

Projekt:  
**Schlüsselburg\_160420**

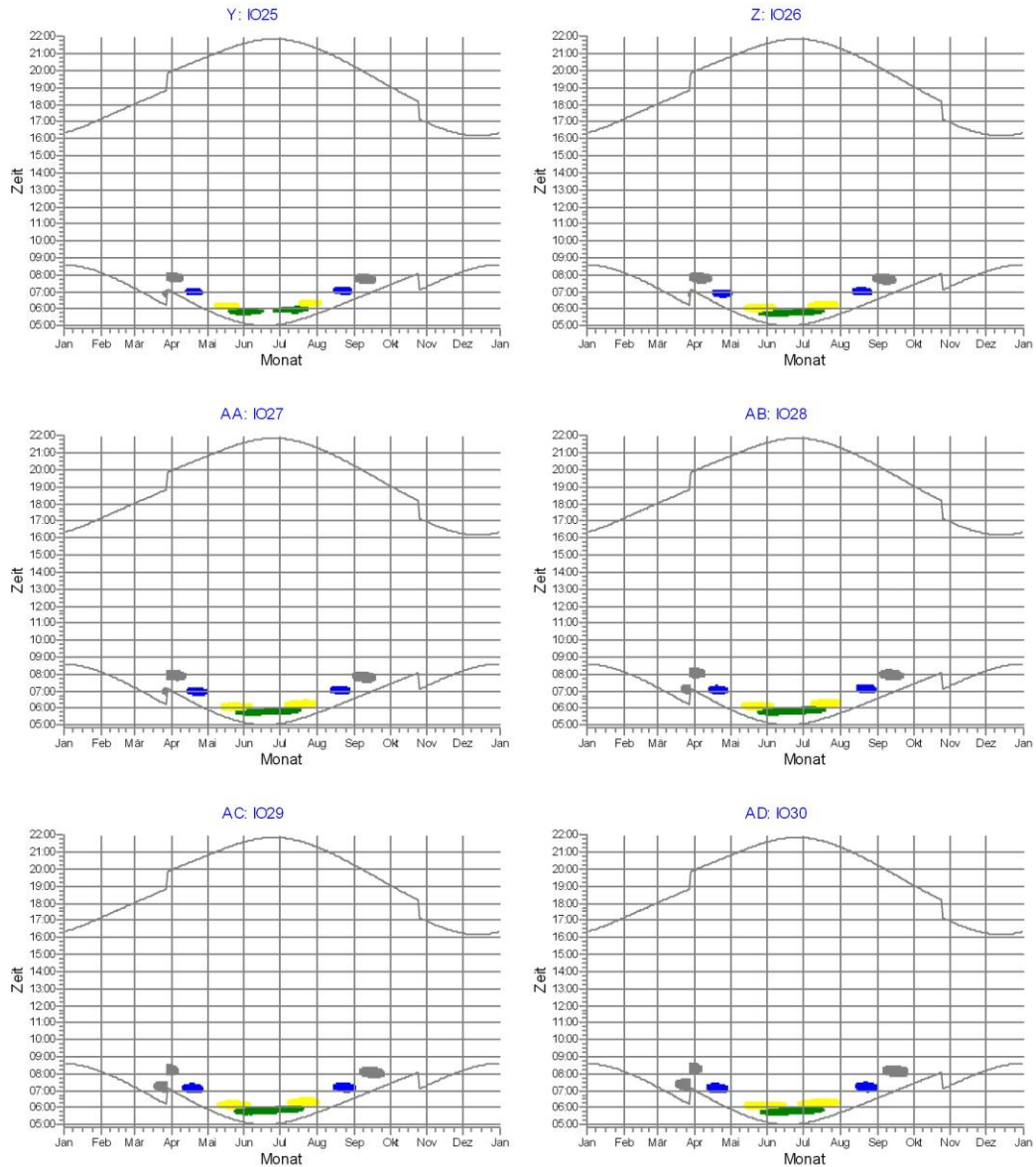
Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Grafischer Kalender

Berechnung: GB



WEA

1: WEA1

2: WEA2

3: WEA3

4: WEA4

Projekt:  
**Schlüsselburg\_160420**

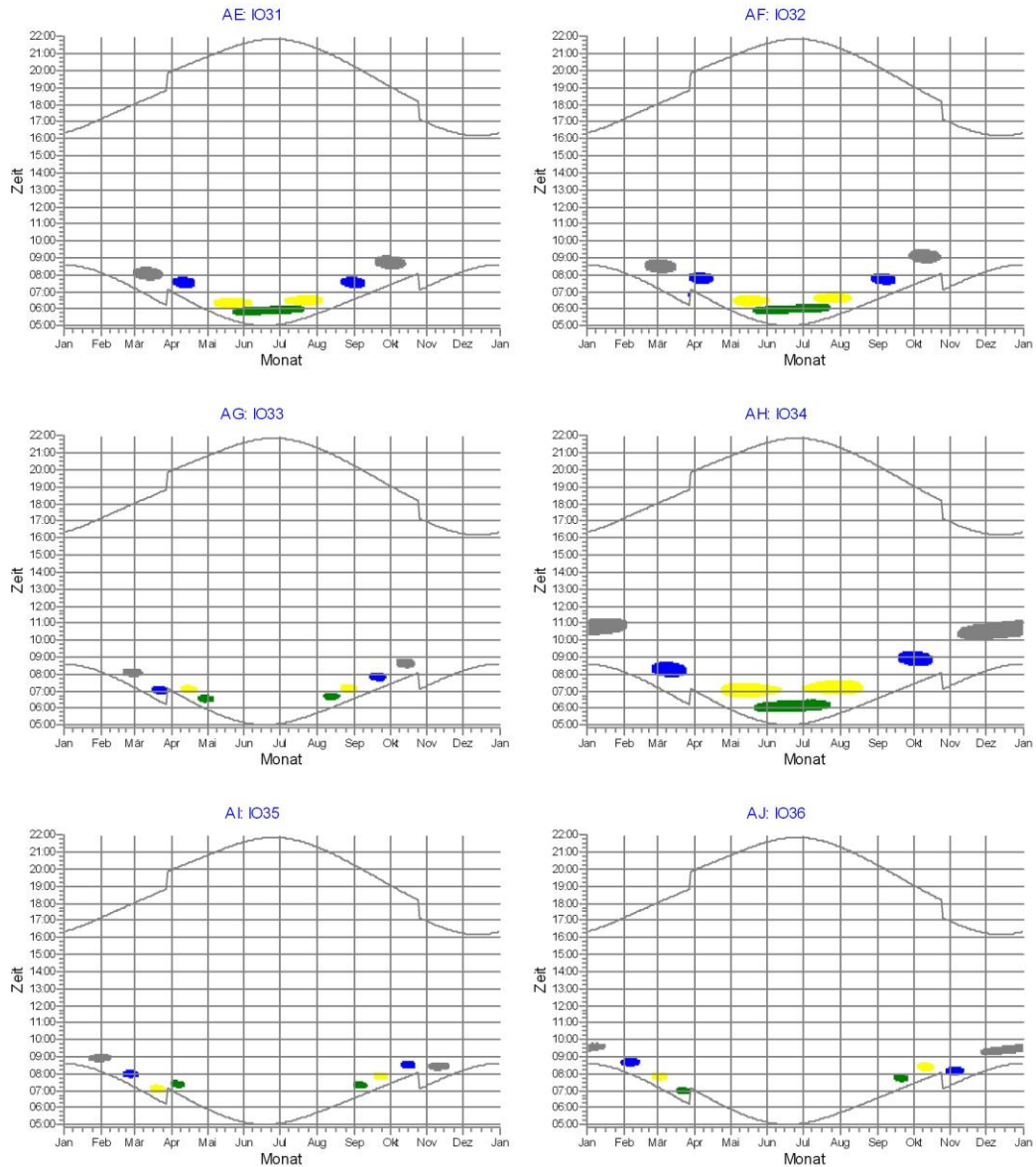
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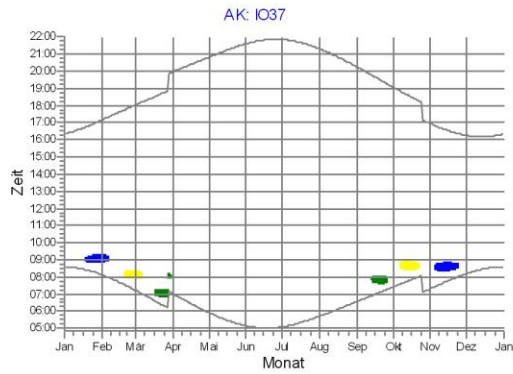
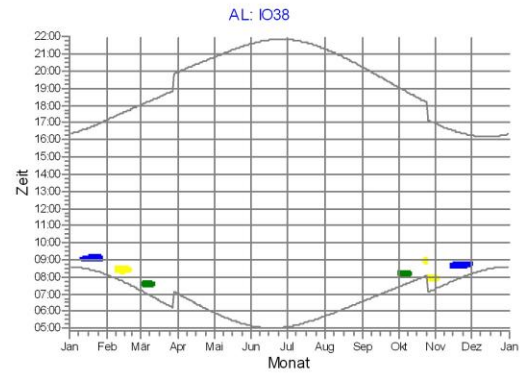
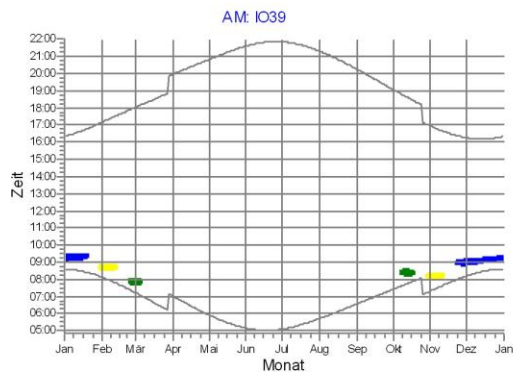
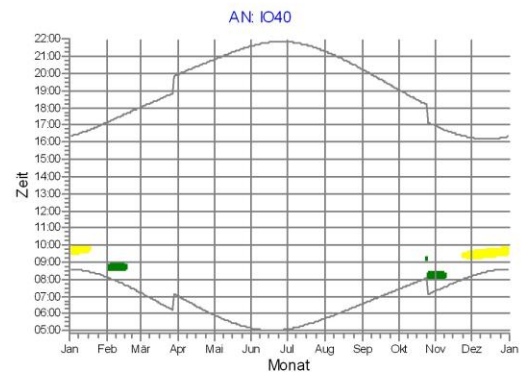
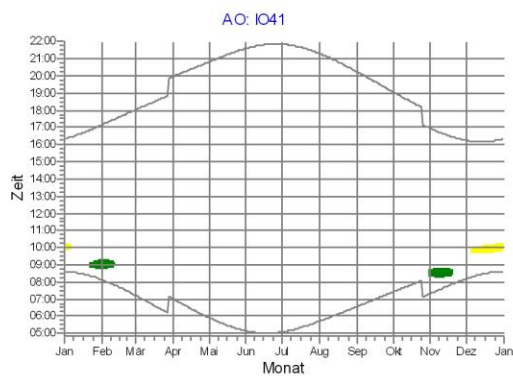
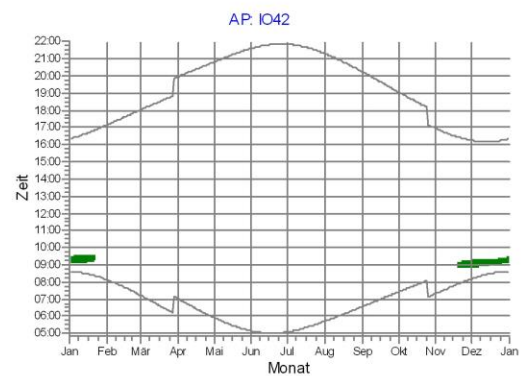
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## SHADOW - Grafischer Kalender

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WEA

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27/07/2016 15:03/3.0.654

## SHADOW - Kalender pro WEA

Berechnung: GBWEA: 1 - WEA1

Voraussetzungen für Berechnung des Schattenwurfs

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) [BREMEN]

| Jan  | Feb  | Mär  | Apr  | Mai  | Jun  | Jul  | Aug  | Sep  | Okt  | Nov  | Dez  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 1.53 | 2.81 | 3.16 | 5.42 | 7.18 | 5.91 | 6.09 | 6.01 | 4.64 | 3.11 | 1.99 | 1.07 |

Betriebsdauer je Sektor

| N   | NNO | ONO | O   | OSO | SSO | S     | SSW   | WSW   | W   | WNW | NNW | Summe |
|-----|-----|-----|-----|-----|-----|-------|-------|-------|-----|-----|-----|-------|
| 307 | 446 | 586 | 378 | 294 | 731 | 1,349 | 1,189 | 1,515 | 960 | 591 | 327 | 8,675 |

: Startwindgeschw. aus Leistungskennlinie

|     | [Januar]                           | [Februar]                           | [März]               | [April]              | [Mai]                | [Juni]               |
|-----|------------------------------------|-------------------------------------|----------------------|----------------------|----------------------|----------------------|
| 1   | 08:35 09:08-09:23/15 14:29-14:32/3 | 08:07 08:50-09:13/23                | 07:13 07:42-08:00/18 | 07:01 07:24-07:26/2  | 05:55 06:25-06:40/15 | 05:08 05:38-06:17/39 |
| 2   | 16:20 13:58-14:25/17               | 17:09 15:53-16:11/18                | 18:02                | 19:57                | 20:49                | 21:36                |
| 3   | 08:35 09:09-09:24/15               | 08:06 08:37-08:47/10 15:54-16:10/16 | 07:11 07:34-07:39/5  | 06:59 07:22-07:29/7  | 05:53 06:25-06:39/14 | 05:07 05:37-06:17/40 |
| 4   | 16:21 13:59-14:26/27               | 17:11 08:50-09:13/23                | 18:04 07:42-07:59/17 | 19:59                | 20:51                | 21:37                |
| 5   | 08:35 09:09-09:25/16               | 08:04 08:36-08:50/14 15:57-16:09/12 | 07:08 07:32-07:58/26 | 06:56 07:19-07:30/11 | 05:51 06:26-06:38/12 | 05:07 05:36-06:17/41 |
| 6   | 16:22 14:00-14:26/26               | 17:13 08:51-09:14/23                | 18:05                | 20:01                | 20:53                | 21:39                |
| 7   | 08:35 09:10-09:26/16               | 08:03 08:35-09:14/39                | 07:06 07:30-07:58/28 | 06:54 07:17-07:31/14 | 05:49 06:26-06:37/11 | 05:06 05:36-06:18/42 |
| 8   | 16:24 14:01-14:26/25               | 17:15 15:59-16:07/8                 | 18:07                | 20:02                | 20:54                | 21:40                |
| 9   | 08:34 09:10-09:27/17               | 08:01 08:34-09:13/39                | 07:04 07:29-07:44/15 | 06:52 07:16-07:31/15 | 05:47 06:28-06:35/7  | 05:05 05:35-06:18/43 |
| 10  | 16:25 14:02-14:26/24               | 17:17                               | 18:09 07:45-07:56/11 | 20:04                | 20:56                | 21:41                |
| 11  | 08:34 09:10-09:28/18               | 07:59 08:33-09:13/40                | 07:02 07:27-07:44/17 | 06:49 07:15-07:30/15 | 05:45                | 05:05 05:34-06:18/44 |
| 12  | 16:26 14:02-14:27/18               | 17:18                               | 18:11                | 07:46 07:53/7        | 20:58                | 21:43                |
| 13  | 08:34 09:10-09:28/18               | 07:57 08:33-09:12/39                | 06:59 07:27-07:44/17 | 06:47 07:15-07:30/15 | 05:43                | 05:04 05:34-06:19/45 |
| 14  | 16:27 14:04-14:26/22               | 17:20                               | 18:13                | 20:08                | 21:00                | 21:43                |
| 15  | 08:33 09:10-09:28/18               | 07:56 08:32-09:11/39                | 06:57 07:28-07:44/16 | 06:45 07:15-07:29/14 | 05:42                | 05:03 05:34-06:19/45 |
| 16  | 16:29 14:05-14:25/20               | 17:22                               | 18:15                | 20:10                | 21:01                | 21:43                |
| 17  | 08:33 09:11-09:29/18               | 07:54 08:32-09:10/38                | 06:55 07:27-07:43/16 | 06:42 07:16-07:29/13 | 05:40                | 05:03 05:33-06:19/46 |
| 18  | 16:30 14:07-14:25/18               | 17:24                               | 18:16                | 20:11                | 21:03                | 21:44                |
| 19  | 08:32 09:11-09:30/19               | 07:52 08:32-08:54/22                | 06:52 07:28-07:42/14 | 06:40 07:16-07:26/10 | 05:38                | 05:02 05:33-06:20/47 |
| 20  | 16:31 14:08-14:25/17               | 17:26 08:38-09:08/12                | 18:18                | 20:13                | 21:04                | 21:45                |
| 21  | 08:32 09:11-09:30/19               | 07:50 08:32-08:54/22                | 06:50 07:28-07:40/12 | 06:38 07:20-07:23/3  | 05:36                | 05:02 05:33-06:19/46 |
| 22  | 16:33 14:10-14:23/13               | 17:28 09:00-09:04/4                 | 18:20                | 20:15                | 21:06                | 21:46                |
| 23  | 08:31 09:11-09:30/19               | 07:48 08:32-08:54/22                | 06:48 07:31-07:37/6  | 06:36                | 05:35                | 05:02 05:32-06:20/48 |
| 24  | 16:34 14:12-14:22/10               | 17:30                               | 18:22                | 20:16                | 21:08                | 21:47                |
| 25  | 08:30 09:12-09:30/18               | 07:46 08:33-08:54/21                | 06:46                | 06:33                | 05:33                | 05:01 05:32-06:20/48 |
| 26  | 16:36 14:16-14:18/2                | 17:32                               | 18:24                | 20:18                | 21:09                | 21:47                |
| 27  | 08:29 09:12-09:31/19               | 07:44 08:33-08:53/20                | 06:43                | 06:31                | 05:31                | 05:01 05:32-06:21/49 |
| 28  | 16:37                              | 17:34 16:57-17:02/5                 | 18:25                | 20:20                | 21:11                | 21:48                |
| 29  | 08:29 09:13-09:31/18               | 07:42 08:34-08:52/18                | 06:41                | 06:29                | 05:30                | 05:01 05:32-06:21/49 |
| 30  | 16:39 15:55-16:05                  | 17:36 16:54-17:05/11                | 18:27                | 20:22                | 21:13                | 21:49                |
| 31  | 08:28 09:13-09:31/18               | 07:40 08:36-08:51/15                | 06:39                | 06:27                | 05:28                | 05:01 05:32-06:21/49 |
| 32  | 16:41 15:53-16:03/10               | 17:37 16:52-17:07/15                | 18:29                | 20:23                | 21:14                | 21:49                |
| 33  | 08:27 09:14-09:31/17               | 07:38 08:38-08:49/11                | 06:36                | 06:24                | 05:27                | 05:01 05:32-06:21/49 |
| 34  | 16:42 15:52-16:05/13               | 17:39 16:51-17:08/17                | 18:31                | 20:25                | 21:16                | 21:50                |
| 35  | 08:26 09:15-09:31/16               | 07:36 16:51-17:09/18                | 06:34 06:57-07:11/14 | 06:22                | 05:25                | 05:01 05:32-06:22/50 |
| 36  | 16:44 15:51-16:06/15               | 17:41                               | 18:32                | 20:27                | 21:17                | 21:50                |
| 37  | 08:25 09:16-09:31/15               | 07:34 16:50-17:10/20                | 06:32 06:55-07:13/18 | 06:20                | 05:24                | 05:01 05:32-06:22/50 |
| 38  | 16:46 15:51-16:08/17               | 17:43                               | 18:34                | 20:29                | 21:19                | 21:50                |
| 39  | 08:24 09:17-09:30/13               | 07:32 16:50-17:10/20                | 06:29 06:52-07:13/21 | 06:18                | 05:22 05:50-05:51/1  | 05:01 05:32-06:22/50 |
| 40  | 16:47 15:50-16:08/18               | 17:45                               | 18:36                | 20:30                | 21:20                | 21:51                |
| 41  | 08:23 09:19-09:29/10               | 07:30 16:49-17:09/20                | 06:27 06:51-07:14/23 | 06:16                | 05:21 05:49-05:55/6  | 05:01 05:32-06:22/50 |
| 42  | 16:49 15:50-16:09/19               | 17:47                               | 18:38                | 20:32                | 21:22                | 21:51                |
| 43  | 08:21 09:21-09:28/7                | 07:28 16:49-17:09/20                | 06:24 06:50-07:14/24 | 06:13                | 05:20 05:47-06:07/20 | 05:01 05:32-06:22/50 |
| 44  | 16:51 15:50-16:10/20               | 17:49                               | 18:40                | 20:33                | 21:23                | 21:51                |
| 45  | 08:20 08:55-09:04/9                | 07:26 16:50-17:09/19                | 06:22 06:50-07:14/24 | 06:11                | 05:18 05:46-06:09/23 | 05:01 05:33-06:23/50 |
| 46  | 16:52 15:50-16:10/20               | 17:51                               | 18:41                | 20:35                | 21:25                | 21:51                |
| 47  | 08:19 08:54-09:06/12               | 07:24 07:48-07:56/8                 | 06:20 06:50-07:14/24 | 06:09 06:33-06:36/3  | 05:17 05:45-06:11/26 | 05:02 05:33-06:23/50 |
| 48  | 16:54 15:50-16:11/21               | 17:52 16:51-17:08/17                | 18:43                | 20:38                | 21:26                | 21:51                |
| 49  | 08:18 08:52-09:07/15               | 07:22 07:46-07:58/12                | 06:17 06:50-07:13/23 | 06:07 06:31-06:38/7  | 05:16 05:44-06:12/28 | 05:02 05:33-06:22/49 |
| 50  | 16:56 15:50-16:11/21               | 17:54 16:52-17:07/15                | 18:45                | 20:39                | 21:27                | 21:51                |
| 51  | 08:16 08:52-09:09/17               | 07:19 07:43-07:58/15                | 06:15 06:51-07:13/22 | 06:05 06:29-06:39/10 | 05:15 05:43-06:13/30 | 05:02 05:34-06:23/49 |
| 52  | 16:58 15:50-16:12/22               | 17:56 16:52-17:05/13                | 18:47                | 20:41                | 21:29                | 21:51                |
| 53  | 08:15 08:51-09:10/16               | 07:17 07:43-07:59/16                | 06:13 06:52-07:12/20 | 06:02 06:27-06:40/13 | 05:13 05:42-06:14/32 | 05:04 05:34-06:23/49 |
| 54  | 17:00 15:50-16:12/22               | 17:58 16:55-17:02/7                 | 18:48                | 20:42                | 21:30                | 21:51                |
| 55  | 08:13 08:51-09:11/20               | 07:15 07:42-08:00/18                | 06:10 06:54-07:10/16 | 06:01 06:25-06:40/15 | 05:12 05:41-06:14/33 | 05:03 05:35-06:24/49 |
| 56  | 17:02 15:51-16:12/21               | 18:00                               | 18:50                | 20:44                | 21:31                | 21:51                |
| 57  | 08:12 08:50-09:12/22               |                                     | 07:08 07:56-08:08/12 | 05:59 06:24-06:40/16 | 05:11 05:40-06:15/35 | 05:04 05:35-06:23/48 |
| 58  | 17:03 15:51-16:12/21               |                                     | 19:02                | 21:35                | 21:51                | 21:51                |
| 59  | 08:11 08:51-09:13/22               |                                     | 07:06 08:00-08:05/5  | 05:57 06:25-06:41/16 | 05:10 05:39-06:16/36 | 05:04 05:36-06:24/48 |
| 60  | 17:05 15:51-16:12/21               |                                     | 19:54                | 20:48                | 21:34                | 21:51                |
| 61  | 08:09 08:50-09:13/23               |                                     | 07:03                | 07:03                | 05:09 05:38-06:16/38 |                      |
| 62  | 17:07 15:53-16:12/19               |                                     | 19:55                | 20:49                | 21:35                |                      |
| 63  |                                    |                                     | 19:57                | 20:51                | 21:37                |                      |
| 64  |                                    |                                     | 19:59                | 20:53                | 21:39                |                      |
| 65  |                                    |                                     | 20:01                | 20:55                | 21:41                |                      |
| 66  |                                    |                                     | 20:03                | 20:57                | 21:43                |                      |
| 67  |                                    |                                     | 20:05                | 20:59                | 21:45                |                      |
| 68  |                                    |                                     | 20:07                | 21:01                | 21:47                |                      |
| 69  |                                    |                                     | 20:09                | 21:03                | 21:49                |                      |
| 70  |                                    |                                     | 20:11                | 21:05                | 21:51                |                      |
| 71  |                                    |                                     | 20:13                | 21:07                | 21:53                |                      |
| 72  |                                    |                                     | 20:15                | 21:09                | 21:55                |                      |
| 73  |                                    |                                     | 20:17                | 21:11                | 21:57                |                      |
| 74  |                                    |                                     | 20:19                | 21:13                | 21:59                |                      |
| 75  |                                    |                                     | 20:21                | 21:15                | 22:01                |                      |
| 76  |                                    |                                     | 20:23                | 21:17                | 22:03                |                      |
| 77  |                                    |                                     | 20:25                | 21:19                | 22:05                |                      |
| 78  |                                    |                                     | 20:27                | 21:21                | 22:07                |                      |
| 79  |                                    |                                     | 20:29                | 21:23                | 22:09                |                      |
| 80  |                                    |                                     | 20:31                | 21:25                | 22:11                |                      |
| 81  |                                    |                                     | 20:33                | 21:27                | 22:13                |                      |
| 82  |                                    |                                     | 20:35                | 21:29                | 22:15                |                      |
| 83  |                                    |                                     | 20:37                | 21:31                | 22:17                |                      |
| 84  |                                    |                                     | 20:39                | 21:33                | 22:19                |                      |
| 85  |                                    |                                     | 20:41                | 21:35                | 22:21                |                      |
| 86  |                                    |                                     | 20:43                | 21:37                | 22:23                |                      |
| 87  |                                    |                                     | 20:45                | 21:39                | 22:25                |                      |
| 88  |                                    |                                     | 20:47                | 21:41                | 22:27                |                      |
| 89  |                                    |                                     | 20:49                | 21:43                | 22:29                |                      |
| 90  |                                    |                                     | 20:51                | 21:45                | 22:31                |                      |
| 91  |                                    |                                     | 20:53                | 21:47                | 22:33                |                      |
| 92  |                                    |                                     | 20:55                | 21:49                | 22:35                |                      |
| 93  |                                    |                                     | 20:57                | 21:51                | 22:37                |                      |
| 94  |                                    |                                     | 20:59                | 21:53                | 22:39                |                      |
| 95  |                                    |                                     | 21:01                | 21:55                | 22:41                |                      |
| 96  |                                    |                                     | 21:03                | 21:57                | 22:43                |                      |
| 97  |                                    |                                     | 21:05                | 21:59                | 22:45                |                      |
| 98  |                                    |                                     | 21:07                | 22:01                | 22:47                |                      |
| 99  |                                    |                                     | 21:09                | 22:03                | 22:49                |                      |
| 100 |                                    |                                     | 21:11                | 22:05                | 22:51                |                      |
| 101 |                                    |                                     | 21:13                | 22:07                | 22:53                |                      |
| 102 |                                    |                                     | 21:15                | 22:09                | 22:55                |                      |
| 103 |                                    |                                     | 21:17                | 22:11                | 22:57                |                      |
| 104 |                                    |                                     | 21:19                | 22:13                | 22:59                |                      |
| 105 |                                    |                                     | 21:21                | 22:15                | 23:01                |                      |
| 106 |                                    |                                     | 21:23                | 22:17                | 23:03                |                      |
| 107 |                                    |                                     | 21:25                | 22:19                | 23:05                |                      |
| 108 |                                    |                                     | 21:27                | 22:21                | 23:07                |                      |
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| 110 |                                    |                                     | 21:31                | 22:25                | 23:11                |                      |
| 111 |                                    |                                     | 21:33                | 22:27                | 23:13                |                      |
| 112 |                                    |                                     | 21:35                | 22:29                | 23:15                |                      |
| 113 |                                    |                                     | 21:37                | 22:31                | 23:17                |                      |
| 114 |                                    |                                     | 21:39                | 22:33                | 23:19                |                      |
| 115 |                                    |                                     | 21:41                | 22:35                | 23:21                |                      |
| 116 |                                    |                                     | 21:43                | 22:37                | 23:23                |                      |
| 117 |                                    |                                     | 21:45                | 22:39                | 23:25                |                      |
| 118 |                                    |                                     | 21:47                | 22:41                | 23:27                |                      |
| 119 |                                    |                                     | 21:49                | 22:43                | 23:29                |                      |
| 120 |                                    |                                     | 21:51                | 22:45                | 23:31                |                      |
| 121 |                                    |                                     | 21:53                | 22:47                | 23:33                |                      |
| 122 |                                    |                                     | 21:55                | 22:49                | 23:35                |                      |
| 123 |                                    |                                     | 21:57                | 22:51                | 23:37                |                      |
| 124 |                                    |                                     | 21:59                | 22:53                | 23:39                |                      |
| 125 |                                    |                                     | 22:01                | 22:55                | 23:41                |                      |
| 126 |                                    |                                     | 22:03                | 22:57                | 23:43                |                      |
| 127 |                                    |                                     | 22:05                | 22:59                | 23:45                |                      |
| 128 |                                    |                                     | 22:07                | 23:01                | 23:47                |                      |
| 129 |                                    |                                     | 22:09                | 23:03                | 23:49                |                      |
| 130 |                                    |                                     | 22:11                | 23:05                | 23:51                |                      |
| 131 |                                    |                                     | 22:13                | 23:07                | 23:53                |                      |
| 132 |                                    |                                     | 22:15                | 23:09                | 23:55                |                      |
| 133 |                                    |                                     | 22:17                | 23:11                | 23:57                |                      |
| 134 |                                    |                                     | 22:19                | 23:13                | 23:59                |                      |
| 135 |                                    |                                     | 22:21                | 23:15                | 24:01                |                      |
| 136 |                                    |                                     | 22:23                | 23:17                | 24:03                |                      |
| 137 |                                    |                                     | 22:25                | 23:19                | 24:05                |                      |
| 138 |                                    |                                     | 22:27                | 23:21                | 24:07                |                      |
| 139 |                                    |                                     | 22:29                | 23:23                | 24:09                |                      |
| 140 |                                    |                                     | 22:31                | 23:25                | 24:11                |                      |
| 141 |                                    |                                     | 22:33                | 23:27                | 24:13                |                      |
| 142 |                                    |                                     | 22:35                | 23:29                | 24:15                |                      |
| 143 |                                    |                                     | 22:37                | 23:31                | 24:17                |                      |
| 144 |                                    |                                     | 22:39                | 23:33                | 24:19                |                      |
| 145 |                                    |                                     | 22:41                | 23:35                | 24:21                |                      |
| 146 |                                    |                                     | 22:43                | 23:37                | 24:23                |                      |
| 147 |                                    |                                     | 22:45                | 23:39                | 24:25                |                      |
| 148 |                                    |                                     | 22:47                | 23:41                | 24:27                |                      |
| 149 |                                    |                                     | 22:49                | 23:43                | 24:29                |                      |
| 150 |                                    |                                     | 22:51                | 23:45                | 24:31                |                      |
| 151 |                                    |                                     | 22:53                | 23:47                | 24:33                |                      |
| 152 |                                    |                                     | 22:55                | 23:49                | 24:35                |                      |
| 153 |                                    |                                     | 22:57                | 23:51                | 24:37                |                      |
| 154 |                                    |                                     | 22:59                | 23:53                | 24:39                |                      |
| 155 |                                    |                                     | 23:01                | 23:55                | 24:41                |                      |
| 156 |                                    |                                     | 23:03                | 23:57                | 24:43                |                      |



Projekt:  
**Schlüsselburg\_160420**

Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Kalender pro WEA

Berechnung: GBWEA: 2 - WEA2

Voraussetzungen für Berechnung des Schattenwurfs

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) [BREMEN]

| Jan  | Feb  | Mär  | Apr  | Mai  | Jun  | Jul  | Aug  | Sep  | Okt  | Nov  | Dez  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 1.53 | 2.81 | 3.16 | 5.42 | 7.18 | 5.91 | 6.09 | 6.01 | 4.64 | 3.11 | 1.99 | 1.07 |

Betriebsdauer je Sektor

| N   | NNO | ONO | O   | OSO | SSO | S     | SSW   | WSW   | W   | WNW | NNW | Summe |
|-----|-----|-----|-----|-----|-----|-------|-------|-------|-----|-----|-----|-------|
| 307 | 446 | 586 | 378 | 294 | 731 | 1,349 | 1,189 | 1,515 | 960 | 591 | 327 | 8,675 |

: Startwindgeschw. aus Leistungskennlinie

| Januar                                                                           | Februar                                                     | März                                         | April                         | Mai                                                        | Juni                                                                      |
|----------------------------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------|-------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------|
| 1 08:35 09:28:09/51/23 15:41-15:44/3<br>16:20 09:53-10:08/15                     | 08:07 08:35-08:48/13<br>17:09                               | 07:13 07:41-08:19/38<br>18:02                | 07:01<br>19:57                | 05:55 06:46-07:22/36<br>20:49                              | 05:08 05:40-06:34/54 19:49-20:29/40<br>21:36 06:50-07:17/27               |
| 2 08:35 09:28:09/51/23 15:41-15:45/4<br>16:21 09:53-10:08/13                     | 08:06 08:34-08:49/15<br>17:11 16:39-16:40/2                 | 07:11 07:40-08:18/38<br>18:04                | 06:59<br>19:59                | 05:53 06:45-07:23/38<br>20:51                              | 05:08 05:40-06:32/52 19:49-20:29/40<br>21:37 06:51-07:18/25               |
| 3 08:35 09:29:09/52/23 15:41-15:47/6<br>16:22 09:56-10:08/12                     | 08:04 08:34-08:51/17<br>17:13 16:36-16:43/7                 | 07:08 07:40-08:17/37<br>18:05                | 06:56<br>20:01                | 05:51 06:44-07:23/39<br>20:53                              | 05:07 05:40-06:28/48 19:48-20:30/42<br>21:39 06:51-07:15/24               |
| 4 08:35 09:29:09/52/23 15:40-15:48/8<br>16:24 09:57-10:07/10                     | 08:03 08:33-08:51/18<br>17:15 16:35-16:45/10                | 07:06 07:41-08:16/35<br>18:07                | 06:54<br>20:02                | 05:49 06:25-06:32/7<br>20:54 06:43-07:23/40                | 05:06 05:40-06:28/48 19:48-20:30/42<br>21:40 06:53-07:15/22               |
| 5 08:34 09:30:09/53/23 15:41-15:49/8<br>16:25 09:59-10:07/8                      | 08:01 08:33-08:51/18<br>17:17 16:34-16:47/13                | 07:04 07:41-08:14/33<br>18:09                | 06:52<br>20:04                | 05:47 06:22-06:34/12<br>20:56 06:42-07:23/41               | 05:05 05:40-06:26/46 19:48-20:31/43<br>21:41 06:54-07:14/20               |
| 6 08:34 09:31:09/53/22 15:40-15:50/10<br>16:26 10:01-10:06/5                     | 07:59 08:33-08:51/18<br>17:18 16:34-16:49/15                | 07:02 07:41-07:57/16<br>18:11 08:01-08:11/10 | 06:49<br>20:06                | 05:45 06:20-06:37/17<br>20:58 06:42-07:24/42               | 05:05 05:40-06:17/37 06:54-07:12/18<br>21:42 06:18-06:24/6 19:48-20:30/42 |
| 7 08:34 09:31:09/53/22 15:41-15:52/11<br>16:27 15:41-15:52/11                    | 07:57 08:33-08:51/18<br>17:20 16:33-16:49/16                | 07:02 07:42-07:56/14<br>18:13                | 06:47<br>20:08                | 05:43 06:19-06:30/19<br>21:00 06:41-07:24/43               | 05:04 05:40-06:17/37 19:48-20:31/43<br>21:43 06:56-07:12/16               |
| 8 08:33 09:31:09/53/22 15:41-15:53/13<br>16:29 15:40-15:53/13                    | 07:56 08:21-08:30/9 16:33-16:49/16<br>17:22 08:33-08:51/18  | 06:57 07:44-07:54/10<br>18:15                | 06:45<br>20:09                | 05:42 06:08-06:11/3 06:41-07:24/43<br>21:01 06:15-06:39/24 | 05:03 05:41-06:17/36 19:48-20:31/43<br>21:43 06:57-07:12/15               |
| 9 08:33 09:33:09/54/21 16:30 15:40-15:55/15<br>16:31 15:41-15:57/16              | 07:54 08:19-08:33/13 16:33-16:49/16<br>17:24 08:34-08:51/17 | 06:55<br>18:16                               | 06:42<br>20:11                | 05:40 06:06-06:07/4<br>21:03 06:41-07:25/44                | 05:03 05:40-06:16/36 19:48-20:32/44<br>21:44 06:58-07:10/12               |
| 10 08:32 09:33:09/54/21 16:31 15:41-15:57/16<br>16:32 15:41-15:57/16             | 07:52 08:18-08:33/15 16:34-16:49/15<br>17:26 08:34-08:50/16 | 06:52<br>18:18                               | 06:40 07:04-07:12/8<br>20:13  | 05:38 06:04-06:40/36<br>21:04 06:41-07:24/43               | 05:02 05:41-06:16/35 19:49-20:32/43<br>21:45 07:00-07:09/9                |
| 11 08:32 09:34:09/54/20 16:33 15:41-15:57/16<br>16:34 15:41-15:58/17             | 07:50 08:17-08:34/17 16:34-16:48/14<br>17:28 08:35-08:49/14 | 06:50<br>18:20                               | 06:38 07:01-07:14/13<br>20:15 | 05:36 06:02-07:24/82<br>21:06                              | 05:02 05:41-06:16/35 19:48-20:32/44<br>21:46 07:01-07:07/8                |
| 12 08:31 09:34:09/54/20 16:34 15:41-15:58/17<br>16:35 15:41-15:58/17             | 07:48 08:17-08:34/17 16:35-16:47/12<br>17:30 08:37-08:47/10 | 06:48<br>18:22                               | 06:36 07:00-07:15/15<br>20:16 | 05:35 06:01-07:24/83<br>21:08                              | 05:02 05:41-06:15/34<br>21:47 19:49-20:33/44                              |
| 13 08:30 09:35:09/53/18 16:36 15:41-15:58/17<br>16:36 15:41-15:58/17             | 07:46 08:16-08:35/19 16:37-16:46/9<br>17:32 08:40-08:44/4   | 06:46<br>18:24                               | 06:33 06:59-07:16/17<br>20:18 | 05:33 05:59-07:24/85<br>21:09                              | 05:01 05:41-06:15/34<br>21:47 19:49-20:33/44                              |
| 14 08:29 09:36:09/53/17 16:37 15:41-15:58/17<br>16:38 15:42-15:59/17             | 07:44 08:16-08:35/19<br>17:34                               | 06:43<br>18:25                               | 06:31 06:58-07:16/18<br>20:20 | 05:31 05:58-07:24/86<br>21:11                              | 05:01 05:41-06-07/26 19:49-20:33/44<br>21:48 06:08-06:14/6                |
| 15 08:29 09:37:09/53/16 16:39 15:42-15:59/17<br>16:40 15:42-15:59/17             | 07:42 08:17-08:35/18<br>17:36                               | 06:41 07:05-07:10/5<br>18:27                 | 06:29 06:57-07:16/19<br>20:22 | 05:30 05:56-07:23/87<br>21:13                              | 05:01 05:42-06-07/25 19:50-20:34/44<br>21:49 06:09-06:14/5                |
| 16 08:28 09:39:09/52/13 16:41 15:42-15:59/17<br>16:42 15:43-16:00/17             | 07:40 08:17-08:34/17<br>17:37                               | 06:39 07:02-07:13/11<br>18:29                | 06:27 06:57-07:16/19<br>20:23 | 05:28 05:55-07:24/89<br>21:14                              | 05:01 05:42-06-07/25 19:50-20:34/44<br>21:49 06:11-06-13/2                |
| 17 08:27 09:40:09/51/11 16:43 15:44-16:00/16<br>16:44 15:44-16:00/16             | 07:38 08:18-08:34/16<br>17:39                               | 06:36 07:00-07:14/14<br>18:31                | 06:24 06:57-07:15/18<br>20:25 | 05:27 05:54-07:24/90<br>21:16                              | 05:01 05:42-06-07/25<br>21:50 19:50-20:34/44                              |
| 18 08:26 09:43:09/50/7 16:45 15:44-16:00/16<br>16:46 15:44-16:00/16              | 07:36 08:19-08:33/14<br>17:41                               | 06:34 06:59-07:15/16<br>18:33                | 06:22 06:58-07:15/17<br>20:27 | 05:25 05:52-07:23/91<br>21:17                              | 05:01 05:42-06-06/24<br>21:50 19:50-20:35/45                              |
| 19 08:25 15:44-16:00/16 16:47 15:45 15:46-15:59/13<br>16:48 15:46-15:59/12       | 07:34 08:20-08:31/11<br>17:43                               | 06:32 06:58-07:16/18<br>18:34                | 06:20 06:58-07:14/16<br>20:29 | 05:24 05:51-06-15/0 19:58-20:17/19<br>21:19                | 05:01 05:42-06-06/24<br>21:50 19:50-20:35/45                              |
| 20 08:24 15:44-15:59/15 16:49 15:47 15:48-15:59/12<br>16:51 15:48-15:59/12       | 07:32 08:04-08:14/10<br>17:45 08:23-08:28/5                 | 06:29 06:57-07:15/18<br>18:36                | 06:18 06:58-07:12/14<br>20:30 | 05:22 05:50-06-15/1 19:57-20:19/22<br>21:20                | 05:01 05:43-06-06/23<br>21:51 19:50-20:35/45                              |
| 21 08:23 15:46-15:59/13 16:52 15:48 15:49-15:57/9<br>16:53 15:49-15:57/9         | 07:30 08:02-08:16/14<br>17:47                               | 06:27 06:57-07:15/18<br>18:38                | 06:16 07:00-07:10/10<br>20:32 | 05:21 05:49-06-15/1 19:54-20:20/26<br>21:22                | 05:01 05:43-06-06/23<br>21:51 19:50-20:35/45                              |
| 22 08:22 15:47-15:59/12 16:54 15:50 15:51-15:55/4<br>16:55 15:51-15:55/4         | 07:28 07:59-08:17/18<br>17:49                               | 06:24 06:57-07:14/17<br>18:40                | 06:13 07:03-07:06/3<br>20:34  | 05:20 05:47-06-15/1 19:54-20:21/27<br>21:23                | 05:01 05:43-06-06/23<br>21:51 19:50-20:35/45                              |
| 23 08:20 15:48-15:57/9 16:56 15:52 15:53-15:57/5<br>16:57 15:53-15:57/5          | 07:26 07:58-08:18/20<br>17:51                               | 06:22 06:57-07:13/16<br>18:41                | 06:11<br>20:35                | 05:18 05:46-06-15/1 19:53-20:23/30<br>21:25                | 05:01 05:43-06-07/24<br>21:51 19:51-20:36/45                              |
| 24 08:19 15:51-15:55/4 16:58 15:54 15:55-15:59/13<br>16:59 15:55-15:59/13        | 07:24 07:58-08:19/21<br>17:53                               | 06:20 06:58-07:12/14<br>18:43                | 06:09 07:00-07:09/9<br>20:37  | 05:17 05:45-06-15/1 19:52-20:24/32<br>21:26                | 05:02 05:43-06-07/24<br>21:51 19:51-20:36/45                              |
| 25 08:18 16:56 15:56 15:57-15:59/13<br>16:57 15:57-15:59/13                      | 07:22 07:47-07:56/9<br>17:54 07:57-08-20/23                 | 06:17 06:59-07:09/10<br>18:45                | 06:07 06:56-07-13/17<br>20:39 | 05:16 05:44-06-15/1 19:51-20:25/34<br>21:27                | 05:02 05:43-06-08/25<br>21:51 19:51-20:36/45                              |
| 26 08:16 16:58 15:58 15:59-15:59/13<br>16:59 15:59-15:59/13                      | 07:19 07:44-08-19/35<br>17:56                               | 06:15 07:03-07:05/2<br>18:47                 | 06:05 06:53-07-15/22<br>20:41 | 05:15 05:43-06-15/1 19:51-20:25/34<br>21:29                | 05:02 05:44-06-09/25<br>21:51 19:52-20:36/44                              |
| 27 08:13 17:00 16:59 15:59-15:59/13<br>17:01 16:59 15:59-15:59/13                | 07:17 07:43-08-19/36<br>17:58                               | 06:13 07:03-07-05/2<br>18:48                 | 06:03 06:51-07-17/26<br>20:42 | 05:13 05:42-06-15/1 19:50-20:26/36<br>21:30                | 05:03 05:44-06-09/25 19:52-20:36/44<br>21:51 19:52-20:36/44               |
| 28 08:13 17:01 16:59 15:59-15:59/13<br>17:02 16:59 15:59-15:59/13                | 07:15 07:42-08-19/37<br>18:00                               | 06:10<br>18:50                               | 06:01 06:49-07-18/29<br>20:44 | 05:12 05:41-06-15/1 19:50-20:27/37<br>21:31                | 05:03 05:44-06-10/26 19:52-20:37/45<br>21:51 19:52-20:36/44               |
| 29 08:12 17:03 16:59 15:59-15:59/13<br>17:04 16:59 15:59-15:59/13                | 17:03<br>18:01                                              | 19:52<br>18:51                               | 05:59 06:47-07-20/33<br>20:46 | 05:11 05:40-06-15/1 19:49-20:27/38<br>21:33                | 05:04 05:44-06-10/26 19:52-20:36/44<br>21:51 19:52-20:36/44               |
| 30 08:11 08:39-08:45/6 17:05 16:59 15:59-15:59/13<br>17:06 16:59 15:59-15:59/13  | 17:05<br>18:02                                              | 19:53<br>18:52                               | 05:57 06:47-07-21/34<br>20:48 | 05:10 05:40-06-15/1 19:49-20:28/39<br>21:34                | 05:04 05:45-06-19/34<br>21:51 19:53-20:37/44                              |
| 31 08:09 08:36-08:47/11 17:07 16:59 15:59-15:59/13<br>17:08 16:59 15:59-15:59/13 | 17:07<br>18:03                                              | 19:55<br>18:53                               | 05:59 06:48-07-22/35<br>20:50 | 05:09 05:39-06-15/1 19:49-20:28/39<br>21:35                | 05:04 05:45-06-19/34<br>21:51 19:53-20:37/44                              |

Sonnenscheindstunden  
Anzahl Minuten mit Schatten

722

754

390

417

357

2852

502

2499

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

| Tag im Monat | Sonnenaufgang (SS:MM)   | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |
|--------------|-------------------------|-------------------|----------------------------------|-----------------------------------|
|              | Sonnenuntergang (SS:MM) | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |

windPRO 3.0.654 | EMD International A/S, Tel. +45 96 35 44 44, www.emd.dk, windpro@emd.dk

27/07/2016 15:25 / 88





Projekt:  
**Schlüsselburg\_160420**

Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Kalender pro WEA

Berechnung: GBWEA: 3 - WEA3

Voraussetzungen für Berechnung des Schattenwurfs

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) [BREMEN]

| Jan  | Feb  | Mär  | Apr  | Mai  | Jun  | Jul  | Aug  | Sep  | Okt  | Nov  | Dez  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 1.53 | 2.81 | 3.16 | 5.42 | 7.18 | 5.91 | 6.09 | 6.01 | 4.64 | 3.11 | 1.99 | 1.07 |

Betriebsdauer je Sektor

| N   | NNO | ONO | O   | OSO | SSO | S     | SSW   | WSW   | W   | WNW | NNW | Summe |
|-----|-----|-----|-----|-----|-----|-------|-------|-------|-----|-----|-----|-------|
| 307 | 446 | 586 | 378 | 294 | 731 | 1,349 | 1,189 | 1,515 | 960 | 591 | 327 | 8,675 |

: Startwindgeschw. aus Leistungskennlinie

|                             | Januar                              | Februar              | März                                | April                               | Mai                  | Juni  |
|-----------------------------|-------------------------------------|----------------------|-------------------------------------|-------------------------------------|----------------------|-------|
| 1                           | 08:35 09:07-09:21/14                | 08:07 08:34-08:45/11 | 07:13 07:52-08:07/15                | 07:01 07:38-08:03/25                | 05:55 06:22-06:59/37 | 05:08 |
| 2                           | 16:20                               | 17:09 08:59-09:15/21 | 18:02 08:07-08:34/27                | 19:57 18:03-18:54/51                | 20:49                | 21:36 |
| 3                           | 08:35 09:07-09:22/15                | 08:06 08:32-08:46/14 | 07:11 07:52-08:04/12                | 06:59 07:37-08:03/26                | 05:53 06:21-06:55/34 | 05:08 |
| 16:21                       | 17:11 08:55-09:14/19                | 18:04 08:04-08:35/31 | 19:59 18:03-18:54/51                | 20:51 06:55-06:57/2                 | 21:37                |       |
| 3                           | 08:35 09:07-09:23/16                | 08:04 08:32-08:48/16 | 07:08 07:55-08:02/7                 | 06:56 07:31-08:03/32                | 05:51 06:21-06:55/34 | 05:07 |
| 16:22                       | 17:13 08:56-09:14/18                | 18:05 08:02-08:36/34 | 20:01 18:04-18:54/50                | 20:53                               | 21:39                |       |
| 8                           | 08:35 09:07-09:23/16                | 08:03 08:31-08:49/18 | 07:06 07:59-08:37/38                | 06:54 07:28-08:04/36                | 05:49 06:20-06:53/33 | 05:06 |
| 16:24                       | 17:15 08:57-09:13/16                | 18:07 08:05-08:35/30 | 20:02 18:05-18:55/50                | 20:54                               | 21:40                |       |
| 5                           | 08:34 09:08-09:24/16                | 08:01 08:31-08:49/18 | 07:04 07:57-08:37/40                | 06:52 07:26-08:04/38                | 05:47 06:20-06:51/31 | 05:05 |
| 16:25                       | 17:17 08:59-09:12/13                | 18:09                | 20:04 18:07-18:55/48                | 20:56 06:50-06:53/3                 | 21:41                |       |
| 6                           | 08:34 09:08-09:25/17                | 07:59 08:31-08:49/18 | 07:02 07:57-08:38/41                | 06:49 07:23-08:03/40                | 05:45 06:21-06:51/30 | 05:05 |
| 16:26                       | 17:18 09:01-09:10/9                 | 18:11                | 20:06 18:07-18:54/47                | 20:58 06:51-06:53/2                 | 21:47                |       |
| 7                           | 08:34 09:08-09:25/17                | 07:57 08:31-08:49/18 | 06:59 07:56-08:38/42                | 06:47 07:22-08:03/41                | 05:43 06:21-06:49/28 | 05:04 |
| 16:27                       | 17:20                               | 18:13                | 20:08 18:07-18:55/48                | 20:59 06:48-06:52/4                 | 21:43                |       |
| 8                           | 08:33 09:08-09:25/17                | 07:56 08:31-08:49/18 | 06:57 07:55-08:38/43                | 06:45 07:22-08:02/40                | 05:42 06:21-06:50/29 | 05:03 |
| 16:29                       | 17:22                               | 18:15                | 20:09 18:07-18:55/48                | 21:01                               | 21:43                |       |
| 9                           | 08:33 09:09-09:26/17                | 07:54 08:31-08:48/17 | 06:55 07:55-08:38/43                | 06:43 07:20-08:01/41                | 05:40 06:22-06:50/28 | 05:03 |
| 16:30                       | 17:24                               | 18:16                | 20:11 18:06-18:54/48                | 21:03                               | 21:44                |       |
| 10                          | 08:32 09:09-09:26/17                | 07:52 08:32-08:48/16 | 06:52 07:55-08:38/43                | 06:40 07:20-08:00/40                | 05:38 06:22-06:48/26 | 05:02 |
| 16:31                       | 17:26                               | 18:18                | 20:13 18:06-18:54/48                | 21:04                               | 21:45                |       |
| 11                          | 08:32 09:09-09:26/17                | 07:50 08:33-08:47/14 | 06:50 07:54-08:37/43                | 06:38 07:08-07:13/5 18:06-18:53/47  | 05:36 06:23-06:45/22 | 05:02 |
| 16:33 09:10-09:27/17        | 17:28                               | 18:20                | 20:15 07:19-08:00/41                | 21:06                               | 21:46                |       |
| 12                          | 08:31 09:09-09:27/16                | 07:48 08:35-08:45/10 | 06:48 07:54-08:37/43                | 06:36 07:05-07:17/12 18:07-18:53/46 | 05:35 06:26-06:33/7  | 05:02 |
| 16:34 09:10-09:27/17        | 17:30                               | 18:22                | 20:16 07:19-07:59/40                | 21:08 06:34-06:49/29                | 21:47                |       |
| 13                          | 08:30 09:09-09:28/17                | 07:46 08:38-08:42/4  | 06:46 07:54-08:37/43                | 06:33 07:02-07:57/55                | 05:33 06:38-06:39/1  | 05:01 |
| 16:36 09:10-09:27/17        | 17:32                               | 18:24                | 20:18 18:06-18:53/47                | 21:09                               | 21:47                |       |
| 14                          | 08:29 09:09-09:29/10 16:01-16:03/2  | 07:44                | 06:43 07:54-08:36/42                | 06:31 06:56-07:54/58                | 05:31                | 05:01 |
| 16:37 09:11-09:27/16        | 17:34                               | 18:25                | 20:20 18:07-18:51/44                | 21:11                               | 21:48                |       |
| 15                          | 08:29 09:08-09:29/12 16:01-16:05/4  | 07:42                | 06:41 07:54-08:36/42                | 06:29 06:54-07:52/58                | 05:30                | 05:01 |
| 16:39 09:11-09:27/16        | 17:36                               | 18:27 17:18-17:34/16 | 20:22 18:07-18:50/43                | 21:13                               | 21:49                |       |
| 16                          | 08:28 09:07-09:30/14 16:00-16:07/7  | 07:40                | 06:39 07:55-08-35/40                | 06:27 06:53-07:47/54                | 05:28                | 05:01 |
| 16:41 09:13-09:27/14        | 17:37                               | 18:29 17:15-17:37/22 | 20:23 18:08-18:50/42                | 21:14                               | 21:49                |       |
| 17                          | 08:27 08:57-09:12/15 16:00-16:09/9  | 07:38                | 06:36 07:01-07:10/9 17:12-17:39/27  | 06:24 06:50-07:43/53                | 05:27                | 05:01 |
| 16:42 09:14-09:27/13        | 17:39                               | 18:31 07:54-08:33/39 | 20:25 18:09-18:49/40                | 21:16                               | 21:49                |       |
| 18                          | 08:26 08:57-09:13/16 16:01-16:11/10 | 07:36                | 06:34 06:58-07:12/14 17:11-17:40/29 | 06:23 06:48-07-41/53                | 05:26                | 05:01 |
| 16:44 09:15-09:27/12        | 17:41                               | 18:33 07:55-08:32/37 | 20:27 18:10-18:48/38                | 21:17                               | 21:50                |       |
| 19                          | 08:25 08:57-09:14/17 16:01-16:13/12 | 07:34                | 06:32 06:57-07:13/16 17:08-17:41/33 | 06:20 06:46-07:22/36 18:10-18:45/35 | 05:24                | 05:01 |
| 16:46 09:17-09:26/9         | 17:43                               | 18:34 07:56-08:31/35 | 20:29 07:23-07:40/17                | 21:19                               | 21:50                |       |
| 20                          | 08:24 08:56-09:13/17 16:00-16:14/14 | 07:32 07:57-08:02/5  | 06:29 06:55-07:13/18 17:07-17:42/35 | 06:18 06:44-07:21/37 18:11-18:44/33 | 05:22                | 05:01 |
| 16:47 09:18-09:26/6         | 17:45                               | 18:36 07:57-08:29/32 | 20:30 07:24-07:36/12                | 21:21                               | 21:51                |       |
| 21                          | 08:23 08:55-09:14/19                | 07:30 07:55-08:05/10 | 06:27 06:55-07:14/19 17:07-17:43/36 | 06:16 06:42-07:21/39                | 05:21                | 05:01 |
| 16:49 16:01-16:15/14        | 17:47                               | 18:38 07:58-08:27/29 | 20:32 18:13-18:42/29                | 21:22                               | 21:51                |       |
| 22                          | 08:21 08:55-09:14/19                | 07:28 07:52-08:06/14 | 06:24 06:54-07:13/19 17:05-17:43/38 | 06:13 06:38-07:20/42                | 05:20                | 05:01 |
| 16:51 16:02-16:16/14        | 17:49                               | 18:40 07:59-08-24/24 | 20:34 18:15-18-40/25                | 21:23                               | 21:51                |       |
| 23                          | 08:20 08:54-09:14/20                | 07:26 07:51-08:07/16 | 06:22 06:54-07:13/19 17:04-17:44/40 | 06:11 06:35-07:19/44                | 05:18                | 05:01 |
| 16:53 16:02-16:15/13        | 17:51                               | 18:41 08:02-08-22/20 | 20:35 18:17-18:38/21                | 21:25                               | 21:51                |       |
| 24                          | 08:19 08:54-09:14/20                | 07:24 07:51-08:08/17 | 06:20 06:54-07:13/19 17:04-17:44/40 | 06:09 06:34-07:19/45                | 05:17                | 05:02 |
| 16:54 16:03-16:16/14        | 17:53                               | 18:43 08:05-08:18/13 | 20:37 18:20-18:35/15                | 21:26                               | 21:51                |       |
| 25                          | 08:18 08:53-09:15/21                | 07:22 07:51-08:08/17 | 06:17 06:54-07:11/17                | 06:07 06:33-07:18/45                | 05:16                | 05:02 |
| 16:56 16:03-16:14/11        | 17:54 08:17-08-22/5                 | 18:45 17:03-17-44/41 | 20:39                               | 21:27                               | 21:51                |       |
| 26                          | 08:16 08:53-09:14/21                | 07:19 07:50-08:07/17 | 06:15 06:55-07:10/15                | 06:05 06:31-07:16/45                | 05:15                | 05:02 |
| 16:58 16:05-16:14/9         | 17:56 08:10-08-27/17                | 18:47 17:03-17-49/44 | 20:41                               | 21:29                               | 21:51                |       |
| 27                          | 08:15 08:53-09:13/20 16:06-16:12/6  | 07:17 07:50-08-08/18 | 06:13 06:57-07-07/11                | 06:03 06:28-07:14/46                | 05:13                | 05:03 |
| 17:00 09:13-09-14/1         | 17:58 08:08-08-30/2                 | 18:48 17:03-17-47/46 | 20:42                               | 21:30                               | 21:51                |       |
| 28                          | 08:13 08:53-09:12/19                | 07:15 07:51-08-08/17 | 06:10 06:46-06-55/7 17:02-17:50/48  | 06:01 06:25-07:12/47                | 05:12                | 05:03 |
| 17:02 09:12-09:15/9         | 18:00 08:08-08-32/24                | 18:50 06:58-07:05/7  | 20:44                               | 21:31                               | 21:51                |       |
| 29                          | 08:12 08:53-09:15/22                | 17:03                | 07:08 07:44-07-59/15                | 05:59 06:23-07:03/40                | 05:11                | 05:04 |
| 17:03                       |                                     | 19:52 18:02-18-52/50 | 20:46                               | 21:31                               | 21:51                |       |
| 30                          | 08:11 08:38-08-41/3                 | 17:05                | 07:06 07:42-08-01/19                | 05:57 06:23-07:01/38                | 05:10                | 05:04 |
| 17:05 08:54-09:16/22        |                                     | 19:54 18:02-18-52/50 | 20:48                               | 21:34                               | 21:51                |       |
| 31                          | 08:09 08:36-08-44/8                 | 17:07                | 07:03 07:39-08-01/22                | 05:55 06:22-06-50/37                | 05:09                | 05:04 |
| 17:07 08:54-09:15/21        |                                     | 19:55 18:02-18-53/51 |                                     | 21:35                               | 21:51                |       |
| Sonnenscheinstunden         | 256                                 |                      | 367                                 | 417                                 | 488                  | 502   |
| Anzahl Minuten mit Schatten | 793                                 | 487                  | 1791                                | 2314                                | 358                  |       |

Projekt:  
**Schlüsselburg\_160420**

Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Kalender pro WEA

Berechnung: GBWEA: 3 - WEA3

Voraussetzungen für Berechnung des Schattenwurfs

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) [BREMEN]

| Jan  | Feb  | Mär  | Apr  | Mai  | Jun  | Jul  | Aug  | Sep  | Okt  | Nov  | Dez  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 1.53 | 2.81 | 3.16 | 5.42 | 7.18 | 5.91 | 6.09 | 6.01 | 4.64 | 3.11 | 1.99 | 1.07 |

Betriebsdauer je Sektor

| N   | NNO | ONO | O   | OSO | SSO | S     | SSW   | WSW   | W   | WNW | NNW | Summe |
|-----|-----|-----|-----|-----|-----|-------|-------|-------|-----|-----|-----|-------|
| 307 | 446 | 586 | 378 | 294 | 731 | 1,349 | 1,189 | 1,515 | 960 | 591 | 327 | 8,675 |

: Startwindgeschw. aus Leistungskennlinie

| Juli                        |       | August        |                      | September |                | Oktober |                | November |                | Dezember |                |
|-----------------------------|-------|---------------|----------------------|-----------|----------------|---------|----------------|----------|----------------|----------|----------------|
| 1                           | 05:05 | 05:43         | 06:35-06:55/20       | 06:34     | 07:07-07:12/5  | 07:24   | 08:33-09:16/43 | 07:19    | 08:02-08:18/16 | 08:11    | 08:44-08:47/3  |
| 2                           | 05:06 | 05:44         | 06:33-06:56/23       | 06:35     | 07:19-07:59/40 | 07:26   | 08:33-09:16/43 | 07:21    | 08:01-08:18/17 | 08:12    | 08:52-09:09/17 |
| 3                           | 05:07 | 05:45         | 06:32-06:59/27       | 06:37     | 07:18-07:59/41 | 07:27   | 08:33-09:16/43 | 07:23    | 08:01-08:19/18 | 08:14    | 08:52-09:09/17 |
| 4                           | 05:07 | 05:47         | 06:31-07:00/29       | 06:39     | 07:19-08:00/41 | 07:29   | 08:33-09:16/43 | 07:24    | 08:01-08:19/18 | 08:15    | 08:53-09:10/17 |
| 5                           | 05:08 | 05:49         | 06:31-07:01/30       | 06:40     | 07:19-08:00/41 | 07:31   | 08:32-09:15/43 | 07:26    | 08:01-08:19/18 | 08:17    | 08:53-09:10/17 |
| 6                           | 05:09 | 05:51         | 06:30-06:59/29       | 06:42     | 07:19-07:59/40 | 07:32   | 08:32-09:14/42 | 07:28    | 08:01-08:19/18 | 08:18    | 08:53-09:10/17 |
| 7                           | 05:10 | 05:52         | 06:30-07:01/31       | 06:44     | 07:21-07:59/38 | 07:34   | 08:33-09:14/41 | 07:30    | 08:01-08:18/17 | 08:19    | 08:55-09:11/16 |
| 8                           | 05:11 | 05:54         | 06:29-07:02/33       | 06:45     | 07:22-07:58/36 | 07:36   | 08:33-09:13/40 | 07:32    | 08:02-08:18/16 | 08:20    | 08:55-09:11/16 |
| 9                           | 05:12 | 05:55         | 06:30-07:03/33       | 06:47     | 07:24-07:57/33 | 07:38   | 08:33-09:12/39 | 07:34    | 08:03-08:17/14 | 08:22    | 08:55-09:11/16 |
| 10                          | 05:13 | 05:57         | 06:30-07:03/33       | 06:49     | 07:30-07:57/27 | 07:39   | 08:34-09:11/37 | 07:35    | 08:05-08:16/11 | 08:23    | 08:57-09:12/15 |
| 11                          | 05:14 | 05:59         | 06:30-07:04/34       | 06:50     | 07:30-07:55/25 | 07:41   | 08:27-08:37/10 | 07:37    | 08:07-08:15/8  | 08:24    | 08:58-09:12/14 |
| 12                          | 05:15 | 06:00         | 06:31-07:07/36       | 06:52     | 07:31-07:54/23 | 07:43   | 08:25-08:39/14 | 07:39    | 08:10-08:11/1  | 08:25    | 08:59-09:12/13 |
| 13                          | 05:16 | 06:02         | 06:31-07:10/39       | 06:54     | 07:32-07:51/19 | 07:45   | 08:24-08:40/16 | 07:41    | 08:25-08:47/22 | 08:26    | 09:00-09:12/12 |
| 14                          | 05:17 | 06:04         | 06:32-07:12/40       | 06:55     | 07:34-07:49/15 | 07:46   | 08:23-08:41/18 | 07:43    | 08:25-08:44/19 | 08:27    | 09:01-09:12/11 |
| 15                          | 05:19 | 06:05         | 06:33-07:20/47       | 06:57     | 07:37-07:46/9  | 07:48   | 08:22-08:39/17 | 07:44    | 08:26-08:46/20 | 08:28    | 09:02-09:13/11 |
| 16                          | 05:20 | 06:07         | 06:36-07:22/46       | 06:59     | 07:45-07:56/11 | 07:50   | 08:22-08:39/17 | 07:46    | 08:26-08:47/21 | 08:29    | 09:03-09:13/10 |
| 17                          | 05:21 | 06:09         | 06:39-07:23/44       | 07:00     | 07:44-07:58/14 | 07:52   | 08:22-08:39/17 | 07:48    | 08:27-08:47/20 | 08:30    | 09:03-09:13/10 |
| 18                          | 05:22 | 06:10         | 06:40-07:24/44       | 07:02     | 07:43-07:59/16 | 07:53   | 08:22-08:39/17 | 07:50    | 08:28-08:48/20 | 08:31    | 09:04-09:13/9  |
| 19                          | 05:24 | 06:12         | 06:41-07:25/44       | 07:04     | 07:41-07:59/18 | 07:55   | 08:23-08:38/15 | 07:52    | 08:29-08:49/20 | 08:32    | 09:05-09:14/9  |
| 20                          | 05:25 | 06:14         | 06:41-07:25/44       | 07:05     | 07:41-07:59/18 | 07:57   | 08:24-08:37/13 | 07:53    | 08:30-08:50/20 | 08:33    | 09:05-09:14/9  |
| 21                          | 05:26 | 06:15         | 06:44-07:26/42       | 07:07     | 07:39-07:58/19 | 07:59   | 08:26-08:35/9  | 07:55    | 08:31-08:50/19 | 08:34    | 09:06-09:14/8  |
| 22                          | 05:28 | 06:17         | 06:47-07:25/38       | 07:09     | 07:40-07:58/18 | 08:01   |                | 07:57    | 08:32-08:49/17 | 08:35    | 09:06-09:14/8  |
| 23                          | 05:29 | 06:19         | 06:49-07:26/37       | 07:10     | 07:40-07:58/18 | 08:02   |                | 07:58    | 08:33-08:50/17 | 08:36    | 09:07-09:16/9  |
| 24                          | 05:30 | 06:20         | 06:49-07:25/36       | 07:12     | 07:40-07:56/16 | 08:04   |                | 08:00    | 08:34-08:50/16 | 08:37    | 09:07-09:16/9  |
| 25                          | 05:32 | 06:22         | 06:51-07:44/53       | 07:14     | 07:41-07:55/14 | 08:06   |                | 08:02    | 08:35-08:50/15 | 08:38    | 09:07-09:16/9  |
| 26                          | 05:33 | 06:24         | 06:53-07:46/53       | 07:15     | 07:42-07:53/11 | 08:08   |                | 08:03    | 08:36-08:50/14 | 08:39    | 09:08-09:17/9  |
| 27                          | 05:35 | 06:25         | 06:55-07:50/55       | 07:17     | 07:46-07:49/3  | 08:10   |                | 08:05    | 08:37-08:49/12 | 08:40    | 09:08-09:18/10 |
| 28                          | 05:36 | 06:26         | 06:56-07:51/54       | 07:19     | 07:48-07:51/16 | 08:12   |                | 08:06    | 08:39-08:49/10 | 08:41    | 09:09-09:18/10 |
| 29                          | 05:38 | 06:28         | 06:57-07:52/58       | 07:20     | 07:50-07:51/17 | 08:14   |                | 08:08    | 08:41-08:49/8  | 08:42    | 09:09-09:18/10 |
| 30                          | 05:39 | 06:30         | 07:03-07:57/54       | 07:22     | 08:04-09:17/43 | 08:16   |                | 08:10    | 08:42-08:48/6  | 08:43    | 09:09-09:20/12 |
| 31                          | 05:41 | 06:38-06:41/3 | 06:32-07:05-07:17/12 | 07:24     | 08:05-09:17/44 | 08:18   |                | 08:12    | 08:43-08:49/5  | 08:44    | 09:09-09:21/13 |
| Sonnenscheinstunden         |       | 505           |                      | 505       |                | 505     |                | 505      |                | 505      |                |
| Anzahl Minuten mit Schatten |       | 10            | 1749                 | 2244      |                | 755     |                | 867      |                | 478      |                |

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

| Tag im Monat | Sonnenaufgang (SS:MM)   | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |
|--------------|-------------------------|-------------------|----------------------------------|-----------------------------------|
|              | Sonnenuntergang (SS:MM) | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |

Projekt:  
**Schlüsselburg\_160420**

Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Kalender pro WEA

Berechnung: GBWEA: 4 - WEA4

Voraussetzungen für Berechnung des Schattenwurfs

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) [BREMEN]  
Jan Feb Mär Apr Mai Jun Jul Aug Sep Okt Nov Dez  
1.53 2.81 3.16 5.42 7.18 5.91 6.09 6.01 4.64 3.11 1.99 1.07

Betriebsdauer je Sektor

N NNO ONO O OSO SSO S SSW WSW W WNW NNW Summe  
307 446 586 378 294 731 1,349 1,189 1,515 960 591 327 8,675  
: Startwindgeschw. aus Leistungskennlinie

|                             | Januar                                       | Februar                                      | März                                         | April                                        | Mai                                          | Juni                                         |
|-----------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------------------|
| 1                           | 08:35 09:21-09:40/19<br>16:20 10:19-11:06/47 | 08:07 08:45-09:05/20<br>17:09 10:41-11:04/23 | 07:13 07:54-08:17/23<br>18:02 08:17-08:53/24 | 07:01 07:34-08:33/59<br>19:57 07:50-08:33/59 | 05:55 19:57-20:16/19<br>05:53 19:56-20:16/20 | 05:08 20:25-20:38/13<br>05:08 20:26-20:37/11 |
| 2                           | 08:35 09:21-09:41/20<br>16:21 10:20-11:07/47 | 08:06 08:45-09:05/20<br>17:11 10:44-11:01/17 | 07:11 07:53-08:16/23<br>18:04 08:16-08:50/34 | 06:59 07:30-08:30/60<br>19:59 07:30-08:30/60 | 05:51 19:56-20:16/20<br>05:50 20:18-20:23/5  | 05:07 20:26-20:36/10<br>05:04 21:39          |
| 3                           | 08:35 09:22-09:41/19<br>16:22 10:21-11:08/47 | 08:04 08:47-09:05/18<br>17:13 10:49-10:57/8  | 07:08 07:54-08:17/23<br>18:06 08:16-08:50/34 | 06:56 07:30-08:30/60<br>20:01 07:28-08:28/60 | 05:51 19:56-20:16/20<br>05:49 19:55-20:16/21 | 05:07 20:26-20:36/10<br>05:06 20:28-20:36/8  |
| 4                           | 08:35 09:22-09:41/19<br>16:24 10:20-11:08/48 | 08:03 08:47-09:05/18<br>17:15 08:48-09:04/16 | 07:06 07:53-08:16/23<br>18:07 08:15-08:50/35 | 06:54 07:28-08:28/60<br>20:02 07:25-08:26/61 | 05:49 19:55-20:16/21<br>05:47 19:55-20:15/20 | 05:06 20:28-20:36/8<br>05:05 20:29-20:34/5   |
| 5                           | 08:34 09:23-09:42/19<br>16:25 10:21-11:09/48 | 08:01 08:48-09:04/16<br>17:17 08:49-09:03/14 | 07:04 07:51-08:14/23<br>18:09 08:13-08:49/36 | 06:52 07:25-08:26/61<br>20:04 07:20-08:22/62 | 05:47 19:55-20:15/20<br>05:45 19:56-20:27/31 | 05:05 20:29-20:34/5<br>05:05 21:42           |
| 6                           | 08:34 09:24-09:43/19<br>16:26 10:21-11:09/48 | 07:59 08:49-09:03/14<br>17:18 08:50-09:01/11 | 07:02 07:50-08:11/21<br>18:11 08:11-08:49/38 | 06:49 07:20-08:22/62<br>20:06 07:17-08:12/55 | 05:45 19:56-20:27/31<br>05:44 19:56-20:28/32 | 05:05 21:42<br>05:04 21:43                   |
| 7                           | 08:34 09:25-09:42/17<br>16:27 10:22-11:10/48 | 07:57 08:50-09:01/11<br>17:20 08:53-08:59/6  | 06:59 07:49-08:06/17<br>18:13 08:06-08:49/43 | 06:47 07:17-08:12/55<br>20:08 07:15-08:09/54 | 05:44 19:56-20:28/32<br>05:42 19:56-20:29/33 | 05:04 21:43<br>05:03 21:44                   |
| 8                           | 08:33 09:25-09:42/17<br>16:29 10:22-11:10/48 | 07:56 08:53-08:59/6<br>17:22 08:54-09:00/11  | 06:57 07:48-08:47/59<br>18:15 16:48-17:11/23 | 06:45 07:15-08:09/54<br>20:09 07:14-08:05/51 | 05:42 19:56-20:29/33<br>05:40 19:57-20:30/33 | 05:03 21:44<br>05:02 21:45                   |
| 9                           | 08:33 09:26-09:43/17<br>16:30 10:23-11:11/48 | 07:54 08:54-09:01/11<br>17:24 08:54-09:01/11 | 06:55 07:47-08:46/59<br>18:16 16:49-17:10/21 | 06:42 07:14-08:05/51<br>20:11 07:12-08:02/50 | 05:38 19:58-20:30/32<br>05:36 19:59-20:33/34 | 05:03 21:45<br>05:02 21:46                   |
| 10                          | 08:32 09:27-09:43/16<br>16:31 10:23-11:11/48 | 07:52 08:54-09:01/11<br>17:26 08:54-09:01/11 | 06:53 07:47-08:46/59<br>18:18 16:51-17:09/18 | 06:40 07:12-08:02/50<br>20:13 07:10-08:00/50 | 05:38 19:58-20:30/32<br>05:36 19:59-20:33/34 | 05:02 21:46<br>05:01 21:47                   |
| 11                          | 08:32 09:28-09:42/14<br>16:33 10:23-11:11/48 | 07:50 08:54-09:01/11<br>17:28 08:54-09:01/11 | 06:50 07:46-08:43/57<br>18:20 16:53-17:05/12 | 06:38 07:10-08:00/50<br>20:15 07:07-07:57/50 | 05:36 19:59-20:33/34<br>05:35 20:01-20:36/35 | 05:02 21:47<br>05:01 21:48                   |
| 12                          | 08:31 09:29-09:42/13<br>16:34 10:24-11:12/48 | 07:48 08:54-09:01/11<br>17:30 08:54-09:01/11 | 06:48 07:45-08:42/57<br>18:22 07:46-08:40/54 | 06:36 07:07-07:57/50<br>20:16 07:05-07:54/49 | 05:35 20:01-20:36/35<br>05:33 20:10-20:37/27 | 05:02 21:48<br>05:01 21:49                   |
| 13                          | 08:30 09:30-09:41/11<br>16:36 10:24-11:12/48 | 07:46 08:54-09:01/11<br>17:32 08:54-09:01/11 | 06:46 07:46-08:40/54<br>18:24 07:45-08:37/52 | 06:33 07:05-07:54/49<br>20:18 07:01-07:51/50 | 05:33 20:10-20:37/27<br>05:31 20:10-20:38/28 | 05:01 21:49<br>05:01 21:50                   |
| 14                          | 08:29 09:31-09:40/9<br>16:37 10:24-11:12/48  | 07:44 08:54-09:01/11<br>17:34 08:54-09:01/11 | 06:43 07:45-08:37/52<br>18:25 07:45-08:33/48 | 06:31 07:01-07:51/50<br>20:20 07:50-07:53/3  | 05:31 20:10-20:38/28<br>05:30 20:10-20:38/28 | 05:01 21:50<br>05:01 21:51                   |
| 15                          | 08:29 09:34-09:39/5<br>16:39 10:25-11:12/47  | 07:42 08:54-09:01/11<br>17:36 08:54-09:01/11 | 06:41 07:45-08:33/48<br>18:27 07:46-08:21/35 | 06:29 06:59-07:48/49<br>20:22 07:47-07:53/5  | 05:30 20:10-20:38/28<br>05:28 20:10-20:39/29 | 05:01 21:51<br>05:01 21:52                   |
| 16                          | 08:28 10:25-11:13/48<br>16:41 10:26-11:13/47 | 07:40 08:54-09:01/11<br>17:38 08:54-09:01/11 | 06:39 07:46-08:21/35<br>18:29 07:46-08:14/25 | 06:27 06:58-07:47/49<br>20:24 07:44-07:52/8  | 05:28 20:10-20:39/29<br>05:27 20:11-20:40/29 | 05:01 21:52<br>05:01 21:53                   |
| 17                          | 08:27 10:26-11:13/47<br>16:42 10:27-11:13/46 | 07:38 08:54-09:01/11<br>17:39 08:54-09:01/11 | 06:36 07:46-08:14/25<br>18:31 07:45-08:19/34 | 06:24 06:57-07:46/49<br>20:25 07:46-07:51/5  | 05:27 20:11-20:40/29<br>05:25 20:11-20:40/29 | 05:01 21:53<br>05:01 21:54                   |
| 18                          | 08:26 10:27-11:13/46<br>16:44 10:28-11:13/45 | 07:36 16:55-17:03/8<br>17:41 08:54-09:01/11  | 06:34 07:44-07:31/17<br>18:33 07:46-08:19/33 | 06:22 06:57-07:45/48<br>20:27 07:43-07:50/7  | 05:25 20:11-20:40/29<br>05:24 20:11-20:40/29 | 05:01 21:54<br>05:01 21:55                   |
| 19                          | 08:25 10:28-11:13/45<br>16:46 10:29-11:12/44 | 07:34 08:27-08:39/12<br>17:43 16:52-17:06/14 | 06:32 07:43-07:34/24<br>18:34 07:47-08:18/31 | 06:20 06:56-07:42/46<br>20:29 07:40-07:49/9  | 05:24 20:11-20:40/29<br>05:22 20:12-20:41/29 | 05:01 21:55<br>05:01 21:56                   |
| 20                          | 08:24 10:27-11:13/46<br>16:47 10:30-11:13/45 | 07:32 08:23-08:42/19<br>17:45 16:51-17:08/17 | 06:29 07:07-07:34/27<br>18:36 07:47-08:15/28 | 06:18 06:56-07:41/46<br>20:30 07:40-07:47/7  | 05:22 20:12-20:41/29<br>05:21 20:12-20:40/28 | 05:01 21:56<br>05:01 21:57                   |
| 21                          | 08:23 10:28-11:13/45<br>16:49 10:31-11:14/40 | 07:30 08:01-08:12/11<br>17:47 08:21-08:45/24 | 06:27 07:05-07:36/31<br>18:38 07:49-08:14/25 | 06:16 06:55-07:39/44<br>20:32 07:37-07:46/9  | 05:21 20:12-20:40/28<br>05:20 20:13-20:40/27 | 05:01 21:57<br>05:01 21:58                   |
| 22                          | 08:21 10:29-11:13/44<br>16:51 10:32-11:11/39 | 07:28 07:58-08:13/15<br>17:49 08:19-08:45/26 | 06:24 07:01-07:36/35<br>18:40 07:50-08:11/21 | 06:13 06:54-07:44/50<br>20:34 06:55-07:41/46 | 05:20 20:13-20:40/27<br>05:18 20:14-20:40/26 | 05:01 21:58<br>05:01 21:59                   |
| 23                          | 08:20 10:30-11:11/39<br>16:53 10:32-11:12/43 | 07:26 07:57-08:15/18<br>17:51 08:17-08:47/30 | 06:22 06:58-07:37/39<br>18:41 07:52-08:16/26 | 06:11 06:55-07:41/46<br>20:35 06:55-07:38/43 | 05:18 20:14-20:40/26<br>05:17 20:15-20:40/25 | 05:01 21:59<br>05:02 22:00                   |
| 24                          | 08:19 08:48-08:59/11<br>16:54 10:31-11:12/41 | 07:24 07:56-08:17/21<br>17:53 08:17-08:48/31 | 06:20 06:57-07:37/40<br>18:43 07:58-08:03/5  | 06:09 06:55-07:38/43<br>20:37 06:55-07:36/41 | 05:17 20:15-20:40/25<br>05:16 20:17-20:40/23 | 05:02 22:01<br>05:02 22:02                   |
| 25                          | 08:18 08:47-09:00/13<br>16:56 10:31-11:11/40 | 07:22 07:55-08:17/22<br>17:54 08:17-08:49/32 | 06:17 06:51-07:37/46<br>18:45 06:47-07:37/50 | 06:07 06:55-07:36/41<br>20:39 06:56-07:20/24 | 05:16 20:17-20:40/23<br>05:15 20:21-20:40/19 | 05:02 22:03<br>05:02 22:04                   |
| 26                          | 08:16 08:47-09:02/15<br>16:58 10:32-11:11/39 | 07:19 07:54-08:17/23<br>17:56 08:17-08:49/32 | 06:15 06:47-07:37/50<br>18:47 06:45-07:37/52 | 06:05 06:56-07:20/24<br>20:40 07:21-07:33/12 | 05:20 20:21-20:40/19<br>05:19 20:21-20:40/19 | 05:02 22:05<br>05:03 22:06                   |
| 27                          | 08:15 08:46-09:02/16<br>17:00 10:33-11:10/37 | 07:17 07:54-08:17/23<br>17:58 08:17-08:50/33 | 06:13 06:45-07:37/52<br>18:48 06:42-07:36/54 | 06:03 06:57-07:18/21<br>20:42 07:01-07:12/11 | 05:18 20:21-20:40/19<br>05:17 20:22-20:40/18 | 05:03 22:07<br>05:03 22:08                   |
| 28                          | 08:13 08:46-09:04/18<br>17:02 10:35-11:10/35 | 07:15 07:54-08:17/23<br>18:00 08:17-08:50/33 | 06:10 06:42-07:36/54<br>18:50 07:40-08:36/56 | 06:01 06:58-07:15/17<br>20:44 19:59-20:13/14 | 05:12 20:22-20:40/18<br>05:11 20:22-20:39/17 | 05:03 22:09<br>05:04 22:10                   |
| 29                          | 08:12 08:45-09:04/19<br>17:03 10:36-11:09/33 | 07:13 07:54-08:17/23<br>18:02 08:17-08:50/33 | 06:08 07:40-08:36/56<br>19:52 07:38-08:35/57 | 05:59 06:59-07:11/12<br>20:46 19:58-20:14/16 | 05:11 20:22-20:39/17<br>05:10 20:23-20:39/16 | 05:04 22:11<br>05:05 22:12                   |
| 30                          | 08:11 08:46-09:05/19<br>17:05 10:38-11:08/30 | 07:11 07:54-08:17/23<br>18:04 08:17-08:50/33 | 06:06 07:38-08:35/57<br>19:54 07:36-08:34/58 | 05:57 07:04-07:08/4<br>20:48 19:57-20:15/18  | 05:10 20:23-20:39/16<br>05:09 20:23-20:38/15 | 05:05 22:13<br>05:06 22:14                   |
| 31                          | 08:09 08:45-09:05/20<br>17:07 10:39-11:06/27 | 07:09 07:54-08:17/23<br>18:06 08:17-08:50/33 | 06:04 07:36-08:34/58<br>19:55 07:36-08:34/58 | 05:55 07:04-07:08/4<br>20:48 19:57-20:15/18  | 05:09 20:23-20:38/15<br>05:08 20:23-20:38/15 | 05:06 22:15<br>05:07 22:16                   |
| Sonnenscheinstunden         | 256                                          | 276                                          | 367                                          | 417                                          | 488                                          | 502                                          |
| Anzahl Minuten mit Schatten | 1733                                         | 850                                          | 1941                                         | 1475                                         | 796                                          | 47                                           |

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

|              |                         |                   |                                  |                                   |
|--------------|-------------------------|-------------------|----------------------------------|-----------------------------------|
| Tag im Monat | Sonnenaufgang (SS:MM)   | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |
|              | Sonnenuntergang (SS:MM) | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |

Projekt:  
**Schlüsselburg\_160420**

Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Kalender pro WEA

Berechnung: GBWEA: 4 - WEA4

Voraussetzungen für Berechnung des Schattenwurfs

Sonnenscheinwahrscheinlichkeit S (Mittlere tägliche Sonnenstunden) [BREMEN]

| Jan  | Feb  | Mär  | Apr  | Mai  | Jun  | Jul  | Aug  | Sep  | Okt  | Nov  | Dez  |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 1.53 | 2.81 | 3.16 | 5.42 | 7.18 | 5.91 | 6.09 | 6.01 | 4.64 | 3.11 | 1.99 | 1.07 |

Betriebsdauer je Sektor

| N   | NNO | ONO | O   | OSO | SSO | S     | SSW   | WSW   | W   | WNW | NNW | Summe |
|-----|-----|-----|-----|-----|-----|-------|-------|-------|-----|-----|-----|-------|
| 307 | 446 | 586 | 378 | 294 | 731 | 1,349 | 1,189 | 1,515 | 960 | 591 | 327 | 8,675 |

: Startwindgeschw. aus Leistungskennlinie

|    | Jul                                                        | August                                       | September                                    | Oktober                                                     | November                                     | Dezember                                     |
|----|------------------------------------------------------------|----------------------------------------------|----------------------------------------------|-------------------------------------------------------------|----------------------------------------------|----------------------------------------------|
| 1  | 05:05<br>21:51                                             | 05:43 20:11-20:46/35<br>21:18                | 06:34 07:09-07:59/50<br>20:14                | 07:24 08:24-09:20/56<br>19:04                               | 07:19<br>16:56                               | 08:11 09:10-09:24/14<br>16:15 10:06-10:53/47 |
| 2  | 05:06<br>21:50                                             | 05:44 20:09-20:42/33<br>21:16                | 06:35 07:11-08:01/50<br>20:12                | 07:26 08:24-09:22/58<br>19:01 17:34-17:42/8                 | 07:21<br>16:54                               | 08:12 09:10-09:26/16<br>16:14 10:06-10:54/48 |
| 3  | 05:07<br>21:50                                             | 05:46 20:08-20:40/32<br>21:14                | 06:37 07:11-08:02/51<br>20:10                | 07:27 08:24-09:23/59<br>18:59 17:30-17:46/16                | 07:23 08:22-08:29/7<br>16:53                 | 08:14 09:09-09:26/17<br>16:13 10:06-10:54/48 |
| 4  | 05:07<br>21:49                                             | 05:47 20:07-20:39/32<br>21:13                | 06:39 07:12-08:06/54<br>20:08                | 07:29 08:25-09:24/59<br>18:57 17:28-17:47/19                | 07:24 08:20-08:31/11<br>16:51                | 08:15 09:10-09:27/17<br>16:13 10:07-10:55/48 |
| 5  | 05:08<br>21:49                                             | 05:49 20:06-20:39/33<br>21:11                | 06:40 07:14-08:09/55<br>20:05                | 07:31 08:24-09:24/60<br>18:54 17:26-17:48/22                | 07:26 08:18-08:33/15<br>16:49                | 08:17 09:10-09:27/17<br>16:12 10:07-10:55/48 |
| 6  | 05:09<br>21:48                                             | 05:51 20:05-20:37/32<br>21:09                | 06:42 07:16-08:18/62<br>20:03                | 07:32 08:25-09:24/59<br>18:52 17:24-17:49/25                | 07:28 08:17-08:34/17<br>16:47                | 08:18 09:09-09:28/19<br>16:12 10:07-10:55/48 |
| 7  | 05:10 20:37-20:39/2<br>21:48                               | 05:52 20:05-20:25/20<br>21:07 20:26-20:35/9  | 06:44 07:20-08:21/61<br>20:01                | 07:34 08:26-08:45/19 17:23-17:50/27<br>18:50 08:45-09:25/40 | 07:30 08:17-08:35/18<br>16:45                | 08:19 09:10-09:29/19<br>16:11 10:08-10:56/48 |
| 8  | 05:11 20:35-20:42/7<br>21:47                               | 05:54 20:04-20:25/21<br>21:05                | 06:45 07:22-08:22/60<br>19:58                | 07:36 08:26-08:49/23 17:23-17:50/27<br>18:47 08:48-09:25/37 | 07:32 08:16-08:35/19<br>16:44                | 08:20 09:10-09:29/19<br>16:11 10:08-10:56/48 |
| 9  | 05:12 20:34-20:43/9<br>21:46                               | 05:55 20:05-20:25/20<br>21:03                | 06:47 07:24-08:24/60<br>19:56                | 07:38 08:27-08:49/22 17:21-17:49/28<br>18:45 08:48-09:24/36 | 07:34 08:16-08:36/20<br>16:42 10:14-10:32/18 | 08:22 09:10-09:29/19<br>16:11 10:09-10:56/47 |
| 10 | 05:13 20:33-20:44/11<br>21:46                              | 05:57 20:04-20:25/21<br>21:01                | 06:49 07:26-08:25/59<br>19:53                | 07:39 08:28-08:50/22 17:21-17:50/29<br>18:43 08:49-09:24/35 | 07:35 08:16-08:36/20<br>16:40 10:12-10:35/23 | 08:23 09:11-09:31/20<br>16:11 10:09-10:56/47 |
| 11 | 05:14 20:33-20:45/12<br>21:45                              | 05:59 20:05-20:25/20<br>20:59                | 06:50 07:26-08:25/59<br>19:51                | 07:41 08:28-08:51/23 17:21-17:50/29<br>18:41 08:50-09:24/34 | 07:37 08:16-08:36/20<br>16:39                | 08:24 09:12-09:31/19<br>16:10 10:10-10:57/47 |
| 12 | 05:15 20:32-20:46/14<br>21:44                              | 06:00 20:04-20:23/19<br>20:58                | 06:52 07:28-08:26/58<br>19:49                | 07:43 08:27-08:50/23 17:20-17:49/29<br>18:38 08:50-09:24/34 | 07:39 08:17-08:36/19<br>16:37 10:09-10:39/30 | 08:25 09:12-09:31/19<br>16:10 10:11-10:58/47 |
| 13 | 05:16 20:31-20:47/16<br>21:43                              | 06:02 07:10-07:17/7<br>20:56 20:05-20:23/18  | 06:54 07:28-08:26/58<br>19:46                | 07:45 08:27-08:51/24 17:19-17:49/30<br>18:36 08:51-09:24/33 | 07:41 08:17-08:36/19<br>16:36 10:08-10:41/33 | 08:26 09:12-09:32/20<br>16:10 10:11-10:58/47 |
| 14 | 05:17 20:31-20:47/16<br>21:42                              | 06:04 07:07-07:20/13<br>20:54 20:06-20:23/17 | 06:55 07:30-08:26/56<br>19:44                | 07:46 08:27-08:51/24 17:18-17:48/30<br>18:34 08:51-09:23/32 | 07:43 08:18-08:36/18<br>16:34 10:07-10:42/35 | 08:27 09:13-09:32/19<br>16:10 10:12-10:58/46 |
| 15 | 05:19 20:30-20:48/18<br>21:41                              | 06:05 07:05-07:23/18<br>20:51 20:07-20:21/14 | 06:57 07:32-08:26/54<br>19:42                | 07:48 08:26-08:49/23 17:17-17:47/30<br>18:32 08:49-09:22/33 | 07:44 08:19-08:35/16<br>16:33 10:06-10:43/37 | 08:28 09:13-09:33/20<br>16:10 10:12-10:59/47 |
| 16 | 05:20 20:30-20:48/18<br>21:40                              | 06:07 07:04-07:26/22<br>20:49 20:09-20:19/10 | 06:59 07:33-08:25/52<br>19:39                | 07:50 08:26-08:49/23 17:17-17:46/29<br>18:29 08:49-09:21/32 | 07:46 08:20-08:35/15<br>16:31 10:05-10:44/39 | 08:29 09:14-09:34/20<br>16:10 10:12-10:58/46 |
| 17 | 05:21 20:31-20:50/19<br>21:39                              | 06:09 07:02-07:40/38<br>20:47 20:12-20:15/3  | 07:00 07:35-08:25/50<br>19:37                | 07:52 08:27-08:48/21 17:18-17:45/27<br>18:27 08:48-09:20/32 | 07:48 08:21-08:34/13<br>16:30 10:05-10:45/40 | 08:30 09:14-09:33/19<br>16:10 10:13-10:59/46 |
| 18 | 05:22 20:28-20:50/22<br>21:38                              | 06:10 07:02-07:43/41<br>20:45                | 07:02 07:38-08:25/47<br>19:35                | 07:53 08:27-08:47/20 17:18-17:43/25<br>18:25 08:48-09:19/31 | 07:50 08:22-08:33/11<br>16:28 10:05-10:46/41 | 08:30 09:14-09:34/20<br>16:11 10:14-11:00/46 |
| 19 | 05:24 20:26-20:50/24<br>21:37                              | 06:12 07:01-07:44/43<br>20:43 07:44-07:45/1  | 07:04 07:43-08:24/41<br>19:32                | 07:55 08:28-08:45/17 17:18-17:42/24<br>18:23 08:49-09:18/29 | 07:52 08:25-08:31/6<br>16:27 10:04-10:47/43  | 08:31 09:15-09:35/20<br>16:11 10:14-11:00/46 |
| 20 | 05:25 20:24-20:50/26<br>21:35                              | 06:14 07:00-07:47/47<br>20:41                | 07:05 07:44-08:23/39<br>19:30 08:40-08:54/14 | 07:57 08:30-08:44/14 17:19-17:41/22<br>18:21 08:50-09:16/26 | 07:53 10:04-10:48/44<br>16:26                | 08:32 09:15-09:35/20<br>16:11 10:14-11:00/46 |
| 21 | 05:26 20:24-20:51/27<br>21:34                              | 06:15 07:00-07:50/50<br>20:39                | 07:07 07:46-08:21/35<br>19:27 08:36-08:56/20 | 07:59 08:32-08:41/9 17:20-17:40/20<br>18:19 08:52-09:14/22  | 07:55 10:04-10:49/45<br>16:25                | 08:32 09:16-09:35/19<br>16:12 10:15-11:01/46 |
| 22 | 05:28 20:23-20:51/28<br>21:33                              | 06:17 06:59-07:44/45<br>20:37 07:42-07:51/9  | 07:09 07:49-08:21/32<br>19:25 08:34-08:58/24 | 08:01 08:55-09:12/17<br>18:16 17:22-17:38/16                | 07:57 10:03-10:49/46<br>16:23                | 08:33 09:16-09:35/19<br>16:12 10:15-11:01/46 |
| 23 | 05:29 20:22-20:50/28<br>21:32                              | 06:19 06:59-07:46/47<br>20:35 07:45-07:52/7  | 07:10 07:51-08:19/28<br>19:23 08:32-09:00/28 | 08:02 08:59-09:07/8<br>18:14 17:23-17:35/12                 | 07:58 10:04-10:50/46<br>16:22                | 08:33 09:17-09:36/19<br>16:13 10:16-11:02/46 |
| 24 | 05:31 20:22-20:51/29<br>21:30                              | 06:20 06:59-07:45/46<br>20:32 07:43-07:52/9  | 07:12 07:52-08:17/25<br>19:20 08:30-09:00/30 | 08:04 17:26-17:31/5<br>18:12                                | 08:00 10:04-10:50/46<br>16:21                | 08:34 09:17-09:37/20<br>16:13 10:16-11:02/46 |
| 25 | 05:32 20:21-20:51/30<br>21:29                              | 06:22 06:59-07:48/49<br>20:30 07:46-07:53/7  | 07:14 07:55-08:15/20<br>19:18 08:29-09:01/32 | 07:06<br>17:10                                              | 08:02 10:04-10:51/47<br>16:20                | 08:34 09:17-09:37/20<br>16:14 10:16-11:03/47 |
| 26 | 05:33 20:21-20:50/29<br>21:27                              | 06:24 07:00-07:49/49<br>20:28 07:49-07:54/5  | 07:15 08:00-08:12/12<br>19:16 08:28-09:02/34 | 07:08<br>17:08                                              | 08:03 10:05-10:52/47<br>16:19                | 08:35 09:18-09:38/20<br>16:15 10:18-11:04/46 |
| 27 | 05:35 20:21-20:50/29<br>21:26                              | 06:25 07:00-07:49/49<br>20:26 07:46-07:54/8  | 07:17 08:28-09:02/34<br>19:13                | 07:10<br>17:06                                              | 08:05 09:13-09:18/5<br>16:18 10:04-10:51/47  | 08:35 09:19-09:38/19<br>16:15 10:18-11:04/46 |
| 28 | 05:36 20:21-20:49/28<br>21:24                              | 06:27 07:01-07:50/49<br>20:23 07:49-07:54/5  | 07:19 08:26-09:02/36<br>19:11 09:04-09:12/8  | 07:12<br>17:04                                              | 08:06 09:11-09:20/9<br>16:17 10:05-10:52/47  | 08:35 09:19-09:39/20<br>16:16 10:18-11:05/47 |
| 29 | 05:38 20:20-20:48/28<br>21:23                              | 06:29 07:02-07:53/51<br>20:21 07:52-07:54/2  | 07:20 08:26-09:17/51<br>19:08                | 07:13<br>17:02                                              | 08:08 09:11-09:22/11<br>16:16 10:05-10:53/48 | 08:35 09:20-09:39/19<br>16:17 10:19-11:05/46 |
| 30 | 05:39 20:21-20:48/27<br>21:21                              | 06:30 07:05-07:54/49<br>20:19                | 07:22 08:25-09:19/54<br>19:06                | 07:15<br>17:00                                              | 08:10 09:10-09:23/13<br>16:16 10:05-10:53/48 | 08:35 09:20-09:40/20<br>16:18 10:19-11:06/47 |
| 31 | 05:41 20:13-20:18/5<br>21:19 20:20-20:47/27                | 06:32 07:07-07:57/50<br>20:17                | 07:24 08:26-09:19/54<br>18:58                | 07:17<br>16:58                                              | 08:11 09:10-09:23/13<br>16:16 10:05-10:53/48 | 08:35 09:21-09:40/19<br>16:19 10:20-11:06/46 |
|    | Sonnenscheinstunden 505<br>Anzahl Minuten mit Schatten 529 | 529<br>1193                                  | 529<br>1593                                  | 529<br>1694                                                 | 529<br>1189                                  | 529<br>2037                                  |

Tabellen-Layout: Die Daten für jeden Tag sind in folgender Matrix wiedergegeben (Sommerzeit wie Bezugsjahr):

| Tag im Monat | Sonnenaufgang (SS:MM)   | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |
|--------------|-------------------------|-------------------|----------------------------------|-----------------------------------|
|              | Sonnenuntergang (SS:MM) | Zeitpunkt (SS:MM) | Schattenanfang-Zeitpunkt (SS:MM) | Schattenende/Minuten mit Schatten |

Projekt:  
**Schlüsselburg\_160420**

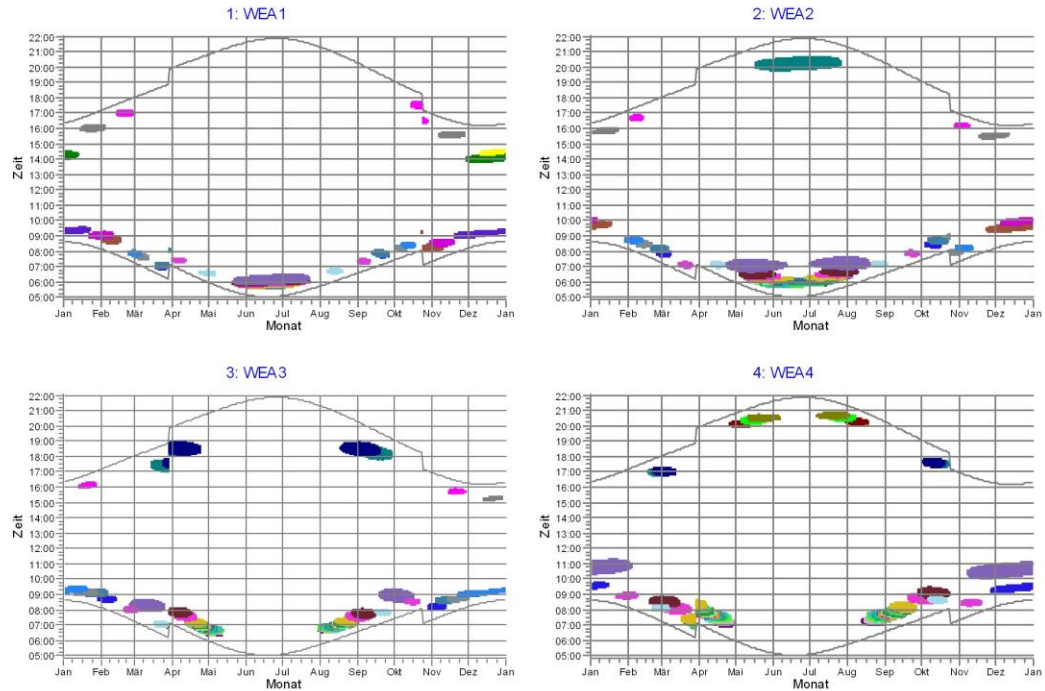
Lizenzierter Anwender:  
**I17-Wind GmbH & Co. KG**  
Am Westersielzug 11  
DE-25840 Friedrichstadt



André Gefke / andre.gefke@i17-wind.de  
Berechnet:  
27/07/2016 15:03/3.0.654

## SHADOW - Grafischer Kalender pro WEA

Berechnung: GB



### Schattenrezeptoren

|         |         |         |          |          |          |
|---------|---------|---------|----------|----------|----------|
| A: IO01 | I: IO09 | P: IO16 | W: IO23  | AD: IO30 | AK: IO37 |
| B: IO02 | J: IO10 | Q: IO17 | X: IO24  | AE: IO31 | AL: IO38 |
| D: IO04 | K: IO11 | R: IO18 | Y: IO25  | AF: IO32 | AM: IO39 |
| E: IO05 | L: IO12 | S: IO19 | Z: IO26  | AG: IO33 | AN: IO40 |
| F: IO06 | M: IO13 | T: IO20 | AA: IO27 | AH: IO34 | AO: IO41 |
| G: IO07 | N: IO14 | U: IO21 | AB: IO28 | AI: IO35 | AP: IO42 |
| H: IO08 | O: IO15 | V: IO22 | AC: IO29 | AJ: IO36 |          |