Past, Present & Future

Driving Sustainable Operations at the National Resources Defense Council

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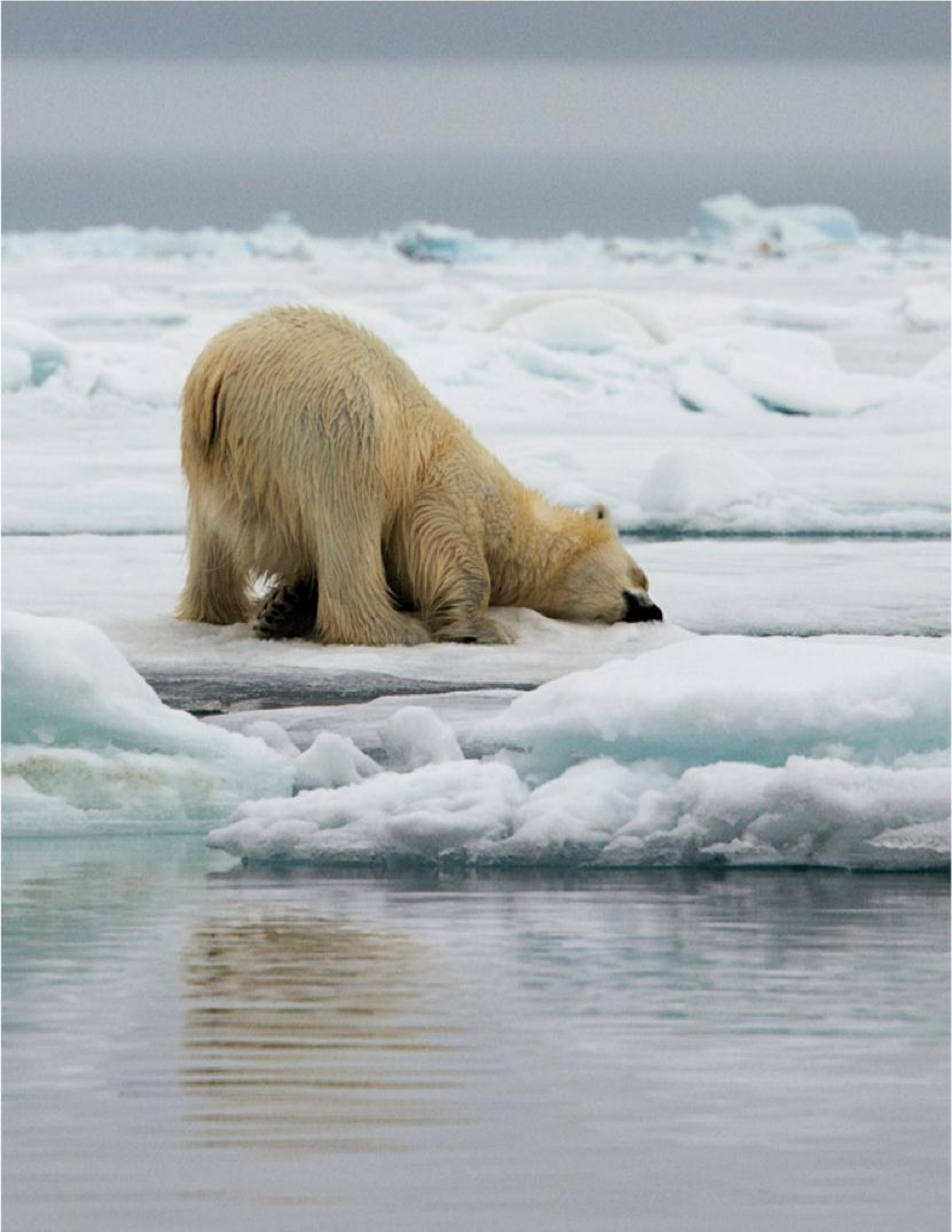

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Terms and Definitions

CH	*Chicago*
DC	*Washington D.C.*
FY	*Fiscal Year*
GHG	*Greenhouse Gas*
HDD	*Heating Degree Day*
IRR	*Internal Rate of Return*
MT	*Bozeman, Montana*
NGO	*Non-Governmental Organization*
NPV	*Net Present Value*
NRDC	*National Resources Defense Council*
NYC	*New York City*
ROI	*Return on Investment*
SF	*San Francisco*
SM	*Santa Monica*
WWF	*World Wildlife Fund*

Meet the Authors: *Columbia University 2015 M.S. Sustainability Management Capstone*

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Introduction

Some of today's most pressing and complex issues are rooted in the subversion of our environment. Establishing solutions to the looming threat of climate change, sea level rise, and the mass destruction of global ecosystem services begs the widespread assistance from policymakers and scientists to bring about action from all. The Natural Resources Defense Council (NRDC) is one of the nation's largest and most effective environmental advocacy groups. Deemed a 'credible and forceful advocate for stringent environmental protection' by the National Journal, the NRDC's mission is straightforward and powerful- *to safeguard the earth: its people, plants and animals, and the natural systems on which all life depends*[1]. Utilizing law, science and the support of 1.4 million members and online activists, NRDC looks to establish sustainability and stewardship of the earth as ethical imperatives and central priorities for society. NRDC is headquartered in New York City, with six additional offices located worldwide. To aptly match its convictions with equal parts advocacy and action, NRDC recognizes the need to lead by example and doing so through the greening of its internal operations.

To this end, NRDC's Facilities, Real Estate and Administration teams developed a Three Year Sustainable Operations Plan in 2012. The Plan was identified projects and long-term systems and processes that would allow NRDC to pursue cost-effective sustainability solutions to ultimately reduce the organization's ecological footprint. Specifically, these projects were selected to collaboratively increase operational efficiency while yield reductions in material usage, greenhouse gas (GHG) emissions, heat and energy usage, and waste generation.

As it stands, non-government organizations (NGOs) are not held to the same standard as private businesses in the demand for transparency and reporting of their internal operations. While NGOs campaign businesses to improve their impact and promote social causes, many have failed to practice what they promote. In the case of organizations whose mission is to promote sustainable business practices, this is an absolute necessity. While many NGOs continue to get a "pass" on sustainability reporting, NRDC has set the bar higher. Not only is NRDC transparent in reporting sustainability efforts (GRI Reporting), but the organization has set impressive and aggressive targets.

Our team evaluated the efficacy of 60 projects included in the Plan, spanning across NRDC's seven office locations: New York City, Washington DC, Chicago, Bozeman, Santa Monica, San Francisco, and Beijing. The team analyzed targets reductions tracked by NRDC for four categories:

(1) energy usage, *(2)* heat usage, *(3)* GHG emissions and *(4)* waste generation.

Target reductions in these four categories were set in 2013 with the goal to achieve results by 2018. Although water consumption is being tracked by NRDC, the organization has not set a target reduction for this metric to date.

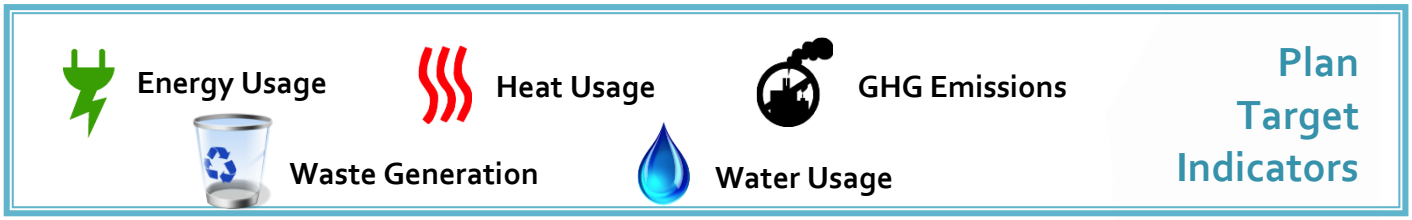
The following evaluation provides valuable insights and recommendations for NRDC to replicate and apply across the entire organization.

[NRDC is a] "..credible and forceful advocate for stringent environmental protection"

-The National Journal

Methodology

The Sustainable Operation Plan was first drafted in 2012 with 45 projects set for the organization as a whole and for individual offices. The Plan was last updated in October 2014 with the addition of 15 new projects. The 60-project plan was developed with co-benefits in mind: increasing operational efficiency, maximizing cost savings, and reducing the organization's environmental footprint. Five year reduction targets for energy and heat use, greenhouse gas emissions and waste generation were subsequently created in 2013 with the intention of achieving full scale results by 2018. Sustainability goals at NRDC are therefore being achieved in two ways, through qualitative projects and quantitative targets.



The Natural Resources Defense Council reached out to Columbia University's Sustainability Management graduate students to complete an evaluation of the existing Sustainable Operations Plan. The purpose of the project was to systematically understand the status of each of the 60 projects in the Plan and to help NRDC showcase its achievements in greening its operations in order to provide leadership and serve as a catalyst in the field. The project goals included evaluating the existing Sustainable Operations Plan, assessing the efficacy of implementation and identifying lessons learned, constructing a communications tool to share these results both internally and externally, and providing recommendations for the future. Evaluating the Plan's efficacy and identifying the lessons learned by NRDC staff was further refined by the capstone team as an analysis of successfully implemented projects, or 'case studies', and an assessment of missed opportunities—implemented projects that were ineffective, and areas which required new projects to help drive reductions in electricity and heat usage, GHG emissions or waste generation.

Project deliverables and goals were guided by answering four main questions:

(1) How efficient is the existing Sustainable Operations Plan?
(2) What strategies proved inefficient or unsuccessful and why?
(3) What opportunities did NRDC miss?
(4) Where can NRDC go next?

A quantitative evaluation of the Plan and its effectiveness was not possible given the lack of tangible, informative data. While the Sustainable Operations Plan has existed at NRDC for the past three years, no reports or documentations were available prior to this capstone that captured the full list of projects in the Plan, their status, office applicability, and/or completion dates. To address this gap, the team created a

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project status matrix, which can easily be filtered against the original four target areas, by location of the projects, or by project status. Project status indicators were labeled as not started, in progress, or completed. The team defined completed projects as those considered to be fully implemented and integrated into the operations of NRDC.

Many of the NRDC staff, facilities administrators and members of the facilities team shared pertinent information with the team while on site at the New York City NRDC headquarters. Therefore, the team's evaluation technique became highly qualitative in nature and was achieved through interviews and staff discussions. The team conducted over 15 in-person interviews with various NRDC staff, from the Senior Director of Facilities Operations to the Chief Engineer of the New York City headquarters.

In addition, the team collected data from a wide array of internal NRDC sources, including Noveda, NRDC's automated virtual data collection system for energy, heat and water consumption; NRDC's electricity bills and existing case studies; studies and reports published by past capstone teams on behalf of the organization, and manual record books of NRDC staff. Manual record books included manually tracked waste, travel and CO_2 emissions, and the New York City office Chief Engineer's manual records of boiler use.

In order to determine if the Sustainable Operations Plan was successful, the team first had to determine the number of projects that have been completed by NRDC to date. Second, to determine if a project was successful, the team had to determine how to quantify and communicate the results. Both of these elements were critical inputs to making the business case for sustainability—significant and time sensitive aspects for the operations team.

There is no doubt that NRDC is making intentional efforts to improve the sustainability of its operations. Several of the completed projects have delivered important reductions in NRDC's energy and heat use, GHG emissions and waste generation. However, the team found that there is no existing mechanism to seamlessly connect the Plan's course of action, targets, milestones, and results. Establishing an intuitive, data driven, centralized hub will help NRDC prioritize future projects and deliver more impactful results.

To this end, the team customized its evaluation approach to generate the most value by creating a database report tool that serves several purposes:

(1) Streamline data collection to quantify impacts
(2) Directly link Plan progress to the four established sustainability targets
(3) Map the current status of achieved versus planned goals, and
(4) Compile organizational data into a scorecard template for internal and external communication purposes

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Creation of this database tool therefore allowed the team to analyze the efficacy of the target reductions in energy, heat, GHG emissions, and waste generation through a quantitative approach and synthesize the results into standardized outputs. This was primarily accomplished through data extraction from Noveda. Not only is Noveda an automated virtual data collection system, but it produces data in real-time with software solutions to optimize the performance of renewable energy systems and therefore help reduce NRDC's carbon footprint[2]. The project status matrix and the database tool are the basis for identification of achievements to highlight, enable the replication of success cases in other NRDC facilities, and present opportunities for improvement both at the project level and system level.

While both the database tool and the project status matrix help NRDC track the Plan's progress and targets, the process of managing performance and managing project ownership needed to be restructured to best optimize the Plan's results. Currently, facility administrators have standing bi-weekly meetings to discuss the Plan, projects, and other operation-focused agendas[3]. However, project ownership and management often includes other actors such as the IT department. Projects have already been identified as overwhelmingly qualitative in nature, therefore communication of progress and results need a greater level of transparency. To increase overall Plan and implementation efficiency, a simple Plan-Do-Check-Act (PDCA) management strategy was developed by the team as an opportunity for improvement. The management strategy offers four steps with clearly identified actions, the optimal frequency of those actions, and the stated ownership of each action within NRDC.

Evaluation

Holistically, the Sustainable Operations Plan was envisioned to drive sustainable change; achievement of the associated target reductions in heat, energy, GHG emissions, and waste generation will increase the sustainability of NRDCs operations. Although it will take longer than anticipated, the team is confident that NRDC will successfully accomplish its goals.

Figure 1 displays the status of the Plan to date. Of the 60 projects in the Plan, only 57%, or 34 projects, have been fully implemented by NRDC. 16 projects are in progress (26%) and 10 project have not been started. This was identified through manually collecting the status and project completion dates for all 60 projects. The initial goal was to complete implementation of all projects by 2014 in a three-step process: all "low-hanging fruit projects", or projects that would be the most feasible and carry the largest impact, were to be implemented in 2012, with a second round of projects implemented in 2013, and the most robust and costly projects to be completed by 2014. Budgetary restrictions account for much of why projects are either in progress or not started. While only 57% of the Plan's projects have been completed, NRDC has already seen positive results in some of its target reductions, such as GHG emissions from purchased heat and electricity (Scope 1&2 emissions). This is an optimal time to evaluate the existing plan; with only half of the projects implemented to date, this evaluation will provide reference for NRDC to better focus its resources and time.

As many projects of the Plan were identified as qualitative, the team could only utilize a limited number of projects that directly connected to or had co-benefits in energy, heat, GHG emissions and waste reductions. Prior to this capstone, water consumption was not included as a target reduction for NRDC's operations, although consumption has been tracked since 2014. For that reason, projects directly contributing to water were considered in the team's analysis as they often had co-benefits in energy reductions.

Of the 34 completed projects completed by NRDC, the team identified 16 projects that were quantitative and could be directly measured against the targets in terms of impact (Figure 3). This increased our ability to evaluate project effectiveness and determine through data, as well as personal staff accounts, which strategies proved inefficient and why.

It is important to note that of the 16 projects the team analyzed, only four projects have been implemented to date across all offices in the NRDC organization. Ten of the projects were targeted in the New York City office with the remaining two projects targeting Santa Monica and Beijing. Not only is the New York office NRDC's headquarters, but it is also the organization's largest office; therefore, targeting this location for more reductions has generated the greatest impact for NRDC. NRDC owns and operates its New York office and therefore has the additional capacity to implement projects, specifically in energy and heating, which are unfeasible to replicate in their rented offices such as Chicago.

After narrowing the evaluation scope from 60 projects to 16, the team collected data across Noveda, electricity bills, existing case studies, reports published by past capstone teams, and manual record logs to quantify and communicate our findings. Waste is tracked manually across all offices, with the exception of Washington DC and Beijing, and uploaded to an Excel file that is circulated across the organization. This file tracks the sum of recycling, composting, e-waste, total waste, and diversion rates.

Energy, heat, and water consumption are tracked in real-time using Noveda. Noveda was scaled throughout the organization in a phased approach. Each office was brought online over a 13 month period: Santa Monica on July 1, 2013; Washington DC on July 26, 2013; Chicago on August 2, 2013; New York City on November 20, 2013; Beijing on July 22, 2014; San Francisco on August 17, 2014.

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The Bozeman, Montana office has not been included in the Noveda monitoring system as this office remains small, consisting of approximately four employees who rent their space[4]. Specifically, Noveda tracks water consumption, oil, natural gas, lighting, plug loads, data center energy use, HVAC, and other energy consumption loads.

Because data was not collected or tracked prior to the creation of the Plan in 2012, the baseline was established against fiscal year 2013 (FY13) in order to track progress in the target reductions for energy, heat, GHG emissions, and waste. NRDC's fiscal year is from July 1 to June 30. This ultimately resulted in a one year gap from when the Plan was initially implemented in FY12 to when data on consumption rates was first tracked in FY13.

With FY14 only recently completed, limited data was available to determine the progress of NRDC's targets. Additionally, because NRDC's fiscal year is not aligned with the calendar year, only six months of energy, heat and water data from FY15 was available at the start of this analysis, providing a total of 1.5 years of usable data. While FY15 will near completion at the time this report is published, most of the team's data analyses only considered the 1.5 years of useable data across FY14 and FY15.

It is important to note that this data, limited in scope, may not deliver an accurate representation of the projects and the Plan overall. As waste is tracked manually, there is a human margin of error in reporting accuracy and associating values to the correct categories and offices. Although Noveda is automated and produces real-time data, the implementation of this system was met with difficultly. Noveda was not implemented at the same time for the six offices that use the system; therefore collected data had to be back-logged to fill in gaps and remove un-explained spikes in data the system would arbitrarily report. By the close of FY16, NRDC will be in a much better position to repeat this evaluation and draw appropriate conclusions.

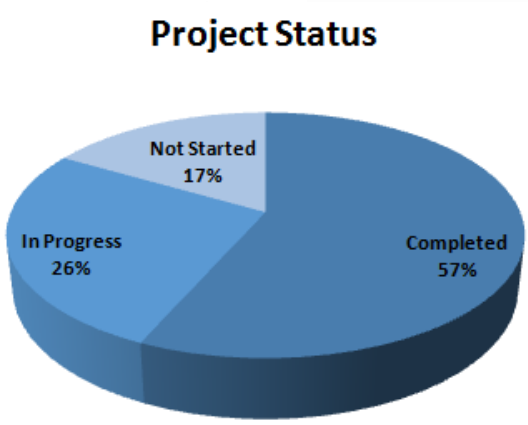

Figure 1: *Current Status of Projects Contained in the Sustainable Operations Plan*, SUMA 2015 Capstone

Facility	Energy	CO_2	Heat	Waste
New York	✓	✓	✓	✓
Chicago	✓	✓	○	✓
San Francisco	✓	✓	✓	✓
Washington DC	✓	✓	✓	○
Santa Monica	✓	✓	✓	✓
Montana	○	○	○	✓
Beijing	✓	✓	○	○

Figure 2: *GAP Analysis- Office Tracking*, SUMA 2015 Capstone

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Project #	Description	NRDC Office(s)	Plan Areas	Status
3	Implement Enterprise-Wide Environmental Performance Monitoring and Verification (Noveda)		Monitoring Impact; Building Efficiency, Systems & Utilization; Water	Completed
5	Xerox Energy Efficiency Rollout		Material Intensity; Energy and GHG Emissions	Completed
6	E-Waste		Recycling and Waste	Completed
15A	Relax Set Points to 77 degrees - winter 73 summer 76	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions	Completed
15B	Report Power Usage Effectiveness (PUE) and other improvements in a case study	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15D	Review and Implement Energy Audit Recommendations	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15H	Clean HVAC coils	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15K	Retrofit Bathrooms on Floors 10-12 Including 10th Floor Shower) as well as Kitchen Faucets to Reduce Water Consumption	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
15N	Audit Data Center Energy Use: Review Power Consumption of the Data Center and Report PUE	SM	Energy and GHG Emissions; Management	Completed
15W	Begin Commissioning and Calibrating Systems for Energy Efficiency: Lighting; LEED Submission	Beijing	Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
21	Waste Tracking and Reduction	ALL	Monitoring Impact; Recycling and Waste	Completed
23	Occupancy Sensor Installations	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emission; Management	Completed
32	Boiler Control	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
33	Air Sealing	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
34	Biofuel	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
38	Install Smart Plugs	NY, CH, DC, SM, SF	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed

Figure 3: *Completed Plan Projects which contribute to Sustainability Targets*, SUMA 2015 Capstone

Sustainable Operations Plan
Success Stories

Biofuel Conversion

Diagnostic

In 2012, approximately 25% of NRDC's scope 1 and 2 emissions came from heating fuel consumption, while the other 75% was associated with electricity consumption[5]. NRDC set a target of 25% reduction in GHG emissions starting in FY 2013. This goal accounted for an 85% reduction in scope 1 and 2 emissions and a 10% reduction in scope 3 travel emissions by 2018[6]. Proposed by the Columbia University Net Zero Capstone for 2015, NRDC implemented the fuel conversion 2 years prior to the proposed date and converted from No. 2 heating oil to the use of 99% biodiesel (B99) in their boiler at the NYC office.

Results

The conversion achieved excellent results since 2013 and the fuel change did not require any new technological adaptation from the previous boiler system. In fact, after taking into consideration volatile oil and biodiesel prices, NRDC spent roughly 17.44% less on heating costs (Figure 4). According to the New York Office's Chief Engineer, the biodiesel, supplied by Tri-State Biodiesel, resulted in combustion efficiencies of over 92%[7]. Typical combustion efficiencies observed prior to the conversion ranged between 80-90%. Because B99 biodiesel is manufactured from recycled vegetable oil, its combustion generates mainly biogenic CO2, therefore almost eliminating the scope 1 emissions generated by the boiler[8]. Therefore, by implementing this project, NRDC reduced its emissions by approximately 101 metric tons of CO2e (see Appendix C for calculation details). This is equivalent to taking 21.5 passenger cars off the road or 242,857 miles/year driven by an average passenger vehicle[9]. This also represents a 15% reduction from the 667 metric tons from scope 1 and 2 FY 2013 baseline, a significant step towards NRDC's 5 year targets. Additionally, the Chief Engineer noted that the boiler was also being used to maintain the fire water protection storage tank above 40 degrees Fahrenheit, which may have caused the boiler to run more often and use more fuel than simply keeping the building warm.

Date	Biodiesel	Biodiesel cost/gal equivalent	Date	Heat No. 2 fuel	Quantity (gal)	Price Difference %
10/10/2014	2.76	3.26	10/13/2014	3.522	3000.5	8.02%
12/18/2014	2.35	2.78	12/15/2015	3.142	2500	13.18%
1/16/2015	1.91	2.26	1/19/2015	2.835	1000	25.64%
1/26/2015	2.11	2.49	1/26/2015	2.817	890.5	13.01%
2/6/2015	1.99	2.35	2/9/2015	2.911	1747.1	23.83%
2/20/2015	2.25	2.66	2/23/2015	3.186	1200.1	19.86%
3/9/2015	2.45	2.89	3/9/2015	3.207	499.9	10.80%
3/24/2015	1.98	2.34	3/23/2015	2.928	300	25.18%
						-17.44%

Figure 4: *Cost Differential between B99 Biodiesel and Heating Oil #2 in FY14*, SUMA 2015 Capstone[10]

Recommendation

The seamless transition achieved in the New York office suggests that other offices can easily implement a fuel change, thereby further reducing the organization's overall greenhouse gas emissions. Even though the Chicago office leases their one floor unit in a large building, advocating for B99 consumption instead of petroleum based fuel would greatly reduce NRDC's carbon footprint. Furthermore, since a large portion of scope 1 and 2 emissions come from electricity consumption, directly buying electricity from renewable sources would also be an effective method to achieving NRDC's greenhouse gas reduction goal. In regards to the fire water protection storage tank on the roof, NRDC should investigate the cost and benefits of installing an electric heating system to reduce boiler use.

As this is NRDC's greatest case for sustainability improvements, the organization should also take an external advocacy role with the City of New York. While this will not necessarily help NRDC to improve its own emissions reductions, NRDC is the first building in the city to achieve the usage of B99 biodiesel. To date, the City of New York has only been able to utilize B20, a blend of 80% petro-diesel and 20% biodiesel[11]. Higher blends of biodiesel have not been integrated by the city due to potential concerns of corrosiveness, and the use of soybean oil over grease. NRDC has proven that B99 can be implemented in its existing boilers without signs of corrosive behavior, and utilize grease instead of the less sustainable soybean oil.

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Heat Energy Usage

Diagnostic

NRDC's New York office is characterized by having low heat energy usage. Figure 5 shows energy performance in 300 buildings across New York State. With a heating index of approximately 4.0 Btu/sqft/HDD, NRDC's New York headquarter is in the top percentile in energy performance. The HDD, or heating degree day, is a measurement of = energy needed to heat a building based on the outside air temperature. Despite the impressive performance, NRDC has continued to further its reductions by implementing 7 additional projects. In the winter of 2013/14, the New York office installed PEPCO, an automated control system for the boiler and just before winter 2014/15, improved the air sealing throughout the building.

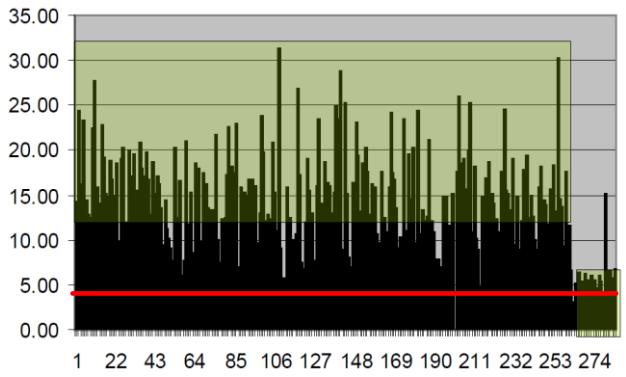

Figure 5: *New York State Building Energy Performance 2001-2005 Compared to NRDC NYC Office Performance (red line)*[12]

Results

According to the team's analysis, these projects have slightly improved the heating index. For the months between November and March, the results were 4.1 Btu/sqft/HDD in FY 2013, 4.0 in FY 2014 and 3.8 in FY 2015. These calculations were based on a conservative analysis in which heating degree days were used to normalize for weather variation (see Appendix D for calculations). A staff member noted that the improvements over time can be explained by the need to keep the boiler on due to the adjusting of set points in the PEPCO system during the first year of implementation. Since the New York office has taken many steps to reduce its heat energy use, the office experienced incremental improvements. Therefore, progress in the previous two years should not be underestimated. It is also crucial to keep in mind that the air sealing project has only been implemented for one year, hence future data from upcoming winters will increase the reliability of the data.

Recommendation

As proposed in the Columbia University Net Zero Building Capstone, installing an energy recovery ventilator would reduce over 5% of the building's energy load[13]. Commercial buildings have ventilation requirements, though this results in heat energy loss in the exhaust. NRDC has the option to lead by example through installation of an energy recovery system in its New York office. In addition, to further improve consistent data collection and monitoring, the use of heating degree days to normalize heat energy consumption due to varying climate conditions is also beneficial to NRDC. Using standardized metrics allows the organization to benchmark its performance against peers and track progress over time. Noveda facilitates this process by having the option to capture and monitor data with heating degree days and cooling degree days.

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Data Center Upgrade

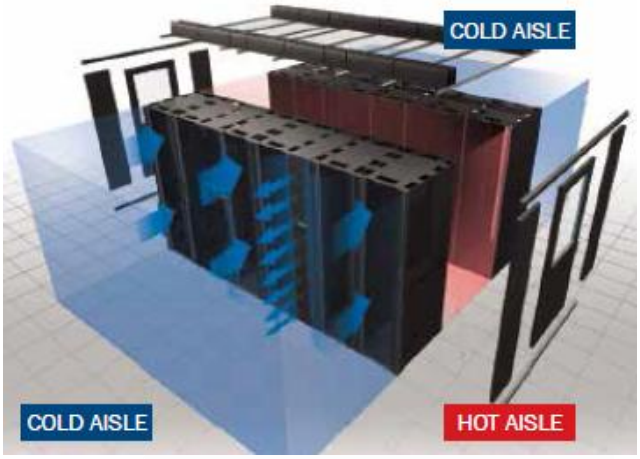
Diagnostic

"Data centers are one of the largest and fastest growing consumers of electricity in the United States. In 2013, U.S. data centers consumed an estimated 91 billion kilowatt-hours of electricity -- enough electricity to power all the households in New York City twice over."
- *Pierre Delforge, NRDC*

NRDC has chosen to make as many reductions in energy use as feasible prior to making the investment to switch to renewable energy as well as purchasing RECs, or renewable energy credits. The New York office's data center was the largest contributor to total electricity consumption in 2012 when the implemented cost and space saving opportunities were initiated. Data centers use energy for cooling and to keep heat away from the server rooms[14]. The New York City office data center upgrade was a giant leap in the right direction and a model for replication for other businesses looking to reduce energy.

Results

Data center energy efficiency is measured by PUE, or power usage effectiveness. PUE is the amount of power entering a data center divided by the power used to run the computer infrastructure within the data center at hand[14]. Changing from the legacy data center to the upgraded center reduced the PUE from 2.09 to an impressive 1.36. This was achieved through a hot aisle containment design. By reorganizing the data center so the hot air was contained within an external case, the space needed to cool the data center reduced by almost half, resulting in a 40% kWh reduction in total energy use and reduced cooling costs[14]. This change additionally resulted in HVAC savings, water savings, and reductions in Scope 1&2 emissions from purchased electricity and heat.



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Recommendation

Through discussions with NRDC, it is not recommended that other offices make the same investments in updating their data centers as the New York City office has. The New York office is the central data center for all other offices, the "hub", with much smaller data centers located in the other offices. Although in some offices, such as Santa Monica, the data center is the largest contributor to this offices' total energy consumption, it is comparably small and would cost more than net benefits received.

While this case shows that NRDC was able to achieve reductions successfully, it cannot achieve further reductions through these means. The next step would be to consider moving to the cloud. Cloud computing is generally more energy and carbon efficient than running on-premise: it offers greater diversity and can serve more customers at the same time[15]. However, virtualization is a timely, costly investment for an already busy IT department to manage. Therefore, moving to the cloud may result in a lower investment and time-management required of this department. NRDC has already begun to explore the costs and benefits of cloud computing through two publications in October 2012: "*The Carbon Emissions of Server Computing for Small-to-Medium-Sized Organizations: A Performance Study of On-Premise vs. The Cloud"* and an issued brief entitled, *"Is Cloud Computing Always Greener?"*

Cloud computing is powered by geothermal energy that not only increases energy efficiency, but decreases CO_2 emissions[15]. Many cloud computing providers allocate CO_2 use on a "per user" or "per transaction" level, a fraction of accounting for the total CO_2 emissions from housing an on-premise server[15]. As the New York office has already optimized the on-premise PUE, the move to a private or public cloud will provide more carbon reductions than server virtualization, which has already been deemed as too costly for NRDC to implement (Figure 6).

Through the utilization of a Database Report Tool developed by this team and explored later in this report, NRDC now has the capacity to see the potential energy and GHG emission reductions per office and organization-wide. For example, if the New York office headquarters moved into the cloud, total energy consumption would decrease 30% and contribute to a 15% reduction across the organization. On the same length, Santa Monica's data center contributes to 16% of its total energy use; moving to the cloud here would reduce this associated electricity but only contribute to a 1.1% reduction across NRDC.

Moving to the cloud would have multiple benefits: increased on-premise space, reduced GHG emissions, reduced total energy consumption, and reduced costs. The reduced costs can be moved into the investment for cloud computing and therefore reduce NRDC's budget requirements for this project. It is recommended that NRDC invest in cloud computing services as provided by IBM or Google. These businesses offer application program interfaces, or APIs, to promote and manage their cloud services. Both offer multiple levels of public and private clouds as well as big data storage and business security[15].

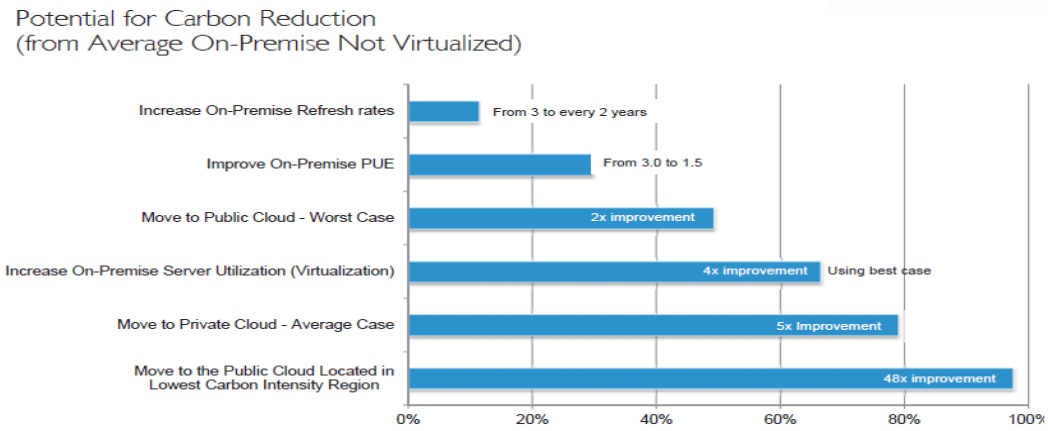

Figure 6: *Carbon Emissions Reduction Potential Applied to NRDC's Current State*[15]

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Air Sealing

Diagnostic

NRDC was in search of methods to minimize the use of the boiler for heating purposes. In addition to the biofuel conversion case study previously described, high-R energy efficient windows and insulation are also crucial in reducing heat loss[16]. The Fall 2012 Columbia University Net Zero Capstone proposed the air sealing initiative, which aimed to eliminate unsolicited air leaks in the building.

Results

The air sealing initiative was implemented in the winter of 2014/15 and successfully used passive strategies to minimize heating needs. NRDC hired a third party company to conduct an air sealing test for the building (6th to 12th floors). By successfully removing air leaks in windows, drop ceilings, and freight elevators, the boiler used 3.4% less in FY15 compared to FY14 (Figure 7). In the Chief Engineer's twenty years of experience in the New York office, it was unheard of for a boiler to turn off for six hours in the middle of winter[7]. Employees also experienced an improvement in thermal comfort as a result of the air sealing installation. Moreover, the air barrier is expected to have a significant impact on air conditioning use[17].

Recommendation

All of NRDC's offices should implement the air sealing initiative, especially in offices located in climate patterns similar to New York. The air sealing project cost the New York office $83,903 and achieved significant reductions in GHG emissions and employee thermal comfort. Since the Chicago and DC office are much smaller than the New York office, the cost of the initiative should also be significantly less. Additionally, to calculate the benefits of the air sealing, NRDC will need to compare HVAC electricity usage for the summer with previous summer seasons before the air barrier installation occurred and adjust for cooling-degree days.

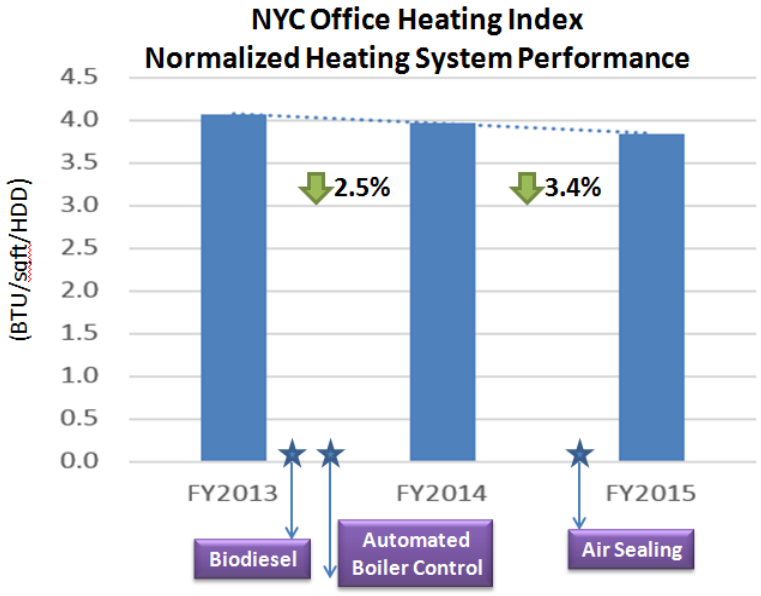

Figure 7: *NYC Office Heating Index Normalized Heating System Performance*, 2015 NRDC Capstone

17

Sustainable Operations Plan
Missed Opportunities

Travel Emissions

Diagnostic

Greenhouse gas emissions from travel (Scope 3) accounted for 80% of the NRDC's total GHG emissions [carbon footprint] in FY 2012[5] and 79% in 2013[6]. While the Sustainable Operations Plan has targeted the improvement of videoconferencing and online collaboration in an effort to reduce travel related emissions, no direct travel restructuring policies have been approved to date. As namely air travel contributes such a great deal to NRDC's overall carbon footprint, the organization will be unable to achieve its projected 2018 reductions without considering travel as a core business activity with medium to high prioritization.

Recommendation

In order to achieve reductions in the carbon footprint of their operations, NRDC needs to formally address this source of emissions through technology utilization and travel policies. The goal of implementing an official Travel Restructure Policy is to increase the efficiency of travel through the monitoring of key employees, flight locations, airline and fuel grade choices, and overall optimization. Currently, the NRDC uses Concur to plan and book all employee fights and correspondences[18]. The development of a new policy recommendation must be developed in cohesion with this operating system. Carbon budgeting and a "cap and communicate" strategy are the best approaches to ease NRDC into setting Scope 3 emissions.

Using 2009 baselines, World Wildlife Australia proposed a 20% reduction in carbon emissions by 2016[19]. The Sustainability Committee designed and proposed three strategies in which have already achieved a 25% reduction in carbon emissions per capita as of 2014. An organization wide "cap and communicate" scheme was designed in FY12-13, allocating an annual 'carbon budget' for each department to manage. "Cap and communicate" along with the recently launched Air-travel Emissions Reduction Initiative (AERI) provides teams with quarterly updates regarding their flights and emissions, and rewards employees for meeting targets. For the final push, WWF Australia announced January as a "No Fly" month beginning 2014 and saw travel emissions drop a total of 14.5 MT CO2e; equivalent to the annual CO_2 emission from 3.1 passenger vehicles or from consuming 33.7 barrels of oil according to the EPA. While this last strategy is too restrictive to implement into NRDC's current working environment, it provides a very hard-lined approach to use if other incentive-based cap allowance strategies are no effective in changing employee [organization-wide] behavior.

The Natural Resource Defense Council should focus on a carbon budget strategy per department and set reduction percentages based on departmental contributions to total emissions. This report will not allocate recommended percentages as this should be driven internally with employee buy-in and proper education to maximize results.

E-Waste

Diagnostic

Each year, NRDC produces e-waste, primarily from its office equipment (computers, hard-drives, and associated peripherals). As reported in the Plan, 6% of Santa Monica and 0% of New York's waste was attributed to e-waste in 2012. The variation in numbers is due to NRDC's IT procedure of purchasing rather than renting its equipment. In the future, NRDC will not look to rent equipment as the organization aims to fully internalize the cost and take full responsibility associated with e-waste. Currently, NRDC is part of the e-Stewards Initiative, an organization that facilitates businesses, non-profit organizations and governmental agencies in e-waste recycling and refurbishing[20]. NRDC has been participating in the voluntary program since 2013 and the initiative has been implemented across all offices[21]. After NRDC collects the e-waste items, the organization then contacts approved vendors for waste collection.

Recommendation

NRDC should set a new standard for its data collection and reporting protocol. Beginning in 2015, the e-Stewards Initiative asked participating organizations to submit a mandatory reporting. On January 30, 2015, NRDC completed its first e-Stewards Enterprise Annual Progress Report. In addition to submitting to the initiative, NRDC should also publish information regarding the initiative on the website as a way to strengthen its reputation and serve as a model for other organizations. In addition to office equipment, NRDC should also encourage employees to bring old, used personal electronic items for recycling. This can be easily publicized through email communication and notice board announcements in office pantries.

Waste Diversion

Diagnostic

As reported in the Plan, NRDC has a 72% waste diversion rate and is on track to meet its 80% goal by FY 2018. However, to hasten this progress, NRDC can implement initiatives that help increase waste diversion rates. Currently, NRDC's New York office has 8 or more trash bins in its kitchen with hopes that employees will sort their trash correctly. NRDC has the right intention, although the process is confusing and overwhelming. Additionally, the process in which waste is collected and tracked at each NRDC facility differs. See Appendix E for details on waste collection per office.

Recommendation

The first initiative is to utilize labeled color-coded waste receptacles in all of NRDC's offices. The city of San Francisco kept it simple and used three bins: green for compost, blue for recycling, and black for landfill[22]. By using properly labeled bins, the city of San Francisco expects to increase diversion rates by 10%. Additionally, San Francisco also works with participating businesses to collect restroom paper towels for composting. Since NRDC already weighs their waste to measure diversion rate, NRDC will be able to quantify these changes within the first few months of action. Although the waste collection and tracking processes differ, by standardizing the waste inputs per facility, NRDC can be in the optimal position to implement automated waste data collection and provide consistency for waste stream comparison. If implemented, these initiatives can help NRDC achieve their FY 2018 goals in waste diversion.

Smart Plugs

Diagnostic

Implementation of smart plugs was first proposed in 2012 as a means to reduce the total electricity consumption of plug loads in various NRDC offices, most specifically in New York, Chicago, and Santa Monica. Smart plugs serve the purpose of eliminating, or reducing, the vampire power load used by devices when unused and sleeping or on standby[23]. NRDC utilizes the ThinkEco Smart Plug Modlet as it plugs directly into the existing wall outlet. Pre-configured schedules were set with automatic shut off time at 7PM and turn on time at 7AM, therefore adjusting all devices to this on and off schedule if plugged in through the modlet. The switch is also set to automatically turn off all devices using the modlet during weekends, since the offices are vacant. The ThinkEco plug load is recorded by the virtual Noveda data collection system as utilized by NRDC.

Results

According to Noveda, plug loads in the New York City office consumed approximately 53,579 kWh in FY14 and are projected to consume 45,178 kWh in FY15, should consumption trends stay consistent for May and June of 2015. The ThinkEco smart plug revealed to contribute 25% of the total plug load in FY14 and 19% in FY15 (Figure 7). It is important to note that the NRDC has made efforts to reduce plug loads through multiple projects. These plug load reduction strategies include implementing Energy Star appliances, adding automated time controls for water coolers, coffee makers and microwaves, reducing elevator loads, and upgrading fax machines, copiers, and A/V equipment. Although plug load decreased as intended by NRDC over the last fiscal year, so too have contributions made by smart plugs.

Through interviews with NRDC staff and facility administrators, it is the understanding of this report that the smart plugs are not-user friendly and contribute to a high level of employee dissatisfaction[24]. In Santa Monica, the router associated with the ThinkEco smart plugs is constantly overloaded and shuts down. When the router goes out, each individual smart plug model must be rebooted and reset to the time switch controls set by the office. As the IT department is spread thin managing their regular and irregular day-to-day activities, resetting the modlet goes often unnoticed. In the New York office, it was revealed that many staff deliberately unplug their devices from the ThinkEco modlet[25]. As these plugs are connected to occupancy sensors, multiple devices were shutting off when an employee left their stations for lunch or a meeting, etc. Employees would lose work that was not saved before the devices shut off from its sleeping status and would have to spend unnecessary time rebooting and duplicating their original efforts.

Employees were made aware of the initiative through electronic communiqués and posters posted in general areas. Installation was met with several gateway issues and limited understanding that monitors and desktops would be plugged into the smart plugs. It was less understood that if an employee required the device to work outside of the 7AM and 7PM monitored times all they had to do was to press the top button to override it[26]. It is unclear if pressing the button would override the shut off for the entire 12 hours that it would regularly be shut off.

Recommendation

It is recommended that all ThinkEco smart plugs be discontinued and removed from all offices. The potential to reduce plug load by a minimal amount does not outweigh the problems and concerns conveyed by current NRDC employees. Facilities administrators agree that the employees were not in favor of the initiative because of the impracticality and inconvenience the modlets have caused. NRDC can make up this gap in efficiency by continuing to reduce plug loads and increasing monitoring in other areas.

It is also recommended that should NRDC wish to continue with the concept of smart plugs, it research the benefits of switching to the Belkin WeMo Switch. The WeMo Switch allows users to control all devices plugged into the smart plug through an app on your mobile device[27]. WeMo is completely modular with a 3.5 to 4.5 rating out of 5 across reviewed published by Amazon, Best Buy, PC Magazine, and Wired[28]. WeMo devices are Wi-Fi enabled, therefore eliminating NRDC's difficulties with the current ThinkEco modlets, which use hotspots. The WeMo switch can be used in combination with occupancy sensors, such as WeMo Motion, to turn off lights and devices. With the WeMo Insight Switch, you can regulate notifications showing how much energy your electronics are using, monitor your devices behavior and cost, and have the ability to turn on and off the switch[27]. The price point of WeMo is the same as ThinkEco, at $50.

Plug Load NYC Floors 8-12	FY14 Total	FY15 Total (Estimate)
Plug Load – Total (kWh)	53,579	45,178
Plug load-Smart Plug (kWh)	13,582	6,094
Plug Load - % Smart Plug	25%	19%
*Assumption: lighting = 45% of electricity floor 10-12 FY14 and 46% FY15.		

Figure 8: *NYC Plug Load* Analysis, SUMA 2015 Capstone

(*Assumptions: Floors 10-12 only report plug load in combination with lighting while floors 8 and 9 report plug load and lighting separately. The percent ratios between plug load and lighting on the 8th floor were used as a model for estimating the plug load on floors 10-12 floors. The 8th floor's configuration was identified as more reliable than the 9th floor and therefore used for a more conservative analysis).

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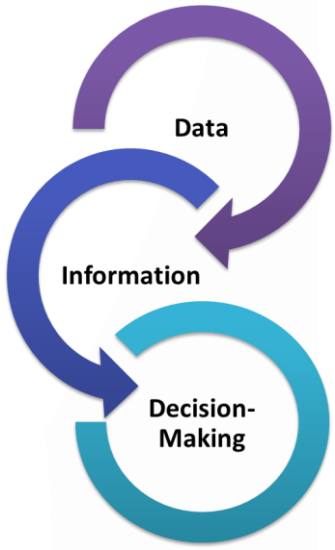
NRDC Operations *Improvement Opportunities*

Data Analysis

Diagnostic



To date, NRDC uses a data collection system called Noveda. It was the first of its kind to track energy, heat and water use daily and store the data virtually. The implementation of Noveda was also an original project in the Plan. However, this system quickly has become outdated and troublesome. Noveda will often record large spikes in energy use that cannot be accounted for. As well, data cannot be drilled down to smaller categories- this means that NRDC cannot identify which plug is consuming the most electricity in a given office or floor. Additionally, the format in which data is exported from Noveda is not user friendly and must be subsequently cleansed and reformatted manually into usable information to identify trends, track progress, and facilitate decision

Solution

Our team developed a tool to turn data collected into usable information to inform the decision-making process. This tool utilizes the existing Noveda structure but allows NRDC to expand its range and capacity to get more out of it without having to invest in a new system. Not only did the team develop the tool, but additionally wrote a 30 page manual so that any employee can train themselves on how to use this reporting tool and its functions (see Appendix K). Currently, data tracked by Noveda can be exported into Excel. This export is shown in Figure 9 below, in which the data is uninformative and not user-friendly unless well versed in the system mechanics.

By exporting the same data into the new Excel-based tool, informative, visual graphs and categorized information is produced automatically as shown in figure 10. Graphs are generated by metric, office, and the organization as a whole (see Appendix I – Appendix J also included for manual waste graphs). Now, NRDC can, for example, look at a weekend in Santa Monica and determine which appliances or office lights were left on. As this database also has the capacity to drill down data on a monthly or even daily basis, NRDC can select a time range for a very specific time period, like a weekend, and determine how much electricity is consumed by the emergency lighting or by the water cooler if left connected.

Since NRDC has completed only 57% of their projects to date, this tool provides the means to prioritize current and upcoming projects based on visual, user-friendly outputs. Project level impacts can easily be estimated by manipulating the graphs and data.

	A	B	C	D	E	F	G
1		7/1/2014	8/1/2014	9/1/2014	10/1/2014	11/1/2014	12/1/2014
2	Electric Utility Delivered (grid in) (kwh)	139572	131879.5	126332.6	107801.6	104250.2	111390.3
3	Electric Utility Delivered (grid in - odom.) (kwh)	2002020	2142387	2276384	1968320	1985815	2090074
4	Electric Utility Received (grid out) (kwh)						
5	Electric Utility Received (grid out - odom.) (kwh)						
6	Electric Power Plant Consumption (kwh)	0	0	0	0	0	0
7	Electric Power Plant Generated (kwh)	1728.601	1664.899	1408.5	1070.8	756.6	538.001
8	Electric Power Plant Generated (odom.) (kwh)	19129	20857.6	22522.5	23931	25001.8	25758.4
9	Natural Gas Consumption (cf)	0	1	2	5827	398	1996
10	Water Plant Consumption (g)	303820.5	246964.5	187419.7	108770.9	79384.11	87959.43
11	Oil Consumed (g)	0	0	11.8	95.1	1289.5	1832.5

Figure 9: *Screen Shot of Noveda Data Extraction*, SUMA 2015 Capstone

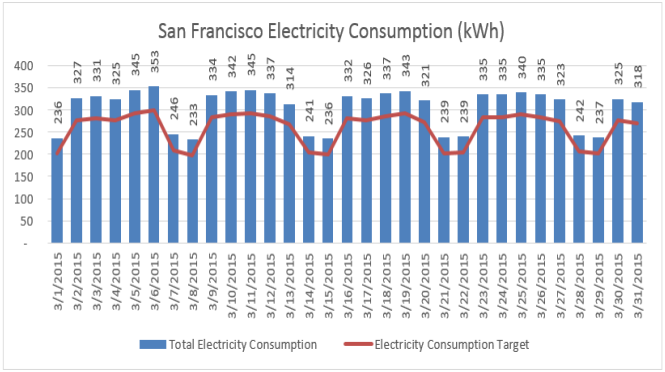


Figure 10: *Example Daily Report Generated by Database Tool*, SUMA 2015 Capstone

Continuous Improvement Strategy

Diagnostic

While individual projects are the drivers of the Plan implementation, upstream activity has the most potential to achieve overarching completion of multisite projects and the associated targets by 2018. This requires maintaining direct data links from the Plan projects and results to sustainability targets, consistent monitoring of progress against targets, and action plans to recalibrate the facilities team on a periodic basis.

Solution

It is strongly recommend that NRDC operations and management adopt the following goal-seeking process based on the International Standards Organization (ISO) definition of the Plan-Do-Check-Act principle as it applies to continuous improvement[29]. A more detailed outline of the process steps are included in Appendix F. The process design shown in figure 11 encompasses key elements including task responsibilities and frequency. The facilities team working to deliver the Plan is motivated and really eager to showcase their work and progress. They exhibit openness to feedback and improvement ideas, which confirms that horizontal responsibilities should be given to promote accountability for specific variables, across all seven offices world-wide.

Implementing a continuous monitoring system enables the operations team to instill a feedback mechanism through action plan follow up and regular review of goals. Although intended for universal use, this system should include site or function specific revisions for each individual office. Given that 26% of Plan projects are "in progress" and 17% are "not started", NRDC will have to clearly understand the root causes for projects which are not implemented or delayed so corrective measures can be appropriately applied for future projects. Also, NRDC will have to generate new action plans to make up for those which are ultimately deemed infeasible, or cancelled, so that they remain in-line to reach their sustainability targets. Conversely, this process will also highlight action plans which have proven successful in any NRDC office and should be immediately assessed for reapplication in other locations. Not only does this approach generate a closed loop, continuous improvement cycle, but the output of this process includes useful reporting and communication tools customized to fit the needs of NRDC.

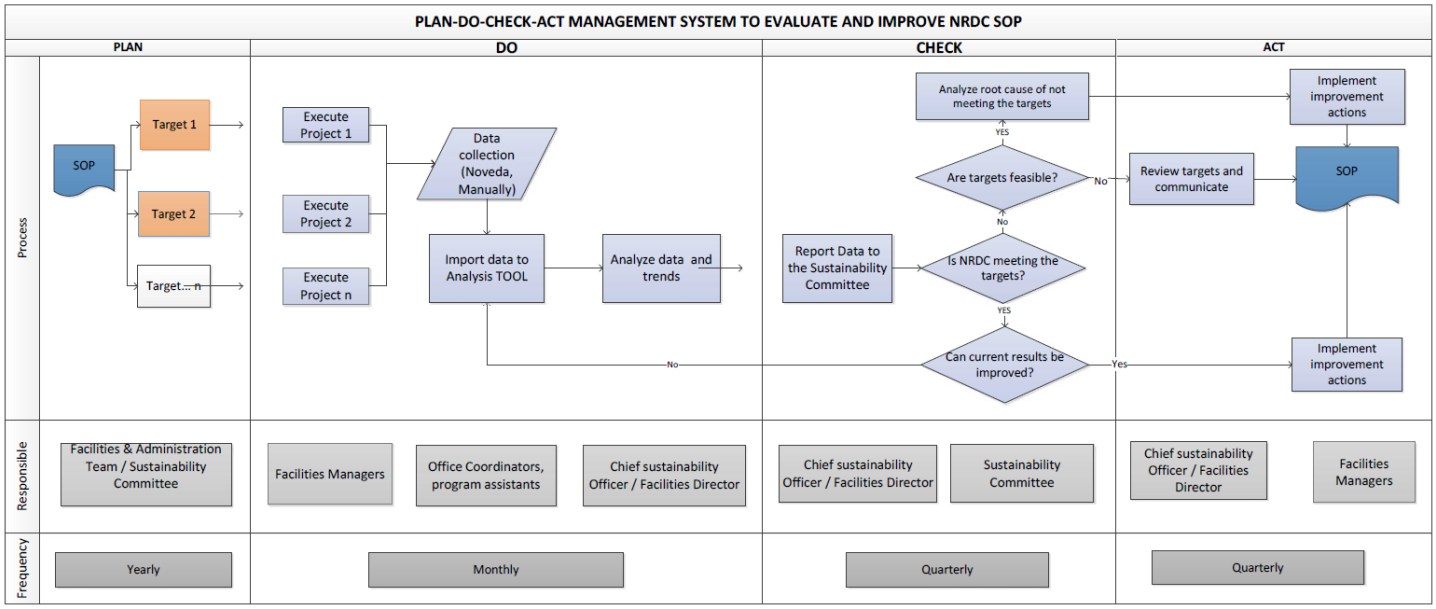


Figure 11: *Proposed Plan-Do-Check-Act Management System*, SUMA 2015 Capstone

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Communications Template

Diagnostic

To determine how NRDC Operations were performing against their targets, first we had to determine which strategies proved ineffective or unsuccessful. Only 57% of NRDC's projects have been implemented to date when the intention was to have full implementation completed by 2014. Through interviews with key staff, the team found that budgetary constraints, time, and a lack of proper training were the main challenges driving this gap. When the Plan was drafted, additional staff was not hired on to manage the prioritization, implementation or tracking of these projects. Therefore existing staff were asked to piggy back this operations plan onto their existing work load without allocating additional time or training. Figure 12 below summarizes NRDC's sustainability targets.

Metric	2018 Target
GHG Emissions- *Total*	⇩ 25%
GHG Emissions- *Electricity & Heat*	⇩ 85%
GHG Emissions- *Travel*	⇩ 10%
Energy- *Electricity Usage*	⇩ 40%
Energy- *Renewables*	⇧ 100%
Heat Usage	⇩ 10%
Waste (% diverted)	⇧ 80%
Water Consumption (gal)	N/A

⇩ Reduce ⇧ Increase

Figure 12: *NRDC Sustainability Targets*, SUMA 2015 Capstone

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Solution

The scorecard in figure 13 below is the primary output of the database tool. It provides a snapshot of statistical progress against the established targets in terms of GHG reductions, energy usage, heat usage, waste, and water consumption. Currently, the scorecard is only populated with FY14 data against FY13 baseline. Based on these figures, each indicator can be classified as *(1)* on target, *(2)* stagnant, or *(3)* off target graphically represented by green, yellow, and red stops lights. The inspiration for this scorecard came from a combination of Philadelphia's GREENWORKS citywide sustainability plan and the US Federal Agency sustainability initiatives scorecard (see Appendix G and H for examples). Not only does the scorecard link with the database tool to automatically populate, but can be used both within the operations team as a dashboard to discuss in its monthly management review meetings and within NRDC as a whole as a communications tool. This communications template can easily be customized for specific audiences as it is in Excel format.

At an environmental advocacy organization like NRDC, demonstrating progress enables them to "walk the talk" in terms of operational sustainability. With this communications tool in place, combined with the data and management strategies recommended prior, the Plan should move toward more aggressive establishment, commitment, and delivery of projects. Financial indicators (NPV, ROI, IRR, among others) should be leveraged to lobby NRDC leadership to allocate budget for the implementation of projects. In addition to cost savings, this action will also generate improvements in NRDC's sustainability targets.

The end of FY15 is quickly approaching on June 30, 2015. A secondary data extraction should occur in July and FY15 results added with the cumulative result. Additionally, recommendations to get NRDC "out of the red" and "into the green" have been included on a case-by-case basis throughout the evaluation's case studies and missed opportunities sections.

Metric	Unit	Baseline (FY13)	Target (FY18)	Totals (FY14)	Progress	Status
GHG Emissions - *Total*	mt CO_2e	3,111	↓ 25%	3065	↓ 1%	
GHG Emissions - *Scope 1&2*	mt CO_2e	667	↓ 85%	574	↓ 14%	
GHG Emission - *Scope 3*	mt CO_2e	2,444	↓ 10%	2,491	↑ 2%	
Energy - *Electricity*	kWh	1,393,045	↓ 40%	1,444,012	↑ 4%	
Energy - *Renewable*	%	7%	↑ 100%	15%	↑ 8%	
Heat Usage	kWh	791,331	↓10%	852,412	↑ 8%	
Waste	% diverted	71%	↑ 80%	72%	↑ 1%	
Water Consumption	gal	N/A	N/A	2,585,977	N/A	

Not on target Needs attention/stagnant On target

Figure 13: *Proposed Communications Template*, SUMA 2015 Capstone

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Conclusion

The Natural Resources Defense Council has been leading the way in the fight for a sustainable future through policy and targeting the effectiveness of its own internal operations. While sustainability is now well implemented in NRDC's operations, there is still a long road ahead into order to achieve its target reductions in energy and heat use, GHG emissions, and waste generation. The work in this report has provided a significant step in highlighting NRDC's greening achievements, enabling the organization to act as leaders and server as a catalyst in this field.

Through an extensive analysis, the team provided NRDC with the means to improve data collection strategies and data analysis, increase operational and project efficiency, and increase the organization's ability to communicate results. The team produced three deliverables to help NRDC communicate the effectiveness of its Sustainable Operations Plan both internally and externally: *(1)* a project status matrix with the ability to filter against the four target areas, location of the projects, or by project status, *(2)* a database tool with the capacity to produce visual, user-friendly reports with the existing data collected by Noveda, and *(3)* a one-page communications template to effectively summarize NRDC's progress in energy and heat use, GHG emissions, waste generation, and water consumption. The team additionally developed a Plan-Do-Check-Act management strategy to increase internal communications with clearly identified actions, the optimal frequency of those actions, and the stated ownership of each action within NRDC.

Project deliverables and goals were guided by answering four main questions:

(1) How efficient is the existing Sustainable Operations Plan?
(2) What strategies proved inefficient or unsuccessful and why?
(3) What opportunities did NRDC miss?
(4) Where can NRDC go next?

The evaluation of the existing Sustainable Operations Plan highlighted four successful projects implemented in the New York City NRDC headquarters- biodiesel, heat energy consumption, air sealing, and the data center upgrade- with recommendations to expand or replicate these projects and implementation strategies in other offices. Five missed opportunities were additionally identified – air travel, E-waste, waste diversion, smart plugs, and data collection efficiency (Noveda) – to address improvement opportunities to further green NRDCs operations.

After highlighting achievements, the purpose of the project was to systematically understand the status of each of the 60 projects in the Plan. Although NRDC has completed 57% of the projects in its Sustainable Operations Plan to date, it has already seen positive results. An example of quantitative results have been seen in the 14% reduction in GHG emissions, and waste generation were evaluated in absolute values rather than per full-time employee (FTE).

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NRDC has seen significant increases in new hires since FY13 as well as several office moves to accommodate additional employees. Therefore even though NRDC increased its electricity consumption, heat usage and travel emissions, this is due to the influx of employees.

As NRDC continues on with the development and implementation of its Sustainable Operations Plan, it will be increasingly difficult to achieve large reductions without strong regulatory changes and large financial investments. The most feasible and largest impact projects of the Plan have already been implemented therefore additional reduction projects predicted to only produce incremental changes. It is recommended that a re-evaluation of the Plan occur again at the end of FY16. At this time, several years of reliable data will be available for a stronger analysis and assessment of the Plan and its impact. Should NRDC continue to grow in the size, ownership over additional office building space will provide greater control over energy and heat consumption rates.

The Natural Resources Defense Council is setting the accountability bar higher for other non-government organizations. In the Sustainability Management master's program at Columbia University, it is often said that you cannot manage what you do not measure. With the help of the team, NRDC has been given the tools to maximize and manage its reduction efforts. The team is confident that NRDC is now better positioned to become a sustainable organization and leader in this field.

Appendix

Appendix A- *Complete Sustainable Operations Plan project listing and status*

Project #	Description	Target Offices	Plan Areas	Current Status
1	Supporting the Sustainable Operations Plan		Material Intensity	Completed
2	Re-organize Facilities and Administration Team to Allow Focus on Sustainable Operations		Management	Completed
3	Implement Enterprise-Wide Environmental Performance Monitoring and Verification (Noveda)		Monitoring Impact; Building Efficiency, Systems & Utilization; Water	Completed
4	Server Virtualization		Monitoring Impact; Energy and GHG Emissions	In Progress
5	Xerox Energy Efficiency Rollout		Material Intensity; Energy and GHG Emissions	Completed
6	E-Waste		Recycling and Waste	Completed
7	IT Procurement Policy- Computers and Servers		Energy and GHG Emissions; Recycling and Waste	Not Started
8	Collaboration Central		Management	Completed
9	Fall Capstone-Develop Net Zero Energy Site Plan for NY Headquarters	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions	Completed
10	Upgrading Conference Call Capabilities and AV Equipment to reduce travel		Energy and GHG Emissions	In Progress
11	Environmentally Responsible Vendor Requirements		Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
12	Materials and Services Procurement		Material Intensity	Completed
13	Green Accounting		Management	Not Started
14	Flexible Workplace Environment (FEW)		Building Efficiency, Systems & Utilization; Management	In Progress
15A-Y	Regional Sustainability Initiatives		Monitoring Impact; Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	In Progress

Project #	Description	Target Offices	Plan Areas	Current Status
15A	Relax Set Points to 77 degrees - winter 73 summer 76	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions	Completed
15B	Report Power Usage Effectiveness (PUE) and other improvements in a case study	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15C	Require Building Energy Audit (level 3)	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15D	Review and Implement Energy Audit Recommendations	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15E	Improve Staircases to Encourage Use of Stairs Instead of Elevators (lighting, paint, cleaning)	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	In Progress
15F	Improve Window Operability and Cross Ventilation	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Not Started
15G	Investigate Demand Side Management Incentives	NY	Energy and GHG Emissions; Management	In Progress
15H	Clean HVAC coils	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15I	Prepare Design for Living Roof	NY	Energy and GHG Emissions; Water	Completed
15J	Waste Management- Replace Waste Management Company	NY	Recycling and Waste; Management	Completed
15K	Retrofit Bathrooms on Floors 10-12 Including 10th Floor Shower) as well as Kitchen Faucets to Reduce Water Consumption	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
15L	Update Tenant Lease for BMPs According to NRDCs Green Lease Document 6th and 7th Floor	NY	Monitoring Impact; Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
15M	With Assistance from **Pierre Delforge**, Monitor and Reduce Plug Load and Data Center Power Use Following Approach Used in San Francisco	SM	Monitoring Impact; Building Efficiency, Systems & Utilization; Energy and GHG Emissions	In progress

Project #	Description	Target Offices	Plan Areas	Current Status
15N	Audit Data Center Energy Use: Review Power Consumption of the Data Center and Report PUE	SM	Energy and GHG Emissions; Management	Completed
15O	Measure Plug Load of the Communications Department's Video Editing Equipment (SM)	SM	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Not Started
15P	Require Comprehensive Energy Audit	SM	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
15Q	Research Possible Upgrades and Operational Efficiencies in Greywater System	SM	Monitoring Impact; Building Efficiency, Systems & Utilization; Management; Energy and GHG Emissions; Water	Completed
15R	Upgrade Existing Solar Panels and Add Additional Panels	SM	Energy and GHG Emissions	Not Started
15S	Look into Improving the Efficiency of the Elevator and Reducing Usage	SM	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Not Started
15T	Living Roof- Review Concept of Living Roof	SM	Energy and GHG Emissions; Water	Not Started
15U	Review Opportunities for Passive Cooling Strategies	SM	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Not Started
15V	Begin Commissioning and Calibrating Systems for Energy Efficiency: Dashboard Noveda Calibrate Lurton System Calibrate BMS for Air Conditioning	DC	Monitoring Impact; Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Water; Management	In progress In Progress In progress
15W	Begin Commissioning and Calibrating Systems for Energy Efficiency: Lighting; LEED Submission	Beijing	Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
15X	Contain Real Estate Requirements: Sublease Expires May 2014; Make Green Lease Adjustments and Right Size Space	CH	Management	Completed
15Y	Contain Real Estate Requirements: Sublease Expires July 2014; Make Green Lease Adjustments and Right Size Space	SF	Management	Completed

Project #	Description	Target Offices	Plan Areas	Current Status
17	Review Resource-Intense Processes Managed Outside Facilities & Administration		Material Intensity	Not Started
18	Summer Capstone- Select Environmental Reporting Standard		Monitoring Impact; Management	Completed
19	Environmental Responsibility Requirements for Building Management Companies		Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste	In Progress
20	Environmental Performance Target Setting and GRI Reporting		Monitoring Impact; Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	Completed
21	Waste Tracking and Reduction	ALL	Monitoring Impact; Recycling and Waste	Completed
22	Green Lease Agreements with Tenants		Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste	Completed
23	Occupancy Sensor Installations	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emission; Management	Completed
24	Water-Source Air Conditioner Schedule Adjustment	NY	Energy and GHG Emissions; Water; Management	In Progress
25	Lighting Upgrade	ALL	Building Efficiency, Systems & Utilization; Energy and GHG Emissions	In Progress
26	Install Timer Switches on Printers and Water Cooler	ALL	Building Efficiency, Systems & Utilization; Energy and GHG Emissions	In Progress
27	Composting	DC	Recycling and Waste; Management	In Progress
28	Bike share	ALL	Energy and GHG Emissions; Management	In Progress
29	CH Expansion LEED & LBC	CH	Building Efficiency, Systems & Utilization; Material Intensity; Energy and GHG Emissions; Water; Recycling and Waste; Management	In Progress
30	Emergency Preparedness Drills	ALL	Management	In Progress
31	Summer Capstone: Business Continuity	CH	Management	Not Started

Project #	Description	Target Offices	Plan Areas	Current Status
32	Boiler Control	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
33	Air Sealing	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
34	Biofuel	NY	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
35	Implement Travel Restructure Policy	ALL	Energy and GHG Emissions; Management	In Progress
37	Relocate office to Bozeman, Construction & Move-In	MT	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed
38	Install Smart Plugs	NY, CH, DC, SM, SF	Building Efficiency, Systems & Utilization; Energy and GHG Emissions; Management	Completed

Appendix B- *NRDC Summary of Environmental Data to Report - Gap Analysis*

Facility	Energy	CO_2	Heat	Waste	Water
New York	✓	✓	✓	✓	✓
Chicago	✓	✓	○	✓	✓
San Francisco	✓	✓	✓	✓	✓
Washington DC	✓	✓	✓	○	✓
Santa Monica	✓	✓	✓	✓	✓
Montana	○	○	○	✓	○
Beijing	✓	✓	○	○	✓

Appendix C- *GHG Emissions Calculations for Biodiesel Conversion*[30, 31, 32]

Scope 1 Emission Factors	CO2		CH4		N2O		CO2e	
Distillate Fue Oil No. 2	10.21	kg/gal	0.00041	kg/gal	0.000080	kg/gal	10.24	kg/gal
Biodiesel	0.00		10	kg/TJ	0.6	kg/TJ	0.05	kg/gal
GWP	1		25		298			

Approximate Heating Oil # 2 Consumption in FY13: source: Superintendent´s Log Book	10,000	gal
Conversion factor used:	947,817,078	Btu/TJ
Energy Content (Btu/gal)		
Heating Oil No 2	139600	
B100 Biodiesel	118170	
ratio	1.18	

Scope 1 GHG reduction achieved (mt CO2e)		
Before	102.4	Emissions with Heating Oil #2
After	1.6	Emissions with B99
Reduction	100.8	

Appendix D- Weather Normalized Heat Index Calculation

	FY13			FY14			FY15		
	Heating Oil #2 Consumed (g)	HDD (Station ID: KNYC)	Heating Index (Btu/sqft/HDD)	Biodiesel Consumed (g)	HDD (Station ID: KNYC)	Heating Index (Btu/sqft/HDD)	Biodiesel Consumed (g)	HDD (Station ID: KNYC)	Heating Index (Btu/sqft/HDD)
Nov	1284	649	3.58	1877.5	598	4.81	1289.5	602	3.28
Dec	2010	736	4.94	2184.4	814	4.11	1832.5	767	3.66
Jan	2409	926	4.71	3013.6	1124	4.11	2602.8	1084	3.68
Feb	1996	872	4.14	2164.8	937	3.54	3152.3	1138	4.24
Mar	1244	790	2.85	1960.3	845	3.55	2216.4	838	4.05
Total	8943	3973	**4.07**	11200.6	4318	**3.97**	11093.5	4429	**3.84**
Heating Index yearly change					**8.7%**	**-2.5%**			**-3.4%**

Notes:

1. FY13´s heating oil consumption sourced from Chief Engineer´s log book; FY14 and FY15 biodiesel consumption downloaded from Noveda
2. HDD (heating degree days) source: www.degreedays.net (using temperature data from www.wunderground.com)
3. Total Area Heated by Boiler (floors 6 through 12) = 77176 sq ft. Source: NRDC´s 40W 20th street rentable area.

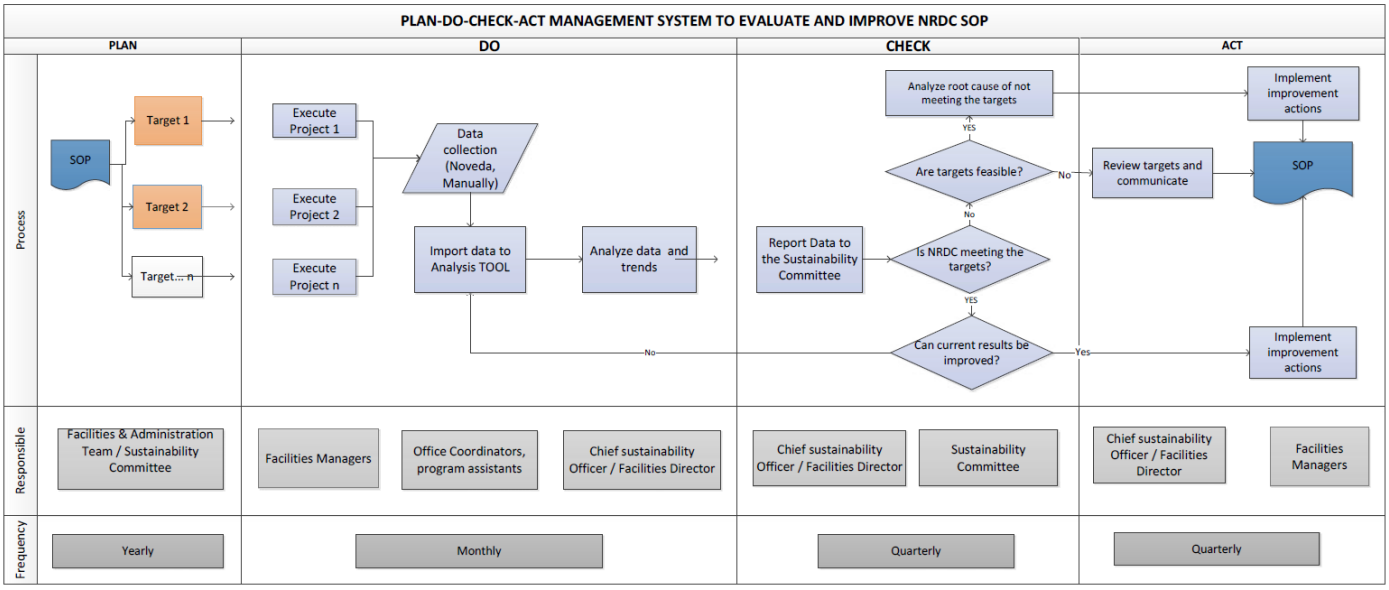
Appendix E- *NRDC Waste Collection and Tracking Gap Analysis*

Description of how each NRDC location Collects and Tracks Waste

NRDC Waste Tracking Summary						
Facility	**Landfill**	**Plastic & Metal Recycling**	**Paper**	**Cardboard**	**Compost**	**E-waste**
New York						
Responsible	NRDC Cleaning Crew					Contractor
Accountable	Facilities Staff					
Chicago						
Responsible	Building Cleaning Crew				Facilities	Contractor
Accountable	Facilities Staff					
San Francisco						
Responsible	Janitorial					
Accountable	Facilities Staff					
Washington DC						
Responsible	Trash Hauler					
Accountable	Facilities Staff					
Santa Monica						
Responsible	Janitorial					
Accountable	Facilities Staff					
Montana						
Responsible	Cleaning Staff					
Accountable	Facilities Staff					

Appendix F- *Proposed Management System Detailed Process Steps Explained*

Plan-Do-Check-Act detailed process map explained for four step approach.



1. **Plan:** In this phase, NRDC should (1) define targets and goals, (2) establish the methodology and projects that will help reach the goals and (3) communicate, train and assign project manager. Some of the strategies used to perform diagnosis and prioritize activities including life cycle analysis, energy audits, and employee interviews.

2. **Do:** This phase includes managing, implementing and monitoring data while it is being collected via Noveda; i.e. when changing lighting to reduce electricity consumption, the project manager should review the KWh monthly, analyze the consumption trend and measure the impact of the project. This person will also be responsible to report the results to the sustainability committee during the quarterly review meetings.

3. **Check:** This phase requires NRDC to evaluate the effectiveness of the projects and identify the gaps and flaws that are preventing the organization from reaching its targets. During the quarterly operation management meeting the organization should ask two main questions: 1) Is NRDC meeting its targets?, and 2) are the targets feasible? If the answer to question 1 is affirmative, then the projects should continue with few or no changes. However, if the answer is negative, then the committee should analyze the efficacy of projects by seeking the root cause in different areas such as: human capital (i.e, lack of training or communication), funding, and technical limitations (i.e. lack of technology, lack of maintenance, obsolete equipment, etc.), among others. Once the root case is identified, NRDC should implement the corrective actions. In contrast, if NRDC targets are not feasible, then the organization must revise them and change the goals to start a new PDCA cycle with new improvements.

4. **Act:** NRDC will take all the necessary actions to continually improve the processes. Ultimately the organization will loop back to the first phase (Plan) and seek further areas of improvement.

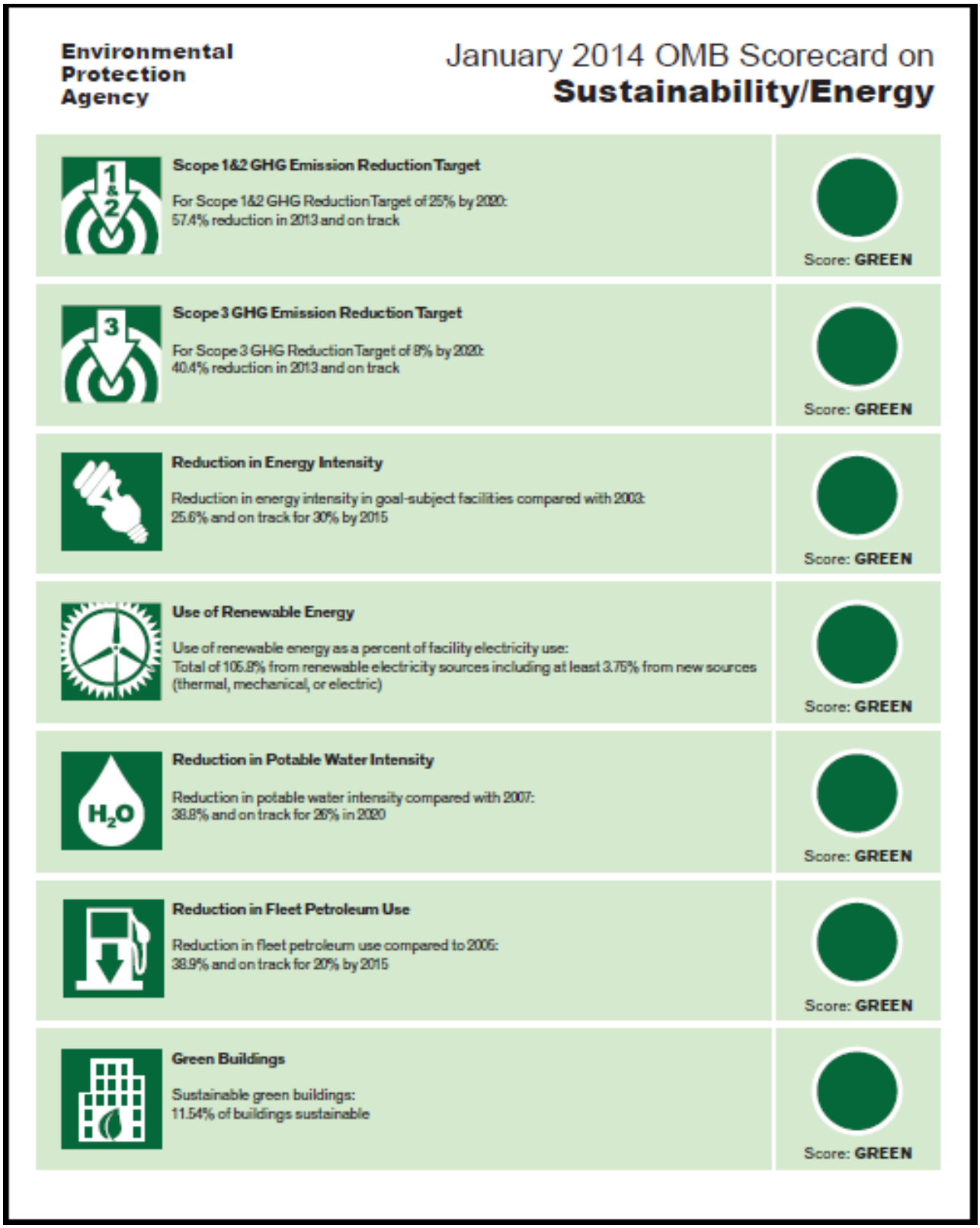
Appendix G- *Excerpt from Philadelphia's GREENWORKS Sustainability Plan*[33]
Inspiration for Communications Template

SUMMARY OF TARGETS

BASELINE	BASELINE YEAR	CURRENT	2015 GOAL
TARGET 1 Lower City Government Energy Consumption by 30 Percent			
3.77 Trillion BTUs	2008	3.50 Trillion BTUs	2.64 Trillion BTUs
TARGET 2 Reduce Citywide Building Energy Consumption by 10 Percent			
122.06 Trillion BTUs	2006	129.36 Trillion BTUs	109.85 Trillion BTUs
TARGET 3 Retrofit 15 Percent of Housing Stock with Insulation, Air Sealing, and Cool Roofs			
3,500 Homes Retrofitted	2008	9,131 Homes Retrofitted	84,400 Homes Retrofitted
TARGET 4 Purchase and Generate 20 Percent of Electricity Used in Philadelphia from Alternative Energy Sources			
2.3% Alternative Energy	2008	14.0% Alternative Energy	20% Alternative Energy
TARGET 5 Reduce Greenhouse Gas Emissions by 20 Percent			
MUNICIPAL			
587,899 t CO_2e	1990	481,726 t CO_2e	470,319 t CO_2e
COMMUNITY			
21.21 Million t CO_2e	1990	21.33 Million t CO_2e	16.97 Million t CO_2e
TARGET 6 Improve Air Quality toward Attainment of Federal Standards			
20 Unhealthy AQI Days	2008	21 Unhealthy AQI Days	10 Unhealthy AQI Days
TARGET 7 Divert 70 Percent of Solid Waste from Landfill			
53% Diversion Rate	2008	77% Diversion Rate	70% Diversion Rate
TARGET 8 Manage Stormwater to Meet Federal Standards			
0 New Greened Acres	2011	102.4 New Greened Acres	450 New Greened Acres
TARGET 9 Provide Walkable Access to Park and Recreation Resources for All Philadelphians			
10,300 Acres of Open Space	2008	10,433 Acres of Open Space	10,800 Acres of Open Space
TARGET 10 Provide Walkable Access to Affordable, Healthy Food for All Philadelphians			
230 Markets, Gardens, and Farms	2008	314 Markets, Gardens, and Farms	316 Markets, Gardens, and Farms
TARGET 11 Increase Tree Coverage Toward 30 Percent in All Neighborhoods by 2025			
0 New Trees	2008	89,287 New Trees	300,000 New Trees
TARGET 12 Reduce Vehicle Miles Traveled by 10 Percent			
5.96 Billion Vehicle Miles Traveled	2005	5.34 Billion Vehicle Miles Traveled	5.36 Billion Vehicle Miles Traveled
TARGET 13 Increase the State of Good Repair in Resilient Infrastructure			
73% in State of Good Repair	2008	77% in State of Good Repair	80% in State of Good Repair
TARGET 14 Increase the Size of the Regional Clean Economy			
GREEN GOODS AND SERVICES			
27% of Workplaces	2012	2012 Most Recent Data Available	Report Best Available Metric
GREEN TECHNOLOGIES AND PRACTICES			
53% of Workplaces	2012	2012 Most Recent Data Available	Report Best Available Metric

2

Appendix H- *EPA Annual Sustainability Scorecard*[34]
Inspiration for Communications Template



Standards for Success — *Red Standard, Yellow Standard, Green Standard*

Scope 1&2 GHG Emission Reduction Target

GREEN: Achieved its 2013 Sustainability Plan proposed reduction for GHG Scopes 1&2 and is on track to achieve its 2020 target.

YELLOW: Achieved at least half of its 2013 Sustainability Plan proposed target for GHG Scopes 1&2.

RED: Did not achieve at least half of its 2013 Sustainability Plan proposed target for GHG Scopes 1&2 or did not provide trajectory for 2020.

Scope 3 GHG Emission Reduction Target

GREEN: Achieved its 2013 Sustainability Plan proposed reduction for GHG Scope 3 and is on track to achieve its 2020 target.

YELLOW: Achieved at least half of its 2013 Sustainability Plan proposed target for GHG Scope 3.

RED: Did not achieve at least half of its 2013 Sustainability Plan proposed target for GHG Scope 3 or did not provide trajectory for FY 2020.

Reduction in Energy Intensity

GREEN: Reduced energy intensity (Btu/GSF*) in EISA goal-subject facilities by at least 24 percent compared with 2003 and is on track for 30 percent reduction by 2015.

YELLOW: Reduced energy intensity (Btu/GSF) in EISA goal-subject facilities by at least 21 percent compared with 2003.

RED: Did not reduce energy intensity (Btu/GSF) in EISA goal-subject facilities by at least 21 percent compared with 2003.

Use of Renewable Energy

GREEN: Uses at least 7.5 percent electricity from renewable sources as a percentage of facility electricity use & at least 3.75 percent of facility electricity use comes from new sources (post-1999). (Thermal and mechanical renewable can be included in the 3.75 percent new requirement, but not the 7.5 percent goal; i.e., an agency meets all new sources requirement with thermal or mechanical energy (3.75 percent) but would still need an additional 7.5 percent from renewable electricity sources.)

YELLOW: Uses at least 7.5 percent renewable energy from electric, thermal or mechanical sources to power facilities and equipment; but less than half was obtained from new sources (post-1999) or part of the requirement was met with thermal and mechanical renewable energy.

RED: Did not use at least 7.5 percent renewable energy from electric, thermal or mechanical sources to power facilities and equipment.

Reduction in Potable Water Intensity

GREEN: Reduced water intensity by at least 12 percent from final approved 2007 baseline and is on track for 26 percent reduction by 2020.

YELLOW: Reduced water intensity by at least 10 percent from final approved 2007 baseline.

RED: Did not reduce water intensity by at least 10 percent from final approved 2007 baseline.

Reduction in Fleet Petroleum Use

GREEN: Achieved a 16 percent reduction in petroleum use in its entire vehicle fleet compared to 2005 and is on track for 20 percent reduction by 2015.

YELLOW: Achieved at least 14 percent reduction in petroleum use in the entire vehicle fleet compared to 2005.

RED: Did not achieve at least 14 percent reduction in petroleum use in its entire vehicle fleet since 2005.

Green Buildings

GREEN: Demonstrates implementation of Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings (GP) for new, existing and leased buildings; and is on track to meet 15% goal by 2015 by reporting that at least 11% of buildings >5,000 GSF meet GP as reported in the Federal Real Property Profile (FRPP).

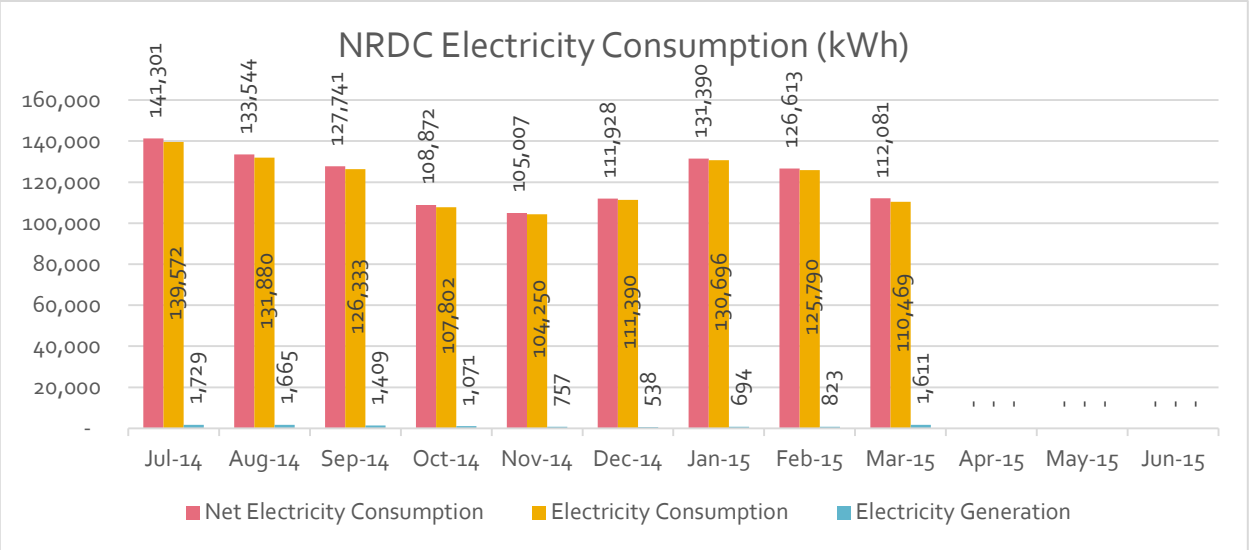
YELLOW: Incorporates Guiding Principles into all new design contracts for construction, major renovations and leases and at least 11 percent of GSF of its building inventory over 5,000 GSF meets GP as reported in FRPP.

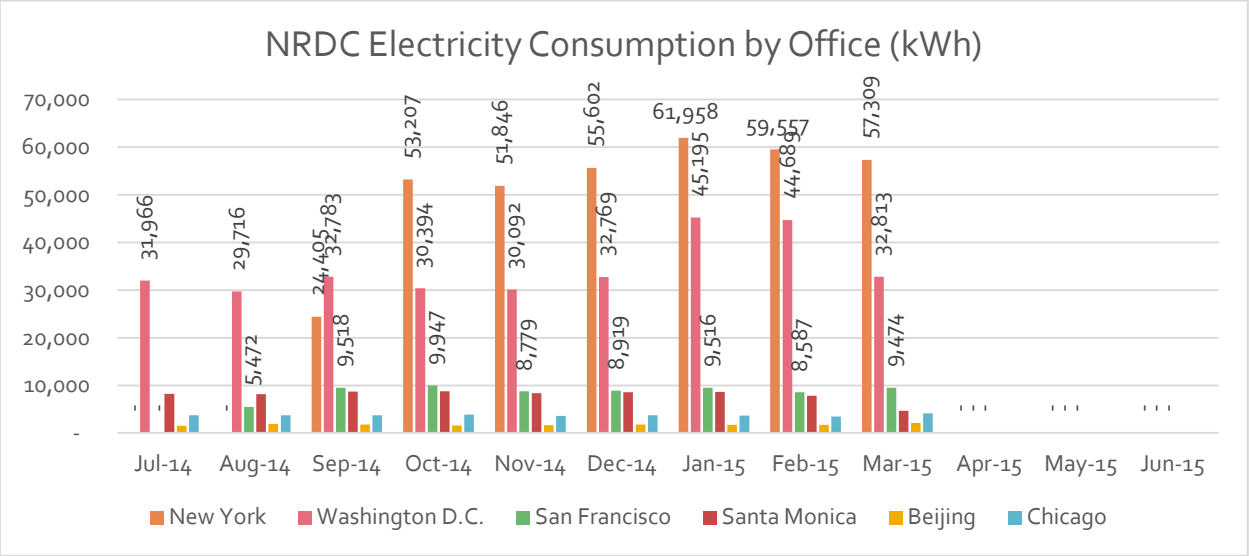
RED: Cannot demonstrate compliance with GP on new construction, major renovations, or leases; and/or less than 11 percent of building inventory, either by number of buildings or GSF, over 5,000 GSF meets GP as reported in FRPP.

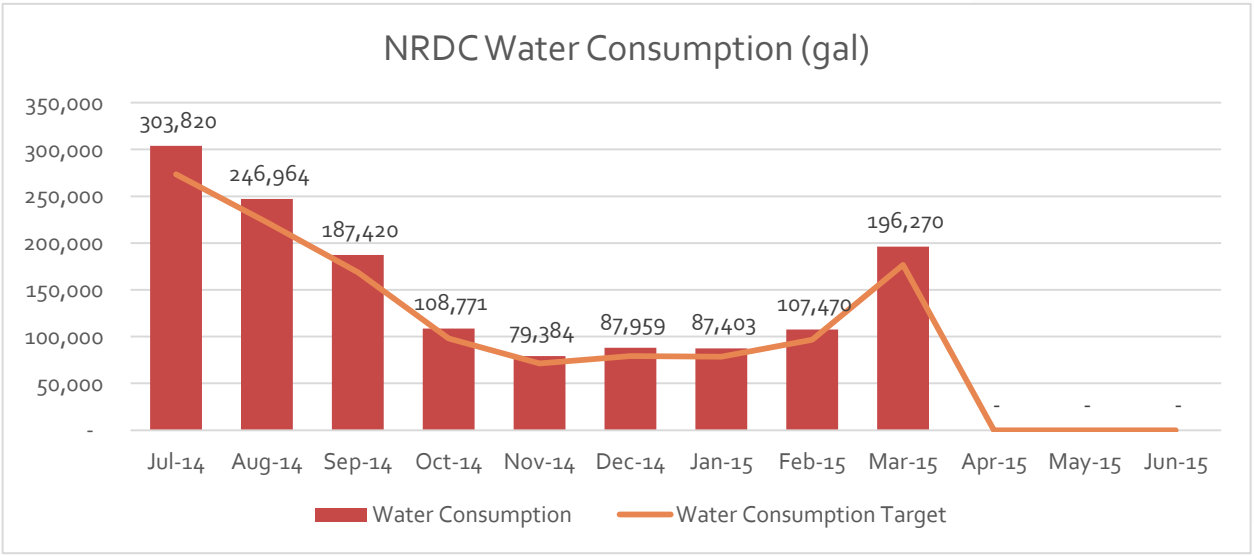
**GSF = Gross Square Footage*

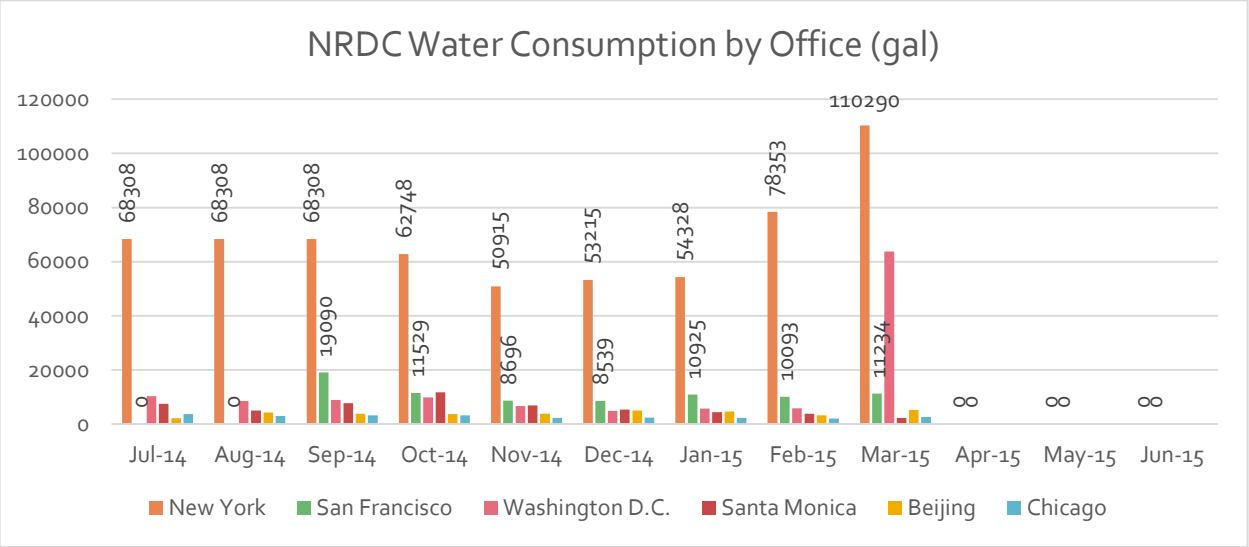
Appendix I- *Database Tool Outputs per NRDC Facility*

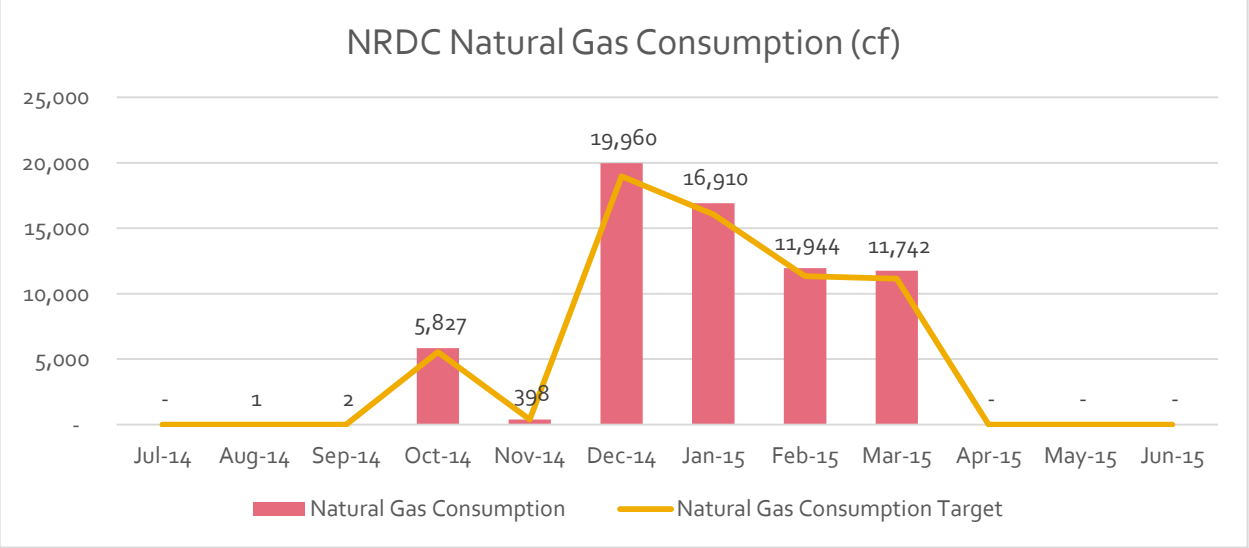
Total NRDC

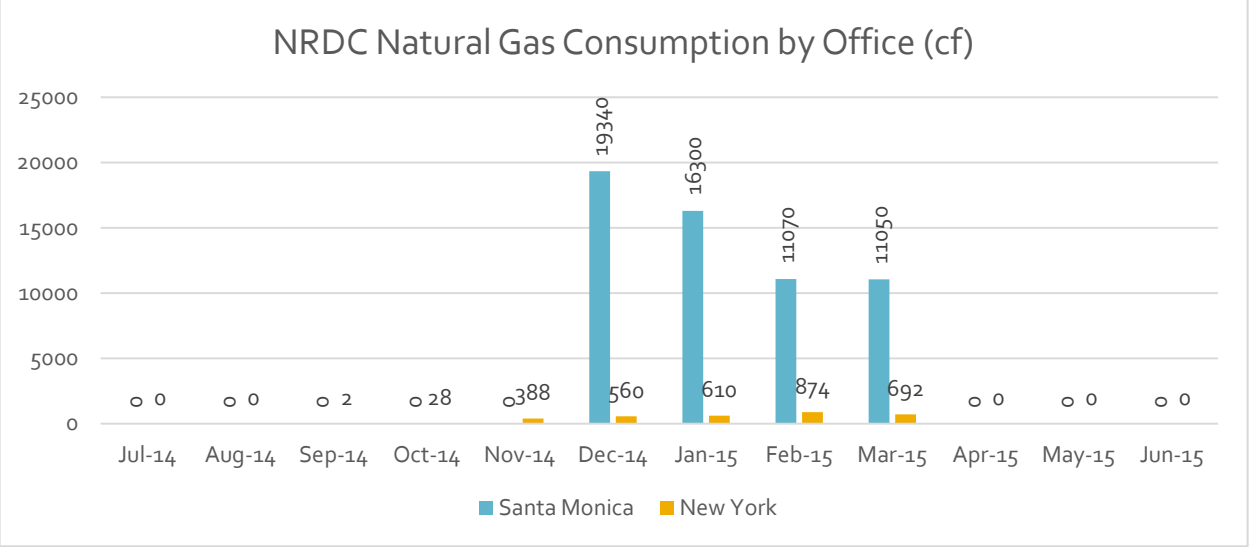


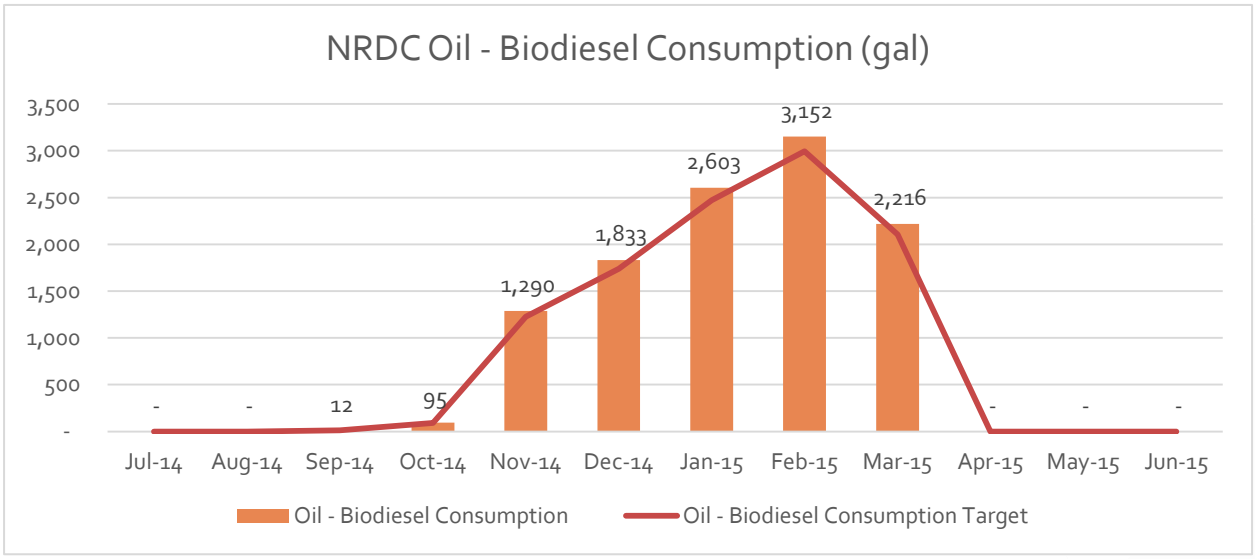




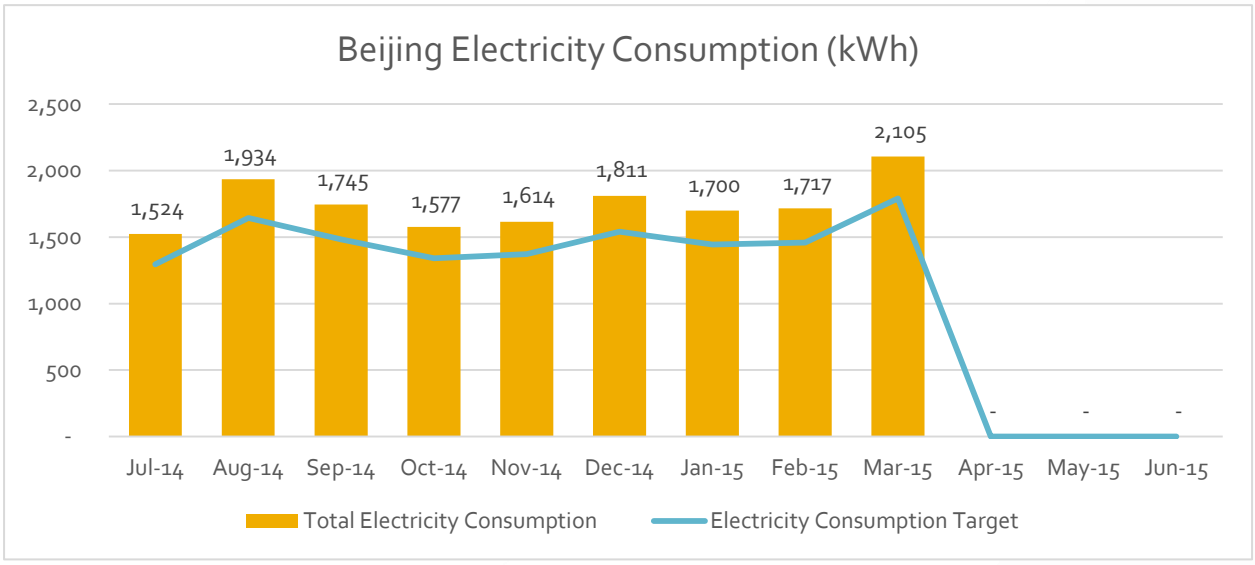

NRDC Water Consumption by Office (gal)
120000
100000
80000
60000
40000
20000
0
68308
0
68308
0
68308
19090
62748
11529
50915
8696
53215
8539
54328
10925
78353
10093
110290
11234
8
8
8
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
New York
San Francisco
Washington D.C.
Santa Monica
Beijing
Chicago

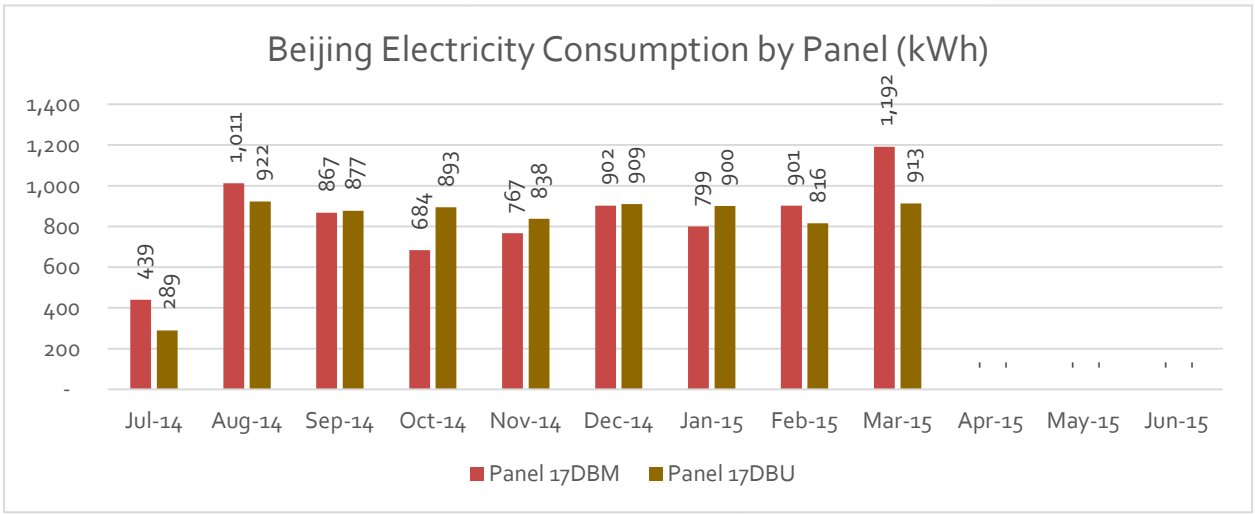

NRDC Natural Gas Consumption (cf)
25,000
20,000
15,000
10,000
5,000
-
-
1
2
5,827
398
19,960
16,910
11,944
11,742
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Natural Gas Consumption
Natural Gas Consumption Target

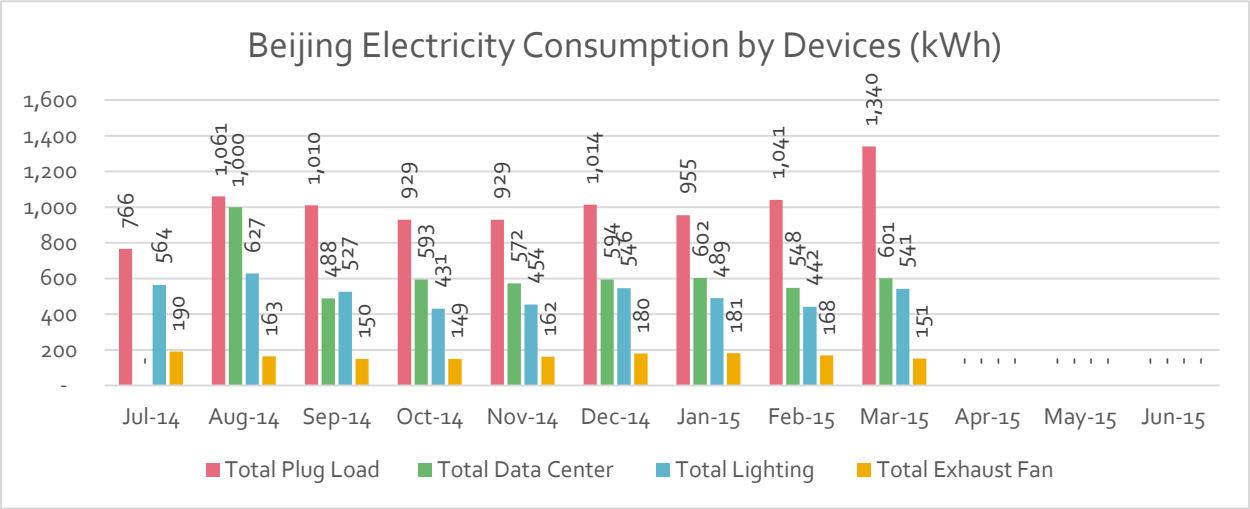

NRDC Natural Gas Consumption by Office (cf)
25000
20000
15000
10000
5000
0
0
0
0
0
0
2
0
28
0
388
19340
560
16300
610
11070
874
11050
692
0
0
0
0
0
0
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Santa Monica
New York

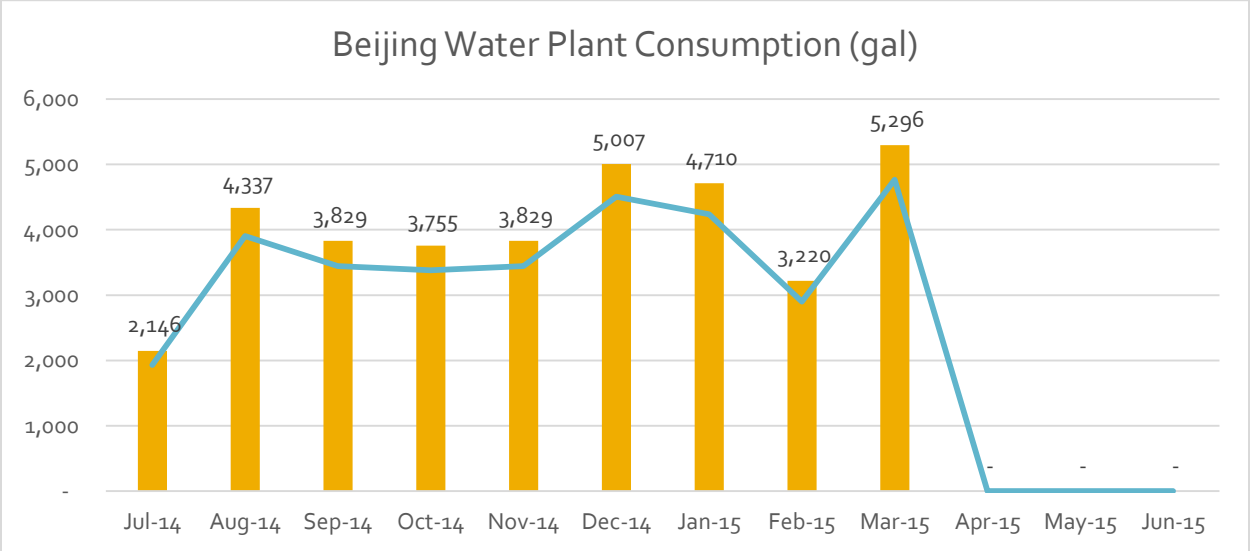

NRDC Oil - Biodiesel Consumption (gal)
3,500
3,000
2,500
2,000
1,500
1,000
500
-
- - 12 95 1,290 1,833 2,603 3,152 2,216 - - -
Jul-14 Aug-14 Sep-14 Oct-14 Nov-14 Dec-14 Jan-15 Feb-15 Mar-15 Apr-15 May-15 Jun-15
Oil - Biodiesel Consumption
Oil - Biodiesel Consumption Target

Beijing

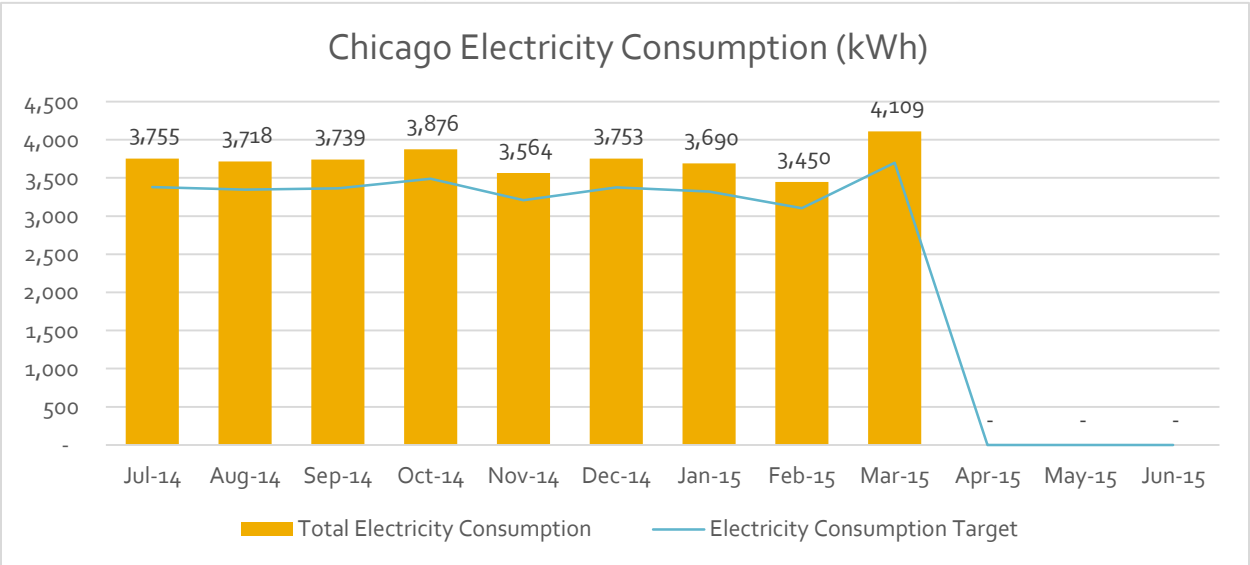

Beijing Electricity Consumption (kWh)
2,500
2,000
1,500
1,000
500
-
1,524 1,934 1,745 1,577 1,614 1,811 1,700 1,717 2,105 - - -
Jul-14 Aug-14 Sep-14 Oct-14 Nov-14 Dec-14 Jan-15 Feb-15 Mar-15 Apr-15 May-15 Jun-15
Total Electricity Consumption
Electricity Consumption Target

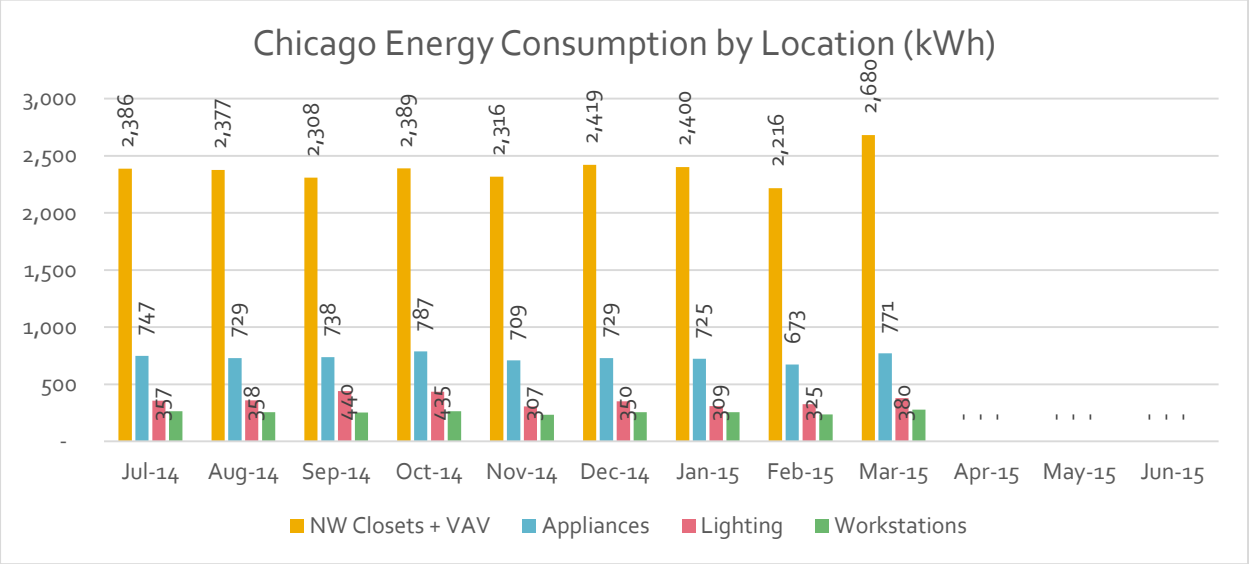

Beijing Electricity Consumption by Panel (kWh)
1,400
1,200
1,000
800
600
400
200
-
439 289 1,011 922 867 877 684 893 767 838 902 909 799 900 901 816 1,192 913 - - - - - -
Jul-14 Aug-14 Sep-14 Oct-14 Nov-14 Dec-14 Jan-15 Feb-15 Mar-15 Apr-15 May-15 Jun-15
Panel 17DBM
Panel 17DBU

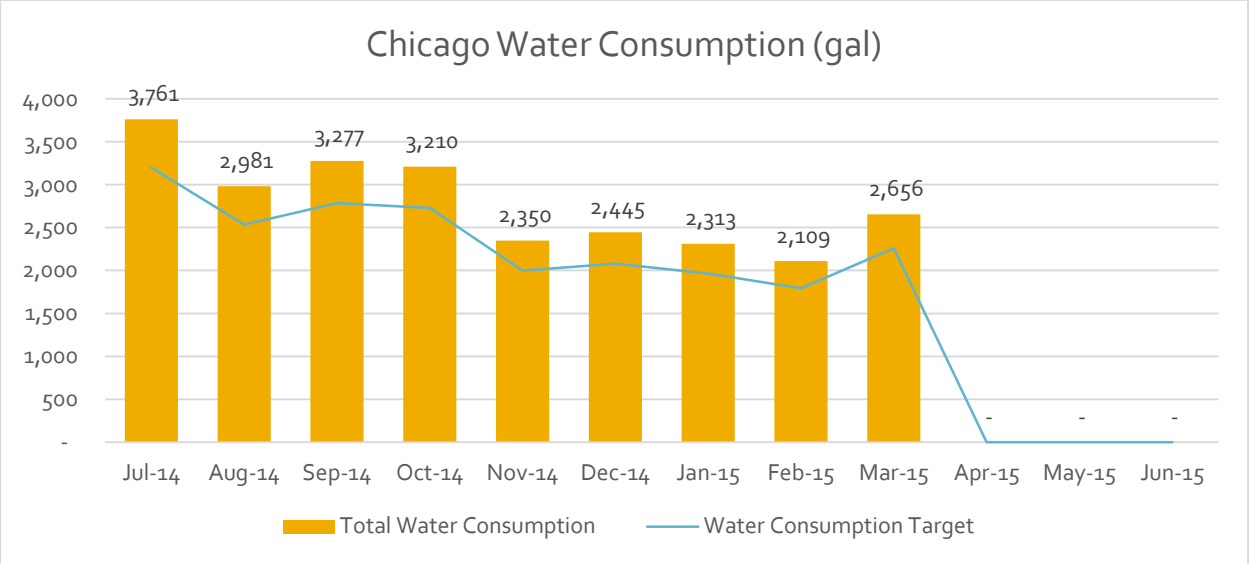

Beijing Electricity Consumption by Devices (kWh)
1,600
1,400
1,200
1,000
800
600
400
200
-
766
-
564
190
1,061
1,000
627
163
1,010
488
527
150
929
593
431
149
929
572
454
162
1,014
594
546
180
955
602
489
181
1,041
548
442
168
1,340
601
541
151
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total Plug Load
Total Data Center
Total Lighting
Total Exhaust Fan


Beijing Water Plant Consumption (gal)
6,000
5,000
4,000
3,000
2,000
1,000
-
2,146
4,337
3,829
3,755
3,829
5,007
4,710
3,220
5,296
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15

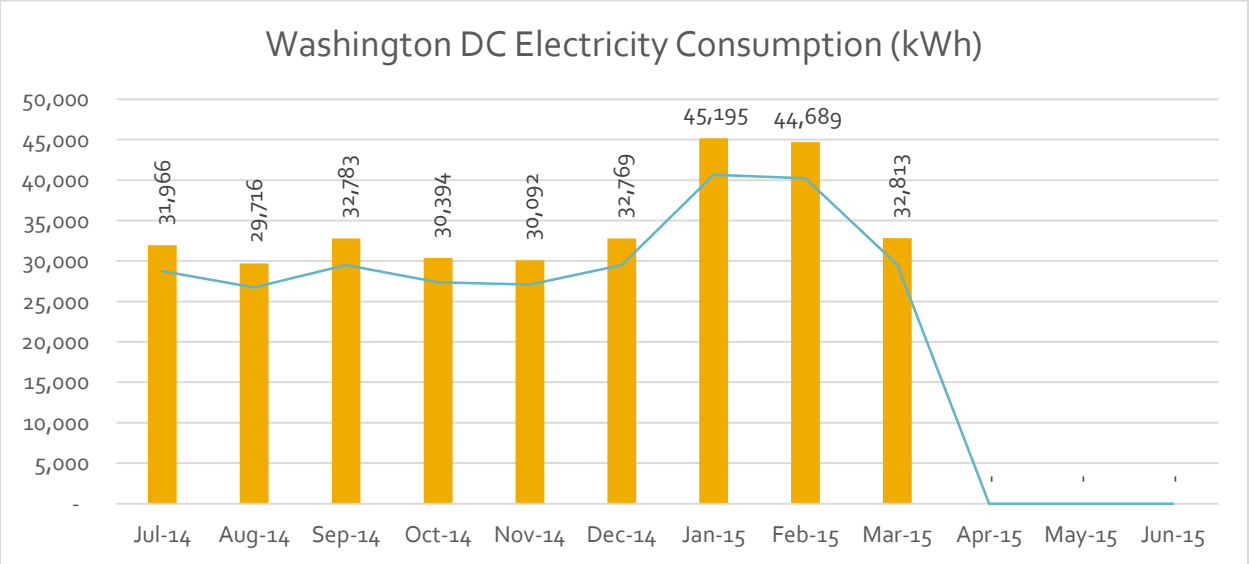
Chicago

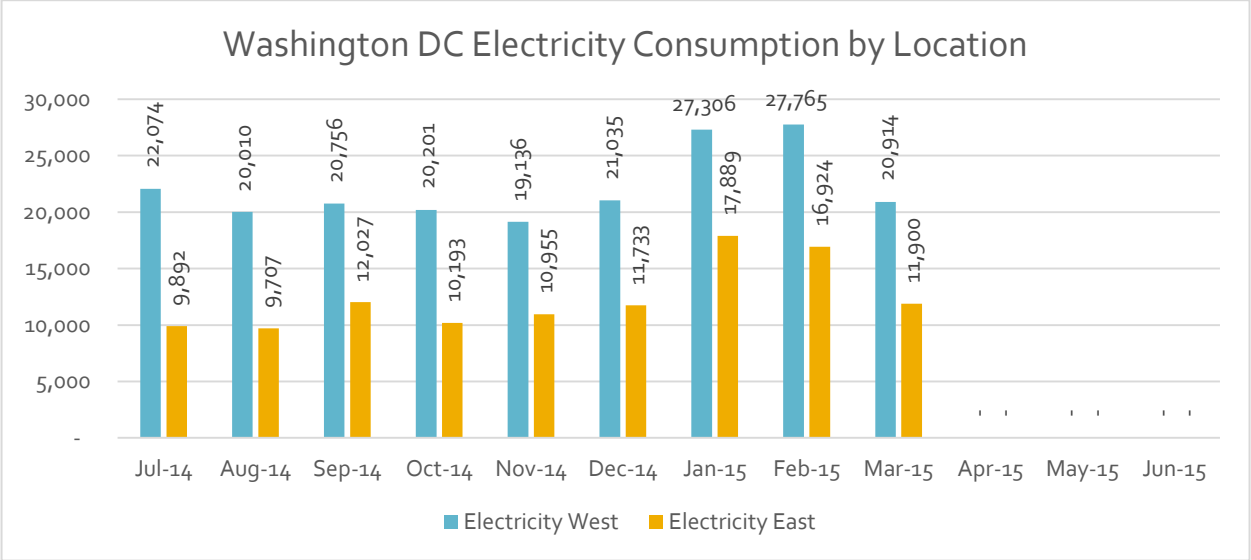

Chicago Electricity Consumption (kWh)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
-
3,755
3,718
3,739
3,876
3,564
3,753
3,690
3,450
4,109
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total Electricity Consumption
Electricity Consumption Target

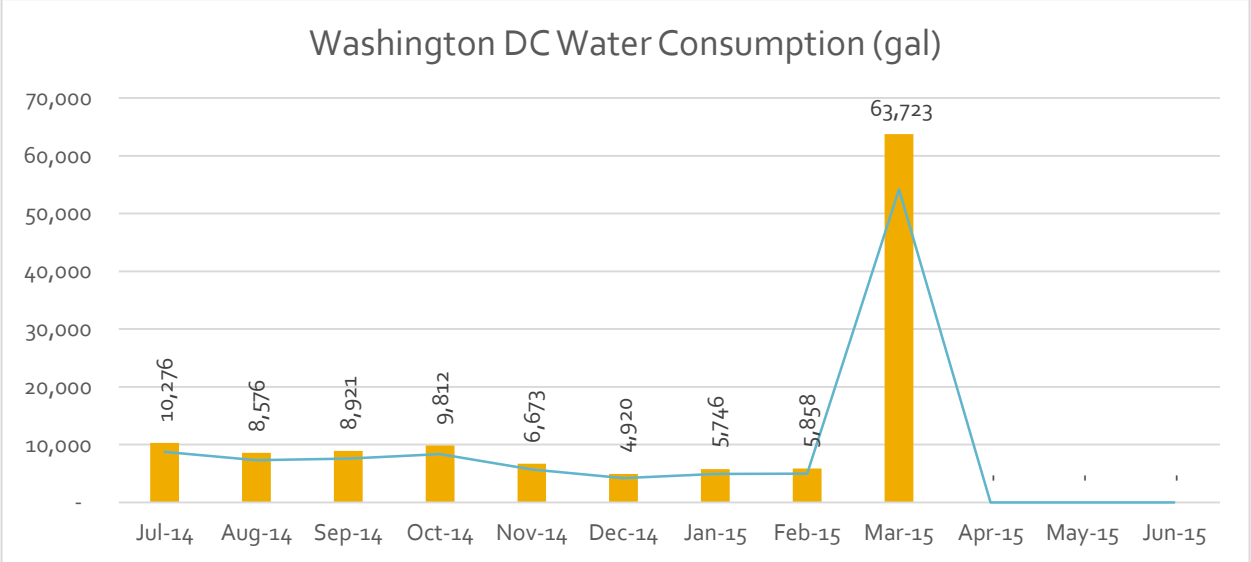


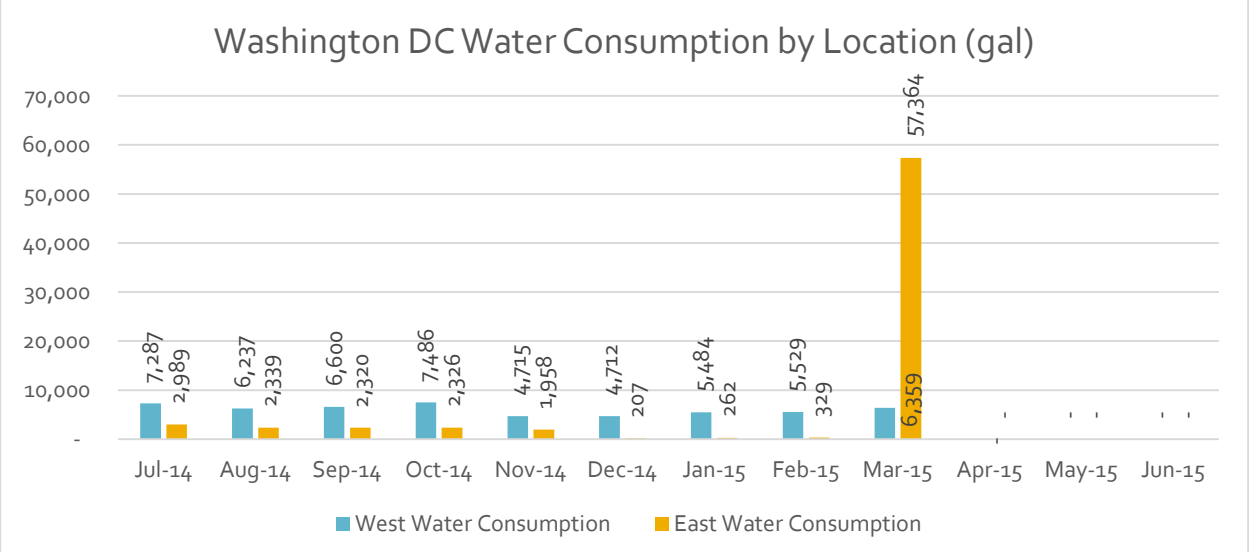


Washington D.C.

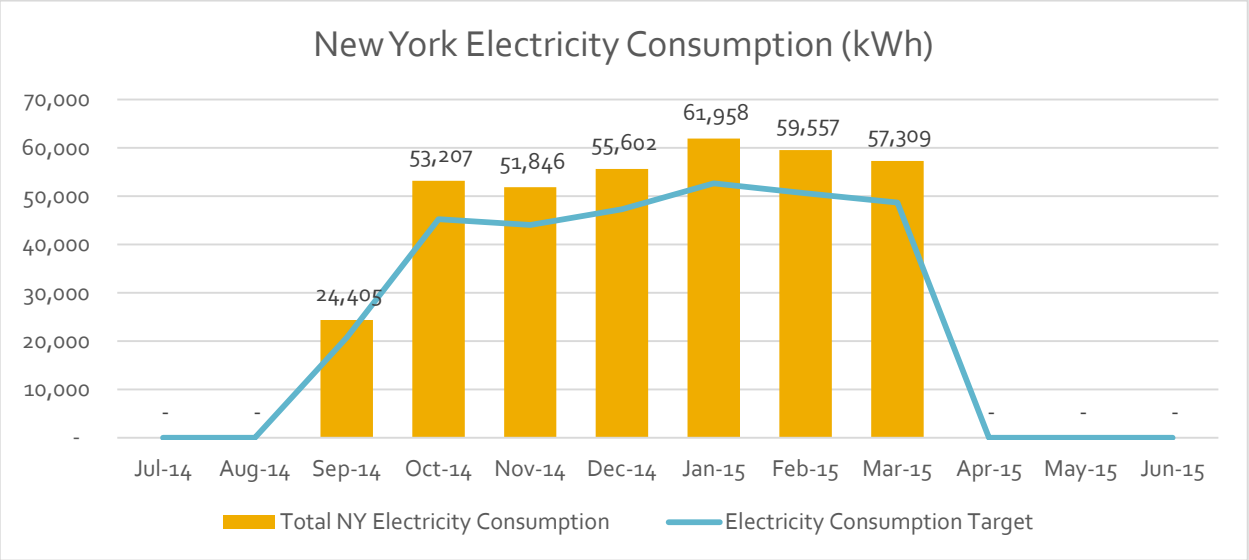


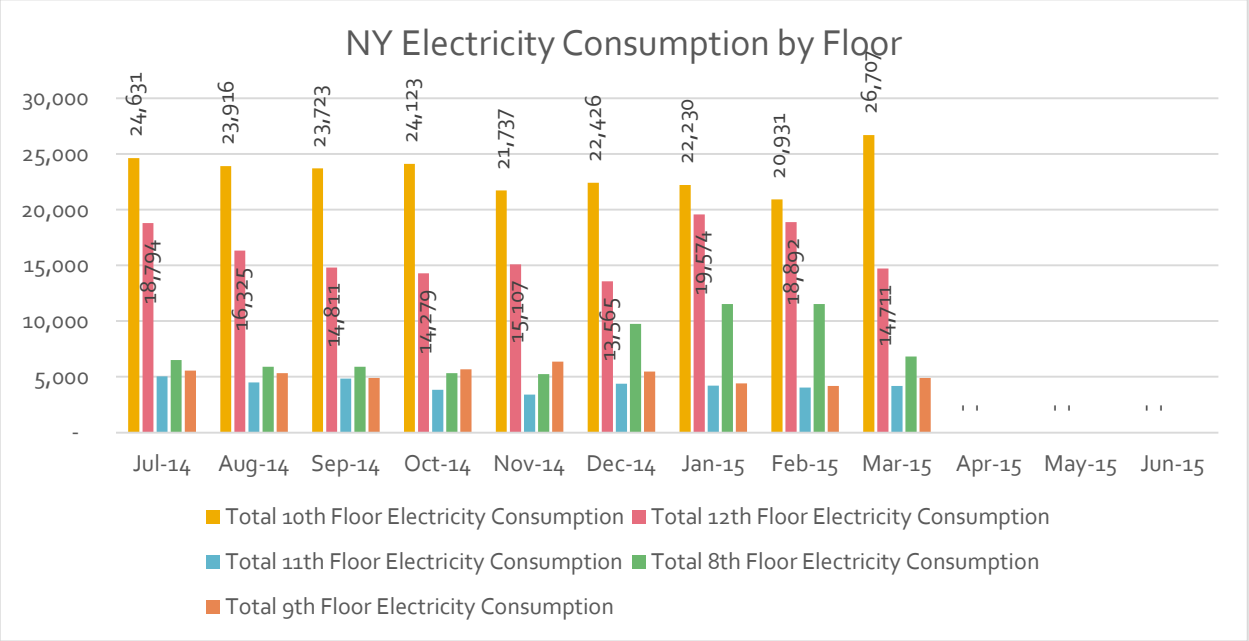

Washington DC Electricity Consumption by Location
30,000
25,000
20,000
15,000
10,000
5,000
-
22,074
9,892
20,010
9,707
20,756
12,027
20,201
10,193
19,136
10,955
21,035
11,733
27,306
17,889
27,765
16,924
20,914
11,900
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Electricity West
Electricity East

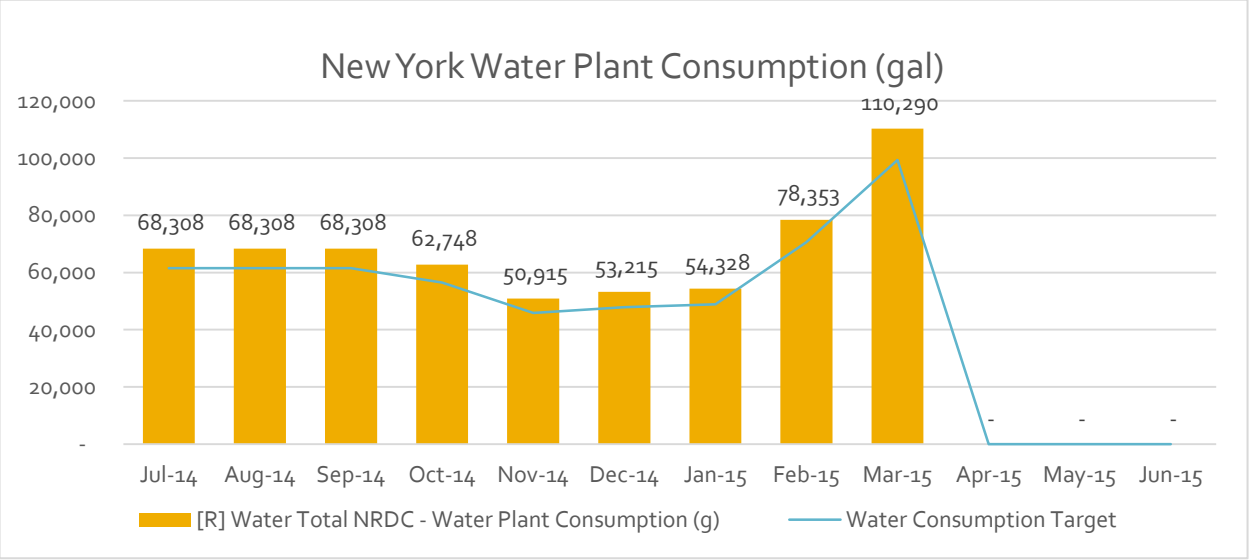

Washington DC Water Consumption (gal)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
10,276
8,576
8,921
9,812
6,673
4,920
5,746
5,858
63,723
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15

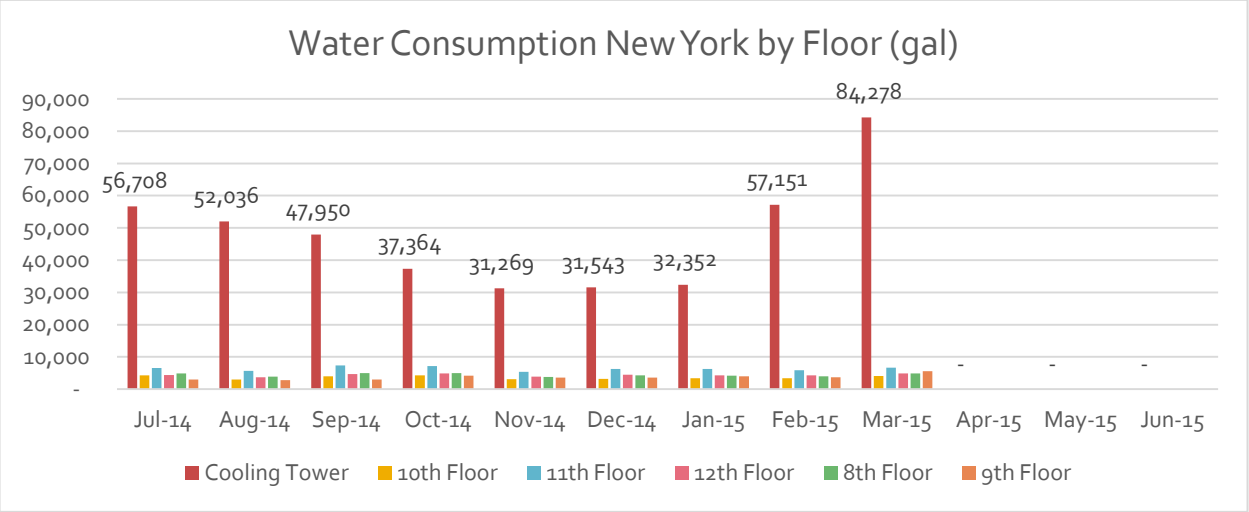

Washington DC Water Consumption by Location (gal)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
7,287
2,989
6,237
2,339
6,600
2,320
7,486
2,326
4,715
1,958
4,712
207
5,484
262
5,529
329
57,364
6,359
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
West Water Consumption
East Water Consumption

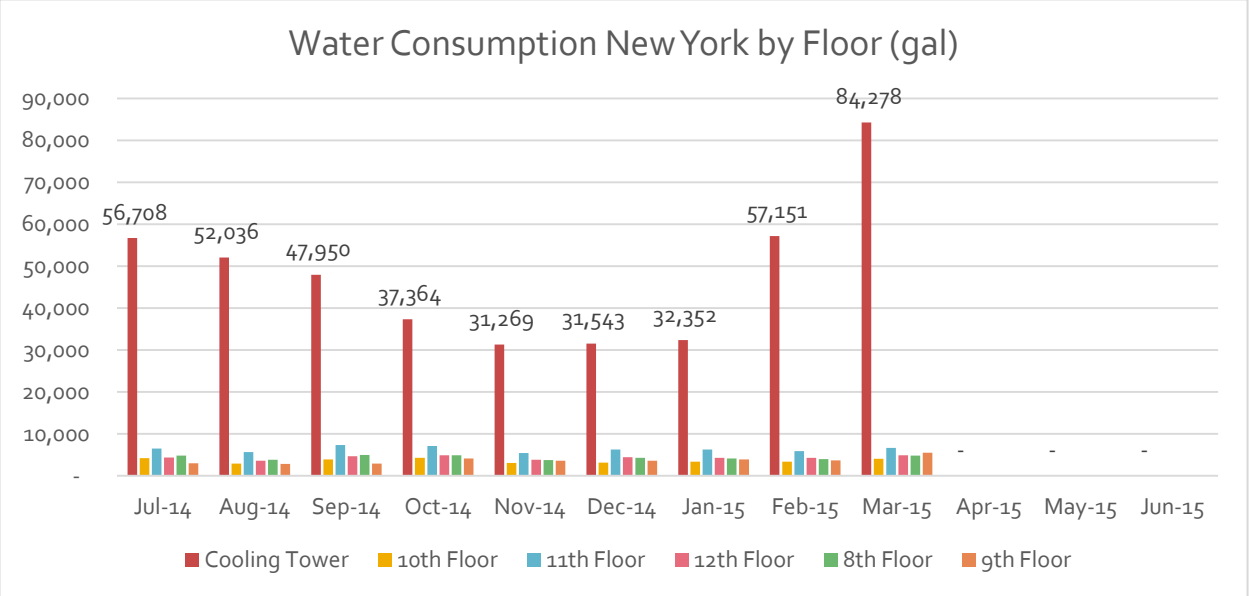
New York

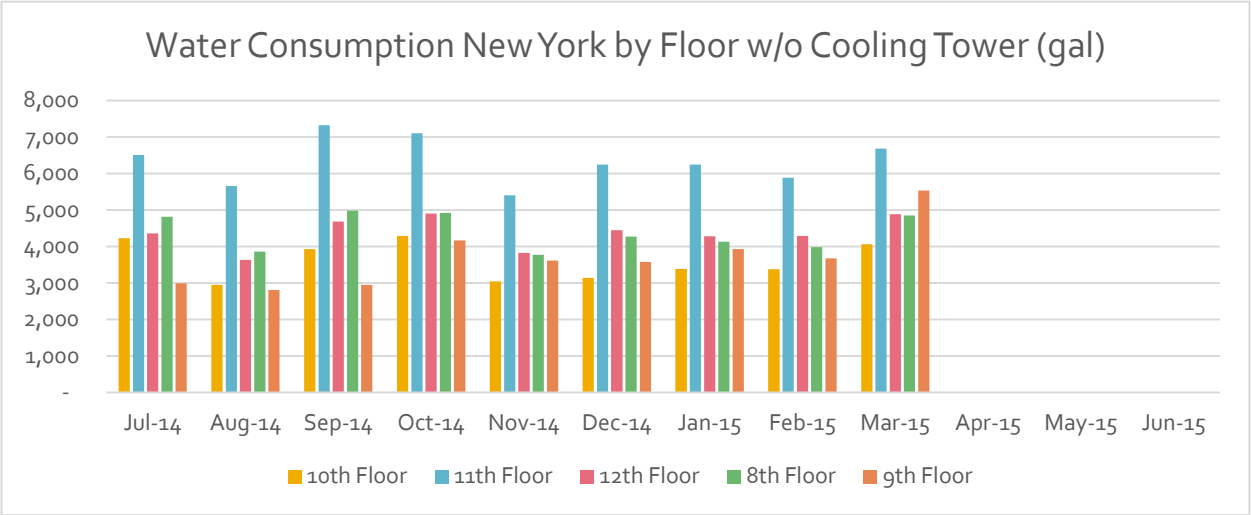

New York Electricity Consumption (kWh)
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
24,405
53,207
51,846
55,602
61,958
59,557
57,309
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total NY Electricity Consumption
Electricity Consumption Target

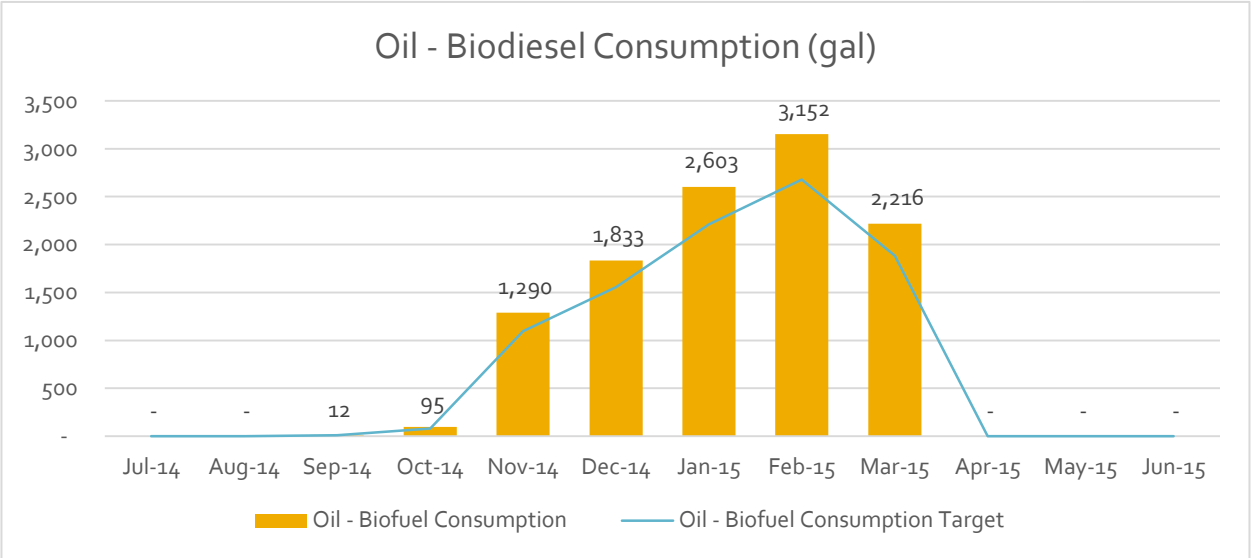

NY Electricity Consumption by Floor
30,000
25,000
20,000
15,000
10,000
5,000
-
24,631
18,794
23,916
16,325
23,723
14,811
24,123
14,279
21,737
15,107
22,426
13,565
22,230
19,574
20,931
18,892
26,707
14,711
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total 10th Floor Electricity Consumption
Total 12th Floor Electricity Consumption
Total 11th Floor Electricity Consumption
Total 8th Floor Electricity Consumption
Total 9th Floor Electricity Consumption

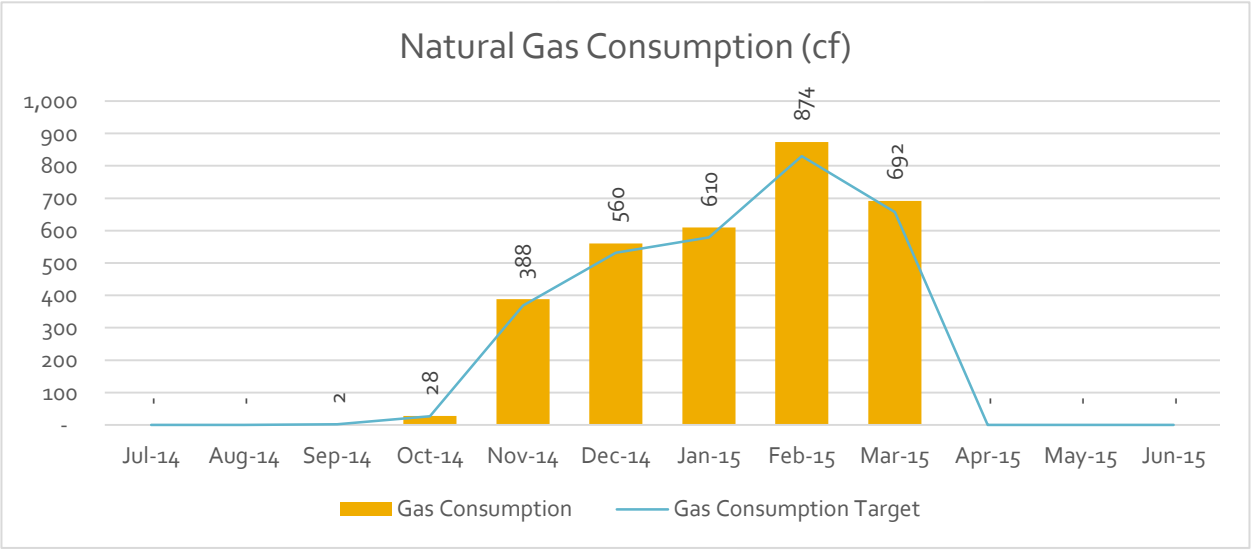

New York Water Plant Consumption (gal)
120,000
100,000
80,000
60,000
40,000
20,000
-
68,308
68,308
68,308
62,748
50,915
53,215
54,328
78,353
110,290
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
[R] Water Total NRDC - Water Plant Consumption (g)
Water Consumption Target


Water Consumption New York by Floor (gal)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
56,708
52,036
47,950
37,364
31,269
31,543
32,352
57,151
84,278
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Cooling Tower
10th Floor
11th Floor
12th Floor
8th Floor
9th Floor

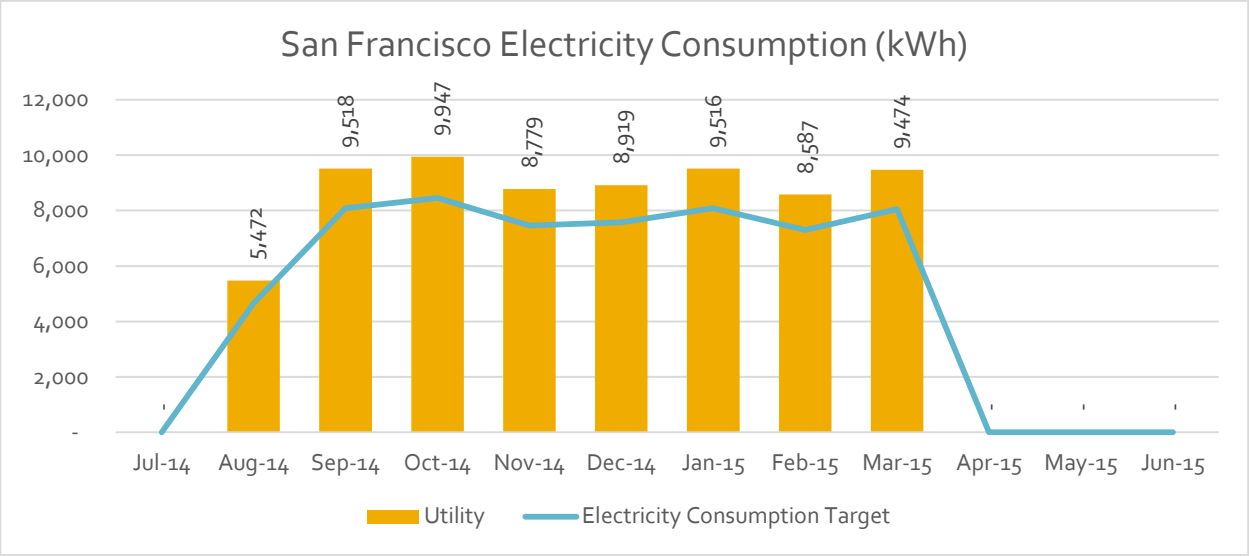

Water Consumption New York by Floor (gal)
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
56,708
52,036
47,950
37,364
31,269
31,543
32,352
57,151
84,278
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Cooling Tower
10th Floor
11th Floor
12th Floor
8th Floor
9th Floor

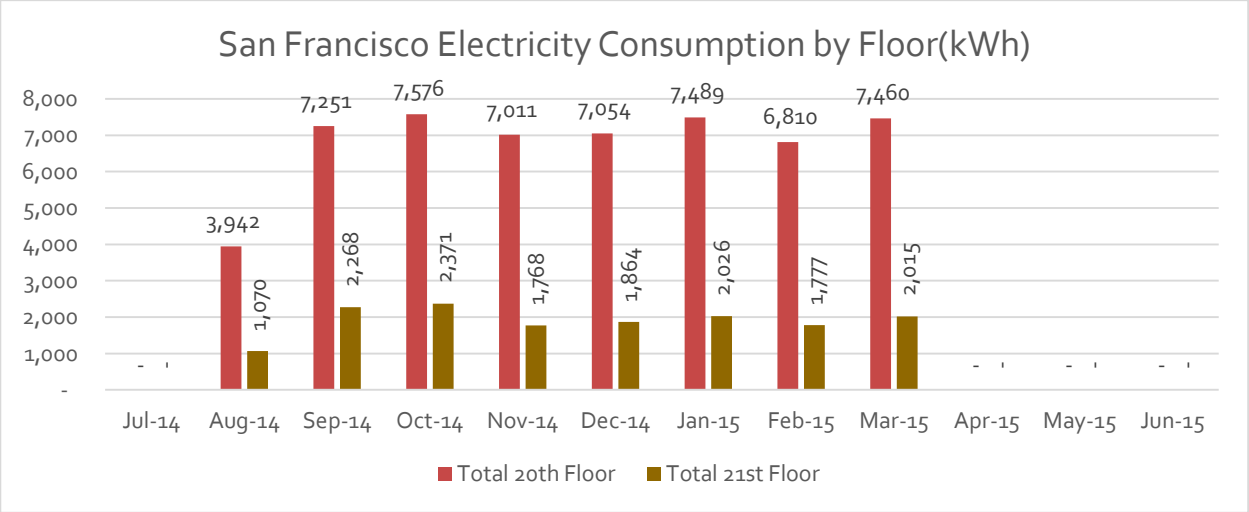

Water Consumption New York by Floor w/o Cooling Tower (gal)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
10th Floor
11th Floor
12th Floor
8th Floor
9th Floor

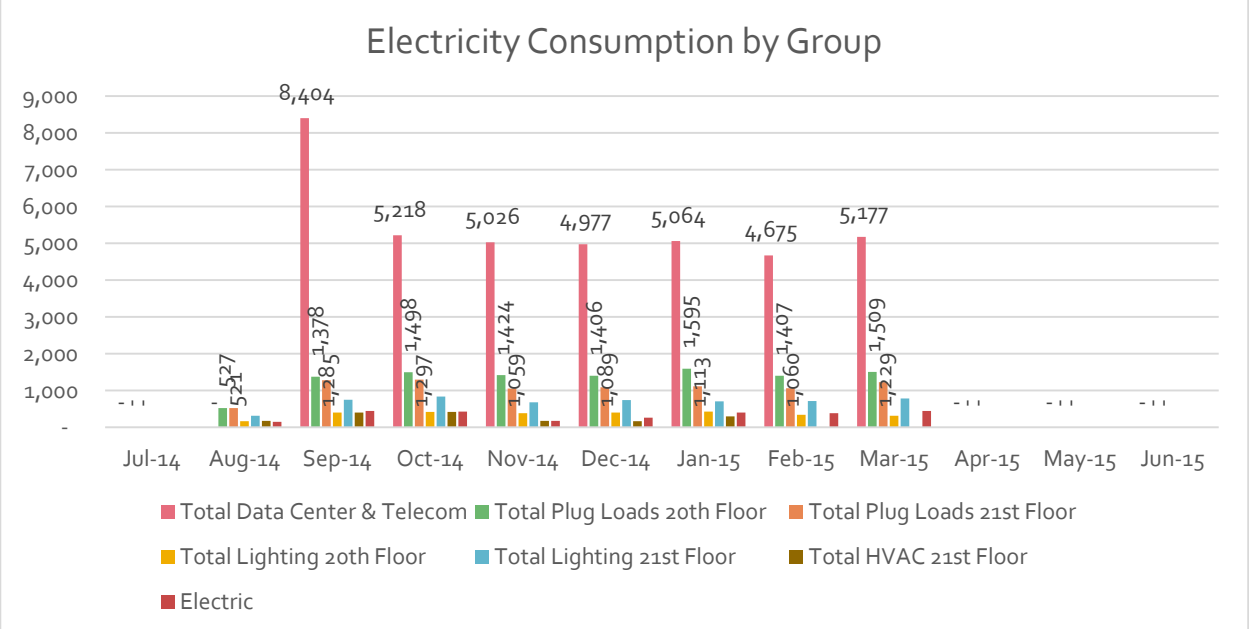

Oil - Biodiesel Consumption (gal)
3,500
3,000
2,500
2,000
1,500
1,000
500
-
-
-
12
95
1,290
1,833
2,603
3,152
2,216
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Oil - Biofuel Consumption
Oil - Biofuel Consumption Target

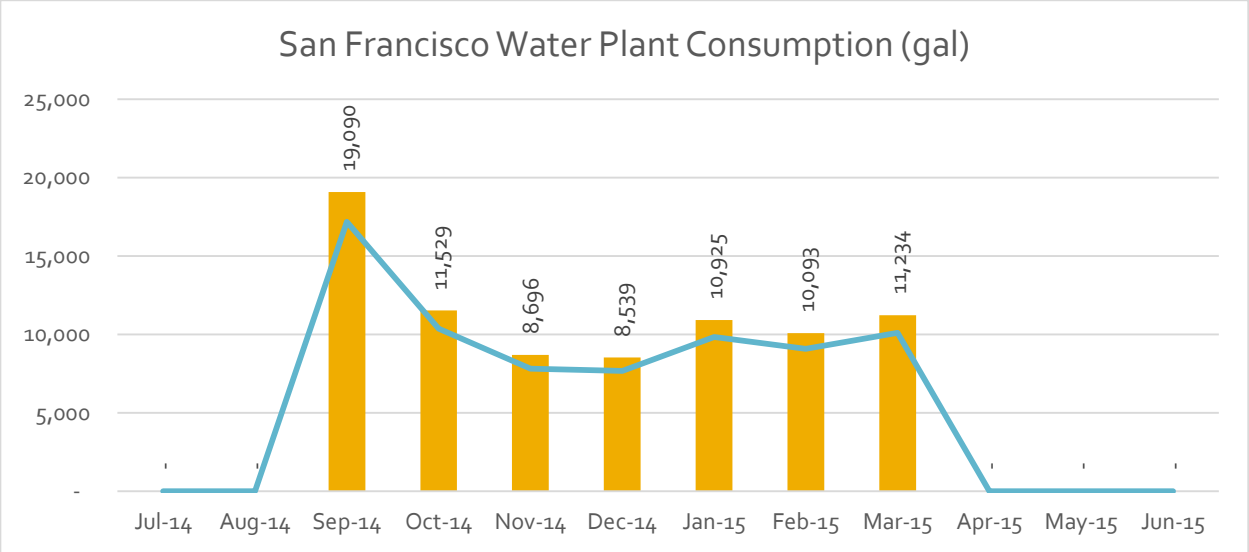

Natural Gas Consumption (cf)
1,000
900
800
700
600
500
400
300
200
100
-
-
-
2
28
388
560
610
874
692
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Gas Consumption
Gas Consumption Target

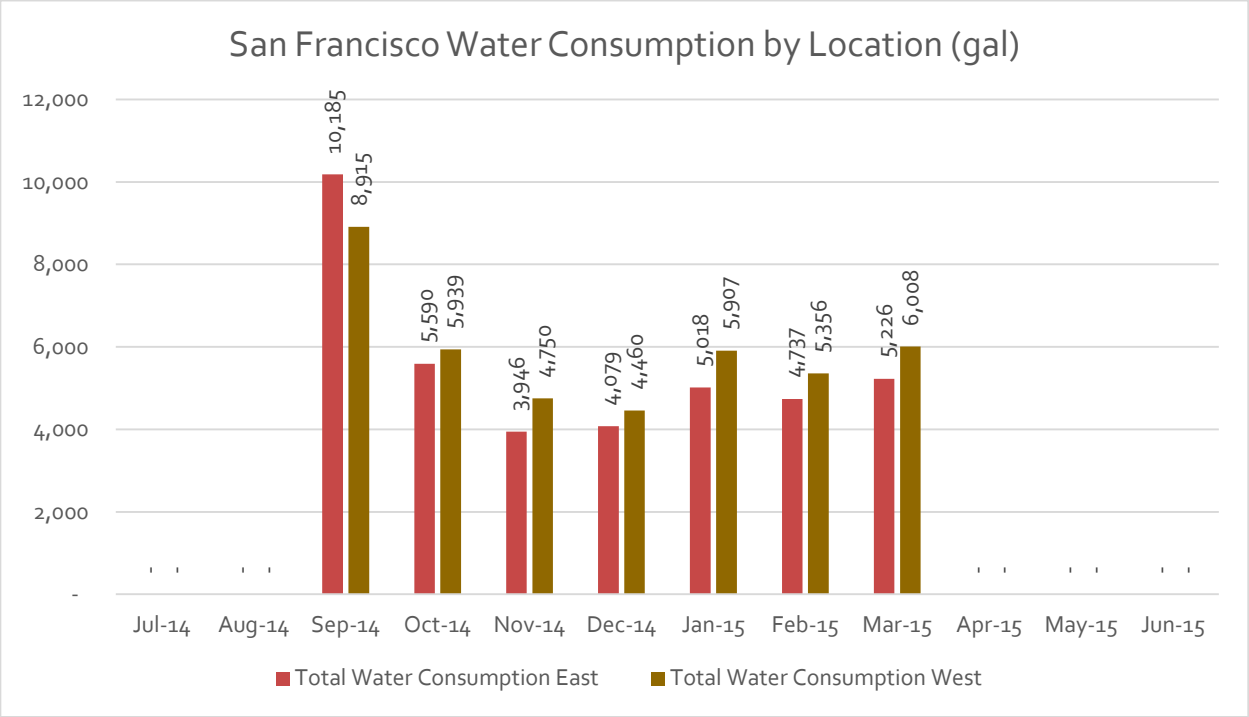
San Francisco



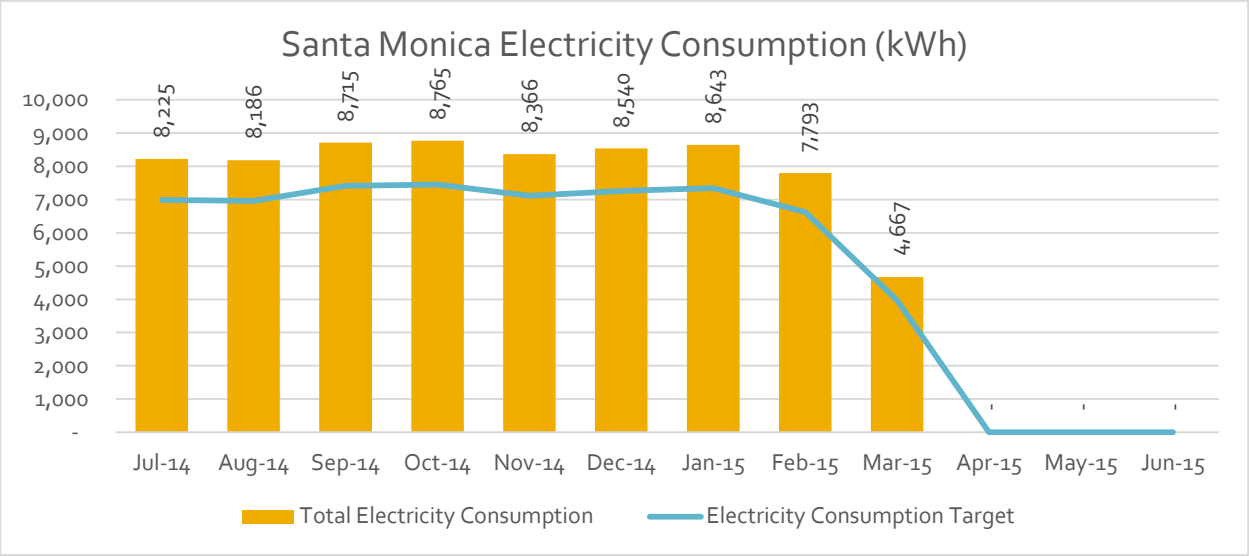


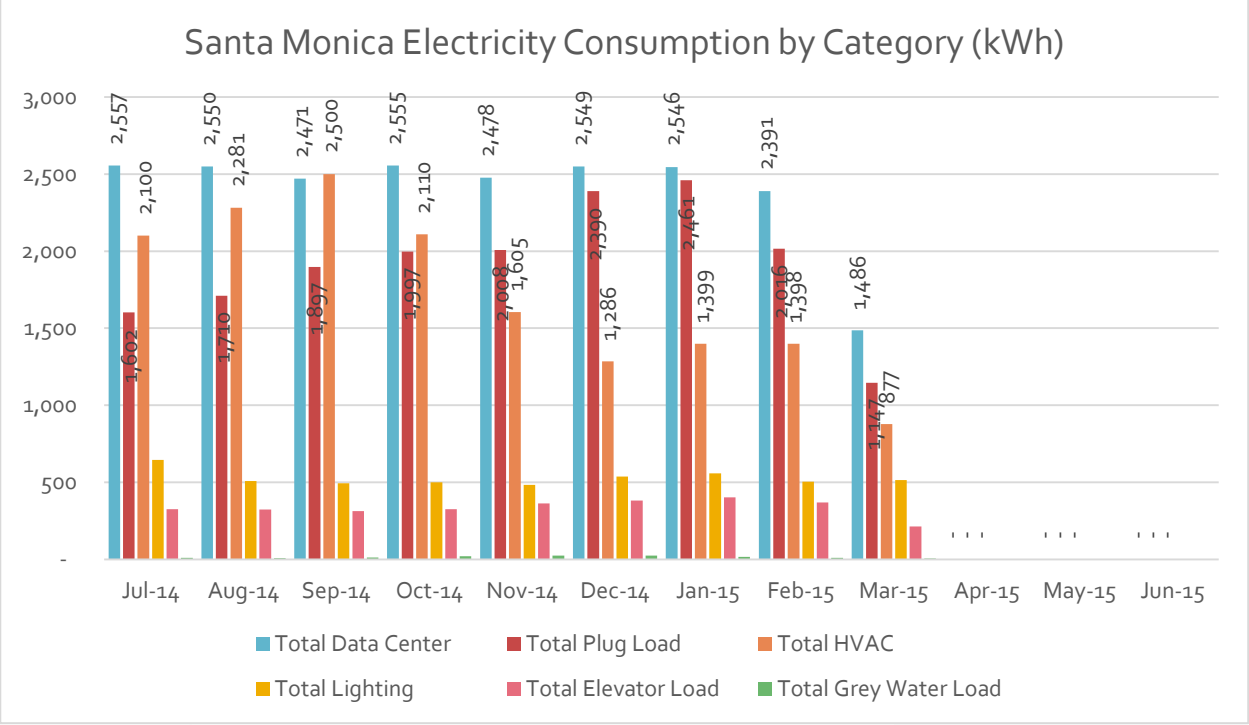


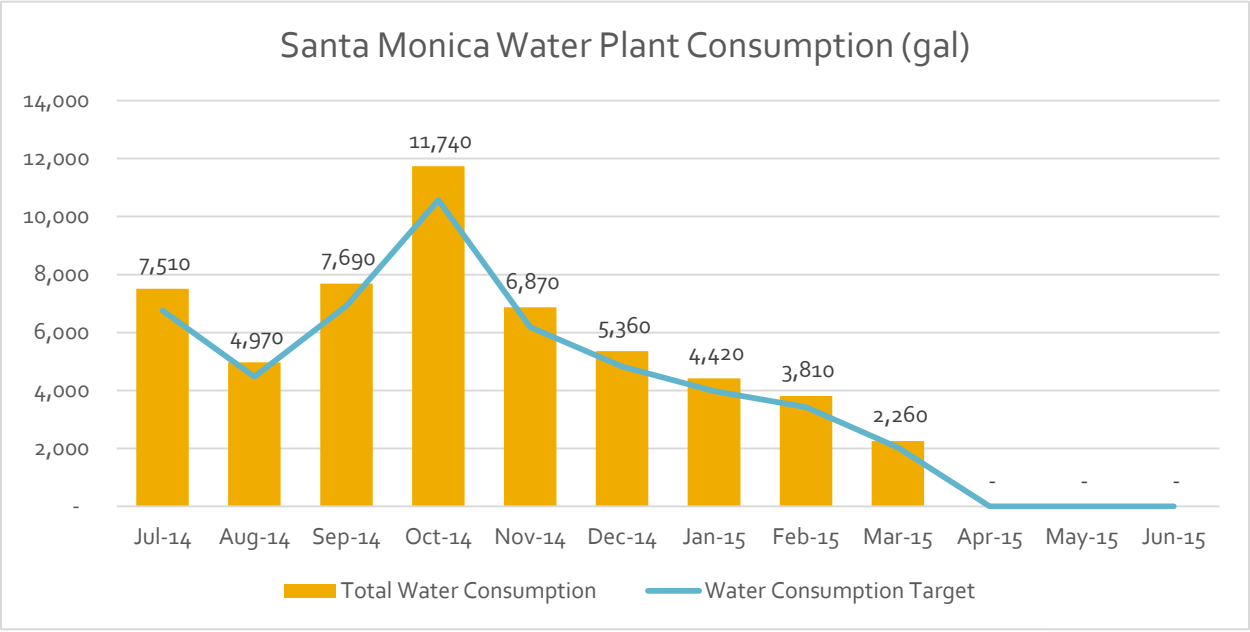

San Francisco Water Plant Consumption (gal)
25,000
20,000
15,000
10,000
5,000
-
19,090
11,529
8,696
8,539
10,925
10,093
11,234
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15

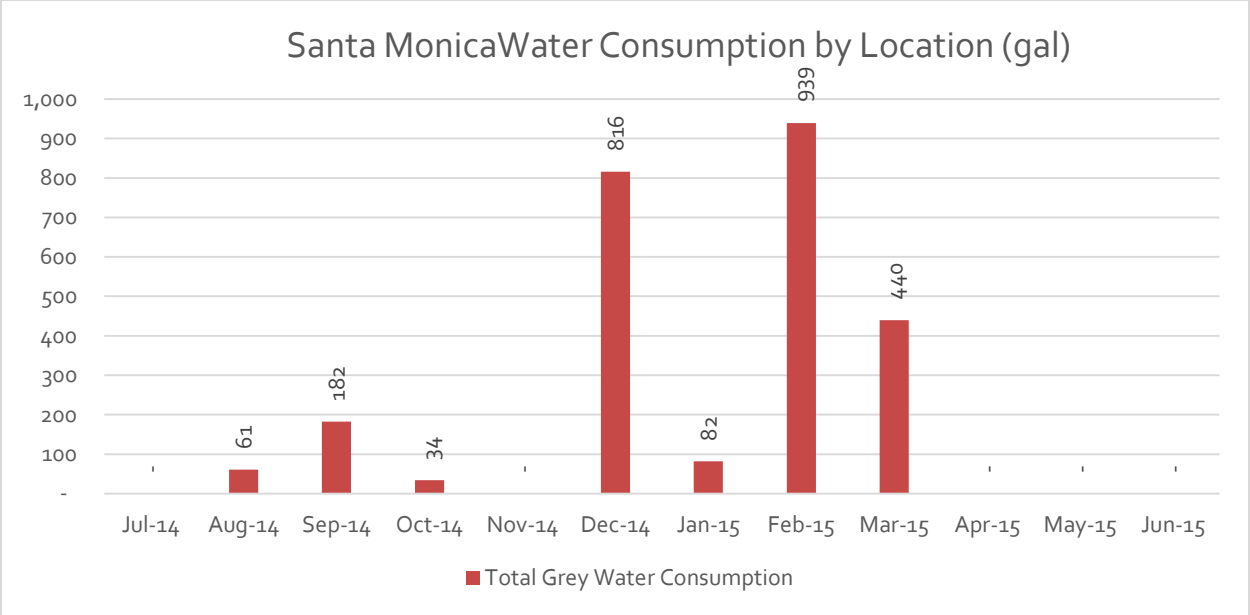

San Francisco Water Consumption by Location (gal)
12,000
10,000
8,000
6,000
4,000
2,000
-
10,185
8,915
5,590
5,939
3,946
4,750
4,079
4,460
5,018
5,907
4,737
5,356
5,226
6,008
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total Water Consumption East
Total Water Consumption West

Santa Monica



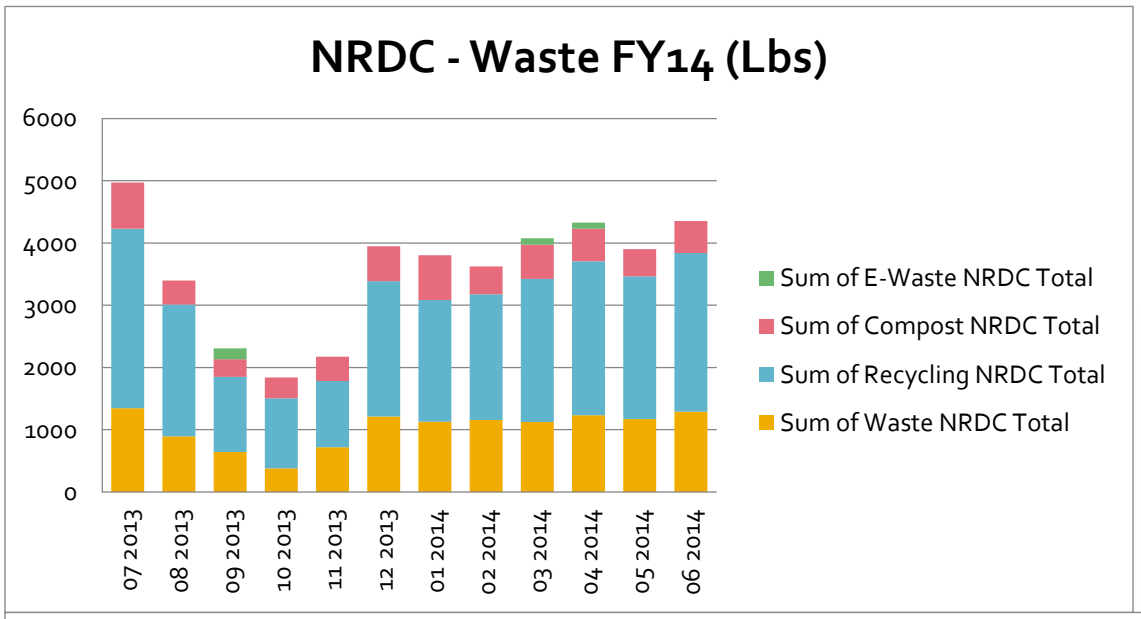


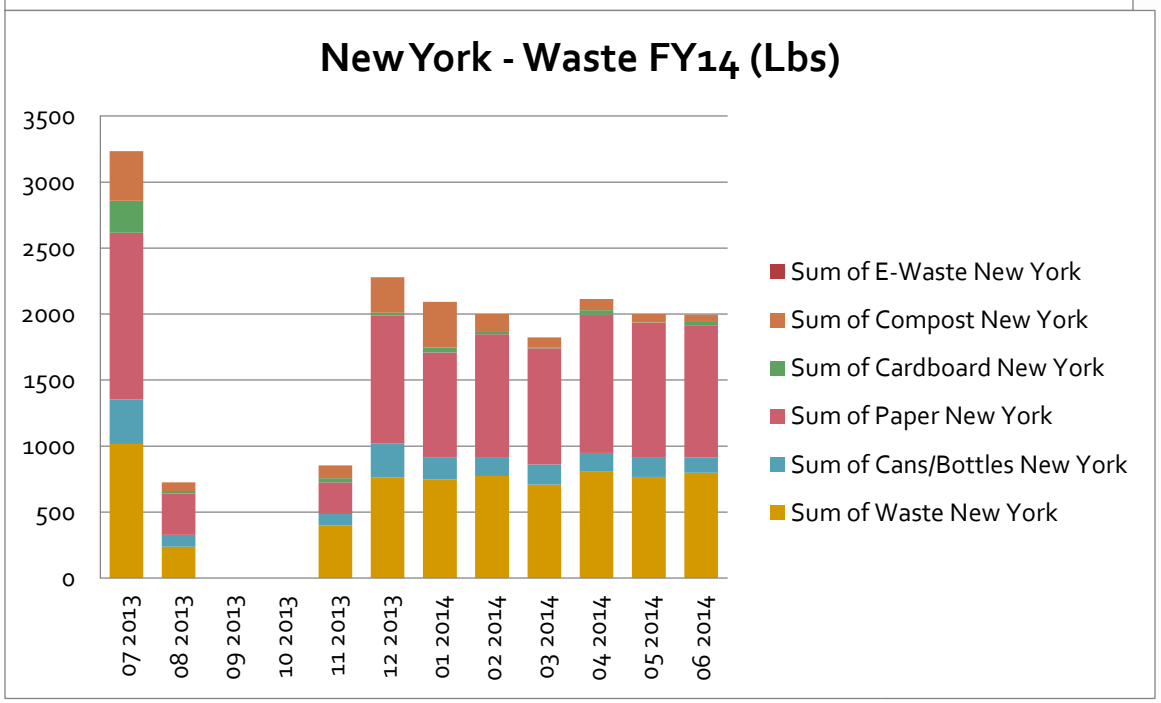

Santa Monica Water Plant Consumption (gal)
14,000
12,000
10,000
8,000
6,000
4,000
2,000
-
7,510
4,970
7,690
11,740
6,870
5,360
4,420
3,810
2,260
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total Water Consumption
Water Consumption Target

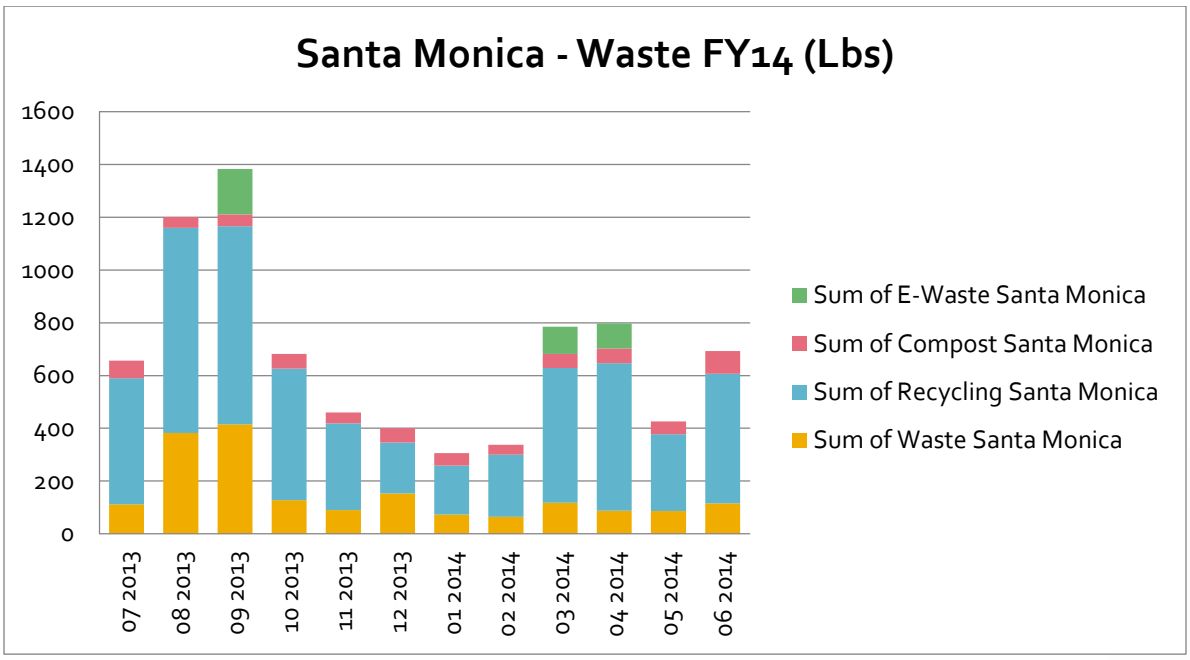

Santa MonicaWater Consumption by Location (gal)
1,000
900
800
700
600
500
400
300
200
100
-
-
61
182
34
-
816
82
939
440
-
-
-
Jul-14
Aug-14
Sep-14
Oct-14
Nov-14
Dec-14
Jan-15
Feb-15
Mar-15
Apr-15
May-15
Jun-15
Total Grey Water Consumption

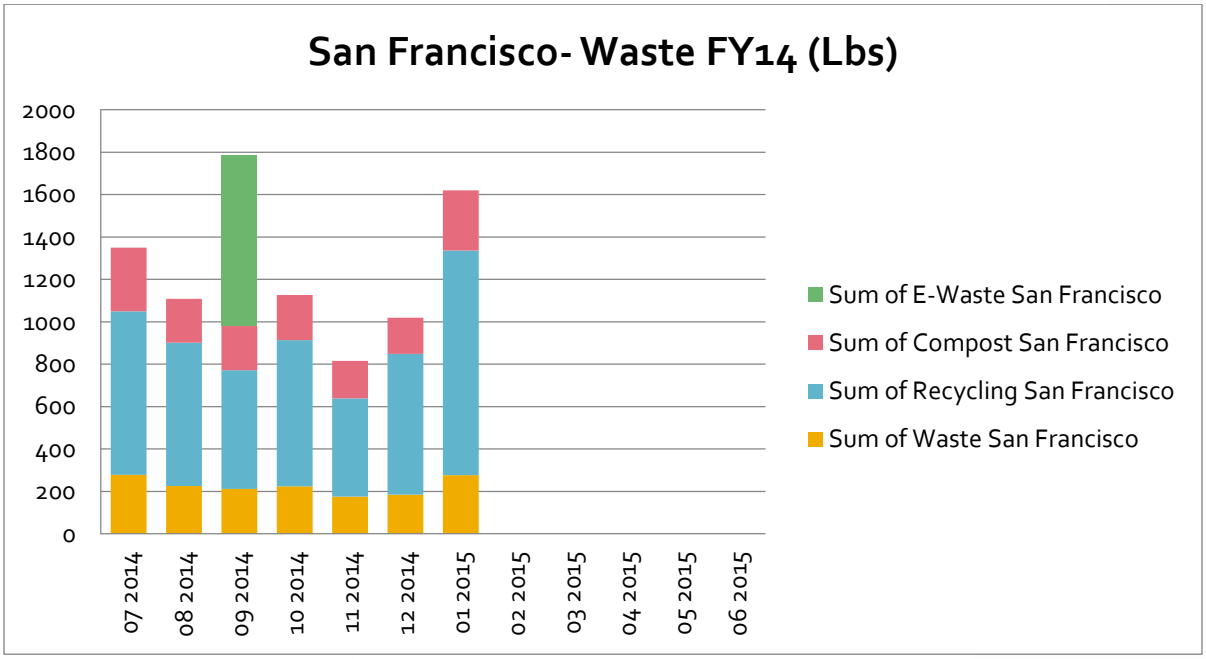
Appendix J- *Waste Reports Generated via NRDC Manual Excel File*

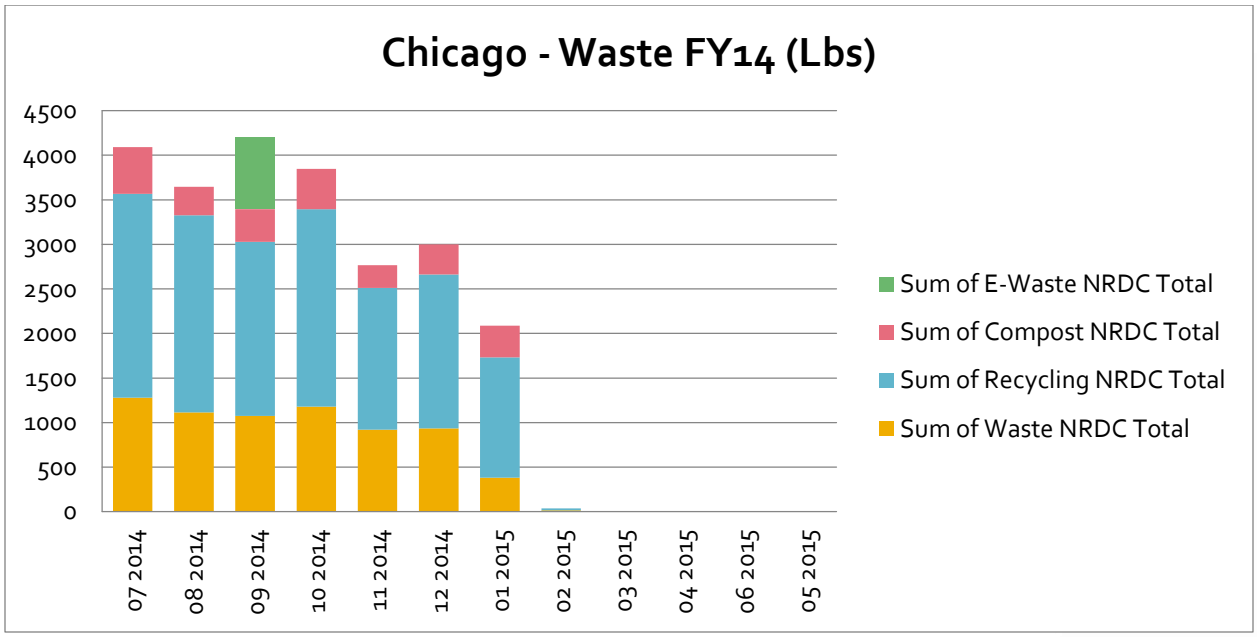
Fiscal Year 2014

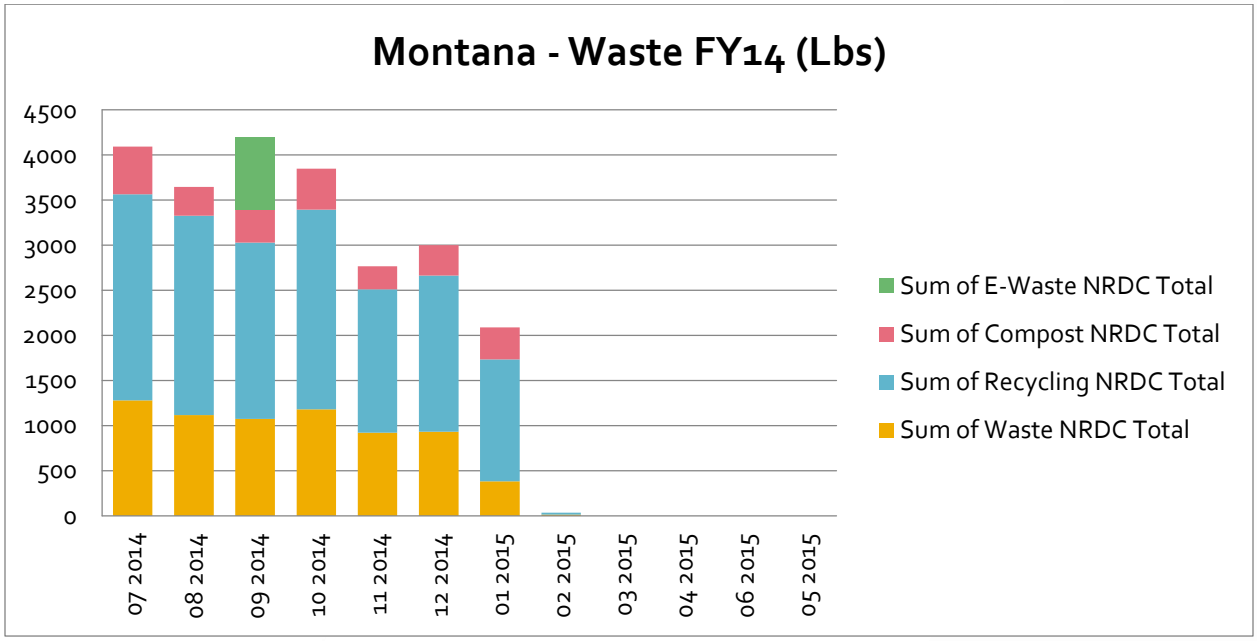




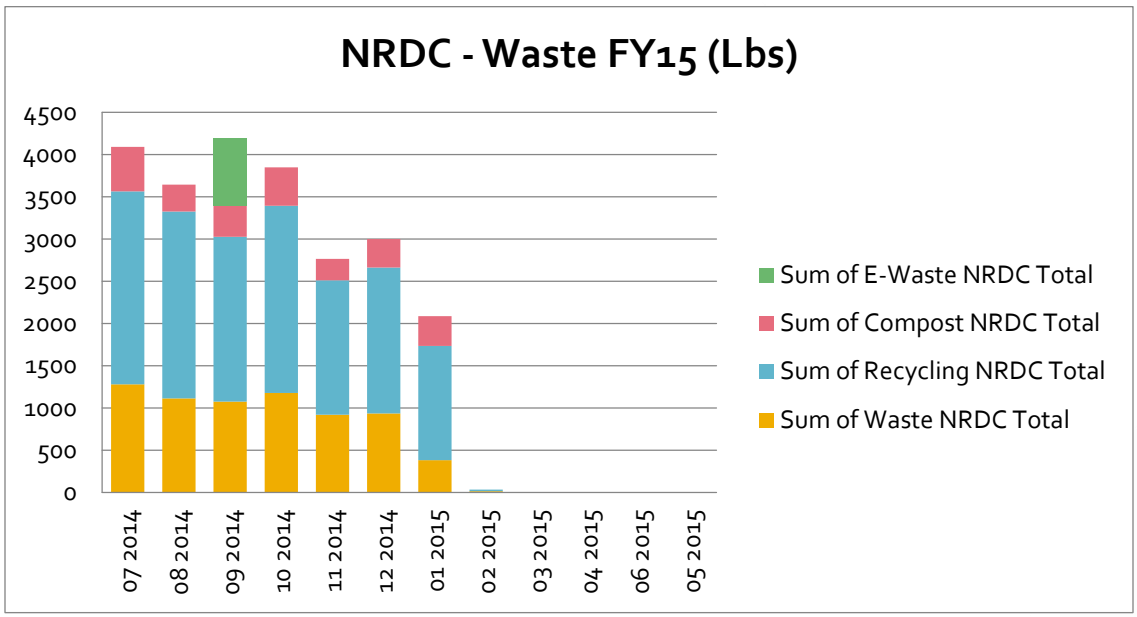

Santa Monica - Waste FY14 (Lbs)
1600
1400
1200
1000
800
600
400
200
0
07 2013
08 2013
09 2013
10 2013
11 2013
12 2013
01 2014
02 2014
03 2014
04 2014
05 2014
06 2014
Sum of E-Waste Santa Monica
Sum of Compost Santa Monica
Sum of Recycling Santa Monica
Sum of Waste Santa Monica

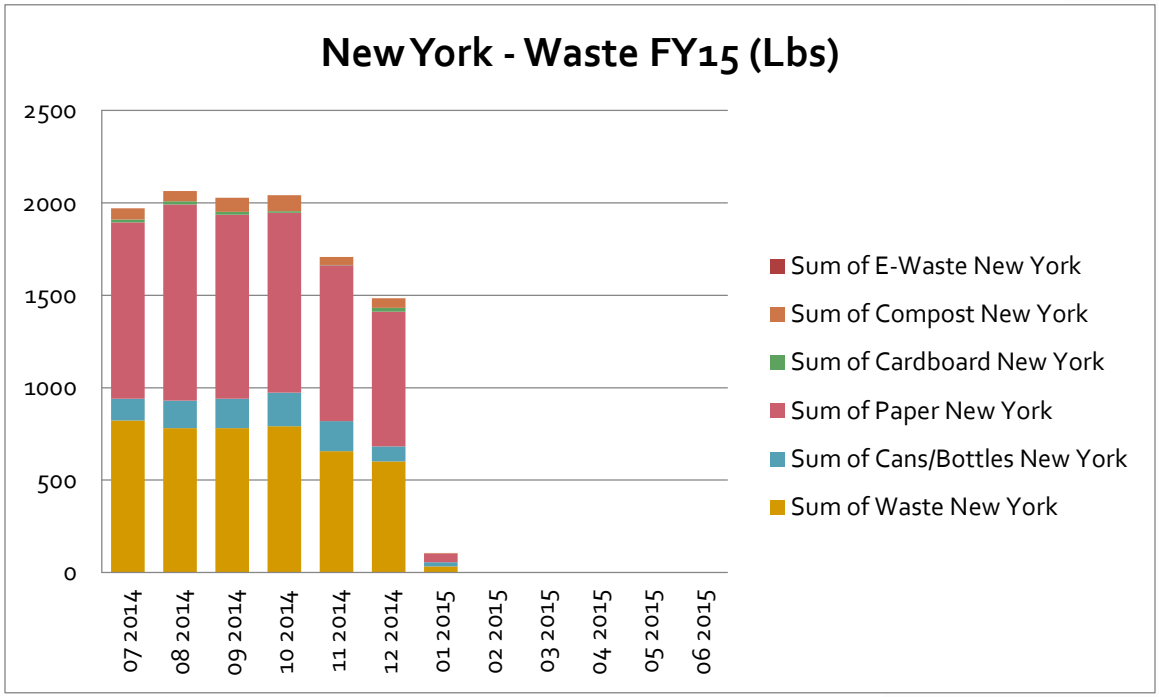

San Francisco- Waste FY14 (Lbs)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
05 2015
06 2015
Sum of E-Waste San Francisco
Sum of Compost San Francisco
Sum of Recycling San Francisco
Sum of Waste San Francisco

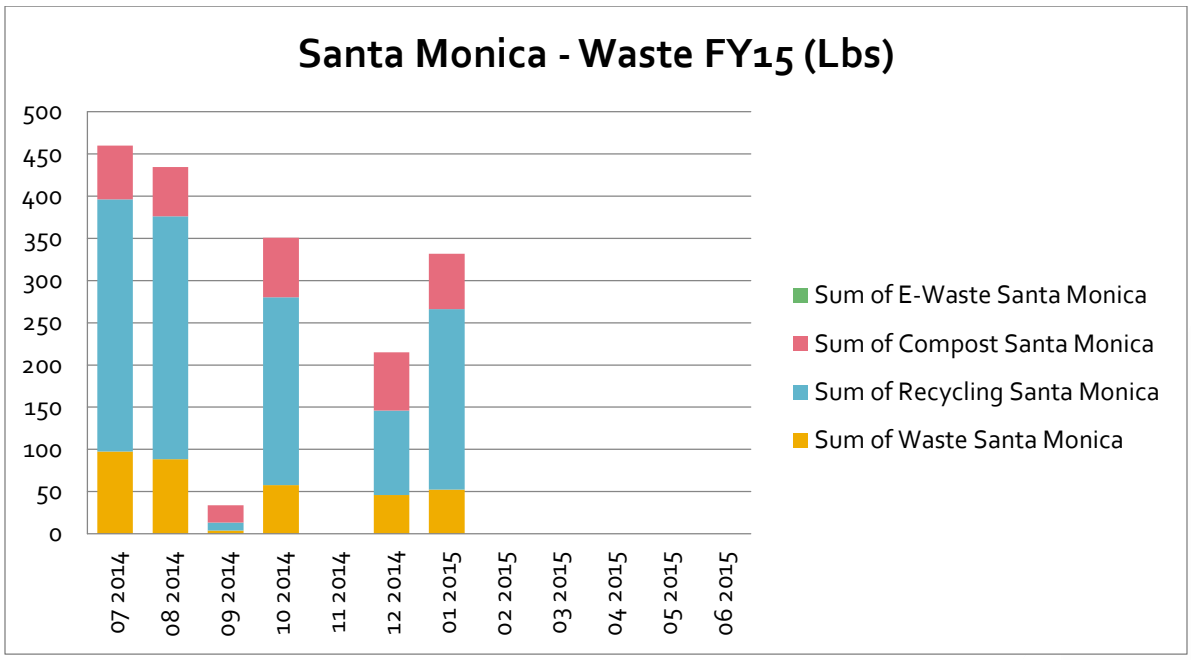

Chicago - Waste FY14 (Lbs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
06 2015
05 2015
Sum of E-Waste NRDC Total
Sum of Compost NRDC Total
Sum of Recycling NRDC Total
Sum of Waste NRDC Total

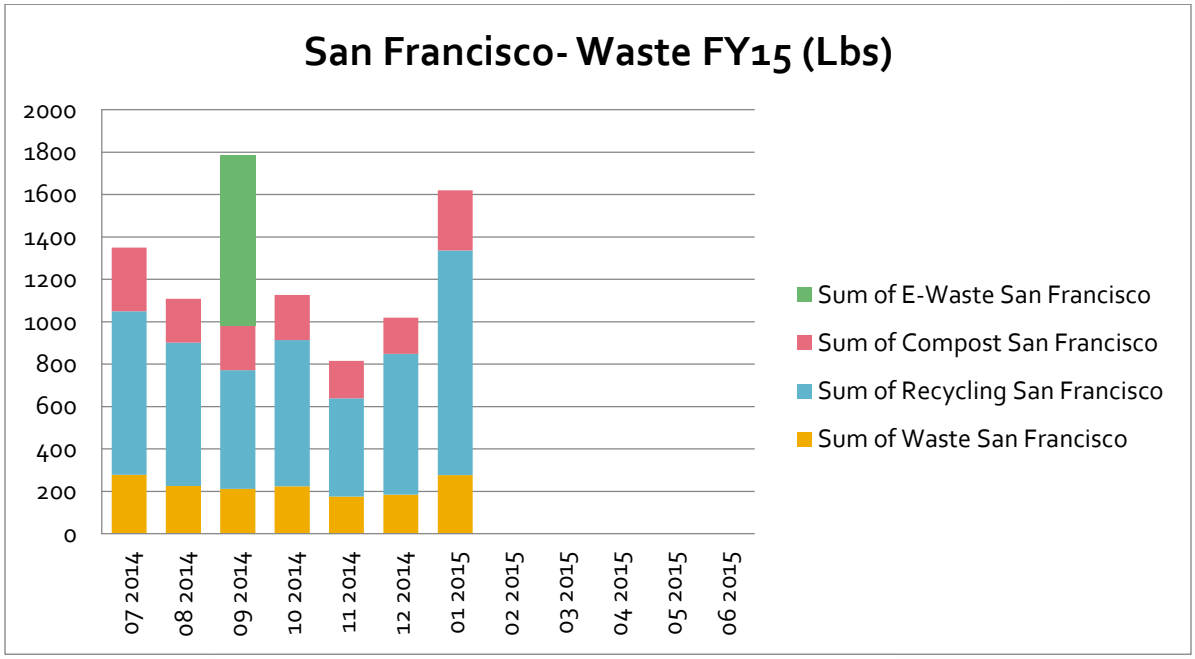

Montana - Waste FY14 (Lbs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
06 2015
05 2015
Sum of E-Waste NRDC Total
Sum of Compost NRDC Total
Sum of Recycling NRDC Total
Sum of Waste NRDC Total

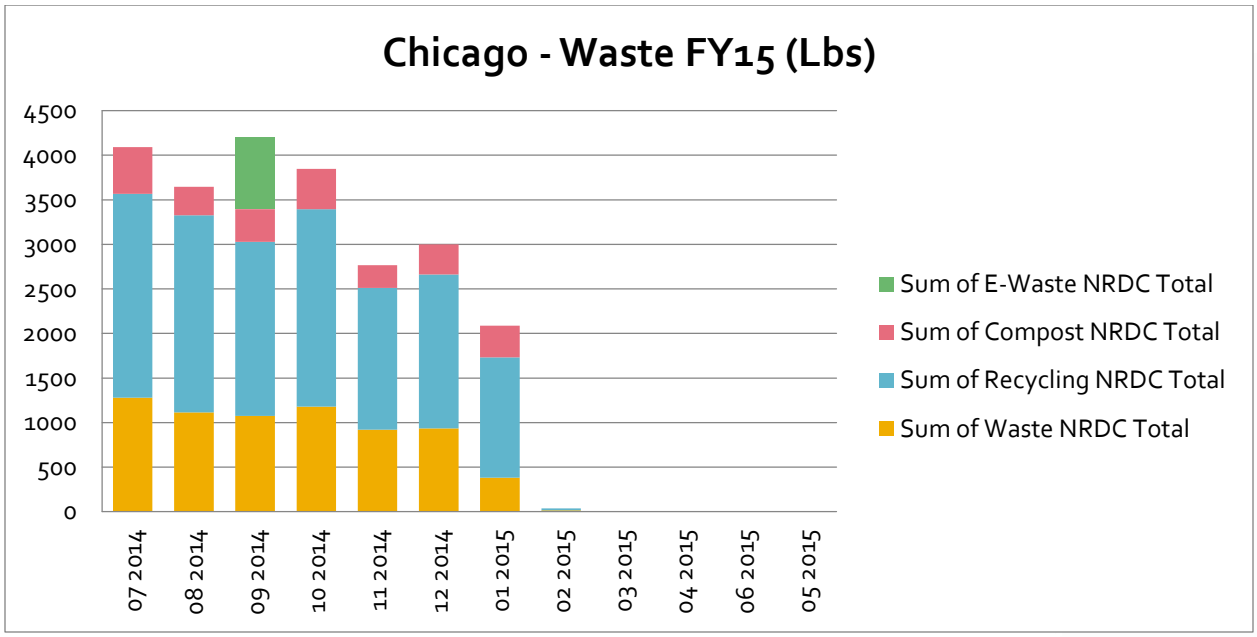
Fiscal

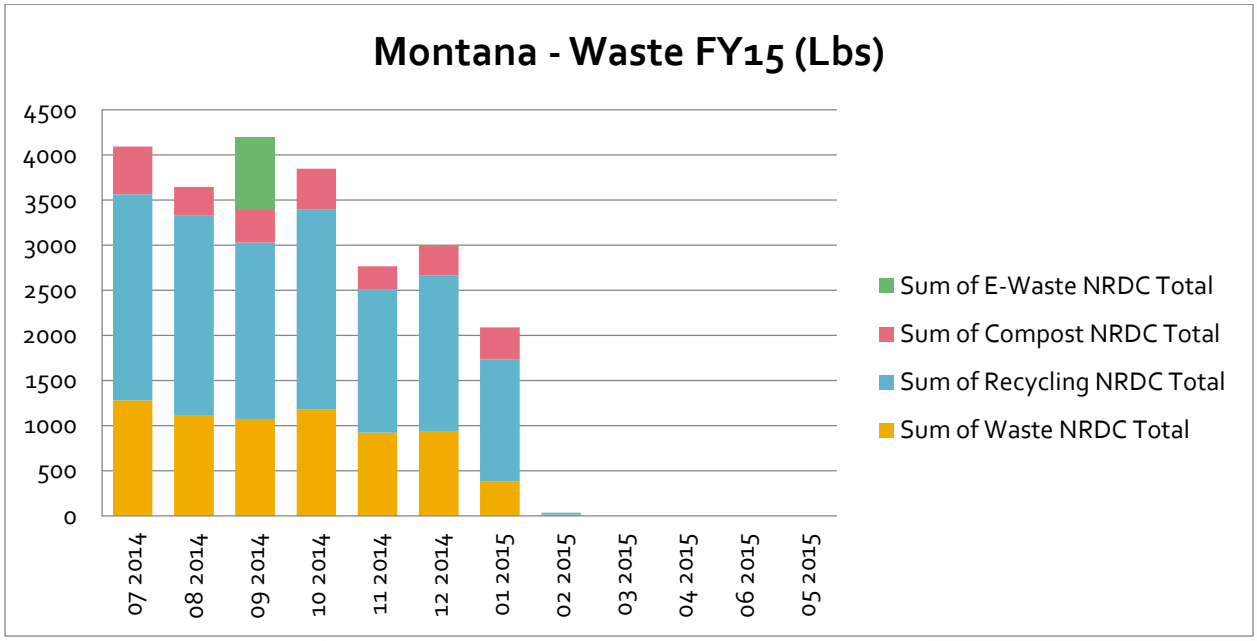

NRDC - Waste FY15 (Lbs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
06 2015
05 2015
Sum of E-Waste NRDC Total
Sum of Compost NRDC Total
Sum of Recycling NRDC Total
Sum of Waste NRDC Total


New York - Waste FY15 (Lbs)
2500
2000
1500
1000
500
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
05 2015
06 2015
Sum of E-Waste New York
Sum of Compost New York
Sum of Cardboard New York
Sum of Paper New York
Sum of Cans/Bottles New York
Sum of Waste New York


Santa Monica - Waste FY15 (Lbs)
500
450
400
350
300
250
200
150
100
50
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
05 2015
06 2015
Sum of E-Waste Santa Monica
Sum of Compost Santa Monica
Sum of Recycling Santa Monica
Sum of Waste Santa Monica


San Francisco- Waste FY15 (Lbs)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
05 2015
06 2015
Sum of E-Waste San Francisco
Sum of Compost San Francisco
Sum of Recycling San Francisco
Sum of Waste San Francisco


Chicago - Waste FY15 (Lbs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
06 2015
05 2015
Sum of E-Waste NRDC Total
Sum of Compost NRDC Total
Sum of Recycling NRDC Total
Sum of Waste NRDC Total


Montana - Waste FY15 (Lbs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
07 2014
08 2014
09 2014
10 2014
11 2014
12 2014
01 2015
02 2015
03 2015
04 2015
06 2015
05 2015
Sum of E-Waste NRDC Total
Sum of Compost NRDC Total
Sum of Recycling NRDC Total
Sum of Waste NRDC Total

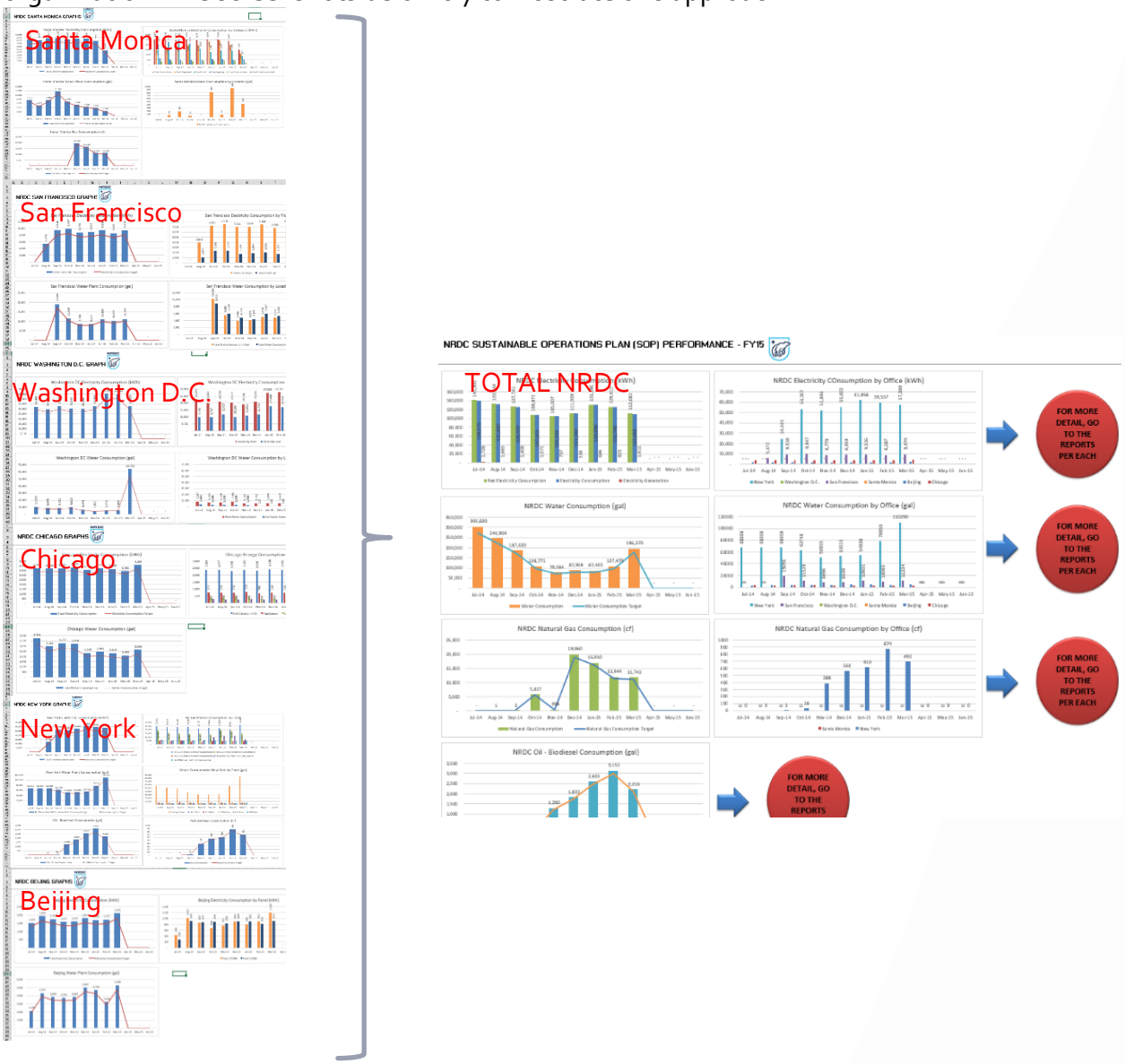
NRDC NOVEDA REPORT TOOL INSTRUCTION MANUAL

TABLE OF CONTENTS

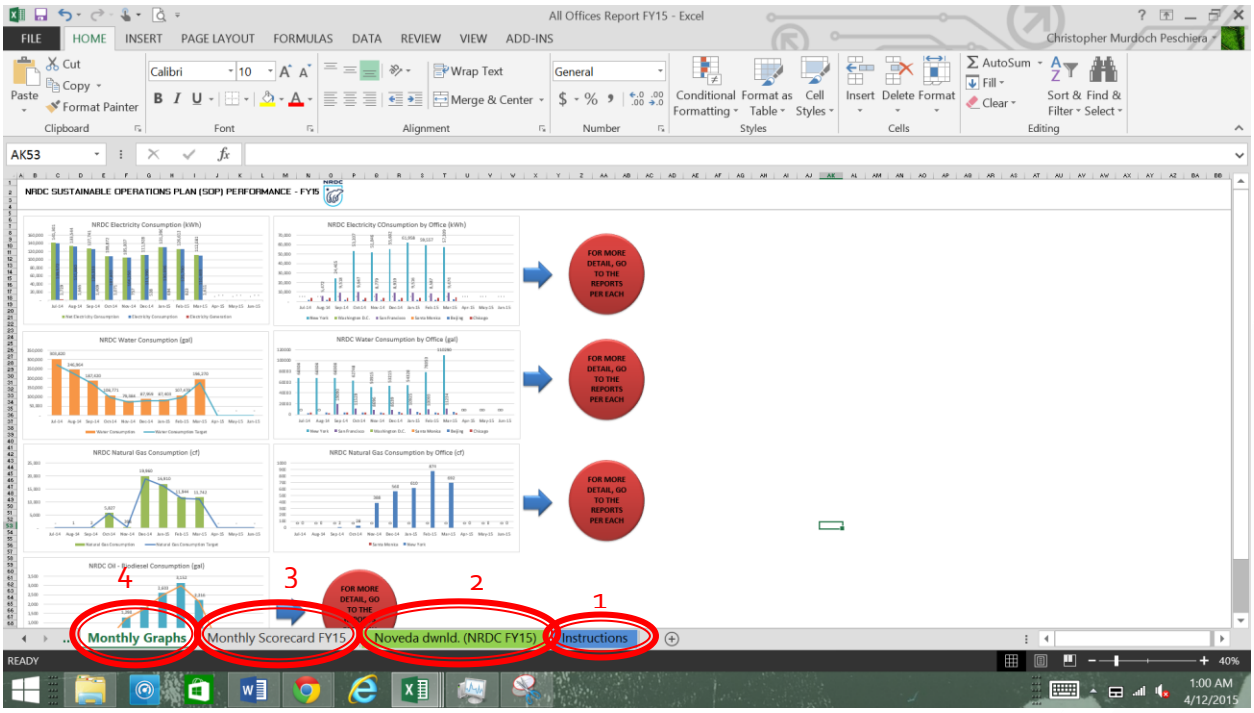
2015

A. **GENERAL INFORMATION**

Each Noveda report tool has been developed in an Excel file, its use is simple and effective. Its purpose is to leverage Noveda data acquisition system and to transform these data into usable information for results tracking and decision making. The files have been designed so the information for each of NRDC's office is populated independently. Then, that information is used to populate a summary for NRDC as a whole organization. The screenshots below try to illustrate this approach.



Each file contains four spreadsheets. The following is a list of the spreadsheets contained in the files and a brief description of their content.



1. Instructions – blue tab: In each file you will find an embedded copy of this manual. This way you will be able to have a reference anytime you are working on the spreadsheets.

2. Noveda dwnld. (XXXX FY##) – Green tab: In this tab the downloaded data from Noveda should be pasted. A step by step direction on how to use the tool is explained in the following sections.

   Note: If there is any inconsistency in the data that need to be corrected, it should be done in this spreadsheet (i.e. an outlier number from the commissioning of Noveda). This action will prevent the formulas in the files to be corrupted.

3. Monthly Scorecard: In this tab the data from Noveda will be grouped and organized according to Impact Categories (i.e. Electricity Consumption, Water Consumption, Gas Consumption, and so on), Unit of Measure – UoM (kWh, gal, cf, and the like). Depending on the office, there are several levels of detail that can be achieved for data drilldown. This levels of detail will help drilldown the data so identifying focus and opportunity areas is made easier. Drilling down the data will also improve the action plan effectiveness. The Noveda system description is also included in one column. It is followed by the month by month results and fiscal year to date result (see NRDC Santa Monica screenshot below for guidance).

NRDC SANTA MONICA SCORECARD

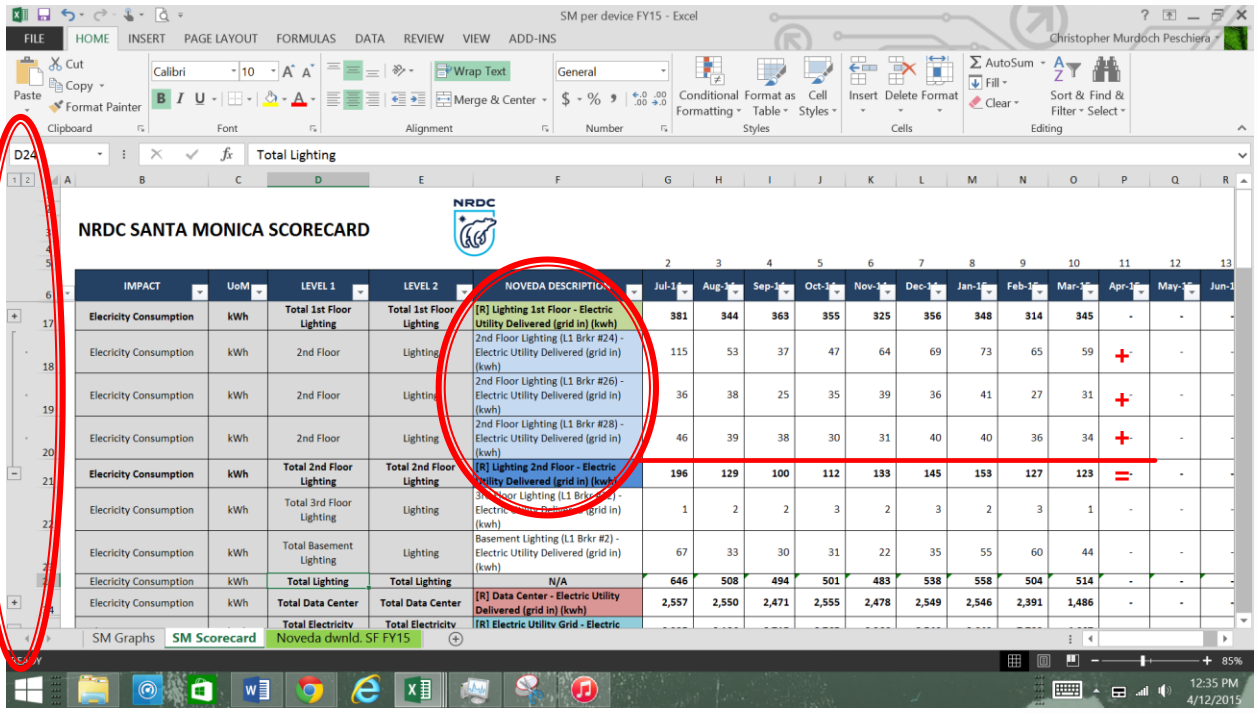
					2	3	4
IMPACT	UoM	LEVEL 1	LEVEL 2	NOVEDA DESCRIPTION	Jul-14	Aug-14	Sep-14
Elecricity Consumption	kWh	Total 1st Floor Lighting	Total 1st Floor Lighting	[R] Lighting 1st Floor - Electric Utility Delivered (grid in) (kwh)	381	344	363
Elecricity Consumption	kWh	Total 2nd Floor Lighting	Total 2nd Floor Lighting	[R] Lighting 2nd Floor - Electric Utility Delivered (grid in) (kwh)	196	129	100

In addition, data is also grouped by lines. There are some colored cells that help identify related rows (see screenshot below showing blue-colored cells). Embedded in this file a PDF file explains how Noveda groups some results.

Note: In the case of New York and Washington D.C., information is missing regarding formulas and calculations made in Noveda.

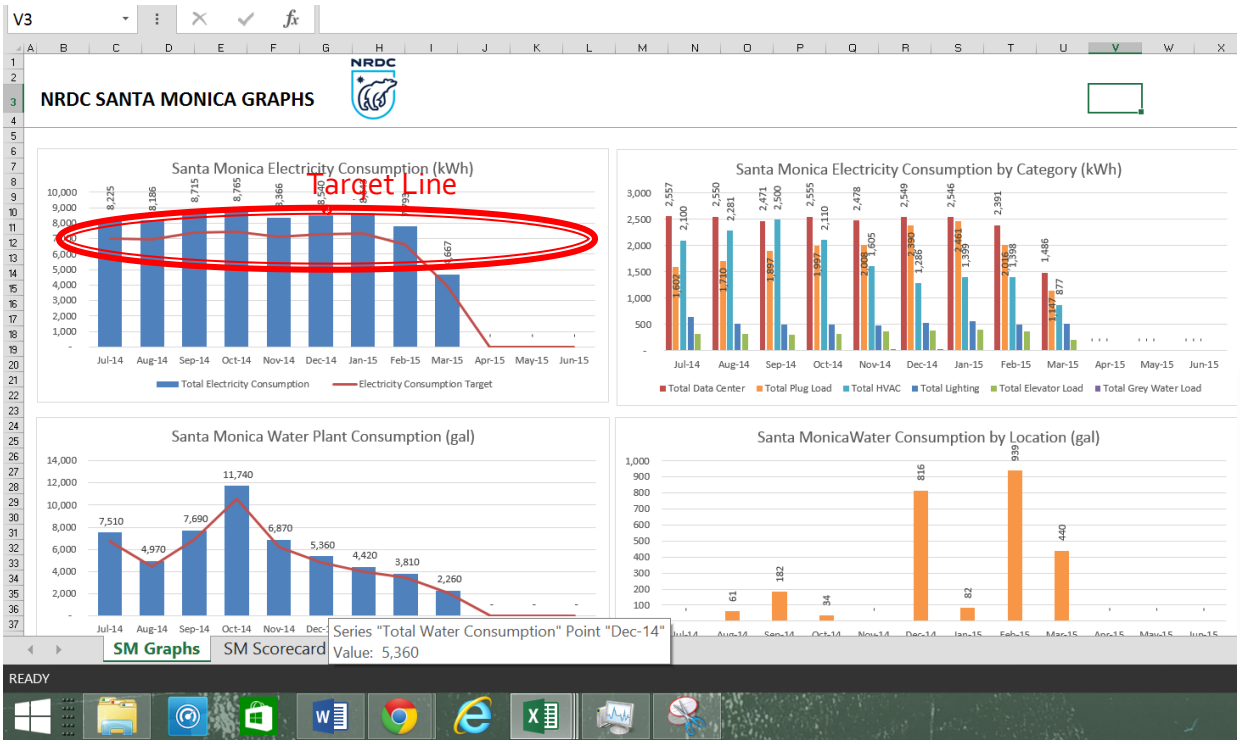
Noveda NRDC Formulas.pdf

In the example below, the sum of the lighter blue cells give as a result the darker blue cell. Also note that rows can be grouped using the "+" and "-" symbols on the left side of the spreadsheet.



Some maintenance is required in this tab. It will be explained in the last section of this manual under the "Tool Worksheet Maintenance", section D. The cells that need maintenance are colored most of the times grey, except for the blue fill and white-letter cells, which are headings that sometimes need to be modified.

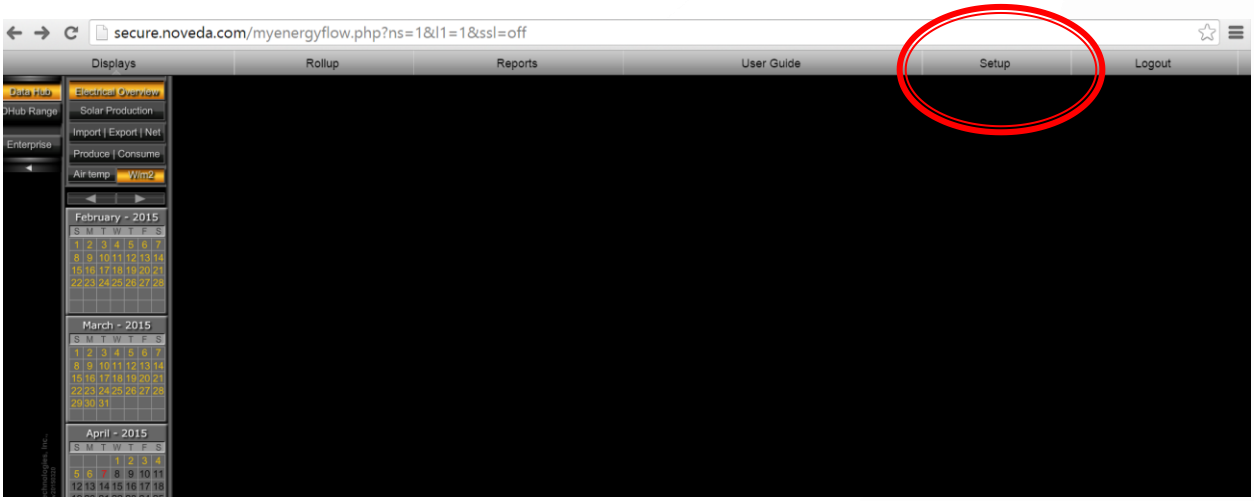
4. Graphs: In this worksheet several graphs for different impact categories and levels are displayed. It is populated automatically from the "Scorecard" worksheet. If other or different levels of detail graphs are needed, they can be generated taking the data from the "Scorecard" worksheet. Moreover, some graphs include a target line. This will help to visually identify variables' trends and compliance against monthly targets (see screenshot below for reference). If needed graphs can be traffic-colored painted (red, yellow, green) to further boost visual impact. The target setting per month has to be manually done in the "Scorecard" worksheet. This will be explained in Section D of this manual.



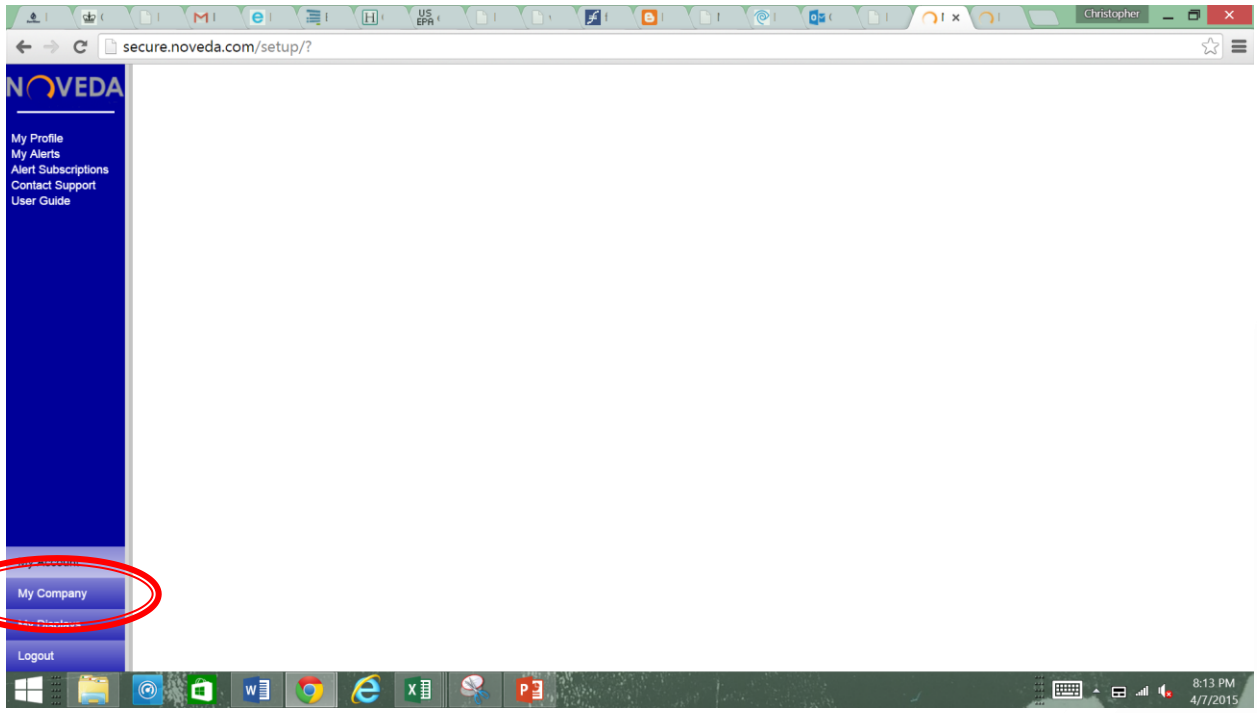
B) NEW DATA EXPORT

If you want to generate or update any of the Noveda report tool Excel files, follow these steps. This manual will work for any office.

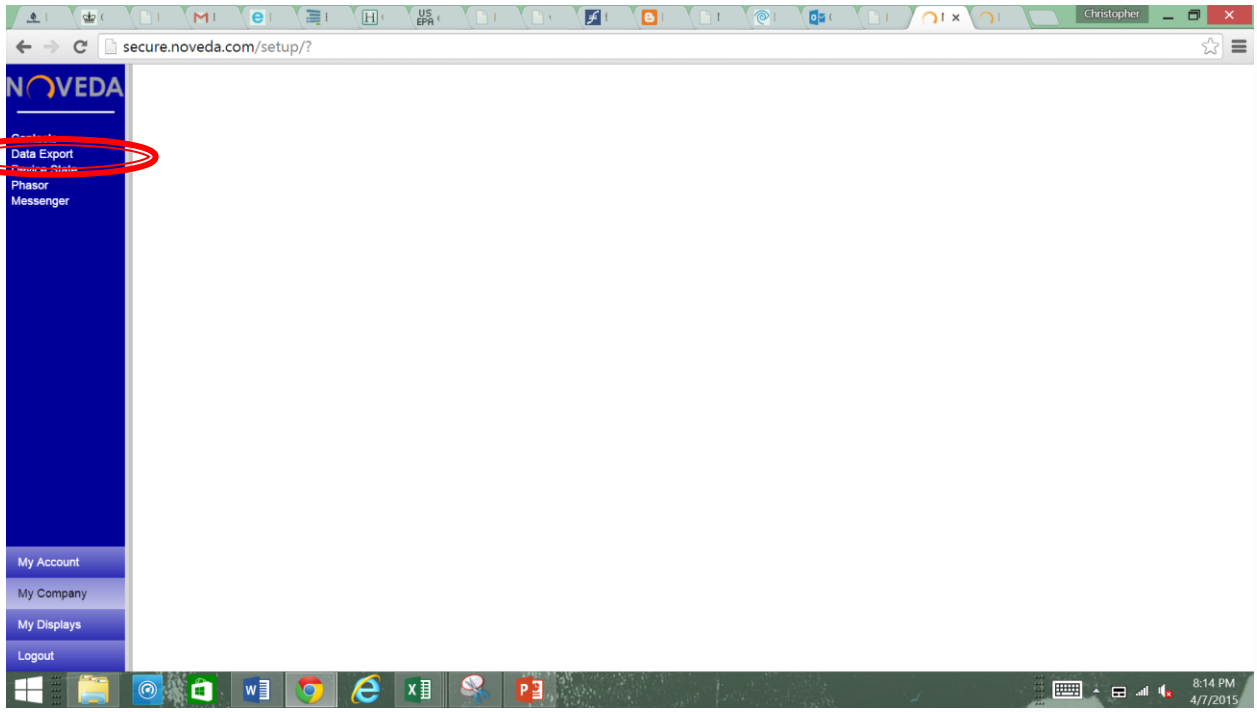
1. Go to secure.noveda.com
2. Log in into the System
3. Click on Setup tab



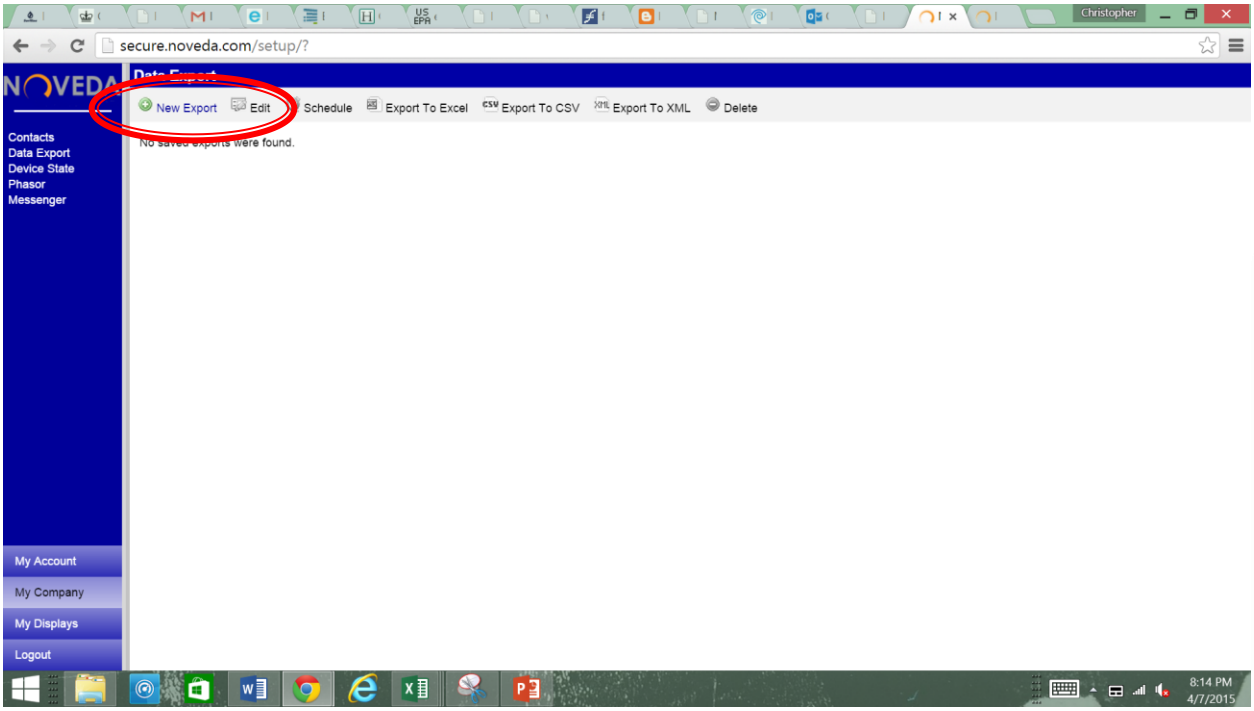
4. Click on 'My Company'



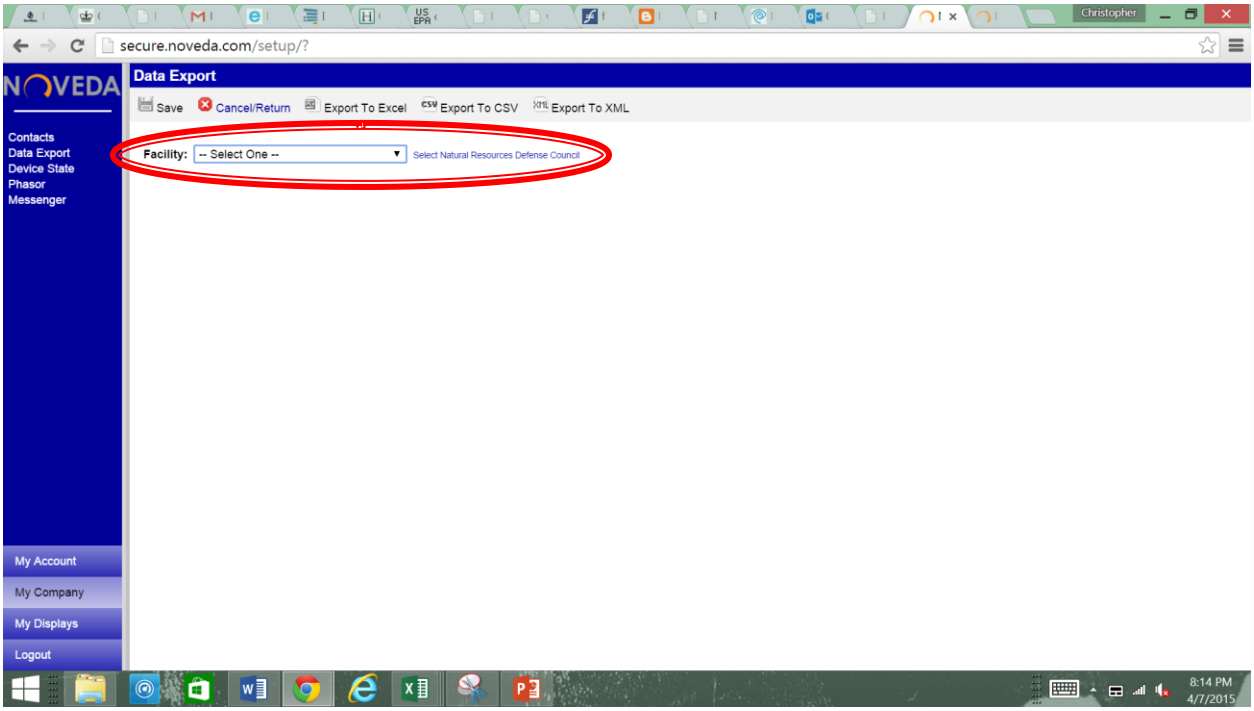
5. Click on 'Data Export'



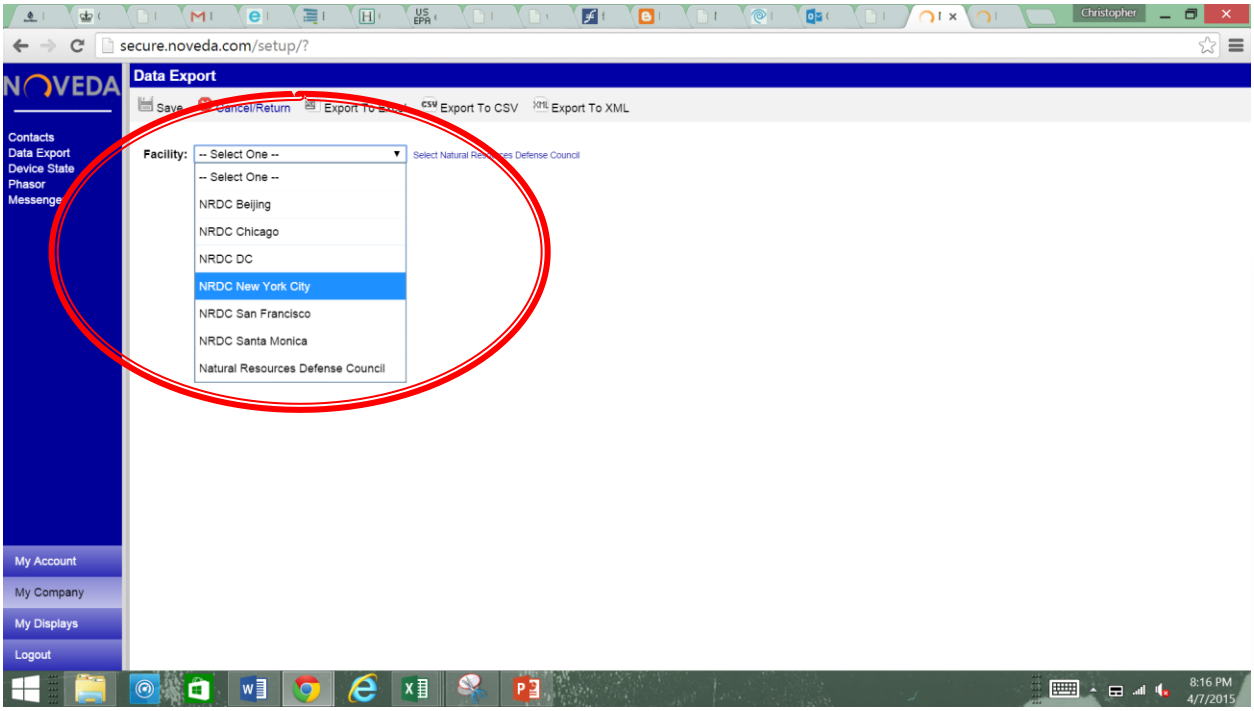
6. Click on 'New Export'



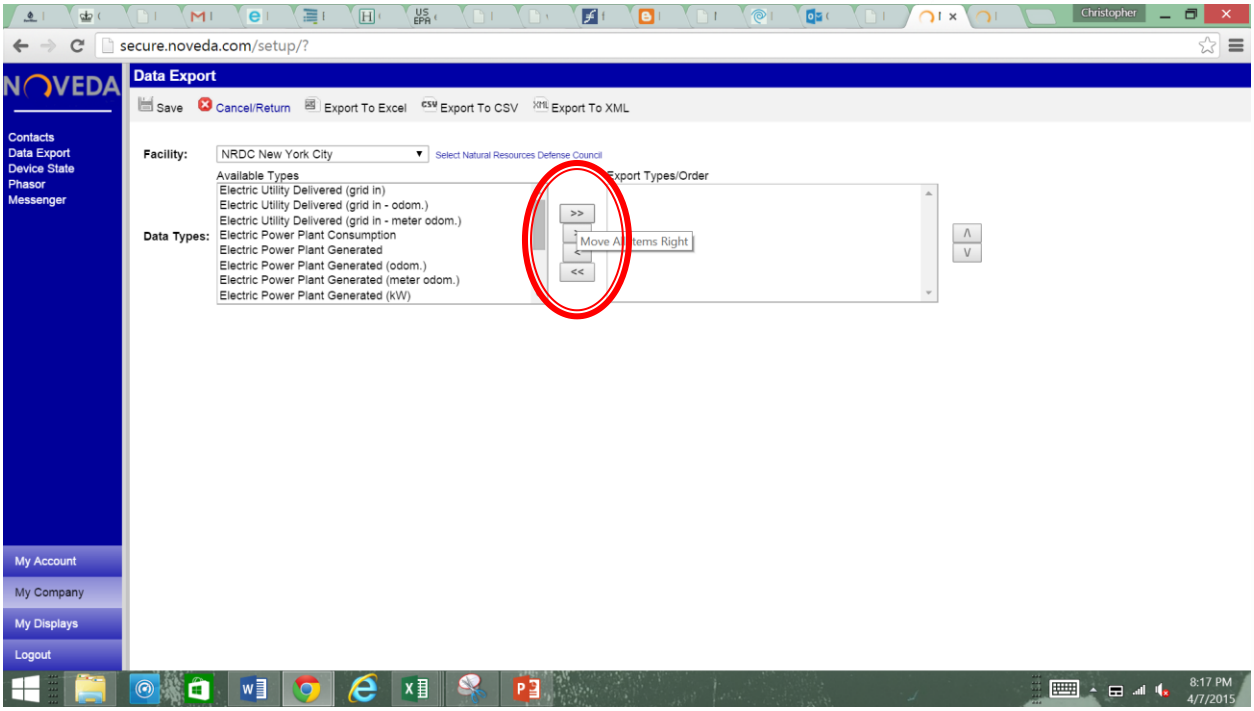
7. On the 'Facility' drop down menu select an office.



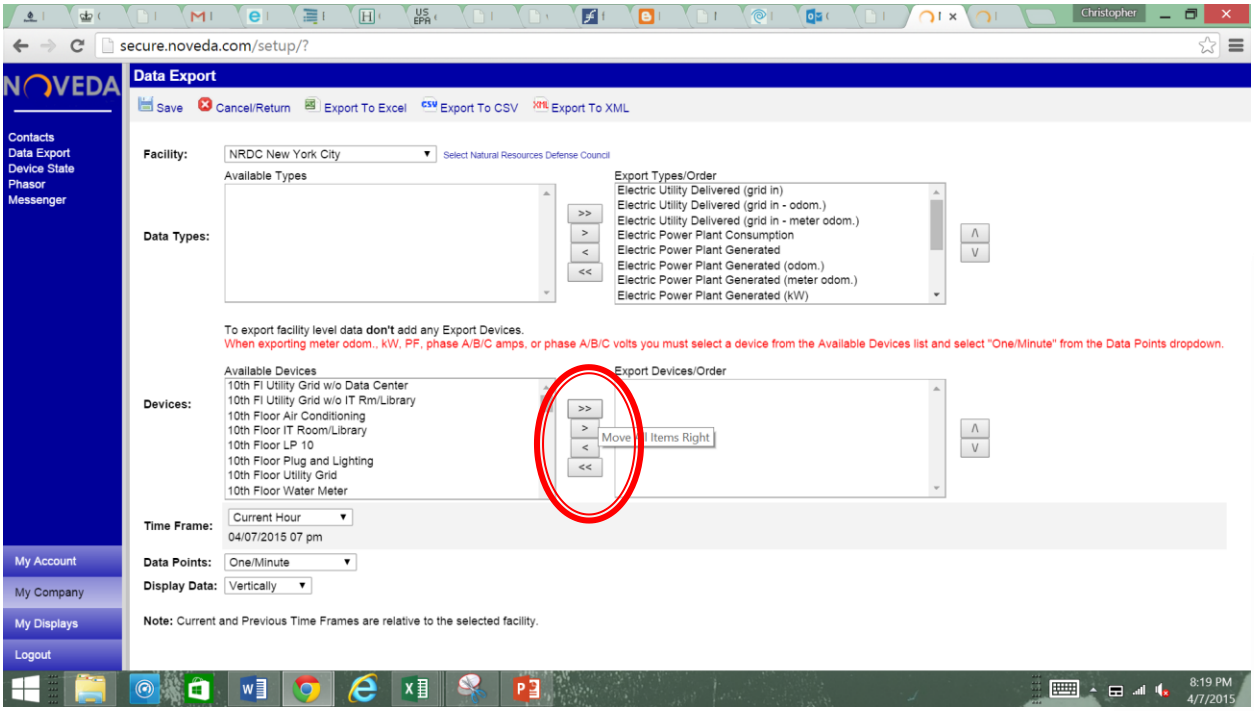
8. NRDC New York City for example



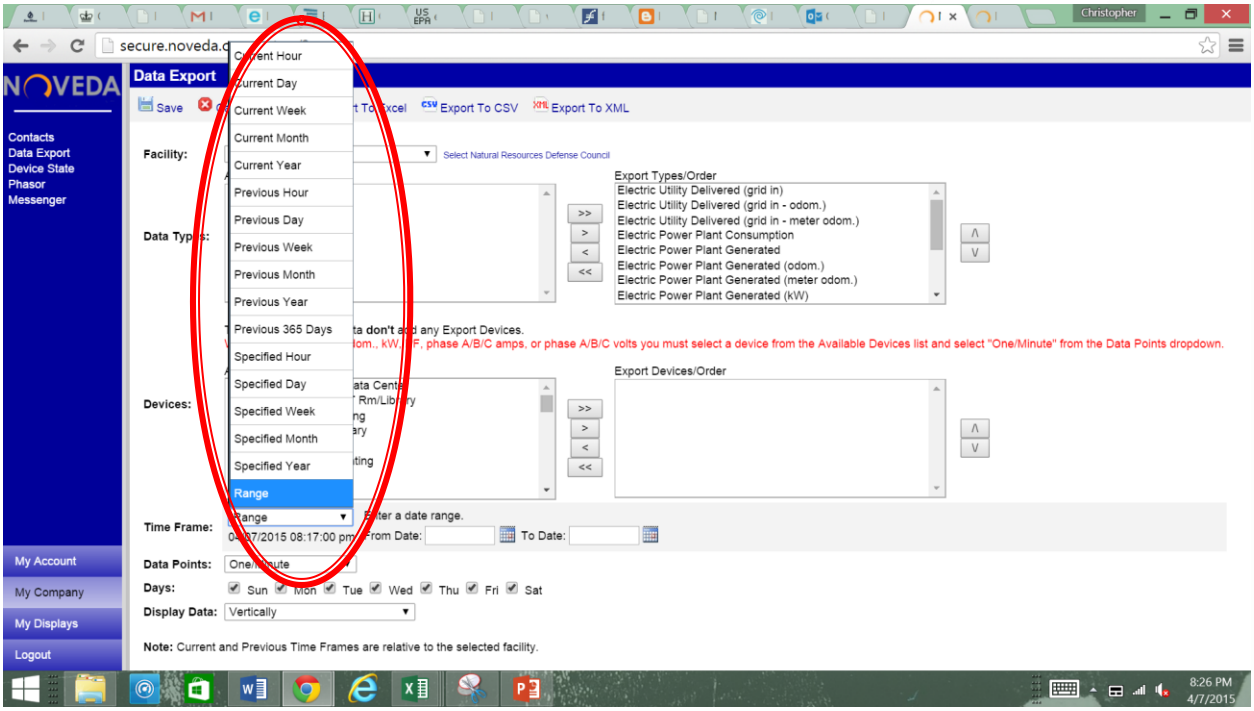
9. On the 'Data Types' select button ">>" to move all items to the right column.



10. On the 'Devices' select button">>" to move all items to the right column.

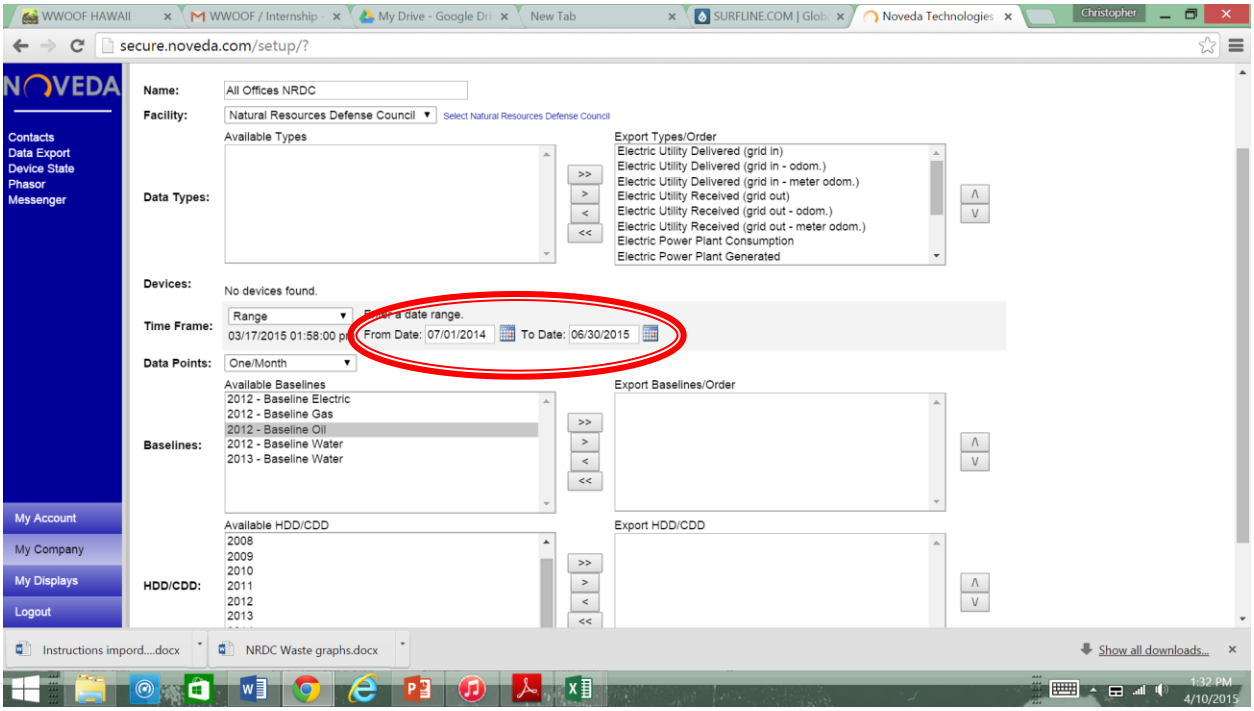


11. On the 'Time Frame' select "Range"



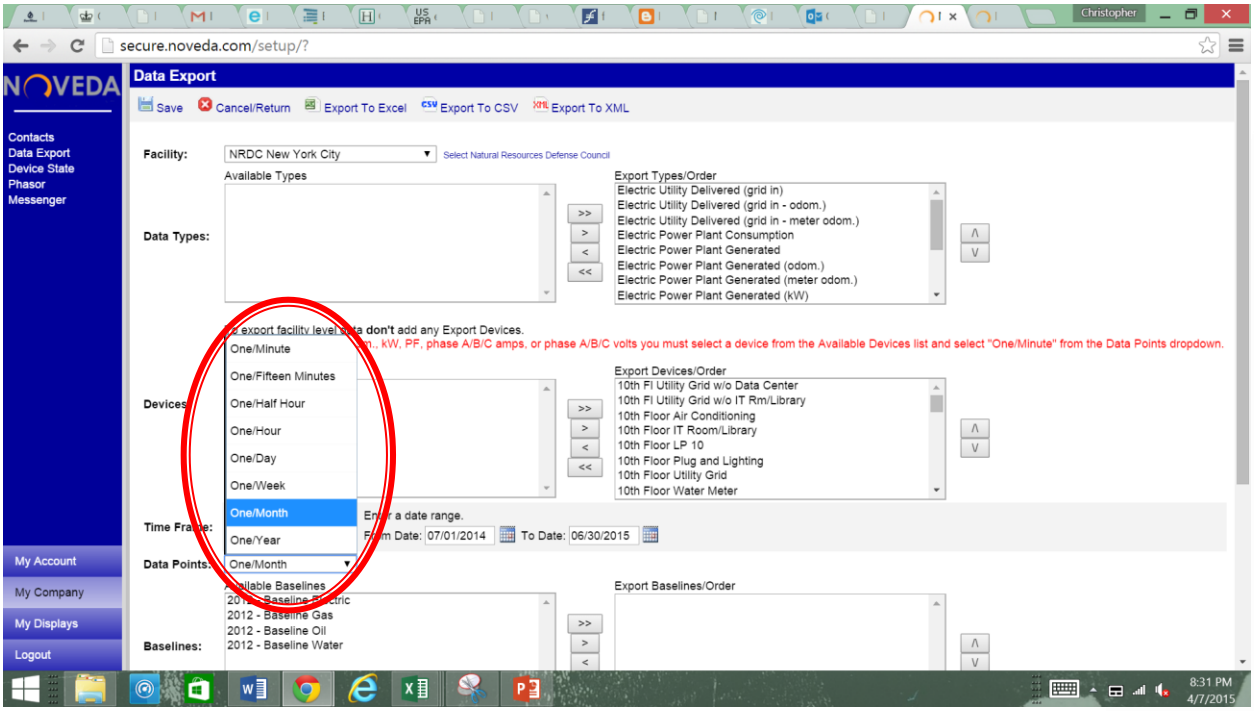
12. Depending on the report you are running, monthly or daily, there two ways to input the dates.

a) <u>If you are running a monthly report for complete Fiscal Year:</u> Always select dates according to one complete fiscal year. For example, for Fiscal Year 2014 select 07/01/2013 to 06/30/2014).
<u>Note:</u> If you are running a report in the middle of a month, the report will display partial data for the month in progress, and for the following months no data will be displayed.

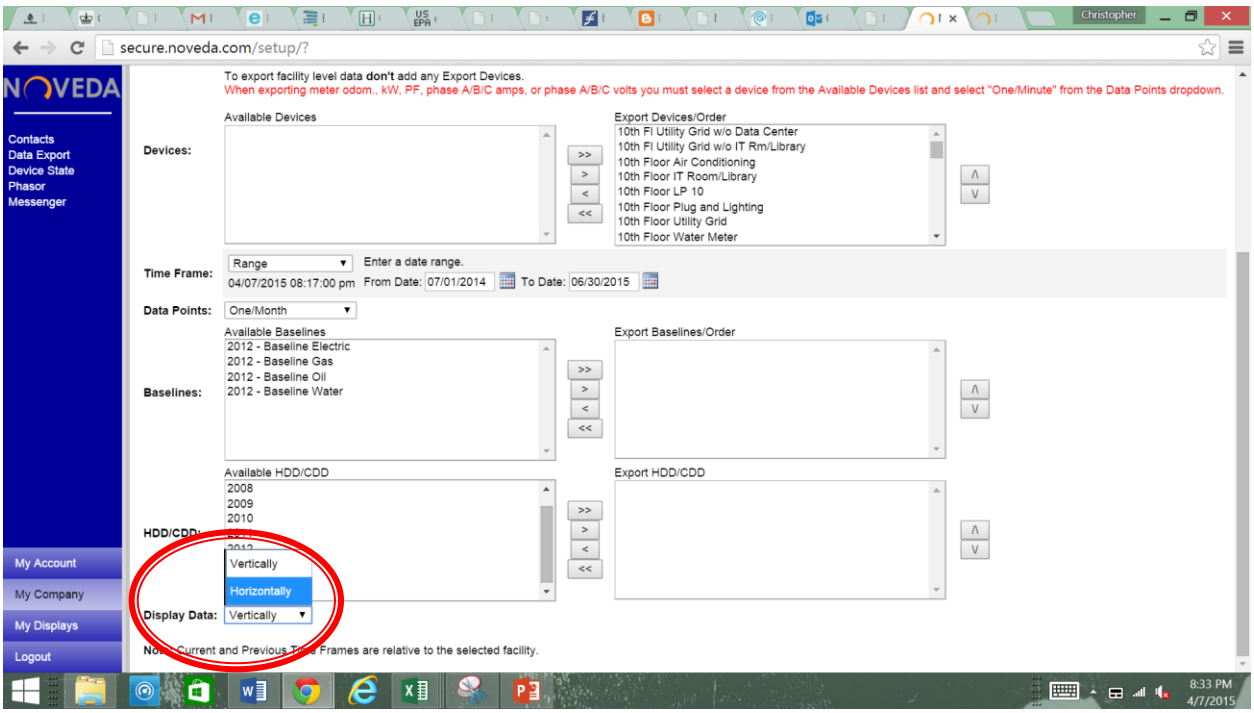


b) <u>If you are running a daily report:</u> Select dates according to the period you want to analyze. For example, for June 2014 select 06/01/2014 to 06/30/2014. Dates do not have to be complete months, nor start the 1st of every month. You may select any random interval as long as it is not more than one (01) year of data.

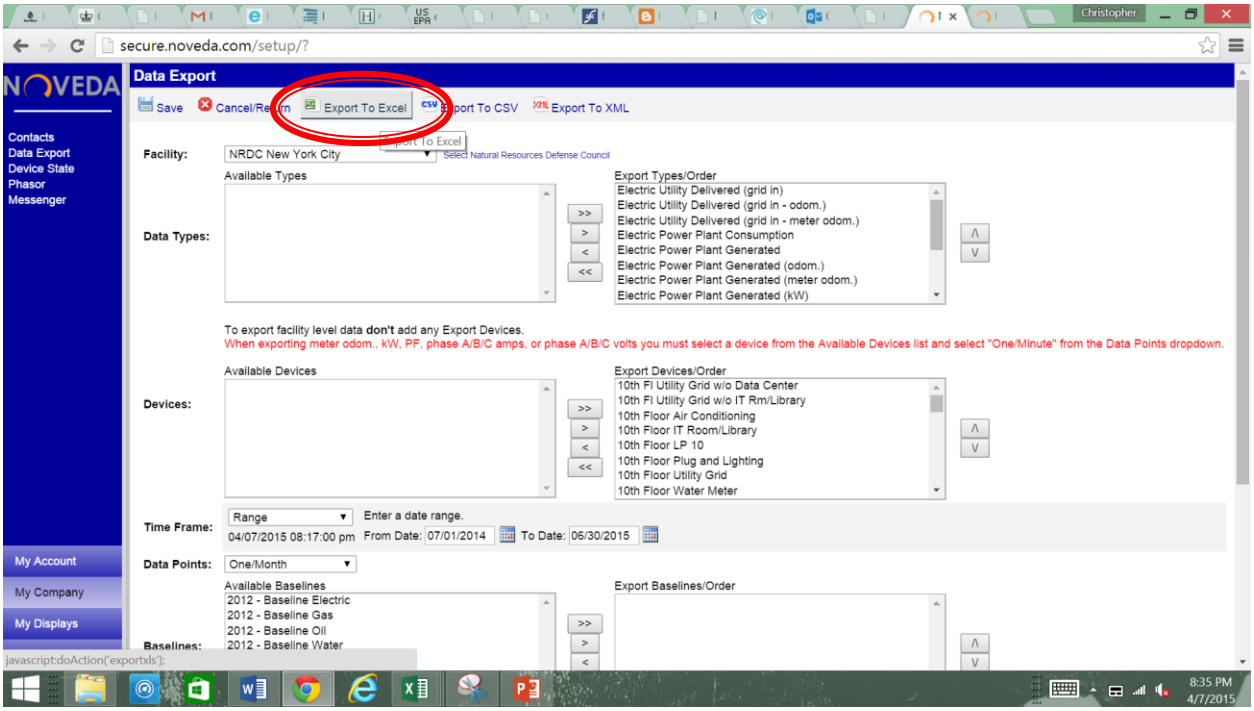
13. On the 'Data Point' select:
    a) <u>If you are running a monthly report for complete Fiscal Year:</u> "One/Month"
    b) <u>If you are running a daily report:</u> "One/Day"



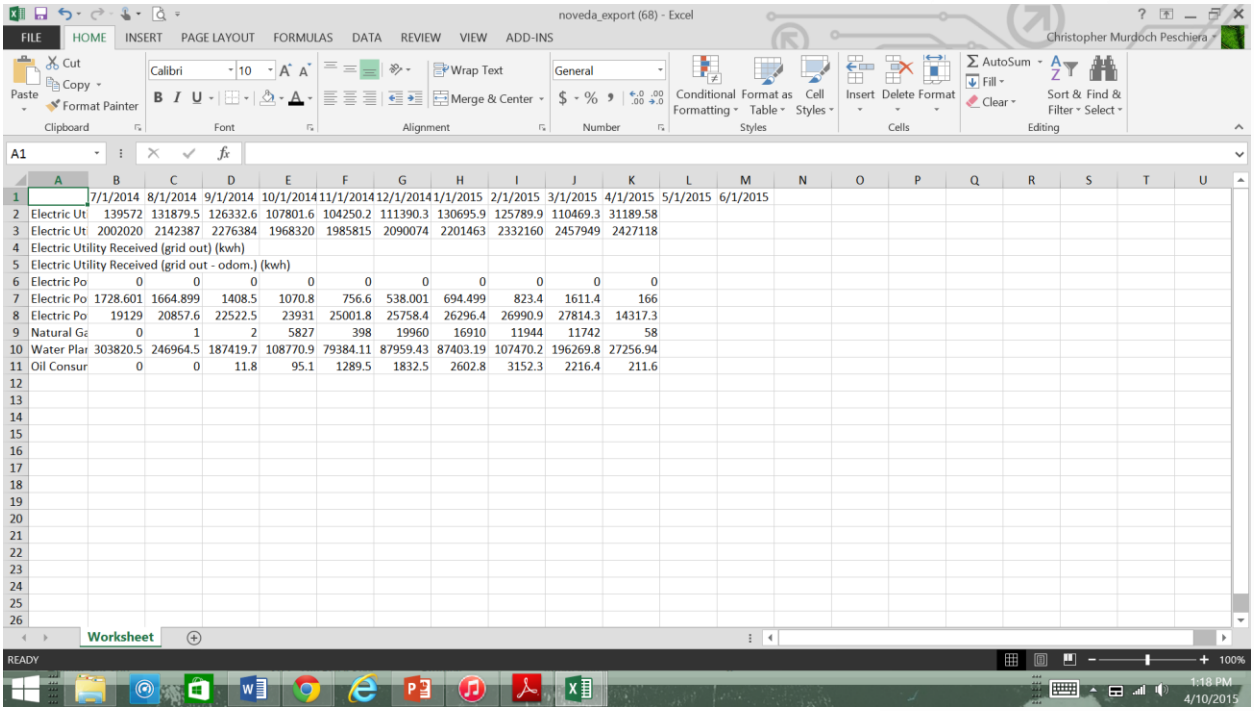
14. For 'Baseline', **<u>don't select anything.</u>**
15. For 'HDD/CDD', **<u>don't select anything.</u>**
16. In 'Display Data' select "Horizontally".



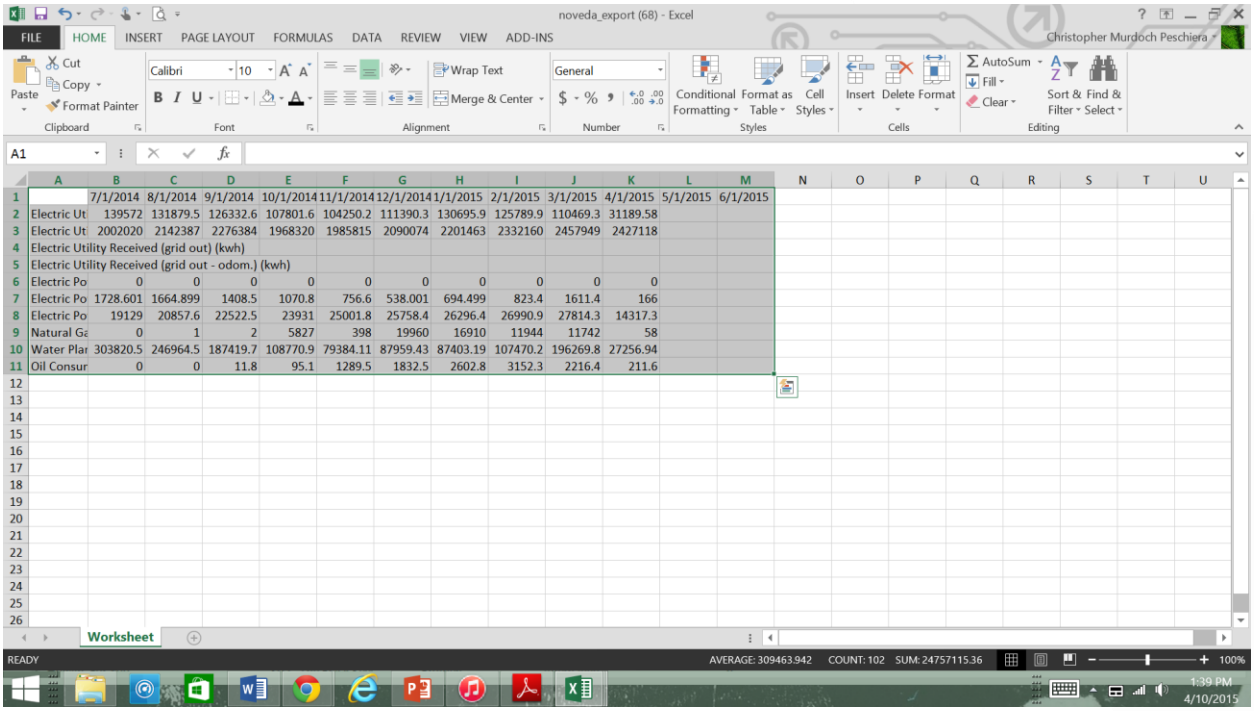
17. Click on "Export To Excel" at the top of the page.



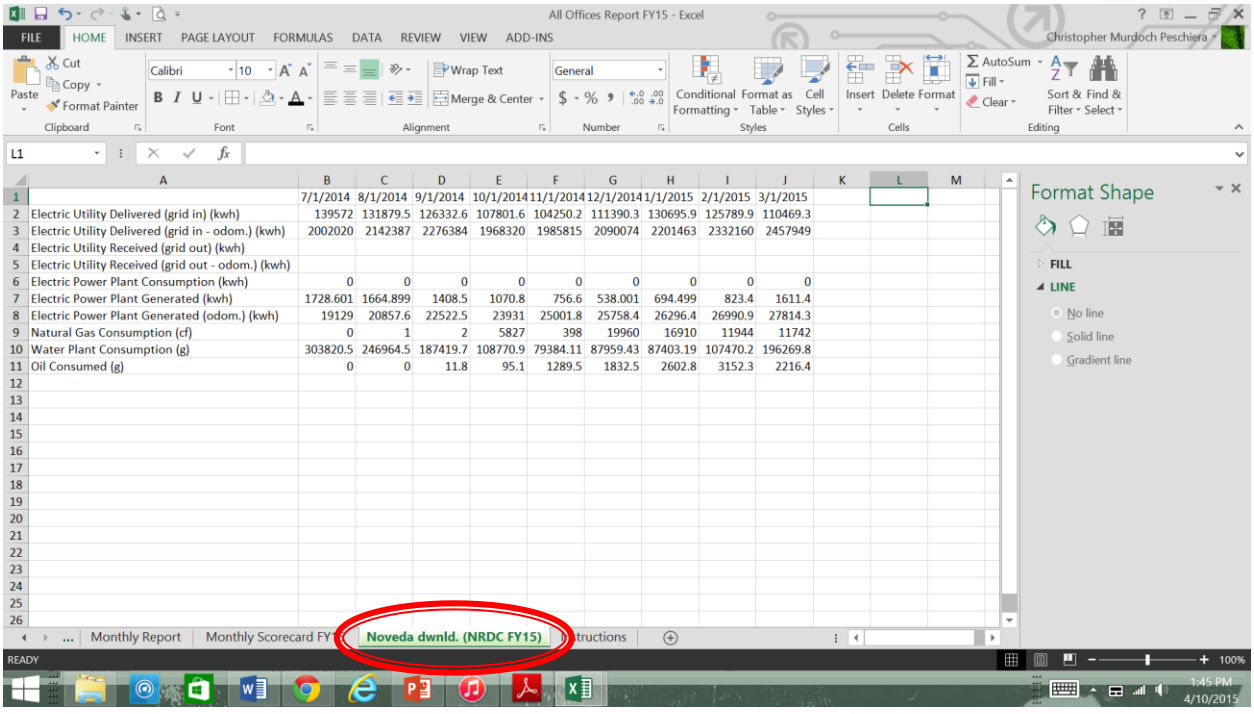
18. Open the downloaded Excel file



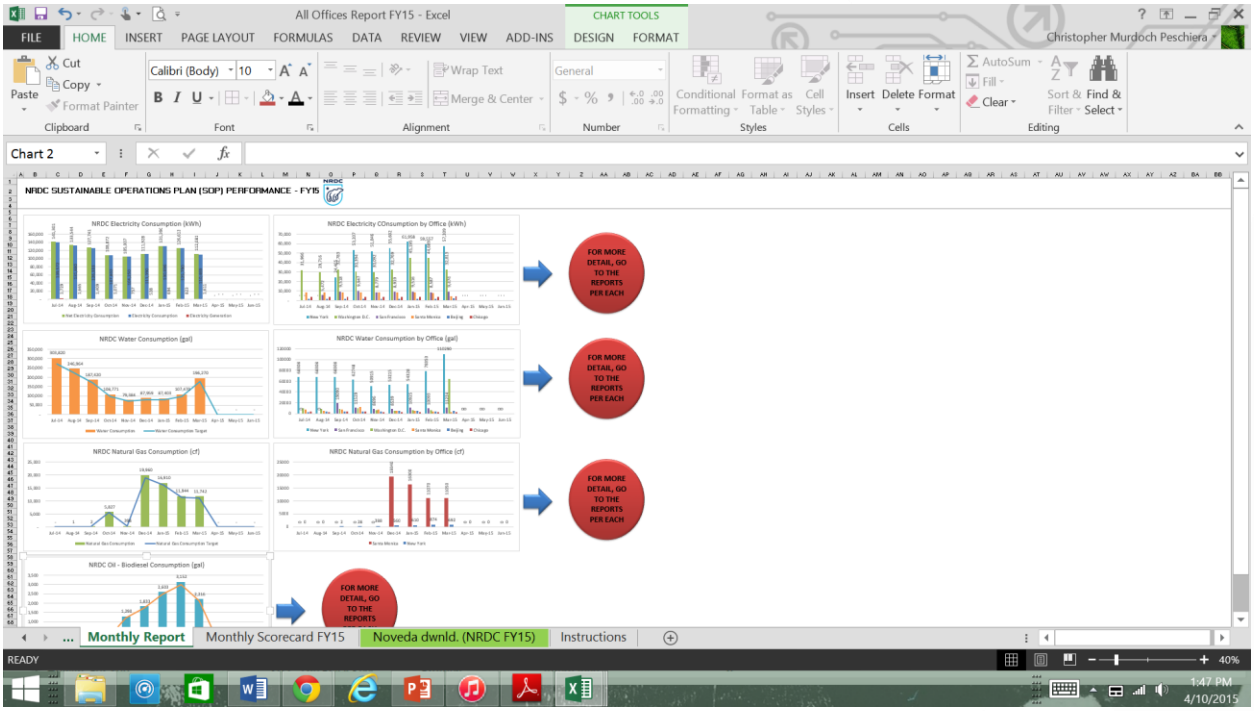
19. Copy entire sheet. Be sure to use the appropriate Excel file for daily and monthly data. The process is the same, however files formulas work differently.



20. Paste the copied sheet in the green tab in the tool ("Noveda dwnld. XXXXX FY##)).



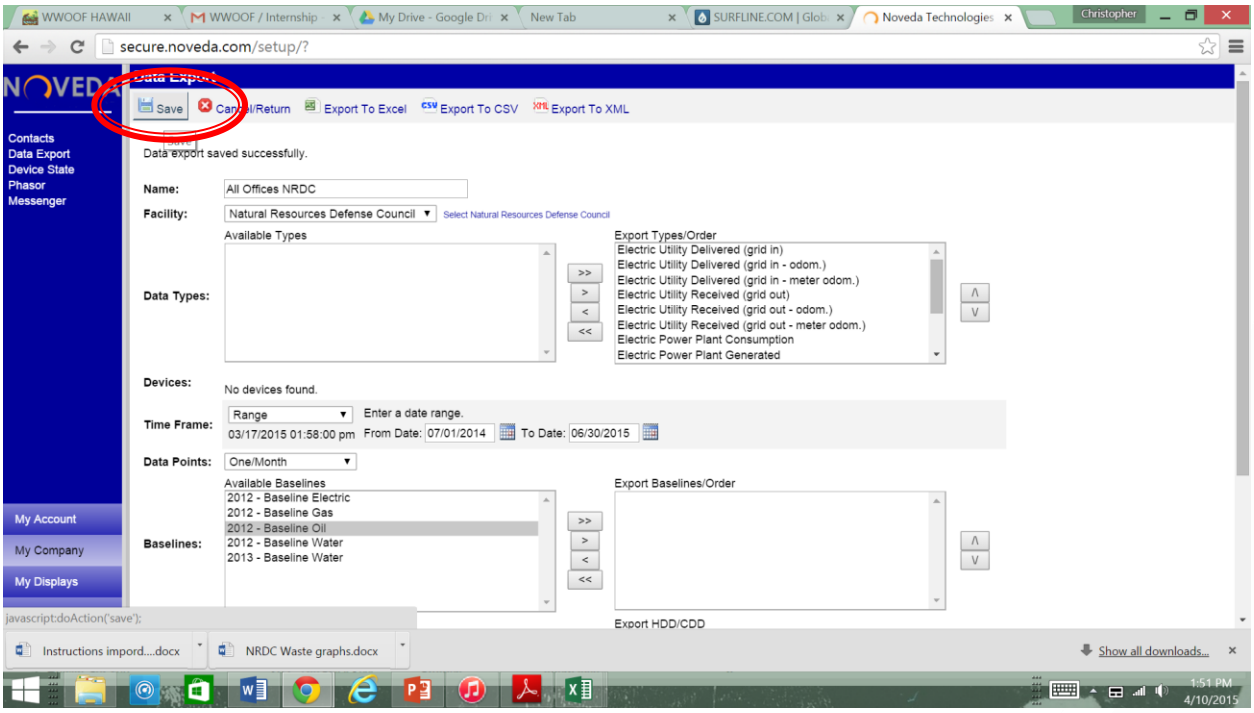
21. The report will be automatically generated



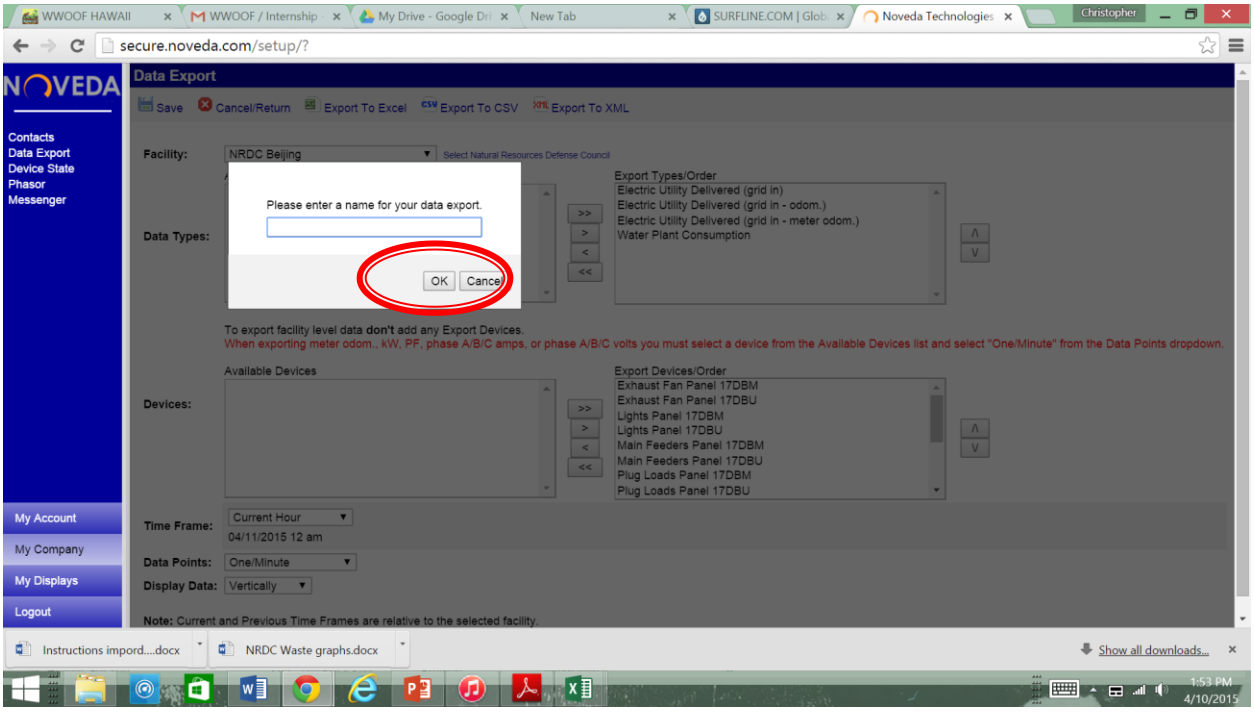
Note: If running a daily report the default number of days included in the spreadsheets is 31. For longer periods drilled down on a daily basis, the formulae on the Scorecard sheet and range in graphs will have to be modified. Otherwise, you can generate several reports considering the 31 days as the maximum range.

C) SAVING REPORTS IN NOVEDA

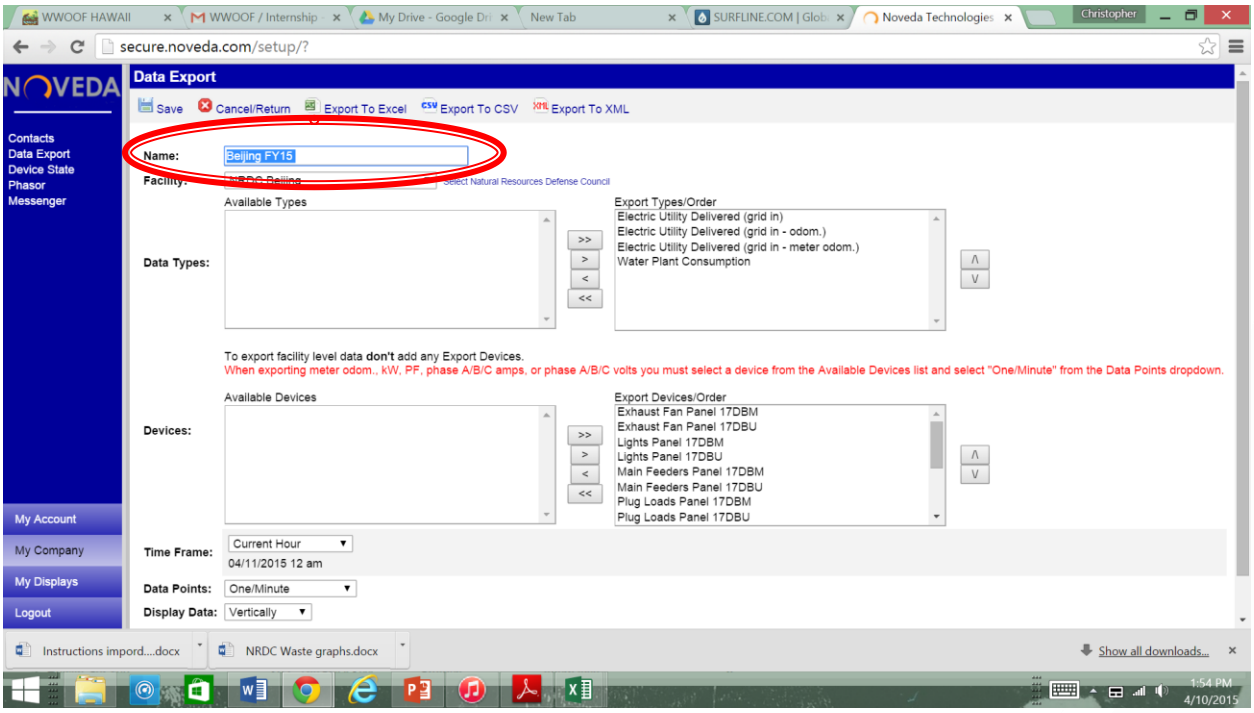
1. Follow steps 1 to 16 from "New Data Export".
2. Click on "Save" at the top of the page.



3. Select a name for your report and click "OK".

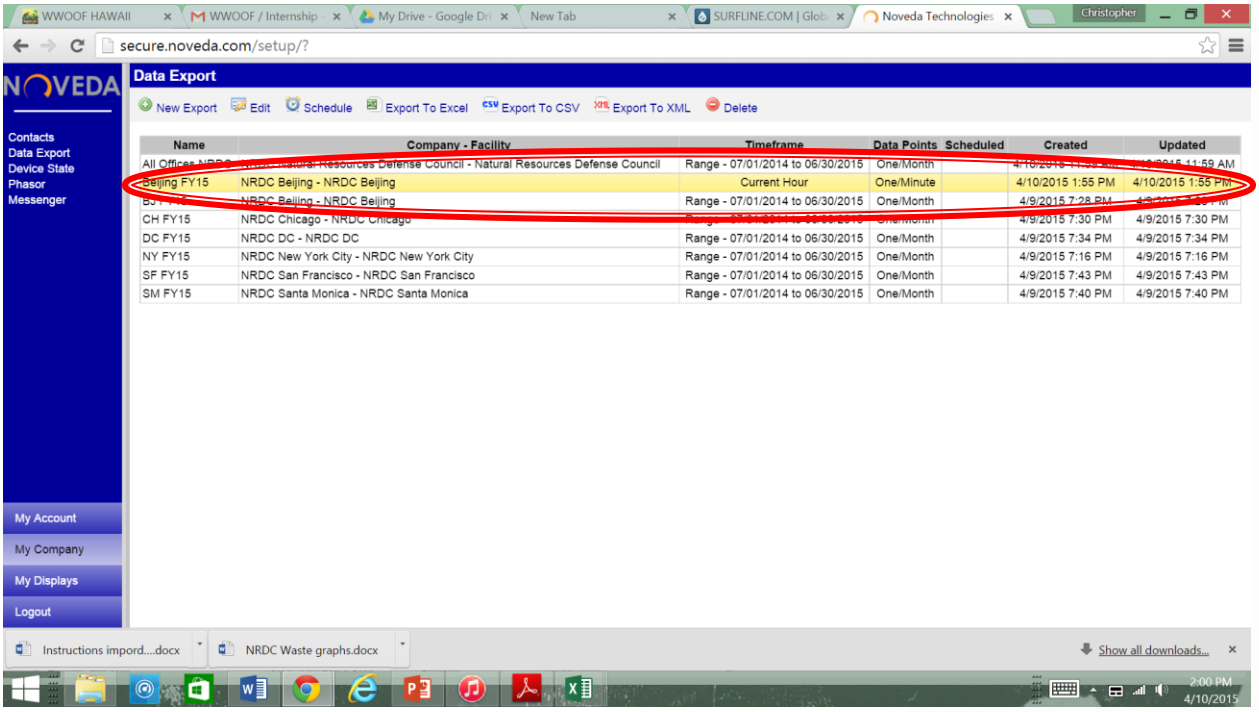


4. Your report will be saved and the name will be displayed under the "Name" field.

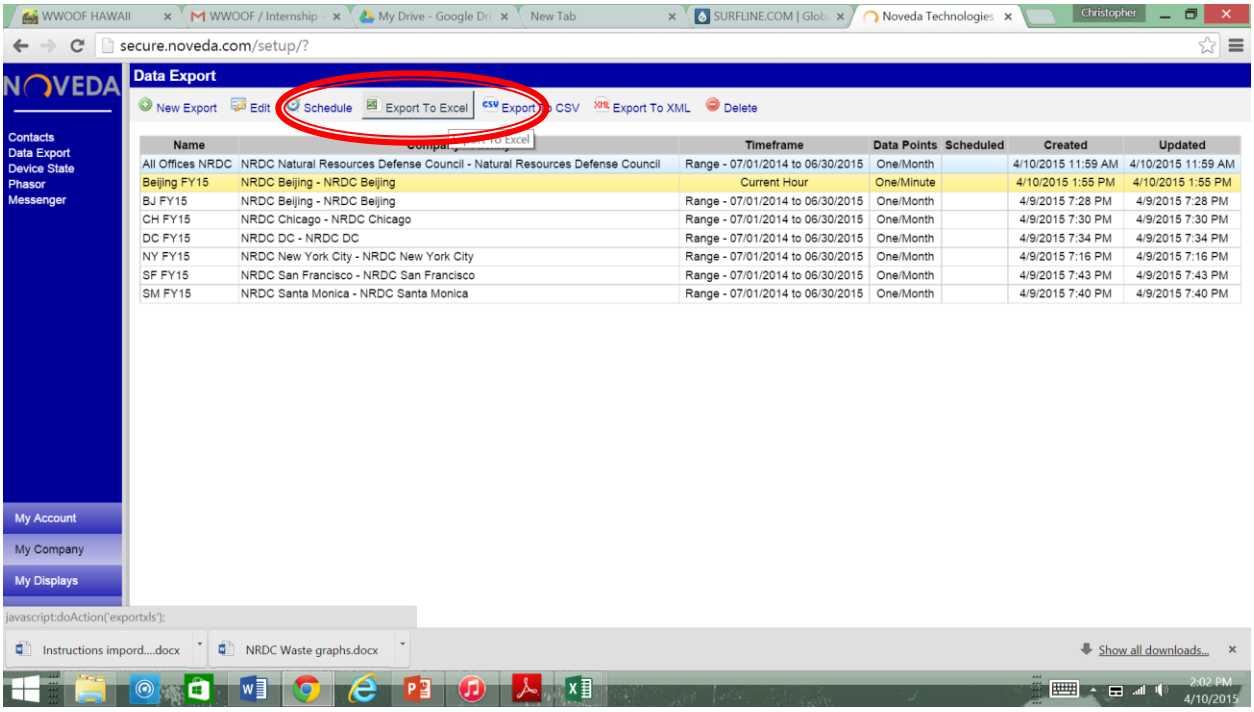


5. Next time you log in to Noveda, follow steps 1 to 5 from "New Data Export".

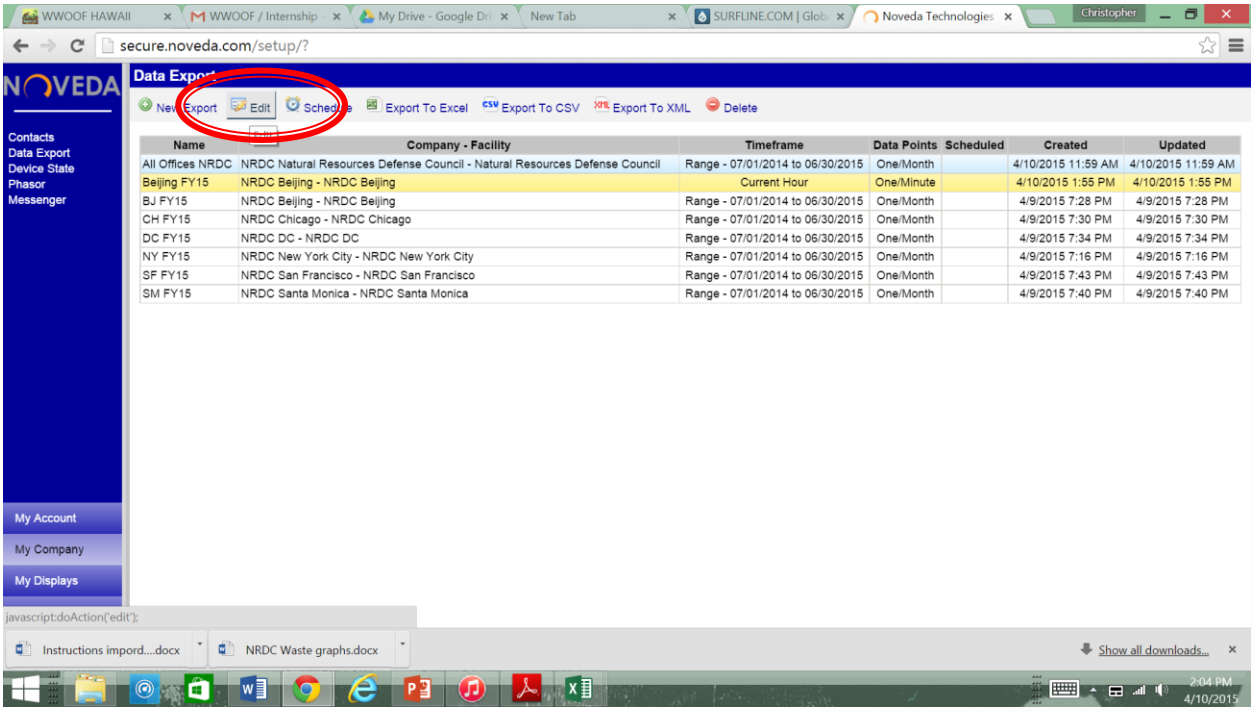
6. Instead of selecting "New Export", look up for your saved report name in the list and click on it.



7. You can either export your report directly to Excel without changing any parameter by clicking on "Export To Excel" and follow steps 18 to 21 from "New Data Export".



8. Or you can change some parameters by clicking on "Edit". This will take you to the parameters page where you modify any variable you want. Then, you can export the data to Excel and follow steps 18 to 21 from "New Data Export".

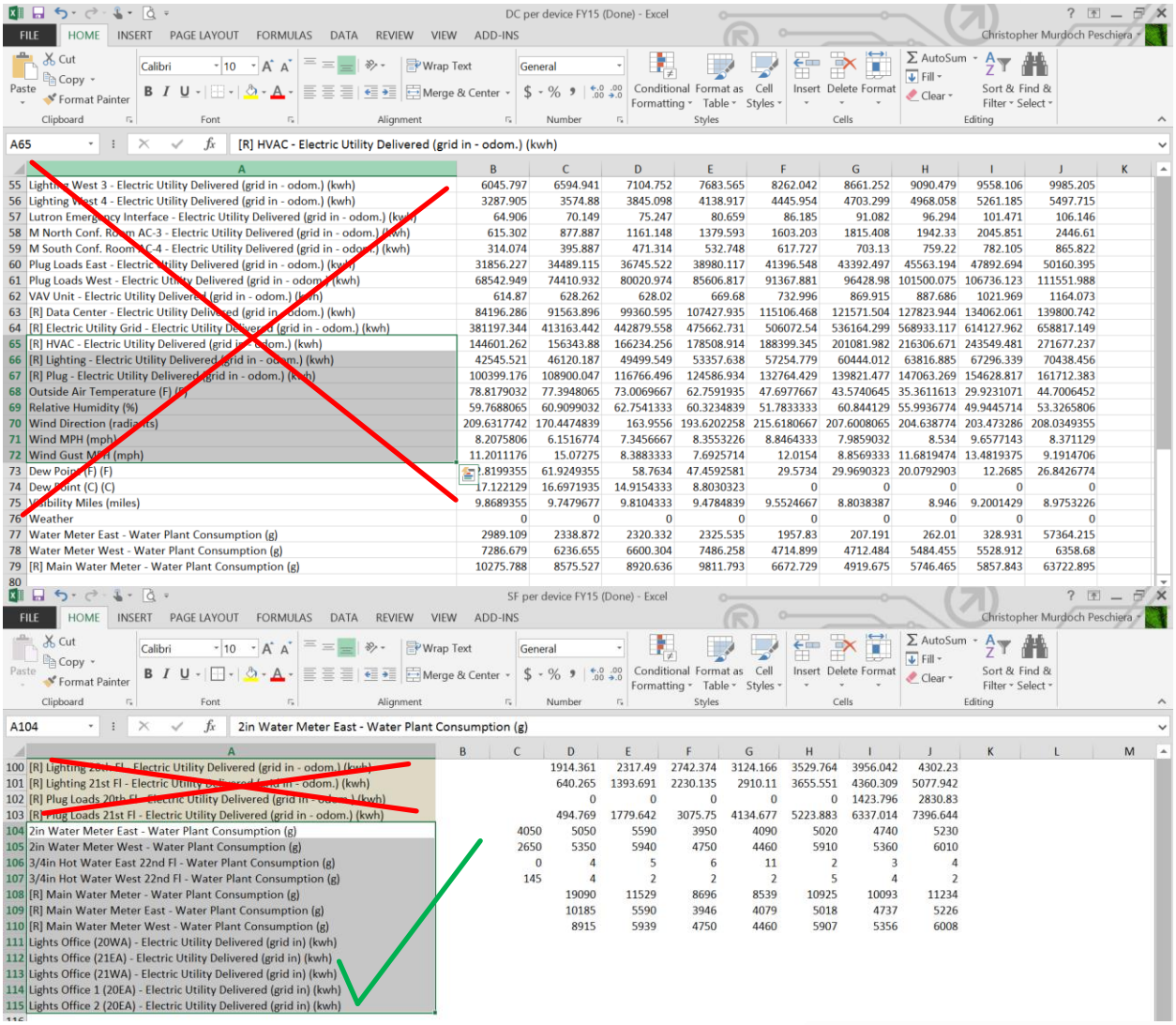


D) NOVEDA REPORT TOOL WORKSHEET MAINTENANCE

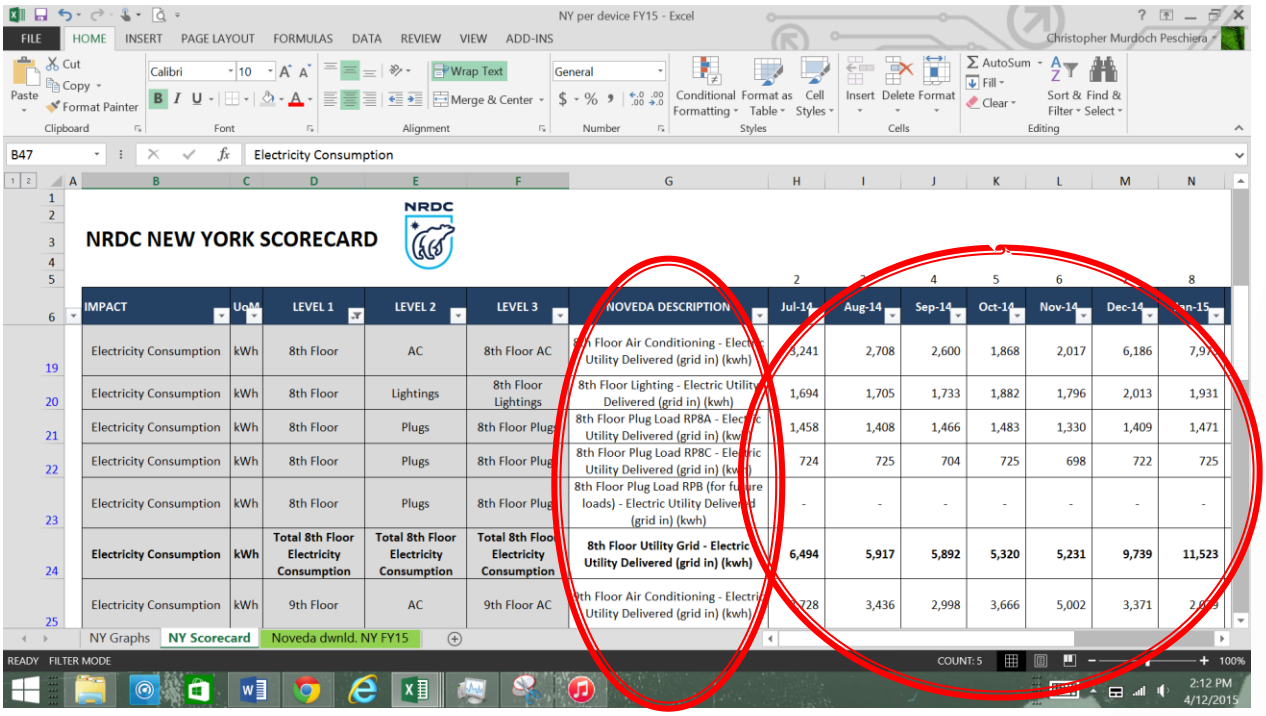
In each of the Excel files, there are two spreadsheets that need maintenance. These spreadsheets are the "Scorecard" and the "Graphs" sheets. Should something change in Noveda software, changes will be required in the spreadsheets. Some changes could be the addition of new devices in any office, new variables to be measured per office, changes of devices descriptions, and the like.

In the first spreadsheet, the Noveda descriptions found in the "Noveda dwnld. XXXXX FY##" should be copied and pasted under the "Noveda Description" header in the "Scorecard" sheet. **Note:** It is important to mention that we are not controlling external Plan variables that are gathered by Noveda such as *Outside Air Temperature (F), Relative Humidity (%), Wind Gusts (mph), Dew Point (F),* and so on. Please don't copy and paste this descriptions in the "Scorecard" sheet.

Regarding electric loads, please do not copy anything containing "*(grid in - odom.)*". These data show cumulative results, so just copy the ones saying *(grid in)".* See screenshots below for examples.



Paste the copied Noveda descriptions in the "Scorecard" sheet under "NOVEDA DESCRIPTION header. Then the results for each of the months per line will be automatically displayed in the scorecard.



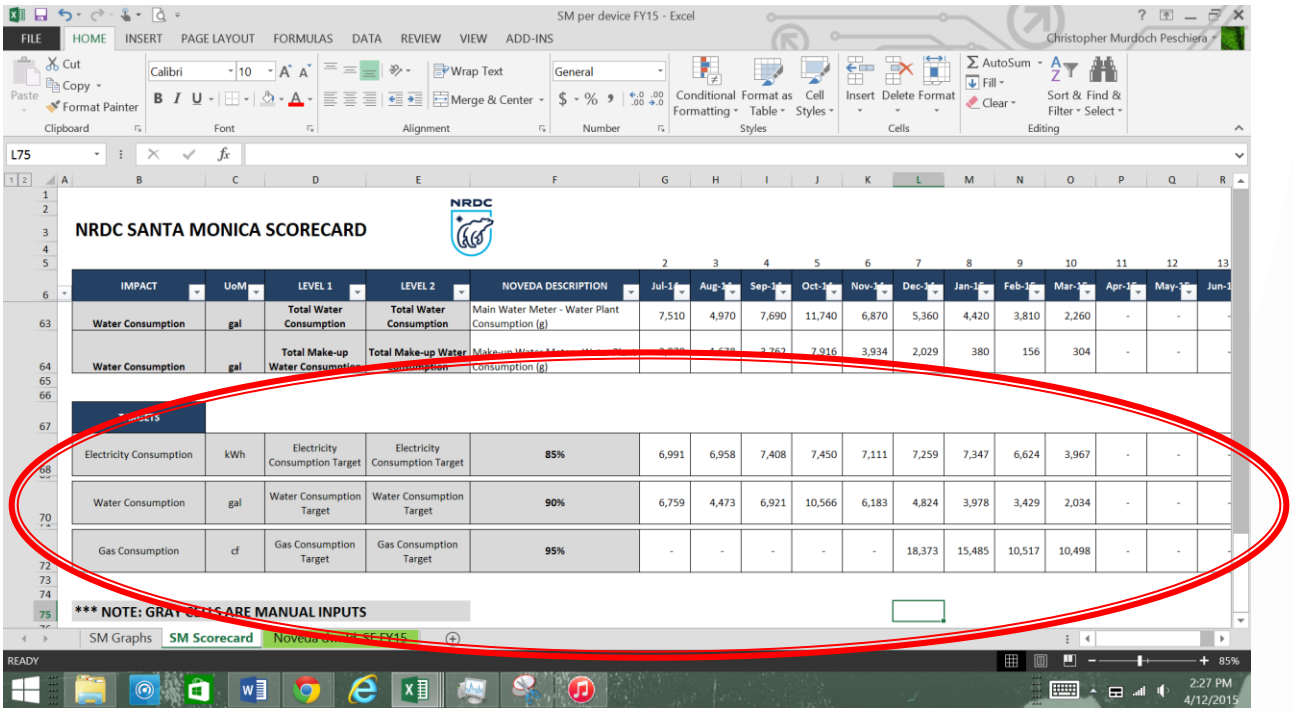
If only and additional line will be added, insert a new line, copy and paste de the description from Noveda and drag down the formulas from the previous cells so that data for each month appears accordingly.

As mentioned before, the scorecard classifies information according to "IMPACT", "UoM", and LEVEL #. These fields are manually input so if a different classification is deemed appropriate, they can be changed as per the user requirements. The intent of this classification is to be able to drilldown the data so that several analysis levels are achieved.

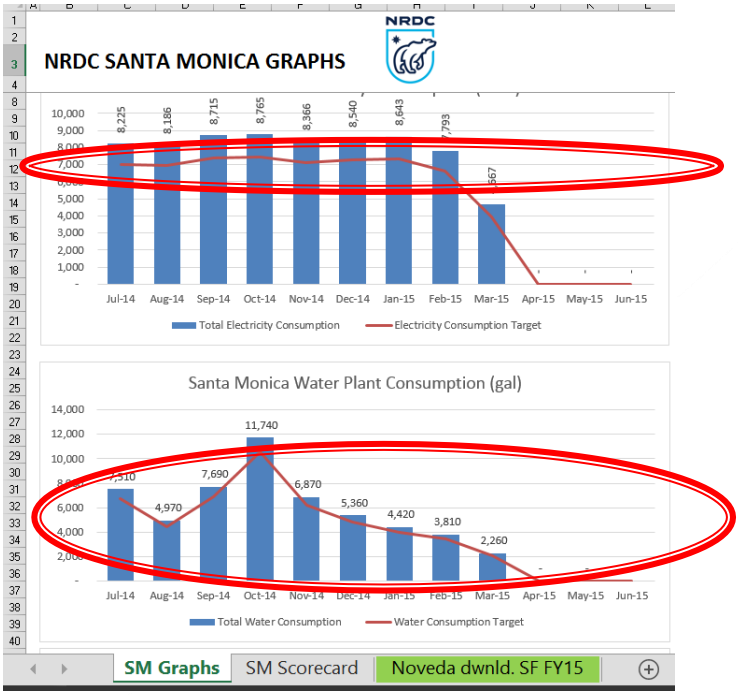
Regarding target setting, in the "Scorecard" sheet in the bottom of the page there are some cells used for target setting. By default they are considering a fix percent of the actual value for a variable; however, these targets should be modified according to project completion dates and the reduction should be in proportion of the action Plan contribution to a specific variable. This will help track and control the effectiveness of the action plans. Values should be established in a monthly basis.

Graphs are also updated automatically once these values are modified.

See below screenshot for details.



Note: Cells that are manually input are colored in grey.



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