



Memorandum

TO: SMART CITIES AND SERVICE
IMPROVEMENTS COMMITTEE

SUBJECT: GREEN INFORMATION
TECHNOLOGY PLAN STATUS
REPORT

FROM: Khaled Tawfik

DATE: May 20, 2022

Approved

Date May 24, 2022

RECOMMENDATION

Accept a status report on Green Technology Plan efforts to adopt Climate Smart practices in technology management and reducing energy consumption and e-waste.

OUTCOME

The Committee will be aware of and provide feedback on the Green Technology Plan and the initiatives completed to support the City's Climate Smart priorities by addressing the environmental impacts of energy consumption, use of consumables, and the production of e-waste generated by the City's use of technology.

BACKGROUND

In 2018, City Council approved Climate Smart San José¹ (Climate Smart), the City's climate action plan, aligned with the 2016 Paris Climate Agreement goals to prevent global temperatures from rising by more than 2° Celsius (or 3.6° Fahrenheit) by 2050. The Climate Smart plan includes nine (9) greenhouse gas (GHG) reduction strategies that help San Jose transform into a climate smart city that is substantially decarbonized and meeting the requirements of Californian climate change laws— all while growing in population by 40 percent. Further, the City declared a “climate emergency” and in November 2021, Council adopted Resolution No. 80284² setting the goal of carbon neutrality in San José by 2030.

In support of the Climate Smart objectives, the Information Technology Department (ITD) initiated a Green Technology Plan to align department activities with strategies that would positively impact the City's technology-related energy and materials consumption, related

¹ Climate Smart San José Plan, February 2018,

<https://www.sanjoseca.gov/home/showpublisheddocument/32171/636705720690400000>

² Resolution No. 80284, October 21, 2021, <https://records.sanjoseca.gov/Resolutions/RES80284.pdf>

e-waste production, and the carbon impact of those activities. ITD set goals focused on reducing extraneous and convenience technology devices, replacing legacy equipment with energy-efficient hardware, applying settings on equipment that lessened consumption of electricity and printing materials, reducing cooling requirements for the City Data Center, and decreasing paper-based activities.

In the 2017-2020 Information Technology Strategic Plan analysis, staff identified that over 70% of the City's technology infrastructure and software was past end-of-life and end-of-support. The City's portfolio of legacy servers, storage and networking equipment, and computers averaged close to ten years old and consumed electricity at an exceptionally high rate compared to modern equipment. At an architectural level, old designs required individual and dedicated physical servers, storage appliances, network devices, and telephony equipment based on each service area, multiplying the number of energy-consuming devices, along with heating, ventilation, and air conditioning (HVAC) costs. The City Data Center had 89 equipment racks, that collectively were approximately at 90% capacity, constituting over 300 server and networking devices.

Due to old equipment and reliability issues, staff retained old equipment when replaced, which resulted in purchasing unnecessary software licenses, accruing additional costs due to power consumption and support, in addition to the climate impact of added energy use. By 2016, the ratio of computers to employees reached 2.4 devices per employee.

The typical refresh cycle for desktops and laptops applies a five-year engineered lifecycle; five to seven year for servers. After five years of progress and priorities from a global pandemic, less than 20% of City computers are now past end-of-life and end-of-support. City computers also now comply with the energy consumption standards identified by ENERGY STAR guidelines³. The shift to laptops saves additional energy use and costs as desktop devices typically consume power at higher rates.

Specific to consumables, City staff relied heavily on printing to perform their duties and to process forms in 2016. City staffs also reported copious printed documents that were never retrieved and were ultimately recycled, resulting in a waste of energy, paper, and toner. As faxing paper documents declined, e-fax options arose, followed by email and secure message options that further reduced paper consumption.

As reported in the San José 2018 Municipal Operations GHG Emissions breakdown report⁴, one of the main contributors resulting in the increase of greenhouse gas emissions was the increased power consumption and HVAC requirements of buildings and facilities.

³ EnergyStar Product Reference: <https://www.energystar.gov/productfinder/product/certified-computers/results>

⁴ 2018 Inventory of Government Operations Greenhouse Gas Emissions, September 2020, (p.8):
<https://www.sanjoseca.gov/home/showpublisheddocument/63881>

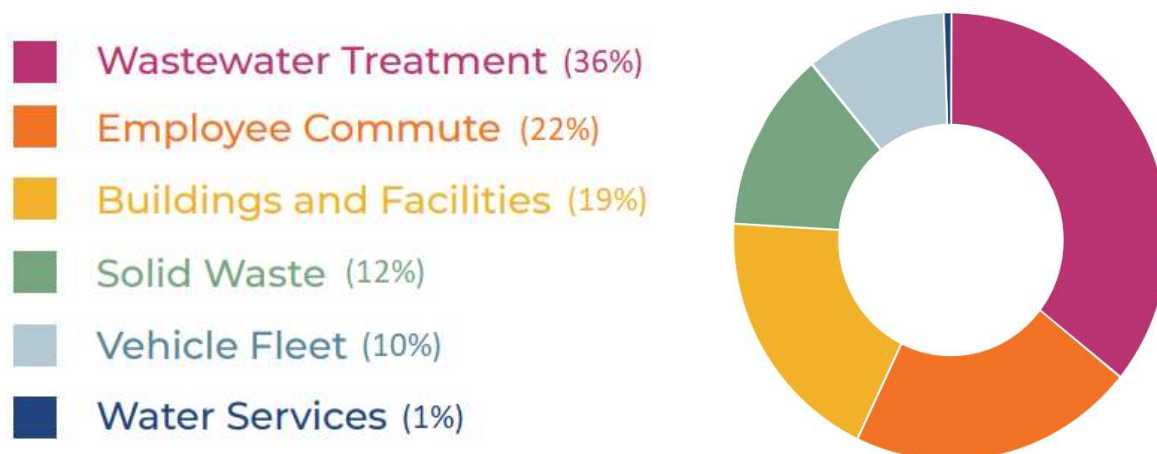


Figure 1: 2018 City of San José Government Operations Emissions by Sector⁵

Thus, the Green Technology Plan initiative started at the end of 2016 defined four main goals for action by ITD, primarily executed by the Help Desk and Customer Technologies teams:

- 1) Increase energy efficiency to significantly reduce energy consumption.
 - 100% procurement of ENERGYSTAR-certified equipment
 - $\geq 90\%$ adoption of ENERGYSTAR operating settings
 - Achieve a $\geq 50\%$ laptop computer fleet from $< 10\%$
 - Support the use of renewable energy sources (Added in 2019)
- 2) Improve performance for customers while significantly reducing e-Waste from PCs, servers, and network equipment.
 - $\geq 90\%$ adoption of converged server and network architectures
 - Achieve a $\leq 1.15:1$ computer-to-employee ratio from 2.4:1
 - Adopt Virtualization and Converged Infrastructure to reduce equipment by $\geq 35\%$
- 3) Reduce City's print consumables and equipment wear.
 - $\geq 30\%$ reduction in paper and toner use through badged and duplex printing
 - $\geq \$400,000$ /year savings from increased lifespan of equipment purchase/lease and reduced consumables costs
 - Coordinate policy to eliminate printing of wide-distribution paper materials in favor of electronic distribution— e.g., forms, agendas, memos, and budget book drafts
- 4) Reduce carbon footprint due to commuting and increase online collaboration.
 - Achieve a $\geq 40\%$ adoption of remote meeting/collaboration technologies
 - Achieve a $\geq 30\%$ use of remote support technologies for ITD Help Desk cases

⁵ 2018 Inventory of Government Operations Greenhouse Gas Emissions, September 2020, (p. 8)
<https://www.sanjoseca.gov/home/showpublisheddocument/68246>

- Support adoption of flexible/alternate work policy to achieve $\geq 10\%$ work-from-home

Over the course of the past five years, ITD made key investments and addressed these goals. In addition, the COVID-19 pandemic and the work-from-home requirements it created further emphasized the need to provide better ways to obtain, transmit, process, store and access data remotely. This combination of factors accelerated the transition to a hybrid workforce model, which presented timely opportunities to reduce greenhouse emissions and use of consumables.

ANALYSIS

Prior to the Green Technology Plan initiatives, the City Data Center hosted physical devices consisting of servers, storage, and network communications devices that occupied significant space and consumed excessive energy to support operations and cooling needs. To achieve the Green Technology Plan goals, the following initiatives were initiated:

Cloud-based Computing

In Fiscal Year 2016-2017, ITD maintained 348 physical servers dedicated to supporting separate applications used by departments. Counting storage appliances and core network equipment, the City's systems hardware occupied ten server racks in support of all City operations. The City's Voice over IP (VOIP) system required physical presence in the City Data Center, taking up nine of the 89 racks. Old technology accounting practices exacerbated this hardware bloat, causing some departments to default to dedicated equipment with high unused capacity when aggregated. This has been replaced by cost-allocation accounting processes that allow departments to benefit from more efficient hardware utilization, higher service levels maintained, and at lower cost.

As ITD executed a refresh of the City's end-of-life and end-of-support technologies, the City made key investments through the City Budget Process to reduce the number of servers and appliances required, virtualizing and consolidating to enable hosting services through on-premises cloud-based appliances that are energy efficient and maintained and tested to stronger standards. In addition, the new environment provides additional flexibility, can be scaled up with more precision and lower cost, and uses a high-availability architecture to maximize resilience while minimizing downtime during upgrades. This modern architecture supports future expansion and positions the City to leverage government and commercial cloud services across the major industry providers. Midway through 2022, the City Data Center now hosts 119 physical servers. The storage and the VOIP environments have condensed into only three racks. Activities to virtualize the remaining physical servers are underway. This constitutes reductions of 229 servers, or 66% of total physical servers and roughly 60% of rack space.

Prior to the Green Technology Plan initiative, ITD leveraged a cloud-based voice solution for all VOIP services to decommission old telephone equipment. The move from traditional telephony to VOIP saved the City electricity use and costs. This was achieved by reducing the total number

of appliances on premises by 64. However, the City’s VOIP solution is now a legacy solution itself.

Device	Before			After		
	Qty	Power	Annual Consumption	Qty	Power	Annual Consumption
Data Center Appliances	66	14.6 kWh	127,896 kWh	2	0.8 kWh	7008 kWh
Phones	~6000	19.2kWh	168,192 kWh	~6000	13.2 kWh	115,632 kWh
Reduction					-19.8 kWh	-173,448 kWh

Figure 2: Telephony Power Reduction

ITD migrated the City’s data storage environment and adopted a cloud-based hybrid storage solution in 2018. This allowed frequently used data to remain on premise for faster performance through local storage and leveraged cloud storage capabilities for the bulk of files. By introducing this hybrid model, ITD reduced the physical data storage footprint in the City Data Center from ten fully occupied data appliance server racks down to half of a server rack.

In 2020, ITD completed implementation of a private-cloud Hyper Converged Infrastructure (HCI) environment—a major refresh of the Citywide server portfolio. This solution is based on virtualized computing technology that combines all elements of a traditional data center: storage, compute, network, and systems management. The solution replaces the traditional physical computing requirements (one physical server per business system rendered) and consolidates hundreds of physical servers into a centralized infrastructure that is highly scalable, more resilient, and that occupies a fraction of the space. The City can now add capacity at much lower costs, with nominal staff time, and with full stand-up of new systems taking hours versus days.

By leveraging the new environment, ITD effectively hosts its own private cloud that can connect to vendor cloud providers when required. This has allowed for 229 physical standalone servers to be decommissioned, reducing the total quantity from 348 to 119 servers and decreasing the total power consumption by approximately 65%, or by 1,504,530 kWh per year—equivalent to what it takes to power 140 average homes⁶ for a year. Finally, new server implementations are hosted in the virtualized environment barring an exception approved by the Chief Information Officer, eliminating future additional physical servers and additional procurement processes.

HCI Energy consumption			
Physical Server Count	Qty	kWh Power	kWh Annual Consumption
Initial	348	261 kWh	~2,286,360 kWh
New	119	89.25 kWh	~781,830 kWh
Reduction	-229	-171.75 kWh	~-1,504,530 kWh

Figure 3: Power Savings from Server Reduction

⁶ US Energy Information Administration FAQ Page: <https://www.eia.gov/tools/faqs/faq.php?id=97&t=3>

Device Consolidation per Employee

Many in the City’s workforce were identified as using more than one computing device that consume about 270 Watt hours (wh) for desktop computers and about 80 wh for laptop computers. Based on 2019 City inventories, for 4,428 employees⁷ the City had issued 3,815 of devices, resulting in consuming approximately 9,921,853 kWh of power per year.

The COVID-19 pandemic presented additional challenges and *opportunities* for the City due to sudden remote work requirements made essential in 2020. In 2016, ITD initiated a standard to reduce the ratio of devices per employee to ≤ 1.15 —essentially a one employee to one computer rule. ITD was able to replace desktops with laptops. ENERGY STAR devices and settings became the standard for computing requirements. As of 2022, the total annual consumption was reduced by 468,358 kWh—equivalent to what it takes to power 43 average homes for a year.

User Device Consumption Summary (excluding PD and Library)		
2022		
<i>Device</i>	Desktops	Laptops
<i>Quantity</i>	3603	1332
<i>Avg kWh Annual Consumption per PC</i>	2365	700
<i>Total kWh Annual Consumption</i>	9,453,495	
<i>Total kWh Annual Consumption Reduction since 2019</i>	468,358	
<i>Total Employee Count</i>	4564	
<i>Device to Employee Ratio</i>	1.08 PCs per City Employee (FTE)	
<i>Reduction 2016 to 2022</i>	-1.32 PCs per City Employee (FTE)	

Figure 4: Device per Employee and Power Usage

Reduce Paper Printouts and Paper Copies

The City executed a project in 2021 to replace all Multi-Function Devices (MFD), which provide photocopying, printing, scanning, and faxing for offices. ITD and the Finance—Purchasing Division worked together to identify functional needs and technical opportunities to advance the Green Technology Plan in the City’s first procurement for MFDs in over ten years. The procurement delivered the following:

- Cost savings – The savings reflected for the duration of the next 5-year lease contract total approximately \$500,000 per year, including rental costs and consumables. By purchasing MFDs that support secure printing, print jobs only get released utilizing badge readers or login, eliminating the need for most standalone and individual printers. The new MFDs also supported policies that enforce standards such as duplex printing by default to save paper, and default black and white printing versus color to save on ink costs.

⁷ Excludes San José Police Department or San José Library figures.

- ***Environmental Impact*** – Historically, users would print documents and forget to claim them at the printers, documents would be misplaced or recycled, and staff would re-print. Badged printing eliminates most abandoned print jobs by requiring a physical badge scan or manual login prior to print, releasing print jobs when the requestor is at the MFD and thus eliminating a significant amount of wasted paper. The MFDs also support fax-to email, SharePoint, OneDrive or shared folders. This prevents the need to receive a fax scan in a paper format and allows for faxes to be kept and read digitally. Based on estimations, these functions will reduce paper consumption (printout, copies, faxes, and scans) by about 21% per year as calculated from the first six months of use.
- ***ENERGY STAR Rating Compliance*** – The new MFDs meet the Federal Environmental Protection Agency Standards. Each MFD is ENERGY STAR v2.0 compliant with an Electronic Product Environmental Assessment Tool (EPEAT) GOLD rating. The MFDs have been configured with policy-based settings to cause them to sleep and conserve energy after 60 minutes of non-use.

Comparison	Previous MFD Estimated Annual	Current Estimated Annual
Total Devices	334	323
Total Sheets	15,658,560	11,666,410
Trees Consumed	1,870	1,400
Unreleased Prints	No Data Feature not available	50,976
Savings	Projected savings ~ \$500,000/year	

Figure 5: Multi-Function Device Impact

ITD initiated a Business Process Automation (BPA) program in early 2020, utilizing new tools to convert paper forms to online processing and electronic signatures. This program took common City paper forms processed on a regular basis and utilizes a web-based portal for online entry, workflow processing, and electronic signatures, without requiring staff to print. City departments and ITD converted 54 paper forms to 31 workflows into the BPA platform and continues to work with departments to automate other processes.

Business Process Automation Summary 2020-2022				
Forms	Workflows	Est # of Pages	Total Requests	Print Reduction
54	31	111	18,251	-90,564

Figure 6: Pages Saved Using Digital forms

Employ E-Waste Handling Practices

“E-waste” is a term describing used electronics that are nearing the end of their useful life, have heavy metal components that can be toxic, and need to be discarded.⁸ Solid waste reduction assists with diverting materials from landfills, minimizes dumping of toxic metals, helps the City implement Council adopted Resolution No. 74077⁹, meets State legal solid waste requirements, and aligns with the upcoming Zero Waste Element of the Climate Smart San José Plan¹⁰ to reduce solid-waste related Greenhouse Gas (GHG) emissions. The U.S. Environmental Protection Agency’s Waste Management Hierarchy prioritizes source-reduction (waste reduction) and reuse before recycling. Below are benefits of these practices as applied to electronics:

- *Source reduction* means avoiding the generation of waste by eliminating the creation of products that are used only once (single-use) or for a short amount of time. ITD has addressed this through the reduction of server appliances and the implementation of scalable virtual machine technology that supports the ability to expand servers without having to buy new equipment and that are engineered for period refresh.
- *Reuse* means using electronics after the product’s normal lifecycle, prolonging utility for as long as possible. ITD has processed legacy phone surplus through third party vendors to repurpose to other agencies.
- *Recycle* means that an electronic product has reached its end-of-life and there is an opportunity to reuse its components through recycling rather than landfilling. Recycling reduces GHGs by lessening the need for natural resource extraction, saving energy and natural resources by avoiding virgin resource extraction and, reduces the GHG footprint. The City contracts with e-waste vendors who responsibly recycle electronics that have reached end-of-life.

CONCLUSION

All City of San José operations are responsible for improving environmental impacts in support of the outcomes defined in the Climate Smart San José initiative adopted by City Council and reinforced by City Council’s designation of a climate emergency. The City made significant improvements since 2017 in applying smart tactics to improve the harm generated by technology-related energy consumption, generation of e-waste, and use of paper and consumables. These efforts were managed through the ITD Green Technology Plan.

⁸ Definition from the EPA website, <https://www.epa.gov/international-cooperation/cleaning-electronic-waste-e-waste>

⁹ In October 2007, Council adopted Resolution 74077 establishing a goal to reduce the amount of material being landfilled by 75 percent by 2013 and a goal of zero waste by 2022. In San José, zero waste is defined as landfilling no more than 10 percent of waste or recycling 90 percent.

¹⁰ Transportation and Environment Committee Status Report on Solid Waste Programs Memorandum, February 7, 2022: <https://sanjose.legistar.com/View.ashx?M=F&ID=10421531&GUID=DD492FE2-0FF2-43C0-8BBF-D186D53A3D0A>

With respect to impact, the City's carbon footprint produced by technology equipment was reduced by 44%, resulting in 1,625,418 kWh saved annually. Desktop replacement strategies resulted in a 12% reduction of endpoint equipment, or approximately 932,400 kWh annually. The ratio of devices per employee was more than halved to 1.08:1. Translating total power consumption savings from Green Technology Plan initiatives, approximately 1,813 fewer metric tons of carbon emissions¹¹ are now generated by the City's technology use. Further, the Multi-Function Device replacement resulted in an estimated \$500,000 of savings annually, while reducing wood products and toner consumption by approximately 25% – totaling over one million prints saved per year. Waste was addressed through the adoption of recycling and reuse best practices employed through the City's certified e-waste and recycling vendor.



Continuing projects include:

Goal #1 – Reduce Equipment Carbon Impact

- Unified Communications as a Service (UCaaS) – ITD is planning a project to move its VOIP telephony solution to a cloud-based platform that will better enable remote workers. Software-based Voice/Video/Text solutions are available that will allow for ITD to potentially remove almost all staff dependency on physical desk phones. Accessible on City desktop, laptop, and mobile device, a UCaaS client would allow employees to have full access to communications tools during assigned work hours. This would reduce greenhouse gas emissions by eliminating redundant telephony equipment in favor of existing networking hardware, as well as support remote work.

Goal #2 – Reduce E-waste

- ITD and Public Works—Facilities will look to track promising efforts with partners that refurbish technology equipment to support accessibility for digital divide communities.

¹¹ Carbon Emissions calculation provided through the EPA Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator?equiv_type=kilowatthoursavoided&equivalency=#results

Goal #3 – Reduce Print Consumables

- ITD will continue to deploy, move, and/or consolidate MFDs where use indicates rationalizing hardware can save equipment with little to no impact on City operations.
- ITD will continue the process of converting paper forms into online digital forms.

Goal #4 – Reduce Commute Carbon Impact

- ITD will continue to issue ENERGY STAR rated laptops and replace legacy desktops with laptops. Staff will work to refine power settings for the City's fleet of computers and servers.

EVALUATION AND FOLLOW-UP

None. The Green Technology Plan will conclude with the report to the Smart Cities and Service Improvements Committee on June 2, 2022.

CLIMATE SMART SAN JOSÉ

The recommendation in this memorandum aligns with one or more Climate Smart San José energy, water, or mobility goals.

PUBLIC OUTREACH

This memorandum will be posted on the City's website for the June 2, 2022, Smart Cities and Service Improvements Committee meeting.

COORDINATION

This memorandum was coordinated with the Information Technology Department, Public Works Department, and Environmental Services Department.

COMMISSION RECOMMENDATION/INPUT

No commission recommendation or input is associated with this action.

COST SUMMARY/IMPLICATIONS

Related fiscal actions were approved in previous fiscal years and are executed. Acceptance of the status report has no new cost implications.

June 2, 2022

Subject: Green Information Technology Plan Status Report

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CEQA

Not a Project, File No. PP17-009, Staff Reports, Assessments, Annual Reports, and Information Memos that involve no approvals of any City action.

/S/

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For questions, please contact Ed Kim, Deputy Chief Information Officer, at (408) 793-6873.