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Factors in wholesale gas pricing

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The birth of the gas industry and interfuel competition

- Until 1970s in advanced West the gas industry was often developed in competition with other energy sources (oil derivatives, coal, electricity)
- Due to the large investment costs of the gas chain and their “sunk” (not fungible) nature, investors required special provisions, ensuring repayment of their outlays
- Dual solution:
 - long term contracts with take or pay obligation
 - pricing after competing fuels

The birth of the gas industry and interfuel competition in today's emerging markets

- The LT contracts & interfuel competition scheme is partly applicable to developing industry in emerging markets
- But today's combined cycle technology (CCGT) gives gas a larger edge in power generation
- A similar impact may come from tighter environmental constraints, or by the opportunity costs of carbon emissions under Kyoto-like Joint Implementation mechanism, or other international carbon abatement agreements

The regulatory framework of interfuel competition

- Competition of other energy sources avoided in several cases the need to regulate prices
- Prices were normally agreed by the parties, with consumers sometimes represented by associations stipulating collective agreements
- Prices awarded consumers a certain edge over competing fuels (on a per energy unit basis)
- In some cases gas costs were significantly lower, hence pricing after competing fuels would ensure large producer rents
- Therefore producer or consumer prices were regulated (e.g. in the U.S. until 1978)

Long term contracts

- Typically 20-30 years, 80-90% take or pay, slow build-up
- Make-up gas: if not taken it may be used 2-3 years later
- Destination market (consuming sector & country) defined in advance, buyer not allowed to resale to others
- Price renegotiation normally every three years
- Parties may ask for further renegotiation in case of substantial changes of market conditions
- *LT contracts provide security of supply to buyer, and security of demand to seller, who could otherwise be abused*

Pricing under long term contracts: the base price

- Discussion about where to fix energy parity with competing fuel, normally oil and its derivatives
- To ensure gas competitiveness, netback with respect to competing fuels is calculated (*end user parity*):

Gas price = price of competing fuel (per energy unit, e.g. MJ, Mcal, Toe) - gas chain costs (transport, storage, distribution)

- gas chain costs usually larger than oil's
- *wellhead parity* would not allow gas competitiveness
- *FOB parity* often requested by producer countries, would only allow a premium gas market due to higher costs of gas chain
- CIF parity has same problems, to a lower extent

The base price of LT contracts: evolution

- Over time, gas chain costs reduced compared to other fuels:
 - gas infrastructure gradually depreciated
 - technical progress, notably in the LNG chain
 - combined cycle technology involved sharp reduction of gas fired power generation
 - environmental concerns led to higher taxation and/or higher pollution abatement costs of fuel oil, coal
- Hence, pricing after competing fuel has led to increased producer prices, moving towards FOB parity with oil
- Tendency may continue, depending on global, local environmental policies

The price escalation of LT contracts: Europe

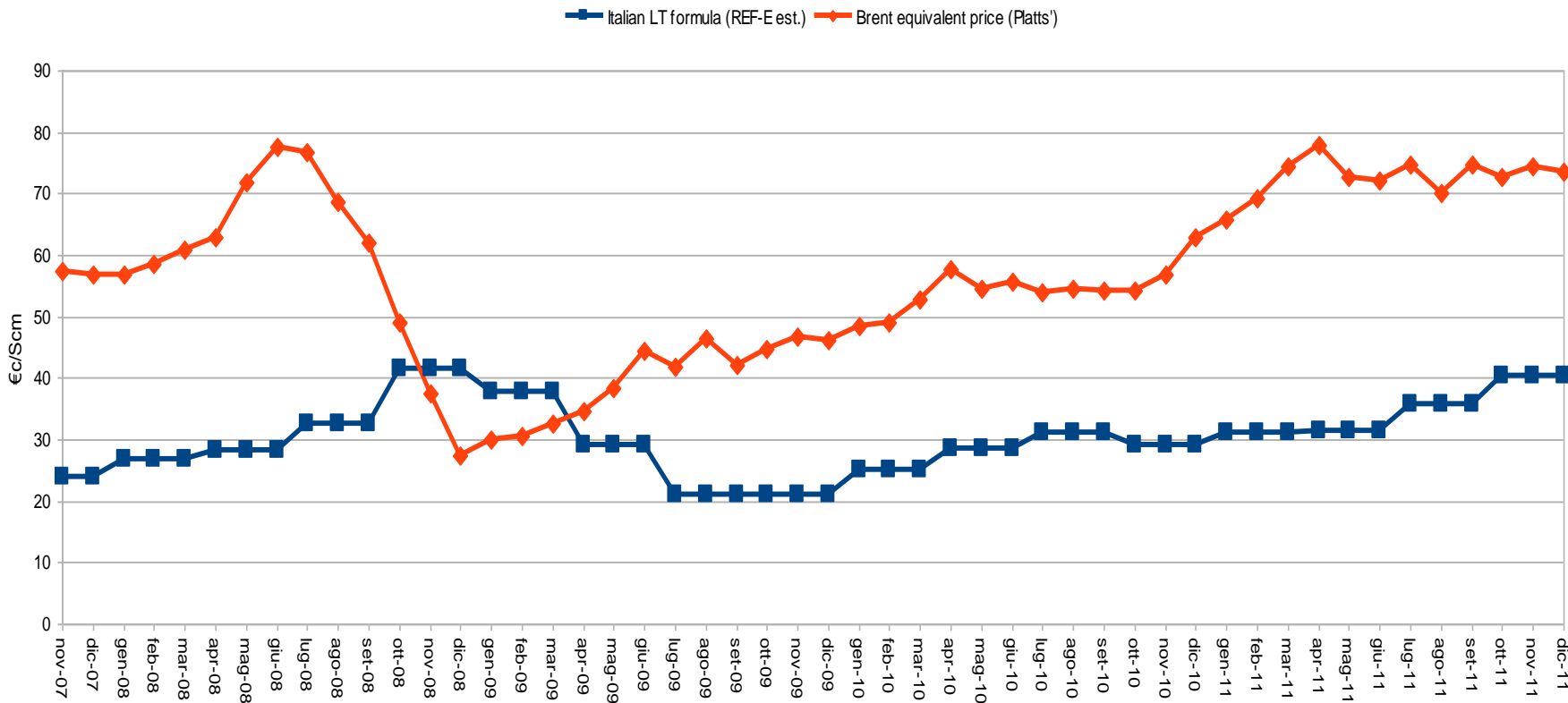
- European approach, pioneered by Netherlands, followed by Russia:
 - for each market, the basket of relevant competing fuels are defined (mostly diesel, fuel oil), usually with some role for crudes
 - international fuel price indexes are agreed (e.g. Platts' published prices)
 - gas prices are adjusted normally every 3 months after a change of 6 – 9 month moving averages of the indexes
 - Example (Italy): 48% diesel, 39% LFO, 13 basket of 8 crudes

The price escalation of LT contracts in Europe: assessment

- Gas prices are predictable and in line with the indexes on average, maintaining the parity agreed with the base price
- In the short term, relative oil/gas price may swing
- Gas price hardly related to gas market conditions
- 6-months delay originally justified by adjustment time, but damages consumers, as it embodies (on average) summer peaks of oil product prices, “driven” by the “driving season”

The price escalation of LT contracts: Italy's example

(Italian price formula vis-a-vis the Brent oil price)



The price escalation of LT contracts: French example (Regulated GdF-Suez average supply price as of 2010)



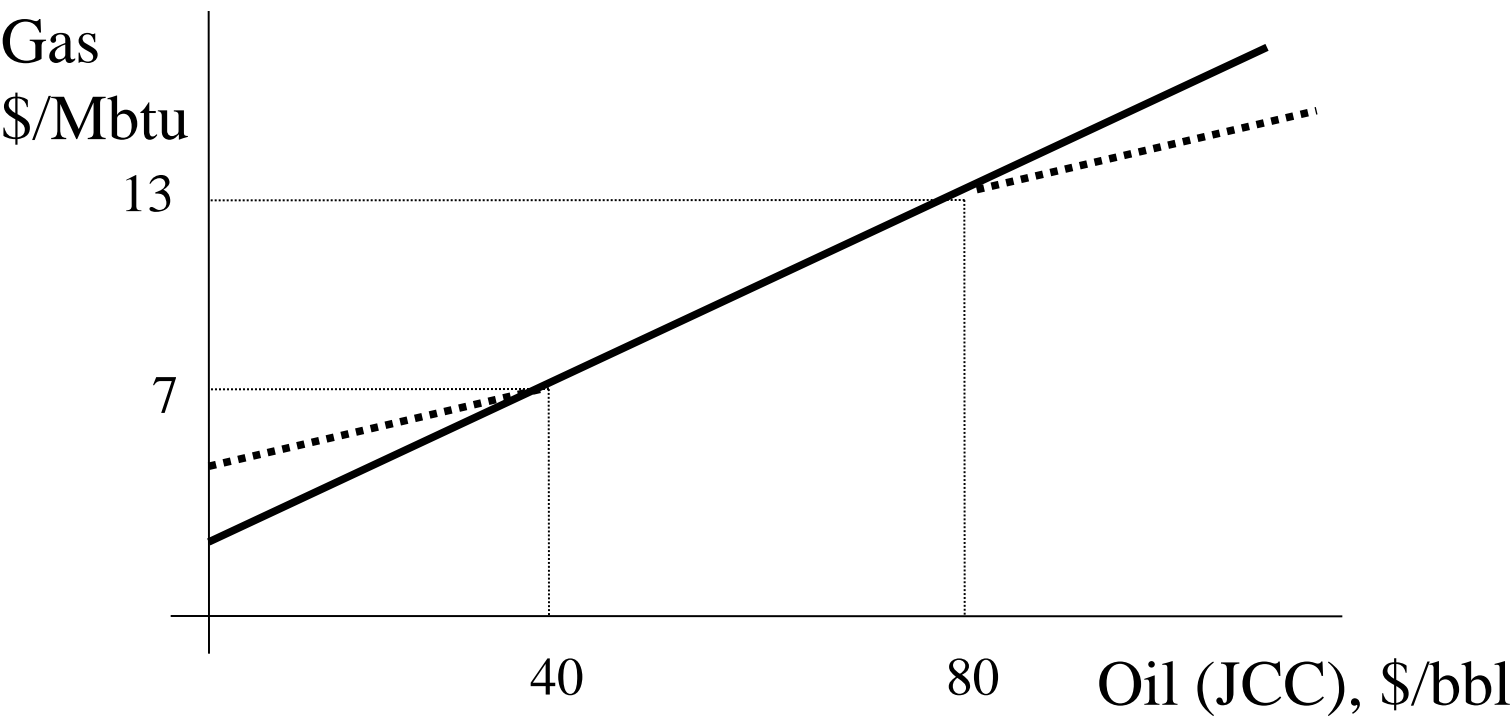
Where ΔI_k is the evolution of the index I_k between the two official releases with:

- 1: light fuel oil with 0.1 sulphur content, moving 6 month average;
- 2: low sulphur heavy fuel oil, moving 6 month average;
- 3: Brent crude, moving 6 month average;
- 4: quarterly future gas price at TTF, the Dutch gas hub, delayed one month (*this is not in the original formula*)
- 5: EUR/US\$ exchange rate, moving 6 month average

The price escalation of LT contracts: Asia

- Originally used for Japan's LNG imports
- Based on a basket of oil crudes
 - most common is the “Japanese Crude Cocktail” (JCC)
 - gas prices are often related to futures crude prices, therefore normally closer to oil price parity even in the short term
- Gas price has an intercept (usually 0.5-1 \$/Mbtu) and a “slope” (ratio between gas price in \$/Mbtu and oil basket average in \$/bbl, usually between 0.11 - 0.17)
- S-curves may be used to avoid too low or too high prices

The price escalation of LT contracts: Asian curves and S-curves



Difficulties with gas to oil pricing in Europe (1)

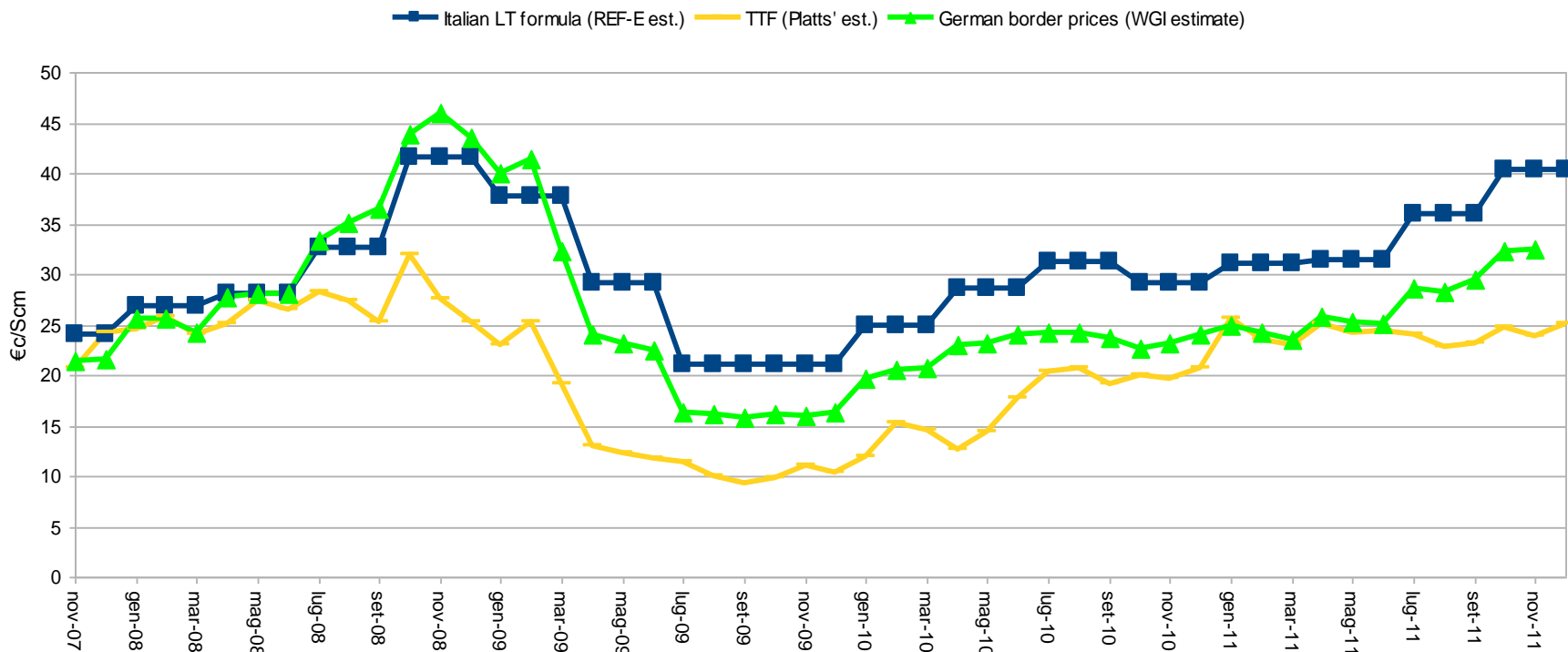
- Very limited competition left between gas and oil derivatives (maybe 10% of the market)
- As markets open, destination clauses (forbidding resale) declared illegal by EU competition authorities
- Producers can no longer discriminate between markets as buyers would resell to higher value markets and get arbitration margins
- Strong increase of LNG supplies (also due to US shale boom), reduced demand → lower pipeline load factors, flexible margins emerge

Gas market pricing starts in Europe

- Independent markets open, at first for balancing purposed
- Trading starts at physical hubs (usually pipeline hubs close to production fields, storage sites, major consuming markets), as in US
- UK develop *virtual hub* concept, imitated by most other EU markets
 - Hub is the main network of a Transmission System Operator
 - Fostered by tariffs based on entry and exit - “entry paid” gas easily traded
 - Physical hubs are pooled, increasing liquidity for relatively smaller markets

Difficulties with gas to oil pricing in Europe (2)

- Due to excess supply, spot market prices fall well below those of LT contracts



Difficulties with gas to oil pricing in Europe (2)

- Buyers cut their LT purchases to minimum take or pay obligations (or even below them)
- Pressure on (mainly non-EU) producers to:
 - change indexation, allowing some reference to spot prices
 - shorten indexation lag
 - reduce take or pay obligations, allow make up
 - cut base prices

Difficulties with gas to oil pricing in Europe (3)

- Suppliers partly agree to switch indexation (Norway, Qatar), others resist on grounds that European markets not yet liquid enough (Russia, partly Algeria)
- Transition towards market based pricing likely, as:
 - further increase of pipeline and LNG import capacity expected
 - pass-through of purchase costs by suppliers to end customers less easy as competition intensifies
 - integrated gas & power companies not fond of oil indexing

Gas market pricing: assessment

- Separates the financial from the physical flows
- Usually ‘flat’ gas volumes (no take or pay flexibility)
- Allows for separate financial risk management (forward markets develop, hedging may become available)
- Provides the ‘right’ gas price at any given time (set by demand and supply balance)
- Can apply to contracts of any length (if forward markets take off)
- But, it requires several suppliers for market liquidity, competition

(J. Stern, P. Heather, Oxford Institute of Energy Studies)

Outlook on wholesale gas pricing in Europe

- LT contracts likely to stay, but with reduced role
 - Mostly required by power generators
 - Based on gas and power prices (or *spark spreads*)
 - No longer a problem as far as markets are liquid (but they are never perfect...)
 - Mostly flat, as flexibility will be bought on markets
 - Flexibility may be bought from storage, LNG, production swings, pipeline load variations, interruptible customers...
- First hints of transition towards market based pricing in Asia (possibly using US price benchmarks like Henry Hub)

Gas pricing in North America - 1

- Mostly determined by market trading in physical hubs
- Markets can be reached by thousands of producers
- Very high spot and forward liquidity
- Significant pip to pipe competition
- Main US hub: Henry Hub, other tens of hubs, mostly large interconnection or city gates
- Increasing role of market centres, associated to hubs and providing several ancillary services (balancing, dispatching, parking, top up/down,...)

Gas pricing in North America - 2

- In fact, prices still broadly related to oil's as there is limited substitution in power generation, steam market
- Link due to market conditions, not contracts
- Strong seasonality and weather influence in both winter & summer, due to heating and cooling uses of gas & power
- Divergence from oil price trends mostly related to unexpected divergences of inventories and climate, and unexpected events, e.g. pipeline or production failures
- Local prices affected by pipeline congestion in peak periods
- Shale gas boom triggered lasting price depression

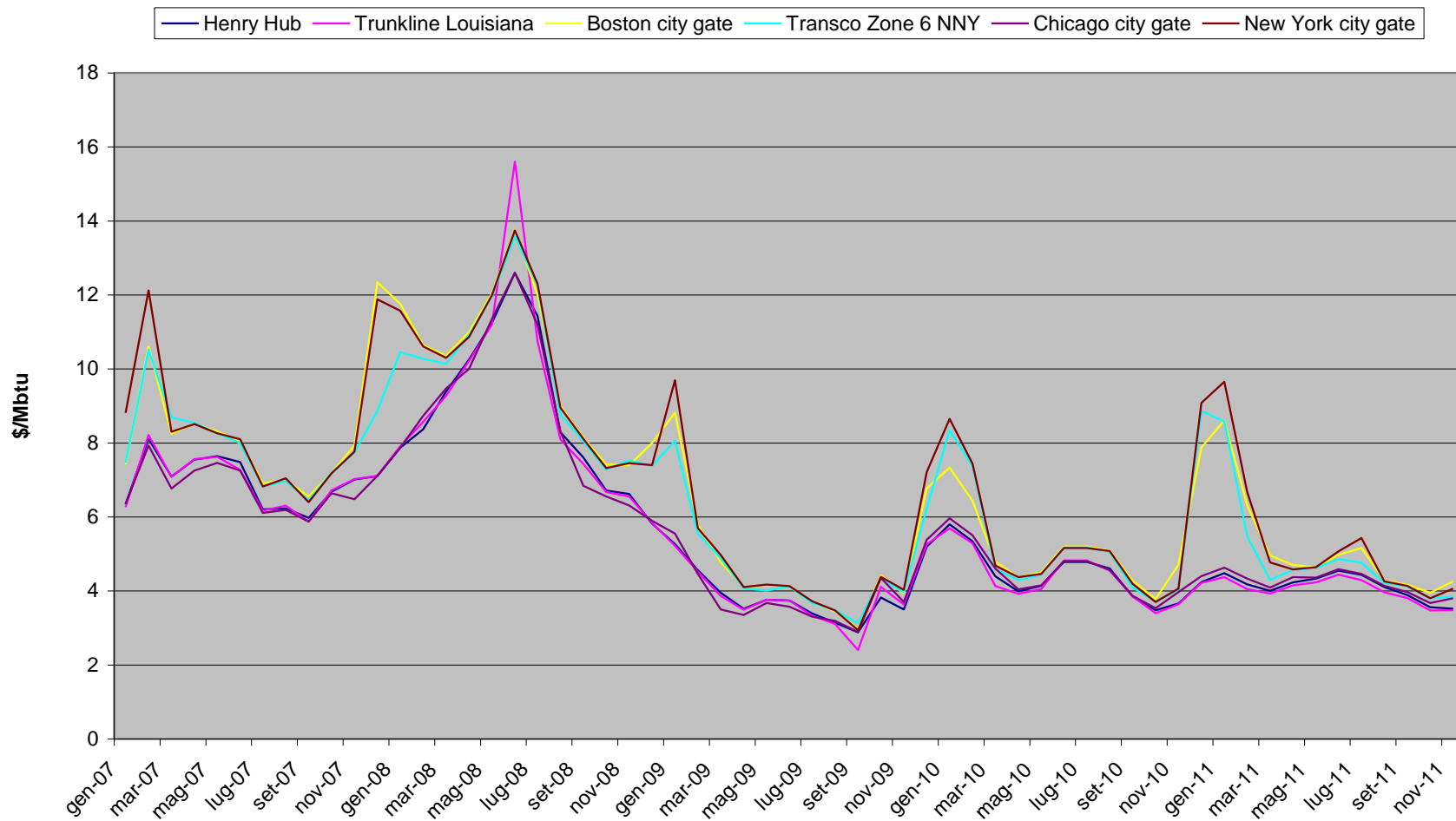


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Gas prices in the U.S.



End user price regulation: where & when

- Not needed if interfuel competition strong - unlikely now, unless coal widely used
- Not needed if gas market is competitive
 - Wholesale market competitive enough in North America, NW Europe
 - In EU retail market open but competition often inadequate
 - Official EU policy requires phasing out of end user price regulation but process is slow, almost half Member States still have caps at least for residential consumers
 - Should foresee at least phasing out conditions

End user price regulation: how

- May use actual gas purchase price, but this would stimulate collusion between traders to or seek cheaper supplies
- Some regulators use a predetermined formula for gas cost update, so that:
 - consumers get a controlled, fair price
 - traders have an incentive to “bargain hard”, get cheaper supplies, which is good for the importing country's economy
 - e.g. France, Italy, with updates every 3 months
- If caps too tight it may jeopardise supply development, scare new entrants, lead to shortages after a few years (US example in 1970's)

Thank you for your attention!