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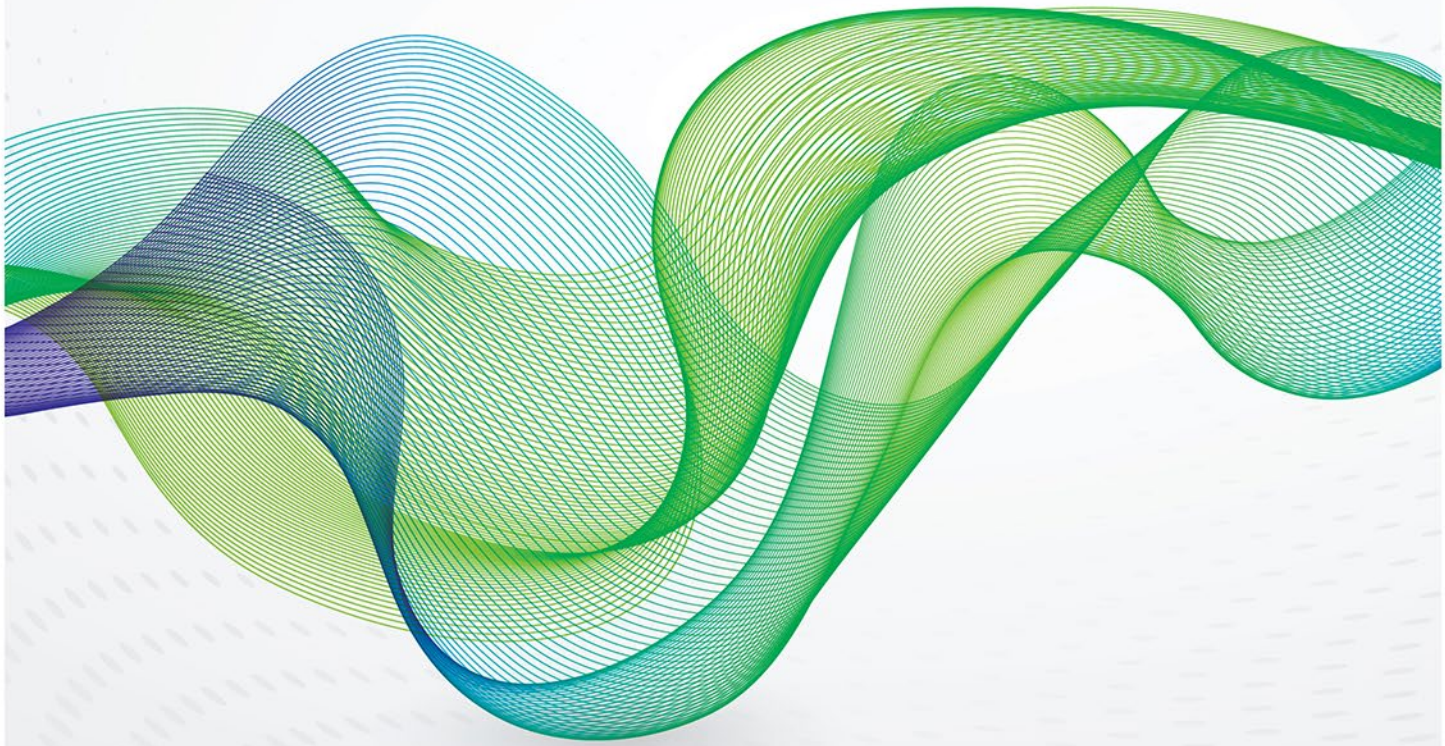
European Traded Gas Hubs:
the supremacy of TTF



OXFORD ENERGY COMMENT

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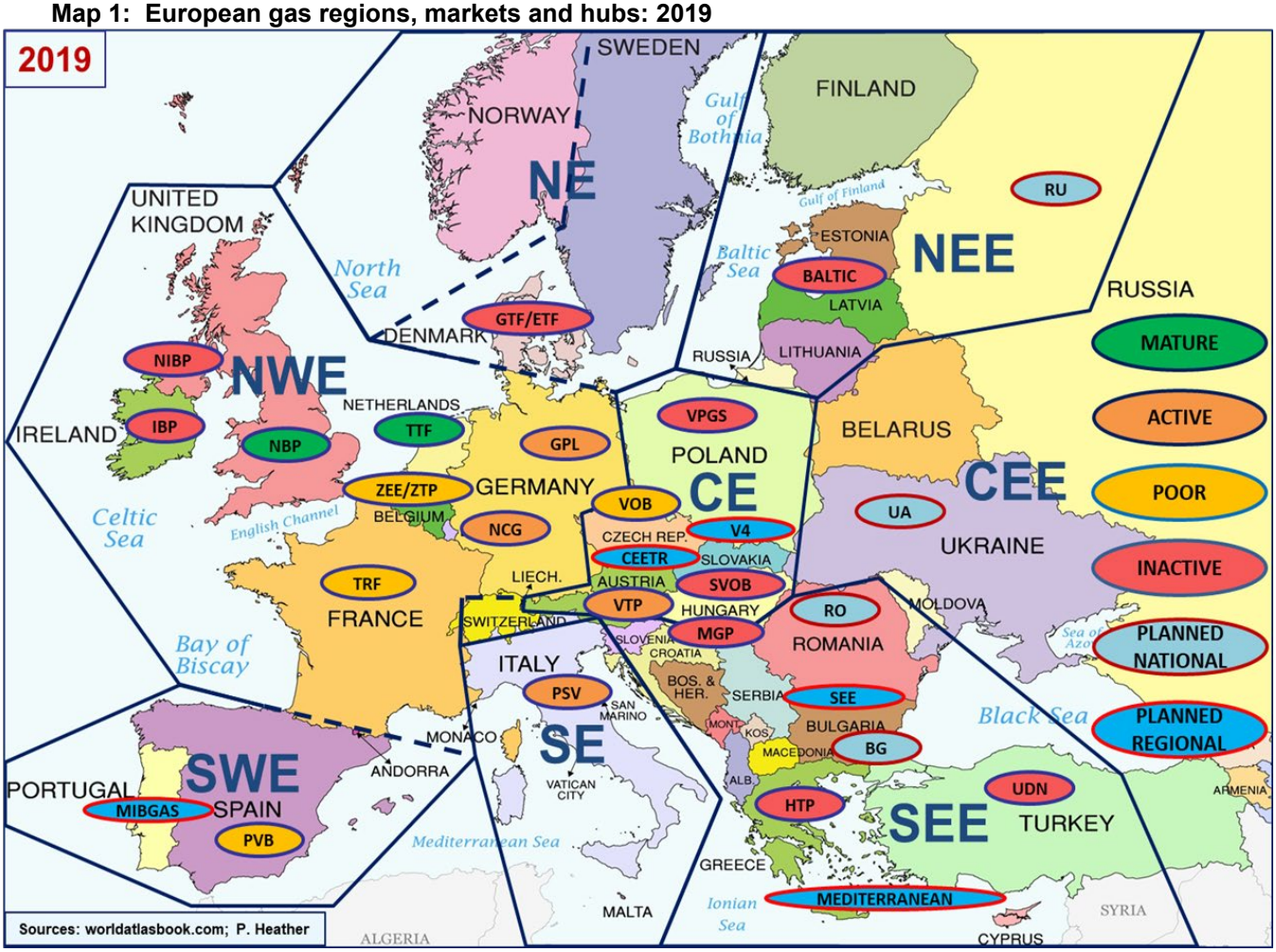
1. Introduction

The Author has been following the development of the European traded gas hubs over many years and has already published a number of Papers and Insights on the subject.[1] This Comment will provide a further update and will look at the results of the analysis of trading data in 2019 for the European traded gas hubs while also considering the importance of the Dutch TTF hub, not only as a national hub but also as a European and global pricing benchmark.

2. Setting the scene…

Map 1 shows all the gas hubs that were operational as at the end of 2019. The colour scheme indicates which hubs are categorised[2] as 'Mature', 'Active', 'Poor' and 'Inactive'. There are just two Mature hubs, the British NBP and the Dutch TTF; four Active hubs, the German NCG and GPL, the Austrian VTP and the Italian PSV; and four Poor hubs, the Belgian ZEE/ZTP, the French TRF, the Spanish PVB and the Czech VOB; the remaining hubs are all Inactive.

Map 1: European gas regions, markets and hubs: 2019



[1] All of which are available to download from the OIES website: **https://www.oxfordenergy.org/authors/patrick-heather/**
[2] As defined by the Author, following his 5 Key Elements analysis; see Heather (2019), Chapter 2.

At the end of a decade of increasing trading of gas in Europe, the total traded volumes in 2019, across all the European traded gas hubs, reached an all-time high[3] but the trend was quite different from hub to hub. There have also been a number of new hubs starting to trade,[4] albeit in relatively very small volumes and these are indicated as Inactive on the Map.

The latest results of the main hubs will be summarised in Section 5 below but the focus of this Comment is on the Dutch TTF. That hub has seen a phenomenal rise in activity since 2014 which –has yet to show any sign of slowing down – not yet at least. As we will see, it is now by far the most liquid, most traded hub, with the greatest number of participants of all the European traded gas hubs.

The analysis this year reveals that there are more 'active' participants[5] on the TTF than on the NBP or NCG hubs and significantly more than on all the other hubs.[6] The more 'active' participants there are, the more liquidity there will be in a market, which is especially important in the mid-far curve for risk management trades.

Table 1: Traded products - 2019

2019 Product evaluation based on absolute volumes*	OTC	CLEARING	WD DA	BOW W/E WDNW BOM	MA MONTHS	QUARTERS	SEASONS	YEARS (CAL + GAS)	EXCHANGE	(% SHARE)	BALANCING TRADES	SPOT PROMPT	FUTURES MONTHS	FUTURES QUARTERS	FUTURES SEASONS	FUTURES YEARS	OPTIONS MONTHS
TTF	Y	Y	Y	Y	Y	Y	Y	Y	ICE PGS CME	90 9 1	N	Y	Y	Y	Y	Y	Y
NBP	Y	Y	Y	Y	Y	Y	Y	Y	ICE PGS CME	99 0 1	Y	Y	Y	Y	Y	Y	Y
NCG	Y	Y	Y	Y	Y	Y	Y	Y	PGS ICE	98 2	N	Y	Y	Y	Y	Y	Y
GASPOOL	Y	Y	Y	Y	Y	Y	Y	Y	PGS ICE	99 1	N	Y	Y	Y	Y	Y	N
PSV	Y	Y	Y	Y	Y	Y	Y	Y	GME PGS ICE	78 14 8	Y	Y	Y	Y	Y	Y	N
TRF	Y	Y	Y	Y	Y	Y	Y	Y	PGS	100	N	Y	Y	Y	Y	Y	N
VTP	Y	Y	Y	Y	Y	Y	Y	Y	PGS	100	N	Y	Y	Y	Y	Y	N
ZEE	Y	Y	Y	Y	Y	Y	Y	Y	PGS	100	Y	Y	Y	Y	Y	Y	N
ZTP	Y	Y	Y	Y	Y	Y	Y	Y	PGS	100	N	Y	Y	Y	Y	Y	N
PVB	Y	Y	Y	Y	Y	Y	Y	Y	MIB PGS	96 4	N	Y	Y	Y	Y	Y	N
VOB	Y	Y	Y	Y	Y	Y	Y	Y	PGS	100	N	Y	Y	Y	Y	Y	N
*KEY:	GREEN: =/>600TWh		AMBER: <600tTWh		BLUE: <250TWh		RED: <50TWh		GREEN: =/>500TWh			AMBER: <500TWh		BLUE= <100TWh		RED: <30TWh	
GREY: No volumes	Hubs column based on OTC + Exchange 'score'/56; OTC column based on 'score'/28; Exchange column based on 'score'/28																
	ICE=ICE/Endex		PGS=PEGAS			CME=CME Europe			MIB=MIBGAS			Y=AVAILABLE			N=NOT AVAILABLE		

Sources: OTC: LEBA, ICIS; Exchange: ICE, ICE-Endex, PEGAS, CME, GME; MIBGAS; P. Heather

TTF is also the hub on which the greatest number of product types are traded and in the greatest volumes, another indication of that hub's maturity and a good indication that it is being used as a risk management hub. Table 1 shows that in 2019 there were more than 500TWh traded in each of all the exchange product types, and more than 600TWh traded in each of all the OTC product types, with the exception of the Within Day and Day Ahead category. That is reflected in the green colour coding in the

[3] Total volumes, including OTC and exchange spot and futures trades: 51,390TWh. Previous high was in 2017: 50,263TWh.
[4] Details of these hubs are given in Heather (2015) and Heather (July 2019).
[5] For an explanation and methodology, see: Heather (July 2019), pp.3-5.
[6] The hub scores in 2019 are shown in the first column of Table 5.

table. The NBP is the only other hub to have a number of products with the green colour coding.[7] The important point to note here is that there is a high volume of trading occurring on TTF in the mid and far curve and also in financial options (alone accounting for 5.9% of the total traded volumes).

Indeed, TTF has become *the* mature risk management hub, not just for the Netherlands but for all of Europe and beyond, as it now also serves as a pricing hub for some LNG cargoes into north-west Europe.

3. The rise, and rise, of TTF

The metric that really shows how TTF has grown almost exponentially in recent years is that of the total volumes traded. Even if some of the other European hubs have continued to develop and to increase their traded volumes, they can in no way match either the rate of growth or the absolute volumes recorded by the TTF.

As Table 2 shows, the total traded volumes at TTF increased by over 40% year-on-year to a staggering 40,390TWh, more than three times greater than its nearest rival the British NBP, which traded 12,480TWh, and a massive eleven times greater than the two German hubs combined! TTF's traded volumes now account for 79% of the total European traded gas market.

Table 2: Traded volumes - 2019

2019	TOTAL TRADED VOLUMES* (TWh)						
HUB	**2008**	**2011**	**2017**	**Δ% =>**	**2018**	**Δ% =>**	**2019**
TTF	560	6295	23460	+20	28220	+43	40390
NBP	10620	18000	20970	-28	15105	-17	12480
NCG	360	880	1730	+2	1760	+25	2205
GPL		310	1130	+2	1150	+20	1375
PSV	160	185	945	+12	1060	+36	1440
TRF	PEG N 185	PEG N 430	PEG N+TRS 640	+18	780	+24	970
VTP	CEGH 165	CEGH 170	530	+23	650	+34	870
ZEE	500	870	510	-10	460	-17	380
ZTP	n/a	n/a	40	+275	150	+27	190
VOB	n/a	n/a	100	-20	80	+19	95
PVB	n/a	n/a	60	+67	100	+30	130

*rounded to nearest 5TWh; not the same data sources in all years.

Sources: 2008: converted from bcm in IEA 2009 Natural Gas Review, p.30;
2011-2019: LEBA, ICIS, ICE, ICE-Endex, EEX, Powernext, PEGAS, CME, CEGH, GME; MIBGAS; P. Heather

In this table,[8] mature hubs are shown in green; the active hubs, with developing depth, liquidity and transparency in amber; and the poor hubs, which cannot yet be considered as deep, transparent or liquid, in red.

[7] The NCG does show the OTC 'Seasons' category as green, as it had a rise last year in volumes of the first two seasons.
[8] The methodology used in this table is: (Volumes) Green: =/>5000; Amber: <5000; Red: <1000.

The rise in traded volumes at the TTF, and to a certain extent the decline in volumes at the NBP, is a result of an increase in hedging and risk management trading (with some of that being transferred from the NBP), as well as more general portfolio optimisation and speculative trading. In more recent years, it has further benefitted from an increase in LNG cargoes being priced against TTF and the inherent hedging and trading around those physical trades. There is a saying in trading circles that 'trading begets trading; that liquidity begets liquidity'. This is certainly the case for the TTF, which grew at a moderate pace in the early part of the decade, growing more strongly from about 2014 and then, since 2017, almost doubling in size. This trend over time is clearly seen in Figure 1 below.

Another important metric is that of the traded gas hubs churn rate.[9] In this one metric all others are, necessarily, reflected: if there are many participants, trading many different products in large quantities, then the churn rate is likely to be high. The churn rate is used by traders as a 'snapshot' of a market's liquidity; some traders will not participate in markets with a churn of less than 10 and many financial players will only participate when the churn is above 12. In his analyses the Author has determined that a hub is 'mature' when the churn rate is 10 times or more.

Table 3 shows the hubs' net[10] market churn rates from 2008 to 2019. As with the traded volumes table, this clearly shows how the TTF churn rate has increased significantly and quickly in the past few years. In 2019 the TTF net churn reached over 97 times. If, instead, the gross[11] churn is calculated, the TTF still recorded a very high 44 times.

Table 3: Churn rates - 2019

2019	TRADED GAS HUBS CHURN RATES*				
HUB	**2008**	**2011**	**2017**	**2018**	**2019**
TTF	3.3	13.9	54.3	70.9	97.1
NBP	14.4	19.8	23.9	17.0	14.3
VTP	CEGH 2.4	CEGH 2.2	5.3	6.9	9.0
NCG	0.4	1.8	3.4	3.8	4.3
GPL		0.8	2.6	2.8	2.9
TRF	FRANCE 0.4	FRANCE 1.0	PEG N 1.7 TRS 0.6	1.7	2.0
ZEE+ZTP	5.1	4.1	2.9	3.3	1.9
PSV	0.2	0.2	1.2	1.4	1.8
VOB	n/a	n/a	1.1	0.9	1.0
PVB	n/a	n/a	0.2	0.3	0.3

*Calculated on a Net Market Churn basis; not the same methodology in all years.

Sources: 2008: Heather (2010), Table 6, p.19; Komlev presentation 2011; calculated from BP and IEA;
2011-2019: LEBA, ICIS, ICE, ICE-Endex, EEX, Powernext, PEGAS, CME, CEGH, GME; MIBGAS; P. Heather

There are two clear benchmark hubs today, the TTF and NBP; only the Austrian VTP is close (using this net calculation) to the 10 times threshold for mature markets. The Belgian ZEE, plus ZTP, hubs continue their slide to the bottom and the remaining hubs are very much struggling.

[9] For an explanation, see: Heather (July 2019), p 11.
[10] The net churn is the total traded volumes at a given hub, divided by its consumption, as defined and used by the EU.
[11] The gross churn is the total traded volumes at a given hub, divided by its physical demand or throughput.

Although the Author has been calculating and publishing the net churn rates since he started to follow the development of the European traded gas hubs, this was because it's been the definition used by the European Commission and as defined in the Gas Target Model. However, in the Author's opinion, this calculation can be misleading as the amount of trading effected at a given hub is impacted by various factors, most importantly the trading of actual physical gas or trading to hedge and risk manage gas, both destined for consumption in that hub area, but also trading in relation to quantities of gas destined for export to neighbouring market areas.

For this reason, the Author believes that using a net churn methodology can be appropriate in the early stages of the development of a hub, as it is initially more focused on internal/national balancing requirements; however, to judge the growing liquidity and maturity of a hub, as it trades further down the curve and attracts risk management volumes, the gross churn methodology is more accurate as it shows a given hub's ability to be a pricing benchmark beyond its own market area.

If using the gross churn calculation, the TTF result is more than halved (due to the large flows of physical gas through the hub area onto other neighbouring hubs) but, as already stated, is still a very high 44 times. The NBP result is only marginally lower as the volumes of physical gas exported are relatively low compared to consumption and stands at 13 times. The biggest 'loser' in moving to a gross churn calculation is the VTP which reduces from 9 times to just 1.7 times. The PSV remains at 1.8 times and the PVB at 0.3 times but all the other hubs show a lower result.[12]

Whichever churn calculation is used, net or gross, TTF is clearly deemed to be a mature hub; indeed, the real proof that it is now the European benchmark hub is that its churn rate, calculated against the physical consumption in BeNeLux, FR, DE, AT and CZ[13] is a very respectable 17.9 times - truly a mature benchmark hub.

4. The decline of NBP

The British NBP reached maturity within just 5 years[14] and was the model upon which the EU based its vision to transform the European gas market into a single liberalised market.[15] There were already many varied market participants by the late 1990s, the ICE futures market had over 10% market share and the churn rate reached a high of 21 times in 2001. Although the traded gas market suffered after the collapse of Enron and TXU Europe, the churn rate remained above 10 times[16] throughout the 2000's. The market grew again in the early 2010's, reaching its all-time peak in 2017, when total traded volumes stood at 20970TWh and the net churn was 23.9 times.

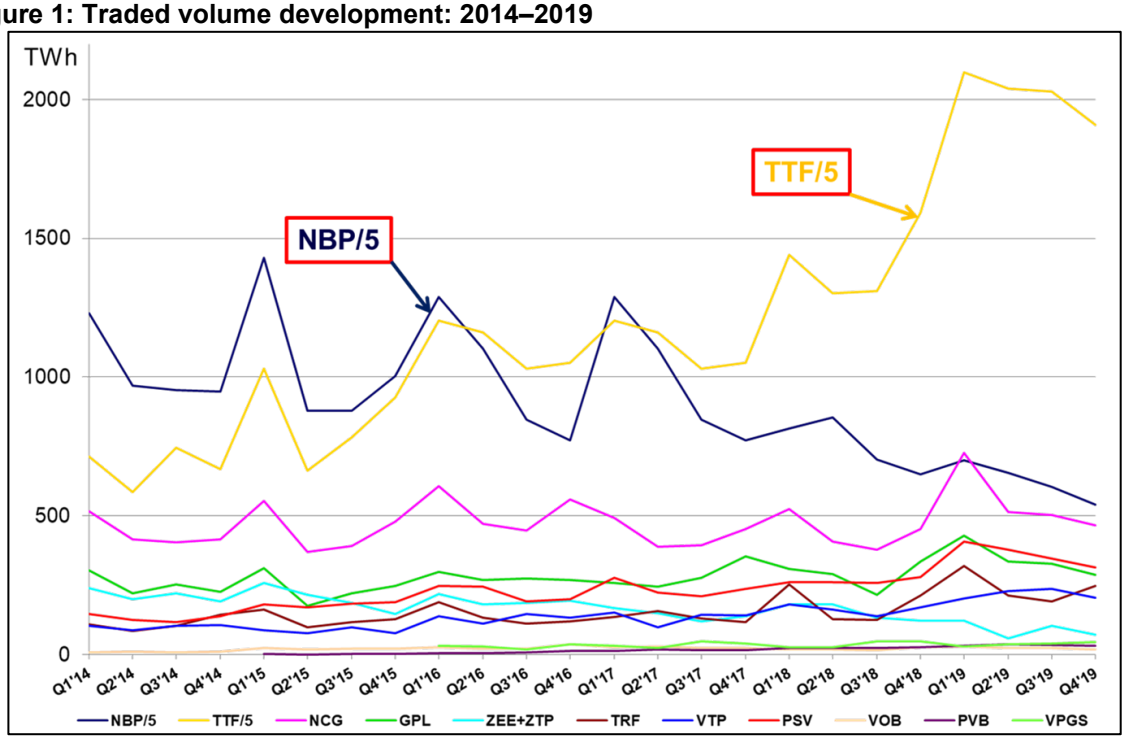
Figure 1 shows the traded volume development for all the main hubs from 2014 to 2019. The TTF and NBP lines represent those hubs' total volumes divided by five in order to scale better on the chart. The NBP, having had its best volume years and remaining fairly steady from 2014 until 2017, started to fall away rapidly from Q1-2018, as can be seen in the Figure.

One of the main reasons for this decline, and that of the Belgian ZEE also, is that they are priced in pence/therm and Continental European traders would prefer to hedge and risk manage in contracts priced in euros/MWh. Whilst there wasn't a viable, liquid, euro denominated contract to trade, they 'made do' with the liquid, mature, Sterling NBP market. The ZEE market has always been predominantly traded on spreads against NBP so that the decline of NBP had an immediate and noticeable impact on the volumes traded at ZEE. Now that TTF has grown to be a mature market, even more liquid than NBP, much of that hedging and risk management trading has moved away from NBP to the benefit of TTF.

[12] NCG 2.5; GPL 1.7; TRF 1.6; ZEE+ZTP 0.8; VOB 0.3.
[13] These countries represent the TTF's close 'sphere of influence', although it is also used as a market reference price further afield, such as in Italy and Spain.
[14] For a full account of the gas market liberalisation in Great Britain, see: Heather (2010).
[15] For an account of the process of transformation in Europe, see: Heather (2012), pp.22-25.
[16] With the exception of 2005, when it was 9.3 times; see: Heather (2010), Table 6, p.19.

However NBP does remain, for the time being at least, a mature market serving as a pricing hub for the British Isles and some LNG cargoes landing in Britain.

Figure 1: Traded volume development: 2014–2019



Sources: LEBA; ICIS; ICE ; ICE-Endex ; EEX ; Powernext ; PEGAS; CEGH ; GME; CME; MIBGAS; TGE; P. Heather

Of the other top tier hubs, the Italian PSV is probably the 'best performer' in terms of traded volumes, having steadily risen up the rankings since 2014 and now being in 4th place, marginally ahead of the German Gaspool. Most of the other hubs are only very slowly progressing.

5. A summary of the main traded gas hubs in 2019

Table 4 shows the summary of the 5 Key Elements in 2019 which is used to rank the 11 main traded gas hubs in Europe. The positions of TTF and NBP have been described above. The combination of each of the Key Elements and their respective scores are what determine the overall rankings of the hubs, as can be easily observed by the colour coding, used in the table and in the map.

TTF and NBP are still the only two mature hubs, scoring a maximum 15 and 14 respectively. Interestingly for the hub that 'led the way' in terms of market liberalization, copied to a large extent by Continental Europe, NBP is now becoming more focused once more on the spot/prompt balancing needs and on the front months and seasons contracts for hedging purposes, with much less interest than in previous years on contracts further forward. This has led to there being slightly wider bid/offer spreads in the mid to far curve products, which in turn has meant that the Tradability Index score has dropped from a maximum of 20 to 16; it is this that has lost NBP its maximum hub score.

There is then a gap to the next tier of hubs, only just classified as active and scoring 8-9. The two German hubs have performed rather disappointingly, remaining fairly static over the past 5 years or so. The 'new entrant' last year in this category was the Italian PSV and, in 2019, it consolidated that position with both higher traded volumes and churn rate. Finally in the active category of hubs is the Austrian VTP. It is placed here mainly due to having a good net churn rate of 9 times but, as explained at the end of chapter 3 above, its gross churn rate would only be 1.7, reducing its ranking.

Table 4: Summary of the 5 Key Elements - 2019

2019	5 KEY ELEMENTS					
HUB	Active Market Participants*	Traded Products**	Traded Volumes	Tradability Index (Q4)	Churn Rate	Score /15***
TTF	167	52	40390	20	97.1	15
NBP	135	42	12480	16	14.3	14
NCG	124	25	2205	15	4.3	9
GPL	95	24	1375	14	2.9	8
PSV	94	24	1440	14	1.8	8
VTP	72	17	970	12	9.0	8
TRF	63	16	870	15	2.0	7
ZEE	52	17	380	7	1.9	7
ZTP	52	13	190	5		7
PVB	56	11	130	0	0.3	5
VOB	45	11	95	5	1.0	5

* Hub Score in the OTC Active Traders table.
** Score /56 derived from the OTC and Exchange product categories in the Traded Products Table.
*** Score based on each of the Key Elements scoring zero for Grey; 1 point for Red; 2 points for Amber; 3 points for Green.

The decline of the Belgian ZEE hub is described above (it actually peaked in 2011) and despite the virtual ZTP hub, which became operational in 2012, helping to sustain the Belgian traded volumes a little, the two hubs are now ranked 8th and 9th respectively, versus ZEE still being ranked 5th in 2015.

The French hubs were consolidated into one Trading Region (TRF) at the end of 2018 but that has not had the result of creating the much greater liquidity that had been anticipated; indeed, the French traded gas market has been very slow to develop and hasn't even doubled its total traded volumes from 2013[17] to 2019, while the net churn is still at a very low 2 times.

The Spanish PVB is developing quite well since its inception and is now just above the Czech VOB, despite having the same score.

6. Where does this leave the remaining European traded gas hubs?

The remaining 8 hubs shown as operational but 'inactive' on Map 1 are still struggling to develop; they were described in detail in Heather (2019).[18] Despite most of these hubs being established for 5-15 years, they simply have not 'got off the ground'

Table 5 shows the position of six of them in 2019 for comparison: the Polish VPGS traded marginally more year-on-year but the volumes were all on the exchange with no recorded OTC trades at all; the Danish hubs, GTF/ETF, recorded slightly higher overall volumes coming mainly from the OTC market; the Hungarian MGP hub saw a five-fold increase in traded volumes,[19] mainly in exchange trading; the Slovak SVOB hub had a nearly three-fold increase, all in OTC trading only; the Greek (HTP) and Turkish (UDN) hubs barely traded. The two Irish hubs (IBP and NIBP) traded very limited volumes, all balancing trades.

[17] The PEGs combined traded a total of 485TWh in 2013.
[18] See: Heather (July 2019), pp.18-22.
[19] Please note that due to a transcription error, Heather (July 2019), Table 7, p.18, shows MGP OTC volumes in MWh; the correct total for MGP trading in 2018 should read 6.89TWh.

Table 5: Traded volumes: emerging hubs - 2019

2019		EMERGING HUBS TRADED VOLUMES (TWh)						
HUB	Est.	OTC			EXCHANGE			TOTAL
		PRMT	CURVE	TOTAL	SPOT	CURVE	TOTAL	
VPGS	2014	No trades reported			24.30	124.42	148.72	**148.72**
GTF/ETF	2004/08	n/a	n/a	83.37	21.79	0.33	22.12	**105.49**
MGP	2010	0.16	0.19	0.35	34.40	0.48	34.88	**35.23**
SVOB	2016	2.08	9.49	11.57	no exchange trading			**11.57**
HTP	2018	Nil	Nil	Nil	very little balancing only*			**Est. <1**
UDN	2011	No activity reported			mostly daily balancing**			**Est. <1**

*the Greek TSO Desfa's balancing platform went live 1st July 2018.
**the Turkish exchange EPİAŞ went live on 1st October 2018.

Sources: ICIS, PEGAS, TGE, CEEGEX, HUDEX, company websites; P. Heather

6. What are the global pricing benchmarks for gas?

The Author developed a methodology in early 2019 to try and determine the relative churn rates of the global pricing benchmarks in gas. The chosen contracts were the US Henry Hub (HH), the Dutch TTF, the British NBP and the Platts JKM.[20] The initial results were published in the Quarterly Gas Review[21] and set out to show the relative liquidity of those chosen benchmarks.

There will always be debate as to which contracts should be used as the numerator and what scope of data to use as the denominator in the churn calculation. The Author deemed it appropriate to use solely the HH as the pricing benchmark for the United States, the TTF as the pricing benchmark for North-West Europe and the JKM for Asian LNG. For this present analysis, he has added the NBP as the pricing benchmark for the British Isles.

Henry Hub has become *the* pricing benchmark in North America, with most of the other 32 Market Centers (or hubs) being priced by differential against it; there are certainly some other hubs that trade in quantity but generally speaking it is only the HH that is used as the reference price. HH is also used to price some LNG cargoes destined for South America, Asia and Europe. For the purposes of this analysis the relevant physical volumes used was US consumption.

TTF has become *the* pricing benchmark for North-West Europe (excluding the British Isles), although several other countries across Europe will also use TTF to price contracts/tariffs. TTF is also used to price some LNG cargoes destined for Europe. For the purposes of this analysis the relevant sphere of influence for the physical volumes used was the gas consumption in BeNeLux, France, Germany, Austria and the Czech Republic.

Although not strictly speaking a 'hub', the JKM has become the pricing benchmark for LNG cargoes delivered into Asia, although it has also been used to price LNG cargoes to other parts of the world. For the purposes of this analysis the relevant physical volumes used were the LNG imports into China, Japan, South Korea and Taiwan.[22]

NBP has been a (North-West) European benchmark hub for over a decade but has lost that mantle to TTF which, as explained in Chapter 4 above, is mainly due to the different currency. However, it remains *the* pricing benchmark for the British Isles and is also used to price some LNG cargoes destined for Europe.

[20] S&P Platts Global Japan Korea Marker.
[21] See: Heather/Bros (2019), pp.9-11.
[22] As published by JODI: JODI Gas World: **http://www.jodidb.org/ReportFolders/reportFolders.aspx**

Table 6 shows the results of this global comparison and uses a similar colour coding to the Author's European hubs analyses; it shows which benchmarks are illiquid, mature, liquid and very liquid. The methodology[23] has been slightly refined from last year's, to allow for the extra categories and to bring it into line with the European hubs' methodology;

Table 6: Global Gas Hubs Churn Ratios - 2019

Representative churn rates 2019 (HH, TTF, NBP: trading/consumption; JKM: trading/LNG imports)			
	Country/Region	**Hub**	**Churn**
VERY LIQUID	United States	HH	45.5
	Netherlands	TTF	97.1
LIQUID	FR-DE-AT-CZ-Benelux	TTF	17.9
MATURE	Britain	NBP	14.3
	UK-IE	NBP	13.4
ILLIQUID	Asia	No hubs yet but increasing spot trading	
	CN-JP-KR-TW	JKM	0.54

Sources: JODI, Platts, CME, LEBA, ICIS, ICE, ICE-Endex, PEGAS; P. Heather

The results clearly show that HH is the premier global gas benchmark with an impressive churn of over 45 times; there is no doubt that this is a very mature and very liquid gas pricing benchmark.

TTF, when compared to its main sphere of influence, has a very respectable churn of 17.9 times; there is no doubt that this is a mature and liquid gas pricing benchmark.

NBP, when compared to the consumption across the United Kingdom and the Republic of Ireland, has a churn of 13.4; this is still a mature gas pricing benchmark.

JKM is effectively still in its infancy as a reference price marker, as the majority of LNG imports into the four countries making up its sphere of influence were until quite recently subject to oil price formation. It is only as the long term contracts became increasingly out-of-the-money that a greater volume of spot cargoes have been trading. These have invariably been priced using the JKM price marker or even traded as cargoes on the Platts MOC[24] platform. Nevertheless, there is no doubt that this marker price is gaining support from the LNG industry, with producers, aggregators and buyers using it more each year.

7. Conclusion

Previous publications by this Author have followed and analysed the development of the European traded gas hubs. They have shown how the once dominant NBP has started to lose its crown, only to be superseded by the TTF.

[23] Dark Green/Very Liquid:=/>40; Mid Green/Liquid:15<40; Light Green/Mature:10<15; Amber/Poor: 5<10; Red/Illiquid:<5. The calorific value conversion factors are now those stated by the IEA for each country.
[24] S&P Global Platts Market On Close.

This Comment has shown how NBP is still a mature and quite liquid gas hub, with many different participants, but the range of traded products is narrowing and the traded volumes have taken a tumble since 2017; however, it is clearly still the reference pricing hub for Great Britain, Northern Ireland and the Republic of Ireland and some LNG cargoes into Europe.

The Belgian hubs, especially the Sterling priced ZEE, have struggled in a competitive market and are rapidly losing ground in the European rankings, while the German hubs have shown very slow progress over the decade, especially considering the size of their physical market. Despite a reasonable increase in 2019, their combined traded volumes were still three and a half times less than those at the NBP. The French TRF has followed a similar trajectory and again, despite a reasonable increase in traded volumes in 2019, they are only slightly more than a quarter of those of Germany; TRF is still classified as a 'poor' hub.

On a positive note, the Italian PSV is continuing the strong growth trend started in 2014, albeit from a low base, and now is ranked equal 4th alongside the German GPL. It is the hub currently showing the most promise for further development[25] and could in time become the reference hub for southern Europe. The emerging hubs are serving a purpose to facilitate balancing in their respective countries but still have very far to go on the path to maturity.[26]

The main message though in this Comment is that TTF has seen phenomenal growth in the last three years, in every metric: TTF is the European hub that has the greatest number of market participants, trading the widest range of products over the entire curve. It traded by far the largest volumes of all the hubs in all the product categories and has by far the highest churn rate.

At a global level, TTF and NBP are important benchmarks in their own market areas but they are also benchmark hubs for their regions and for the pricing of LNG cargoes.

The final conclusion has to be that, in 2019, TTF is now quite simply the supreme traded gas hub in Europe as well as a global price reference.

[25] See: Heather (March 2019), pp.27-29.
[26] For a full explanation of the path to maturity, see: Heather (2015), Chapter 3.2, pp.6-8.

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