

Appendix B

ICT-RELATED ELECTRICITY USE PROJECTIONS

U.S. Residential		2001 Base			2006			
households (million)				106				111.5
electricity intensity (kWh/hh)				11,600				12,300
avg. sq. ft. per hh				1,684				1,713
ICT Equipment	% of hh	# units (million)	unit kWh/yr	unit TWh/yr	% of hh	# units (million)	unit kWh/yr	unit TWh/yr
Computer/office								
desktop	65	110	7.2		85	100	8.5	
notebook	6	10	0.1		10	10	0.1	
PDA (charger)	15	10	0.2		75	10	0.8	
printer, other periph	90	20	1.8		120	20	2.4	
modem	45	20	0.9		40	45	20	0.9
broadband modem	9	40	0.4		30	33	40	1.3
copier/fax	12	275	3.3		20	22	225	5.0
subtotal			13.7					19.0
(EIA 2001)			14.7					17.6
TV/video								
cable/sat TV/video	72	76	450	34.3	80	89	450	40.1
broadcast TV/video	27	29	350	10.0	19	21	350	7.4
digital TV (incrm.)	1	1	180	0.2	5	6	180	1.0
dig cable/sat box	18	19	100	1.9	50	56	90	5.0
game console		65	10	0.7	100	112	10	1.1
subtotal			47.1					54.7
(EIA, 2001)			41.0					52.7
Audio								
component stereo	75	150	11.3		70	78	150	11.7
compact stereo	50	110	5.5		50	56	110	6.1
portable stereo	75	17	1.3		75	84	17	1.4
clock radio	150	15	2.3		150	167	15	2.5
MP3 player	5	10	0.1		50	56	10	0.6
subtotal			20.3					22.3
Communications/network								
powered phone/ans		100	26	2.6		100	26	2.6
cordless phone/ans		100	30	3.0		150	30	4.5
cell phone charger		40	10	0.4		75	10	0.8
home network-base	3	3	100	0.3	20	22	100	2.2
security sys/connect	12	13	125	1.6	30	446	2.25	2.4
ICT connections		10	2.75	0.0		223	2.25	0.5
appliance connects		0	2.75	0.0		45	2.25	0.1
HVAC/light connects		2	2.75	0.0		223	2.25	0.5
subtotal			7.9					13.6
Subtotal ICT equipment			89					110

U.S. Residential		2001 Base			2006			
households (million)				106				111.5
electricity intensity (kWh/hh)				11,600				12,300
avg. sq. ft. per hh				1,684				1,713
ICT Equipment	% of hh	# units (million)	unit kWh/yr	TWh/yr	% of hh	# units (million)	unit kWh/yr	TWh/yr
Home EMS	% SP ^a	% pene- tration	% SC&L ^b		% SP ^a	% pene- tration	% SC&L ^b	
phase 1	3	2	34	-0.3	3	7	34	-1.0
phase 2	9	0	34	0.0	9	2	34	-0.8
phase 3	15	0	34	0.0	15	1	34	-0.7
subtotal EMS				-0.3				-2.5
Telework								
% of work force	9%	17			13%	25		
avg days per week	2				2.1			
office equip (incrm)		17	220	3.0		25	210	4.4
office lighting		17	150	2.0		25	140	2.9
office space conditioning		17	500	6.8		25	500	10.5
subtotal home office		17	870	11.8		25	850	17.9
rest of home (2/3 x office)		17	580	7.9		25	567	11.9
subtotal telework			1,450	19.7			1,417	29.8
subtotal ICT-driven				109				137
subtotal non-ICT				1,121				1,241
Total residential				1,230				1,378
EIA ICT				56				70
EIA non-ICT				1,174				1,300
EIA total residential				1,230				1,370
difference from EIA								
TWh				0				8
%				0.0				0.6

References and sources of data:

EIA, 2001
 Arrington, 2001
 Kawamoto et al., 2001
 Rosen and Meier, 1999
 Rosen and Meier, 2000
 Rosen, Meier, and Zandelin, 2001

^aSP = savings potential.

^bSC&L = space conditioning and lighting.

U.S. Residential		Reference 2021			Zaibatsu 2021			
households (million)				128				
electricity intensity (kWh/hh)				13,200				
avg. sq. ft. per hh				1,792				
ICT Equipment	% of hh	# units (million)	unit kWh/yr	unit TWh/yr	% of hh	# units (million)	unit kWh/yr	unit TWh/yr
Computer/office								
desktop		100	100	10.0		120	100	12.0
notebook		25	10	0.3		30	10	0.3
PDA (charger)		150	10	1.5		150	10	1.5
printer, other periph		150	20	3.0		160	20	3.2
modem	2	3	20	0.1	2	3	20	0.1
broadband modem	90	115	40	4.6	96	123	40	4.9
copier/fax	30	38	150	5.8	35	45	150	6.7
subtotal (EIA, 2001)				25.2				28.7
				33.7				33.7
TV/video								
cable/sat TV+video	95	122	450	54.7	98	125	450	56.4
other TV/video	4	5	350	1.8	1	1	350	0.4
digital TV (add kWh)	95	122	180	21.9	98	125	180	22.6
dig cable/sat box	95	122	60	7.3	98	125	60	7.5
game console	150	192	10	1.9	150	192	10	1.9
subtotal (EIA, 2001)				87.6				88.9
				76.3				76.3
Audio								
component stereo	75	96	150	14.4	75	96	150	14.4
compact stereo	50	64	110	7.0	50	64	110	7.0
portable stereo	75	96	17	1.6	75	96	17	1.6
clock radio	150	192	15	2.9	150	192	15	2.9
MP3 player	150	192	10	1.9	150	192	10	1.9
subtotal				27.9				27.9
Communications/network								
powered phone/ans		100	26	2.6		110	28	3.1
cordless phone/ans		200	30	6.0		200	28	5.6
cell phone charger		30	10	0.3		25	10	0.3
home network-base security	90	115	150	17.3	95	122	150	18.2
sys/connect		3,456	1.34	4.6		3,648	1.34	4.9
ICT connections		3,456	1.34	4.6		3,648	1.34	4.9
appliance connects		3,584	1.34	4.8		4,096	1.34	5.5
HVAC/light connects		8,960	1.34	12.0		10,240	1.34	13.7
subtotal				52.3				56.2
Subtotal ICT equipment				193				202

U.S. Residential		Reference 2021			Zaibatsu 2021			
households (million)				128				
electricity intensity (kWh/hh)				13,200				
avg. sq. ft. per hh				1792				
Item	% of hh	# units (million)	unit kWh/yr	TWh/yr	% of hh	# units (million)	unit kWh/yr	TWh/yr
Home EMS	% SP ^a	% pene- tration	% SC&L ^b		% SP ^a	% pene- tration	% SC&L ^b	
phase 1	3	20	33	-3.4	3	20	33	-3.4
phase 2	9	20	33	-10.1	9	25	33	-12.6
phase 3	15	30	33	-25.2	15	35	33	-29.5
subtotal EMS				-38.7				-45.4
Telework								
% of work force	18	40			14	30		
avg days per week	2.5				2			
office equip (incred)		40	180	7.2		30	180	4.3
office lighting		40	110	4.4		30	110	2.6
office space conditioning		40	500	20.0		30	500	12.0
subtotal home office		40	790	31.6		30	790	19.0
rest of home (2/3 x office)		40	527	21.1		30	527	12.6
subtotal telework			1,317	52.7		30	1,317	31.6
subtotal ICT-driven				207				188
subtotal non-ICT				1,516				1,516
Total residential				1,723				1,704
EIA ICT				113				113
EIA non-ICT				1,587				1,587
EIA total residential				1,700				1,700
difference from EIA								
TWh				23				4
%				1.3				0.2

^aSP = savings potential.

^bSC&L = space conditioning and lighting.

U.S. Residential households (million) electricity intensity (kWh/hh) avg. sq. ft. per hh					Net Insecurity 2021			
ICT Equipment	Cybertopia 2021				% of hh	# units		
	% of hh	# units (million)	unit kWh/yr	TWh/yr		% of hh	# units (million)	unit kWh/yr
Computer/office								
desktop		120	100	12.0		100	100	10.0
notebook		30	10	0.3		25	10	0.3
PDA (charger)		200	10	2.0		50	10	0.5
printer, other periph		180	20	3.6		150	20	3.0
modem	2	3	20	0.1	2	3	20	0.1
broadband modem	93	119	40	4.8	50	64	40	2.6
copier/fax	40	51	150	7.7	30	38	150	5.8
subtotal				30.4				22.1
(EIA, 2001)				33.7				33.7
TV/video								
cable/sat TV+video	95	122	450	54.7	98	125	450	56.4
other TV/video	4	5	350	1.8	1	1	350	0.4
digital TV (add kWh)	98	125	180	22.6	99	127	400	50.7
dig cable/sat box	95	122	60	7.3	99	127	60	7.6
game console	150	192	10	1.9	170	218	10	2.2
subtotal				88.3				117.4
(EIA, 2001)				76.3				76.3
Audio								
component stereo	75	96	150	14.4	80	102	150	15.4
compact stereo	50	64	110	7.0	60	77	110	8.4
portable stereo	75	96	17	1.6	80	102	17	1.7
clock radio	150	192	15	2.9	150	192	15	2.9
MP3 player	150	192	10	1.9	150	192	10	1.9
subtotal				27.9				30.3
Communications/network								
powered phone/ans		100	28	2.8		100	28	2.8
cordless phone/ans		200	28	5.6		200	28	5.6
cell phone charger		30	10	0.3		30	10	0.3
home network- base	95	122	150	18.2	80	102	150	15.4
security connects		3,648	1.34	4.9		3,072	1.34	4.1
ICT connections		3,648	1.34	4.9		1,024	1.34	1.4
appliance connects		4,608	1.34	6.2		896	1.34	1.2
HVAC/light connects		11,520	1.34	15.4		8,960	1.34	12.0
subtotal				58.3				42.8
Subtotal ICT equipment				205				213

U.S. Residential		Cybertopia 2021			Net Insecurity 2021			
households (million)								
electricity intensity (kWh/hh)								
avg. sq. ft. per hh								
Item	% of hh	# units (million)	unit kWh/yr	unit TWh/yr	% of hh	# units (million)	unit kWh/yr	unit TWh/yr
Home EMS	% SP ^a	% pene- tration	% SC&L ^b		% SP ^a	% pene- tration	% SC&L ^b	
phase 1	3	10	33	-1.7	3	40	33	-6.7
phase 2	9	20	33	-10.1	9	20	33	-10.1
phase 3	15	60	33	-50.5	15	10	33	-8.4
subtotal EMS				-62.3				-25.2
Telework								
% of work force	28	60			9	20		
avg days per week	3				2			
office equip (incrm)		60	180	13.0		20	180	2.9
office lighting		60	110	7.9		20	110	1.8
office space conditioning		60	500	36.0		20	500	8.0
subtotal home office		60	790	56.9		20	790	12.6
rest of home (2/3 x office)		60	527	37.9		20	527	8.4
subtotal telework			1,317	94.8			1,317	21.1
subtotal ICT-driven				237				208
subtotal non-ICT				1,516				1,516
Total residential				1,753				1,724
EIA ICT				113				113
EIA non-ICT				1,587				1,587
EIA total residential				1,700				1,700
difference from EIA								
TWh				53				24
%				3.1				1.4

^aSP = savings potential.

^bSC&L = space conditioning and lighting.

U.S. Commercial				2001 Base			2006		
floor space (billion square feet)				66.1			72.9		
electricity intensity (kWh/sq ft)				17.7			18.4		
Item	# units	unit		# units	unit		# units	unit	
	(million)	kWh/yr	TWh/yr	(million)	kWh/yr	TWh/yr	(million)	kWh/yr	
ICT equipment									
PC equipment	69 (PCs)	650	44.5	83 (PCs)	600	50.0			
other office ICT			28.8			35.0			
data centers	12M ft ²	350	4.2	28M ft ²	350	9.8			
FTTC, FTTH terminals	0	1,750	0.0	2	430	0.9			
other network ICT			14.0			19.0			
subtotal ICT equipment			91.5			114.7			
Building EMS									
	% SP ^a	% pene- tration	% SC&L ^b	% SP ^a	% pene- tration	% SC&L ^b			
phase 1	6	10	51	6	20	48		-7.7	
phase 2	16	0	51	16	15	48		-15.4	
phase 3	24	0	51	24	5	48		-7.7	
subtotal EMS								-30.9	
E-commerce									
	% online	% space saved	retail % of elec	% online	% space saved	retail % of elec			
B2C—retail space	2	50	14	7	50	14		-5.5	
			warehse % of elec			warehse % of elec			
B2B—warehouse sp	5	10	6.8	20	10	6.8		-1.5	
subtotal e-commerce								-7.0	
Telework									
	million	kWh/yr		million	kWh/yr				
number	9	12.8		13	18.8				
avg days per week	2			2.1					
electricity savings			-3,034			-3,300		-61.9	
subtotal ICT-driven			47			15			
subtotal non-ICT			1,123			1,253			
Total commercial			1,170			1,268			
EIA ICT			152			204			
EIA non-ICT			1,018			1,136			
EIA total commercial			1,170			1,340			
difference from EIA									
TWH			0			-72			
%			0			-5			

References and data sources

CBECs, 1995

EIA, 2001

Kawamoto et al., 2001

Roth, Goldstein, and Kleinman, 2002

Mitchell-Jackson, 2001

^aSP = savings potential.^bSC&L = space conditioning and lighting.

ICT-Related Electricity Use Projections 125

U.S. Commercial		Reference 2021			Zaibatsu 2021		
floorspace (billion sq ft)				91.1			
electricity intensity (kWh/sq ft)				20.2			
Item	# units (million)	unit kWh/yr	unit TWh/yr		# units (million)	unit kWh/yr	unit TWh/yr
ICT Equipment							
PC equipment				65.0			70.0
other office ICT				45.0			50.0
data centers	65M ft ²	400		26.0	75M ft ²	400	30.0
FTTC, FTTH terminals	96	100		9.6	110	100	11.0
other network ICT				32.0			35.0
subtotal ICT equipment				177.6			196.0
Building EMS	% SP ^a	% pene- tration	% SC&L ^b		% SP ^a	% pene- tration	% SC&L ^b
phase 1	6	20	40	-8.8	6	20	40
phase 2	16	25	40	-29.4	16	25	40
phase 3	24	30	40	-53.0	24	35	40
subtotal EMS				-91.3			
E-commerce	% online	% space saved	retail % of elec warehse % of elec		% online	% space saved	retail % of elec warehse % of elec
B2C—retail space	20	50	14	-15.6	25	50	14
B2B—warehouse sp	70	10	6.8	-5.4	75	10	6.8
subtotal e-commerce				-21.0			
Telework		million	kWh/yr			million	kWh/yr
number	18	30.0			14	22.5	
avg days per week	2.5				2		
electricity savings			-4,315	-129.5			-3,452
							-77.7
subtotal ICT-driven				-64			-7
subtotal non-ICT				1,648			1,646
Total commercial				1,583			1,639
EIA ICT				346			346
EIA non-ICT				1,494			1,494
EIA total commercial				1,840			1,840
difference from EIA							
TWH				-257			-201
%				-14			-11

^aSP = savings potential.

^bSC&L = space conditioning and lighting.

U.S. Commercial		Cybertopia 2021			Net Insecurity 2021			
Item	# units (million)	unit kWh/yr	TWh/yr	# units (million)	unit kWh/yr	TWh/yr		
ICT equipment								
PC equipment			50.0			90.0		
other office ICT			40.0			70.0		
data centers	50M ft ²	400	20.0	45M ft ²		18.0		
FTTC, FTTH terminals	83	100	8.3	64	100	6.4		
other network ICT			30.0			35.0		
subtotal ICT equipment			148.3			219.4		
Building EMS	% SP ^a	% pene- tration	% SC&L ^b	% SP ^a	% pene- tration	% SC&L ^b		
phase 1	6	15	40	-6.6	6	20	40	-8.8
phase 2	16	25	40	-29.4	16	20	40	-23.6
phase 3	24	50	40	-88.3	24	25	40	-44.2
subtotal EMS				-124.4				-76.5
E-commerce	% online	% space saved	retail % of elec	% online	% space saved	retail % of elec		
B2C—retail space	35	50	14	-27.3	7	50	14	-5.5
			warehse % of elec			warehse % of elec		
B2B—warehouse sp	80	10	6.8	-6.2	60	10	6.8	-4.6
subtotal e-commerce				-33.5				-10.1
Telework		million	kWh/yr		million	kWh/yr		
number	28%	45.0		9%	15.0			
avg days per week	3			2				
electricity savings			-5,178	-233.0			-3,452	-51.8
subtotal ICT-driven				-243				81
subtotal non-ICT				1,646				1,646
Total commercial				1,403				1,727
EIA ICT				346				346
EIA non-ICT				1,494				1,494
EIA total commercial				1,840				1,840
difference from EIA								
TWH				-437				-113
%				-24				-6

^aSP = savings potential.^bSC&L = space conditioning and lighting.

U.S. Industrial		2001 Base			2006		
industrial output (billion 1992\$)		4,969			5,830		
electricity intensity (kWh/\$output)		0.21			0.20		
Item	# units	unit	unit	unit	# units	unit	unit
	(million)	kWh/yr	TWh/yr		(million)	kWh/yr	TWh/yr
ICT equipment							
office equipment		12.7			14.0		
production ICT equip		4.0			7.0		
subtotal ICT equipment		16.7			21.0		
Process control	% SP ^a	% pene- tration	drives % of elec	%	% SP ^a	% pene- tration	drives % of elec
adj speed motors	15	10.0	51	-7.8	17	20.0	50 -19.3
Building EMS	% SP ^a	% pene- tration	HVAC & lgt % of use	%	% SP ^a	% pene- tration	HVAC & lgt % of use
Phase 1	6	10	16	-1.0	6	15	16 -1.6
Phase 2	16	1	16	-0.3	16	10	16 -2.9
Phase 3	24	0	16	0.0	24	5	16 -2.2
subtotal EMS		-1.2			-6.7		
E-commerce	% online	% inven saved	intensity (kWh/\$)	%	% online	% inven saved	intensity (kWh/\$)
inventory savings	5	10	0.21	-1.1	20	15	0.20 -6.9
Telework		million	kWh/yr		million	kWh/yr	
number	9%	4.3			13%	6.3	
avg days/week	2				2.1		
electricity savings		-3,034 -12.9			-3,300 -20.6		
subtotal ICT-driven		-6			-33		
subtotal non-ICT		1,029			1,141		
Total industrial		1,023			1,108		
EIA total industrial		1,023			1,134		
difference from EIA							
TWh		0			-26		
%		0			-2		

References and data sources

EIA, 2001
 Kawamoto et al., 2001
 Roth, Goldstein, and Kleinman, 2002
 MECS, 1998

^aSP = savings potential.

U.S. Industrial		Reference 2021			Zaibatsu 2021			
industrial output (billion 1992\$)		8,667			8,667			
electricity intensity (kWh/\$output)		0.14			0.15			
Item	# units	unit	TWh/yr	# units	unit	TWh/yr		
	(million)	kWh/yr	TWh/yr	(million)	kWh/yr	TWh/yr		
office equipment			19.0			21.0		
production ICT equip			16.0			17.0		
subtotal ICT equipment			35.0			38.0		
Process control	% SP^a	% pene- tration	drives % of elec	%	% SP^a	% pene- tration	drives % of elec	
adj speed motors	20	40.0	49	-56.3	20	45.0	49	-63.3
Building EMS	% SP^a	% pene- tration	HVAC & lgt % of use	%	% SP^a	% pene- tration	HVAC & lgt % of use	%
phase 1	6	20	15	-2.6	6	20	15	-2.6
phase 2	16	20	15	-6.9	16	20	15	-6.9
phase 3	24	25	15	-12.9	24	30	15	-15.5
subtotal EMS				-22.4				-25.0
E-commerce	% online	% inven saved	intensity (kwh/\$)	%	% online	% inven saved	intensity (kwh/\$)	%
inventory savings	70	20	0.14	-34.3	75	25	0.15	-49.2
Telework		million				million		
number	18%	10.0			14%	7.5		
avg days /week	2.5				2			
electricity savings			-4,315	-43.2			-3,452	-25.9
subtotal ICT-driven				-121				-125
subtotal non-ICT				1,445				1,448
Total industrial				1,324				1,323
EIA total industrial				1,436				1,436
difference from EIA								
TWh				-112				-113
%				-8				-8

^aSP = savings potential.

U.S. Industrial		Cybertopia 2021				Net Insecurity 2021			
				8,667				8,667	
				0.12				0.14	
Item	# units (million)	unit kWh/yr	unit TWh/yr		# units (million)	unit kWh/yr	unit TWh/yr		
office equipment			20.0				19.0		
production ICT equip			18.0				16.0		
subtotal ICT equipment			38.0				35.0		
Process control	% SP ^a	% pene- tration	drives % of elec	%	% SP ^a	% pene- tration	drives % of elec	%	
adj speed motors	20	50.0	49	-70.4	20	40.0	49	-56.3	
Building EMS	% SP ^a	% pene- tration	HVAC & lgt % of use		% SP ^a	% pene- tration	HVAC & lgt % of use		
phase 1	6	20	15	-2.6	6	15	15	-1.9	
phase 2	16	25	15	-8.6	16	20	15	-6.9	
phase 3	24	35	15	-18.1	24	25	15	-12.9	
subtotal EMS				-29.3				-21.8	
E-commerce	% online	% inven saved	intensity (kWh/\$)	%	% online	% inven saved	intensity (kWh/\$)	%	
inventory savings	80	35	0.12	-58.8	60	20	0.14	-29.4	
Telework		million	kWh/yr			million	kWh/yr		
number	28%	15.0			9%	5.0			
avg days per week	3				2				
electricity savings			-5,178	-77.7			-3,452	-17.3	
subtotal ICT-driven				-198				-90	
subtotal non-ICT				1,448				1,448	
Total industrial				1,250				1,358	
EIA total industrial				1,436				1,436	
difference from EIA									
TWh				-186				-78	
%				-13				-5	

^aSP = savings potential.

Total:	TWh/yr					
	2001	2006	Reference 2021	Zaibatsu 2021	Cyber- topia 2021	Net Insecurity 2021
Residential + Commercial + Industrial						
Computer, office, network equipment	118	148	222	246	199	261
Other ICT equipment	79	98	184	190	193	206
Process controls	-8	-19	-56	-63	-70	-56
Building EMS	-5	-40	-152	-171	-216	-124
E-commerce	-3	-14	-55	-75	-92	-40
Telework	-32	-53	-120	-72	-216	-48
Subtotal ICT-driven	150	119	22	55	-203	200
Subtotal non-ICT	3,273	3,635	4,608	4,610	4,610	4,610
Total	3,423	3,755	4,630	4,665	4,407	4,810
EIA total	3,423	3,844	4,976	4,976	4,976	4,976
difference from EIA						
TWh	0	-89	-346	-311	-569	-166
%	0	-2	-7	-6	-11	-3