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29															
30															
31															
32															
33															
34															
35															
36	0.39	0.07	1355	112878	9811.7	0.85	0.93	17348	488000	69394	0.37	0.01	249	20711	847.5



										0.250	0.078	13.74	1145	1.79
0.52	0.01	307	25613	687	0.98	0.01	482	40157	548	0.444	0.014	304.2	25353	28.7



27											
28											
29											
30	0.41	0.098	8.69	244.4	30.24						
31	0.78	0.052	12.17	342	141.12						
32											
33											
34											
35											
36	0.927	0.057	2709.2	76209	3889.3	0.516	0.034	886.9	73912	12071	

Appendix D - continued

Energy saving measure [Fo]														
Utilization of efficient type of fuel-energy resources [F11]					Application of diamond coated instruments [F12]					Improvement of valve system [F13]				
$\alpha_{11}$	$\beta_{11}$	$\gamma_{11}$ , mln. AMD	$\pi_{11}$ , MWh	$C_{11}$ , mln. AMD	$\alpha_{12}$	$\beta_{12}$	$\gamma_{12}$ , mln. AMD	$\pi_{12}$ , MWh	$C_{12}$ , mln. AMD	$\alpha_{13}$	$\beta_{13}$	$\gamma_{13}$ , mln. AMD	$\pi_{13}$ , MWh	$C_{13}$ , mln. AMD
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
										0.250	0.042	11.438	953.2	36.7
										0.150	0.032	21.0	1753.1	50.5
										0.250	0.086	28.0	2334.5	78.4
0.091	0.321	44.70	3725.2	122.5										
0.035	0.521	49.80	4150.0	104.6						0.280	0.098	74.6	6217.9	208.9
0.021	0.435	3.04	253.3	8.5	0.785	0.123	32.1	2677.8	9.6					
					0.000	0.000	0.0	0.0	0.0					
					0.857	0.103	13.5	1127.8	4.1					
0.056	0.334	4.38	365.0	10.9	0.661	0.037	5.6	470.7	2.8	0.110	0.092	2.4	198.3	6.9
					0.225	0.093	1.43	119.4	0.29					
0.056	0.334	1.94	161.4	8.0						0.110	0.095	34.2	2850.0	88.9

										0.320	0.098	58.4	4863.3	169.2
										0.220	0.091	3.1	256.2	8.9
										0.180	0.115	41.9	3488.8	33.5
										0.220	0.132	2.1	171.3	3.7
0.095	0.421	28.2	2349.2	222.4						0.150	0.125	13.2	1100.6	14.5
0.080	0.385	4.53	377.7	11.3						0.110	0.095	1.5	128.1	1.8
0.068	0.040	136.6	11382	488.3	0.775	0.001	52.7	4396	16.8	0.231	0.025	291.8	24315	702.1



27															
28															
29											0.120	0.434	105.3	8777.6	45.3
30						0.241	0.087	4.6	128.21	17.8					
31	0.258	0.059	10.70	892.0	22.5	0.86	0.2791	72.5	2038	1391.1	0.114	0.421	33.8	2819.0	5.1
32											0.558	0.350	1626.3	135524.5	2925.3
33											0.496	0.424	3635.3	302945.6	6788.1
34															
35															
36	0.387	0.019	363.7	30312	1179.5	0.653	0.009	303.1	8525	2183.1	0.486	0.234	5707.3	475606	9944.4

Appendix D - continued

Energy saving measure [Fo]										
Total energy saving measures [Fo]										
Electric energy					Natural gas					
$\alpha_0$	$\beta_0$	$\gamma_0$ , mln. AMD	$\pi_0$ , MWh	$C_0$ , mln. AMD	$a_0$	$\beta_0$	$\gamma_0$ , mln. AMD	$\pi_0$ , thousand m3	$C_0$ , mln. AMD	
95	96	97	98	99	100	101	102	103	104	
0.680	0.929	695	57944	10282	0.000	0.000	0	0	0	
0.477	0.424	900	74962	2708	0.854	0.134	101	2843	304	
0.000	0.000	0	0	0	0.340	0.028	0.6	18.1	2.0	
0.554	0.603	437	36458	562	0.709	0.310	266	7484	814	
0.460	0.272	191	15956	531	0.593	0.071	1.3	36.9	4.1	
0.307	0.746	6.8	566.1	8.0	0.000	0.000	0.0	0.0	0.0	
0.100	0.414	1	66	1	0.000	0.000	0.0	0.0	0.0	
0.372	0.622	633	52733	1518	0.422	0.103	114	3203	317	
0.292	0.237	6	517	25	0.252	0.061	0	1	0	
0.394	0.813	393	32775	1302	0.856	0.041	212	5952	489	
0.445	0.734	109	9067	198	0.731	0.153	144	4047	593	
0.324	0.047	0	42	2	0.310	0.063	1	25	3	
0.661	0.271	27.4	2284.6	43.8	0.000	0.000	0	0	0	
0.307	0.798	57.3	4775.3	109.4	0.848	0.122	10	291	70	
0.512	0.065	1.0	85.6	1.4	0.000	0.000	0	0	0	
0.211	0.150	2.2	180.8	2.9	0.420	0.071	0	5	1	
4.678	0.076	1166.9	97238	2984.0	0.863	1.020	19408	545936	71279	

0.367	1.811	1237.9	103161	9848.5	0.000	0.000	0	0	0
0.354	0.108	1	94	2	0.000	0.000	0	0	0
0.613	0.228	81	6749	106	0.000	0.000	0	0	0
0.250	0.454	7	559	9	0.000	0.000	0	0	0
0.204	0.500	16	1305	28	0.322	0.153	5	141	11
0.377	0.156	69	5726	212	0.000	0.000	0	0	0
0.000	0.000	0	0	0	0.000	0.000	0	0	0
0.299	1.164	286	23870	1011	0.000	0.000	0	0	0
0.000	0.000	0	0	0	0.000	0.000	0	0	0
0.000	0.000	0	0	0	0.000	0.000	0	0	0
0.000	0.000	0	0	0	0.000	0.000	0	0	0
0.193	0.592	231	19264	147	0.000	0.000	0	0	0
0.220	0.132	2	171	4	0.352	0.174	13	373	48
0.130	1.589	146	12145	376	0.849	0.330	85	2380	1532
0.494	0.507	2082	173514	3209	0.000	0.000	0	0	0
0.496	0.424	3635	302946	6788	0.000	0.000	0	0	0
0.088	0.471	6	506	13	0.000	0.000	0	0	0
0.000	0.000	0	0	0	0.000	0.000	0	0	0
0.860	0.288	12428	1035658	42034	0.857	0.463	20361	572734	75466

- $\alpha_i$  the share of i-th measure, relative unit, based on expert and research estimates
- $\beta_i$  relative potential of i-th measure
- $\gamma_i$  energy (natural gas) saved as a result of implementation of i-th measure, million AMD,  $\gamma_i = A\alpha\beta 12$ , (1kWh=12 AMD), or  $\gamma_i = A\alpha\beta 39105$  (1 thousand m<sup>3</sup> of natural gas is 39105 AMD)
- $\pi_i$  potential of i-th measure, in natural unit, MWh or thousand m<sup>3</sup>,  $\pi_i = A\alpha\beta$
- $C_i$  cost of energy saving measures in the i-th industrial company, billion AMD,  $C_i = \gamma_i T$ , where T is the payback period
- A total consumption of electric energy or natural gas.

**APPENDIX E: ENERGY SAVING POTENTIAL IN STREET LIGHTING THROUGHOUT ARMENIA. INSTALLATION OF NARIUM LAMPS IN STREET LIGHTING SYSTEM**

N	Location (marzes, cities, villages)	Annual electric energy consumption			Annual energy saving, MWh
		Designed	Actual	Proposed	
1	Yerevan	13,528.00	13,040.00	11,260.00	2,268.00
2	Aragatsotn Marz	888.50	235.10	505.60	382.80
	c. Ashtarak	168.80	168.80	42.00	126.80
	c. Talin	490.56	63.51	318.86	171.70
	c. Aparan	191.63	2.74	107.31	84.32
	v. Tsaghkahovit	37.50	0.00	37.50	0.00
3	Lori Marz	1,231.40	1,076.40	846.80	384.60
	c. Alaverdi	72.54	72.54	41.34	31.21
	c. Stepanavan	53.28	30.96	10.66	42.62
	c. Spitak	7.04	4.85	3.94	3.10
	c. Tashir	43.53	26.55	29.57	13.96
	c. Vanadzor	990.00	935.00	728.75	261.25
	c. Akhtala	65.00	6.50	32.50	32.50
4	Armavir Marz	1,641.50	756.90	960.10	681.40
	c. Armavir	392.40	67.50	219.74	172.66
	c. Echmiadzin	135.00	135.00	88.80	46.20
	c. Metsamor	382.85	261.95	214.40	168.45
5	Syunik Marz	731.20	292.40	437.20	294.00
	c. Kapan	253.58	184.28	83.16	170.42
	c. Goris	48.31	24.34	29.47	18.84
	c. Meghri	54.03	8.93	34.20	19.83
	c. Sisian	182.50	11.41	128.66	53.84
	c. Qajaran	123.19	10.95	119.17	4.02
	c. Agarak	69.64	52.54	42.53	27.11
6	Vayots Dzor Marz	584.00	102.20	327.00	257.00
	c. Vayq	175.20	10.95	98.11	77.09
	c. Jermuk	219.00	73.00	122.64	96.36
	c. Yeghegnadzor	189.90	18.25	106.29	83.51
7	Kotayk Marz	1,892.90	654.30	1,063.10	829.80

N	Location (marzes, cities, villages)	Annual electric energy consumption			Annual energy saving, MWh
		Designed	Actual	Proposed	
	c. Hrazdan	245.44	54.19	137.45	107.99
	c. Tsaghkadzor	68.99	68.99	38.63	30.35
	c. Charentsavan	237.46	181.58	131.53	105.92
	c. Abovyan	147.83	147.83	66.43	81.40
	c. Byureghavan	23.10	11.00	12.94	10.16
	c. Eghvard	150.00	0.00	84.00	66.00
	c. Nor Hachn	88.61	24.23	51.61	37.00
	v. Aghavnadzor	78.84	5.84	44.15	34.69
	v. Meghradzor	119.72	10.22	67.04	52.68
	v. Solak	91.25	18.25	51.10	40.15
	v. Qaghsi	35.04	4.38	19.62	15.42
	v. Alapars	124.10	14.60	69.50	54.60
	v. Argel	68.14	8.21	68.14	0.00
	v. Nor Geghi	174.24	15.84	87.12	87.12
	v. Proshyan	72.00	22.50	21.00	51.00
	v. Arinj	40.50	37.80	22.68	17.82
	v. Balahovit	27.00	13.50	15.12	11.88
	v. Akunq	51.30	13.30	25.65	25.65
	v. Qasakh	49.35	2.10	49.35	0.00
8	Gegharqunik Marz	2,507.90	293.20	874.70	1,633.10
	c. Gavar	2,340.00	151.20	777.60	1,562.40
	c. Martuni	25.92	23.76	16.20	9.72
	c. Sevan	90.09	76.44	51.87	38.22
	c. Vardenis	51.84	41.76	29.03	22.81
9	Ararat Marz	252.76	252.76	71.14	181.62
	c. Ararat	21.90	21.90	4.38	17.52
	c. Vedi	9.13	9.13	1.83	7.30
	c. Artashat	67.53	67.53	13.51	54.02
	c. Masis	62.05	62.05	12.41	49.64
	v. Argavand	0.73	0.73	0.73	0.00
	v. Vedi	10.20	10.22	3.29	6.94
	v. Nor Kyanq	11.86	11.86	3.36	8.50
	v. Mrgavan	22.63	22.63	11.75	10.88
	v. Mkhchyan	39.42	39.42	15.51	23.91

N	Location (marzes, cities, villages)	Annual electric energy consumption			Annual energy saving, MWh
		Designed	Actual	Proposed	
	v. Kanachut	7.30	7.30	4.38	2.92
10	Tavush Marz	628.20	413.07	473.97	154.23
11	Shirak Marz	7,857.36	1,925.10	6,145.92	1,711.44
	c. Gyumri	7,263.00	1,739.00	5,898.00	1,366.00
	c. Maralik	270.00	60.30	151.20	118.80
	c. Artik	324.00	126.00	97.20	226.80
	TOTAL	31,744.00	19,041.40	22,965.70	8,778.40

The energy efficiency of lighting fixtures is determined by the following equation:

$$K_E = P_{old} / P_{new} = 2.19 ,$$

where  $P_{old}$  and  $P_{new}$  are the old and new power capacity of the lamps.

The lighting efficiency is determined by the following equation:

$$K_L = \Phi_{old} / \Phi_{new} = 1.38 ,$$

where  $\Phi_{old}$  and  $\Phi_{new}$  are the old and new light emission capacity of the lamps.

## Abbreviations

NSS	national security service
PGFS	pressurized gas filling station
USA	United States of America
CIS	Commonwealth of Independent States
HVEN	High Voltage Electricity Networks CJSC
ES&RE	Energy saving and renewable energy
USSR	Union of Soviet Sociualistic Republics
ANPP	Armenian Nuclear power Plant
HPP	Hydroelectric Power Plant
AEN	Armenian Electricity Netwroks CJSC
GDP	Gross Domestic Product
RA	Republic of Armenia
MIA	Ministry of Internal Affairs, the Police of RA
MD	Ministry of Defense
TPP	Thermal Power Plant
RF	Russian Federation
LLC	Limited Liability Company
t.c.f.	tons of conditional fuel
o.e.	oil equivalent
t.o.e.	tons of oil equivalent
CJSC	Closed Joint Stock Company
ETL	Electricity transmission lines