

# SHORT TERM OPERATING RESERVE

## ANNUAL MARKET REPORT 2016/17

### Summary

This Annual Market Report summarises the tenth year (1<sup>st</sup> April 2016 to 31<sup>st</sup> March 2017) of the Short Term Operating Reserve (STOR) service. Information on STOR capacity, pricing, availability and utilisation is presented. The key points are:

- Up to 4068MW was contracted for a single season and a maximum of 2677MW Committed, 1034MW Flexible, and 585MW Premium Flexible at points across the year.
- Average contracted prices were £4.25/MW/h for Availability and £150.57/MWh for Utilisation. Removing for long-term STOR this was £3.25/MW/h and £142.28/MWh respectively.
- Total availability payments amounted to £53.6m.
- A total of 220GWh was utilised from STOR units costing £22.3m.
- Total STOR expenditure in 2016/17 was £75.9m.
- Links to further sources information on STOR can be found in Section 8 of this report.
- This report refers to STOR year 10 (2016/17). We are now part way through STOR year 11 (2017/18). Current contracted MW's, average accepted availability and utilisation prices can be found in the STOR TR33 Market Information Report.

#### **Disclaimer of liability**

The information contained or referred to in this market report and all other information relating to Short Term Operating Reserve which is provided by National Grid at any time whether before or after the date of publication of this market report is provided in good faith. Although National Grid makes reasonable efforts to ensure the accuracy and integrity of such information, no warranty or representation or other obligation or commitment of any kind is given by National Grid, its employees or advisors as to the accuracy, completeness, timeliness or fitness for any purpose of any such information. Neither National Grid nor its employees or advisors shall be under any liability for any error nor misstatement contained in this market report and will not be liable for any loss caused as a result of the reader doing or not doing anything as a result of reading this market report or any part of it.

#### **Copyright**

Any and all copyright and all other intellectual property rights contained in this document belong to National Grid. To the extent that you re-use the document, in its original form and without making any modifications or adaptations thereto, you must reproduce, clearly and prominently, the following copyright statement in your own documentation:

© National Grid plc, all rights reserved.

## 1. Introduction

At certain times of the day, National Grid may need access to sources of extra power to help manage actual demand on the system being different than forecast or unforeseen generation unavailability. As a result, National Grid will procure STOR either in the form of increased generation or demand reduction that is non-synchronised and manually instructed. This report covers the tenth year (Y10) of STOR from 1<sup>st</sup> April 2016 to 31<sup>st</sup> March 2017.

As the requirement for STOR varies by time of year, week, and day, National Grid will procure STOR on a seasonal basis. The STOR year is divided into six Seasons of varying lengths with the time the service is needed in each season varying on the time of year. The STOR Seasons are often expressed in the form of 'Year.Season' for example '10.2' refers to Year 10 Season 2. The times during the day in which STOR is required are known as Windows. There are normally two, up to three, Windows a day. The Window times vary by Season and day type - Working Day (WD) and Non Working Day (NWD). Providers can also make themselves available outside of these Windows referred to as Optional Windows (OW). The Windows for Y10 is given in Appendix A.

STOR is procured through Tender Rounds (TR), typically three a year. The tendered period can be for any Season up to two financial years ahead set at the first TR that year. Each TR is given an independent number designation for example 'TR28' is Tender Round 28.

STOR Services can take the form of a Committed (C), Flexible (F), or Premium Flexible (PF) service. More details on these types can be found in the General Description of STOR, as found in Sections 8 of this report. Providers are paid an Availability fee when available within the contracted Window and a Utilisation fee for energy delivered following an instruction ("Call-off"). These fees are tendered parameters.

Any feedback on this report is welcome and should be directed to [commercial.operation@nationalgrid.com](mailto:commercial.operation@nationalgrid.com) or through your Account Manager.

## 2. Tender Information for 2016/17

Figure 1 illustrates the proportion of STOR Providers by size<sup>1</sup> and response time across all Seasons. There are minor differences between the Seasons. Note that size is not specifically assessed during the tender as benefits are compared on a per MW basis, but is a consideration in meeting the volume requirement.

The charts show that around 67.1% of units are between 3-10MW and 59.7% can deliver their contracted level within ten minutes of instruction.

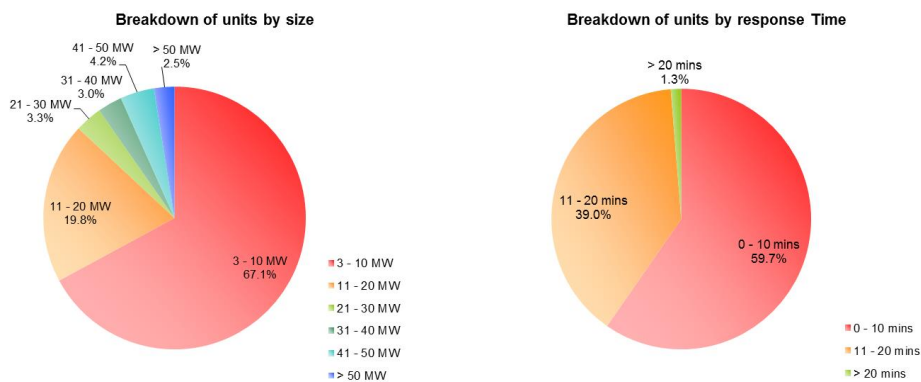


Figure 1: Breakdown of STOR Provider parameters by size and response time

<sup>1</sup> For aggregators using multiple sub sites for the provision of a single contract, the contract is used to denote the unit size

**Table 1: STOR Tendered capacity, Availability price, and Utilisation price Y10**

Season		10.1			10.2			10.3			10.4			10.5			10.6			
Type of Service		C	F	PF	C	F	PF	C	F	PF	C	F	PF	C	F	PF	C	F	PF	
MW	Tender Round																			
	TR11	Accepted	116	-	-	116	-	-	116	-	-	116	-	-	116	-	-	116	-	-
		Tendered	540	-	-	536	-	-	538	-	-	540	-	-	542	-	-	542	-	-
	TR12	Accepted	273	-	-	271	-	-	272	-	-	273	-	-	274	-	-	274	-	-
		Tendered	860	-	-	854	-	-	857	-	-	860	-	-	863	-	-	863	-	-
	TR25	Accepted	294	3	-	268	3	-	270	3	-	148	3	-	120	104	-	120	84	-
		Tendered	2,603	3	260	2,593	3	254	2,606	3	254	2,759	3	260	1,787	174	592	1,781	144	624
	TR26	Accepted	1,098	46	106	1,095	40	95	1,093	40	95	1,219	54	95	751	71	554	750	71	554
		Tendered	1,718	46	277	1,707	40	266	1,705	40	266	1,839	54	266	960	71	737	959	71	737
	TR27	Accepted	508	-	5	497	-	5	502	-	5	450	-	5	352	-	31	347	-	31
		Tendered	1,068	-	5	1,081	-	5	1,067	-	5	1,023	-	5	352	5	31	347	5	31
	TR28	Accepted	226	120	28	226	166	28	187	65	-	330	65	-	323	220	-	323	220	-
		Tendered	692	120	57	784	166	57	822	65	15	1,019	65	15	1,149	220	93	1,149	220	93
	TR29	Accepted	-	-	-	-	-	-	87	266	28	141	282	43	94	178	-	94	218	-
		Tendered	-	-	-	-	-	-	183	266	28	241	290	82	799	178	-	799	218	-
	TR30	Accepted	-	-	-	-	-	-	-	-	-	-	-	-	425	411	-	425	441	-
		Tendered	-	-	-	-	-	-	-	-	-	-	-	-	736	425	-	736	455	-
		Accepted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Tendered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Accepted MW for season		2,515	169	139	2,473	209	128	2,527	374	128	2,677	404	143	2,455	984	585	2,449	1,034	585
Total Accepted MW		2823			2810			3029			3224			4024			4068			
Availability Price (average £/MWh)*	Tender Round																			
	TR11	Accepted	11.00	-	-	11.00	-	-	11.00	-	-	11.00	-	-	11.00	-	-	11.00	-	-
		Tendered	17.53	-	-	17.49	-	-	17.51	-	-	17.53	-	-	17.55	-	-	17.55	-	-
	TR12	Accepted	11.51	-	-	11.51	-	-	11.51	-	-	11.51	-	-	11.52	-	-	11.52	-	-
		Tendered	12.03	-	-	12.02	-	-	12.02	-	-	12.03	-	-	12.03	-	-	12.03	-	-
	TR25	Accepted	1.86	0.50	-	1.87	0.50	-	1.89	0.50	-	1.83	0.50	-	1.79	0.78	-	1.79	0.73	-
		Tendered	3.77	0.50	3.58	3.78	0.50	3.59	3.79	0.50	3.59	4.81	0.50	3.58	5.82	1.15	2.88	5.82	1.66	2.82
	TR26	Accepted	1.52	1.91	0.84	1.52	1.95	0.84	1.52	1.95	0.84	1.54	1.91	0.84	2.85	2.12	0.98	2.85	2.12	0.98
		Tendered	2.16	1.91	1.41	2.16	1.95	1.43	2.17	1.95	1.43	2.39	1.91	1.43	3.25	2.12	1.20	3.25	2.12	1.20
	TR27	Accepted	4.05	-	1.17	4.01	-	1.17	4.03	-	1.17	4.27	-	1.17	5.95	-	0.71	5.94	-	0.71
		Tendered	3.33	-	1.17	3.30	-	1.17	3.40	-	1.17	3.46	-	1.17	5.95	5.50	0.71	5.94	5.50	0.71
	TR28	Accepted	2.07	0.40	0.50	2.07	0.42	0.50	2.80	1.16	-	5.45	1.16	-	8.22	4.74	-	8.22	4.74	-
		Tendered	3.04	0.40	0.83	3.04	0.42	0.83	3.27	1.16	1.29	3.95	1.16	1.29	15.83	4.74	4.37	15.83	4.74	4.37
	TR29	Accepted	-	-	-	-	-	-	5.01	0.01	0.50	3.57	0.01	0.38	10.13	6.98	-	10.13	7.27	-
		Tendered	-	-	-	-	-	-	5.45	0.01	0.50	4.56	0.07	2.55	17.36	6.98	-	17.36	7.27	-
	TR30	Accepted	-	-	-	-	-	-	-	-	-	-	-	-	20.12	0.15	-	20.12	0.14	-
		Tendered	-	-	-	-	-	-	-	-	-	-	-	-	19.94	0.52	-	19.94	0.48	-
		Accepted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Tendered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	*Average Accepted Availability Price per Season £/MWh/h		3.33			3.30			3.26			3.45			6.10			6.09		
Utilisation Price (average £/MWh)*	Tender Round																			
	TR11	Accepted	224	-	-	224	-	-	224	-	-	224	-	-	224	-	-	224	-	-
		Tendered	195	-	-	193	-	-	195	-	-	195	-	-	197	-	-	198	-	-
	TR12	Accepted	206	-	-	206	-	-	206	-	-	206	-	-	206	-	-	206	-	-
		Tendered	217	-	-	217	-	-	217	-	-	217	-	-	217	-	-	217	-	-
	TR25	Accepted	199	91	-	205	91	-	205	91	-	193	91	-	203	123	-	203	119	-
		Tendered	166	91	113	165	91	113	165	91	114	166	91	113	178	125	123	178	131	122
	TR26	Accepted	163	91	108	163	93	109	163	93	109	170	90	109	187	114	116	187	114	116
		Tendered	164	91	144	164	93	146	164	93	146	169	90	146	187	114	127	187	114	127
	TR27	Accepted	131	-	83	131	-	83	131	-	83	133	-	83	166	-	90	166	-	90
		Tendered	139	-	83	137	-	83	138	-	83	139	-	83	166	175	90	166	175	90
	TR28	Accepted	97	76	90	97	76	90	99	84	-	129	84	-	158	86	-	158	86	-
		Tendered	129	76	96	131	76	96	128	84	92	133	84	92	145	86	132	145	86	132
	TR29	Accepted	-	-	-	-	-	-	98	71	90	103	71	153	132	87	-	132	85	-
		Tendered	-	-	-	-	-	-	133	71	90	128	73	111	156	87	-	156	85	-
	TR30	Accepted	-	-	-	-	-	-	-	-	-	-	-	-	173	73	-	173	72	-
		Tendered	-	-	-	-	-	-	-	-	-	-	-	-	228	77	-	228	76	-
		Accepted	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Tendered	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	*Average Accepted Utilisation Price per Season £/MWh		154.50			153.71			148.86			149.90			149.02			147.43		

\*Average prices are weighted by MW and hours tendered. Committed(C), Flexible(F), Premium Flexible(PF). PF tenders accepted as F is shown as F, and not included in PF Tendered volume

Table 1 summarises all the tenders received for Y10 delivery by TR in terms of tendered capability, Availability prices and Utilisation prices. Note that contracts agreed during TR11 and 12 were long-term STOR contracts, which were for 15 years in length out to March 2025. The opportunity for which was subsequently discontinued hence the gap between TR12 and TR25.

### 3. Availability and Utilisation

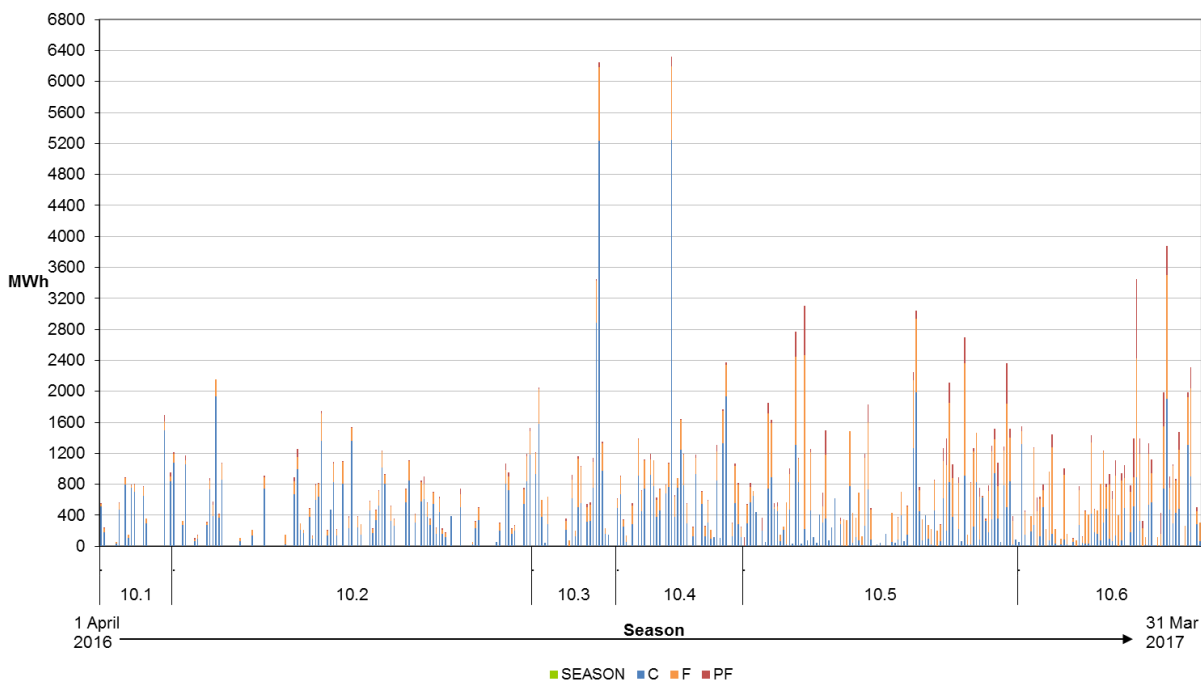
Table 2 shows the total availability and utilisation expenditure by season. The total availability payments made in Y10 was £53.6m & total utilisation payments were £22.3m.

**Table 2: Outturn availability, utilisation, and expenditure by Season**

		Season					
		10.1	10.2	10.3	10.4	10.5	10.6
No. days on which STOR was utilised:		12	68	19	35	85	56
Total availability expenditure (£m)	C	2.0	11.5	2.8	4.4	19.4	13.0
	F	0.0	0.0	0.0	0.0	0.1	0.1
	PF	0.0	0.0	0.0	0.0	0.2	0.1
Total utilisation (GWh)	C	6.9	32.6	16.0	24.1	28.4	15.9
	F	0.8	8.6	5.6	9.1	31.6	26.7
	PF	0.2	1.1	0.4	0.6	5.7	5.7
Total utilisation expenditure (£m)	C	0.7	3.1	1.9	2.7	4.3	2.4
	F	0.1	0.6	0.4	0.6	2.3	1.9
	PF	0.0	0.1	0.0	0.1	0.7	0.6

Figure 2 is a stacked timeline chart that shows when STOR was utilised and the daily energy provided. STOR was used on 275 days with a daily mean utilisation of 800MWh. The total energy provided in Y10 inclusive of the Optional Window is 220GWh at a cost of £22.3m. This is equivalent to £101.4/MWh. For comparison, the average non-long-term STOR contracted Utilisation price is £142.3/MWh.

**Daily STOR utilisation in Y10**



**Figure 2: Daily STOR utilisation in Y10**

### 4. Utilisation by Season and Price

Figure 3 plots utilisation volume per Season hour, excluding OW, to allow direct comparison between Seasons of varying lengths. Figure 4 shows the total STOR utilisation by price bins and STOR Window. The number of units contracted and the capacity by Utilisation price is given in Table 3. These figures are different to Table 1 and Figure 1, as Table 3 shows what was contracted after terminations and MW reductions. The contracted MW for the £150.01 – 175.00 bin contains the largest volume of MW, particularly in Seasons 5 & 6 when STOR was called upon frequently.

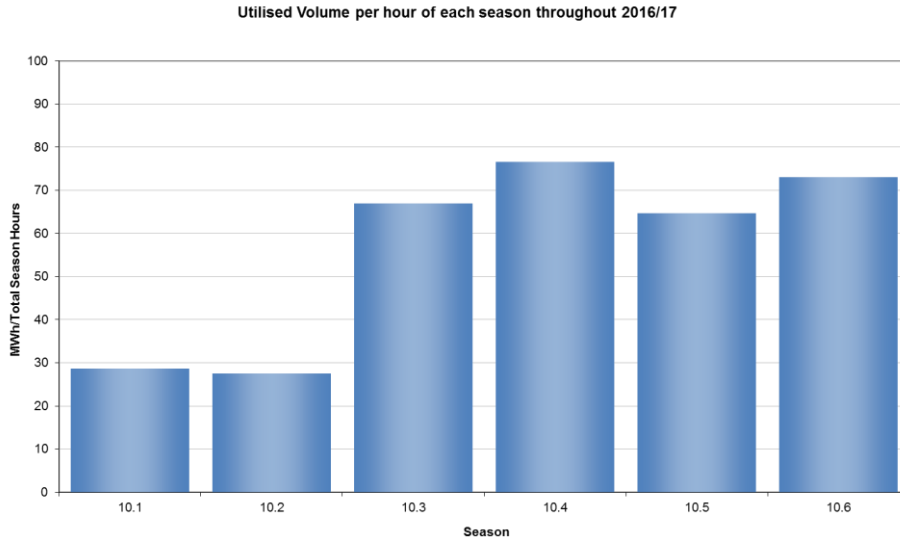


Figure 3: Total STOR utilisation per Season hour

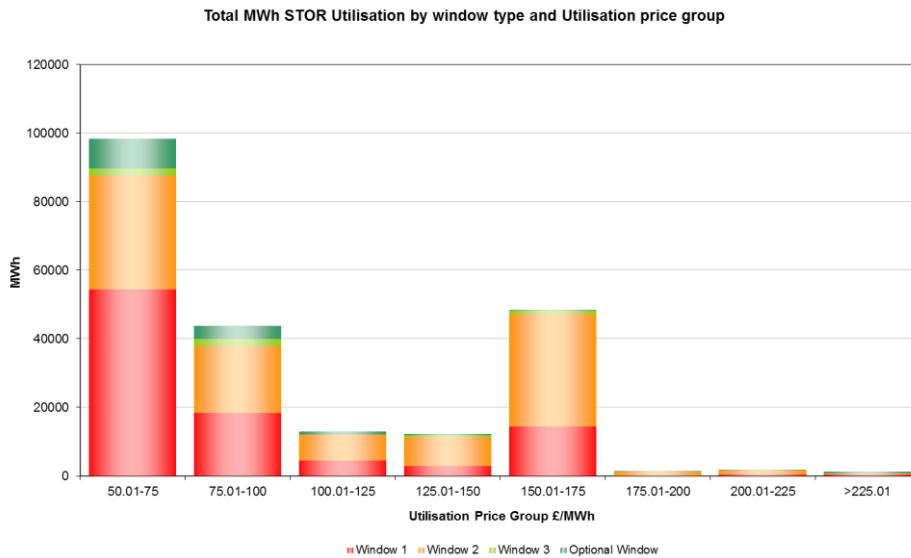


Figure 4: Total STOR utilisation by Utilisation Price

Table 3: Contracted number of units and capacity by Utilisation price bins

Utilisation price group £/MWh	Season											
	10.1		10.2		10.3		10.4		10.5		10.6	
	Units	MW	Units	MW	Units	MW	Units	MW	Units	MW	Units	MW
£50.01-75	20	148	24	189	50	390	54	406	76	462	90	552
£75.01-100	67	554	66	508	47	463	47	466	39	521	38	501
£100.01-125	11	101	10	90	17	159	17	161	19	356	19	356
£125.01-150	40	553	39	535	38	533	38	539	24	217	23	210
£150.01-175	7	357	7	348	4	340	5	480	19	1129	18	1099
£175.01-200	8	152	8	150	10	157	12	175	18	247	18	247
£200.01-225	23	549	23	547	23	549	23	555	30	620	30	619
>£225.01	12	290	12	290	12	290	12	293	6	93	6	93

### 5. Utilisation by Location

There are occasions in which particular STOR units are utilised with consideration of its geographic location along with its submitted prices, for example when there are transmission constraints. Figure 5 shows the aggregate utilisation for each season by unit location. Note that Multiple refers to aggregated units containing sub-units from various geographic locations.

Total STOR Utilisation per Season by Location

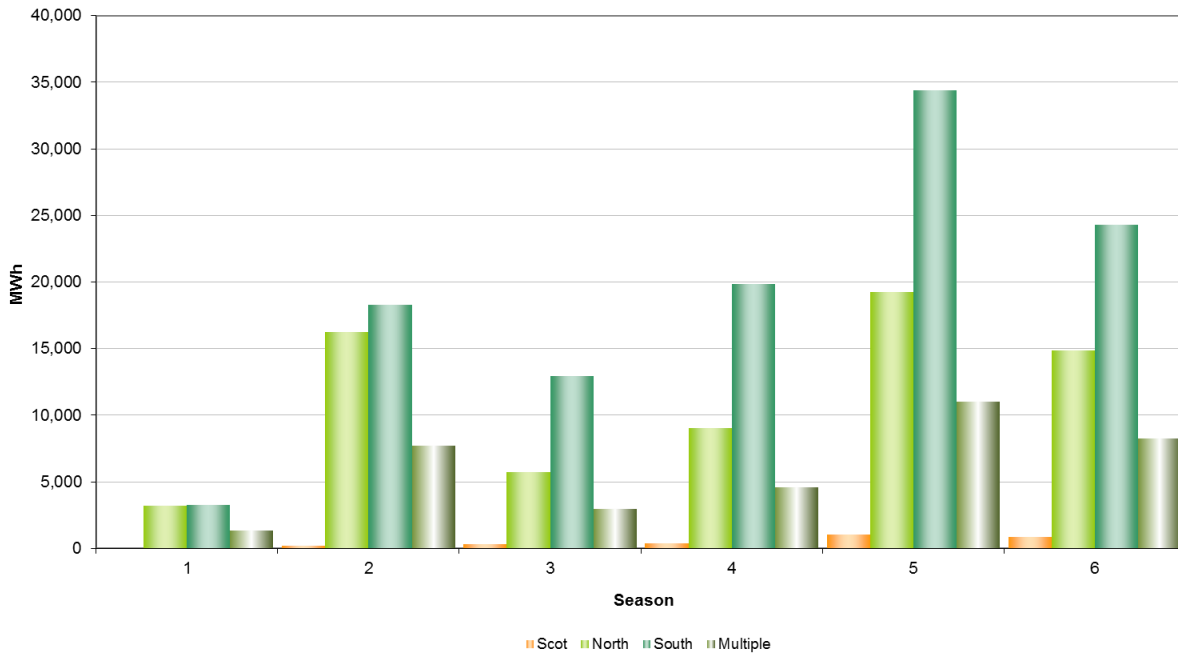


Figure 5: Total STOR energy utilisation per season by location

Table 4 gives additional information by locations including the number of units, capacity and hours utilised. Again, Table 4 shows the position after terminations and contract reductions.

Table 4: Number of units, capacity, hours and energy utilised by location

Unit Location	Season											
	10.1				10.2				10.3			
	No. of units	Total MW	Total Util. Hours	Total Util. MWh	No. of units	Total MW	Total Util. Hours	Total Util. MWh	No. of units	Total MW	Total Util. Hours	Total Util. MWh
Scotland	1	40	-	-	1	40	5	182	1	40	8	338
North	53	951	320	3,189	51	922	1,675	16,211	51	926	554	5,735
South	75	1,322	351	3,264	78	1,304	2,532	18,277	85	1,508	1,353	12,961
Multiple	59	391	194	1,353	59	391	1,327	7,679	64	407	678	2,948

Unit Location	Season											
	10.4				10.5				10.6			
	No. of units	Total MW	Total Util. Hours	Total Util. MWh	No. of units	Total MW	Total Util. Hours	Total Util. MWh	No. of units	Total MW	Total Util. Hours	Total Util. MWh
Scotland	1	40	10	403	2	65	29	1,040	2	65	24	850
North	55	948	816	9,002	66	1,531	1,380	19,258	78	1,581	1,359	14,845
South	86	1,665	1,949	19,868	99	1,594	2,829	34,388	99	1,583	2,285	24,268
Multiple	66	422	953	4,595	64	455	1,946	10,999	63	448	1,313	8,240

### 6. Utilisation by Day Type

Figure 6 depicts the total STOR utilisation, including for the Optional Window, for each day of the week. Note that as Seasons are of differing lengths, this is reflected in the height of some of the curves. The Season lengths are given in Appendix A.

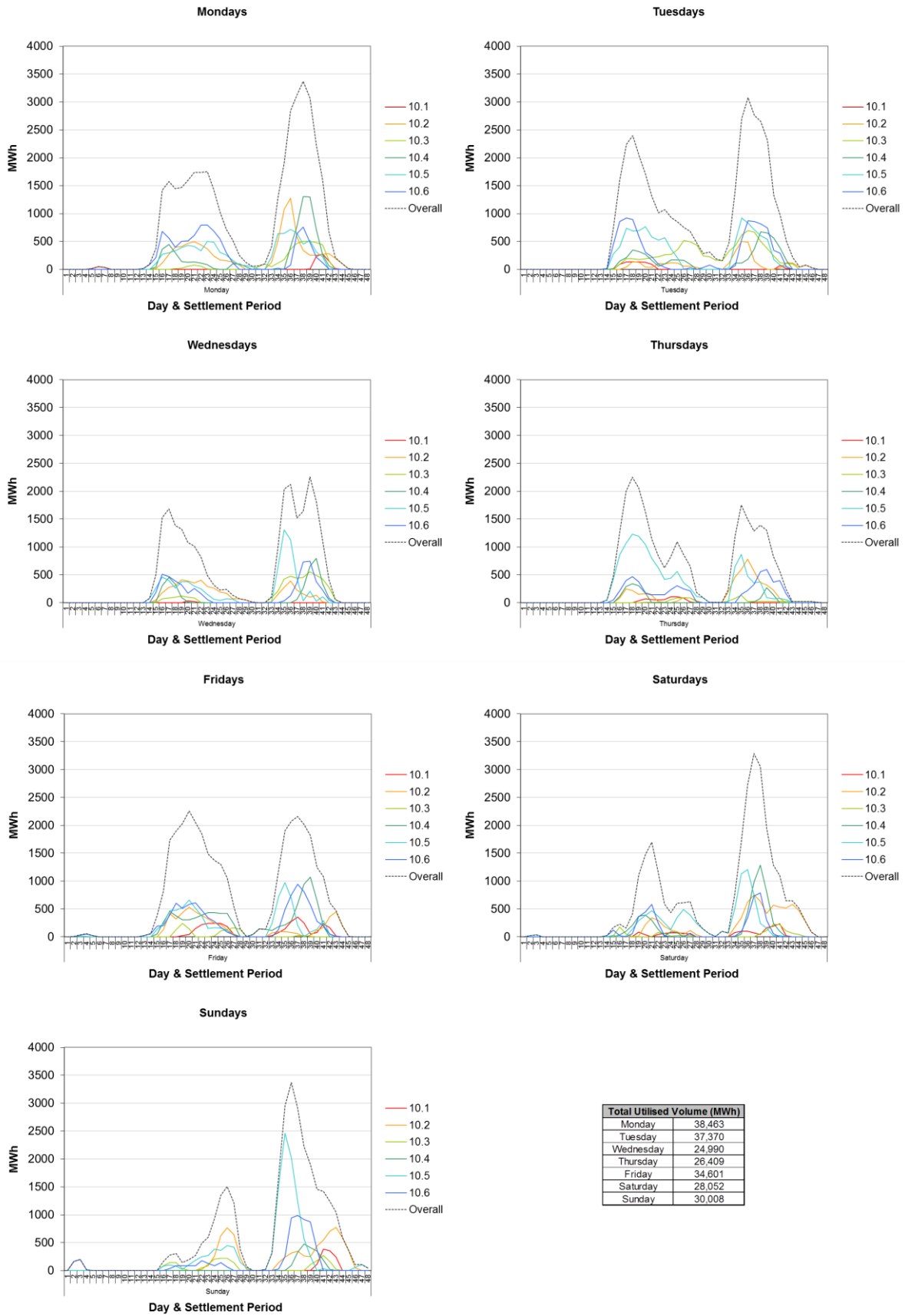


Figure 6: Total utilised energy for each day of the week

## 7. Frequency of Call-offs

The duration profile of Call-offs is given in Figure 7. It shows that around 90% of instructions last for at least thirty minutes. The average call-off duration is approximately 100 minutes. Season 3 had several long STOR instructions which in the context of all instructions in year 10, these are considered low probability events. It should also be noted that Season 3 had the second lowest utilisation; therefore longer instructions will have a more pronounced impact on the curve.

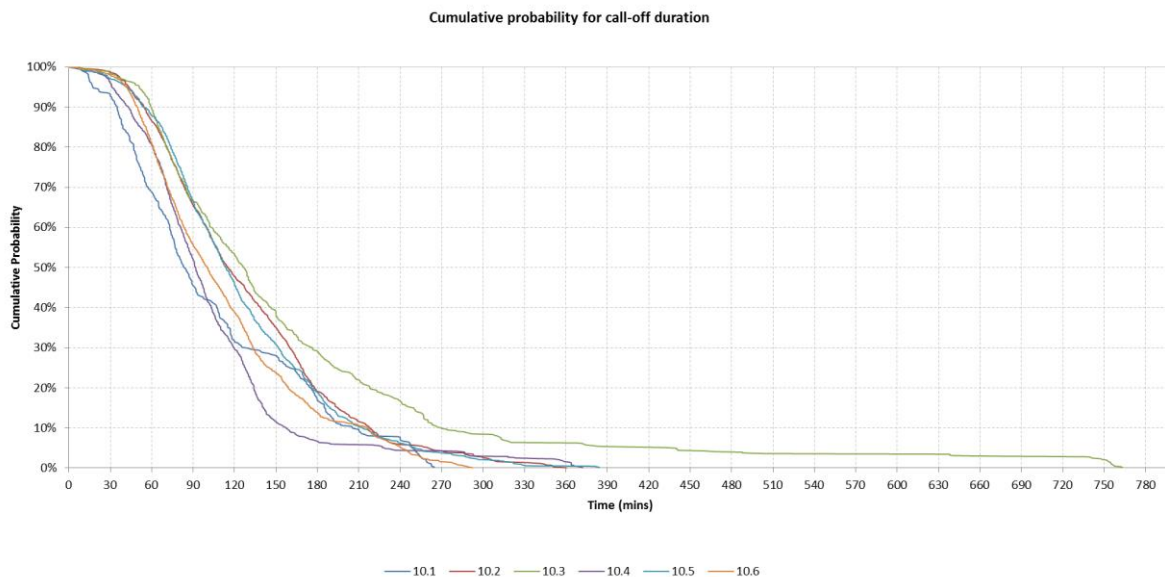


Figure 7: Duration curves showing the percentage of Call-offs and length of utilisation

## 8. Further Information

STOR: General Description of the Service	<a href="#">STOR General Description of the Service</a>
Tender Assessment Principles	<a href="#">STOR Tenders Assessment Principles</a>
Procurement Guidelines Report	<a href="#">Balancing Services Procurement Guidelines</a>
Previous STOR Annual	<a href="#">Year 8 Report</a> <a href="#">Year 8 Data</a>
Market Reports	<a href="#">TR33 Report</a> <a href="#">TR33 Data</a>



## Appendix A

## STOR windows for Year 10 (2016/17)

Year 10 Seasons - 2016/17							
Season	Dates	WD		NWD		Indicative Hours	
		Start Time	End Time	Start Time	End Time	WD	NWD
1	05:00 on 1st April 2016 to 05:00 on 25th April 2016	07:00	13:30	10:00	14:00	130.0	16.0
		19:00	22:00	19:30	22:00	60.0	10.0
2	05:00 on 25th April 2016 to 05:00 22nd August 2016	07:30	14:00	09:30	13:30	650.0	76.0
		16:00	18:00	19:30	22:30	200.0	57.0
		19:30	22:30	0	0	300.0	
3	05:00 on 22nd August 2016 to 05:00 on 19th September 2016	07:30	14:00	10:30	13:30	149.5	15.0
		16:00	21:30	19:00	22:00	126.5	15.0
4	05:00 on 19th September 2016 to 05:00 on 31st October 2016	07:00	13:30	10:30	13:30	234.0	18.0
		16:30	21:00	17:30	21:00	162.0	21.0
5	05:00 on 31st October 2016 to 05:00 on 30th January 2017	07:00	13:30	10:30	13:30	487.5	48.0
		16:00	21:00	16:00	20:30	375.0	72.0
6	05:00 on 30th January 2017 to 05:00 on 1st April 2017	07:00	13:30	10:30	13:30	344.5	24.0
		16:30	21:00	16:30	21:00	238.5	36.0
						<b>3457.5</b>	<b>408.0</b>