Supplementary Materials

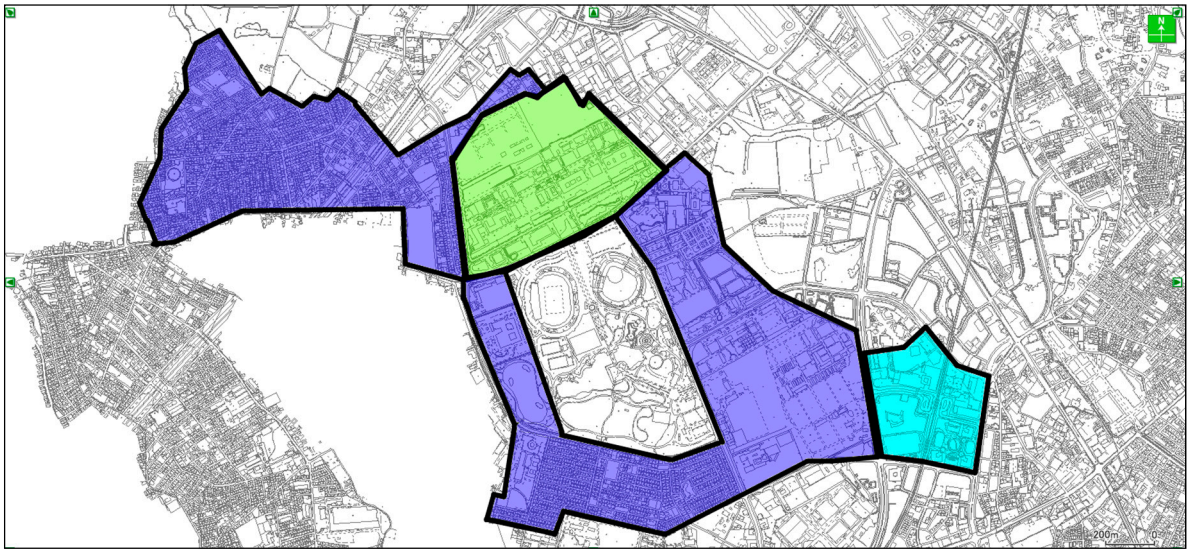

Figure S1. Map showing the surrounding area of Kashiwa Campus of the University of Tokyo. The green-shaded area represents the campus area; the blue-shaded area represents nearby residential area; the aqua-shaded area represents the current area of the Kashiwanoha Smart City.

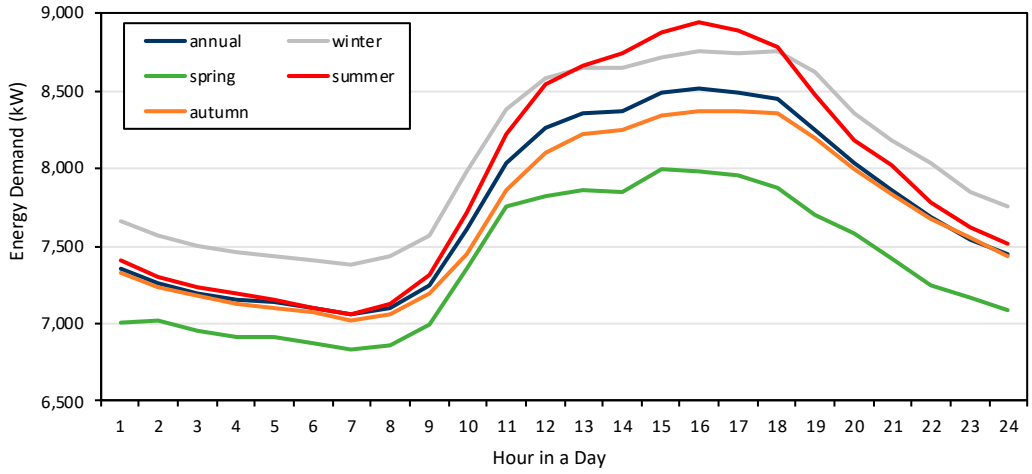

Figure S2. The estimated campus-wide energy demand in a day, showing in annual and seasonal average, based on the actual electricity consumption data in previous year.

Table S1. The average hourly sun irradiance at the designated location in 2017 based on the Kashiwa Meteorological Center [15].

Hour	Average Sun Irradiance (W/m2)				
	Annual	Spring	Summer	Autumn	Winter [a]
0000-0100	-	-	-	-	-
0100-0200	-	-	-	-	-
0200-0300	-	-	-	-	-
0300-0400	-	-	-	-	-
0400-0500	-	-	-	-	-
0500-0600	1	1	2	-	-
0600-0700	18	26	43	3	-
0700-0800	73	116	133	41	2
0800-0900	177	266	240	134	63
0900-1000	317	410	377	249	75
1000-1100	430	515	486	342	378
1100-1200	506	608	551	400	465
1200-1300	536	632	576	419	516
1300-1400	523	631	560	403	495
1400-1500	467	545	527	356	436
1500-1600	359	439	423	253	318
1600-1700	230	299	313	141	165
1700-1800	89	122	153	43	38
1800-1900	31	41	79	4	1
1900-2000	4	3	13	-	-
2000-2100	-	-	-	-	-
2100-2200	-	-	-	-	-
2200-2300	-	-	-	-	-
2300-2400	-	-	-	-	-

[a] Data for winter is represented by the period of 01 December 2017–31 December 2017 and 01 January 2017–28 February 2017.

Table S2. The balance of system cost for a utility scale solar plants in Japan at 2015 [19].

Categories	**Subcategories**	**Cost, USD/kW**
Hardware	Cabling/wiring	91
	Grid connection	174
	Monitoring and control	38
	Racking and mounting	205
	Safety and security	30
Installation	Electrical installation	110
	Inspection	19
	Mechanical installation	348
Soft costs	Customer acquisition	30
	Financing costs	103
	Incentive application	98
	Margin	371
	Permitting	53
	System design	8
TOTAL		1678

Table S3. Inventory data of setting up a 14,851 kWp solar photovoltaic system on campus that is estimated based on the dataset in Ecoinvent v3. (A negative value represents an output of by-product.)

Category	Item	Amount	Unit
Electricity	electricity	1.14E+04	kWh
Inverter	sheet rolling, steel	1.16E+05	kg
	steel, low-alloyed, hot rolled	1.16E+05	kg
	electricity, medium voltage	1.05E+05	kWh
	copper	6.55E+04	kg
	wire drawing, copper	6.55E+04	kg
	corrugated board box	2.97E+04	kg
	aluminum, cast alloy	1.66E+04	kg
	section bar extrusion, aluminum	1.66E+04	kg
	inductor, ring core choke type	4.17E+03	kg
	capacitor, film type, for through-hole mounting	4.05E+03	kg
	polystyrene foam slab	3.56E+03	kg
	capacitor, electrolyte type, > 2cm height	3.04E+03	kg
	electric connector, wire clamp	2.82E+03	kg
	fleece, polyethylene	7.13E+02	kg
	diode, glass-, for through-hole mounting	5.58E+02	kg
	transistor, wired, small size, through-hole mounting	4.51E+02	kg
	integrated circuit, logic type	3.33E+02	kg
	capacitor, tantalum-, for through-hole mounting	2.73E+02	kg
	styrene-acrylonitrile copolymer	1.19E+02	kg
	polyvinylchloride, suspension polymerized	1.32E+01	kg
	waste polyethylene	-7.13E+02	kg
	waste polystyrene	-3.68E+03	kg
Mounting system	aluminum, wrought alloy	3.20E+05	kg
	section bar extrusion, aluminum	3.20E+05	kg
	sheet rolling, steel	1.69E+05	kg
	steel, low-alloyed, hot rolled	1.69E+05	kg
	corrugated board box	1.50E+04	kg
	polystyrene, high impact	7.92E+02	kg
	polyethylene, high density, granulate	1.58E+02	kg
	waste polyethylene/polypropylene product	-1.58E+02	kg
	waste polystyrene isolation, flame-retardant	-7.92E+02	kg
	scrap steel	-7.43E+03	kg
	scrap aluminum	-1.40E+04	kg
	waste paperboard	-1.50E+04	kg
Solar panel	solar glass, low-iron	1.17E+06	kg
	tempering, flat glass	1.17E+06	kg
	aluminum alloy, $AlMg_3$	3.06E+05	kg
	corrugated board box	1.27E+05	kg
	ethylvinylacetate, foil	1.16E+05	kg
	photovoltaic cell, multi-Si wafer	1.08E+05	m^2
	tap water	1.05E+05	kg
	polyethylene terephthalate, granulate, amorphous	4.33E+04	kg
	heat, district or industrial, natural gas	2.41E+04	MJ
	electricity, medium voltage	2.33E+04	kWh

	glass fiber reinforced plastic, polyamide, injection molded	2.18E+04	kg
	silicone product	1.42E+04	kg
	copper	1.31E+04	kg
	wire drawing, copper	1.31E+04	kg
	polyvinyl fluoride, film	1.28E+04	kg
	acetone, liquid	1.51E+03	kg
	brazing solder, cadmium free	1.02E+03	kg
	1-propanol	9.46E+02	kg
	methanol	2.51E+02	kg
	vinyl acetate	1.91E+02	kg
	lubricating oil	1.87E+02	kg
	nickel, 99.5%	1.86E+01	kg
	municipal solid waste	-1.49E+02	kg
	waste mineral oil	-1.87E+02	kg
	wastewater	-2.47E+03	m^3
	waste polyvinyl fluoride	-1.28E+04	kg
Electric installation	copper	7.28E+04	kg
	wire drawing, copper	7.28E+04	kg
	polyethylene, high density, granulate	7.13E+04	kg
	polyvinylchloride, bulk polymerized	1.05E+04	kg
	steel, low-alloyed, hot rolled	4.26E+03	kg
	nylon 6	1.14E+03	kg
	polycarbonate	9.90E+02	kg
	zinc	1.98E+02	kg
	brass	9.90E+01	kg
	epoxy resin, liquid	9.90E+00	kg
	scrap copper	-9.90E+01	kg
	waste polyethylene/polypropylene product	-1.00E+03	kg
	scrap steel	-4.46E+03	kg
	waste polyvinylchloride	-1.05E+04	kg
	waste electric wiring	-1.45E+05	kg

Table S4. Residents living within 2 km walking distance from Kashiwa Campus and smart city residents connected to smart grid.

Number of residents living within 2 km		Number of residents connected to smart grid	
Isehara 1-chome	760	Park City Kashiwanoha Campus Ichibangai	2,931
Kashiwanoha 1-chome	471		
Kashiwanoha 2-chome	1,082	Park City Kashiwanoha Campus Nibangai	2,640
Kashiwanoha 3-chome	890		
Kashiwanoha 4-chome	0	Park City Kashiwanoha Campus Gate Tower	1,041
Kashiwanoha 5-chome	368		
Kashiwanoha 6-chome	776	Park City Kashiwanoha Campus Gate Tower West	1,485
Midoridai 1-chome	682		
Midoridai 2-chome	1,128	Park Axis Kashiwanoha	435
Midoridai 3-chome	1,202		
Midoridai 4-chome	817		
Midoridai 5-chome	278		
Total	**8,454**	**Total**	**8,532**