



Dissemination activity 3

Reform of the Slovenian network charging methodology

Instituto de Investigación Tecnológica - IIT

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- Methodology 1
 - Tariff structure
- Methodology 2
 - Tariff structure
- Data for simulations
- Impact analysis on customer groups
- Impact analysis on active customers
- Recommendations





Methodology 1:

ToU capacity and energy charges for withdrawal (generators and injections do not pay use of network charges)







January February Marah

Resulting tariff under methodology 1 (Time-blocks)



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M	March					Time-block		S	Season					
De	ecember							TIME-DIOCK	Sea	son 1	Season 2	Holida	y S1	Holiday S2
	Season 1	<u>г</u>	Season 2	Н	liday Season 1	н	olidays Season 2	1	207	70.1	1743.7	173	0.9	1525
Hour	AV ton-10		AV-ton20		Average top-10		Average top-10	2	192	22.2	1575.3	159	5.6	1398.
0	1531.2	0	1401.0	0	1404.8	0	1321.2	3	154	40.1	1391.3	138	1.2	1291.
1	1479.5	1	1362.3	1	1345.2	1	1290.6			Season	Season	Holiday	Holida	V
2	1459.1	2	1344.1	2	1336.8	2	1269.0		Hour	1	2	S1	S2	y
3	1461.1	3	1345.4	3	1318.4	3	1266.9		0	1	5	5	5	
4	1493.3	4	1367.5	4	1319.0	4	1263.2		1	4	5	5	5	
5	1586.8	5	1448.0	5	1354.6	5	1284.2		1	4	5 E	5 E	Э Е	
6	1842.8	6	1575.9	6	1472.9	6	1333.2		2	4	р С	ວ 	о Г	
7	2048.4	7	1728.4	7	1605.8	7	1390.2		3	4	5	5	5	
8	2090.3	8	1768.7	8	1712.5	8	1444.3		4	4	5	5	5	
9	2080.9	9	1760.8	9	1768.8	9	1509.4		5	4	5	5	5	
10	2096.9	10	1762.0	10	1777.6	10	1543.1		6	2	4	5	5	
11	2109.8	11	1800.1	11	1788.4	11	1548.1		7	1	3	4	5	
12	2095.3	12	1795.1	12	1749.7	12	1543.8		8	1	3	3	5	
13	2033.8	13	1777.4	13	1685.8	13	1480.4		9	. 1	3	3	4	
14	1976.6	14	1727.8	14	1605.3	14	1431.3		10	. 1	3	3	4	
15	1947.0	15	1697.3	15	1584.5	15	1387.9		11	1	3	3	4	
16	1982.2	16	1702.4	16	1617.6	16	1371.6		12	1	3	3	4	
17	2044.5	17	1730.1	17	1697.3	17	1398.3		13	1	3	3	4	
18	2056.7	18	1715.3	18	1727.6	18	1406.6		14	2	3	4	5	
19	2044.9	19	1702.0	19	1727.1	19	1401.3		15	2	3	4	5	
20	1962.3	20	1641.8	20	1673.9	20	1371.9		16	2	3	4	5	
21	1822.6	21	1563.4	21	1564.7	21	1377.1		17	1	3	3	5	
22	1708.9	22	1520.1	22	1481.9	22	1328.8		18	1	3	3	5	- not
23	1601.0	23	1470.9	23	1397.2	23	1267.9		19	1	3	3	5	
									20	2	4	3	5	

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Resulting tariff under methodology 1 (Transmission tariffs)



	Voltage	Voltage Transmission capacity charges (€/kW year)					
	level	Time-block 1	Time-block 2	Time-block 3	Time-block 4	Time-block 5	
0: LV	0	1,36612	0,65128	0,56931	0,02883	-	
1: LVSS	1	7,16056	2,73804	1,95166	0,13180	-	
2:MV	2	7,78229	3,43309	2,05238	0,18714	-	
3:MVSS	3	10,69986	5,86866	4,01631	0,31702	-	
4:HV	4	7,40765	3,73679	2,59695	0,33918	-	

Voltage level	Transmission energy charges (€/kWh)						
	Time-block 1	Time-block 2	Time-block 3	Time-block 4	Time-block 5		
0	0,00437	0,00433	0,00405	0,00396	0,00 <mark>360</mark>		
1	0,00440	0,00432	0,00424	0,00402	0,00 <mark>36</mark> 6		
2	0,00439	0,00431	0,00423	0,00402	0,0 <mark>0366</mark>		
3	0,00453	0,00446	0,00442	0,00422	0,0 <mark>0389</mark>		
4	0,00456	0,00450	0,00443	0,00425	<mark>0,0</mark> 0391		



Resulting tariff under methodology 1 (Distribution tariffs)



	Voltage	Distribution capacity charges (€/kW year)					
	level	Time-block 1	Time-block 2	Time-block 3	Time-block 4	Time-block 5	
0: LV	0	10,23132	4,17232	4,92076	0,93759	0,04758	
1: LVSS	1	25,44204	10,57340	8,03745	0,81351	0,03382	
2:MV	2	18,93110	8,26912	5,53487	0,23756	-	
3:MVSS	3	8,71905	4,52942	3,58365	0,25312		
4D:HV	4D	2,26831	1,03890	0,14420	0,00838	-	

Voltage	Distribution energy charges (€/kWh)						
level	Time-block 1	Time-block 2	Time-block 3	Time-block 4	Time-block 5		
0	0,00918	0,00927	0,00839	0,00885	0,00855		
1	0,00704	0,00706	0,00649	0,00676	0,00647		
2	0,00484	0,00483	0,00437	0,00455	0,00427		
3	0,00130	0,00129	0,00127	0,00125	0,00122		
4D	0,00029	0,00029	0,00029	0,00029	0,00029		



Different contracted capacities by time-blocks



Commercial customer with:

charged capacity between 17 and 43 kW annual consumption higher than 20 MWh

Time- block	Initial Charged Cap (kW)	Max Cap (kW)	Contr Cap (kW)
1	24	14.232	14.2
2	24	16.880	16.9
3	24	16.704	16.9
4	24	18.376	18.4
5	24	16.712	18.4
	\sim		



Household customer with:

charged capacity between 7 and 14 kW annual consumption between 2.5 and 5 MWh

Time-	Initial Cha	rged	Max Cap	Contr Cap	
block	Cap. (k\	V)	(kW)	(kW)	
1	7		3.984	4.0	
2	7		3.872	4.0	
3	7		4.188	4.2	
4	7		3.656	4.2	
5	7	/	4.468	4.5	
cominas eau					









Contracted capacity vs excess demand charge



Commercial customer with:

charged capacity between 17 and 43 kW annual consumption higher than 20 MWh

Time-	Initial	Contr Cap
block	Contr. Cap.	(kW)
	(kW)	
1	14.2	11.4
2	16.9	16.9
3	16.9	16.9
4	18.4	18.4
5	18.4	18.4

Regu	lar customer under	M1
Fransmission	Capacity	40.58
	Energy	155.62
	Total	196.19
Distribution	Capacity	317.21
	Energy	342.55
	Total	659.76
「otal		855.95

Number of 15-min samples when capacity is overpassed: 37

Number of 15-min samples when capacity is overpassed: 3

	ELEKIROINSIIIUI MILA	in vilmar in elektroindustriik		
Customer with reduced contracted capacity under M1				
Transmission	Capacity	36.69		
	Energy	155.62		
	Total	192.31		
Distribution	Capacity	288.08		
	Energy	342.55		
	Total	630.63		
Total		822.94		
Factor of reduction	n for CC at TP1			
Cumulative exces	s demand charge (/€/kW)		
TB1	13 0160362	(ant)		
Square reet of Su	m of (Cd-Cc)A2 (k)	' \		
Square root of Su)		
Exceeding canaci	7.232240900			
Exceeding capaci	100 6506396			
Final navment (€)	100.00000000			
r mar payment (c)	923 59			
Customer with	reduced contracted			
Customer with	reduced contracted under M1	d capacity		
Customer with Transmission	reduced contracted under M1 Capacity	d capacity 9.45		
Customer with Transmission	reduced contracted under M1 Capacity Energy	d capacity 9.45 12.66		
Customer with Transmission	reduced contracted under M1 Capacity Energy Total	9.45 12.66 22.11		
Customer with Transmission Distribution	reduced contracted under M1 Capacity Energy Total Capacity	9.45 9.45 12.66 22.11 73.98		
Customer with Transmission Distribution	reduced contracted under M1 Capacity Energy Total Capacity Energy	9.45 12.66 22.11 73.98 27.72		
Customer with Transmission Distribution	reduced contracted under M1 Capacity Energy Total Capacity Energy Total	9.45 12.66 22.11 73.98 27.72 101.70		
Customer with Transmission Distribution	reduced contracted under M1 Capacity Energy Total Capacity Energy Total	9.45 12.66 22.11 73.98 27.72 101.70 123.81		
Customer with Transmission Distribution	reduced contracted under M1 Capacity Energy Total Capacity Energy Total	9.45 12.66 22.11 73.98 27.72 101.70 123.81		
Customer with Transmission Distribution Total Factor of reductio	reduced contracted under M1 Capacity Energy Total Capacity Energy Total	9.45 12.66 22.11 73.98 27.72 101.70 123.81		
Customer with Transmission Distribution Total Factor of reductio Cumulative excess	reduced contracted under M1 Capacity Energy Total Capacity Energy Total n for CC at TB1 0.8 ss demand charge	9.45 12.66 22.11 73.98 27.72 101.70 123.81		
Customer with Transmission Distribution Total Factor of reductio Cumulative exces TB1	reduced contracted under M1 Capacity Energy Total Capacity Energy Total n for CC at TB1 0.8 ss demand charge 13.9169368	9.45 12.66 22.11 73.98 27.72 101.70 123.81 (€/kW)		
Customer with Transmission Distribution Total Factor of reductio Cumulative exces TB1 Square root of Su	reduced contracted under M1 Capacity Energy Total Capacity Energy Total n for CC at TB1 0.8 ss demand charge 13.9169368 m of (Cd-Cc)^2 (kV	9.45 12.66 22.11 73.98 27.72 101.70 123.81 (€/kW)		
Customer with Transmission Distribution Total Factor of reduction Cumulative excess TB1 Square root of Su	reduced contracted under M1 Capacity Energy Total Capacity Energy Total n for CC at TB1 0.8 s demand charge 13.9169368 m of (Cd-Cc)^2 (kV 0.812081984	9.45 12.66 22.11 73.98 27.72 101.70 123.81 (€/kW)		
Customer with Transmission Distribution Total Factor of reductio Cumulative exces TB1 Square root of Su Exceeding capac	reduced contracted under M1 Capacity Energy Total Capacity Energy Total n for CC at TB1 0.8 s demand charge 13.9169368 m of (Cd-Cc)^2 (kV 0.812081984 ity payment (€)	9.45 12.66 22.11 73.98 27.72 101.70 123.81 (€/kW)		
Customer with Transmission Distribution Total Factor of reductio Cumulative exces TB1 Square root of Su Exceeding capac	reduced contracted under M1 Capacity Energy Total Capacity Energy Total Capacity Energy Total 0.8 s demand charge 13.9169368 m of (Cd-Cc)^2 (kV 0.812081984 ity payment (€) 11.30169366	9.45 12.66 22.11 73.98 27.72 101.70 123.81 (€/kW)		
Customer with Transmission Distribution Total Factor of reductio Cumulative exces TB1 Square root of Su Exceeding capac Final payment (€)	reduced contracted under M1 Capacity Energy Total Capacity Energy Total n for CC at TB1 0.8 s demand charge 13.9169368 m of (Cd-Cc)^2 (kV 0.812081984 ity payment (€) 11.30169366	9.45 12.66 22.11 73.98 27.72 101.70 123.81 (€/kW)		

Household customer with: charged capacity between 7 and 14 kW

annual consumption between 2.5 and 5 MWh

Time- block	Initial Contr. Cap. (kW)	Contr Cap (kW)
1	4.0	3.2
2	4.0	4.0
3	4.2	4.2
4	4.2	4.2
5	4.7	4.7

Regular customer under M1					
Transmission	Capacity	10.54			
	Energy	12.66			
	Total	23.20			
Distribution	Capacity	82.13			
	Energy	27.72			
	Total	109.95			
Total		133.05			



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Methodology 2:

Forward-looking peak coincident (symmetric for withdrawal and injection) and fixed residual charges (to customers, neither to generators nor storage)





commas.eau



Resulting tariff under methodology 2 Incremental charges for consumption (+) and rewards for injections (-)



Charges for 09/01/2019 (weekday winter) 200,00 Forward looking and energy losses 150,00 charges (€/MWh) 100,00 50,00 0,00 3 9 11 12 13 14 15 16 17 18 19 20 21 22 23 24 1 2 4 5 6 8 10 Charges to HV/MV —— Charges to MV Charges to HV Charges to MV/LV —— Charges to LV



Weekend winter- 20/01/2019





0: LV 1: LVSS 2:MV 3:MVSS 4:HV

Resulting tariff under methodology 2 (energy losses and AS charges)

Transmission

Energy losses costs associated to each voltage level and customer group							
	(€/kWh)						
 Customer VL4 Total group							
0	0,00098	0,00098					
1	0,00094	0,00094					
2	0,00094	0,00094					
3	0,00092	0,00092					
4	0,00092	0,00092					

Customer group	Average ancillary services charges (€/kWh)
0	0,00191
1	0,00184
2	0,00184
3	0,00180
4	0,00180

Distribution

Energy losses costs associated to each voltage level and customer group (€/kWh)								
Customer group	VLO	VL1	VL2	VL3	VL4	Total		
0	0,00218	0,00031	0,00133	0,00013	0,00008	0,00404		
1		0,00030	0,00128	0,00012	0,00008	0,00179		
2			0,00127	0,00012	0,00008	0,00148		
3				0,00012	0,00008	0,00020		
4					0,00008	0,00008		



Resulting tariff under methodology 2 (Residual charges)



Transmission

			·			
	Voltage level	Residual costs allocation to voltage level (€)	Residual charge (€)	Contracted capacity (kW)	Residual charge (€/kW year)	Residual charge (€/kW month)
4: HV	4	37.258.951,34	6.498.233,21	371.971	17,46972	1,45581
3: MVSS	3	-	3.787.593,53	148.538	25,49917	2,12493
2:MV	2	-	11.514.991,46	883.482	13,03365	1,08614
1:LVSS	1	-	1.406.900,07	137.659	10,22018	0,85168
0:LV	0	-	14.051.233,06	8.146.559	1,72481	0,14373

Distribution

		Residual charges (€/MW)								
	Voltage level	Residual costs allocation to voltage level (€)	Residual charge (€)	Contracted capacity (kW)	R_sidual charge (€/kW year)	Residual charge (€/kW month)				
	4	5.440.904,90	89.568,54	22.133	4,04676	0,33723				
	3	16.013.410,72	2.665.991,51	147.013	18,13439	1,51120				
	2	33.026.141,06	21.426.962,78	819.472	26,14728	2,17894				
	1	28.322.647,17	5.341.843,02	137.659	38,80487	3,23374				
comilla	0	71.605.519,54	124.884.257,54	8.138.507	15,34486	1,27874				









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Data for tariff calculation and tariff impacts



- All calculations were done with data for 2019
- Transmission costs: network, energy losses and ancillary services costs
- Distribution costs: network and energy losses costs
- Aggregated hourly consumption, generation, flows and energy losses were considered for each voltage level (from 15-min samples)

				Consumption connected to (MWh)						
Day	Hou	r Min		HV	HV/MV		MV	MV/LV	LV	
		Generation connected to (MWh)								
			ew HV culated)	HV/MV		MV	MV/LV	LV		
					Flo	ows (MW	′h)			
	From HV to HV/MV (measured)		HV to MV ured)	From H HV/M (calcula	V to From V to ted) (calcu	HV/MV MV ulated)	From MV to MV/LV (calculated)	From M\ (calc	//LV to LV ulated)	
			[CALCULATED] Losses (MWh))				
omil	las.e	du		HV	HV/MV	MV	MV/LV	LV	cross border Data from ELES	

Connection method	Load factor (operating hour	
	T ≥ 6000 h	
	6000 ur > T ≥ 2500 h	
	T < 2500 h	
HV/MV Substation	T ≥ 2500 h	
	T < 2500 h	
	T ≥ 2500 h	
	T < 2500 h	
MV/LV Substation	T ≥ 2500 h	
	T < 2500 h	
	T ≥ 2500 h	
	T < 2500 h	
	without metering power	
	Connection method	



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charges (€/year)

netwrk

Annual

Impact analysis for power metered consumers



High Voltage >6000h High Voltage <2500h +84% 7,000,000 160,000 +134% +126% +67% Annual network charges (€/year) 140,000 6,000,000 120,000 5,000,000 68,331 100,000 4,113,689 4,000,000 4.298.427 80,000 20,580 3,000,000 60,000 2,000,000 40,000 1,000,000 20,000 Current Summary M1 Summary M2 Current Summary M1 Summary M2 Transmission capacity charge Transmission Energy charge Transmission capacity charge Transmission Energy charge





Distribution Capacity charge Distribution Energy charge



Impact analysis for power metered consumers (ii)









Low Voltage <2500h



Impact analysis for LV non power metered consumers (average household customer)















■ Distribution Capacity charge ■ Distribution Energy charge



Impact analysis for LV non power metered consumers (Commercial customer)







Cost shifts between customer groups by voltage levels Transmission tariffs



			Current methodology		Methodology 1		Methodoogy 2	
Voltage level	Contracted capacity (MW)	Energy consumed (MWh)	Current capacity (€/year)	Current energy (€/year)	Money recovered by TSO capacity charges (€/year)	Money recovered by TSO energy charges (€/year)	Money recovered by TSO capacity charges (€/year)	Money recovered by TSO energy charges including ancillary services (€/year)
HV	371,971	2,122,660,118	2,125,894	2,192,669	5,237,564	8,914,533	6,498,233	8,557,517
MV SS	148,538	1,243,187,544	3,187,942	373,815	3,104,716	5,240,968	3,787,594	3,720,558
MV	883,482	3,960,406,205	10,744,694	8,409,022	11,887,158	16,073,273	11,514,991	17,863,166
LV SS	137,659	483,365,515	1,801,038	826,341	1,649,440	1,979,889	1,406,900	1,737,878
LV	8,146,559	4,937,972,150	39,415,307	25,166,603.63	21,307,663	19,701,378	14,051,233	25,676,083
TOTAL	9,688,209	12,747,591,532	57,274,875.55	36,968,451.56	43,186,541.41	51,910,040.59	37,258,951.34	57,555,202.35

Network costs (€)	14.395.514
Network losses (€)	11.981.022

Ancillary services (€) 25.533.505

Voltage level	Current tariffs	Current methodology with measured data	M1	M2	Contracted capacity M1	Energy M1
HV	5%	11%	15%	16%	12%	17%
MV SS	4%	7%	9%	8%	7%	10%
MV	20%	31%	29%	31%	28%	31%
LV SS	3%	4%	4%	3%	4%	4%
LV	69%	47%	43%	42%	49%	38%



Cost shifts between customer groups by voltage levels Distribution tariffs



			Current methodology		Methodology 1		Methodoogy 2	
Voltage level	Contracted capacity (MW)	Energy consumed (MWh)	Current capacity (€/year)	Current energy (€/year)	Money recovered by DSO capacity charges (€/year)	Money recovered by DSO energy charges (€/year)	Money recovered by DSO capacity charges (€/year)	Money recovered by DSO energy charges i ć (€/year)
HV	22,133	165,949,396	-	-	76,577	48,438	89,569	580,045
MV SS	147,013	1,243,287,053	2,071,320	284,275	2,511,755	1,561,256	2,665,992	1,034,275
MV	819,472	3,755,389,708	20,188,143	22,797,702	27,020,161	16,753,418	21,426,963	27,295,487
LV SS	137,659	483,377,937	4,501,456	2,888,787	6,180,924	3,213,081	5,341,843	2,942,589
LV	8,138,507	4,925,567,686	55,574,097	158,249,599.04	165,289,615	42,908,915	124,884,258	81,243,407
TOTAL	9,264,784	10,573,571,781	82,335,016.31	184,220,364.32	201,079,031.75	64,485,107.25	154,408,623.38	113,095,802.58

	Current	M1	M2
HV	0%	0%	0%
MVSS	1%	2%	1%
MV	16%	16%	18%
LV SS	3%	4%	3%
LV	80%	78%	77%



Share of total customers under each group



LV commercial customers without metered power

		1	2	
	charged	< 20 M/M/b	> 20 < E00 MW/b	Total annual
No.	capacity (kW)	< 20 101 001	> 20 < 500 IVI VII	consumption (kWh)
1	< 8kW	4	.75%	70,986,585
2	8-14kW	0.56%	2.24%	146,032,053
3	17-43kW	0.58%	2.32%	731,912,411

LV household customers without metered power

		1	2	3	4	5	
	charged	< 1N/N/b	> 1 < 2 5 M/M/b	> 2.5 < 5 MW/b		> 15 MM/b	Total annual
No.	capacity (kW)		/1<2,51010011	~ 2,3 < SIVIVVII	> 3 < 13 1010011		consumption (kWh)
1	<=6kW	0.73%	2.94%	7.10%	13.72	%	613,836,837
2	7-14kW	1.25%	4.99%	12.06%	19.55%	3.74%	1,566,664,294
3	17kW	0.69%	2.77%	6.69%	10.85%	2.08%	1,325,300,979
4	>=22kW	0.33% 0.03%					<mark>53,</mark> 039,758



Tariff impacts for all customer groups



Customers with metered power

	<2500		>2500		>6000	
	M1-Current	M2-Current	M1-Current	M2-Current	M1-Current	M2-Current
HV	67%	84%	137%	145%	126%	134%
MV SS	80%	102%	104%	123%		
MV	17%	27%	26%	37%		
LV SS	24%	32%	33%	37%		
LV	-48%	-32%	-40%	-27%		

LV commercial customers without metered power

	<201	۸Wh	>20MWh		
	M1-Current	M2-Current	M1-Current	M2-Current	
<8 kW	11%	3%			
8-14 kW	32%	17%	-42%	-37%	
17-43 kW	20%	10%	-38%	-29%	

LV household customers without metered power

	<1 MWh		1-2.5 MWh		2.5-5 MWh		5-15 MWh		>15 MWh	
	M1-Current	M2-Current								
<6 kW	133%	75%	36%	13%	-5%	-13%	-29%	-26%		
7-14 kW	123%	70%	45%	19%	4%	-7%	-22%	-24%	-47%	-35%
17 kW	136%	78%	62%	31%	19%	2%	-13%	-18%	-43%	-32%
>22 kW	54%	27%							-33%	-27%







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Tariff impact on EV charging



Scenario 1: household with charged capacity less than 6kW and annual consumption above 5MWh/year

- Slow charging in off-peak hours@3,6kW to charge 20kWh/100km from 0am to 6 am.
- Slow charging in peak hours@3,6kW to charge 20kWh/100km from 4pm to 10 pm.

Scenario 2: household with charged capacity 17kW and annual consumption between 5 and 15MWh

- Fast charging in peak hour @11kW to charge 20kWh/100km from 12am to 2pm.
- Slow charging in peak hours@3,6kW to charge 20kWh/100km from 4pm to 10 pm.

		Capacity (kW)			
Tari	ff	Without EV charging	With slow off-peak EV charging	With slow peak EV charging	
Current (charged capacity)		6.00	6.00	6.00	
	TB1	5.91	5.91	9.07	
Rad (accelurated	TB2	5.91	5.91	9.07	
	TB3	7.08	7.08	9.10	
capacities)	TB4	7.08	7.08	9.10	
	TB5	7.08	8.30	9.18	
M2 (capacity for r	esidual charge)	6.00	6.00	6.00	

			Capacity (kW)		
Tariff		Without EV charging	With fast peak EV charging	With slow peak EV charging	
Current (charged capacity)		17.00	17.00	17.00	
	TB1	6.78	15.59	8.78	
Rad / accenter of a	TB2	6.78	15.59	8.78	
	TB3	6.85	17.85	10.35	
capacities)	TB4	6.94	17.85	10.35	
	TB5	7.06	17.85	10.35	
M2 (capacity for residual charge)		17.00	17.00	17.00	

Tariff impact on EV charging – Scenario 1









Tariff impact on EV charging – Scenario 2







Tariff impact on PV selfconsumption



Commercial: charged capacity 14kW and annual consumption >20MWh with **10 kWp of PV**

	Variable	Without PV	With PV	
Current cont	racted capacity (kW)	14.00	14.00	
	TB1	10.82	9.87	
M1	TB2	10.82	9.87	
contracted	TB3	11.02	9.87	
(kW)	TB4	11.02	9.87	
	TB5	11.02	9.87	
M2 contra	cted capacity (kW)	14.00	14.00	
Energy consu	umed (MWh)	36.99	25.14	
Energy gener	ated (MWh)		13.95	
Energy self-c	onsumed (MWh)		11.85	85%
Energy inject	ed (MWh)		2.10	

Household: charged capacity 11kW and annual consumption >5<15MWh with **3.5 kWp of PV**

Variable	Without PV	With PV		
Current contracted capaci	ity (kW)	11.00	11.00	
	TB1	4.62	4.49	
M1 contracted consolity	TB2	4.62	4.49	
	TB3	6.90	6.38	
	TB4	6.90	6.38	
	TB5	<u>6.9</u> 0	6.38	
M2 contracted capacity	(kW)	11.00	11.00	
Energy consumed (MWh)		6.76	4.15	
Energy generated (MWh)		4.88		
Energy self-consumed (MWI		2. <mark>61</mark>	539	
Energy injected (MWh)			2.27	

Tariff impact on PV selfconsumption (ii)









Tariff impact on energy communities with common PV

Before being a member of the Energy community



Household customer 7-14kW_>2.5<5MWh

				or the Energy community			
	S	Summary M1		S	ummary M2		
	Transmissior	n Capacity	10.54	Transmissior	n Residual	7.71]
		Energy	12.66		Energy	13.53	
		Total	23.20		Total	21.23	
	Distribution	Capacity	82.13	Distribution	Residual	68.56]
		Energy	27.72		Energy	36.45	
		Total	109.85		Total	105.01	
	Total		133.05	Total		126.24]
sh	are of energy	community (%	b)			5	50%
٧	plant size (k	Wp)					3.5
Ī	ergy consume	d without EC (kV	Vh)			3188	3.08
In	ergy generated	l associated to c	ustomer (kV	Vh)		2127	7.10
le	t energy consu	Imption (kWh)				2403	3.68
In	ergy injected (1	not rewarded und	der current a	ind M1 method	ologies) (kWh)	1342	2.70
6	of injected ene	ergy into the grid	over genera	ted energy (%)	6	53%
		After being a r	nember of	the Energy o	community		
	S	Summary M1		S	ummary M2		Ś
	Transmissior	n Capacity	10.49	Transmissior	n Residual	7.71	1
		Energy	9.50		Energy charg	12.03	
					Energy rewar	- 4.12	
		Total	19.99		Total	19.73	1
	Distribution	Capacity	81.61	Distribution	Residual	68.56	1
		Energy	20.97		Energy charg	28.93	
	Energy comr	nunity charge	1.71		Energy rewar	- 18.26	
		Total	104.29		Total	79.23]
	Total		124.28	Total		98.90	
	Variation		-7%	Variation		-22%	





Dynamic local tariffs pCPT and nCPT



A **household consumer** with charged capacity of 7-14 kW and energy consumption 2.5-5 MWh has been subject to CPT under the three tariffs (current, M1 and M2):

pCPT (Positive critical peak tariff):

- Current: Increased base energy tariff (MT) by 15 times, pCPT:MT->15:1
- M1: Increased energy tariff in corresponding Time-block by 15 times, pCPT:TBi->15:1
- M2: Increased incremental energy tariff in corresponding hour by 15 times, pCPT:ICh->15:1

nCPT (Negative critical peak tariff):

- Current: Decreased base energy tariff (MT) by 4 times, nCPT:MT ->0.25:1
- M1: Decreased energy tariff in corresponding Time-block by 4 times, pCPT:TBi->0.25:1

 M2: Decreased incremental energy tariff in corresponding hour by 4 times, pCPT:ICh->0.25:1



Dynamic local tariffs pCPT and nCPT



The selected **activation hours** were:

- 114 hours of pCPT (see Table)
- 1924 hours of nCPT
 - All days between midnight and 4 am
 - Summer days (May, June, July) between 11 am and 4 pm

Demand response: reductions of 20% when pCPT and increment of 11 kW per hour when nCPT are simulated.

	Before demand response		After demand reduction		After demand increase	
Time block	Energy consumption (kWh)	Contracted capacity (kW)	Energy consumption (kWh)	Contracted capacity (kW)	Energy consumption (kWh)	Contracted capacity (kW)
1	324.4	4.0	323.7	4.0	324.4	4.0
2	261.8	4.0	260.8	4.0	261.8	4.0
3	1029.3	4.2	1026.2	4.2	4229.3	13.8
4	774.6	4.2	770.1	4.2	5064.6	13.8
5	797.9	4.5	792.1	4.5	12547.9	13.8

Activation date	Beginning hour- 3 hours of
Activation date	application
16/02/2020	18:30:00
08/03/2020	19:00:00
12/03/2020	19:00:00
14/03/2020	18:30:00
15/03/2020	19:00:00
20/03/2020	19:00:00
22/03/2020	18:30:00
28/03/2020	19:00:00
30/03/2020	19:15:00
30/05/2020	20:30:00
08/06/2020	20:45:00
16/06/2020	20:30:00
20/06/2020	20:30:00
04/07/2020	20:30:00
13/07/2020	20:00:00
19/07/2020	21:00:00
25/07/2020	20:30:00
01/08/2020	20:30:00
09/08/2020	20:30:00
16/08/2020	20:30:00
23/08/2020	20:30:00
07/09/2020	19:30:00
14/09/2020	20:00:00
19/09/2020	19:30:00
27/09/2020	19:30:00
05/10/2020	19:00:00
11/10/2020	19:30:00
16/10/2020	19:00:00
22/10/2020	19:00:00
24/10/2020	19:30:00
02/11/2020	19:30:00
08/11/2020	19:00:00
14/11/2020	18:00:00
19/11/2020	19:00:00
22/11/2020	18:00:00
05/12/2020	17:00:00
14/12/2020	17:30:00
20/12/2020	18:30:00



Dynamic local tariffs pCPT and nCPT (ii)



Network charges (€/year) under each tariff structure for pCPT (20% demand reduction) and nCPT (+11kW demand increase)

DR of 20% reduction when pCPT	Current	M1	M2
pCPT without demand reduction	213.53	146.45	131.92
pCPT with 20% demand reduction	206.32	143.58	130.67
Savings	-3%	-2%	-1%

DR of increase of 11 kW when nCPT	Current	M1	M2
Base tariff with demand increase	813.44	432.97	259.47
nCPT with demand increase	349.99	250.44	185.33
Savings	-57%	-42%	-29%
nCPT with demand increase and exemption for excessed contracted capacity in M1	N/A	188.07	N/A
Savings	N/A	-57%	N/A

There is a need for fine-tuning CPT price factors under M1 and M2



Summary of Methodology 1



- **Producers and injections** into the grid coming from active customers **are not charged**, but neither rewarded.
- Methodology 1 is justified while the **penetration of distributed** generation or active customers is small.
- Methodology 1 is proposed as a transition between the current method and Methodology 2, which is more cost-reflective, but more complex.
- Time of use capacity and energy charges promote efficient development of active customers, i.e. electric vehicle charging
- Time of use withdrawal capacity and energy charges promote self-consumption and energy communities with no injection to the grid Promotion of behind the meter storage in this type of installations



Summary of Methodology 2



- Methodology 2 for cost-reflective charges **does not discriminate among producers or consumers**, among withdrawals and injections into the grid.
- Residual charges are only allocated to consumers
- Hourly differentiated network charges efficiently signal the network impacts caused by electric vehicle charging, self-consumption, or energy storage.
- Energy communities are treated as regular customers, as independent active customers and producers causing injections or withdrawals
- For the sake of facilitating the practical application, time-blocks could be applied defining typical days along the year and joining those hours with similar charges after the forward-looking charges calculation
- Customers without smart-meters could be treated as in Methodology 1, where charges are joined to one single charge. In this case, customers without smart-meters would face one energy charge and one residual charge



Contents



- Methodology 1
 - Tariff structure
- Methodology 2
 - Tariff structure
- Data for simulations
- Impact analysis on customer groups
- Impact analysis on active customers
- Recommendations





SWOT – New tariffs M1 and M2



Str • •	rengths Cost-reflectivity with time discrimination M1: different contracted capacities could be chosen according to flexible customer needs M2: symmetric treatment of consumers and generators through peak coincident energy charges	 Weaknesses Complexity to be understood by residential customers. Higher in M2 		
Ор •	The need to adapt required mandates of the CEP, specifically for active customers and energy communities Enable the efficient treatment of flexibility costs and their allocation	 Adequate dissemination required for social acceptance in the transition 		



Recommendations



- Migrate from current tariffs to M1 tariffs
- Initially contracted capacities should be adjusted for all timeblocks to already charged capacities
- Provide **smart meter qualified information** to customers about the actual peak use of the network for each time-block
- Customers would adapt their contracted capacities
- After several years of experience migrate from tariffs M1 to tariffs M2



Recommendations Tariff M1



- Energy withdrawals (15-min samples) from regular and active customers and standalone storage are subject to network capacity and energy charges differentiated by time-blocks
- Injections from generators, standalone storage (pumping hydro plants or battery installations) or active consumers are neither charged nor rewarded
- Standalone storage and active customers may incur in extra network charges due to explicit flexibility provision for system services. To achieve a level playing field with generators, it is recommended to exempt standalone storage and active customers from those extra charges.
 comillas.edu



Storage exclusively providing flexibility, baseline no charging or discharging





Recommendations Tariff M2



- Generators, standalone storage (pumping hydro plants or battery installations) and regular & active consumers are subject to network peak-coincident energy charges(rewarded/charged) on their net injection/withdrawal profiles (15-min samples)
- Peak-coincident energy charges can be either positive or negative (reward), double charging of storage, understood as paying both for withdrawing and injecting energy, is avoided
- Residual charges are only allocated to consumers. Generators and standalone storage are exempted. They are considered market assets that would internalize in their energy offers those costs which are not costreflective
- The provision of explicit flexibility for system services does not need any exemptions. Generators, standalone storage or active consumers will be charged/rewarded by the net-metered hourly consumption/injection once the flexibility services have been provided



Thank you very much



Questions?

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Dissemination activity 3

Reform of the Slovenian network charging methodology

Back-up slides

Instituto de Investigación Tecnológica - IIT

December 1st, 2021





Slovenian current network tariffs



 Cost allocation to customer groups according to estimated contribution to system peak

2. Allocation to energy and capacity charges

3. Allocation to day-night charges

	Customer group	Customer group				Tariffs*			
	Voltage level	Type of connection	Load factor	Capacity (EUR/kW/month	Consumed (EUR/kWh)		energy		
					VT	MT	ET		
			$T \geq 6{,}000 \ hr$						
	HV		6,000 $>~T~\geq$						
	(VN)		2,500 hr						
			$T{<}2,{500}\ hr$						
	MV Busbar MV	Bushar MV	$T \geq 2{,}500 \ hr$						
		Busbal Wiv	$T{<}2,{500}\ hr$						
	(SN)		$T \geq 2{,}500 \ hr$						
			$T{<}2,{500}\ hr$						
	Busbar LV	Bushar I V	$T \geq 2{,}500 \ hr$						
		$T{<}2,{500}\ hr$							
			$T \geq 2{,}500 \ hr$						
	IV		T < 2,500 hr						
	LV (NN)	charging EV							
		Without							
			power						
			measurement						
			household						



Customers without smart-meters under tariff M1



- For the case of LV customers without smart metering, a simplified capacity and energy tariff with no time-blocks is calculated as the aggregation of the different terms calculated for regular LV tariffs.
- LV customers without smart-meters would face:
 - one contracted capacity term, assuming that the contracted capacity is the same for all time-blocks, calculated as the sum of all the timeblock capacity charges for regular LV tariffs, and
 - one energy term (or two, depending on the electromechanical meter) calculated as the weighted average of the energy time-block charges for regular LV tariffs.