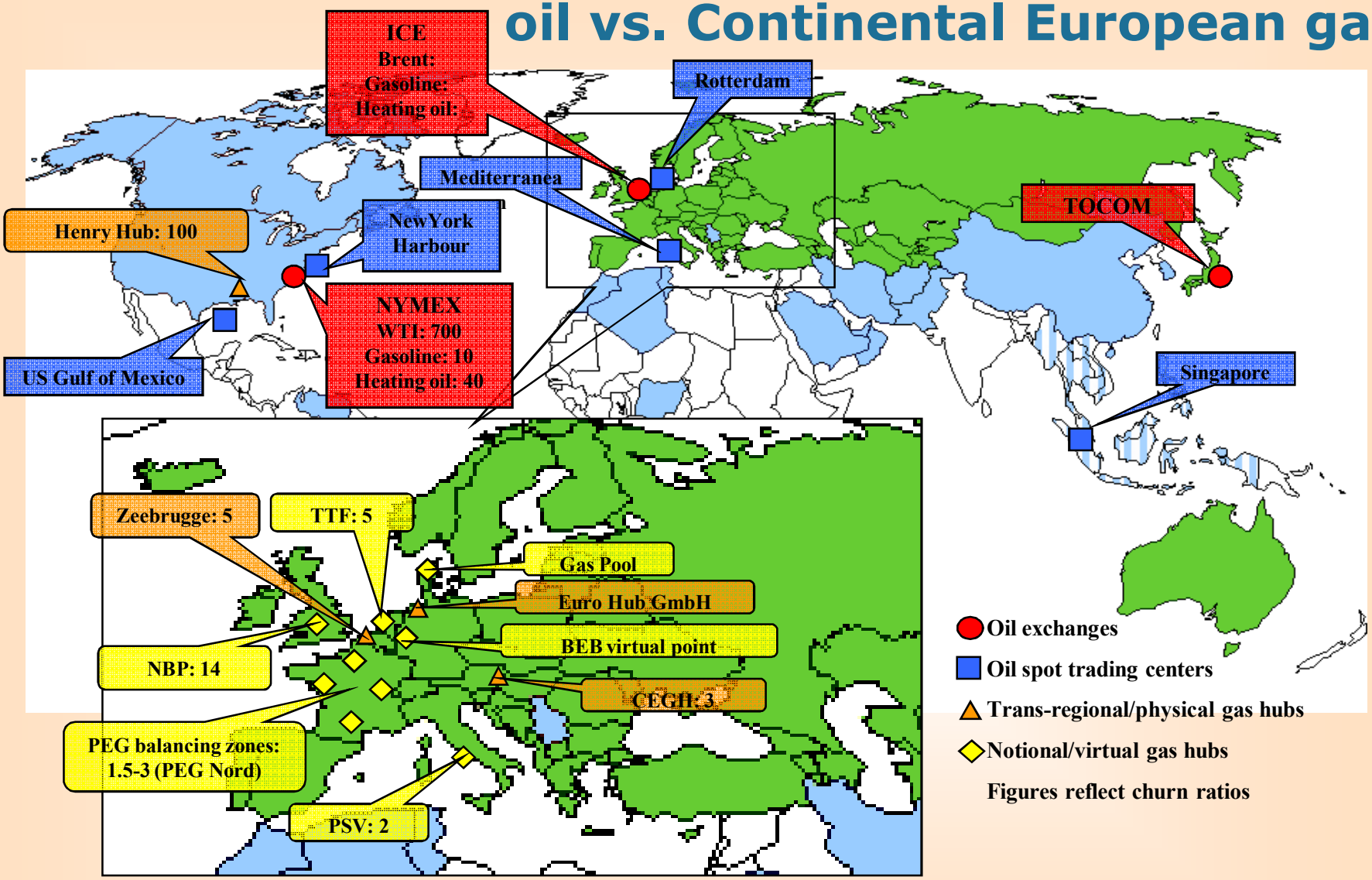
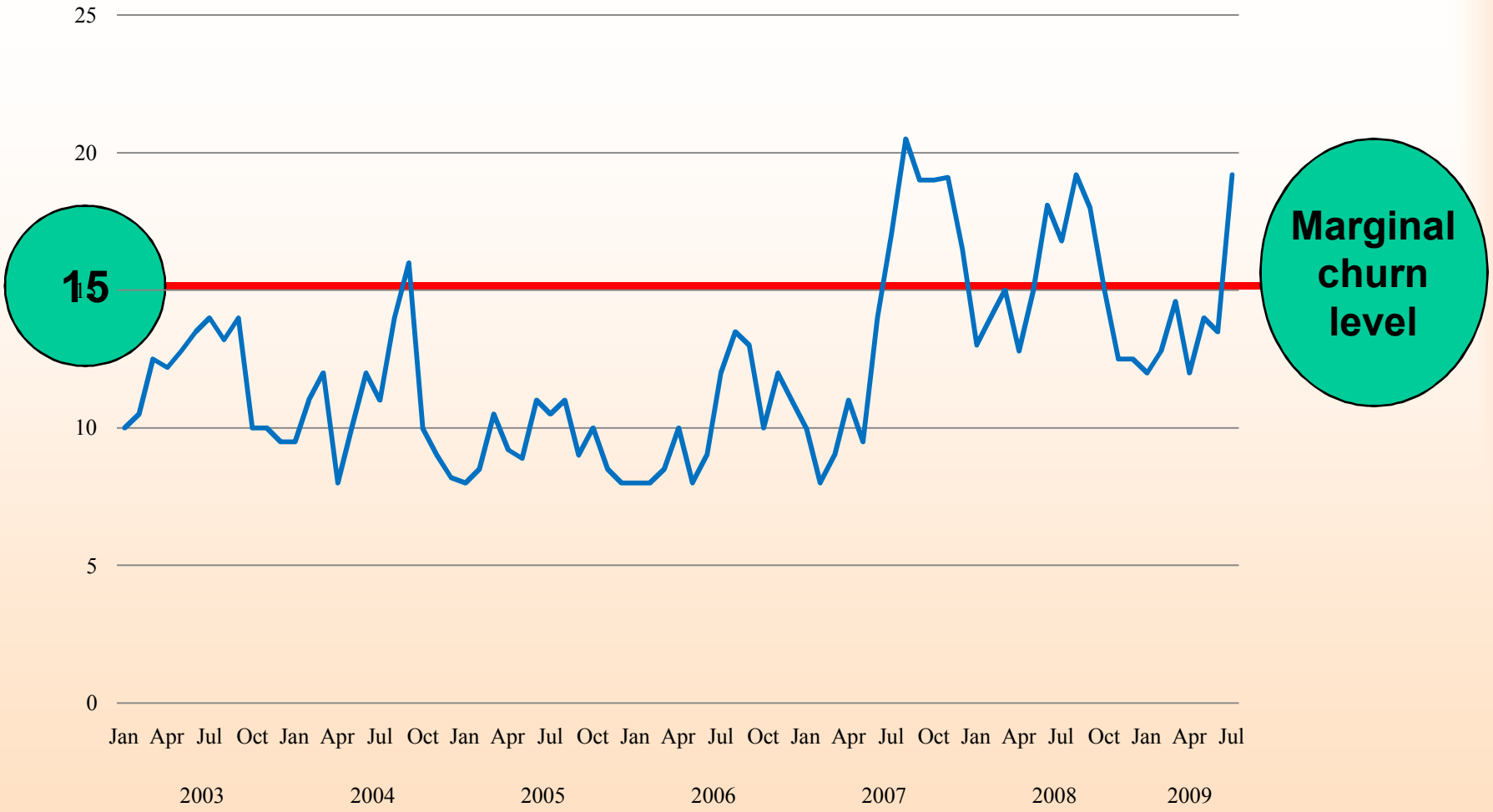
Comparative liquidity of marketplaces: worldwide oil vs. Continental European gas



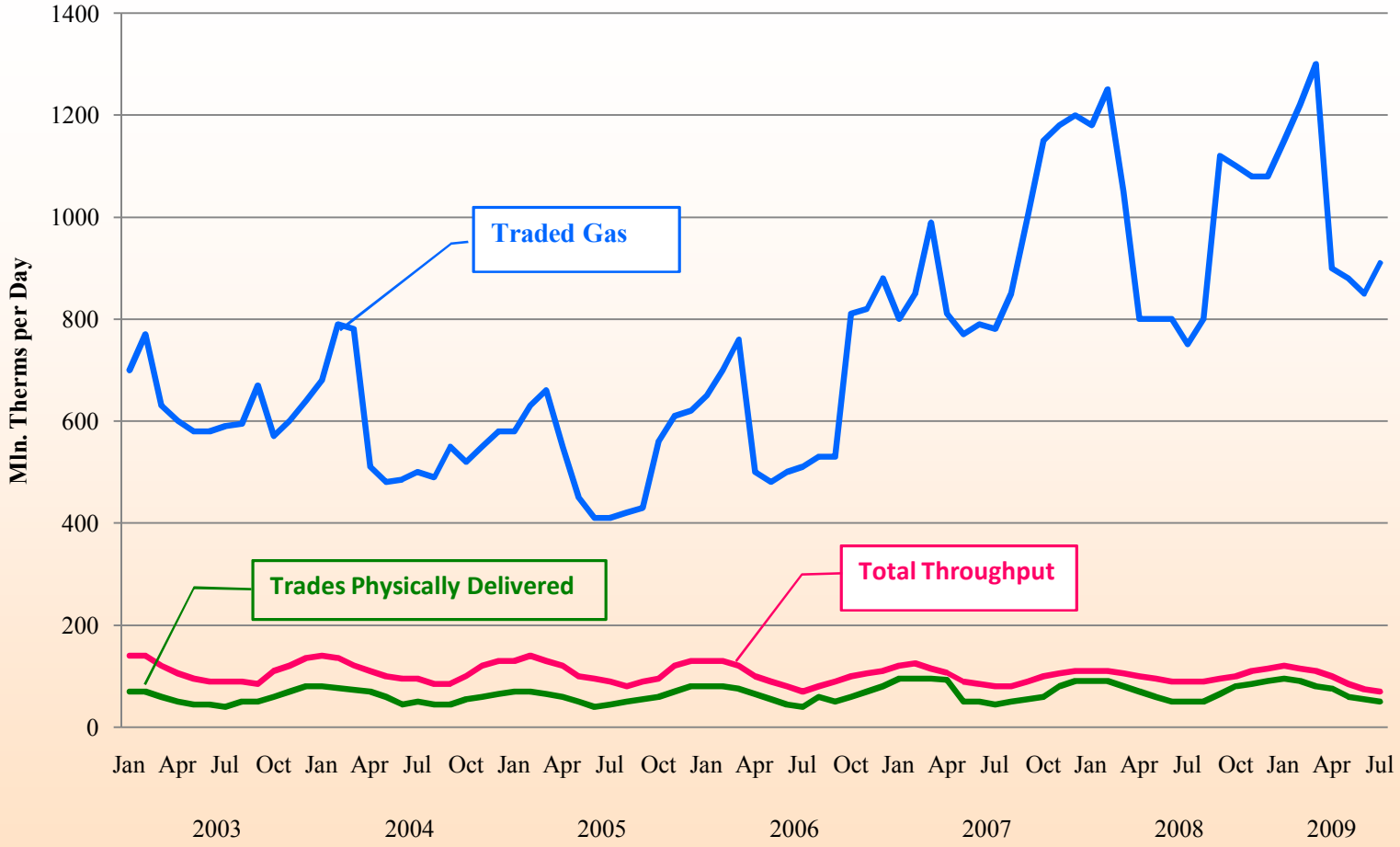
(*) BEB hub = Bunde (Germany) at German/Dutch border, CEGH = Central European gas hub (Baumgarten, Austria), NBP = Notional Balancing Point (UK hub), PEGs = French hubs (GdF), PSV = Punto di Scambio Virtuale (Italian hub), TTF = Title Transfer Facility (Dutch hub); (**) churn figures for European hubs - 2008 average (J.Stern, September 2009, NG 34, p.7)

NBP churning factor, 2003-2009



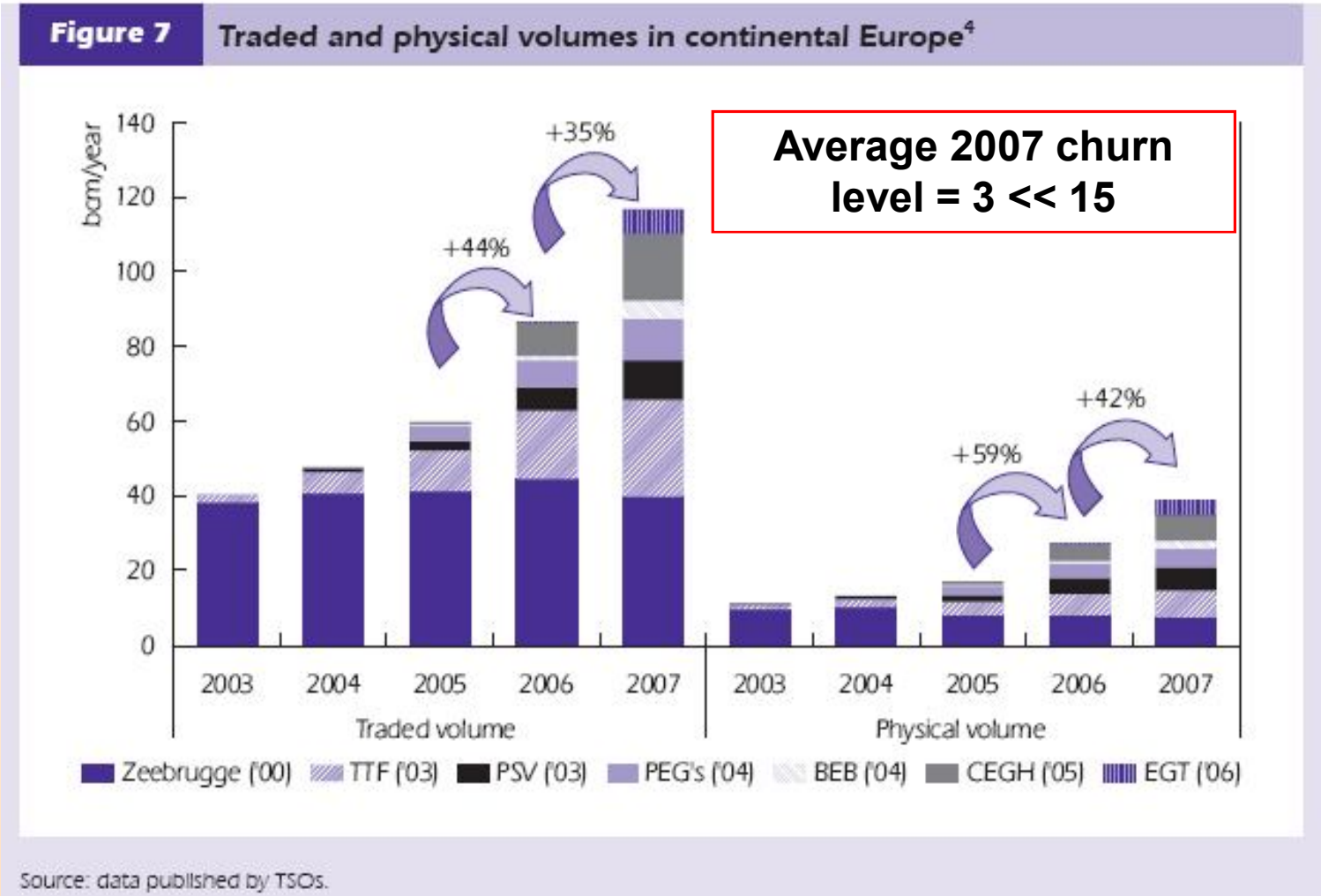
Source: “Gas Matters” for corresponding years

NBP total throughput, trades and delivered trades, 2003-2009



Source: “Gas Matters” for corresponding years

Traded and physical gas volumes in continental Europe (w/o NBP)



Source: IEA. Natural Gas Market Review 2008, p.32

Results of J.Stern's FLAME polls on expected time of gas price decoupling from oil prices

Table 1: When do you expect European long tern contract gas prices will become decoupled from oil and determined by spot and futures prices? (% of total)

YEAR OF CONFERENCE POLL:	2004	2005	2008	2009
Before end 2010	24	15	8.7	3.8
Before end 2015	36	15	22.1	20.3
Later than 2015	15	39	42.5	44.3
Never	24	31	28.8	31.6

Source: FLAME Conference for respective years

Source: J.Stern. Continental European Long-Term Gas Contracts: is a transition away from oil product-linked pricing inevitable and imminent?, OIES, NG34, September 2009, p.5

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Conclusions (1)

- Gas market of Continental Europe is not prepared (and should it be?) to switch over to gas-to-gas competition as the key pricing mechanism.
- Not appropriate - too risky today and in foreseeable future - to peg gas prices in EU-oriented LTGECs (integral element of upstream investment projects) to gas-to-gas competition at European spot trading hubs (in particular, at UK NBP) rather than to basket of gas substitutes based on replacement value.
- During long-lasting adaptation of existing pricing mechanisms - no revolutionary switches to gas-to-gas competition as universally prevailing one.

Conclusions (2)

Adaptation of LTGEC pricing formulas:

- Broader range of gas substitutes, incl. (where appropriate) gas-to-gas competition as one of formula ingredients - besides coal, primary energy and other energies in addition to HFO/LFO => to reflect greater competition among energies on gas market;
- Shortening of time intervals used in gas price formula reviews, increasing frequency of price reviews => to reflect greater intensity and volatility of price fluctuations for gas substitutes (mostly commodities);
- LTGEC pricing basket of major gas exporters to Europe would drift towards more complicated structure of pricing formula, similar to current gas price structure at the UK market;
- Continuing diminishment of LTGEC mean duration within broad diapason;
- => modified Groningen LTGEC model to prevail over Anglo-Saxon model.