

SHADOW - Main Result

Calculation: Bracklyn Wind Farm Shadow Curtailment
Assumptions for shadow calculations

Maximum distance for influence 1,850 m
Minimum sun height over horizon for influence 3 °
Day step for calculation 1 days
Time step for calculation 1 minutes

Sunshine probability S (Average daily sunshine hours) [DUBLIN ARPT]
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
1.96 2.27 3.21 4.94 6.07 5.43 5.34 5.06 4.08 3.10 2.29 1.56

Operational time
N NNE ENE E ESE SSE S SSW WSW W WNW NNW Sum
409 346 438 517 427 607 952 1,066 1,454 1,213 783 548 8,760

Flicker curtailment according to specified plan

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values. A WTG will be visible if it is visible from any part of the receiver window.

The ZVI calculation is based on the following assumptions:
Height contours used: Elevation Grid Data Object: Bracklyn Wind Farm_EMDGr
Obstacles used in calculation
Eye height for map: 1.5 m
Grid resolution: 1.0 m

All coordinates are in
Irish ITM-IRENET95 (IE), geocentric, GRS80

WTGs

	Eastings	Northing	Z	Row data/Description	Valid	Manufact.	Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	RPM [RPM]											
1	660,970	759,136	84.8	T1	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
2	660,780	758,679	91.4	T2	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
3	660,893	758,066	92.6	T3	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
4	661,188	757,707	83.5	T4	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
5	660,780	757,320	83.3	T5	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
6	661,425	758,848	81.0	T6	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
7	661,617	758,418	86.4	T7	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											
8	662,348	758,513	77.6	T10	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0 </tr <tr> <td>9</td> <td>662,152</td> <td>758,072</td> <td>83.5</td> <td>T11</td> <td>Yes</td> <td>VESTAS</td> <td>V162-6.0-6,000</td> <td>6,000</td> <td>162.0</td> <td>104.0</td> <td>0.0</td> </tr>	9	662,152	758,072	83.5	T11	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0
9	662,152	758,072	83.5	T11	Yes	VESTAS	V162-6.0-6,000	6,000	162.0	104.0	0.0											



Scale 1:75,000
New WTG Shadow receptor

Shadow receptor-Input

No.	Name	Eastings	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window	Direction mode	Eye height (ZVI) a.g.l.
				[m]	[m]	[m]	[m]	[°]		[m]
H01	H01 - Landowner	660,170	758,037	88.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H02	H02 - Landowner	660,169	758,025	87.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H03	H03 - Landowner	660,150	758,269	93.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H04	H04 - Landowner	660,044	757,887	86.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H05	H05	661,044	760,215	88.5	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H06	H06 - Landowner	659,723	758,423	87.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H07	H07	660,885	760,250	88.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H08	H08	661,072	760,258	90.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H09	H09	661,111	760,261	92.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H10	H10	661,211	760,262	97.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H11	H11	661,571	760,147	95.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H12	H12	659,669	759,253	87.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H13	H13	660,787	760,414	89.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H14	H14	660,716	760,476	91.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H15	H15	660,736	755,932	78.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H16	H16	662,517	759,896	78.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H17	H17	659,761	759,934	83.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H18	H18	659,494	759,449	86.3	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H19	H19	660,536	760,582	93.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H20	H20	659,462	759,455	86.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H21	H21	659,277	757,604	79.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H22	H22	659,244	758,791	83.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0

To be continued on next page...

SHADOW - Main Result

Calculation: Bracklyn Wind Farm Shadow Curtailment

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No.	Name	Easting	Northing	Z	Width	Height	Elevation a.g.l.	Slope of window [°]	Direction mode	Eye height (ZVI) a.g.l. [m]
H23	H23	660,542	760,624	94.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H24	H24	659,669	759,994	86.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H25	H25	660,476	755,777	81.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H26	H26	659,190	757,359	80.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H27	H27	660,471	755,755	83.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H28	H28	659,366	759,422	84.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H29	H29	659,187	757,200	82.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H30	H30	660,440	755,756	83.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H31	H31	659,185	757,154	82.5	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H32	H32	660,416	755,750	83.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H33	H33	659,262	759,276	82.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H34	H34	659,160	758,898	81.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H35	H35	659,097	758,664	83.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H36	H36	659,079	758,773	82.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H37	H37	659,077	758,607	83.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H38	H38	661,869	760,587	86.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H39	H39	662,632	760,213	79.5	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H40	H40	659,184	759,356	83.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H41	H41	659,056	758,881	81.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H42	H42	660,441	760,790	95.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H43	H43	660,236	760,717	88.3	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H44	H44	659,133	757,893	79.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H45	H45	660,278	760,741	92.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H46	H46	660,356	760,773	93.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H47	H47	660,327	760,762	93.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H48	H48	660,574	760,843	94.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H49	H49	659,233	759,505	85.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H50	H50	660,528	760,839	94.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H51	H51	659,314	759,734	86.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H52	H52	660,039	760,631	93.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H53	H53	660,004	760,611	93.5	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H54	H54	659,321	759,765	87.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H55	H55	659,873	755,802	84.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H56	H56	659,008	758,607	82.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H57	H57	659,004	758,563	83.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H58	H58	659,011	758,471	85.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H59	H59	662,672	760,267	80.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H60	H60	659,908	760,576	95.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H61	H61	660,519	760,868	94.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H62	H62	659,856	760,538	92.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H63	H63	658,994	758,517	83.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H64	H64	659,225	756,425	86.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H65	H65	659,095	757,971	78.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H66	H66	659,017	758,308	79.9	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H67	H67	659,005	758,358	83.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H68	H68	662,747	760,275	78.4	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H69	H69	659,743	760,472	93.0	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H70	H70	659,913	760,612	94.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H71	H71	659,992	760,666	94.3	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H72	H72	659,254	759,735	86.5	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H73	H73	659,244	759,709	85.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H74	H74	659,230	759,674	85.6	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H75	H75	662,710	760,301	79.7	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H76	H76	659,028	758,173	83.1	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H77	H77	659,473	760,180	87.2	2.5	2.5	0.5	90.0	"Green house mode"	3.0
H78	H78	663,754	758,268	77.8	2.5	2.5	0.5	90.0	"Green house mode"	3.0

SHADOW - Main Result

Calculation: Bracklyn Wind Farm Shadow Curtailment

Calculation Results

Shadow receptor

No.	Name	Shadow, worst case			Shadow, expected values			
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	Avoided hours per year [h/year]	Avoided days per year [days/year]	Shadow hours per year [h/year]	Avoided hours per year [h/year]
H01*	H01 - Landowner	105:58	272	0:30	40:30		19:04	7:44
H02*	H02 - Landowner	110:01	271	0:30	37:09		19:45	7:15
H03*	H03 - Landowner	108:43	285	0:30	29:37		20:59	5:37
H04*	H04 - Landowner	84:37	230	0:30	19:33	1	16:29	4:02
H05	H05	0:00	0	0:00			0:00	
H06*	H06 - Landowner	75:27	258	0:30	4:18		14:15	0:54
H07	H07	0:00	0	0:00			0:00	
H08	H08	0:00	0	0:00			0:00	
H09	H09	0:00	0	0:00			0:00	
H10	H10	0:00	0	0:00			0:00	
H11	H11	11:44	35	0:25			1:42	
H12*	H12	40:09	154	0:30	0:02		6:31	0:00
H13	H13	0:00	0	0:00			0:00	
H14	H14	0:00	0	0:00			0:00	
H15	H15	0:00	0	0:00			0:00	
H16	H16	19:08	78	0:26			3:17	
H17	H17	26:47	84	0:27			3:38	
H18*	H18	16:26	63	0:26	0:01		2:42	0:00
H19	H19	0:00	0	0:00			0:00	
H20	H20	15:19	61	0:25			2:32	
H21	H21	26:11	110	0:23			5:34	
H22	H22	17:23	78	0:24			3:20	
H23	H23	0:00	0	0:00			0:00	
H24	H24	23:42	81	0:24			3:10	
H25	H25	0:00	0	0:00			0:00	
H26	H26	12:49	57	0:22			2:48	
H27	H27	0:00	0	0:00			0:00	
H28	H28	13:16	57	0:24			2:14	
H29	H29	6:15	27	0:22			1:21	
H30	H30	0:00	0	0:00			0:00	
H31	H31	6:19	28	0:21			1:23	
H32	H32	0:00	0	0:00			0:00	
H33	H33	11:36	52	0:22			2:01	
H34	H34	10:39	49	0:22			2:08	
H35	H35	5:42	26	0:21			1:09	
H36	H36	5:29	24	0:21			1:03	
H37	H37	5:31	26	0:21			1:09	
H38	H38	0:00	0	0:00			0:00	
H39	H39	13:29	55	0:21			2:03	
H40	H40	9:48	48	0:21			1:41	
H41	H41	5:11	26	0:20			0:58	
H42	H42	0:00	0	0:00			0:00	
H43	H43	0:00	0	0:00			0:00	
H44	H44	18:13	87	0:20			3:53	
H45	H45	0:00	0	0:00			0:00	
H46	H46	0:00	0	0:00			0:00	
H47	H47	0:00	0	0:00			0:00	
H48	H48	0:00	0	0:00			0:00	
H49	H49	10:07	50	0:21			1:41	
H50	H50	0:00	0	0:00			0:00	
H51	H51	10:59	53	0:20			1:42	
H52	H52	0:00	0	0:00			0:00	
H53	H53	0:00	0	0:00			0:00	
H54	H54	10:53	54	0:20			1:41	
H55	H55	0:00	0	0:00			0:00	
H56	H56	4:59	24	0:19			1:02	
H57	H57	4:51	25	0:19			1:02	
H58	H58	4:53	24	0:19			1:04	
H59	H59	0:00	0	0:00			0:00	
H60	H60	0:00	0	0:00			0:00	
H61	H61	0:00	0	0:00			0:00	
H62	H62	6:32	29	0:17			0:47	

To be continued on next page...

SHADOW - Main Result

Calculation: Bracklyn Wind Farm Shadow Curtailment

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No.	Name	Shadow, worst case			Avoided		Shadow, expected values	
		Shadow hours per year [h/year]	Shadow days per year [days/year]	Max shadow hours per day [h/day]	hours per year [h/year]	days per year [days/year]	Shadow hours per year [h/year]	Avoided hours per year [h/year]
H63	H63	4:52	24	0:19			1:04	
H64	H64	8:40	42	0:19			2:05	
H65	H65	16:28	80	0:20			3:28	
H66*	H66	4:18	25	0:18	1:03	1	0:58	0:14
H67*	H67	4:41	24	0:19	0:20	1	1:03	0:04
H68	H68	0:00	0	0:00			0:00	
H69	H69	12:40	51	0:20			1:36	
H70	H70	0:00	0	0:00			0:00	
H71	H71	0:00	0	0:00			0:00	
H72	H72	4:06	23	0:18			0:40	
H73	H73	9:42	50	0:19			1:31	
H74	H74	9:37	50	0:19			1:31	
H75	H75	0:00	0	0:00			0:00	
H76	H76	0:00	0	0:00			0:00	
H77	H77	5:22	28	0:19			0:48	
H78	H78	15:07	60	0:25			3:09	

* Receptors where shadow flicker is reduced by curtailment

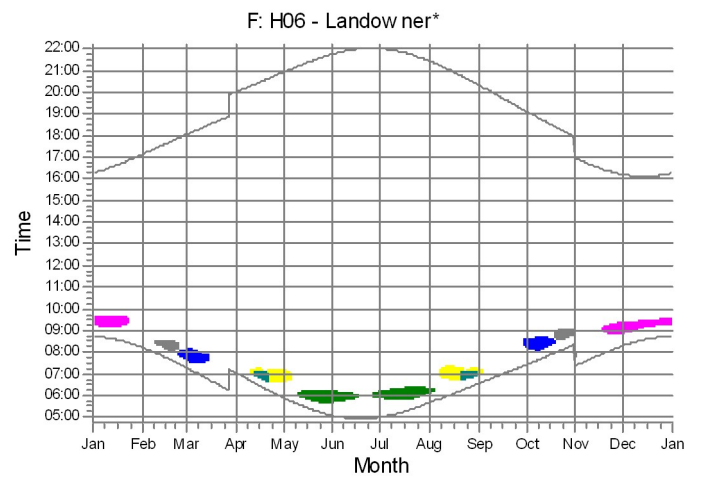
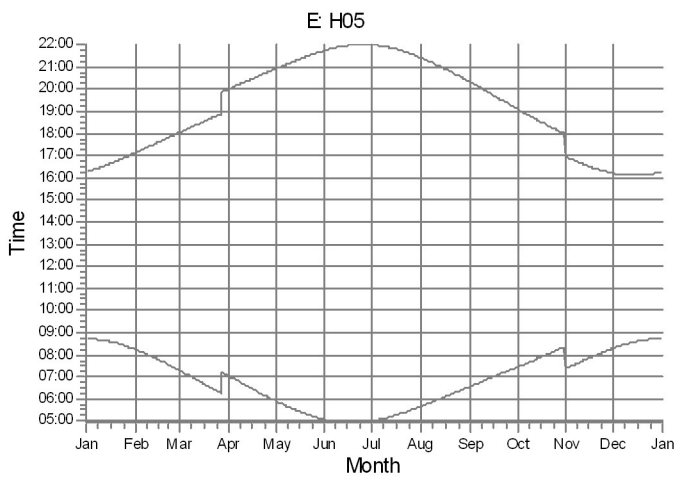
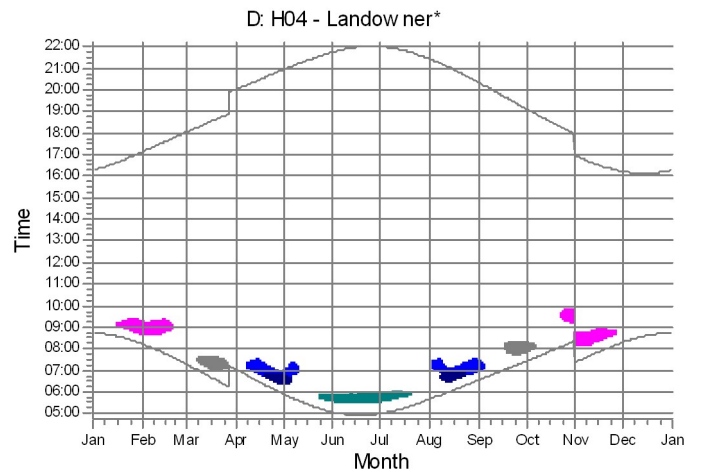
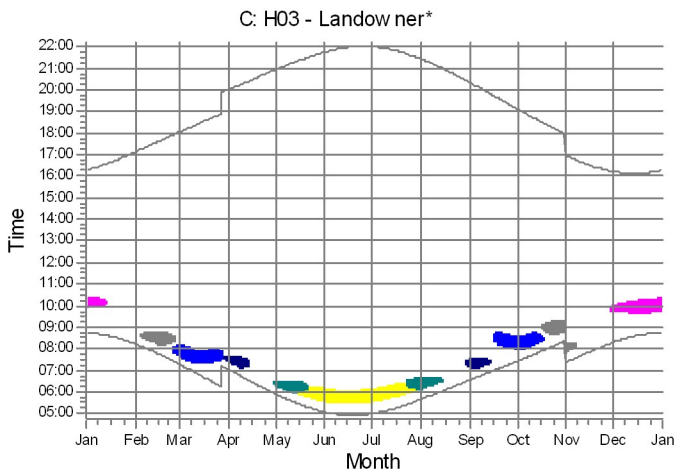
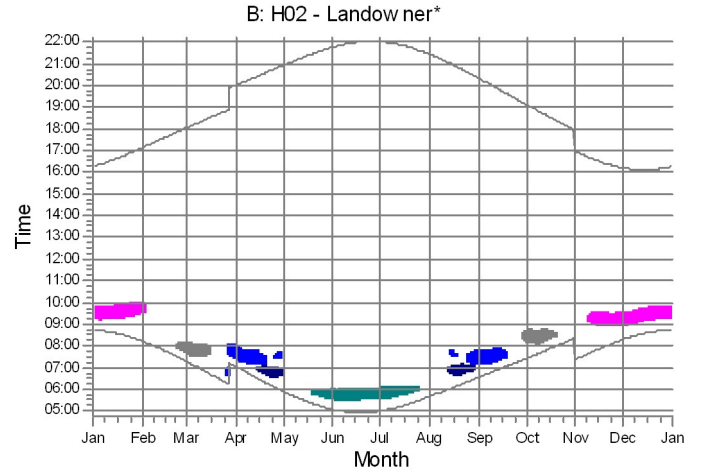
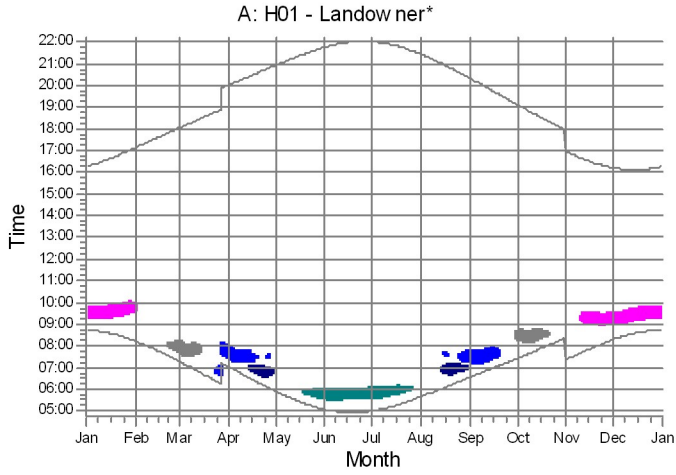
Total amount of flickering on the shadow receptors caused by each WTG

No.	Name	Worst case [h/year]	Stopped due to flicker curtailment [h/year]	Expected [h/year]
1	T1	101:57		18:07
2	T2	137:48	18:32	26:44
3	T3	96:45	46:20	19:02
4	T4	46:38	1:29	7:59
5	T5	121:10	18:58	19:13
6	T6	69:41	1:38	14:06
7	T7	21:10		4:48
8	T10	9:08		1:59
9	T11	5:59		1:09

Total times in Receptor wise and WTG wise tables can differ, as a WTG can lead to flicker at 2 or more receptors simultaneously and/or receptors may receive flicker from 2 or more WTGs simultaneously.

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment



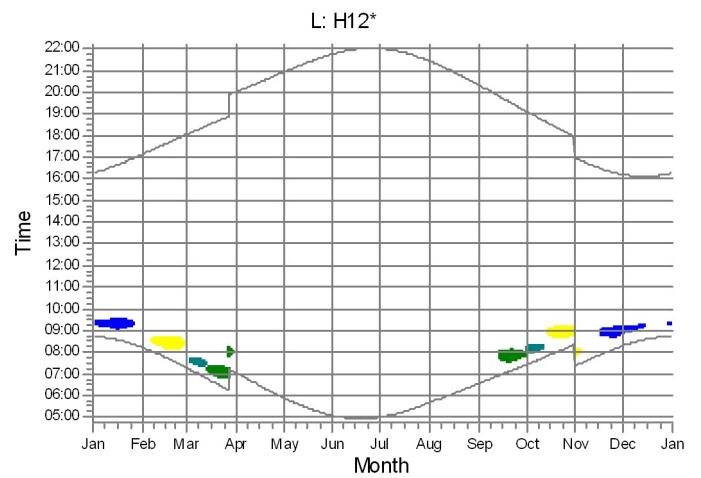
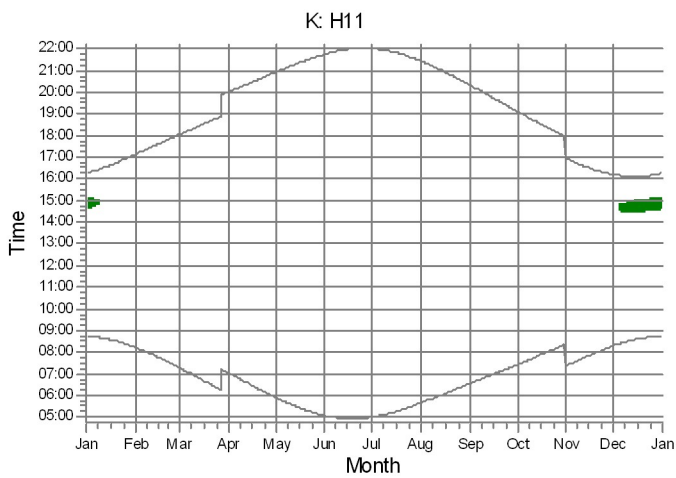
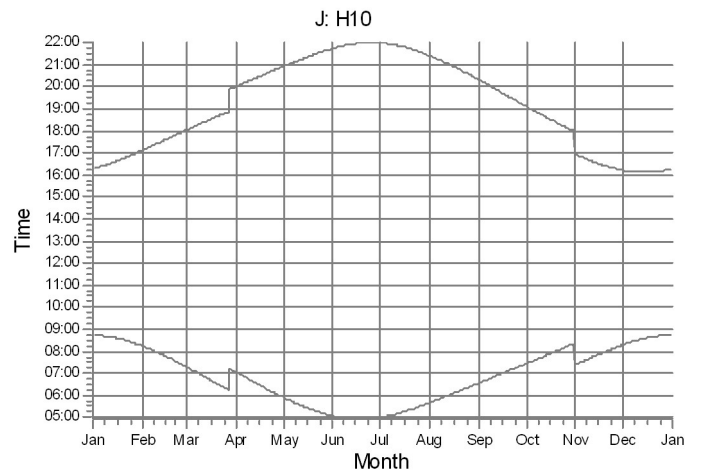
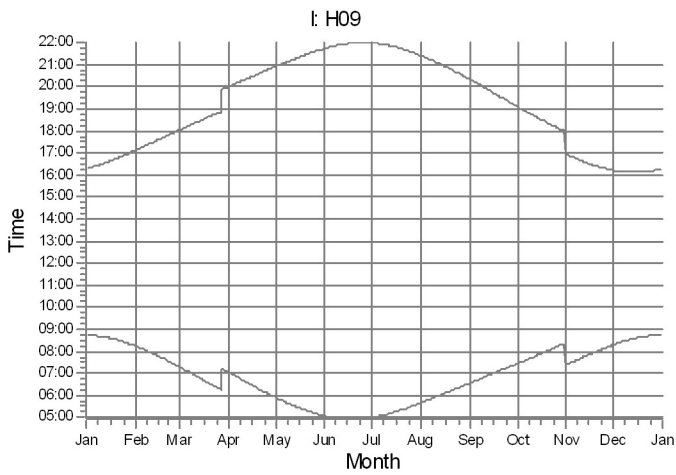
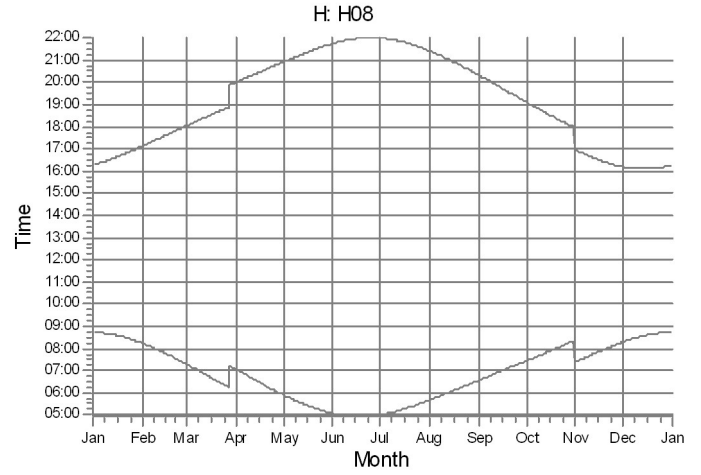
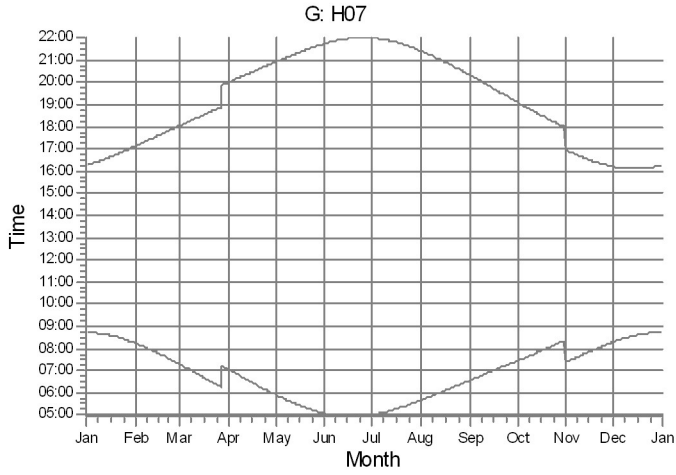
WTGs



* Results reduced by flicker curtailment

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment



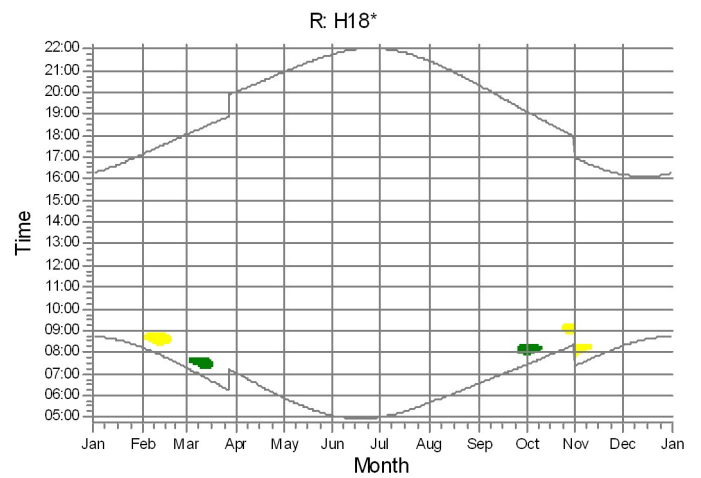
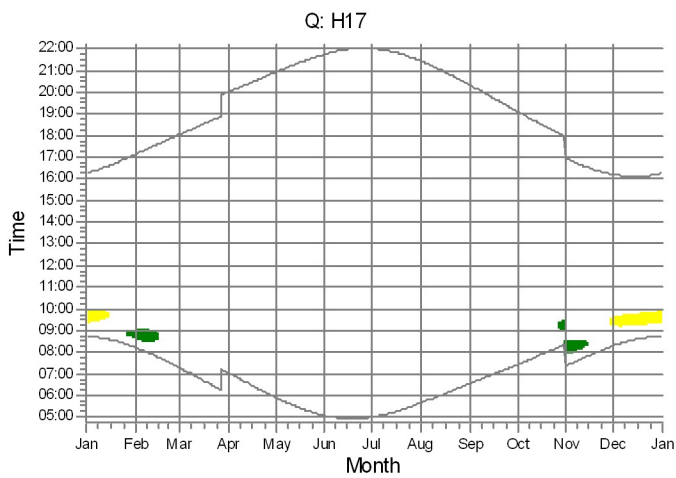
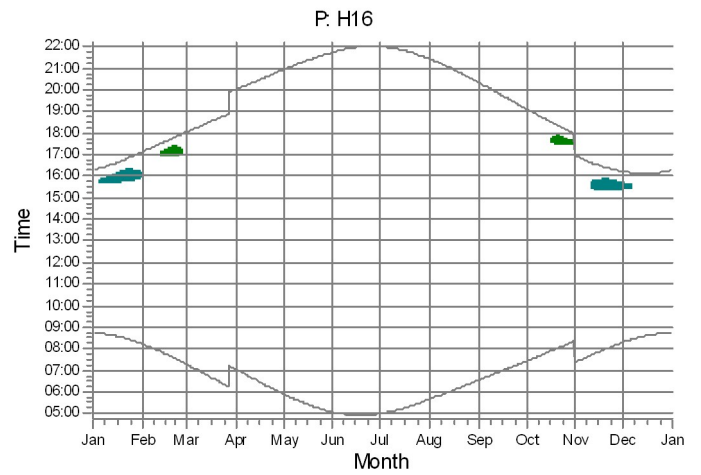
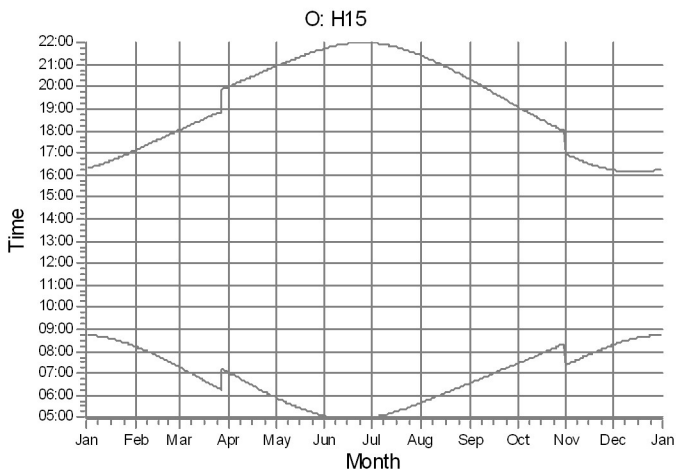
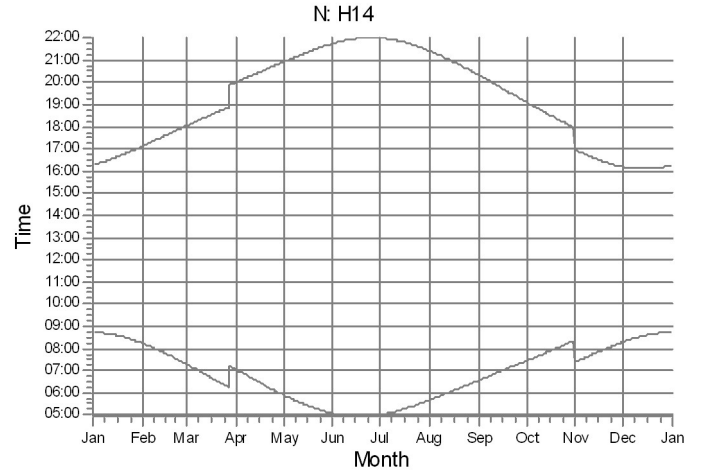
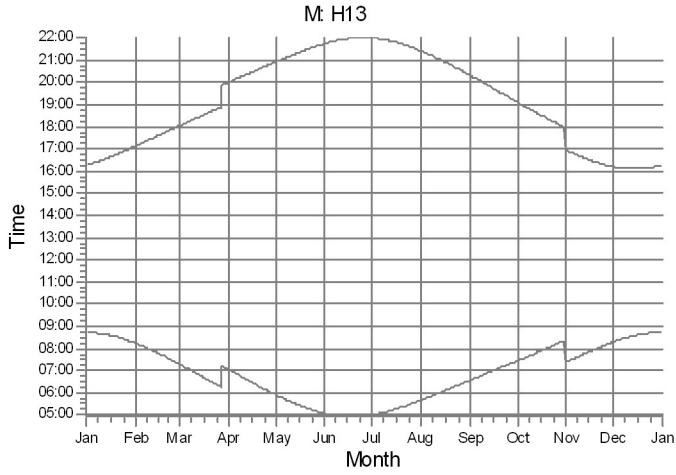
WTGs



* Results reduced by flicker curtailment

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment



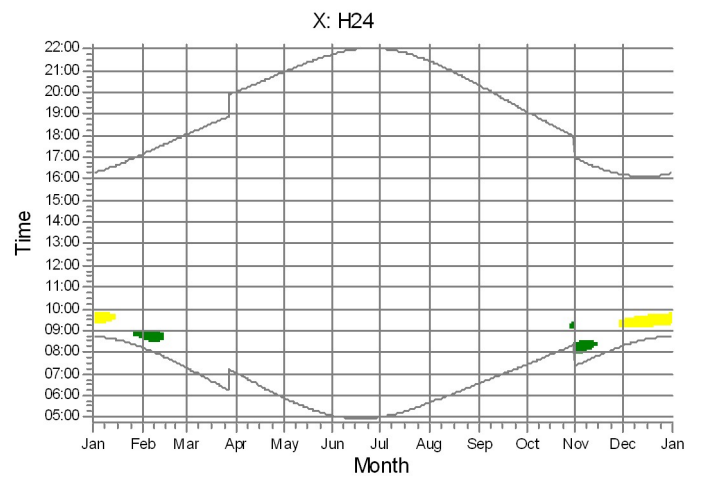
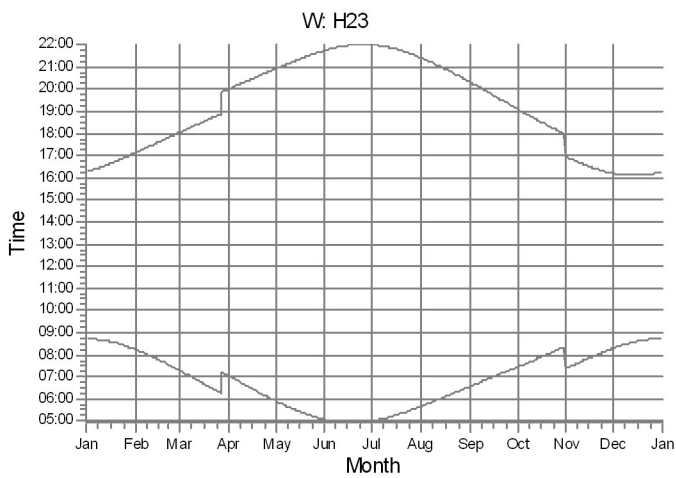
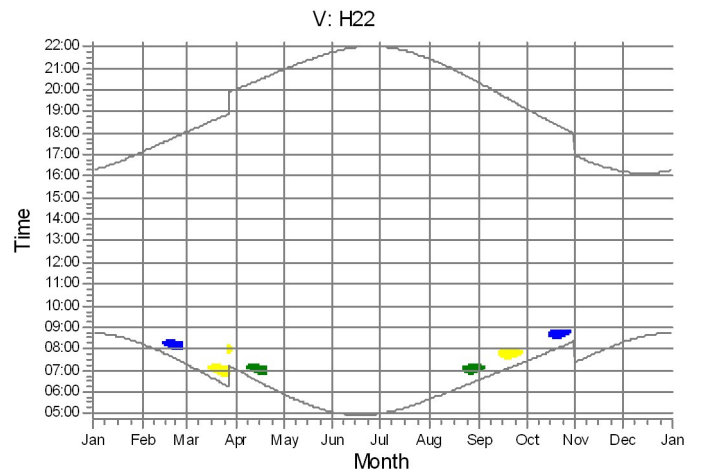
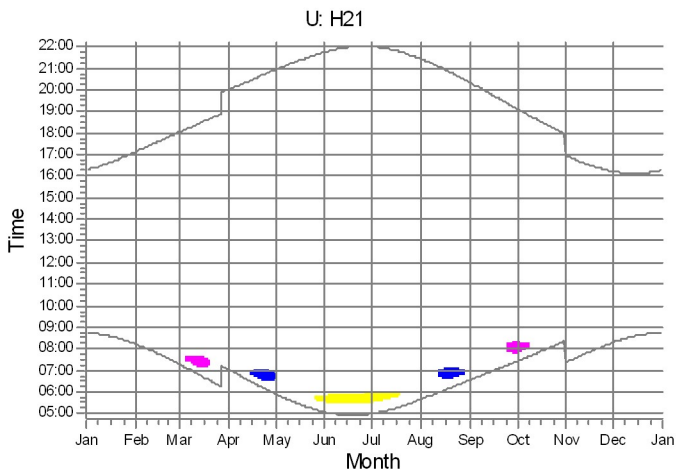
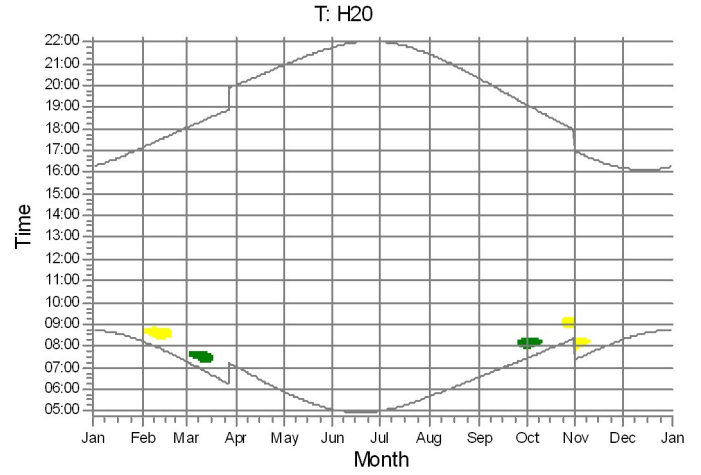
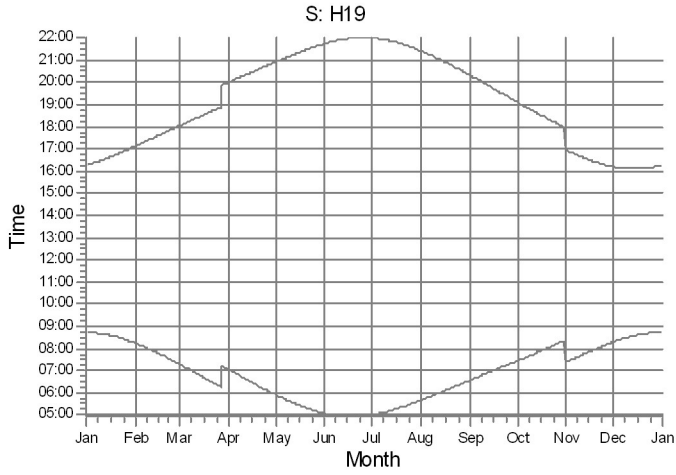
WTGs



* Results reduced by flicker curtailment

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

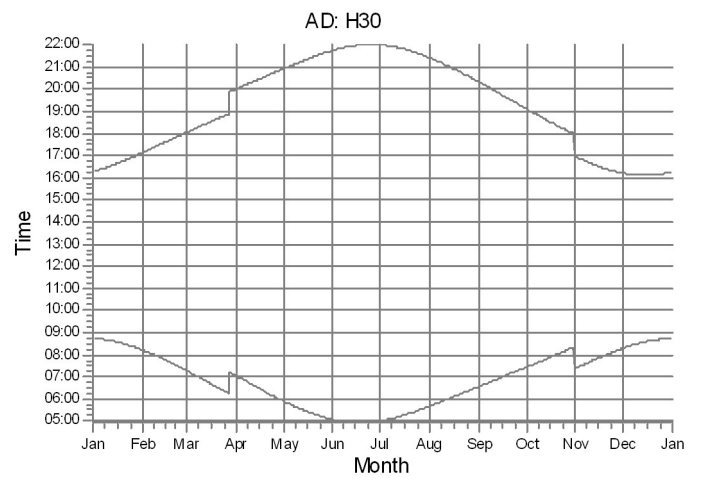
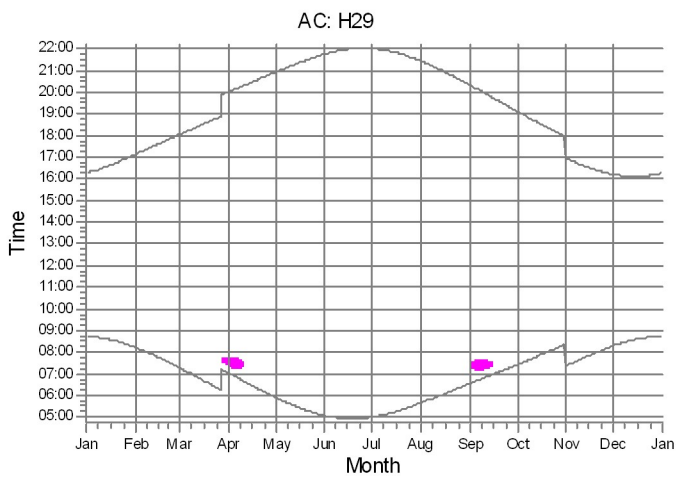
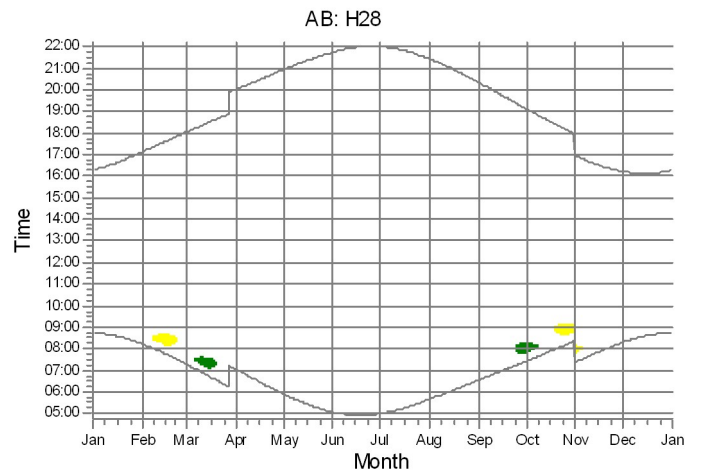
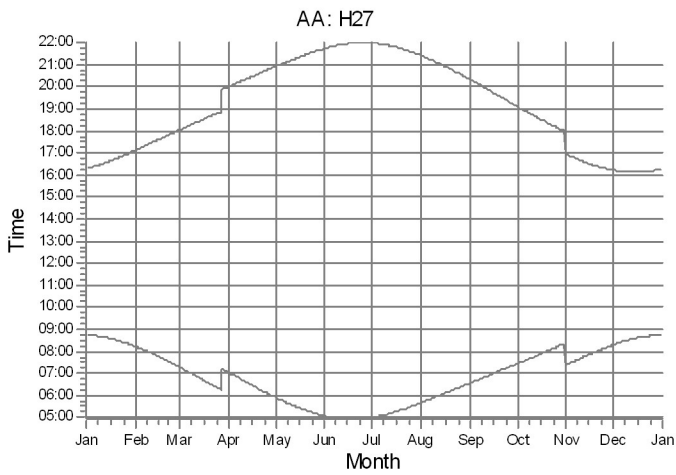
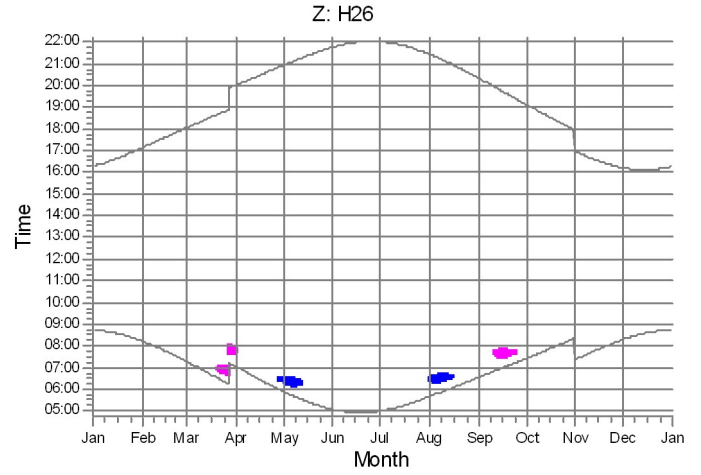
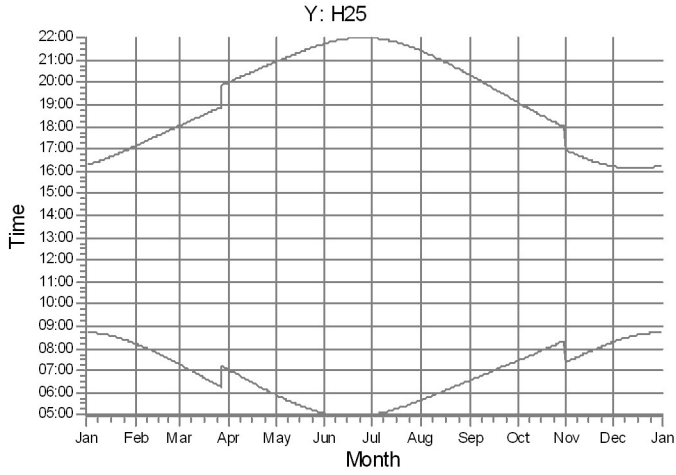


WTGs

- 1: T1
- 2: T2
- 3: T3
- 5: T5

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

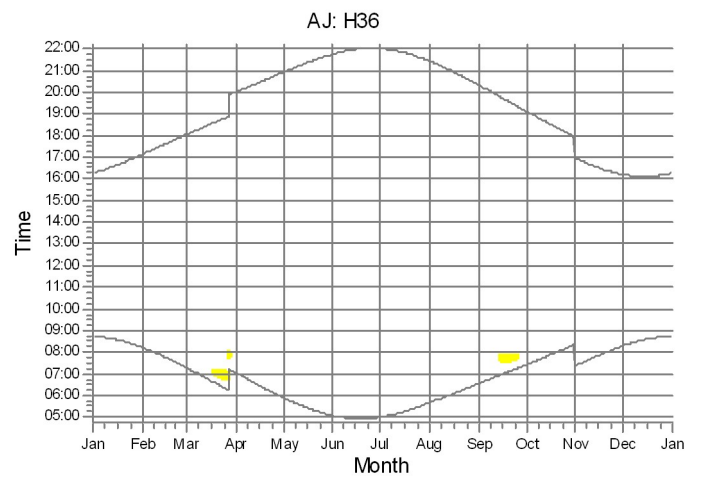
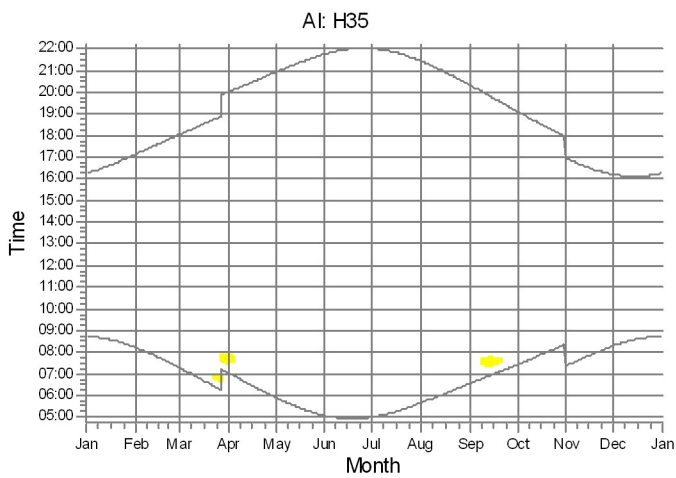
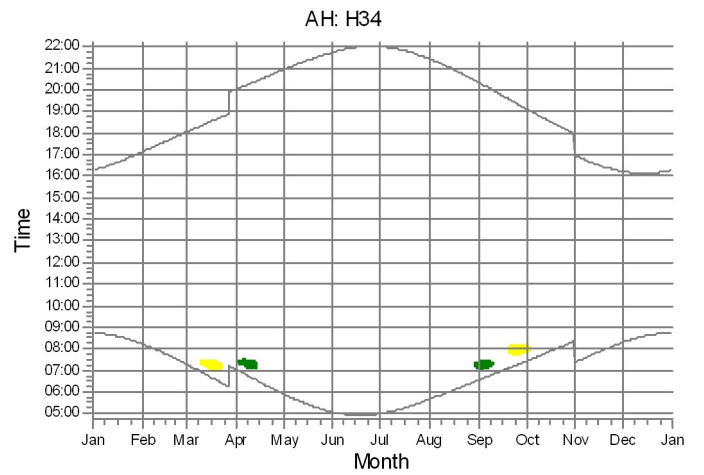
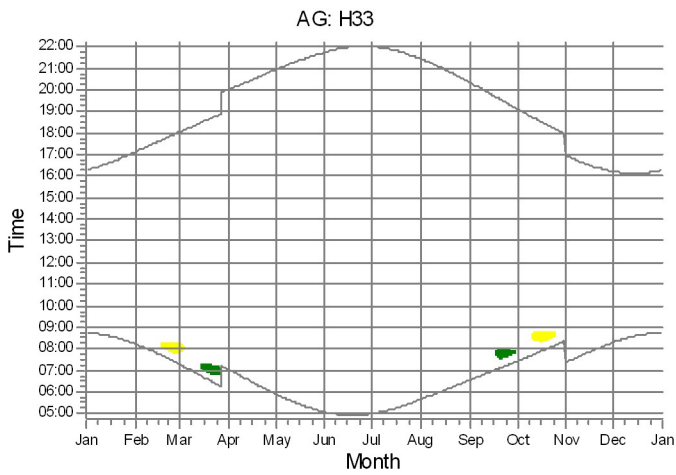
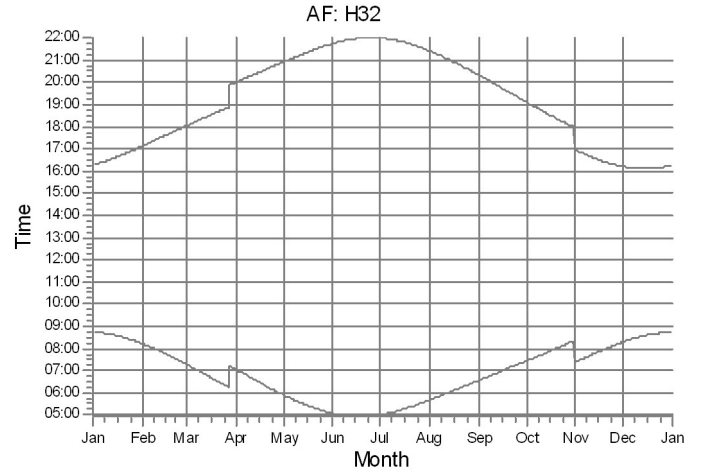
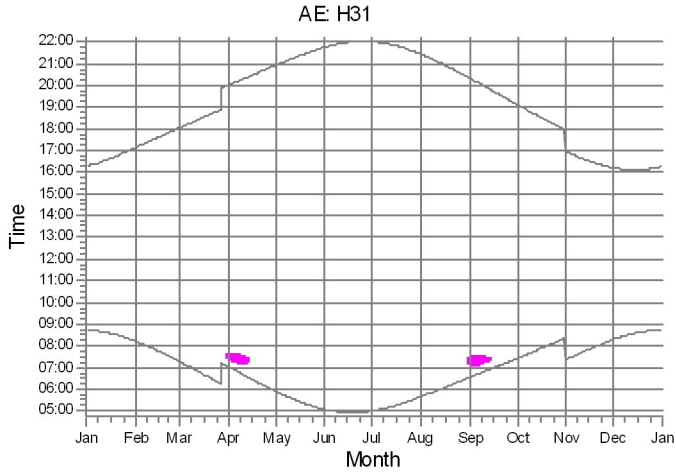


WTGs

- 1: T1
- 2: T2
- 3: T3
- 5: T5

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

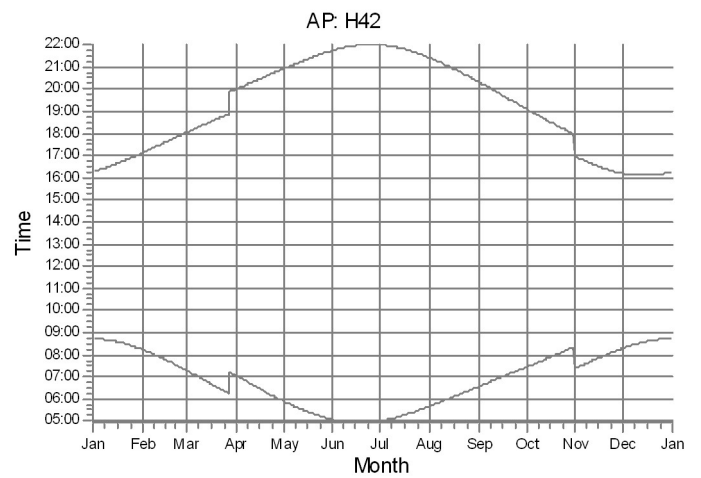
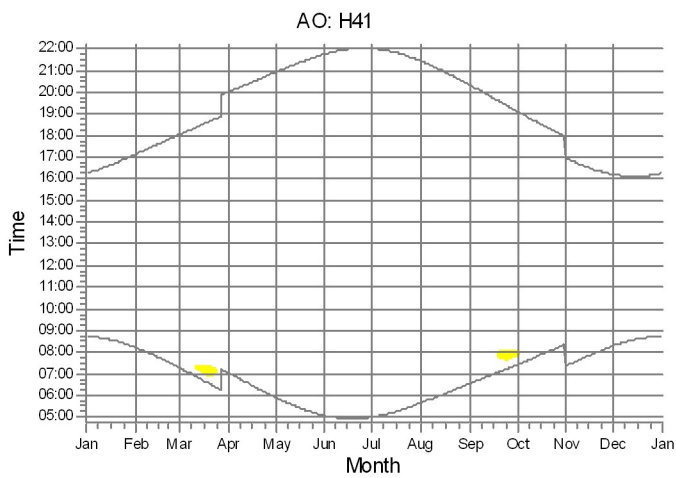
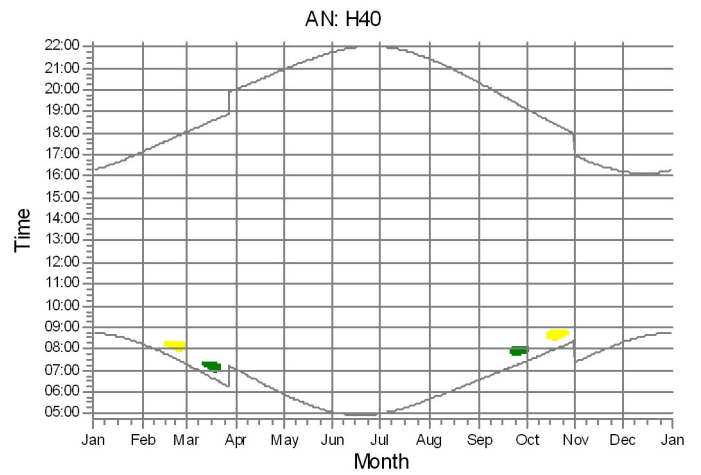
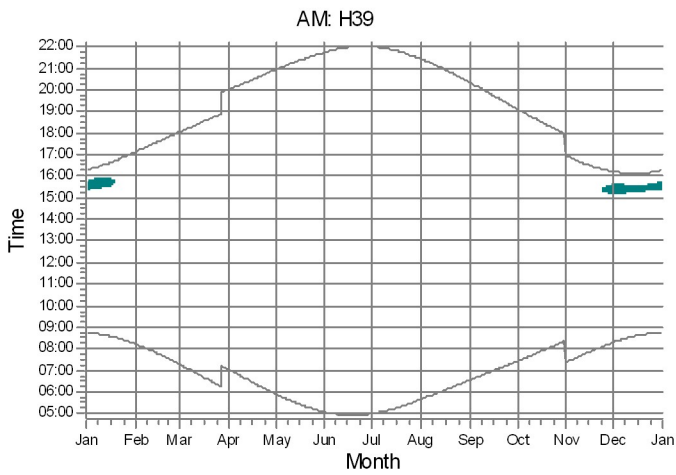
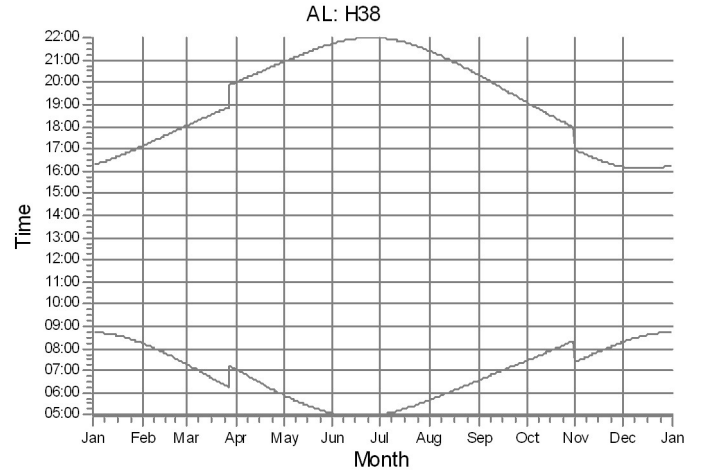
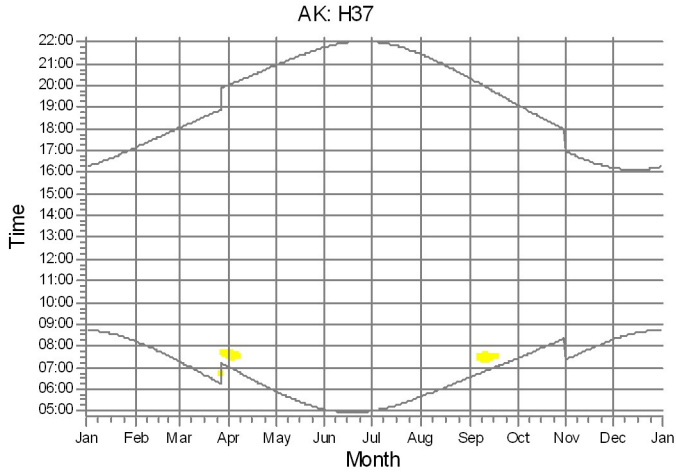


WTGs



SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

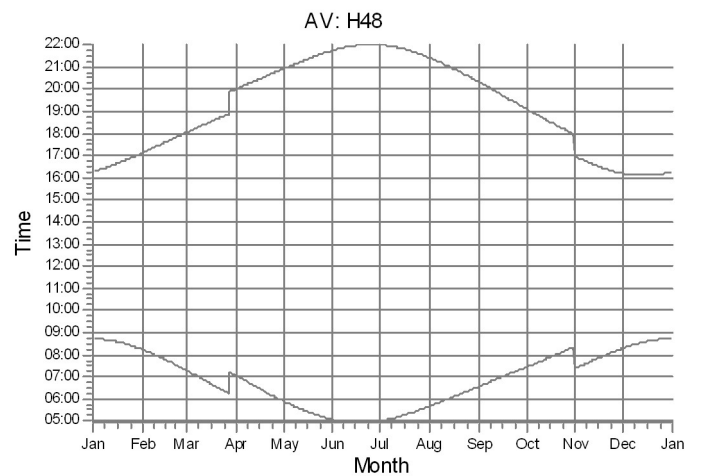
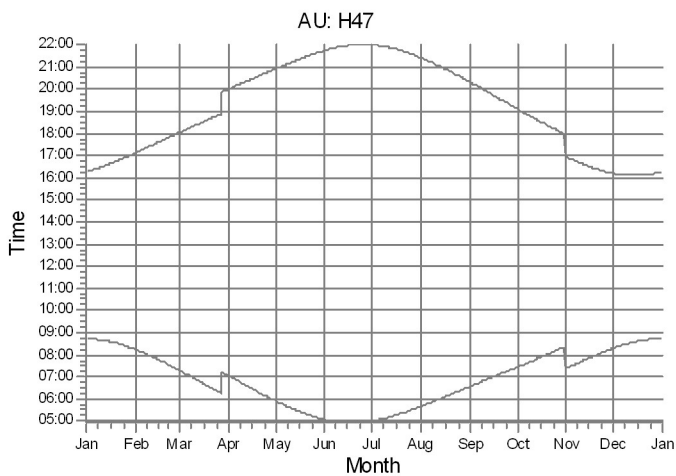
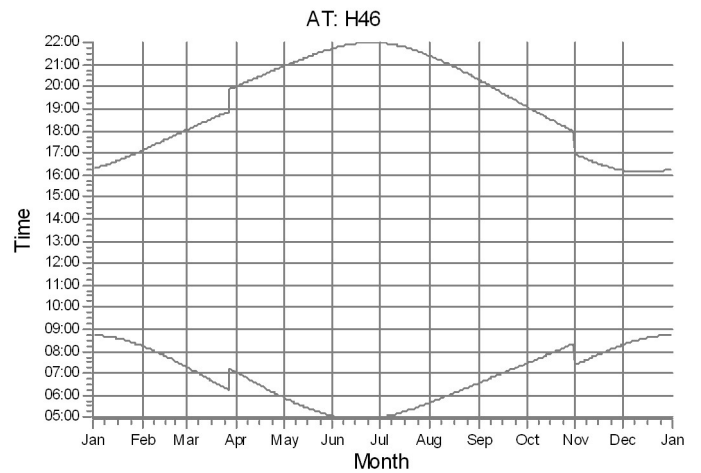
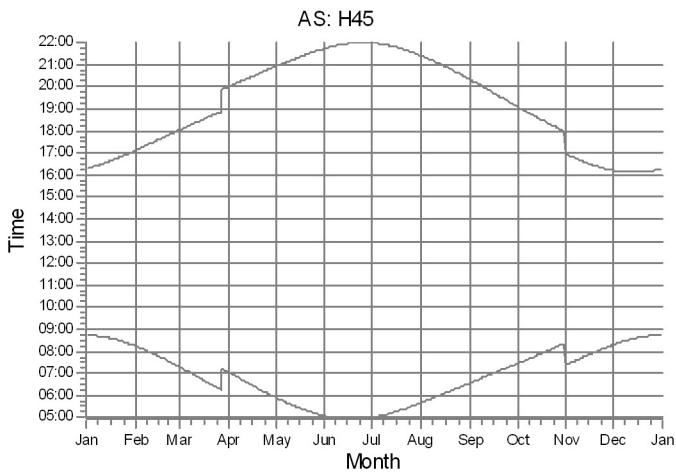
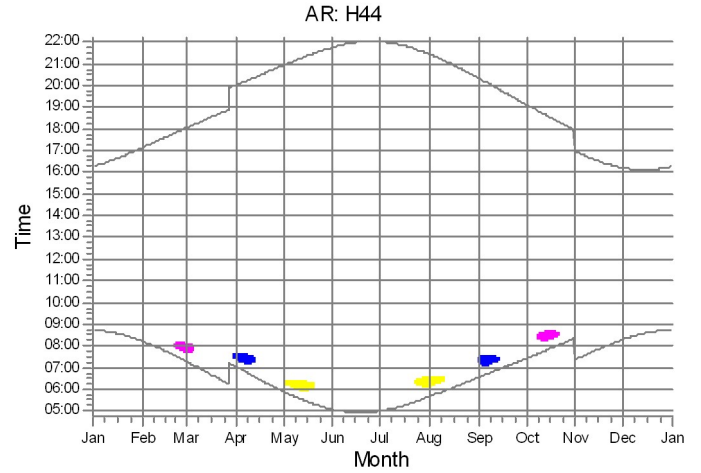
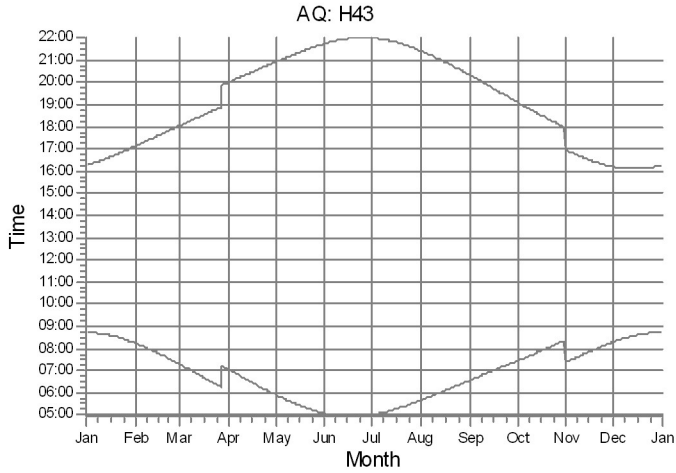


WTGs



SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

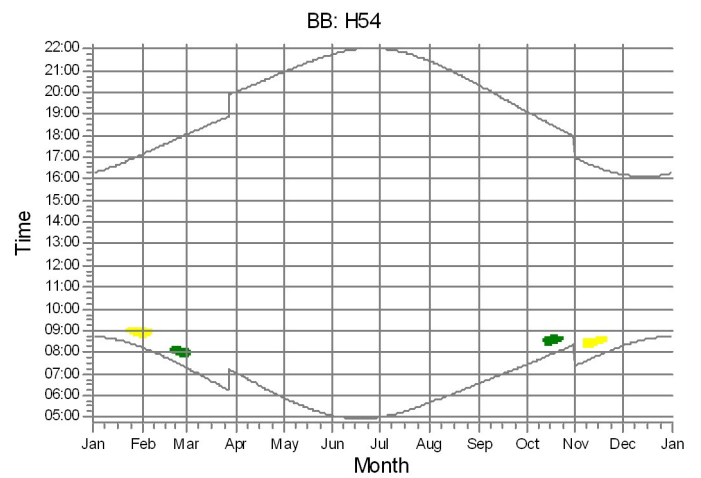
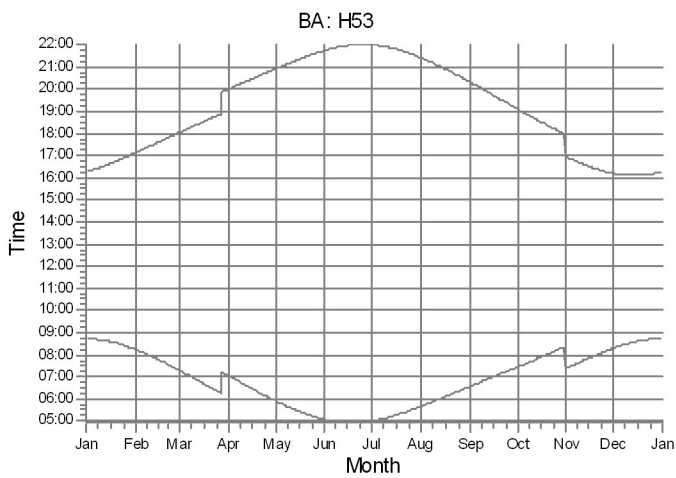
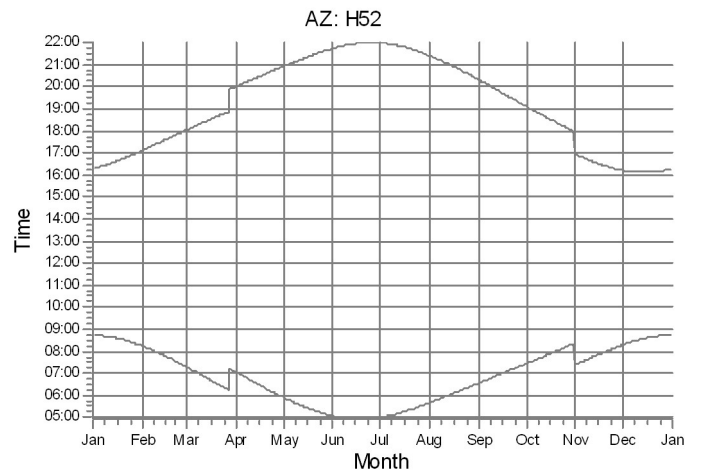
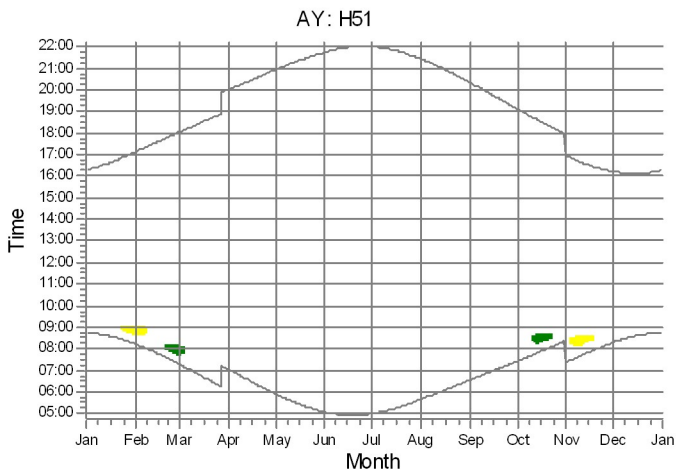
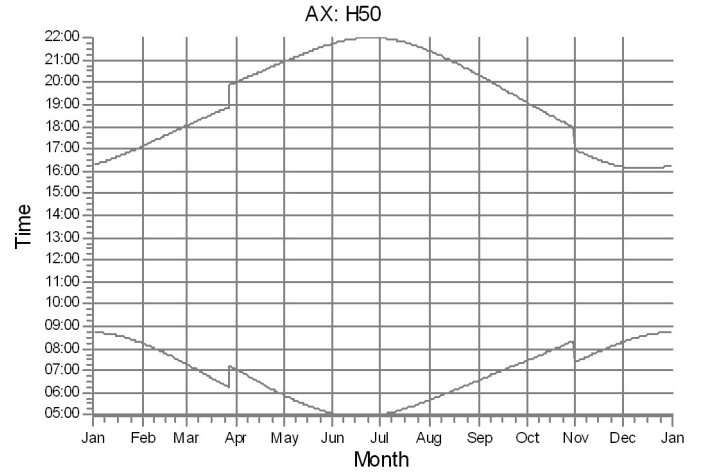
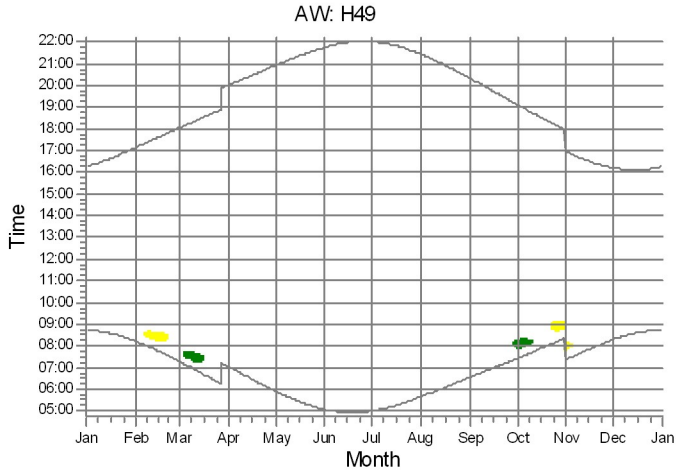


WTGs



SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

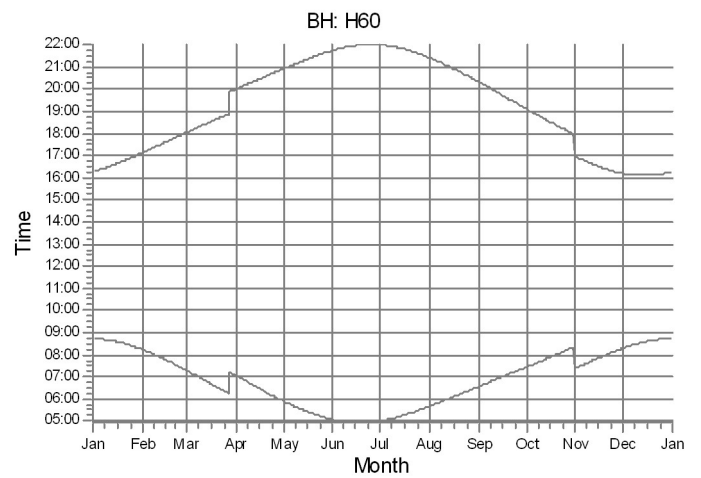
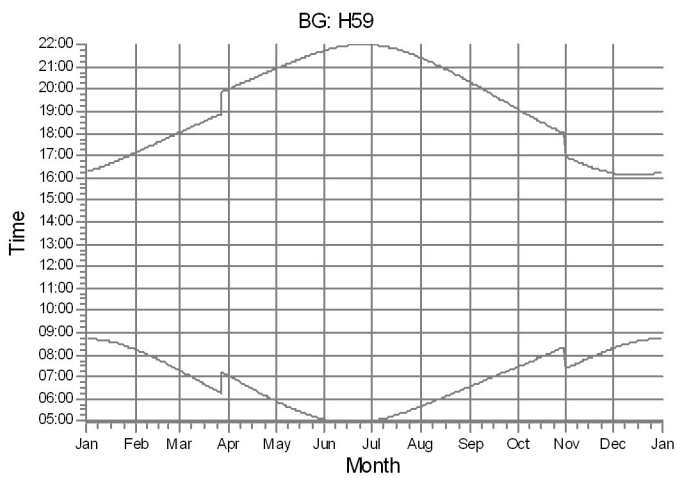
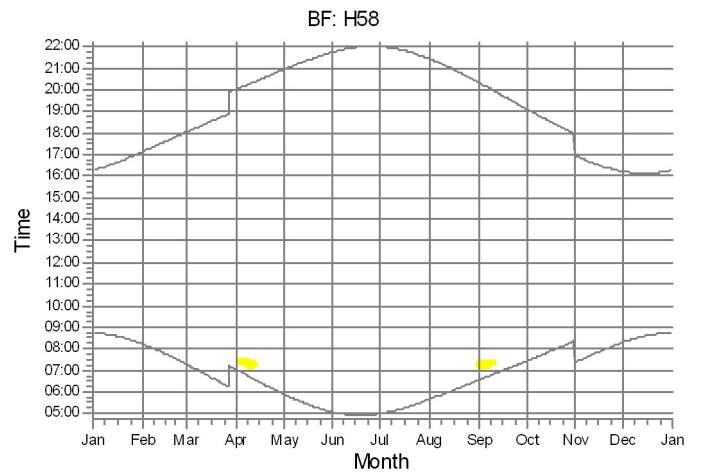
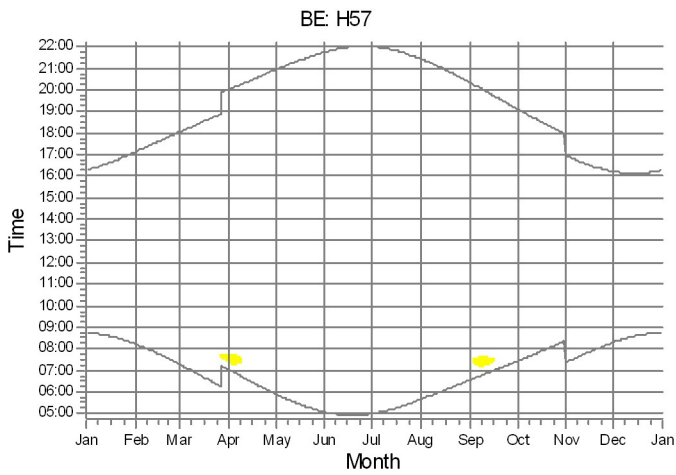
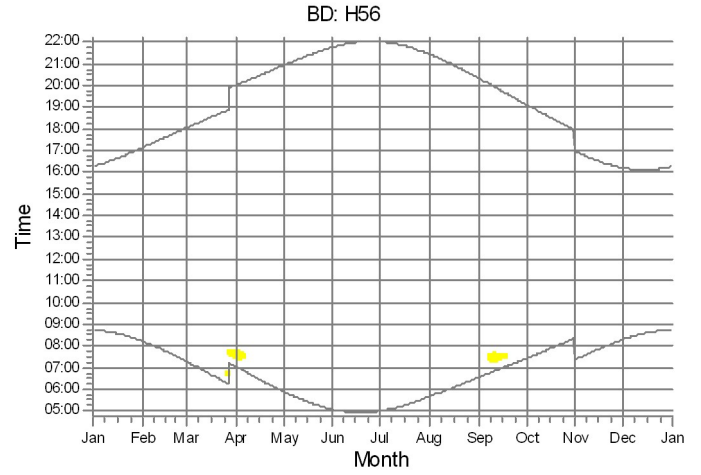
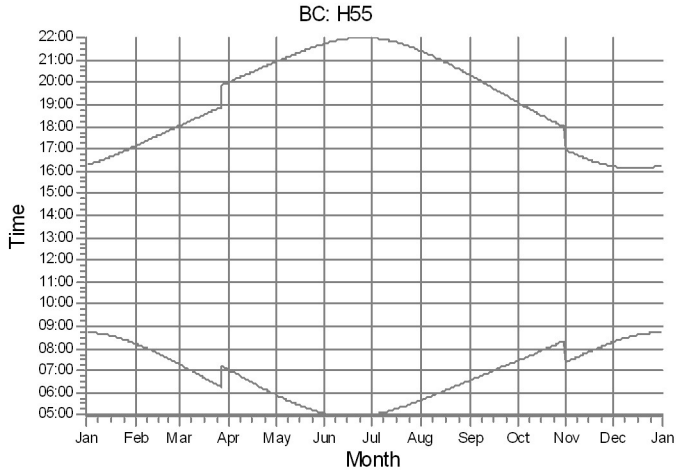


WTGs



SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

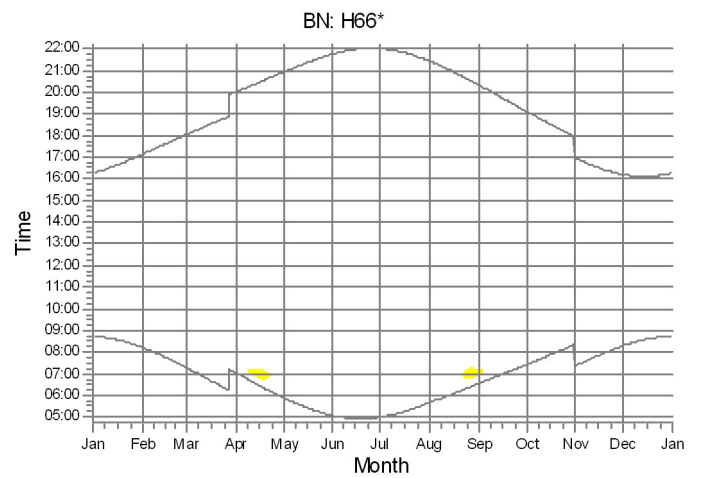
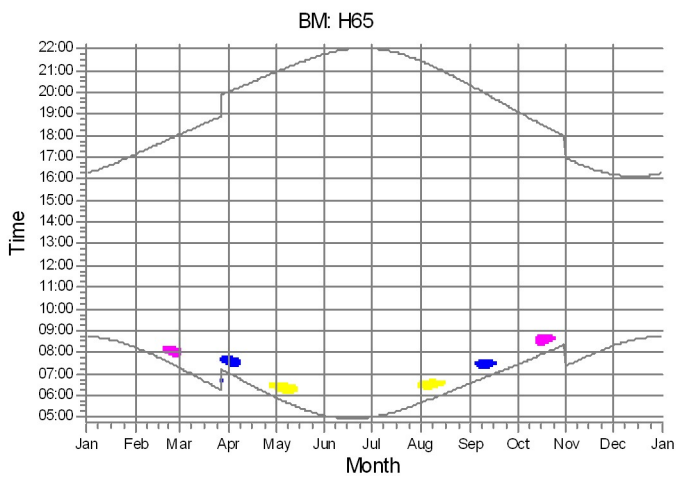
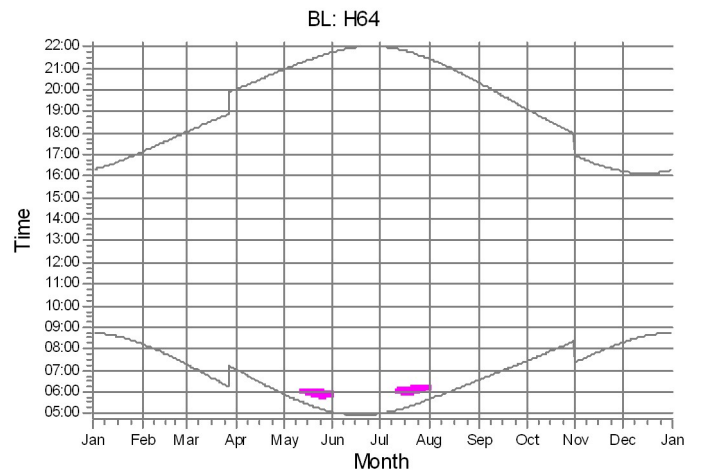
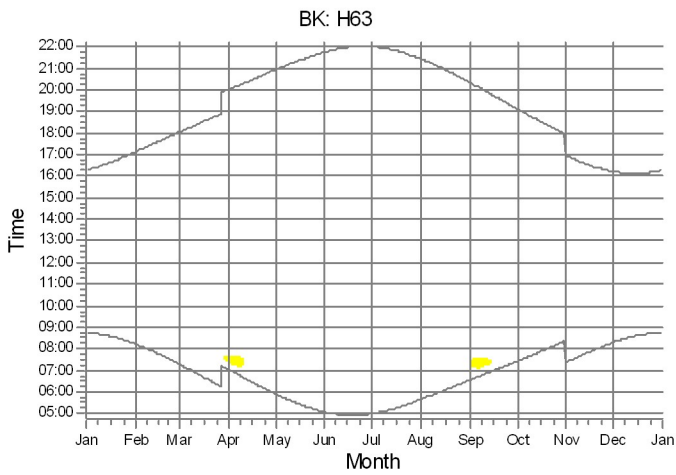
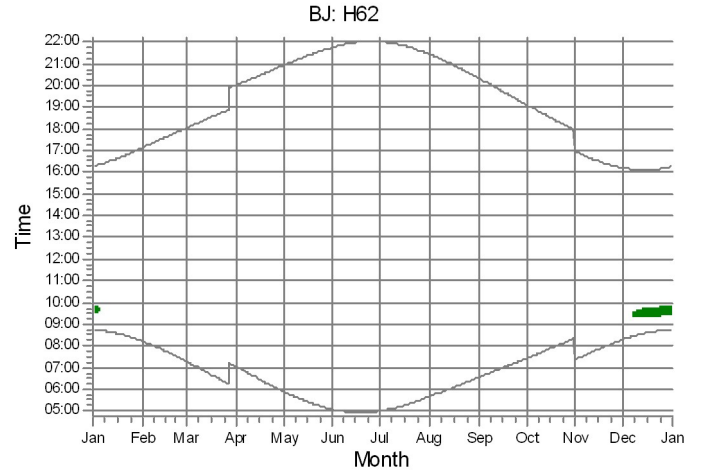
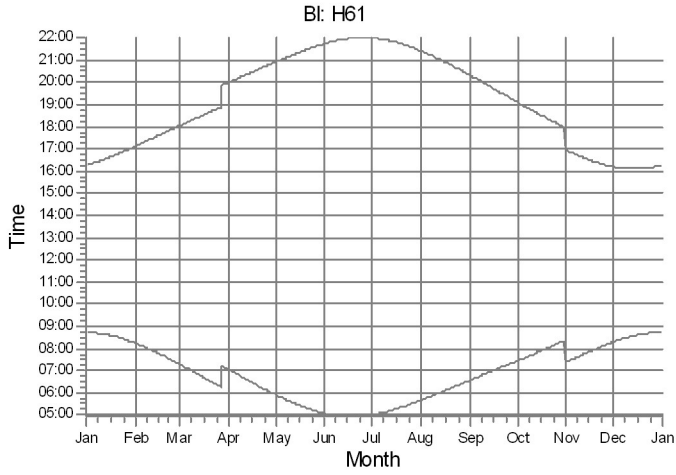


WTGs

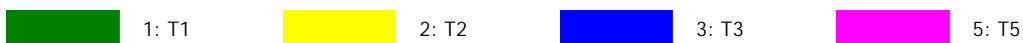
2: T2

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment



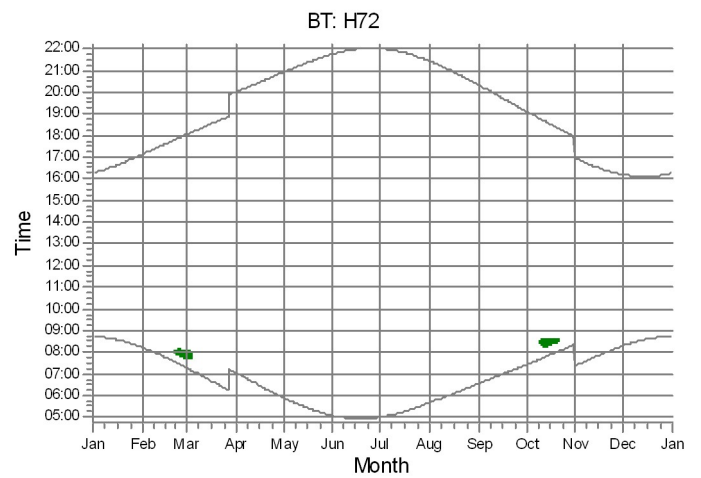
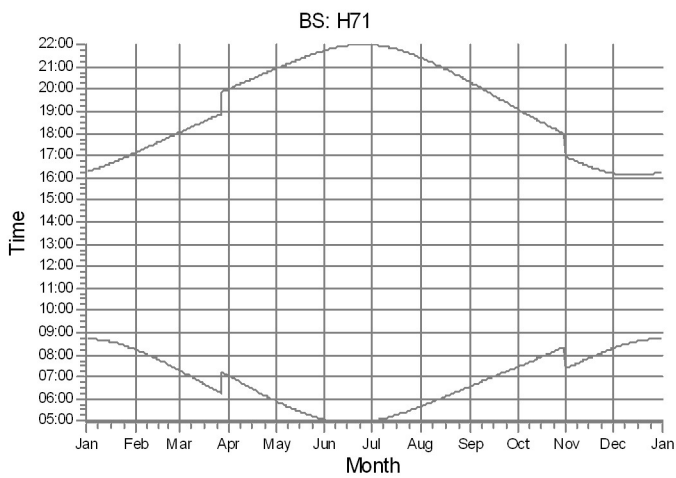
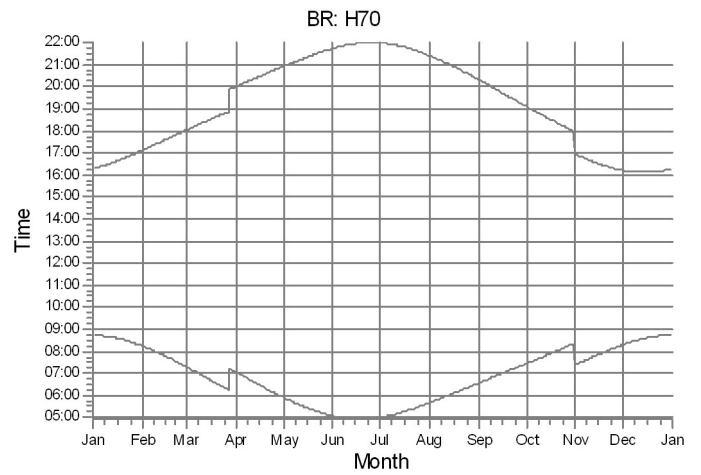
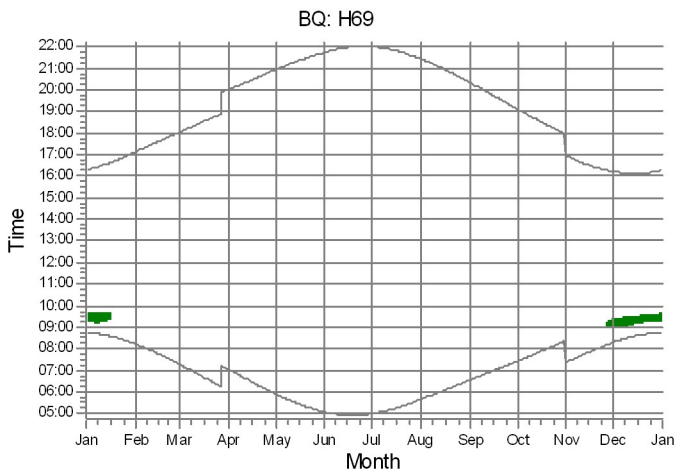
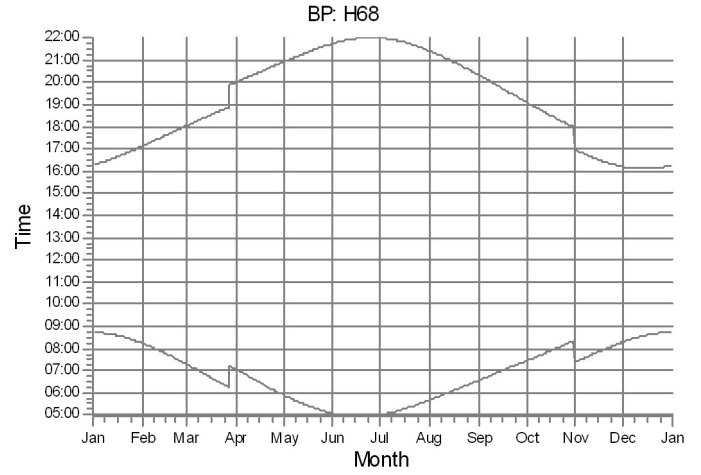
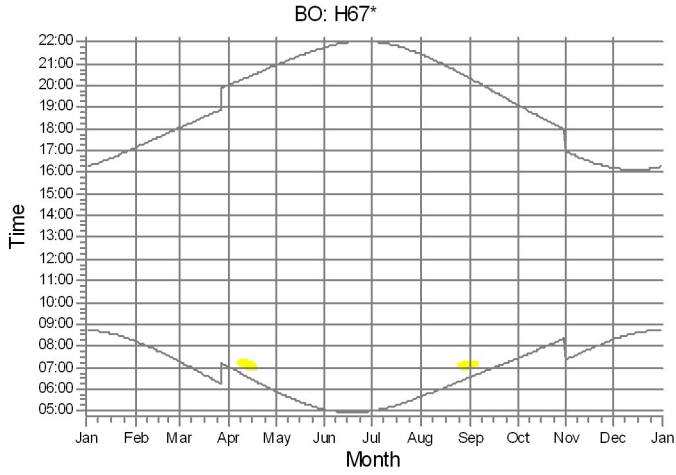
WTGs



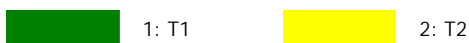
* Results reduced by flicker curtailment

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment



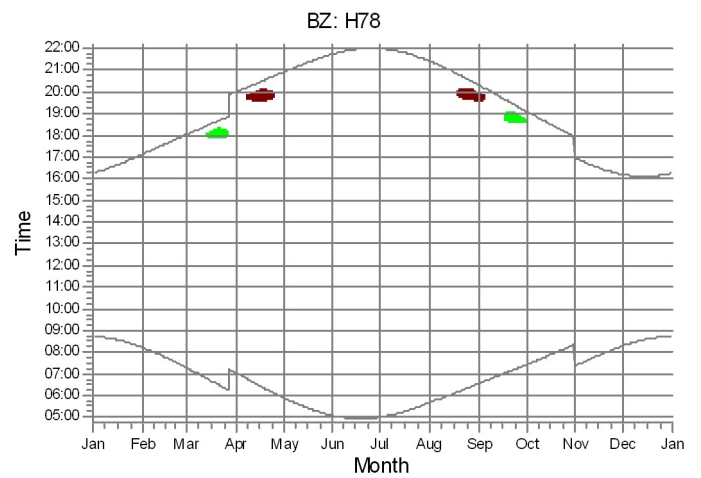
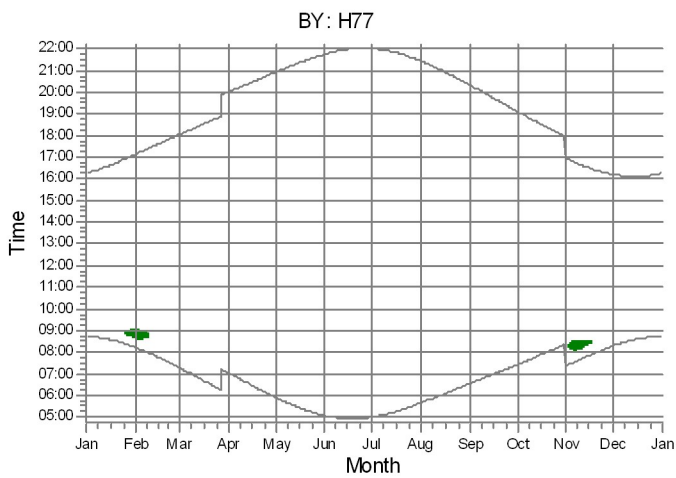
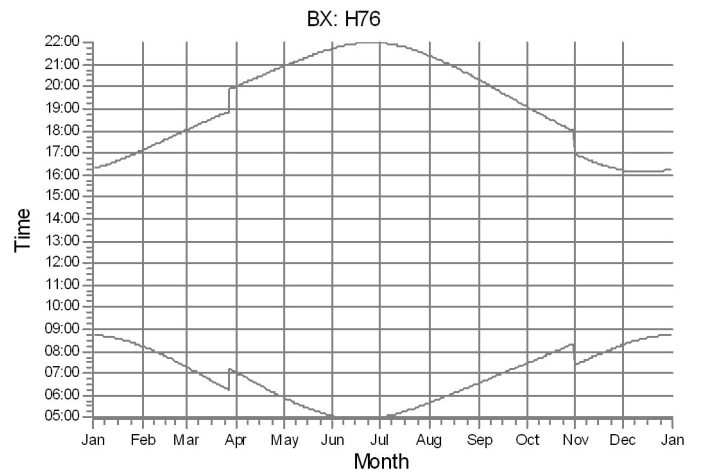
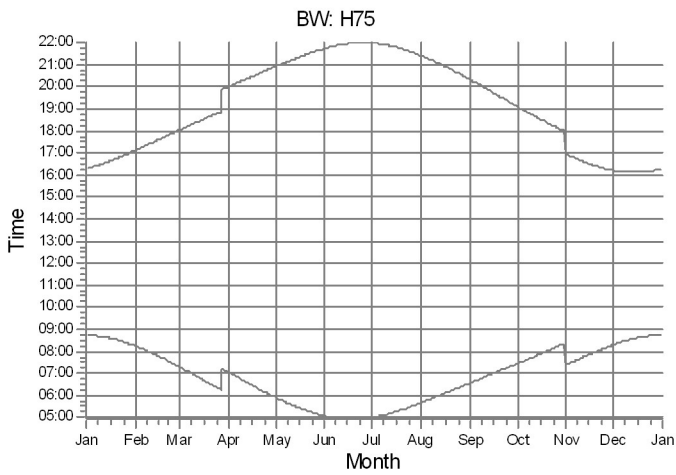
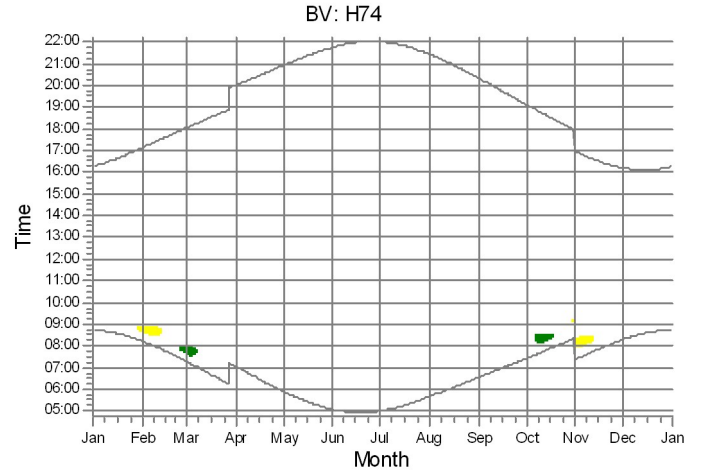
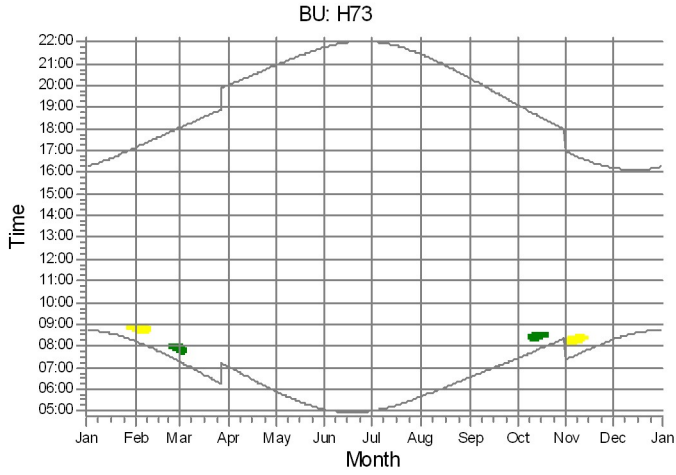
WTGs



* Results reduced by flicker curtailment

SHADOW - Calendar, graphical

Calculation: Bracklyn Wind Farm Shadow Curtailment

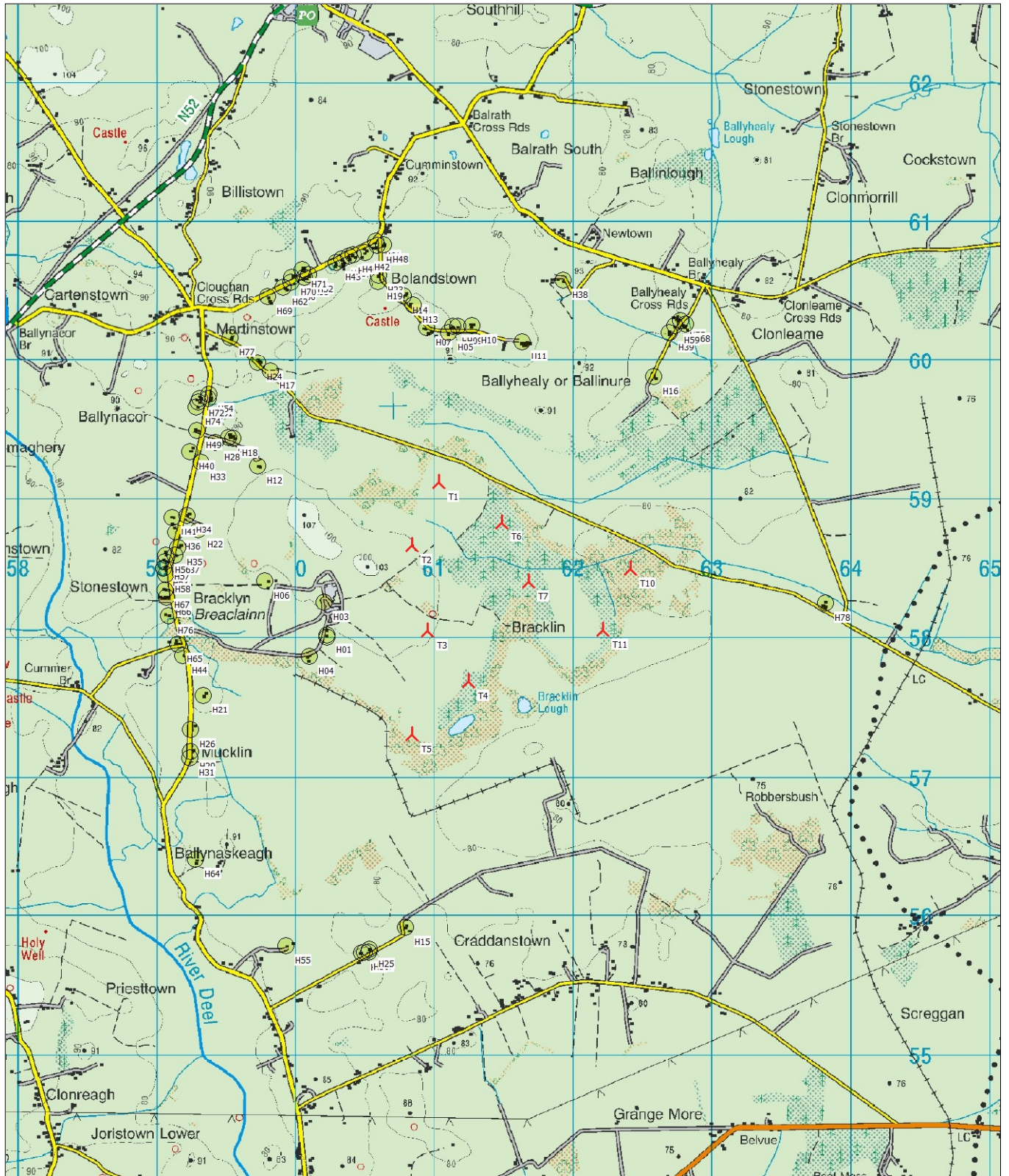


WTGs



SHADOW - Map

Calculation: Bracklyn Wind Farm Shadow Curtailment



0 500 1000 1500 2000 m

Map: Bracklyn Discovery Series Map , Print scale 1:40,000, Map center Irish ITM-IRENET95 (IE), geocentric, GRS80 East: 661,374 North: 758,309
▲ New WTG ● Shadow receptor

Flicker map level: Elevation Grid Data Object: Bracklyn Wind Farm_EMDGrid_5.wpg (22)