

Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIU R. SAV.

1 ALTERNATYVA

SHADOW - Main Result

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m

Assumptions for shadow calculations

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

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) [KAUNAS]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,41	2,36	4,03	5,55	8,35	8,36	8,16	7,72	5,06	3,23	1,33	0,98

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
932	508	243	283	557	625	749	976	1.164	1.012	775	552	8.376

Idle start wind speed: Cut in wind speed from power curve

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: Height Contours: MAPFILES_Telsiai23_0.map (1)

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 30,0 m

WTGs

	Lithuanian TM LKS94-LKS94 (LT)			Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
	East	North	Z		Valid	Manufact.					Calculation distance [m]	RPM [RPM]
T01a	399.384	6.212.733	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T01b	399.633	6.213.215	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T02	400.355	6.212.415	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T03	400.625	6.213.038	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T04	401.360	6.213.286	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T05	402.299	6.213.212	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T06a	403.896	6.212.161	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T06b	404.657	6.211.913	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T06c	405.439	6.212.089	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T07	404.508	6.212.729	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T08	405.714	6.211.367	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T09	406.370	6.211.916	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T10	400.437	6.211.661	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T11	400.923	6.211.096	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T12	401.726	6.211.214	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T13	400.221	6.210.133	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T14	400.844	6.209.977	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T15	401.378	6.209.621	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T16	401.045	6.209.035	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T17	401.767	6.208.477	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T18	403.913	6.207.263	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T19	402.771	6.205.892	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T20	402.755	6.205.084	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T21	405.182	6.205.602	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T22	402.010	6.204.814	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T23	403.049	6.204.340	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T24	403.660	6.204.067	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T25a	405.015	6.204.093	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T25b	404.578	6.203.244	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T26	403.792	6.203.277	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8

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1 ALTERNATYVA

SHADOW - Main Result

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m

Shadow receptor-Input

No.	Lithuanian TM LKS94-LKS94 (LT)						Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Width	Height	Height a.g.l. [m]			
A	398.948	6.213.431	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
B	398.587	6.212.798	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
C	399.128	6.212.417	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
D	399.910	6.211.777	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
E	401.594	6.213.181	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
F	401.745	6.212.884	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
G	402.750	6.212.857	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
H	403.741	6.212.902	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
I	403.352	6.212.328	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
J	400.527	6.209.693	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
K	402.531	6.209.681	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
L	403.054	6.208.476	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
M	402.058	6.205.606	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
N	402.856	6.205.524	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
O	403.212	6.205.565	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
P	403.405	6.205.420	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
R	403.476	6.206.129	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
S	404.202	6.205.773	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
T	405.551	6.205.361	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
U	405.005	6.204.869	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
V	403.530	6.205.696	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Z	404.252	6.207.360	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Shadow hours per year [h/year]
A	20:18
B	25:24
C	11:08
D	26:00
E	29:14
F	15:27
G	9:57
H	24:14
I	29:34
J	16:20
K	11:41
L	12:08
M	36:59
N	28:31
O	15:03
P	17:52
R	15:52
S	13:32
T	1:45
U	12:08
V	28:35
Z	44:08

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

No.	Name	Worst case [h/year]	Expected [h/year]
T01a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (201)	100:23	17:07
T01b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (215)	99:38	25:07

To be continued on next page...

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...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
T02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (200)	60:57	11:54
T03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (199)	72:48	18:03
T04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (198)	18:58	5:11
T05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (211)	100:43	27:57
T06a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (202)	168:18	27:19
T06b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (210)	34:45	5:03
T06c	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (209)	7:10	1:13
T07	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (188)	75:52	18:54
T08	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (208)	0:00	0:00
T09	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (190)	0:00	0:00
T10	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (189)	130:08	26:15
T11	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (192)	18:59	3:10
T12	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (197)	26:40	3:29
T13	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (196)	0:00	0:00
T14	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (195)	16:05	2:59
T15	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (216)	73:58	18:30
T16	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (191)	58:05	8:02
T17	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (194)	58:25	7:59
T18	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (193)	232:52	56:15
T19	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (217)	203:34	54:47
T20	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (204)	368:37	55:32
T21	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (205)	64:06	13:10
T22	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (206)	126:40	16:00
T23	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (203)	105:17	10:45
T24	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (207)	37:51	4:23
T25a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (212)	97:11	9:41
T25b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (214)	0:00	0:00
T26	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (213)	18:28	1:48

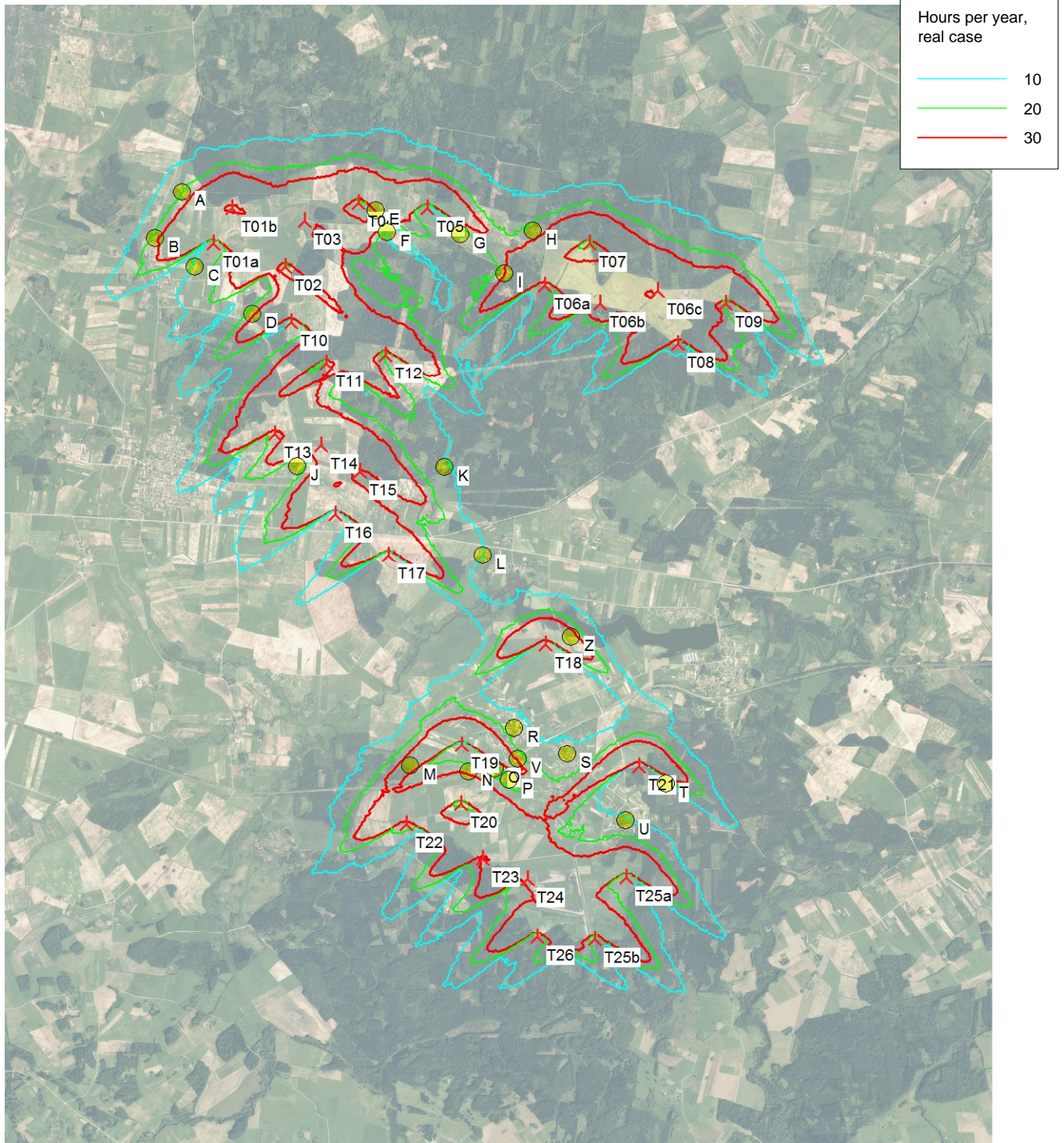
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1 ALTERNATYVA

SHADOW - Map

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m



Hours per year, real case	
—	10
—	20
—	30

0 1 2 3 4 km

Map: Telsiai23 , Print scale 1:80.000, Map center Lithuanian TM LKS94-LKS94 (LT) East: 403.353 North: 6.207.942

New WTG

Shadow receptor

Flicker map level: Height Contours: MAPFILES_Telsiai23_0.map (1)

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2 ALTERNATYVA**SHADOW - Main Result****Calculation:** VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m**Assumptions for shadow calculations**

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

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3 °

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1 days

Time step for calculation

1 minutes

Sunshine probability S (Average daily sunshine hours) [KAUNAS]

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Operational time

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Grid resolution: 30,0 m

WTGs

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2 ALTERNATYVA

SHADOW - Main Result

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m

Shadow receptor-Input

No.	Lithuanian TM LKS94-LKS94 (LT)						Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Width	Height	Height a.g.l. [m]			
A	398.948	6.213.431	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
B	398.587	6.212.798	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
C	399.128	6.212.417	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
D	399.910	6.211.777	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
E	401.594	6.213.181	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
F	401.745	6.212.884	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
G	402.750	6.212.857	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
H	403.741	6.212.902	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
I	403.352	6.212.328	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
J	400.527	6.209.693	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
K	402.531	6.209.681	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
L	403.054	6.208.476	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
M	402.058	6.205.606	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
N	402.856	6.205.524	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
O	403.212	6.205.565	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
P	403.405	6.205.420	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
R	403.476	6.206.129	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
S	404.202	6.205.773	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
T	405.551	6.205.361	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
U	405.005	6.204.869	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
V	403.530	6.205.696	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Z	404.252	6.207.360	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Shadow hours per year [h/year]
A	10:57
B	11:38
C	13:33
D	25:21
E	27:17
F	13:15
G	9:58
H	24:15
I	29:34
J	29:25
K	8:40
L	6:37
M	15:20
N	28:20
O	16:46
P	18:55
R	6:27
S	9:39
T	3:27
U	12:27
V	9:15
Z	44:08

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

No.	Name	Worst case [h/year]	Expected [h/year]
T01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (231)	73:25	17:10
T02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (230)	75:20	14:43

To be continued on next page...

Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIO R. SAV.

2 ALTERNATYVA

SHADOW - Main Result

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m

...continued from previous page

No.	Name	Worst case [h/year]	Expected [h/year]
T03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (229)	70:30	15:32
T04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (228)	18:58	5:11
T05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (241)	100:43	27:57
T06a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (232)	168:18	27:19
T06b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (240)	34:45	5:03
T06c	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (239)	7:17	1:14
T07	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (218)	75:52	18:54
T08	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (238)	0:00	0:00
T09	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (220)	0:00	0:00
T10	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (219)	130:08	26:15
T11	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (222)	18:54	3:10
T12	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (227)	26:51	3:31
T13	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (226)	0:00	0:00
T14	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (225)	88:50	25:31
T16	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (221)	58:05	8:02
T17	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (224)	58:25	7:59
T18	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (223)	232:52	56:15
T20	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (234)	368:37	55:30
T21	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (235)	64:06	13:08
T22	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (236)	126:40	16:00
T23	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (233)	107:51	11:02
T24	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (237)	73:30	8:12
T25a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (242)	102:14	10:16
T25b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (244)	0:00	0:00
T26	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (243)	18:28	1:46

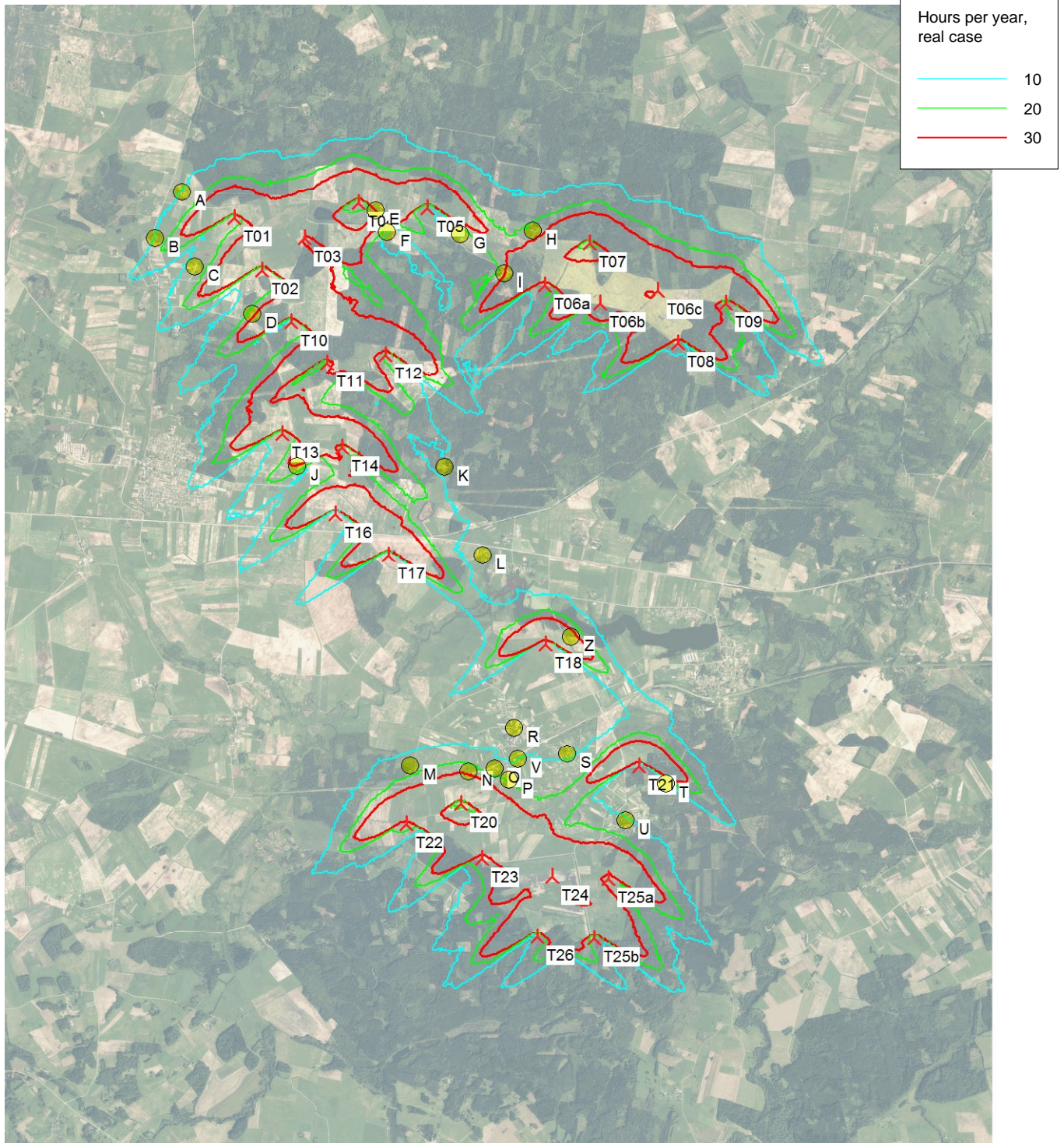
Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIO R. SAV.

2 ALTERNATYVA

SHADOW - Map

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m



Hours per year, real case	
—	10
—	20
—	30

0 1 2 3 4 km

Map: Telsiai23 , Print scale 1:80.000, Map center Lithuanian TM LKS94-LKS94 (LT) East: 403.353 North: 6.207.942

New WTG Shadow receptor

Flicker map level: Height Contours: MAPFILES_Telsiai23_0.map (1)

Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIO R. SAV.

3 ALTERNATYVA**SHADOW - Main Result****Calculation:** VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m**Assumptions for shadow calculations**

Maximum distance for influence

Calculate only when more than 20 % of sun is covered by the blade

Please look in WTG table

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) [KAUNAS]

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1,41	2,36	4,03	5,55	8,35	8,36	8,16	7,72	5,06	3,23	1,33	0,98

Operational time

N	NNE	ENE	E	ESE	SSE	S	SSW	WSW	W	WNW	NNW	Sum
932	508	243	283	557	625	749	976	1.164	1.012	775	552	8.376

Idle start wind speed: Cut in wind speed from power curve

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: Height Contours: MAPFILES_Telsiai23_0.map (1)

Obstacles used in calculation

Eye height: 1,5 m

Grid resolution: 30,0 m

WTGs

	Lithuanian TM LKS94-LKS94 (LT)			Row data/Description	WTG type		Type-generator	Power, rated [kW]	Rotor diameter [m]	Hub height [m]	Shadow data	
	East	North	Z [m]		Valid	Manufact.					Calculation distance [m]	RPM [RPM]
T01	399.666	6.213.077	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T02	400.040	6.212.369	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T03	400.620	6.212.800	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T04	401.360	6.213.286	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T05	402.299	6.213.212	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T06a	404.362	6.212.316	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T06b	405.436	6.212.093	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T08	405.716	6.211.373	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T09	406.370	6.211.916	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T10	400.437	6.211.661	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T11	400.926	6.211.096	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T12	401.723	6.211.214	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T13	400.318	6.210.131	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T14	401.130	6.209.941	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T16	401.045	6.209.035	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T17	401.767	6.208.477	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T18	403.913	6.207.263	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T20	402.755	6.205.084	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T21	405.182	6.205.602	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T22	402.010	6.204.814	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T23	403.044	6.204.349	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T24	403.999	6.204.104	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T25a	404.764	6.204.072	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T25b	404.576	6.203.249	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8
T26	403.792	6.203.277	120,0	Siemens Gamesa S...	Yes	Siemens Gamesa	SG 6.0-170-6.200	6.200	170,0	165,0	2.037	8,8

Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIU R. SAV.

3 ALTERNATYVA**SHADOW - Main Result****Calculation:** VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m**Shadow receptor-Input**

No.	Lithuanian TM LKS94-LKS94 (LT)						Degrees from south cw [°]	Slope of window [°]	Direction mode
	East	North	Z	Width	Height	Height a.g.l. [m]			
A	398.948	6.213.431	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
B	398.587	6.212.798	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
C	399.128	6.212.417	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
D	399.910	6.211.777	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
E	401.594	6.213.181	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
F	401.745	6.212.884	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
G	402.750	6.212.857	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
H	403.741	6.212.902	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
I	403.352	6.212.328	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
J	400.527	6.209.693	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
K	402.531	6.209.681	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
L	403.054	6.208.476	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
M	402.058	6.205.606	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
N	402.856	6.205.524	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
O	403.212	6.205.565	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
P	403.405	6.205.420	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
R	403.476	6.206.129	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
S	404.202	6.205.773	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
T	405.551	6.205.361	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
U	405.005	6.204.869	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
V	403.530	6.205.696	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"
Z	404.252	6.207.360	120,0	1,0	1,0	1,0	0,0	90,0	"Green house mode"

Calculation Results

Shadow receptor

Shadow, expected values

No.	Shadow hours per year [h/year]
A	10:57
B	11:38
C	13:33
D	25:21
E	27:17
F	13:15
G	7:12
H	10:55
I	9:16
J	29:25
K	8:40
L	6:37
M	15:20
N	28:20
O	16:46
P	18:55
R	6:27
S	9:39
T	3:27
U	12:27
V	9:15
Z	44:08

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

No.	Name	Worst case [h/year]	Expected [h/year]
T01	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (257)	73:25	17:10
T02	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (256)	75:20	14:43

To be continued on next page...

Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIU R. SAV.

3 ALTERNATYVA

SHADOW - Main Result

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m

...continued from previous page

No.	Name	Worst case	Expected
		[h/year]	[h/year]
T03	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (255)	70:30	15:32
T04	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (254)	18:58	5:11
T05	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (266)	100:43	27:57
T06a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (258)	74:48	14:15
T06b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (265)	7:17	1:15
T08	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (264)	0:00	0:00
T09	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (246)	0:00	0:00
T10	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (245)	130:08	26:15
T11	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (248)	18:54	3:10
T12	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (253)	26:51	3:31
T13	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (252)	0:00	0:00
T14	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (251)	88:50	25:31
T16	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (247)	58:05	8:02
T17	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (250)	58:25	7:59
T18	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (249)	232:52	56:15
T20	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (260)	368:37	55:30
T21	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (261)	64:06	13:08
T22	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (262)	126:40	16:00
T23	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (259)	107:51	11:02
T24	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (263)	73:30	8:12
T25a	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (267)	102:14	10:16
T25b	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (269)	0:00	0:00
T26	Siemens Gamesa SG 6.0-170 6200 170.0 !O! hub: 165,0 m (TOT: 250,0 m) (268)	18:28	1:46

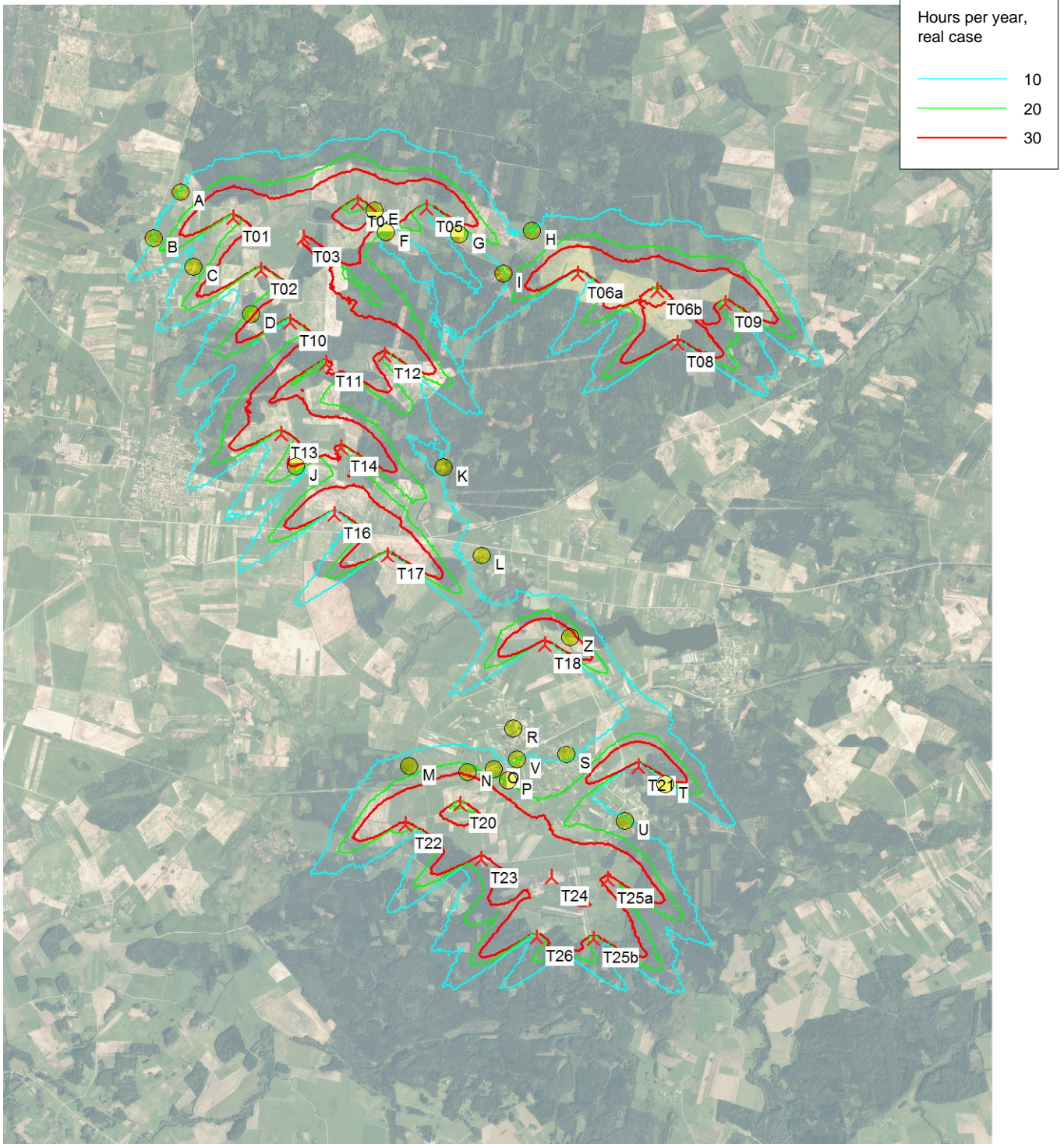
Project:

UAB „TELSIU VEJO PARKAS“ VEJO ELEKTRINIŲ PARKAS TELSIO R. SAV.

3 ALTERNATYVA

SHADOW - Map

Calculation: VE modelis SIEMENS GAMESA SG 6.0-170, boksto aukstis 165 m, rotoriaus skersmuo 170 m



Hours per year, real case	
Cyan line	10
Green line	20
Red line	30

0 1 2 3 4 km

Map: Telsiai23 , Print scale 1:80.000, Map center Lithuanian TM LKS94-LKS94 (LT) East: 403.353 North: 6.207.942

New WTG

Shadow receptor

Flicker map level: Height Contours: MAPFILES_Telsiai23_0.map (1)