Detailed Analyses for Hospital Diagnostic X-ray Environmental Assessment

Transparency Document 1

- Study boundaries and x-ray delivery process (the life cycle analysis basis)

The study boundaries were the x-ray room on a 24 hour basis in which at various times a patient enters and exits the room. Patient check in and waiting room activities are not considered. Data were collected on all activities within the boundaries identified. The process for the delivery of a series of x-rays, for both GE and Philips machines, begins with the technician escorting a patient into the room. A patient may be wearing a hospital gown. The technician positions the patient for the first x-ray and leaves the room or area. The technician sets the machine by choosing the imaging protocol based on the prescribed x-ray and anatomy size, pushes the plunger of the device, waits for several milliseconds for a steady picture, and pushes the plunger once again to take the image. This is repeated for the next x-ray. The number of images per patient varies according to the exams prescribed; for example a chest x-ray would include both front and side views. When all the series for that patient are completed the patient is escorted out of the room. When necessary, the x-ray equipment is wiped down with cleaning materials. Moreover, as a regular hospital cleaning procedure, the room floor is mopped 2 to 3 times each day. All equipment in GE and Philips rooms, as well as all other areas, remain in ready mode (all equipment powered, constant temperature maintained, and lights on) 24 hours per day 365 days per year for emergency purposes. During off hours, technicians are on call for emergencies.

- Data Collection Methods

Data collection took the form of observation, time studies, real time metered power consumption, review of imaging department scheduling records, and review of technical manuals and literature. These were not plug studies as such information does not focus on the actual patient needs. Time studies were conducted to determine the duration spent setting up x-ray room and equipment, preparing a patient for the delivery of an x-ray service, post processing of x-ray, and x-ray room clean up. Table 1-1 lists data collection categories and sources.

Table 1-1: Collected data and method

	Data Collected	Source for Energy Information	Observed # of Series	
			GE	Philips
Power	X-ray Scanners	Portable power cell meter	74 Patients	44 Patients
	Ancillary Devices	Equipment information/ratings	-	-
	Lighting	Equipment information/ratings	-	-
	HVAC	TRACE™ 700 Software	-	-
Materials	Medical Textiles	Sample amounts	250 Patients	153 Patients
	Medical Consumables	Sample amounts	250 Patients	153 Patients
	Cleaning products	Sample amounts and interviews	-	-

- Study Sample Characteristics

The study sample consists of both single anatomy scans (with multiple images) and multiple anatomy scans. Table 1-2 depicts the observed number of x-ray series during the study period. The majority (88%) of x-ray series were delivered for a single anatomy scans. The other 12% were series of x-ray images taken of 2 to 6 anatomical parts in a single visit to the x-ray department. As an instance, one patient had three prescribed anatomical parts and total of 15 images (exposures) were taken; 7 images from spine, 5 images from hip and 3 images from arm. The mentioned example clears the definitions that were used in the following Table 1-2. In the Table, the overall average exposure per patient is the result of dividing the total exposures by the total number of patients. The same were used for calculation of average exposure per prescribed anatomy and average anatomies per patient.

Table 1-2: The sample size for multiple anatomy scans and single anatomy scan

Scanner	Scan Type	Number of patients	Total Scanned Anatomy	Total exposures	Average Exposures per patient	Average Exposures per Anatomy	Average Anatomies per patient
GE (250 Patients)	Single Anatomy	219 (88%)	219	772	4.416	3.768	1.172
	Multiple Anatomies	31 (12%)	74	332			
Philips (153 Patients)	Single Anatomy	134 (88%)	134	509	4.582	3.983	1.150
	Multiple Anatomies	19 (12%)	42	192			

Transparency Document 2

- Active Energy Calculations

The Active Power signal of the actual x-ray is composed of 3 elements, A, X, and B; where A is power during filament heating, speeding up of the rotor, and some verification processes; B is the post exposure verification and recording of the image; and X is the x-ray exposure or when radiation is delivered.

In order to monitor the GE and Philips scanners energy consumption, a portable power meter was connected to the input wires of the machines. Portable Power Cell (PPC-3) measured the voltage and current use of equipment in order to calculate the power as an output in kW. The power cell reads the equipment power draw (kW) every 15 milliseconds and therefore, a pattern, similar to power signature in Figure 2 of the manuscript, was recorded for every patient. Therefore, energy consumed is calculated by taking the area under the power-time curve. Here, Figure 2-1 is a schematic view for the defined terms of A, B, and X related to active energy.

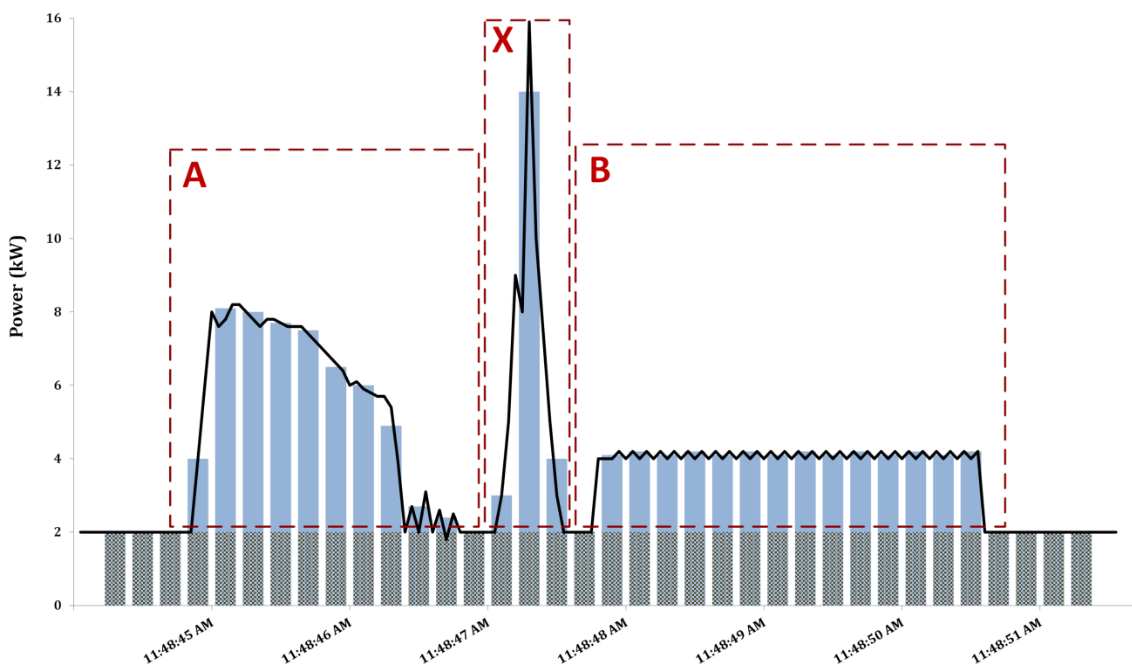

Figure 2-1 Active power above standby power profile during active x-ray steps

The gray patterned area, standby power, was subtracted from all the collected power data-points in the first step of the active energy calculation. The measured standby power for GE scanner was 1.94 kW and for Philips scanner was 0.86 kW. Then, all power data-points recorded during the time period of A, B, and X were averaged in each 12 sec increments. In Figure 2-1, the blue solid bars are representation for those values, however, for precise mean value the duration should be reduced to 15 milliseconds. The product of these average (kW) and duration (hours) will result to energy (kWh).

The calculated energies for all the exposures will result to the patient active energy, i.e. energy to directly acquire the x-ray image. Table 2-1 shows the steps of the active energy calculation related to the same x-ray series for the power signature was shown in Figure 2 of the manuscript. In Table 2-1, the max recorded power data-points were also reported in order to make different sections recognizable.

Table 2-1: Active energy calculation example for chest signature shown in the manuscript

		Max Power (kW)	Average kW above Standby Power (for GE above 1.94 kW)	Time (Seconds)	Energy (watt-hour)
1st Exposure: Front View	A_1	8.289	4.897	1.270	1.728
	X_1	15.715	4.022	0.135	0.151
	B_1	4.204	2.217	2.585	1.592
	1st Exposure Energy (watt-hour)				3.470
2nd Exposure: Side View	A_2	8.585	4.988	1.255	1.739
	X_2	63.152	16.584	0.165	0.760
	B_2	4.138	2.007	2.510	1.399
	2nd Exposure Energy (watt-hour)				3.898
Active Energy per Patient (watt-hour) = 3.470 + 3.898 = 7.369					

The power measurements and energy calculations were conducted for 74 GE patients and 44 Philips patients, who had single anatomy scans. Table 2-2, summarizes the observed value for exposure energy consumptions and by use of this study outcomes, average exposure energy consumptions were calculated as 3.32 watt-hours per exposure for GE and 1.57 watt-hours per exposure for Philips.

Table 2-2: Exposure Energy Consumptions for Single Anatomy Patients

Single Anatomy Scans	Scanned Anatomy	Number of patients	Exposures	Average Exposure per Anatomy	Power-Meter Measurement (# of Patients, # of Exposures)	Average Exposure Energy (watt-hour)
GE Scanner	Head	7	18	2.57	(3, 11)	3.084
	Chest	81	178	2.20	(26, 60)	3.001
	Spine	20	123	6.15	(5, 36)	4.955
	Shoulder	11	40	3.64	(6 ,21)	2.849
	Abdomen-Pelvis	21	73	3.48	(4, 14)	3.558
	Upper Extremities	14	40	2.86	(8, 21)	2.771
	Lower Extremities	65	300	4.62	(22, 109)	2.925
	Weighted Average for a Single Anatomy Patient					**3.318**
Philips Scanner	Head	5	12	2.40	(3, 7)	1.549
	Chest	45	94	2.09	(10, 20)	1.225
	Spine	22	113	5.14	(7, 36)	2.098
	Shoulder	12	65	5.42	(4, 26)	1.363
	Abdomen-Pelvis	16	79	4.94	(6, 24)	2.356
	Upper Extremities	8	30	3.75	(2, 7)	0.997
	Lower Extremities	26	116	4.46	(12, 59)	1.067
	Weighted Average for a Single Anatomy Patient					**1.570**

Having the average exposure energies for both machines, and also the average number of exposures for various types of patient anatomies, the outcomes can be extrapolated for the entire sample. Table 2-3 shows the calculated active energy per patient as 0.0147 kWh per patient and 0.0072 kWh per patient for GE and Philips, respectively.

Table 2-3: Estimation Process of Active Energy per Patient

	Scanned Anatomy	Number of patients	Exposures	Average Exposure per Patient	Measured Exposure Energy (watt-hour)	Average Active Energy per Patient (watt-hour)
GE Scanner	1-Scanned Anatomy Patients	219	772	3.53	3.318	11.69
	2-Scanned Anatomies Patients	23	187	8.1	-	= 3.318 * 8.1 = 26.97
	3-Scanned Anatomies Patients	6	84	14.0	-	= 3.318 * 14.0 = 46.45
	4-Scanned Anatomies Patients	1	18	18.0	-	= 3.318 * 18.0 = 59.72
	6-Scanned Anatomies Patients	1	43	43.0	-	= 3.318 * 43.0 = 142.66
	GE Scanner - Active Energy per Patient (based on percent of patients with various numbers of scanned anatomies)					**14.65**
Philips Scanner	1-Scanned Anatomy Patients	134	509	3.80	1.570	5.96
	2-Scanned Anatomies Patients	17	144	8.5	-	= 1.570 * 8.5 = 13.30
	4-Scanned Anatomies Patients	2	48	24.0	-	= 1.570 * 24 = 37.68
	Philips Scanner - Active Energy per Patient (based on percent of patients with various numbers of scanned anatomies)					**7.19**

- Standby Energy Calculations

Standby energy is the product of entire treatment duration (patient-in to patient-out) and standby power, which are 1.94 kW and 0.86 kW for GE and Philips scanners, respectively. In addition to the scanner, the standby power includes the attached computer and monitors that process the taken image by the machine, Table 2-4.

Table 2-4: Included equipment for standby energy of two machines

Equipment	Brand
2 GE Console Monitors	NEC MultiSync LCD 1990 Xi
GE console Chassis	HP xw8200 Workstation
Philips console Monitor	EIZO FlexScan S1910-M - LCD display
Philips Console Chassis	Sun Blade 2500

Seven minutes and forty five seconds (7.75 minutes) is the average patient duration in GE room while it measured as nine minutes and forty nine seconds (9.81 minutes) for Philips room. The difference in patient service duration can be partly explained by the degree of automation; where the GE scanner is highly automated. Also, the GE scanner has extra detector underneath the bed, which reduces the service duration as the technicians do not need to leave the control room to set the detector underneath the bed when needed.

Even though the time to deliver a series of x-rays is smaller for the GE machine, standby energy consumed by the GE machine is almost 1.8 times greater than the Philips machine due to the greater GE standby power. Considering the power consumption in standby mode as well as the service duration, the standby energy consumptions are estimated as 0.251 kWh and 0.141 kWh per patient for the GE and Philips, respectively.

- Idle Energy Calculations

Idle Energy is the energy consumed while the x-ray scanners are waiting for the next patient; i.e. the x-ray room and all equipment are empty and idle. The idle energy during the 8-hour working shift is a function of the scanner utilization ratio and could not be estimated per patient directly. Alternatively idle energy is calculated for a fixed utilization ratio over the 8-hour work day (21.5 days per month). In this study utilization is assumed to be 50% for both machines to allow a comparable analysis, which can be translated to monthly treatment of 666 patients for GE room and 526 patients for Philips room (666 Patients × 7.75 minutes = 86 hours, 526Patients × 9.81 minutes = 86 hours). The observed utilization rate was 46% for GE and 36% for Philips. Since the number of x-ray series delivered after hours (after 8 hour day) and on weekends were found to be a rare occasion, that time (after hours and weekends) is counted as idle time. So in a month 730 total hours minus 86 patient-hours is 644 hours in idle mode for both rooms. The product of 644 hours idle time by standby power of two scanners (1.94 kW and 0.86 kW for GE and Philips scanners) will result to the monthly idle energy consumptions of 1249.4 kWh and 553.8 kWh for GE and Philips room, respectively.

- Ancillary Devices and Lighting Fixtures

In addition to the x-ray scanners and the equipment in Table 2-5, there were several pieces of ancillary equipment used in the radiology department. These included the cassette readers and computers, server computer, and printer. The cassette readers are used about 20 to 25 times per day for special views which cannot be performed by machine detector. The printer, also, is used once or twice in a week for very special cases. All images taken are transferred to doctors electronically by use of a department server computer. Although the utilization ratio of the ancillary equipment is low, all of these are kept ON to be available in emergency situation. For all of these pieces, the standby power is used in this study. The value of power for each entry in the Table was taken from equipment rating provided by the manufacturer, Table 2-5. Also, the radiology department, which includes GE and Philips rooms as well as a shared area for printer, cassette readers and the server, is equipped by 32 watt fluorescent and 120 watt incandescent light bulbs. For the shared pieces and shared lighting fixtures, 50% of the energy consumption was assigned to each x-ray scanner. Therefore monthly energy consumption of 458.1 kWh for GE room ancillary equipment and 303.3 kWh for Philips room ancillary equipment are calculated. Also, GE room and Philips room monthly lighting energy consumptions were calculated as 272.3 kWh and 248.9 kWh, respectively.

Table 2-5: The ancillary equipment and lighting fixtures energy consumption

Room	Equipment	Model	Power (kW)	Time Used per month (hours)	GE Energy Consumption per month (kWh)	Philips Energy Consumption per month (kWh)
GE	CR Equipment	FCR XG5000 Image Reader	0.3	730	219.0	-
GE	CR Computer	Dell OptiPlex GX620 Mini-Tower	0.06	730	43.8	-
GE	CR Monitor	Elo 1515L 15" Touchmonitor	0.032	730	23.36	-
Philips	CR Equipment	FujiFilm FCR Carbon™	0.1	730	-	73.0
Philips	CR Computer	Dell OptiPlex GX620 Small Form	0.048	730	-	35.04
Philips	CR Monitor	Elo 1515L 15" Touchmonitor	0.032	730	-	23.36
Share	Server PC	Dell OptiPlex 755 Small Form	0.048	730	17.52	17.52
Share	Server Monitor	Dell 15 inch LCD Monitor	0.032	730	11.68	11.68
Share	Printer	DryPix 5000 Dry Laser Imager	0.32	730	116.8	116.8
Share	Printer Monitor	Dell 15 inch LCD Monitor	0.032	730	11.68	11.68
Share	Printer PC	Dell OptiPlex GX150 Ultra Small	0.039	730	14.235	14.235
Ancillary Energy (kWh) per Month					**458.08**	**303.32**
Ancillary Energy (kWh) per Patient					**0.688**	**0.577**
GE	5 Fluorescent bulbs	32 watt T8	0.032	86	13.76	-
GE	8 Incandescent bulbs	120 watt	0.12	172	165.12	-
Philips	4 Fluorescent bulbs	32 watt	0.032	86	-	11.008
Philips	7 Incandescent bulbs	120 watt	0.12	172	-	144.48
Share	8 Fluorescent bulbs	32 watt	0.032	730	93.44	93.44
Lighting Energy (kWh) per Month					**272.32**	**248.93**
Lighting Energy (kWh) per Patient					**0.409**	**0.473**

- Heating, Ventilation and Air Conditioning (HVAC)

The estimation of HVAC energy consumption in a particular area of a building with central HVAC units which serve the whole building is a challenge [Reference: SM2.1]. Moreover, hospitals and other healthcare facilities require a clean environment, which is partly achieved by having HVAC remove humidity and control room pressure 24 hours a day/365 days a year. Essentially the

HVAC energy is just determined by the room size which is generally not tailored for any specific scanner, when the building design was done years ago. Note that the HVAC energy consumption is excluded from the reported patient-care results in the manuscript. This was mainly because the HVAC energy consumption is largely constant and varies neither with fluctuation of occupants during the day nor with the radiology department activities. As such, the HVAC energy is generally not medical-based energy and thus not under the control of the radiology department staff. However, the values are discussed here for transparency.

The heating, ventilation, and air conditioning (HVAC) energy consumption for the radiology department at the hospital was estimated using the TRACE™ 700 software package. This software package requires a variety of information as input for the energy simulation. These include the geometry and geographical location of the building, the indoor temperature, and the type of the HVAC system. The output of the simulation is the energy intensity of the building, signifying the energy consumed by the HVAC per unit area of the building. Using the energy intensity and the room area, Table 2-6, the monthly HVAC energy consumption was calculated to be 596.6 kWh and 627.8 kWh for GE and Philips rooms, respectively.

Table 2-6: The HVAC energy consumption for different functional units

	Room Area (m^2)	**Share of printer and CR room (m^2)**	**Energy Intensity Per month (kWh/m2)**	**Monthly HVAC energy consumption (kWh)**	**Number of patients in 50% utilization over**	**HVAC energy consumption per patient (kWh)**	**Average Number of exposures per patient**	**HVAC energy consumption per exposure (kWh)**

					a mo nt h			
GE Room	20	19	14.606	596.6	666	0.855	4.416	0.194
Philips Room	24	19	14.606	627.8	526	1.194	4.582	0.261

- Utilization Ratio Sensitivity Analyses

Patient-care energy consumption values include 5 elements; 1) active, 2) standby, 3) idle, 4) ancillary, and 5) lighting energies. Using different calculation methods, three elements were estimated on monthly basis, while active and standby energy values are per patient basis. Therefore, if there is an increase in the number of service deliveries during a month, the share of idle, ancillary and lighting energy per patient will decrease while, per patient active and standby energy remains the same . To explore the effect of changing in the number of patients on the final results, the in-hospital energy use per patient has been plotted in Figure 2-2 for different levels of utilization (patients per normal 8 hour operation).

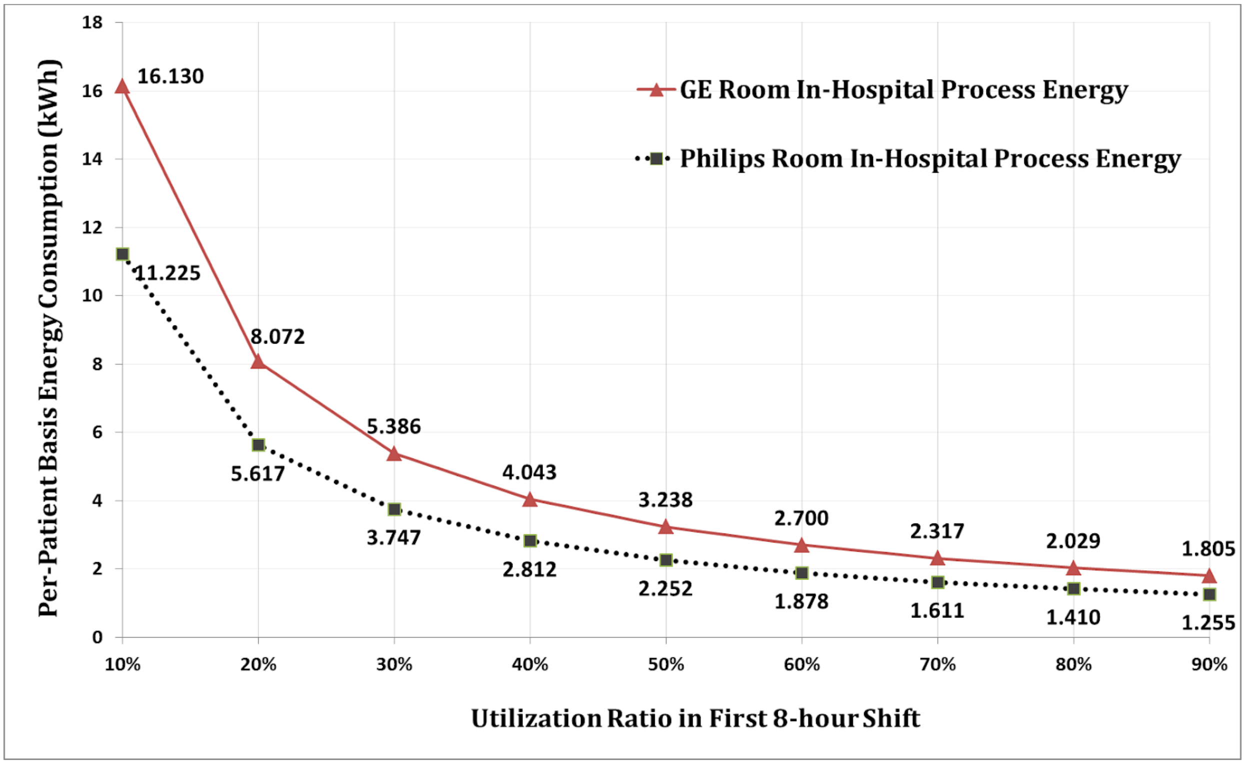

Figure 2-2: Dependency of the patient-based process energy consumption on room utilization

The plot reveals the high impact of idle, ancillary and lighting sources on energy consumption, as the increase in patient-dependent energy consumption cannot offset the reduction caused by the share of these sources per patient. Therefore, the energy consumption per patient reduces drastically by increasing the utilization of the x-ray room. The utilization dependent plot, Figure 2.2, makes the results adjustable for further use by other healthcare facilities utilization studies.

Transparency Document 3

- Reusable Textile Materials

Patient gowns, fitted-sheets, and pillow-covers are the medical textiles recorded during observation for both x-ray rooms. In this study, the natural resource energy for medical textiles includes the manufacture of consumables, laundry of reusable textiles, packaging, and transport (hospital to laundry round trip) processes [Reference SM3.1]. The natural resource energy consumption related to the medical textiles is calculated as 1.258 nre-kWh per patient for GE room and 1.442 nre-kWh per patient for Philips room. Table 3-1 shows recorded amounts and cradle-to-gate natural resource energy (nre) in reusable medical textiles in GE and Philips rooms. Utilizing values in Table 1-2 of SM1, these per patient energies can be expressed per exposure and per anatomy.

Table 3-1: Medical Textiles Cradle-to-Gate Energy Utilization in X-ray Rooms of Hospital 1

	Consumption Weight (gram) per Patient		Cradle-to-Gate Energy (nre- kWh) per Patient	
	GE	Philips	GE	Philips
Reusable textile Gown	64.8	33.75	0.441	0.23
Fitted Sheet	90.16	135.24	0.614	0.92
Pillow Cover	29.808	42.849	0.203	0.292
Total	184.768 grams	211.839 grams	1.258 nre-kWh	1.442 nre-kWh

- Disposable Materials

The consumable use rates were recorded over the observed time or estimated based on interviews with technicians. The list of products consumed per patient for service delivery at the hospital is reported as Table 3-2. In Table 3-3 and 3-4, these products are expressed as chemical or material composition based on the information published by manufacturer or found on the internet generally from the material safety data sheets (MSDS). From the materials compositions, the values of these cradle-to-gate (CTG) natural resource energies, i.e. the energy consumed for producing the materials, were obtained from the LCI database [Reference: SM3.2]. For the solid consumables, the after-use energy consumption, which is related to disposal, was excluded in this study as most are inert plastics and only incur a small energy use for landfill operations. In hospitals, the solid medical waste regulated by EPA should be disposed of by either hazardous waste incineration or steam autoclave sterilization with sanitary landfill [Reference: SM3.2]. For the liquid wastes, the wastewater treatment is likewise not included because of a lack of organic content data.

Table 3-2: Medical textiles utilization and disposable materials rate of consumption during delivery of x-ray service in hospital

type	Consumables	Source of the data	Unit Weight		Observed Count	p
Reusable Textile	Gown	Observed 250 GE & 153 Philips Patients	225 grams	GE	72 gowns	
				Philips	23 gowns	
Reusable Textile	Fitted Sheet	Observed 250 GE & 153 Philips Patients	460 grams	GE	49 sheets	
				Philips	45 sheets	
Reusable Textile	Pillow Cover	Observed 250 GE & 153 Philips Patients	81 grams	GE	92 pillow covers	
				Philips	81 pillow covers	
Total for Reusable, (grams)				**GE**		
				Philips		
Disposable	Pair of gloves	Observed 250 GE & 153 Philips Patients	11 grams	GE	52 pair of gloves	
				Philips	19 pair of gloves	
Disposable	Shorts	Observed 250 GE & 153 Philips Patients	27 grams	GE	15 shorts	
				Philips	23 shorts	
Disposable	Isolation plastic Gown	Observed 250 GE & 153 Philips Patients	47 grams	GE	6 plastic gowns	
				Philips	2 plastic gowns	
Disposable	Floor neutral cleaner	Janitorial Interview	-	GE	380 grams/month	
				Philips	465 grams/month	
Disposable	Floor disinfectant concentrate	Janitorial Interview	-	GE	380 grams/month	
				Philips	465 grams/month	
Disposable	Bed cleaning & disinfectant solution	Technician Interview	-	GE	2041 grams/month	
				Philips	2041 grams/month	
Disposable	Bed disinfectant Container	Technician Interview	84 grams	GE	2 pack per month	
				Philips	2 pack per month	
Disposable	Wiping cloth	Technician Interview	5 grams	GE	640 cloths/month	
				Philips	640 cloths/month	
Disposable	Wiping cloth container	Technician Interview	158 grams	GE	4 pack PDI/month	
				Philips	4 pack PDI/month	
Total for Disposables, (grams)				**GE**		
				Philips		

Table 3-3: Disposable products consumed for the delivery of x-ray service

Disposable Products and its weight	Referenc e	Major Materials	Materials	GE roor rate of mat consumpt (gram/pati
Pair of gloves	[SM3.3]	Nitrile Rubber copolymer	Butadiene (Assumed 50%)	1.144
			Acrylonitrile (Assumed 50%)	1.144
Shorts	[SM3.4]	Polypropylene(SMS)	Polypropylene spunbond-meltblown-spunbond (SMS)	1.620
Isolation Gown	[SM3.4]	Polypropylene(SMS)	Polypropylene spunbond-meltblown-spunbond (SMS)	1.128
Floor Neutral Cleaner	[SM3.5]	Water (82%)	Water (82%)	0.468
		Solute (18%)	Sodium xylene sulfonate (13%)	0.074 *
			Alcohol ethoxylate (5%)	0.029 *
Floor Disinfectant Concentrate	[SM3.6]	Water (73%)	Water (73%)	0.417
		Solute (27%)	n-Alkyl Dimethyl Benzyl Ammonium Chloride (8.2%)	0.047 *
			Didecyl dimethyl ammonium chloride (8.7%)	0.050 *
			Ethyl alcohol (5%)	0.029 *
			Lauryl dimethyl amine oxide (5%)	0.029 *
Bed Cleaning and Disinfectant Solution	[SM3.7]	Water (78%)	Water (78%)	2.391
		Solute (22%)	Phenylphenol (9.1%)	0.279
			Tertiary amyl phenol (7.7%)	0.236
			Potassium hydroxide (5%)	0.153 *
		Package	PVC	0.252
Wiping Cloths	[SM3.8]	Disposable wash cloths	Isopropyl Alcohol (55%)	2.752
			Airlaid cellulose (45%)	2.251
		Package	PVC	0.949

* The materials with masses were less than 0.154 grams per patient for GE room and 0.195 grams per patient for Philips room were excluded from the life cycle analysis (1 wt% cut-off rule).

Table 3-4: Matrix of products, materials, and CTG life cycle natural resource energy, KWhnre per patient

Products-Materials Matrix (gram per-patient)	**Isopropy l Alcohol** Cradle-to -gate energy = 62.6 MJ/kg	**Polypro pylene (SMS)** Cradle-to -gate energy= 33 MJ/kg	**Water** Cradle-to-g ate energy = 0.0008 MJ/kg	**Air laid cellulos e** Cradle-to -gate energy = 30 MJ/kg	**PVC** Cradle-to- gate energy = 21.6 MJ/kg	**Butadie ne** Cradle-to -gate energy = 27.9 MJ/kg	**Acryloni trile** Cradle-to -gate energy = 19.7 MJ/kg	**Phenylp henol** Cradle-to -gate energy = 31.9 MJ/kg

	GE	Philips	GE	Philips	GE	Philips	GE	Philips	GE	Philips	GE	Philips	GE	Philips	GE	Philips
Pair of Gloves											1.144	0.682	1.144	0.682		
Shorts			1.620	4.050												
Isolation Gown			1.128	0.611												
Floor neutral cleaner					0.468	0.725										
Floor disinfectant concentrate					0.417	0.645										
Bed cleaning and disinfectant solution					2.391	3.026			0.252	0.319					0.279	0.3 3
Wiping Cloths	2.752	3.484					2.251	2.851	0.949	1.202						
Ingredients Rate of Consumption (grams/patient)	**2.752**	**3.484**	**2.748**	**4.661**	**3.276**	**4.396**	**2.251**	**2.851**	**1.201**	**1.521**	**1.144**	**0.682**	**1.144**	**0.682**	**0.279**	**0.3 3**
CTG life cycle energy (MJnre/patient)	**0.172**	**0.218**	**0.091**	**0.154**	**0.0008**	**0.0008**	**0.068**	**0.086**	**0.026**	**0.033**	**0.032**	**0.019**	**0.023**	**0.013**	**0.009**	**0.0 1**
CTG life cycle energy (kWhnre/patient)	**0.048**	**0.061**	**0.025**	**0.043**	**0.000**	**0.000**	**0.019**	**0.024**	**0.007**	**0.009**	**0.009**	**0.005**	**0.006**	**0.004**	**0.002**	**0.0 3**

Transparency Document References

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