Evaluation of the probability of interruption, as established in the Commission Regulation (EU) 2017/460, 16th March

VIP Ibérico and High-pressure Network / LNG Terminal Interconnection

Gas Year 2021 / 2022

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1 Framework

The publication of Commission Regulation (EU) 2017/460 of 16th March 2017 establishing a network code on harmonised transmission tariffs structures for gas (Tariff Network Code) has defined, among others, the rules for the calculation of reserve prices for standard capacity products for interruptible capacity. In particular, Article 16 (1) specifies that reserve prices for standard capacity products for in terruptible capacity should be calculated by applying a discount to the reserve prices of their respective firm standard capacity products, through the application of the formula[1]:

$$Discount_{ex-ante} = Pro \times A \times 100\% \qquad (1)$$

- (Pro) – probability of interruption;
- (A) – adjustment factor, applied to reflect the estimated economic value of the type of standard capacity product for interruptible capacity

Additionally, Article 183 (17) of the Portuguese Tariff [2]Regulation for the gas sector regarding the information to be delivered to the NRA, foresees that, for the establishment of the prices to be applied to standard capacity products for interruptible capacity for the use of the national transport network, transmission system operator must provide to the NRA, on an annual basis, the evaluation of the probability of interruption, according to the above-mentioned Comission Regulation. This assessment shall include:

1) a list of all types of standard capacity products for interruptible capacity offered, including the respective probability of interruption and level of discount to be applied;
2) an explanation on how the probability of interruption is calculated for each type of product;
3) the data used to calculate the probability of interruption.

Regarding the prices for standard capacity products for interruptible capacity, according to Article 167 (2) of the Portuguese Tariff Regulation, transmission system operator shall also suggest a value for parameter A, the adjustment factor that reflects the estimated economic value for each os these products, as also mentioned in Article (16) of the (EU) 2017/460 of 16th March 2017.

[1] As an alternative to applying ex-ante discount, as established in Article 16 (4) the National Regulatory Authority may decide to apply an ex-post discount, whereby network users are compensated after the actual interruptions incurred.
[2] Regulation nº 368/2021.

This document sets out the proposals of the transmission system operator for each of these parameters, in accordance with the definitions considered in the Tariff Regulation for the gas sector, for the application of the ex-ante discount on the following points:

- VIP Ibérico;
- Interconnection between the high-pressure network and the LNG Terminal.

2 Methodology

2.1 Probability of interruption

The probability of interruption shall be calculated for each type of standard capacity product offered, for which the following equation shall apply, according to Article (16) of the (EU) 2017/460 of 16th March 2017:

$$\text{Pro} = \frac{\text{N} \times \text{D}_{\text{int}}}{\text{D}} \times \frac{\text{CAP}_{\text{av. int}}}{\text{CAP}} \qquad (2)$$

- (N) is the expected number of interruptions over D;
- (Dint) is the average duration of expected interruptions;
- (D) is the total duration of the respective type of standard capacity product for interruptible capacity;
- (CAP av.int) is the expected average amount of interrupted capacity for each interruption where such amount is related to the respective type of standard capacity product for interruptible capacity;
- (CAP) is the total amount of interruptible capacity for the respective type of standard capacity product for interruptible capacity.

2.1.1 Capacity Management in the interconnection points

In practice, when all firm capacity (where additional capacity is included) is contracted for a certain gas day, its underutilisation, either due to a low nomination or to a decrease in a renomination cycle, will produce an interruptible capacity, as shown in figure 1.

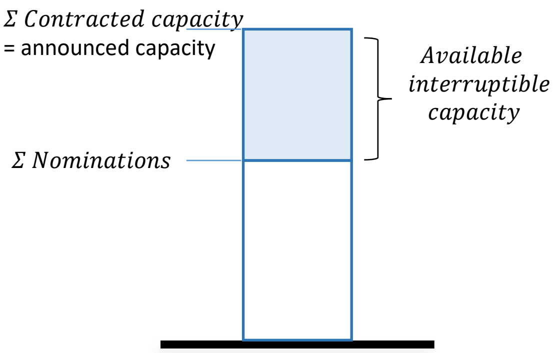

Figure 1

Such interruptible capacity may be contracted according to the rules defined in (EU) 2017/460 of 16th March 2017 as shown in figure 2.

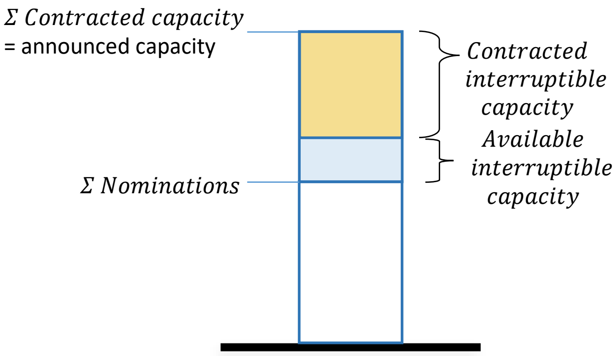

Figure 2

Under these circumstances, any further future renominations for higher values within the respective firm capacity contracted, will imply a shortage on the previously announced interruptible capacity. This occurrence may affect the interruptible capacities that had already been assigned, and thus creating an interruption of capacity, as shown in figure 3.

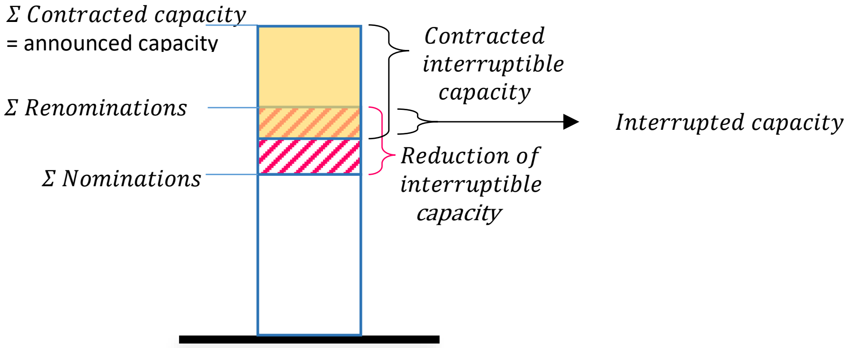

Figure 3

2.1.2 Interruption of interruptible capacity

Interruptible capacity products may be offered when all firm capacity is contracted but is not being requested and thus not being used. This idle capacity, altough eventually previously confirmed could be interrupted due to the subsequent renominations performed by the network users entitled to the corresponding firm capacity.

Assuming that the market's historical behaviour regarding the use of the contracted firm capacity has identical statistical significance in situations where the firm capacity is sold out, it is reasonable to accept that the probability of interruption of interruptible capacity on a given gas day results from the product between (i) the probability of contracting available interruptible capacity due to under-use of contracted firm capacity, illustrated in figure 1, and (ii) the probability of reducing the available interruptible capacity (variation of use by renomination to a higher value), illustrated in figure 2.

The following equation (3) shall apply:

$$\frac{N \times D_{int}}{D} = C \times PC(d) \times PR(d) \times R \qquad (3)$$

- (C) - Ratio of the number of days on which interruptible capacity is expected to be contracted, in relation to the period considered.
- (PC(d)) - Probability of contracting a certain interruptible capacity on gas day d.

- (PR (d)) – Probability of reduction of a given interruptible capacity available on gas day d, obtained as a function of increases in the use of firm capacity in renomination processes occuring in a relevant historical period.
- (R) - Ratio of the number of days on which the increase in the use of firm capacity is expected in renomination processes, in relation to the period considered.

As it is not possible to measure the behaviour of the market when it is contracting interruptible capacity, it is proposed to assume a behaviour of the frequency of occurrences in the contracting interval PC(d) identical to the frequency distribution found for PR(d).

It is considered that variable C is increased to the unit value, in order to simplify the methodology and because, for the time being, there is not sufficient data available for its modelling.

2.2 Factor 'A'

Factor 'A' is applied to reflect the estimated economic value of the type of standard capacity product for interruptible capacity, calculated for each, some or all interconnection points, and shall be no less than 1.

For the present analysis, it is appropriate to apply a unit value (A=1) to each of the standard capacity products for interruptible capacity at any of the interconnection points concerned.

3 Analysis for the VIP Ibérico

3.1 Offer of standard capacity products for interruptible capacity

Regulation (EU) 2017/459, establishing a network code on capacity allocation mechanisms in gas transmission systems, requires transmission system operators to offer standard capacity products for interruptible capacity in VIP Iberico according to the following:

- daily capacity product for interruptible capacity in both directions at interconnection points where the respective standard capacity product for firm capacity was sold out day-ahead or was not offered, to be allocated through an auction process;
- within-day capacity products for interruptible capacity, in both directions, shall only be allocated when firm capacity (additional capacity included), is sold out and shall be allocated through an over-nomination procedure.

These products shall be offered according to the rules defined in Regulation (EU) 2017/459, regarding capacity allocation mechanisms in gas transmission system.

3.2 Historical use of capacities

The virtual interconnection point, VIP Ibérico, had no interruption of interruptible capacity due to physical congestion during the period under analysis.

Tables (1 and 2) in the following pararaphs show the levels of contracting and utilisation of contrated capacities referred to the contracting of firm capacities in VIP Ibérico in biannual periods from October 2016 to September 2020.

- Direction Spain - Portugal

Table 1: Contracting capacities and utilisation of contracted capacity levels referred to firm capacities SP -> PT

Biennium	*% Contrating*	*% Utilisation*
2016-17 and 2017-18	76,92%	70,07%
2017-18 and 2018-19	69,46%	45,91%
2018-19 and 2019-20	53,02%	26,75%

- Direction Portugal - Spain

Table 2: Contracting capacities and utilisation of contrated capacity levels referred to firm capacities – PT -> SP

Biennium	*% Contrating*	*% Utilisation*
2016-17 and 2017-18	0,00%	1,50%
2017-18 and 2018-19	3,59%	16,38%
2018-19 ande 2019-20	9,24%	36,30%

The highest levels of contracting were verified in the direction Spain - Portugal, between 2016 to 2018, prone to a higher dynamic in the re-nominations compatible with the assumptions of statistical significance of the methodology applied. Therefore, the period between October 2016 and September 2018 is considered to be the relevant historical period that best characterizes the expected occurrence of interruption of interruptible capacity products for the gas year 2021-2022. The following graphs detail the use of capacity in the specified period.

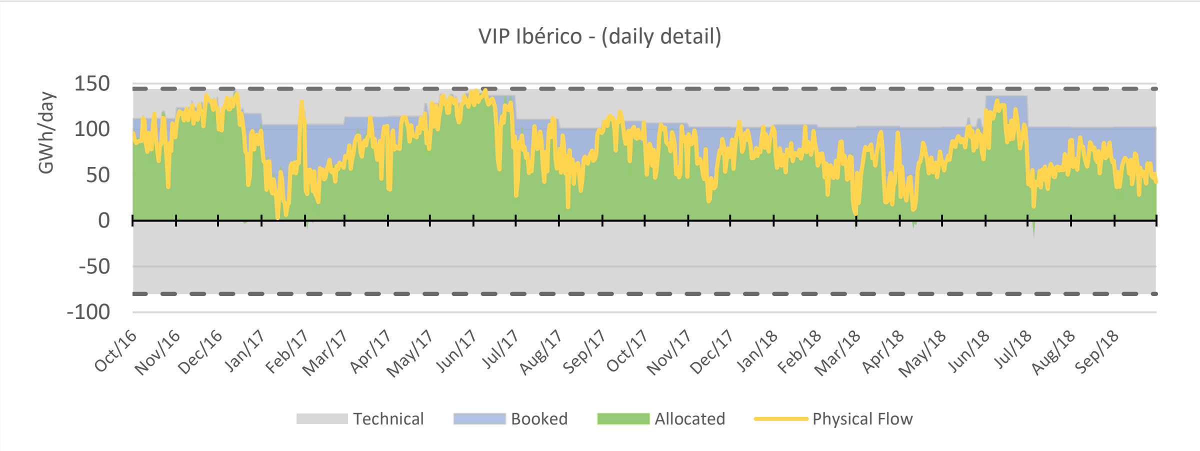

Figure 4: Use of capacities in the period oct'16-set'18

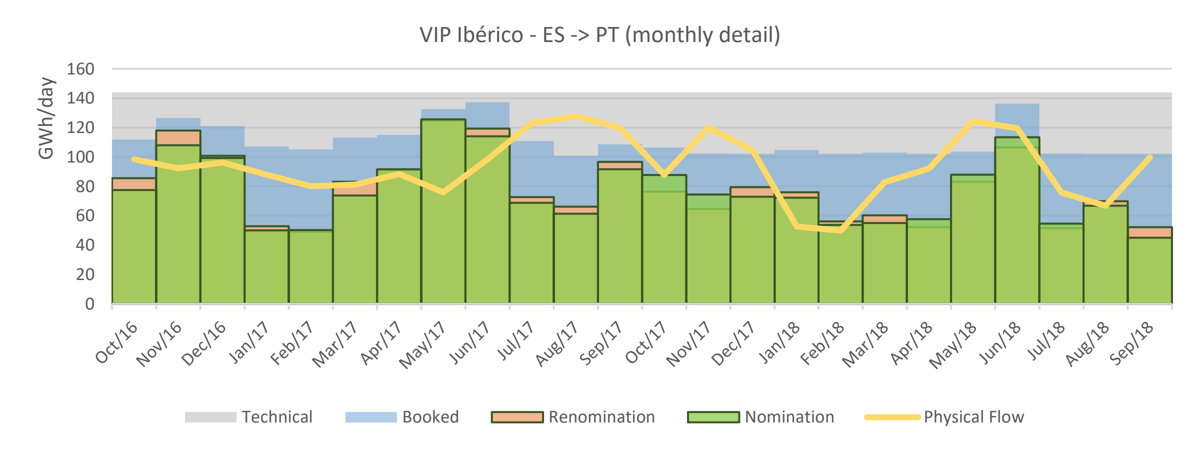

Figure 5: Average monthly use of capacities in the period oct'16-set'18. Renomination quantities above nominations displayed in orange.

3.3 Calculation of the probability of interruption for the period 2021 / 2022

Through the analyses of the increase in the use of capacity resulting from the renomination processes, it was possible to calculate the frequency of reduction applied to the interruptible capacity (referred to the available interruptible capacity), thus determining the distribution of reduction of this capacity, PR(d), expected on gas day d, as shown in figure 6.

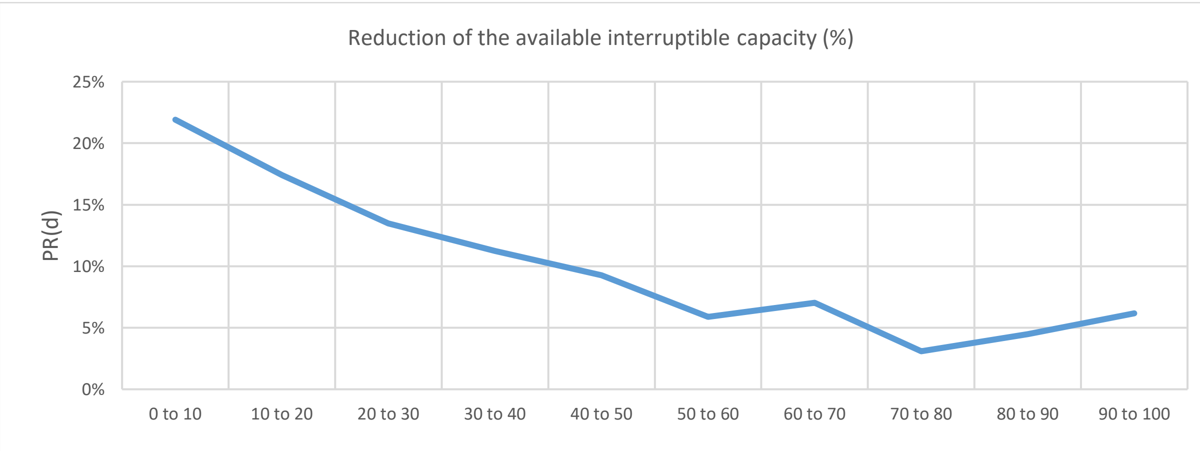

Figure 6: Reduction of interruptible capacity for each gas day PR(d)

As already mentioned in paragraph 2.1.2, it is assumed that the probability of contracting interruptible capacity, PC(d), presents the same distribution as the reduction of the available interruptible capacity, determined for PR(d), with the former competing with the latter in the reduction of this capacity, but in opposite directions. The expected number of interruptions for each set of interruptible capacity reduction hypothesis by contracting, PC(d), and by renomination, PR(d), for each available interruptible capacity interval, is shown in the matrix in Table 3, by multiplying the second by the third term of the equation (3).

Table 3: Expected interruptions for each set of hypothesis of reduction of interruptible capacity, by contracting, PC(d), and by renomination, PR(d)

		0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100
		PR(d)									
	PC(d)	21,91%	17,42%	13,48%	11,24%	9,27%	5,90%	7,02%	3,09%	4,49%	6,18%
90 to 100	6,18%	1,354%	1,076%	0,833%	0,694%	0,573%	0,365%	0,434%	0,191%	0,278%	0,382%
80 to 90	4,49%		0,783%	0,606%	0,505%	0,417%	0,265%	0,316%	0,139%	0,202%	0,278%
70 to 80	3,09%			0,417%	0,347%	0,286%	0,182%	0,217%	0,095%	0,139%	0,191%
60 to 70	7,02%				0,789%	0,651%	0,414%	0,493%	0,217%	0,316%	0,434%
50 to 60	5,90%					0,547%	0,348%	0,414%	0,182%	0,265%	0,365%
40 to 50	9,27%						0,547%	0,651%	0,286%	0,417%	0,573%
30 to 40	11,24%							0,789%	0,347%	0,505%	0,694%
20 to 30	13,48%								0,417%	0,606%	0,833%
10 to 20	17,42%									0,783%	1,076%
0 to 10	21,91%										1,354%

No interruption: PC(d) x PR(d) = 0

Example: If in a given time when there is available interruptible capacity, a level of contracting of this capacity occurs in the interval up to 10% (an event which has a probability of occurrence PC(d) = 21.91%), the reduction of interruptible capacity up to 90% cannot have any impact. Only when the level of reduction in the capacity level is in the 90 to 100% range (independent event with probability of occurrence PR(d) = 6.18%) will an interruption occur, with a 1.354% probability. The same interpretation should be made for each contracting interval, but for this purpose the accumulation of probabilities along the intervals of successively reduced capacities should be taken into account.

For each interval of available interruptible capacity, the quociente between the interruptible capacity hypothesis ($CAP_{av.int}$) and contracted interruptible capacity (*CAP*) is the interrupted contracted interruptible capacity. The matrix in Table 4 shows the contracted interruptible capacities likely to be interrupted for each combination of the variables mentioned ($CAP_{av.int}$) and (*CAP*). With the definition of this variable, it will be possible to quantify the amount affected by each expected interruption record, from table 3.

Table 4: Interrupted contracted interruptible capacity for each set of hypothesis of interrupted capacity ($CAP_{av.int}$) and contracted interruptible capaciy (CAP): $CAP_{av.int} / CAP$

		0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100
		Interrupted Capacity (C)									
	Contracted Interruptible Capacity (L)	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
90 to 100	100%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
80 to 90	90%		11%	22%	33%	44%	56%	67%	78%	89%	100%
70 to 80	80%			13%	25%	38%	50%	63%	75%	88%	100%
60 to 70	70%				14%	29%	43%	57%	71%	86%	100%
50 to 60	60%					17%	33%	50%	67%	83%	100%
40 to 50	50%						20%	40%	60%	80%	100%
30 to 40	40%							25%	50%	75%	100%
20 to 30	30%								33%	67%	100%
10 to 20	20%									50%	100%
0 to 10	10%										100%

Example: Each entry in the table results from the application of the following expression: Max.{L+C-100%;0}/L - where "C" and "L" correspond to each value in the "interrupted capacity" column and to each value in the "contracted interruptible capacity" line, respectively. Applying the example described, "C" = 30%, "L" = 80%, and so the contracted interruptible capacity interrupted will be Max.{80%+30%-100%;0}/80% = 13%.

Taking as reference the days where the use of firm capacity increases in renomination processes, the probability of interruption will be obtained through the product of the probability of occurrence of an interruption (CP(d) x PR(d)), from table 3, by the contracted interruptible capacity affected, i.e. interrupted ($CAP_{av.int}/CAP$), referred to the available interruptible capacity (table 4). The result of this operation is shown in table 5.

Table 5: Product beween the probability of occurrence of aninterruption, PC(d) x PR (d) from table 3, by the interrupted contracted interruptible capacity, CAPav,int/CAP

		0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100
		Interrupted capacity									
	interrupted contracted interruptible capacity	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
90 to 100	100%	0,135%	0,215%	0,250%	0,278%	0,286%	0,219%	0,304%	0,153%	0,250%	0,382%
80 to 90	90%		0,087%	0,135%	0,168%	0,185%	0,147%	0,210%	0,108%	0,180%	0,278%
70 to 80	80%			0,052%	0,087%	0,107%	0,091%	0,136%	0,072%	0,122%	0,191%
60 to 70	70%				0,113%	0,186%	0,178%	0,282%	0,155%	0,271%	0,434%
50 to 60	60%					0,091%	0,116%	0,207%	0,122%	0,221%	0,365%
40 to 50	50%						0,109%	0,260%	0,172%	0,333%	0,573%
30 to 40	40%							0,197%	0,174%	0,379%	0,694%
20 to 30	30%								0,139%	0,404%	0,833%
10 to 20	20%									0,391%	1,076%
0 to 10	10%										1,354%
							Σ [PC(d) x PR(d) x $CAP_{av.int}$/ CAP] =				14,655%

By applying the sum to the set of probability distributions calculated in the matrix in Table 5, it is possible to calculate the probability of interruption, considering the days of increases in firm capacity in renomination processes as a reference. Since the probabilities calculated so far were determined in the scope of the ratio of available firm capacity increases in renomination processes, R, it is necessary to transpose this reality to the referential of the period considered in the study, applying the last term of equation (3). The value calculated for R for the period under consideration is 48.77%, resulting in a calculated PRO of

$$PRO = \Sigma \left[PC(d)xPR(d) \times \frac{CAP_{av.int}}{CAP}\right] xR = \mathbf{7,147}\%,$$

This shall be the probability of interruption to be considered, applied equally to both directions.

4 Analysis for the high-pressure network/LNG Terminal connection

4.1 Types of standard capacity products for interruptible capacity

According to Manual de Procedimentos de Acesso às Infraestruturas do setor do gás natural, published in Diretiva nº 07/2020, Procedure nº 4 establishes that the transmission system operator shall offer standard capacity products for interruptible capacity for:

- within-day interruptible capacity on regaseification, in case all firm capacity, including additional capacity eventually offered, has been sold-out, to be confirmed through a renomination mechanism.

These products shall be offered according to the same rules that apply to VIP Ibérico, as defined in Regulation (EU) 2017/459, establishing capacity allocation mechanisms in gas system networks, applied to the regaseification capacity.

4.2 Historical use of capacities

For the biennium in analysis, the connection point between the high-pressure network and the LNG Terminal registered no interruption of capacity due to physical constraints.

The following table (table 6) shows the levels of both contracting and ustilisation of contracted firm capacities for the biennial periods from october'16 through september'20.

Table 6: Contracting capacities and utilisation of contracted capacity levels referred to firm capacities – Regasification

Biennium	*% Contract*	*% Utilisation*
2016-17 and 2017-18	55,86%	92,09%
2017-18 and 2018-19	74,61%	89,29%
2018-19 and 2019-20	94,65%	87,06%

It is observed that the 2018-2020 biennium reached the highest levels of contracting, prone to higher dynamics of renomination compatible with the assumptions of statistical significance of the methodology in application. Therefore, the period between October 2018 and September 2020 is considered the relevant historical period that best characterises the expected occurrence of standard capacity products for interruptible capacity for the 2021-2022 gas year. The following graphs (Figure 7 and 8) show the levels of contracting and utilisation of regasification capacity in the period from October 2018 to September 2020. Throughout this period, it can be seen from figures 7 and 8 that regasification capacity utilisation is high, with an increase from gas year 2018/2019 to gas year 2019/2020. The utilisation rate of regasification capacity is due to the interest of the market agents in supplying their customers through LNG.

This interest has been increasing over the period considered, with the market successively contracting more capacity for longer periods, culminating in the sale of all capacity for gas year 2019/2020 at the annual capacity auction. Demand for regasification capacity results in 89% of the announced technical capacity being contracted in gas year 2018/2019, with this figure reaching 100% in gas year 2019/2020. As for utilisation, it represented 90% of contracted capacity, 80% of technical capacity, in 2018/2019, falling to 84% of contracted capacity in 2019/2020, which still, and in view of the increase in contracted capacity, represents 84% of technical capacity. It is also worth mention that in 15% of the period in analysis, capacity utilisation equalled the contracted capacity, and in 41% of these events, there was no more available capacity, meaning that the regasification capacity available for market use was completely exhausted. Thus, and considering the behaviour explained in the use of regasification capacity, it is considered that there are favourable conditions for the occurrence of capacity interruption due to congestion.

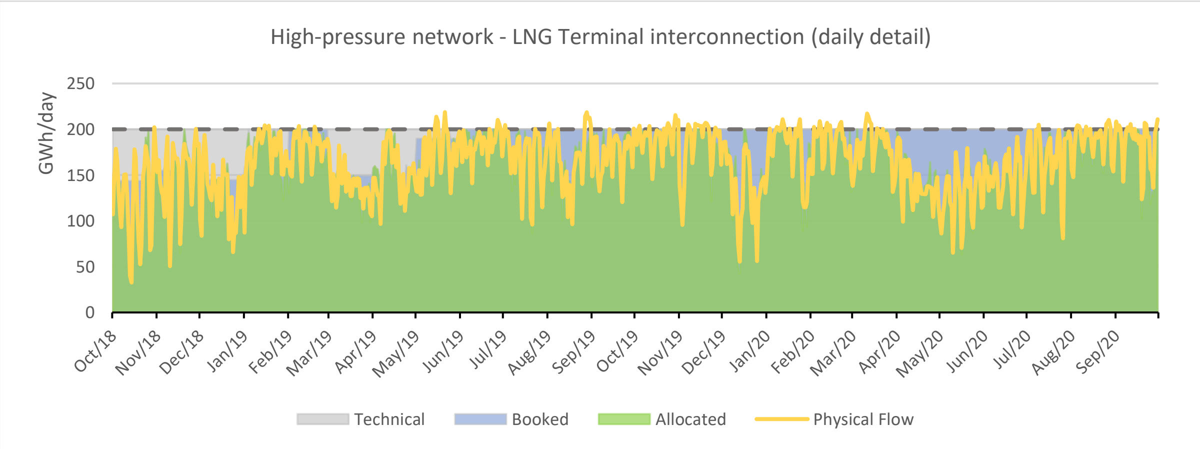

Figure 7: Capacity utilisation in the period

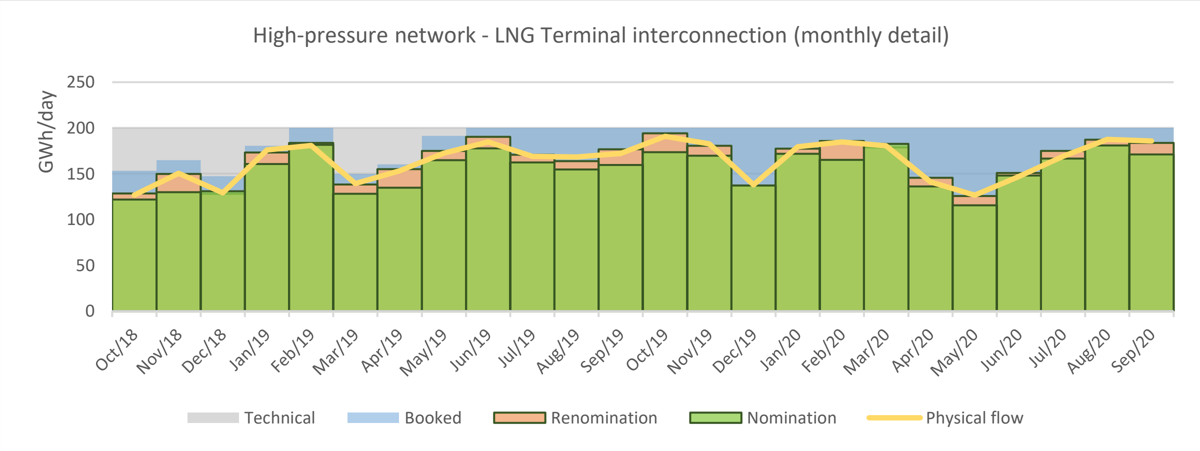

Figure 8: Capacity monthly average utilisation in the period. Renomination quantities above nominations displayed in orange.

For the above mentioned, the period from October 2018 to September 2020 is considered to be of historic relevance, that best characterises the expected occurrence of interruption of standard capacity products for interruptible capacity for gas year 2021-2022.

4.3 Calculation of probability of interruption for 2021 / 2022

By analysing the history of increases in capacity utilisation of the renomination processes, it was possible to determine the frequency of interruptible capacity reduction experienced, determining the distribution of this capacity reduction, PR(d), expected on gas day d, as shown in figure 9.

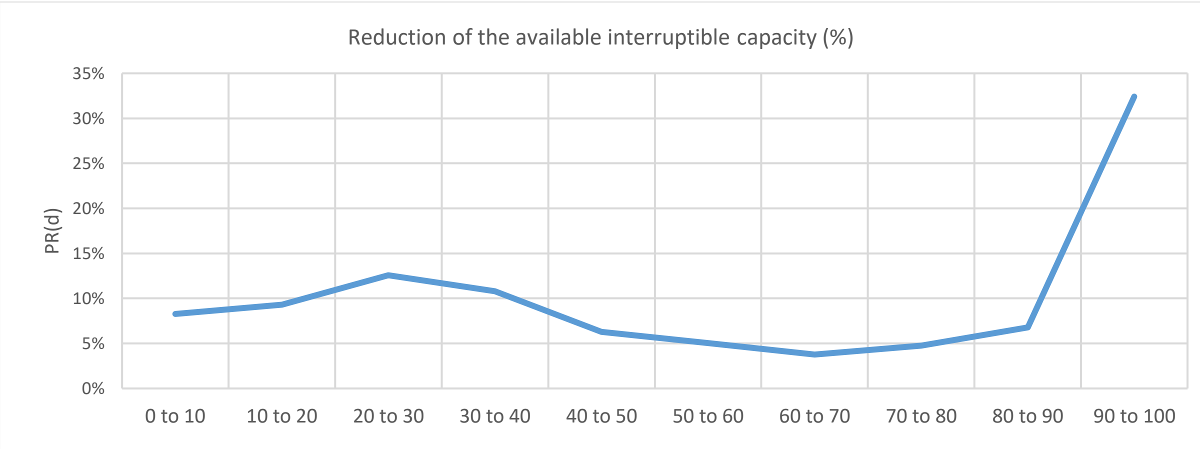

Figura 9: Reduction of interruptible capacity expected for each gas day PR(d)

As already mentioned in 2.1.2, it is assumed that the probability of contracting interruptible capacity, PC(d), presents the same distribution as the reduction in available interruptible capacity, determined for PR(d), with the former competing with the latter in the reduction of this capacity, but in opposite directions.

The expected number of interruptions for each set of interruptible capacity reduction hypothesis by contracting, PC(d), and by renomination, PR(d), for each available interruptible capacity interval, is shown in the matrix in Table 7, by multiplying the second by the third term of equation (3).

Table 7: Interruptions expected for each set of hypothesis of reduction of interruptible capacity, contracted, PC(d), and renominated, PR(d)

		0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100
		PR(d)									
	PC(d)	8,29%	9,30%	12,56%	10,80%	6,28%	5,03%	3,77%	4,77%	6,78%	32,41%
90 to 100	32,41%	2,687%	3,013%	4,072%	3,502%	2,036%	1,629%	1,222%	1,547%	2,199%	10,505%
80 to 90	6,78%		0,631%	0,852%	0,733%	0,426%	0,341%	0,256%	0,324%	0,460%	2,199%
70 to 80	4,77%			0,600%	0,516%	0,300%	0,240%	0,180%	0,228%	0,324%	1,547%
60 to 70	3,77%				0,407%	0,237%	0,189%	0,142%	0,180%	0,256%	1,222%
50 to 60	5,03%					0,316%	0,253%	0,189%	0,240%	0,341%	1,629%
40 to 50	6,28%						0,316%	0,237%	0,300%	0,426%	2,036%
30 to 40	10,80%							0,407%	0,516%	0,733%	3,502%
20 to 30	12,56%								0,600%	0,852%	4,072%
10 to 20	9,30%									0,631%	3,013%
0 to 10	8,29%										2,687%

No interruption:
PC(d) x PR(d) = 0

Example: if in a given time when there is interruptible capacity available, a level of contracting of this capacity occurs in the interval of up to 10% (an event which has a probability of occurrence PC(d) = 8.29%), the reduction of interruptible capacity up to 90% cannot have any impact. Only when the level of reduction in the capacity level is in the 90 to 100% range (independent event with probability of occurrence PR(d) = 32.41%) will an interruption occur, with a 2.687% probability. The same interpretation should be made for each contracting interval, but for this purpose, the accumulation of probabilities along the intervals of successively reduced capacities should be taken into account.

For each interval of available interruptible capacity, the quociente between the interruptible capacity hypothesis ($CAP_{av.int}$) and contracted interruptible capacity (CAP) is the interrupted contracted interruptible capacity. The matrix in Table 8 shows the contracted interruptible capacities likely to be interrupted for each combination of the variables mentioned, $CAP_{av.int}$ and CAP. With the definition of this variable, it will be possible to quantify the quantity affected by each expected interruption record, from table 7.

Table 8: Interruption of contracted interruptible capacity for each set of hypothesis of interrupted capacity ($CAP_{av.int}$) and contracted interruptible capacity (CAP): $CAP_{av.int} / CAP$.

		0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100
		Interrupted Capacity (C)									
	contracted interruptible capacity (L)	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
90 to 100	100%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
80 to 90	90%		11%	22%	33%	44%	56%	67%	78%	89%	100%
70 to 80	80%			13%	25%	38%	50%	63%	75%	88%	100%
60 to 70	70%				14%	29%	43%	57%	71%	86%	100%
50 to 60	60%					17%	33%	50%	67%	83%	100%
40 to 50	50%						20%	40%	60%	80%	100%
30 to 40	40%							25%	50%	75%	100%
20 to 30	30%								33%	67%	100%
10 to 20	20%									50%	100%
0 to 10	10%										100%

Exemplo: Each entry in the table results from the application of the following expression: Max.{L+C-100%;0}/L - where "C" and "L" correspond to each value in the "interrupted capacity" column and to each value in the "contracted interruptible capacity" line, respectively. Applying the example described, "C" = 30%, "L" = 80%, and so the contracted interruptible capacity interrupted will be Max.{80%+30%-100%;0}/80% = 13%.

Considering as reference the days where the use of firm capacity increases in renomination processes, the probability of interruption will be obtained through the product of the probability of the occurrence of an interruption (PC(d) x PR(d)), from table 7, by the contracted interruptible capacity affected, i.e., interrupted ($CAP_{av.int} / CAP$), against the available interruptible capacity (table 8). The result of this operation is shown in table 9.

Table 9: Product between the probability of occurrence of an interruption, PC(d) x PR (d) in table 7, by the interrupted contracted interruptible capacity, CAPav.int/CAP

		0 to 10	10 to 20	20 to 30	30 to 40	40 to 50	50 to 60	60 to 70	70 to 80	80 to 90	90 to 100
		Interrupted Capacity									
	Interrupted contracted interruptible capacity	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
90 to 100	100%	0,269%	0,603%	1,222%	1,401%	1,018%	0,977%	0,855%	1,238%	1,979%	10,505%
80 to 90	90%		0,070%	0,189%	0,244%	0,189%	0,189%	0,170%	0,252%	0,409%	2,199%
70 to 80	80%			0,075%	0,129%	0,112%	0,120%	0,112%	0,171%	0,283%	1,547%
60 to 70	70%				0,058%	0,068%	0,081%	0,081%	0,129%	0,219%	1,222%
50 to 60	60%					0,053%	0,084%	0,095%	0,160%	0,284%	1,629%
40 to 50	50%						0,063%	0,095%	0,180%	0,341%	2,036%
30 to 40	40%							0,102%	0,258%	0,550%	3,502%
20 to 30	30%								0,200%	0,568%	4,072%
10 to 20	20%									0,315%	3,013%
0 to 10	10%										2,687%
							Σ [PC(d) x PR(d) x $CAP_{av.int}$/ CAP] =				48,6726%

By applying the sum to the set of probability distributions calculated in the matrix in Table 9, it is possible to calculate the probability of interruption, considering the days of increases in firm capacity in renomination processes as a reference. Since the probabilities calculated so far were determined in the scope of the ratio of firm capacity increases in renomination processes, R, it is necessary to transpose this reality to the referential of the period considered in the study, applying the last term of equation (3). The value calculated for R for the period under consideration is 54.45%, resulting in a calculated PRO of:

$$PRO = \Sigma \left[PC(d)xPR(d) \times \frac{CAP_{av.int}}{CAP}\right] xR = \mathbf{26,5002}\%,$$

This shall be the probability of interruption to be considered, which reflects the more recente behaviour of network users.

5 Conclusions

Having in mind the application of an ex-ante discount when determining tariffs for interruptible capacity in the 2021-2022 gas year, the transmission system operator submits a reasoned proposal for the parameters set out in the Tariff Regulations for the gas sector. These parameters are: (i) the probability of interruption of interruptible capacity (Pro); and (ii) adjustment factor to the estimated economic value of the type of product (A).

In the study regarding the determination of the probability, a common methodology was applied both to VIP Ibérico and to the High-pressure network and LNG Terminal interconnection. This option is based on the fact that, in both cases, the offer of interruptible capacity and the respective interruption results from the nomination behaviour and subsequent renomination, regarding the specificities in the use of the infrastructures in each point. This approach incorporates quantitative elements of the use of the respective points in relevant history in the most recent regulatory periods, considering for this purpose the biennium with the highest level of contracting.

For factor 'A' it was considered appropriate to apply a unit value (A=1) to each of the standard standard capacity products for interruptible capacity at any of the interconnection points concerned, and considering there is a neutral variation in the economic value of each product against the respective probability values determined by the methodology.

The following table shows the transmission system operator's proposal for these parameters:

Connection Point	Product	Pro	A
VIP Ibérico	Daily Within-day	7,15 %	1
HP network / LNG Terminal	Within-day	26,50 %	1