WIKIMEDIA FOUNDATION SUSTAINABILITY ASSESSMENT AND CARBON FOOTPRINT

Final Results

June 7, 2019

ABOUT THIS REPORT

About SSC

- Strategic Sustainability Consulting provides organizations with tools and expertise to understand and manage their social and environmental impacts. Through sustainability assessments, green office auditing, supply chain management, stakeholder consultations, sustainability disclosure and social marketing, SSC helps organizations embrace their larger societal responsibilities and be the good corporate citizens to which they aspire.

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Caveats and limitations

- Based on information provided during this project, we believe that information and conclusions in this report are complete, accurate and useful. However, the data and related materials contained here are provided "as is" without warranty of any kind, either express or implied. The entire risk of use of the data shall be with the user.

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SCOPE OF PROJECT

Goal: to identify your sustainability strengths and weaknesses, and to generate a detailed list of recommendations for future improvements prioritized by "bang for the buck."

Scope: Our consultant will conduct a sustainability assessment (qualitative) and carbon footprint (quantitative) based on information collected remotely. The results will be presented back to your team in an onsite meeting in San Francisco.

Deliverables:

- Report that outlines your current performance across a wide variety of sustainability topics, including a "top 10" list of the most important recommendations across all of the area.
- Discussion of sustainability communication options and suggestions -- how you can most effectively tell your sustainability story with different stakeholders (staff and contractors, volunteers, donors, etc.).
- Onsite presentation where you and your team can ask questions and discuss with the consultant the best way to proceed with the recommendations.

WHAT IS SUSTAINABILITY?

SUSTAINABILITY DEFINED
(ASK 100 PEOPLE, GET 100 ANSWERS)

Sustainability is the avoidance of the depletion of natural resources in order to maintain an ecological balance (dictionary.com)

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. (Bruntland Commission)

Sustainability focuses on meeting the needs of the present without compromising the ability of future generations to meet their needs. The concept of sustainability is composed of three pillars: economic, environmental, and social—also known informally as profits, planet, and people. (Investopedia)

Sustainability is the process of people maintaining change in a balanced environment, in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. (Wikipedia)

Sustainable practices support ecological, human, and economic health and vitality. Sustainability presumes that resources are finite, and should be used conservatively and wisely with a view to long-term priorities and consequences of the ways in which resources are used. (UCLA Sustainability Committee)

FOR THE PURPOSES OF THIS REPORT:

Environmental sustainability is the sole focus of this report

- While we recognize that social justice (human rights, diversity, equity inclusion, etc) and financial/governance responsibility (privacy, free speech, etc.) are key elements of sustainability, they are excluded from the scope of this report.

This analysis focuses on the Wikimedia Foundation only, not the wider impacts of the Wikipedia movement.

- Includes the impact of travel (paid by WMF) for volunteers, scholarships to Wikimania, Hackathon, Wikimedia Summit, etc.
- Excludes environmental footprint of all grant-funded activity, cash investments and endowment investments (although environmental impacts of WMF's endowments/investments are a priority, they are not addressed here)

ENVIRONMENTAL SUSTAINABILITY FOR INTERNET MEDIA COMPANIES

Green Office Practices (eco-behavior, green purchasing, optimizing commuting and travel)

Green IT (especially around environmental footprint of hardware infrastructure)

ACCOUNTING METRIC	CATEGORY	UNIT OF MEASURE
(1) Total energy consumed, (2) percentage grid electricity, (3) percentage renewable	Quantitative	Gigajoules (GJ), Percentage (%)
(1) Total water withdrawn, (2) total water consumed, percentage of each in regions with High or Extremely High Baseline Water Stress	Quantitative	Thousand cubic meters (m^3), Percentage (%)
Discussion of the integration of environmental considerations into strategic planning for data center needs	Discussion and Analysis	n/a

SWOT ASSESSMENT

Strengths, Weaknesses, Opportunities, Threats

STRENGTHS

Senior leaders at WMF support exploring sustainability impacts and opportunities, including a 2017 Board Resolution

High enthusiasm across the organization (see survey results)

Lots of green building features already in place through property management and LEED certified building

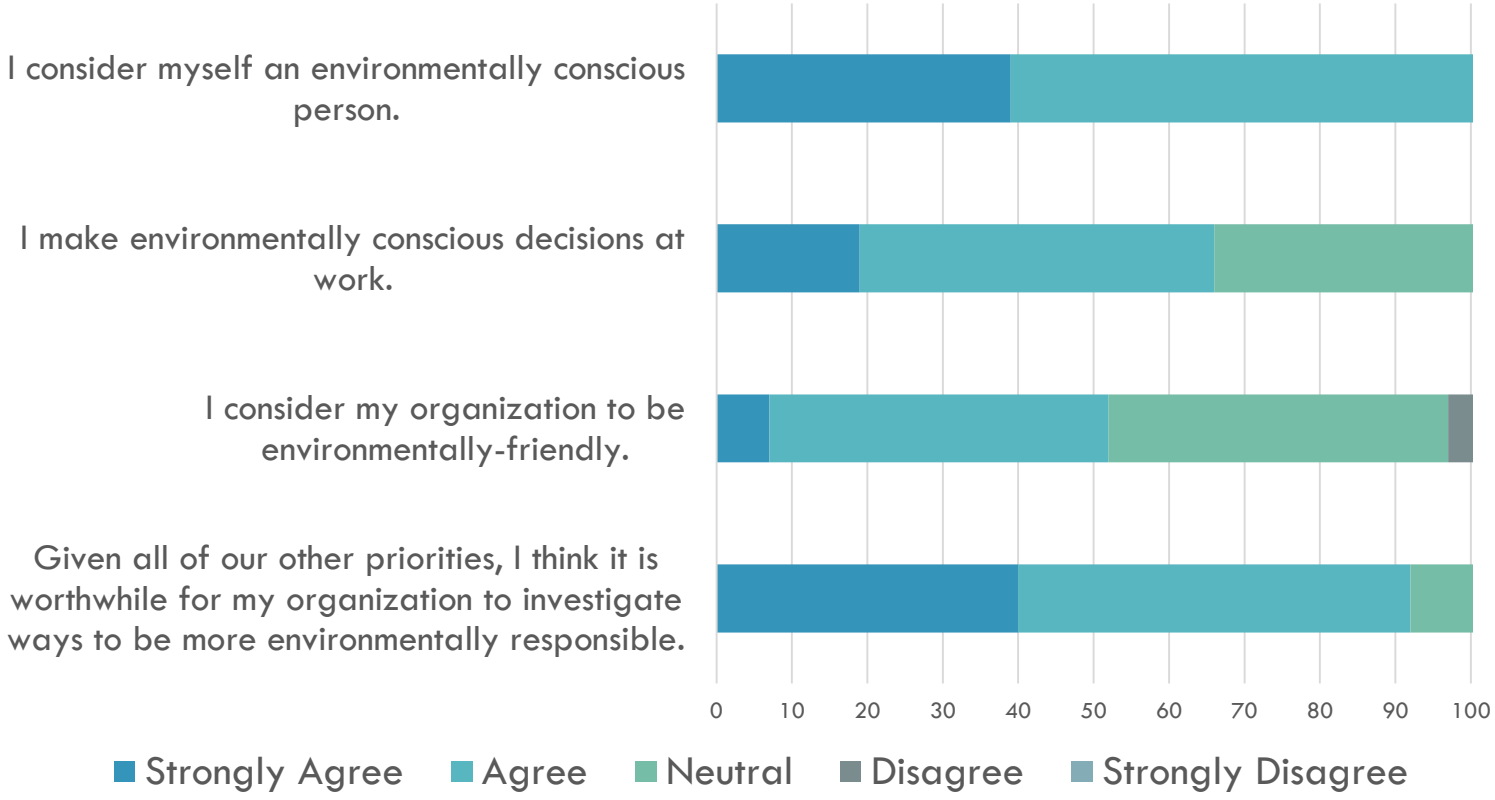
"Green IT" architecture built into the Wiki model – overall code and design is energy efficient

Knowledgeable and/or enthusiastic people wanting to dive into green IT impacts

Telecommuting already a core part of the internal culture

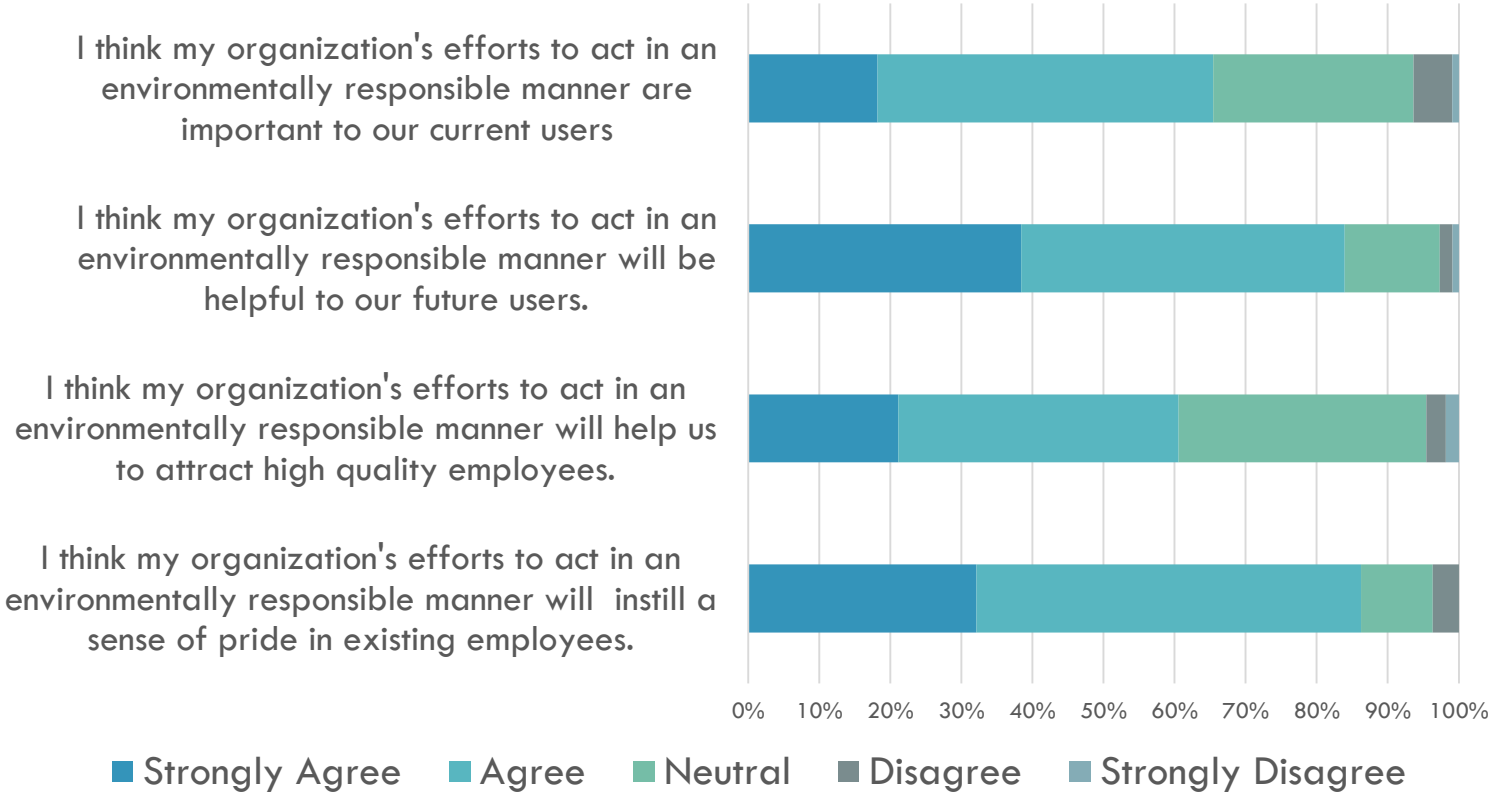
Organizational culture that encourages grassroots initiatives – little friction from bureaucracy

EMPLOYEE SURVEY RESULTS



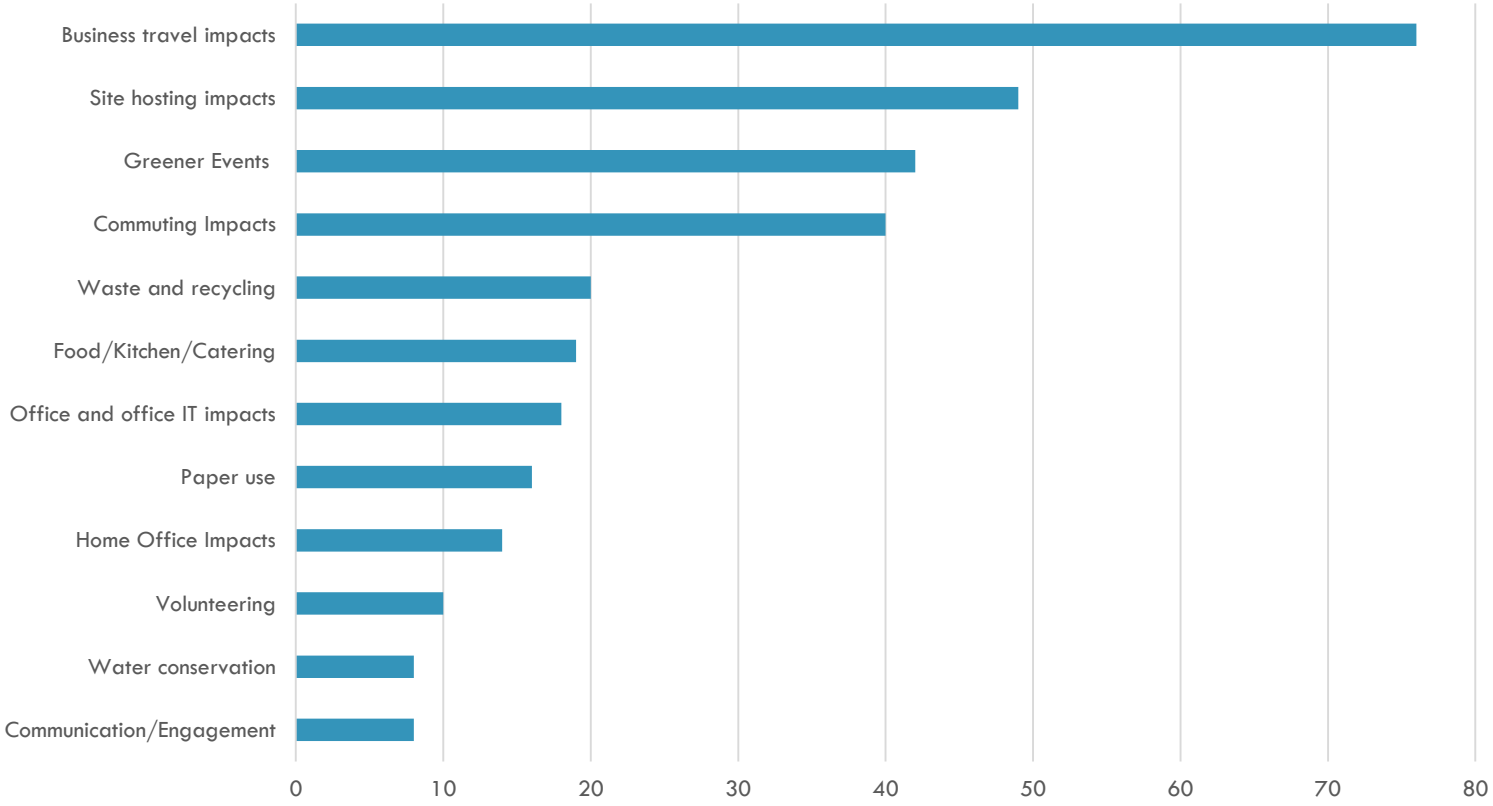
From 2019 Employee Survey

EMPLOYEE SURVEY RESPONSES (CONTINUED)



From 2019 Employee Survey

WHERE DO YOU THINK WIKIMEDIA SHOULD FOCUS ITS ENVIRONMENTAL EFFORTS?



From 2019 Employee Survey

GREEN BUILDING ACCOMPLISHMENTS

Post Montgomery Center (Certified LEED Platinum) is one of the greenest, large office buildings in San Francisco. Current ownership and management has taken a strong, pro-active approach to **conservation, waste diversion, environmental protection, energy efficiency and ecologically friendly purchasing practices.** Building system upgrades, environmentally conscious best practices, and conservation efforts have contributed to making Post Montgomery Center an award-winning, highly energy-efficient 21st century premier asset.

Green measures you will find at Post Montgomery Center: an energy efficient "light harvesting" lighting system that reduces energy usage for lighting by 20%, title 24 compliant "Cool Roof" systems in both One Montgomery Tower and Crocker Galleria, eco-friendly cleaning methods, materials and equipment, environmentally friendly restroom supplies, an education program engaging building tenants in sustainable practices, the installation of two Electrical Vehicle (EV) Charging Stations capable of fully recharging four vehicles simultaneously in only four hours

The intent of Post Montgomery Center's Green Program is to:

- Reduce energy and water consumption
- Improve indoor air quality
- Have a beneficial impact on the health of all building occupants
- Improve the cleanliness of the property
- Reduce the building's detrimental impact on the environment

WEAKNESSES

Little about sustainability has been codified

Relying on personal initiative to maintain sustainability practices can be difficult to maintain

People feel good about current practices, but sometimes struggle to name specifics

Limited time and resources for sustainability-related things

Electricity is a significant source of carbon emissions – more than twice the next biggest source (air travel)

Travel (air and hotel) are also significant sources of carbon emissions – but core part of the Wikimedia experience

WHAT ARE WIKIMEDIA'S BIGGEST SUSTAINABILITY SUCCESS STORIES?

Remote workforce policies and practices, and location in an urban area with lots of public transit options (16)

Green IT practices: attempts to make our servers run on sustainable energy, simple technical architecture, which is a consequence of our privacy and non-commercialization values, means WMF sustains Wikipedia and related sites with probably one thousandth the servers of comparable volume websites. The way our technology works is efficient by nature. We could always improve, but I am willing to bet that our carbon per hour of user experience served is the lowest on the internet, that we would be considered an outlier. So our efforts to improve our carbon footprint are important, but I'm saying we already sort of do that by nature of how our technology works (for example, we don't require sign-in). We don't run ads (all those ad networks have a massive energy consumption on server and client side. Dark mode. (6)

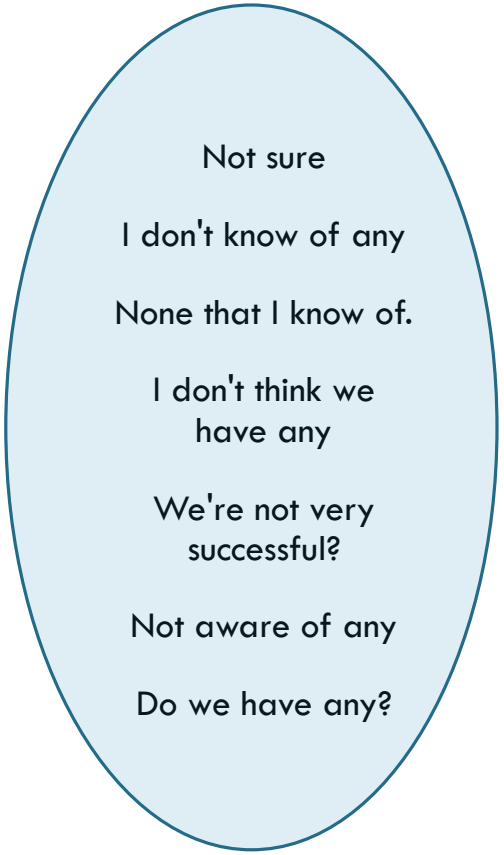
LEED certified building (4)

Paperless policy, use of Google Docs, switching some of AP's workflow and Credit Card workflow to using PDF. We're using approximately 60-70% less papers in AP processing and 95% less papers in CC reconciliation now (3)

Small things: badge holders in some events, laptops with community members, Laptop recycling program (2)

Addition of "Environmental Sustainability" program into annual plan.

The best thing we do for the environment is exist at a smaller footprint than some of our peers in Big Tech. We only have hundreds of employees instead of thousands, and a few data centers instead of more than a few. Our operations don't require the existence of an environmentally devastating corporate campus. We're mostly paperless. We're required to follow San Francisco municipal ordinances which makes us pretty good by default.



OPPORTUNITIES

Explicit sustainability commitments are still relatively rare in the Internet Media sector – room to claim leadership advantage

Set clear sustainability expectations throughout value chain – what roles and responsibilities should be in place:

- Green champion at each site (and for each event?)
- Steering committee to review and advise on corporate-wide initiatives and policies
- Data reporting?

Moving servers to renewable energy options is the single most impactful thing to reduce the organization's carbon footprint

Exploring virtual meetings/events can also have a substantial impact

Tell your sustainability story! Engage stakeholders across all channels

- Employees are eager to learn more and get involved
- What about volunteers?
- What about users?
- What about wider community?

THREATS

Relying on donations/funding from outside sources, staying lean is critical – is there budget for premium green ideas (renewable energy)?

Sustainability is increasingly important to employees (especially millennials!) – without a strong green strategy we lose competitive advantage for recruitment and retention

Maintaining culture with a remote workforce can be a tough balancing act – what do we sacrifice by (further) reducing face time?

Lack of public communication on green issues – by not staking a claim, stakeholders (like Greenpeace) are left to fill in the blanks

CARBON FOOTPRINT RESULTS

CO2-eq emissions baseline

See appendix for more information

WHAT IS A CARBON FOOTPRINT?

A CO2 Footprint is a measure of the impact the activities of a company have on the environment translated into the amount of greenhouse gases (GHG) produced by these activities.

A CO2 Footprint is considered the "Best Practice" for measuring GHG gases for the following reasons:

- It is a standard/generally accepted way of doing things in industry
- There is a reliable methodology & preferred procedure for conducting the inventory (GHG Protocol Corporate Standard, and others, based on this Standard.)
- It provides a general outline to address a variety of efficiency issues across multiple facilities within organizations.

GREENHOUSE GAS PROTOCOL

CARBON FOOTPRINT METHODOLOGY

Greenhouse gas account (GHG) accounting and reporting shall be based on the following principles:

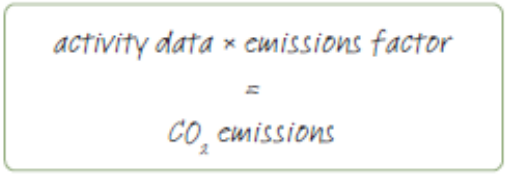
- RELEVANCE: Ensure the GHG inventory appropriately reflects the GHG emissions of the company and serves the decision-making needs of users – both internal and external to the company.
- COMPLETENESS: Account for and report on all GHG emission sources and activities within the chosen inventory boundary. Disclose and justify any specific exclusions.
- CONSISTENCY: Use consistent methodologies to allow for meaningful comparisons of emissions over time. Transparently document any changes to the data, inventory boundary, methods, or any other relevant factors in the time series.
- TRANSPARENCY: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
- ACCURACY: Ensure that the quantification of GHG emissions is systematically neither over nor under actual emissions, as far as can be judged, and that uncertainties are reduced as far as practicable. Achieve sufficient accuracy to enable users to make decisions with reasonable assurance as to the integrity of the reported information.

GREENHOUSE GAS PROTOCOL

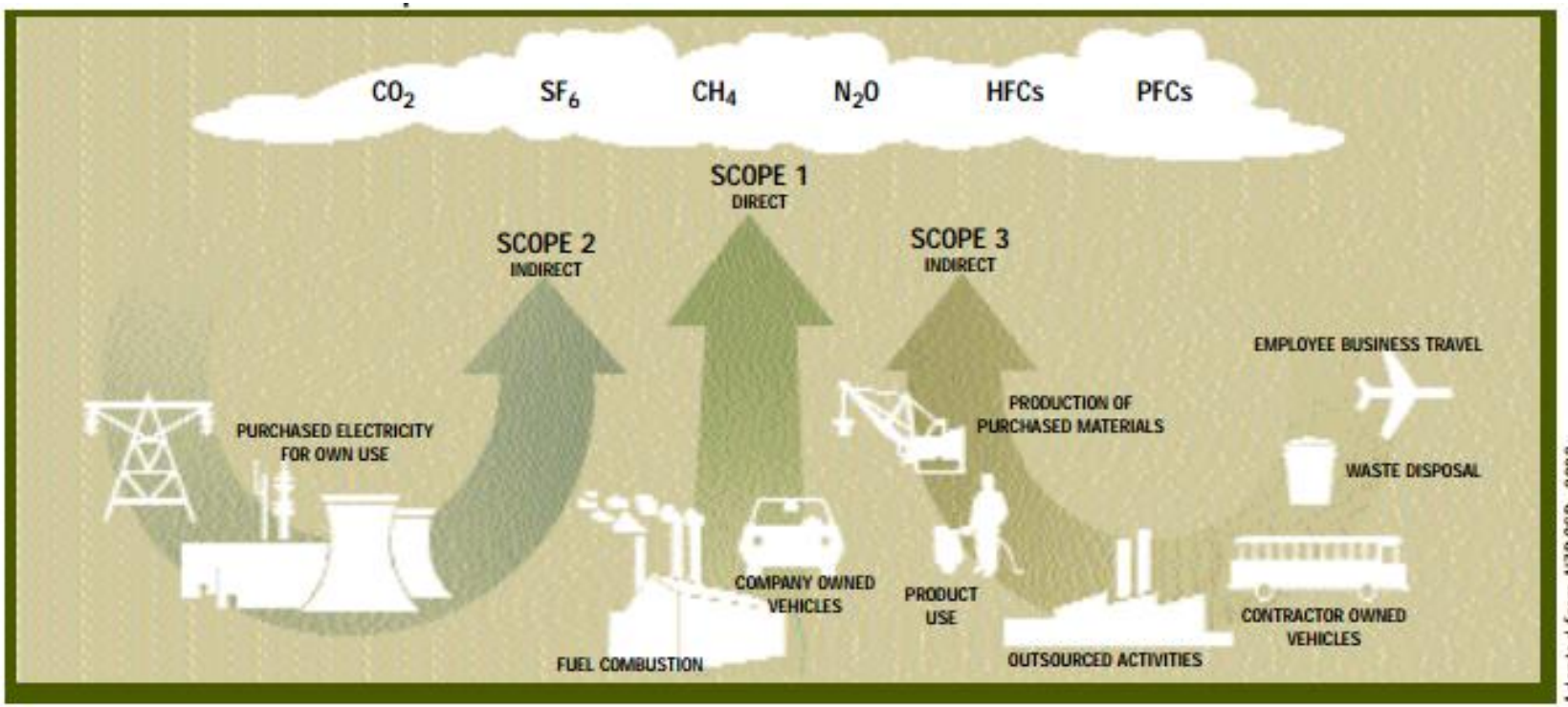
CARBON FOOTPRINT METHODOLOGY

Select best available emission factors to be used for the 7 greenhouse gasses (GHGs):

- There are seven main GHGs that contribute to climate change, as covered by the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), Sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3)
- Different activities emit different gases. This report contains information on the Kyoto Protocol GHG gases produced by the following activities:
  - Electricity, Stationary Combustion, Mobile Combustion, Refrigerants, Water Usage and Wastewater Treatment, Waste Management, staff and contractors Commuting, Business Travel (vehicle)
- Select a GHG emissions calculation approach – IPCC 2013 GWP
- Collect activity data and choose emission factor (see table <insert here>)



CARBON FOOTPRINT METHODOLOGY



GREENHOUSE GAS PROTOCOL

A Corporate Accounting and Reporting Standard

CARBON FOOTPRINT METHODOLOGY

Scope 1: Direct GHG emissions

Direct GHG emissions occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment.

Scope 2: Electricity indirect GHG emissions

Scope 2 accounts for GHG emissions from the generation of purchased electricity[2] consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the organizational boundary of the company. Scope 2 emissions physically occur at the facility where electricity is generated.

Scope 3: Other indirect GHG emissions

Scope 3 is an optional reporting category that allows for the treatment of all other indirect emissions. Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

GREENHOUSE GAS PROTOCOL

CARBON FOOTPRINT METHODOLOGY

Gather operational data (inventory phase) for an agreed-upon period of time:

- Data collection period: January 1, 2018-December 31, 2018

Identify greenhouse gas (GHG) emissions sources

Scope 1 Activities

Activity Group	Included (Y/N)
Stationary Combustion	Y
Refrigerants for heating/cooling	Y
Mobile combustion: corporate fleet vehicles	N
Fugitive Emissions	N
Mobile combustion: non-road vehicles	N

Scope 2 Activities

Activity Group	Included (Y/N)
Grid Electricity	Y
Steam	Y

GREENHOUSE GAS PROTOCOL

Scope 3 Activities

Activity Group	Included (Y/N)
Waste generated in operations to Waste Treatment	Y
Water Usage & Treatment	Y
Staff and Contractor Commuting	Y
Purchased Goods & Services	N
Capital Goods	N
Upstream Leased Assets	N
Business Travel	Y
Upstream Transportation and Distribution	N
Downstream Transportation and Distribution	N
Processing of Sold Products	N
Use of Sold Products	N
End of life processing of Sold Products	N
Downstream Franchises & Leased Assets	N
Upstream Leased Assets	N

Note: detailed descriptions on how these activities are defined by the GHG Protocol can be found here: https://ghgprotocol.org/corporate-standard

CARBON FOOTPRINT METHODOLOGY

Define System Boundaries (Organizational & Operational):

- Organizational Boundaries
  - Equity share approach: a company accounts for greenhouse gas (GHG) emissions from operations according to its share of equity in the operation
  - Control Approach: a company accounts for 100 percent of the GHG emissions from operations over which it has control. It does not account for GHG emissions from operations in which it owns an interest but has no control.
- Operational Boundaries: an operational boundary defines the scope of direct and indirect emissions for operations that fall within a company's established organizational boundary
  - Scope 1: Direct GHG emissions Companies report GHG emissions from sources they own or control as scope 1.
  - Scope 2: Electricity indirect GHG emissions Companies report the emissions from the generation of purchased electricity that is consumed in its owned or controlled equipment or operations as scope 2. Scope 2 includes indirect emissions from generation only; other upstream emissions associated with the production and processing of upstream fuels, or transmission or distribution of energy within a grid, are tracked in scope 3.
  - Scope 3: Other indirect GHG emissions Scope 3 is optional, but it provides an opportunity to be innovative in GHG management

SCOPE OF 2018 CARBON FOOTPRINT - ACTIVITY

Scope	Activity	Notes
1	Natural Gas	Post Montgomery Center – Total Building Consumption Information prorated for WMF % of total area
1	Refrigerants	Post Montgomery Center building is chilled via their Central Plant chilled water cooling system. WMF refrigerants are only used in their 2 heat pumps installed in their server room on their floor. These are small units that were installed in 2012, require only 2.4 lbs. of R410A each and did not require charging in 2018.
2	Electricity	Headquarters: Post Montgomery Center - Consumption Information prorated for WMF % of total area. Data Centers: - Ashburn (Equinix): 137.8kW - Dallas (CyrusOne): 87.4kW - San Francisco (Digital Realty Trust): 3.4kW Realtime data:https://grafana.wikimedia.org/d/000000397/site-power-usage?orgId=1&from=now-1M%2FM&to=now-1M%2FM Other Data Center electricity consumption was provided by WMF IT Staff. - Data Center PUI was estimated from publicly available information from the hosting companies where available. Where PUI was not available, estimated based upon 'best in class' data (Google.)
2	Steam	Post Montgomery Center – Total Building Consumption Information prorated for WMF % of total area
3	Water Usage	Post Montgomery Center – Total Building Consumption Information prorated for WMF % of total area
3	WWT	Post Montgomery Center – Total Building Consumption Information prorated for WMF % of total area
3	Waste to landfill	Post Montgomery Center – Total Building Consumption Information prorated for WMF % of total area
3	Recycling	Post Montgomery Center – Total Building Consumption Information prorated for WMF % of total area
3	eWaste	Actual weight provided by GreenCitizen
3	Staff and Contractor Commuting	Survey
3	Business Travel	Data obtained from WMF Travel Department
3	Events	Data obtained from WMF Travel Department – categorized into: 1. Movement Events (e.g. Wikimania, hackathons, TechConf, professional conferences, other community-facing events (i.e. GLAM Wiki, Wiki+Education, Iberoconf etc)) -- travel that would still happen even if all staff worked in the same building. 2. Co-Location Events (All-hands, Offsites, office visits) -- travel that results from having remote workers

SCOPE OF 2018 CARBON FOOTPRINT – FUNCTIONAL AREAS

Grouping	Square Feet	# Staff	Notes
WMF Headquarters	19,000	81	Estimation based upon total staff and contractors count prorated to survey responses. Total WMF staff and contractors count = 338. Of the 112 total responding to the survey, 27 were from the SFO office, 24.1%.
Telecommuting (within US)	N/A	133	Estimation based upon total staff and contractor count prorated to survey responses. Total WMF staff and contractors count = 338. Of the 112 total responding to the survey, 44 work from home in the US, 39.3% of 338 total WMF staff.
Telecommuting (outside US)	N/A	124	Estimation based upon total staff and contractor count prorated to survey responses. Total WMF staff and contractors count = 338. Of the 112 total responding to the survey, 41 work from home outside the US, 36.6% of total WMF staff.
Data Centers and WMF server room	N/A	N/A	8 Data Centers were reported. eGrid emission factors were selected based upon publicly available data for each Data Center location. For Data Centers reporting 100% renewable grid-mixes – data was not available for their specific grid-mix. It may be that they're actually purchasing RECs to offset their emissions. The server room at WMF headquarters is metered separately, data was provided for that meter by the chief building engineer of Post Montgomery.
Events • Movement • Co-Location	N/A	Used total data	Events were modeled for all attendees, and, then, scaled back to account for WMF staff and volunteers only. Hotel accommodation emission factors were based upon each event location and scaled according to the number of rooms booked by month/event. It was assumed that 2 meals (breakfast and lunch) were provided each day. Air haul distances were approximated from the allocation of short, medium and long haul reported by WMF Travel along with total CO2-eq emissions reported to offset. Hotel emission factors and water usage/room were calculated using the Hotel Sustainability Benchmarking Tool 2015: Energy, Water, and Carbon. https://www.hotelfootprints.org/. Each event was then categorized by whether it was related to the Wiki 'movement' or 'co-location' to accurately assess impacts attributable to telecommuting.

Note: While some staff and contractors assigned to the WMF headquarters in San Francisco work from home occasionally, "telecommuting" categories in this report refer to those people who work PRIMARILY from home (or outside of the SFO building).

CARBON FOOTPRINT METHODOLOGY

Gather operational data (inventory phase) for an agreed-upon period of time

- Identify greenhouse gas (GHG) emissions sources
  - Stationary combustion fuel use all facilities (Scope 1)
  - Electricity all facilities (Scope 2)
  - Steam all facilities (Scope 2)
  - Office & Production waste (Scope 3 Upstream)
  - Staff and Contractors Commuting (Scope 3 Upstream)
  - Business Travel (Scope 3 Upstream)
  - Waste to landfill & beneficial reuse (Scope 3 Upstream)
  - Water usage & treatment all facilities (Scope 3 Upstream & Scope 3 Downstream)

- Data collection period: January 1, 2018-December 31, 2018

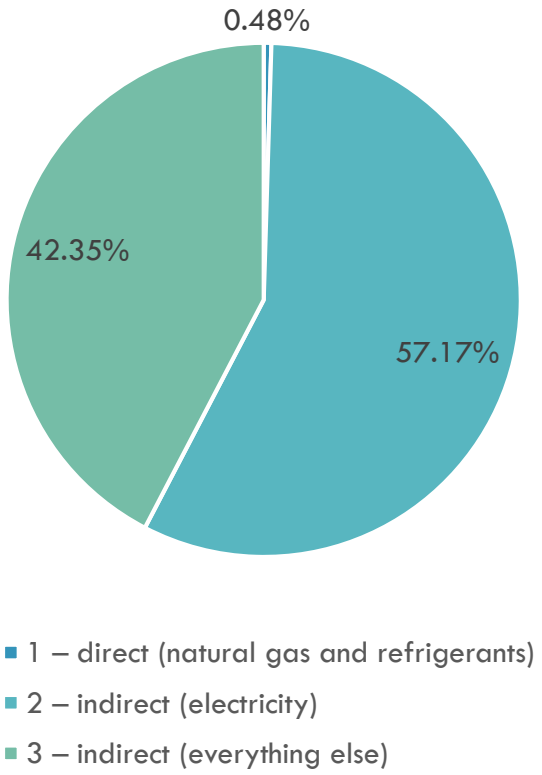
GREENHOUSE GAS PROTOCOL

ACTIVITY DATA

Activity	WMF Headquarters	Telecommuting (within US)	Telecommuting (outside US)	Data Centers and WMF Server	Co-location Events	Movement Events
Natural Gas Usage (kWh)	15,541.17	N/A	N/A	N/A	*included in Hotel emissions	*included in Hotel emissions
Refrigerants Usage (kg)	0	N/A	N/A	N/A	N/A	N/A
Electricity Usage (kWh)	238,695.34	N/A	N/A	2,842,452.36	*included in Hotel emissions	*included in Hotel emissions
Steam (btus)	298,098,778.59	N/A	N/A	N/A	*included in Hotel emissions	*included in Hotel emissions
Commuting (km)	198,038.00 (*reported)	33,859.63 (*reported)	20,701.45 (*reported)	N/A	N/A	N/A
Business Travel – Air (km)	143,064.24	21,565.21	7,830.00	N/A	845,761.49 (*extrapolated)	4,669,090.81 (*extrapolated)
Business Travel – Ground (km)	2,438.16	1,551.41	7,823.20	N/A	Not accounted for	Not accounted for
Hotel Stays (# stays)	5	11	18	N/A	2,832	2,785
Event Meals	N/A	N/A	N/A	N/A	5,664	5,570
Water Usage (m3)	781.83	N/A	N/A	21,071.91	1,723.56	1,540.95
WWT (m3)	781.83	N/A	N/A	21,071.91	1,723.56	1,540.95
eWaste (t)	0.23	N/A	N/A	Not accounted for	Not accounted for	Not accounted for
Waste – MSW (t)	4.34	N/A	N/A	Not accounted for	Not accounted for	Not accounted for
Waste – Recycled (t)	4.62	N/A	N/A	Not accounted for	Not accounted for	Not accounted for
Waste – Compost (t)	4.65	N/A	N/A	N/A	Not accounted for	Not accounted for

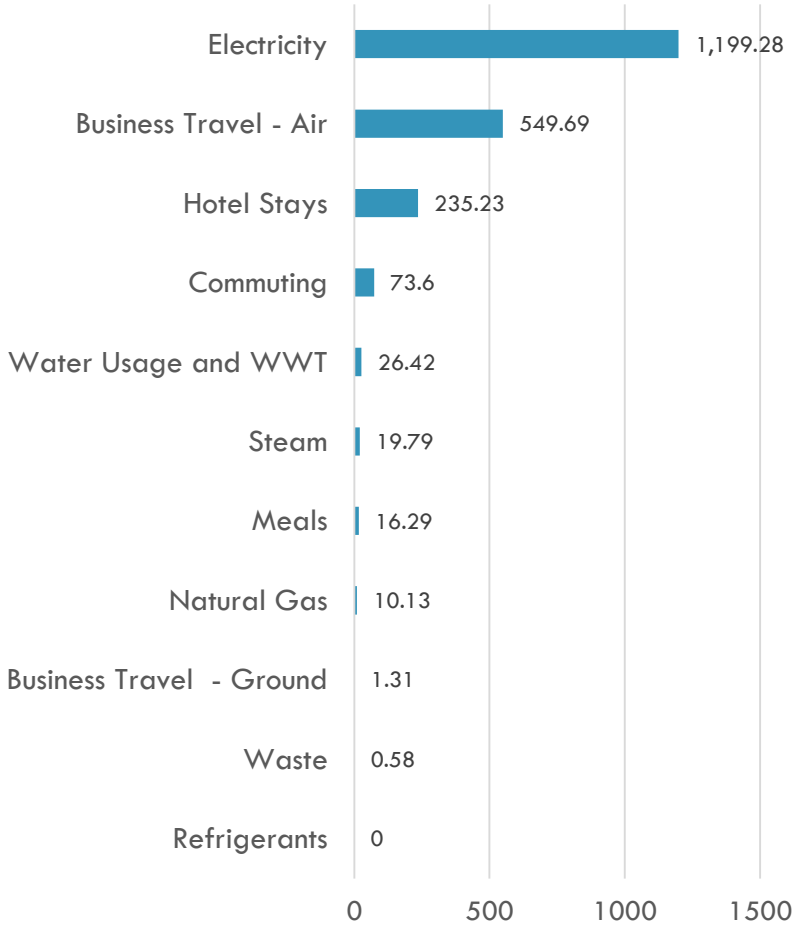
CARBON FOOTPRINT TOTALS

Scope	tCO2-e	%
1 – direct (natural gas and refrigerants)	10.13	0.48%
2 – indirect (electricity)	1,219.07	57.17%
3 – indirect (everything else)	903.11	42.35%
Total	2,132.32	100.00%



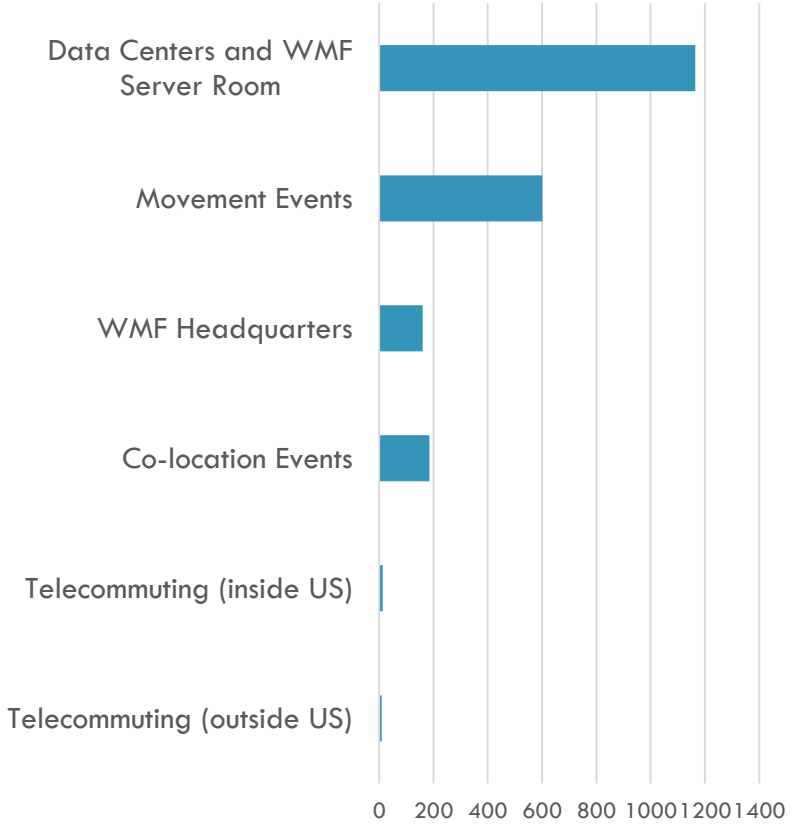
CARBON FOOTPRINT BY ACTIVITY

Activity	tCO2-eq
Refrigerants	0
Waste	0.58
Business Travel - Ground	1.31
Natural Gas	10.13
Meals	16.29
Steam	19.79
Water Usage and WWT	26.42
Commuting	73.6
Hotel Stays	235.23
Business Travel - Air	549.69
Electricity	1,199.28



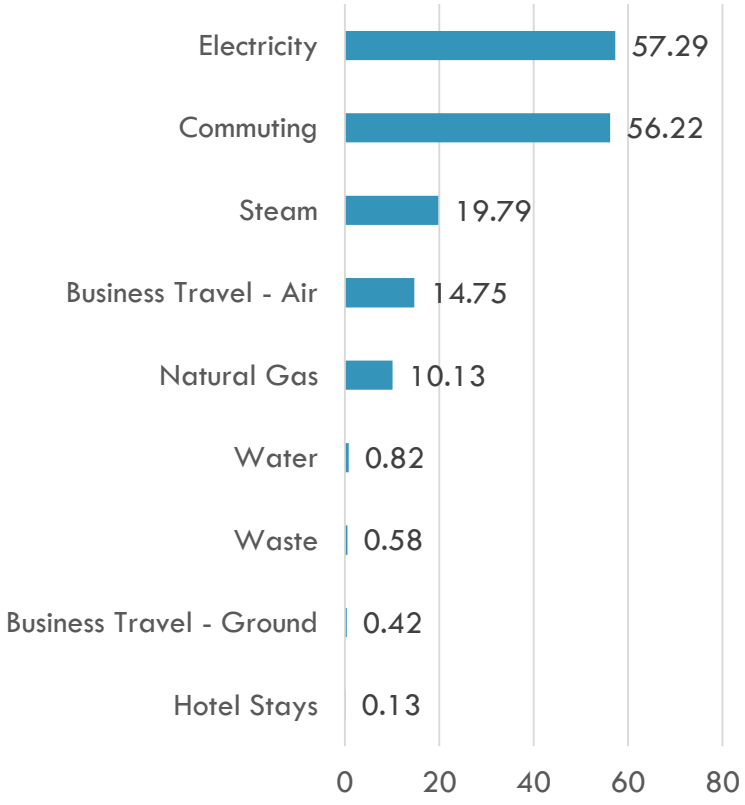
CARBON FOOTPRINT BY FUNCTIONAL AREA

Functional Area	tCO2-eq	tCO2-eq
Telecommuting (outside US)	9.26	0.43%
Telecommuting (within US)	12.7	0.60%
Co-location Events	184.43	8.65%
WMF Headquarters	160.13	7.51%
Movement Events	601.62	28.21%
Data Centers and WMF Server Room	1,164.16	54.60%



SFO HEADQUARTERS IMPACTS

Activity	t CO2-eq
Hotel Stays	0.13
Business Travel - Ground	0.42
Waste	0.58
Water	0.82
Natural Gas	10.13
Business Travel - Air	14.75
Steam	19.79
Commuting	56.22
Electricity	57.29



TOP 10 RECOMMENDATIONS

CONTEXT: BOARD RESOLUTION ON ENVIRONMENTAL IMPACT (FEB 2017)

The Wikimedia Foundation is committed to seeking ways to reduce the impact of our activities on the environment. We aim to always act responsibly and sustainably as possible, including favoring renewable energy for our operations. We believe that a long-term commitment to sustainability is an essential component of our work towards the Wikimedia mission and vision.

To this end, the Wikimedia Foundation makes the following commitments:

- We will seek to minimize our overall impact on the environment;
- We will consider sustainability as an important part of decisions around servers, operations, travel, offices, and other procurement;
- We will use green energy where it is available and financially prudent; and
- Starting in 2018, we will include an environmental impact statement in our annual plan.

#1: DEVELOP A SUSTAINABILITY POLICY STATEMENT

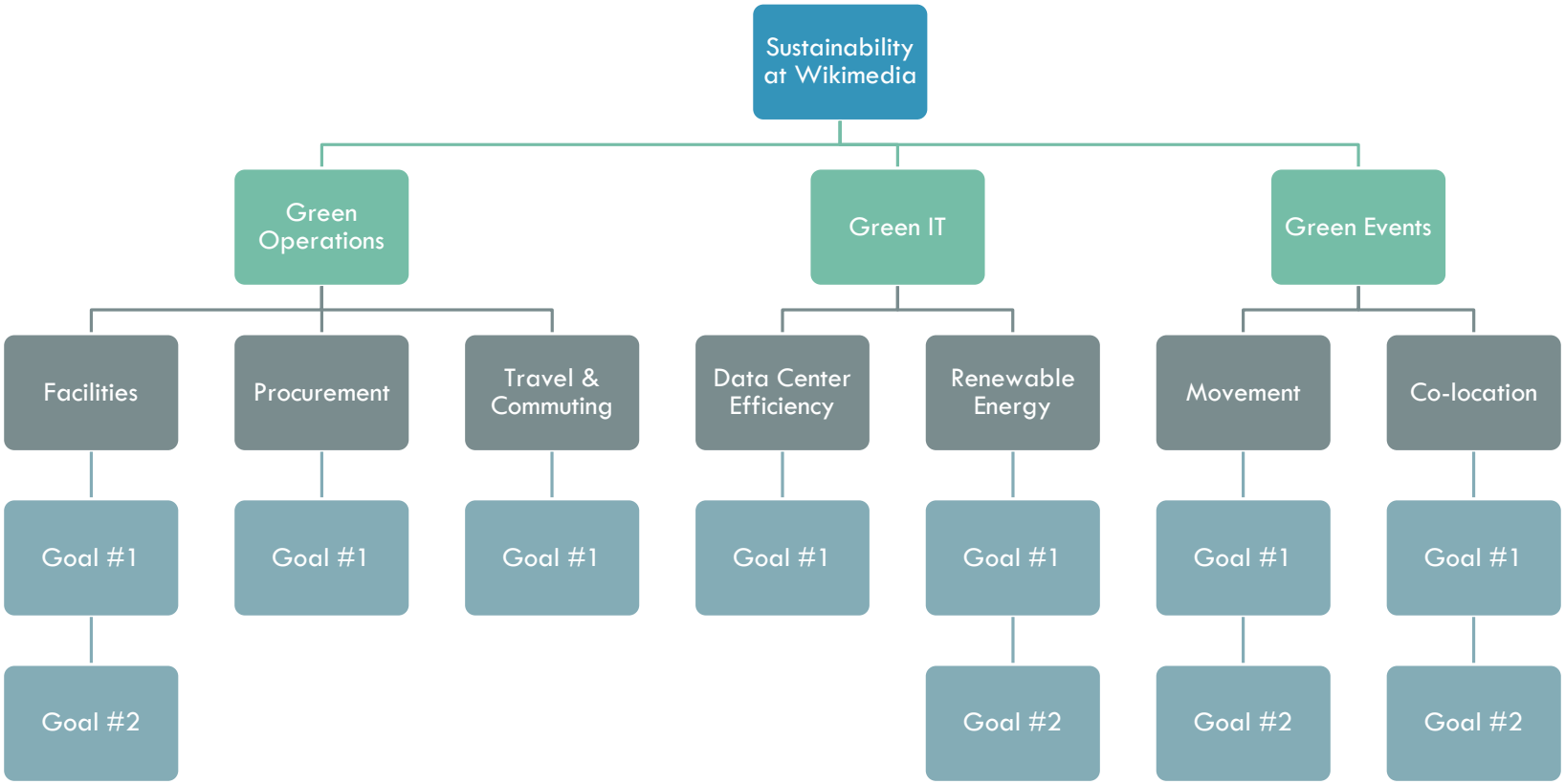
Contents

- Definition/context of what sustainability means to WMF
- Key priority areas
- Roles and responsibilities

Tips

- Aim for MECE: https://en.wikipedia.org/wiki/MECE_principle
- Tie in framework (see recommendation #2 below)

#2: DEVELOP A SUSTAINABILITY FRAMEWORK



Example

#3: DEVELOP GREEN KEY PERFORMANCE INDICATORS

How

For each sustainability program (see previously slide), choose 1-2 key performance indicators (KPIs).

Example: Travel & Commuting

- % of commuting miles avoided
- % of people using public transit

Example: All hands

- % people participating remotely
- # tCO2-eq avoided through event bundling

Create a reporting template and schedule for aggregating, validating and communicating results back to stakeholders

Why

This process sets you up to create quantitative goals in the future

Quantitative goals allow you to:

- Measure progress over time
- Aggregate impact across offices
- Claim credit

#4: FORM A GREEN DATA CENTER TASKFORCE

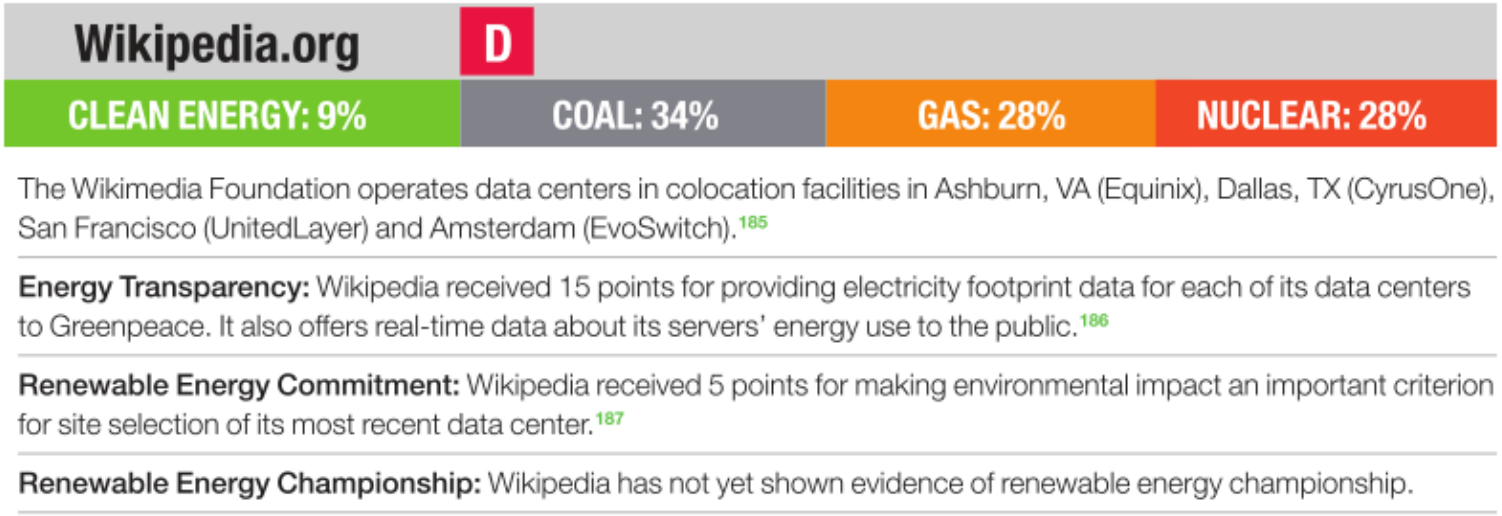
Prioritize data centers with high energy use, low efficiency and dirty grids

- Pursue options to move servers to "greener" grid mixes?
  - Most impactful: Virginia → California
- Investigate options to move servers to data centers with commitment to renewable energy
  - Bay Area: UnitedLayer → Datapipe
  - Metro DC Area: Equinix → EvoSwitch
- Consider purchasing renewable energy credits (RECs) to offset fossil fuel component of data center energy use

Investigate and implement options for increasing data center efficiency in existing facilities

https://www.quotecolo.com/best-7-enterprise-bay-area-colocation-providers/

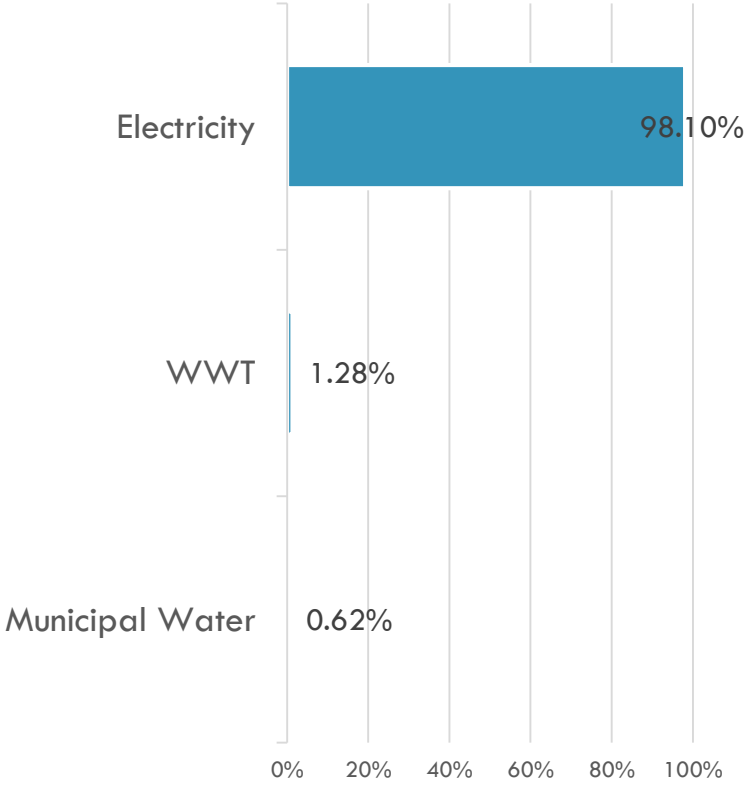
GREENPEACE "CLEAN CLICK CAMPAIGN" (2015)



https://meta.wikimedia.org/wiki/Sustainability_Initiative

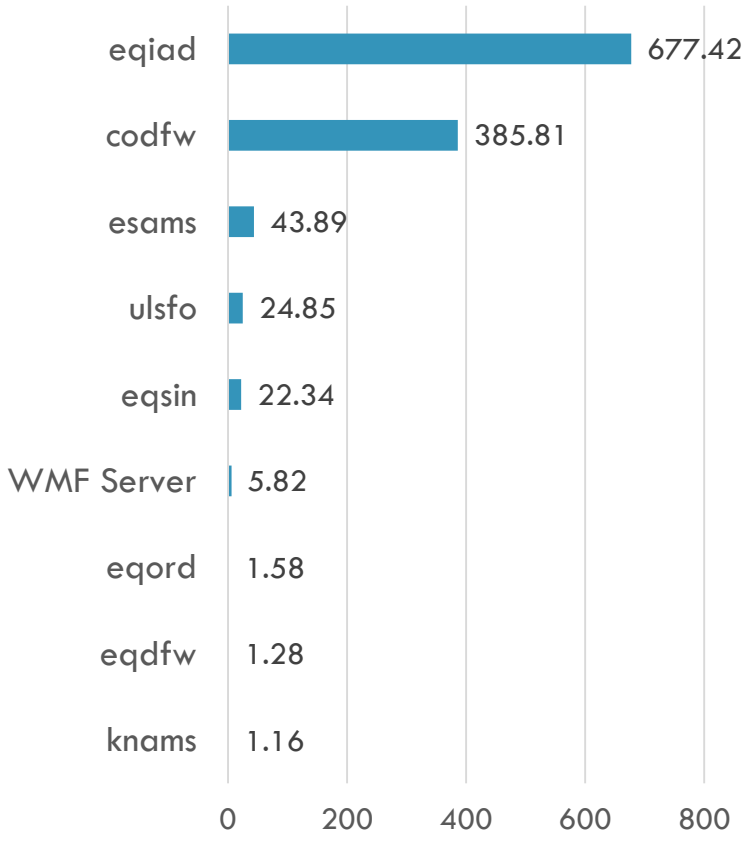
DATA CENTERS & WMF SERVER IMPACTS

Data Center - Activity	T CO2-eq/activity
Municipal Water	7.25
WWT	14.92
Electricity	1,142.00



DATA CENTERS IMPACTS

Data Center	T CO2-eq/Data Center	Location/grid mix
knams	1.16	Amsterdam
eqdfw	1.28	US-TX/ERCOT
eqord	1.58	US-IL/RCFW
WMF Server	5.82	US-SFO/CAMX
eqsin	22.34	Singapore
ulsfo	24.85	US-SFO/CAMX
esams	43.89	Netherlands
codfw	385.81	US-TX/ERCOT
eqiad	677.42	US-VA/SERC



DATA CENTER – RENEWABLE ENERGY

Data Center	Location/grid mix	kg CO2-eq/kWh	% Renewable
eqdfw	US-TX/ERCOT	0.46	14.43%
eqord	US-IL/RCFW	0.57	4.82%
ulsfo	US-SFO/CAMX	0.24	36.78%
codfw	US-TX/ERCOT	0.46	14.43%
eqiad	US-VA/SERC	0.37	5.59%

DETAILED DATA CENTER DATA COLLECTION

Data Center	Location	Provider	Date opened	Average Data Center energy consumption (kW) Calendar Year 2018	Average Estimated Total Facility Po Consumption (kWh) Calendar Year 2018	PUE	Po consumption (kWh) - Data Centers	Estimated Po consumption (kWh) - overhead	Estimated Water Consumption (m3)
eqiad	Ashburn, VA	Equinix (Website)	Feb-11	131.6	1,821,449.28	1.58	1,152,816.00	668,633.28	3,309.57
codfw	Carrollton, TX	CyrusOne (Website)	May-14	85.9	835,257.24	1.11	752,484.00	82,773.24	1,517.66
esams	Haarlem - 2031 BE Netherlands	IronMountain (Website)	Dec-08	7	73,584.00	1.2	61,320.00	12,264.00	133.70
ulsfo	San Francisco, CA	DigitalRealty (Website)	Jun-12	3.4	33,358.08	1.12	29,784.00	3,574.08	16,011.88
eqsin	Singapore	Equinix (Website)	Dec-17	3.4	47,058.72	1.58	29,784.00	17,274.72	85.51
eqord	Chicago, IL	Equinix (Website)	Feb-15	0.2	2,768.16	1.58	1,752.00	1,016.16	5.03
eqdfw	DFW		Feb-15	0.2	2,768.16	1.58	1,752.00	1,016.16	5.03
knams	Amsterdam	Interxion (Website)	Jul-05	0.2	1,944.72	1.11	1,752.00	192.72	3.53
WMF Servers	SFO Headquarters						24,264		

For more information on PUE as a benchmarking tool, see https://www.42u.com/measurement/pue-dcie.htm

DATA CENTER RECOMMENDATIONS

Ashburn, VA data center - eqiad

- Highest power consumption of all WMF servers in the US
- Least efficient data center of WMF servers in the US
- Low % renewable energy – 5.59%

Annual Estimated Po Consumption (kWh)	Annual Emissions (t) from Po Consumption (SERC grid mix)	Projected Emissions (t) when relocated to CAMX grid mix (% renewable = 36.78%)	Estimated CO2-eq (t) avoided
1,821,449.28	673.94	437.15	236.79*

*This annual savings is greater than the total WMF SFO headquarter office annual emissions.
By relocating this data center – it would be possible to offset WMF headquarters emissions.

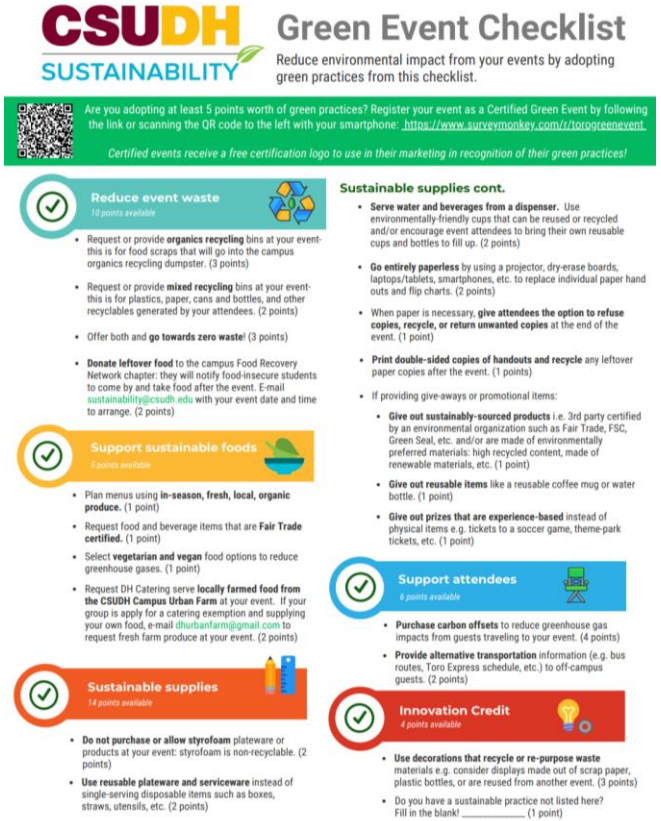
#5: EVALUATE GREEN EVENT OPTIONS

Develop a "green events guide" with checklist of options to consider at each type of event

- Hotel selection
- Public transit options
- Food and beverage
- Waste & recycling
- Swag

Enable and incentivize remote participation

- Video streaming of all sessions at events like Wikimania



CSUDH SUSTAINABILITY

Green Event Checklist

Reduce environmental impact from your events by adopting green practices from this checklist.

Are you adopting at least 5 points worth of green practices? Register your event as a Certified Green Event by following the link or scanning the QR code to the left with your smartphone: https://www.surveymonkey.com/r/torogreenevent

Certified events receive a free certification logo to use in their marketing in recognition of their green practices!

Reduce event waste

10 points available

- Request or provide **organics recycling** bins at your event- this is for food scraps that will go into the campus organics recycling dumpster. (3 points)
- Request or provide **mixed recycling** bins at your event- this is for plastics, paper, cans and bottles, and other recyclables generated by your attendees. (2 points)
- Offer both and **go towards zero waste**! (3 points)
- **Donate leftover food** to the campus Food Recovery Network chapter: they will notify food-insecure students to come by and take food after the event. E-mail sustainability@csudh.edu with your event date and time to arrange. (2 points)

Support sustainable foods

5 points available

- Plan menus using **in-season, fresh, local, organic produce.** (1 point)
- Request food and beverage items that are **Fair Trade certified.** (1 point)
- Select **vegetarian and vegan** food options to reduce greenhouse gases. (1 point)
- Request DH Catering serve **locally farmed food from the CSUDH Campus Urban Farm** at your event. If your group is apply for a catering exemption and supplying your own food, e-mail dhurbanfarm@gmail.com to request fresh farm produce at your event. (2 points)

Sustainable supplies

14 points available

- **Do not purchase or allow styrofoam** plateware or products at your event: styrofoam is non-recyclable. (2 points)
- **Use reusable plateware and serviceware** instead of single-serving disposable items such as boxes, straws, utensils, etc. (2 points)

Sustainable supplies cont.

- **Serve water and beverages from a dispenser.** Use environmentally-friendly cups that can be reused or recycled and/or encourage event attendees to bring their own reusable cups and bottles to fill up. (2 points)
- **Go entirely paperless** by using a projector, dry-erase boards, laptops/tablets, smartphones, etc. to replace individual paper hand outs and flip charts. (2 points)
- When paper is necessary, **give attendees the option to refuse copies, recycle, or return unwanted copies** at the end of the event. (1 point)
- **Print double-sided copies of handouts and recycle** any leftover paper copies after the event. (1 points)
- If providing give-aways or promotional items:
  - **Give out sustainably-sourced products** i.e. 3rd party certified by an environmental organization such as Fair Trade, FSC, Green Seal, etc. and/or are made of environmentally preferred materials: high recycled content, made of renewable materials, etc. (1 point)
  - **Give out reusable items** like a reusable coffee mug or water bottle. (1 point)
  - **Give out prizes that are experience-based** instead of physical items e.g. tickets to a soccer game, theme-park tickets, etc. (1 point)

Support attendees

6 points available

- **Purchase carbon offsets** to reduce greenhouse gas impacts from guests traveling to your event. (4 points)
- **Provide alternative transportation** information (e.g. bus routes, Toro Express schedule, etc.) to off-campus guests. (2 points)

Innovation Credit

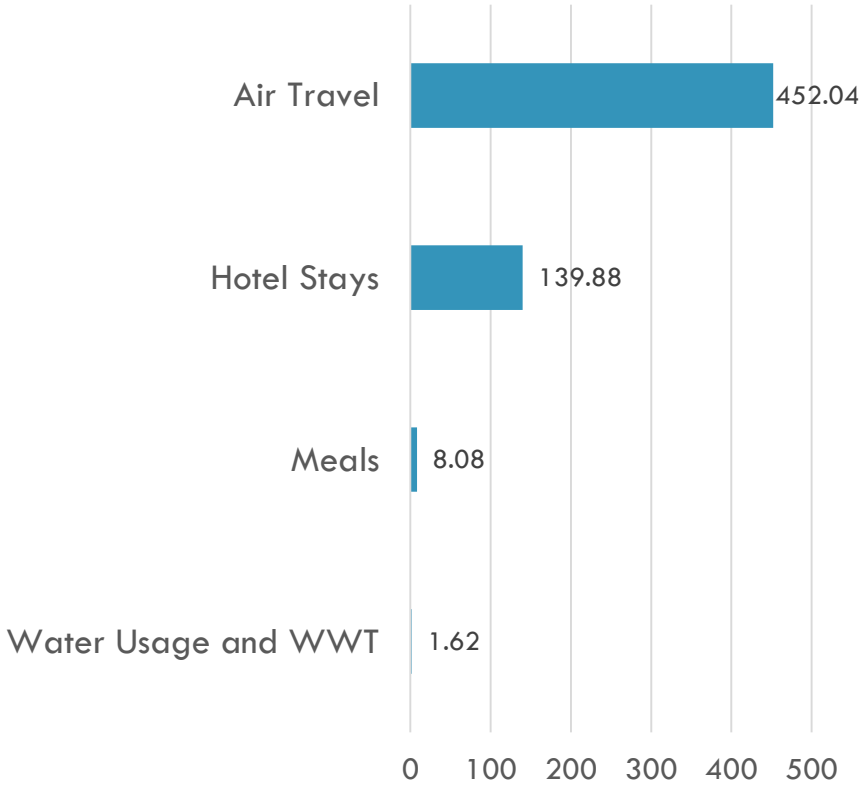
4 points available

- **Use decorations that recycle or re-purpose waste** materials e.g. consider displays made out of scrap paper, plastic bottles, or are reused from another event. (3 points)
- Do you have a sustainable practice not listed here? Fill in the blank! _____ (1 point)

https://www.csudh.edu/Assets/csudh-sites/sustainability/docs/CSUDH%20Green%20Event%20Checklist_LSU%20and%20Facilities.pdf

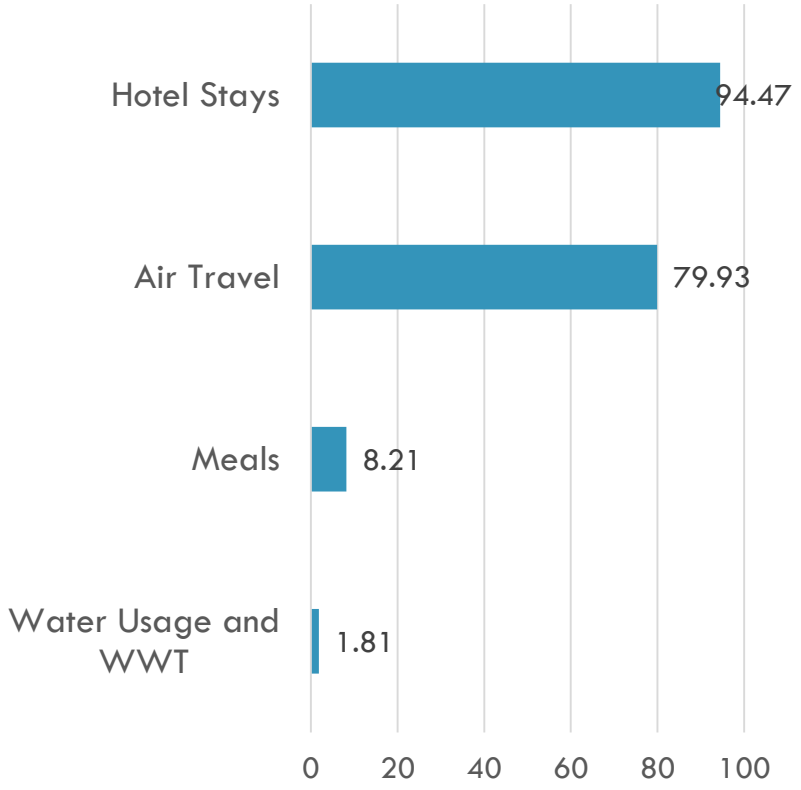
MOVEMENT EVENTS IMPACTS

Activity	t CO2-eq
Water Usage and WWT	1.62
Meals	8.08
Hotel Stays	139.88
Air Travel	452.04



CO-LOCATION EVENTS IMPACTS

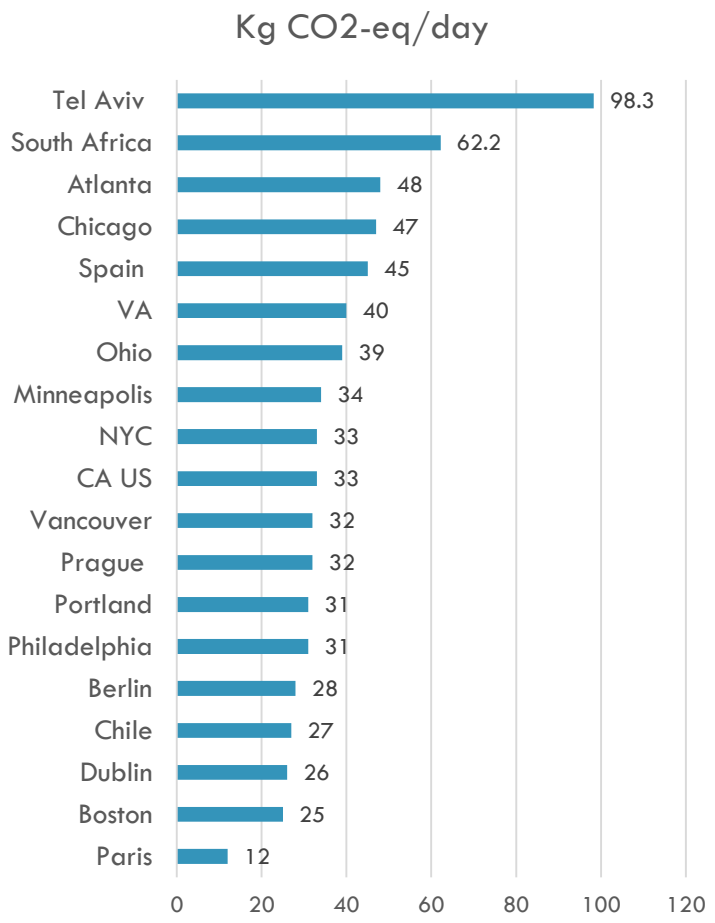
Activity	t CO2-eq
Water Usage and WWT	1.81
Meals	8.21
Air Travel	79.93
Hotel Stays	94.47



The events are specifically designed to give telecommuting staff a chance to interact face to face.

HOTEL GUEST ROOM IMPACTS

Hotels – Locations	kg CO2-eq/day
Paris	12
Boston	25
Dublin	26
Chile	27
Berlin	28
Philadelphia	31
Portland	31
Prague	32
Vancouver	32
CA US	33
NYC	33
Minneapolis	34
Ohio	39
VA	40
Spain	45
Chicago	47
Atlanta	48
South Africa	62.2
Tel Aviv	98.3



#6: OPTIMIZE COMMUTING AND TELECOMMUTING PRACTICES

Overall, Wikimedia has an excellent commuting profile

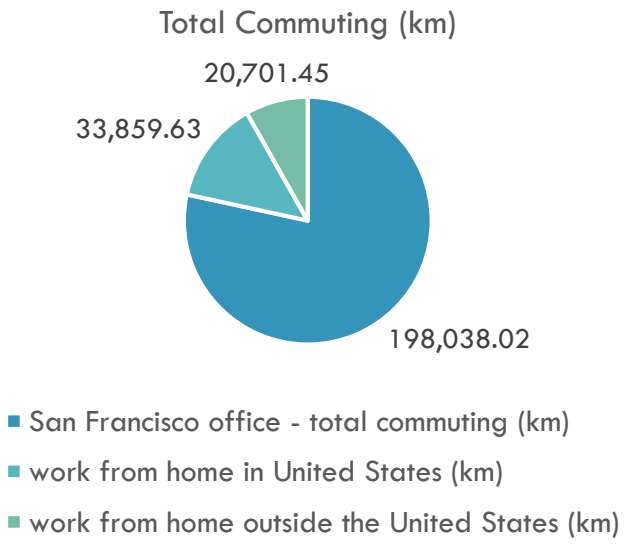
- Extensive telecommuting (e.g. work from home)
- Only 24% of miles commuted by SF staff are in personal vehicles (alone)

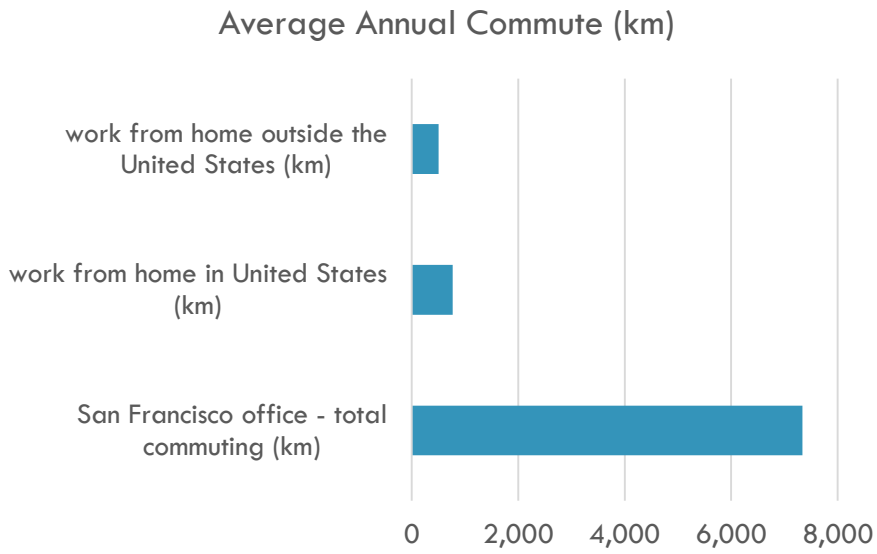
Even so:

- Almost 200,000 km of annual commuting by SF staff, with 48,000 km driven in a car alone
- 54,600 km of "commuting alternatives" by telecommuting staff (within US and outside of US)
  - Going to coffee shops, co-working spaces
  - Periodic trips into the SF office
  - Higher percentage of commuting in personal vehicles (alone) – 35% (US staff) and 51% (staff outside US)

What opportunities are there to further reduce commuting impacts?

Location	Total Commuting (km)	Average Annual Commute (km)
San Francisco office - total commuting (km)	198,038.02	7,334.74
work from home in United States (km)	33,859.63	769.54
work from home outside the United States (km)	20,701.45	504.91

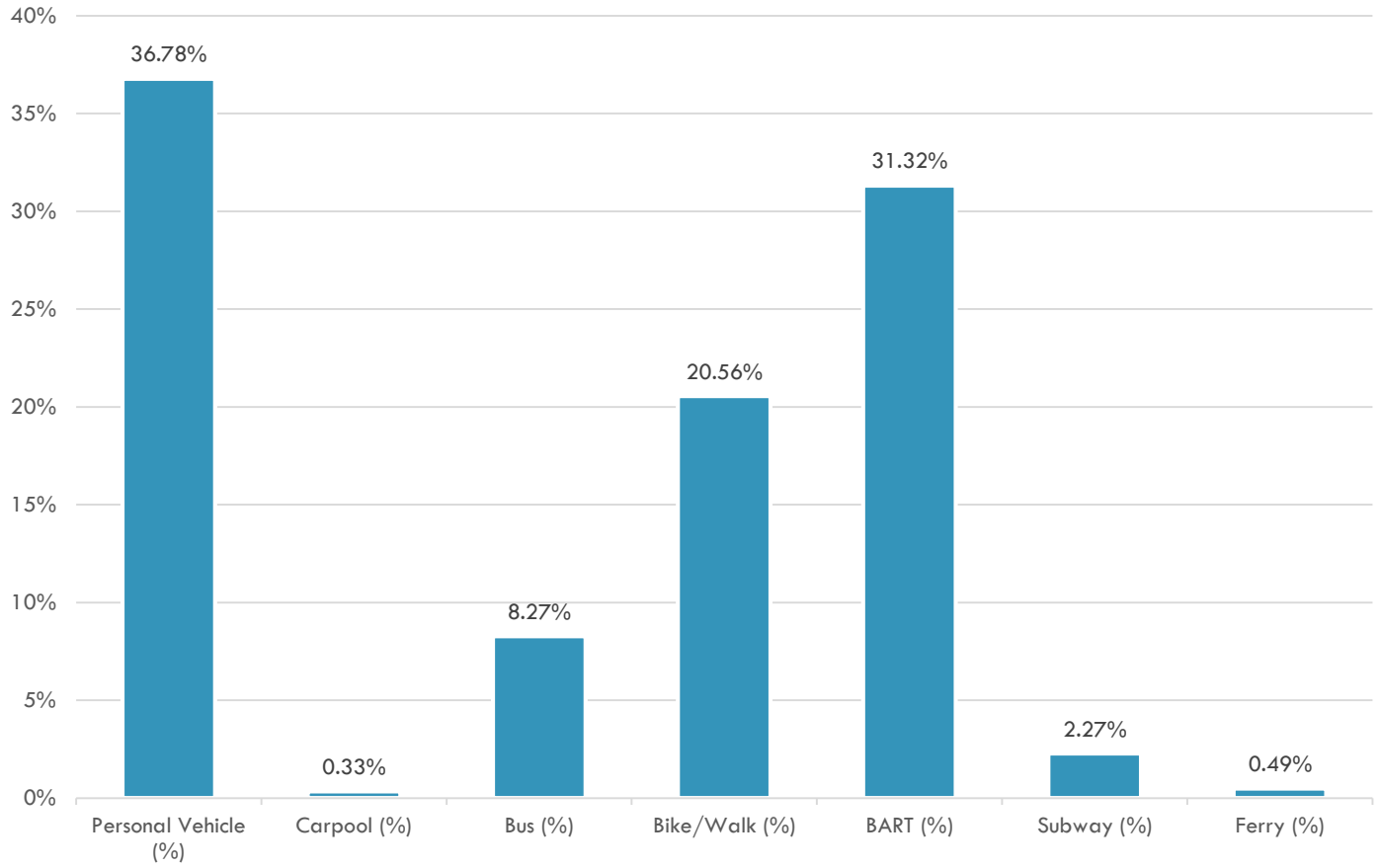




COMMUTING BY MODE

Location	Average 1- way Commute (km)	Personal Vehicle (%)	Carpool (%)	Bus (%)	Bike/Walk (%)	BART (%)	Subway (%)	Ferry (%)
WMF – SFO - Headquarters	7.4	24.2%	1%	7.5%	5.3%	56.4%	4.9%	0.8%
WMF – Telecommute - US	N/A	35.45%	0%	11.35%	22.80%	30.40%	0%	0%
WMF – Telecommute – outside US	N/A	50.69%	0%	5.97%	33.58%	7.16%	1.92%	0.68%

% COMMUTING DISTANCE BY MODE (ALL STAFF)



#8: EXAMINE TELECOMMUTING OPTIONS

Overall, telecommuting significantly reduces the organization's commuting related carbon footprint.

However, remote workforce also typically travel longer distances to come to the SF office when they do come in.

And, they attend special events specifically designed to provide face-to-face opportunities

Q1. Is telecommuting really better, given the extra travel distances (when the come into the office) and extra event impacts?

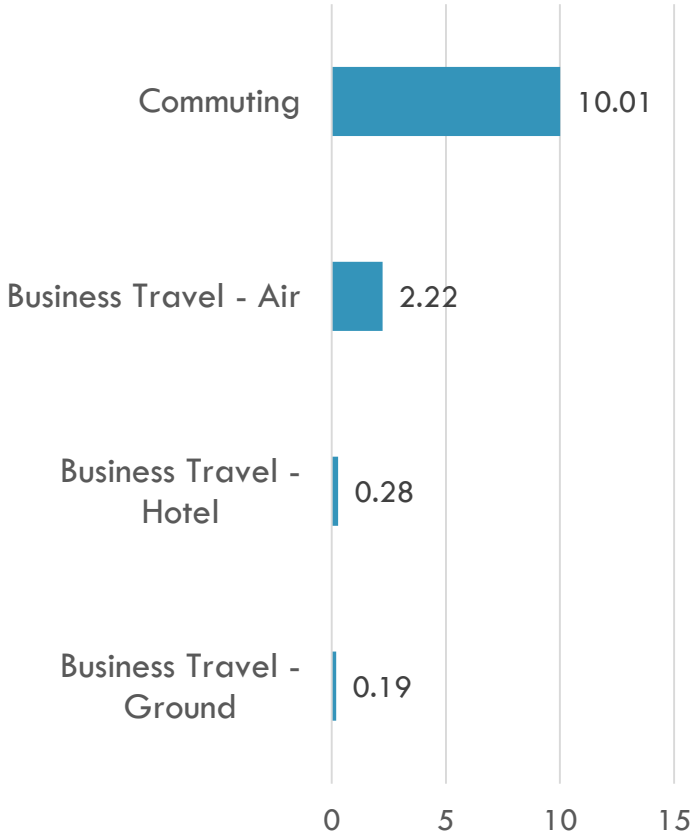
Q2. Where is there opportunity to optimize these impacts?

TELECOMMUTING SLIDE – SUMMARY

Office	Staff and Contractor Estimated Count	% Total Staff and Contractor	% of Annual Telecommuting Days
WMF SFO Headquarters	81	24%	17%
Telecommuting (within US)	133	39%	100%
Telecommuting (outside US)	124	37%	100%

TELECOMMUTING (WITHIN US)

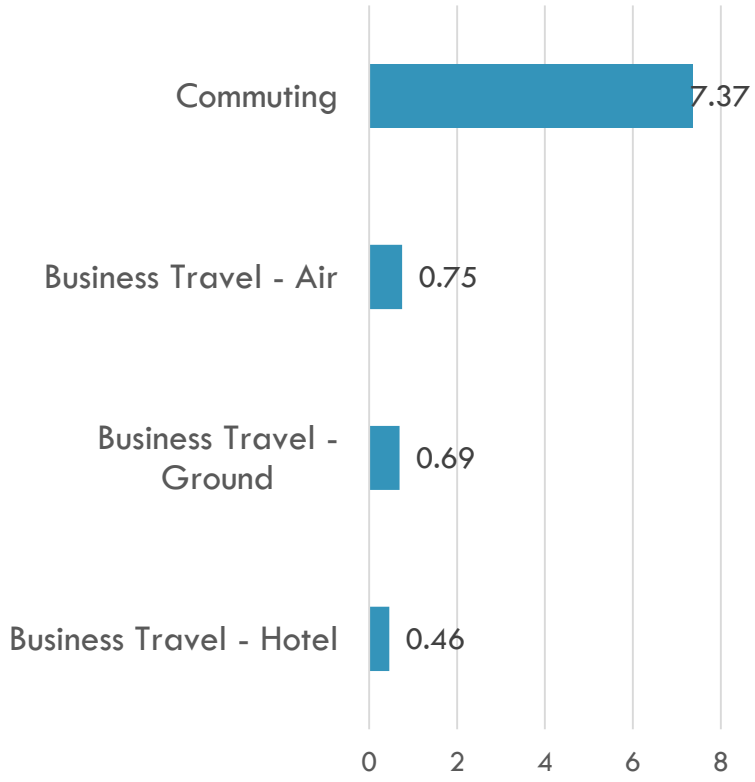
Activity	t CO2-eq
Business Travel - Ground	0.19
Business Travel - Hotel	0.28
Business Travel - Air	2.22
Commuting (alternatives)	10.01



This slide reflects the impacts of remote workers periodically coming into the SF office – often from great distances. Commuting alternatives include: going to a coffeeshop or co-working space, etc.

TELECOMMUTING (OUTSIDE US)

Activity	t CO2-eq
Business Travel - Hotel	0.46
Business Travel - Ground	0.69
Business Travel - Air	0.75
Commuting (alternatives)	7.37



This slide reflects the impacts of remote workers periodically coming into the SF office – often from great distances. Commuting alternatives include: going to a coffeeshop or co-working space, etc.

WHAT IS THE REAL CO2-EQ FOR EACH TELECOMMUTER?

Office Space projected increased annual emissions scenario
Based upon SF office space data of 1.98 t CO2-eq annually per FTE
Telecommuting Staff estimated count – 257
Providing office space for an additional 257 onsite staff would increase CO2-eq annual emissions by 508.86 t annually (1.98 * 257)

Current telecommuting emissions including telecommuting events = 206.39 t CO2-eq annually.

Conclusion
Even with all emissions associated with telecommuting events (air travel, land, hotel accommodations and meals), it is still less carbon intensive to telecommute than to provide office space. (And that doesn't count daily commuting impacts.)

Room for improvement: focus on reducing air travel for events designed for telecommuters – piggy-back on other events?

#7: DEVELOP A SUSTAINABILITY OFFICE PLAN

Create documentation for:

- Purchasing common office suppliers (paper, kitchen supplies, cleaning supplies, etc.)
- Green office features (recycling, permanent dishware, water filters, etc.)
- Additional nearby options (fitness centers, food trucks, farmers markets, walking map, etc.)

Consider additional guidance:

- Green lease toolkit, used in conjunction with lease expiration dates
- Office retrofitting guide, for new offices and office undergoing refurbishment

EXAMPLES FROM WHAT'S ALREADY IN PLACE

Waste and Recycling

- The building provides recycling and composting. Employees are expected to sort their trash correctly. Recycling programs for servers, laptops, toners. Used batteries are properly disposed of through a service provided by the building and green citizen.

Eliminating single-use plastic

- We use ceramic dishes, metal tableware and have an energy efficient dishwasher. For monthly staff lunches, breakfast and special events, we use disposable compostable tableware whenever possible. Sometimes our food deliveries come with plastic ware but we try to discourage them from bringing it to us.

Lower impact food options

- We procure our weekly snacks from COSTCO & Safeway. We also receive a weekly delivery of organic locally sourced fruit. Our monthly staff lunches and breakfast come from local restaurants who often have sustainable practices. We have used food donation services in the past and we also encourage staff to take food home if there are leftovers.

#8: DEVELOP A SUGGESTION BOX PROCESS

42 ideas submitted through the employee survey

Group them into categories (energy, waste & recycling, commuting, paper, etc.) and eliminate duplicates

Review as a team by category (one topic per month?) and choose 2-3 priorities:

Green Champions in each department are responsible for:

- Investigating and implementing as appropriate
- Reporting back on progress

There's nothing wrong with recycled napkins and using tap water at the office instead of bottles or whatever, but it probably doesn't really dent where we're damaging the environment.

More consideration should be put into work travel -- does taking a longer flight for slightly less money make sense when the environmental impact is much greater.

Probably some room to reduce amount of swag (water bottles, etc.) and type of swag to be more environmentally-conscious..

People in the SF office could use a refresher on trash/compost/recycling, particularly after food-heavy events

Canned sodas and sparking water at the office could be replaced with a cool fountain.

Plant-based, or at least non-meat, catering.

Use renewable energy for servers

Evaluate and apply ethical and sustainable standards on our own investments and also make sure that our 401k service provider offers similar standards.

Buying less in office snacks that come in wrappers is beneficial as this will help us reduce our single use plastic.

Carbon offset credits for travel, less flights

I think our biggest carbon sin is air travel, by far. We should look into meeting planning software that helps us figure out the timing of meetings, where to plan them, etc. We could also consider planning more multi-team offsites, which has added business benefits. The long-term solution is probably going to involve remote presence technology but I don't think the tech is there yet to replace the real thing of seeing a real human in person.

#9: DETERMINE OVERSIGHT AND ACCOUNTABILITY ROLES

One of the big challenges for creating and implementing a Wikimedia sustainability strategy is the lack of time and resources

Volunteer steering committee

- Sets the strategy
- Aggregates and organizes results
- Connects resources

Every department has a dedicated Green Champion

- Implements specific action plan
- Reports results

How do we compensate, reward and recognize this work?

What role do volunteers play?

#10: DEVELOP A COMMUNICATIONS PLAN

Targeted

- How to use and improve power-savings in the SF office
- Refresher on recycling and composting at SF office
- Paper reduction opportunities, tips and tricks

Ongoing

- Meta Wiki - structure based on sustainability framework
- Standing agenda item at all-hands
- Internal (Google Docs, Slack, etc.)

Annual

- Environmental impact statement

ENVIRONMENTAL IMPACT STATEMENT FOR 2019 ANNUAL PLAN

(TO BE COMPLETED BY WMF)

Focus Area	Actions	Lead	Budget	Difficulty	Timeline
Facilities	• Provide quarterly refresher training to staff at SF office (recycling/composting, paper reduction, energy conservation, etc.) • Track annual carbon footprint of WMF operations against 2018 baseline		$ $$	X XX	Quarterly Annually
Procurement	• Develop eco-purchasing guide for key procurement categories (paper, furniture, IT, etc.)		$	X	Once
Travel & Commuting	• Review options and incentives for alternative commuting (carpooling, public transit, etc.)		$	X	Once
Data Center Efficiency	• Develop data center efficiency plan to improve efficiency in existing data centers by 10% by 2022		$	XXX	Once
Data Center Renewable Energy	• Develop roadmap and decision criteria for increasing renewable energy options for new and existing data centers		$	XXX	Once
Movement Events	• Develop “green events” checklist and implement criteria moving forward • Beginning TBD, all major movement events are fully video-streamed		$$	XX XX	Once Ongoing
Co-location Events	• Develop criteria for minimizing eco-impact of co-location events (green hotels, optimizing travel, piggy-backing on other events, etc.)		$	X	Once

DISCUSSION AND NEXT STEPS

IN MAY 2019 MEETING, SSC PRESENTED DRAFT RESULTS TO WMF

General agreement on results:

- Passed the "sanity check" – team agreed with findings that data centers, events, travel/commuting are the biggest drivers of environmental impact
- Some people surprised by the 25% of total miles driven by solo car commuting in SF: SFers thought it was high, everybody else thought it was low. Full dataset provided by SSC – opportunity to dive deeper.

Hot topics for discussion:

- Credibility and ROI of carbon offsets
- High cost/investment of data centers makes moving them a BIG deal
- What is our framework for analyzing our choices and making decisions?
- What is the best use of our resources, keeping in mind we are accountable to our donors?

KEY TOPICS FOR CONSIDERATION

What do we want to do?

- How ambitious do we want to be
- Where should we start

How are we going to do it?

- Personnel
- Budget
- Roles and responsibilities

How are we going to communicate results?

- Where
- When
- How often

APPENDIX

Methodology and Activity Data

INTENSITY METRICS

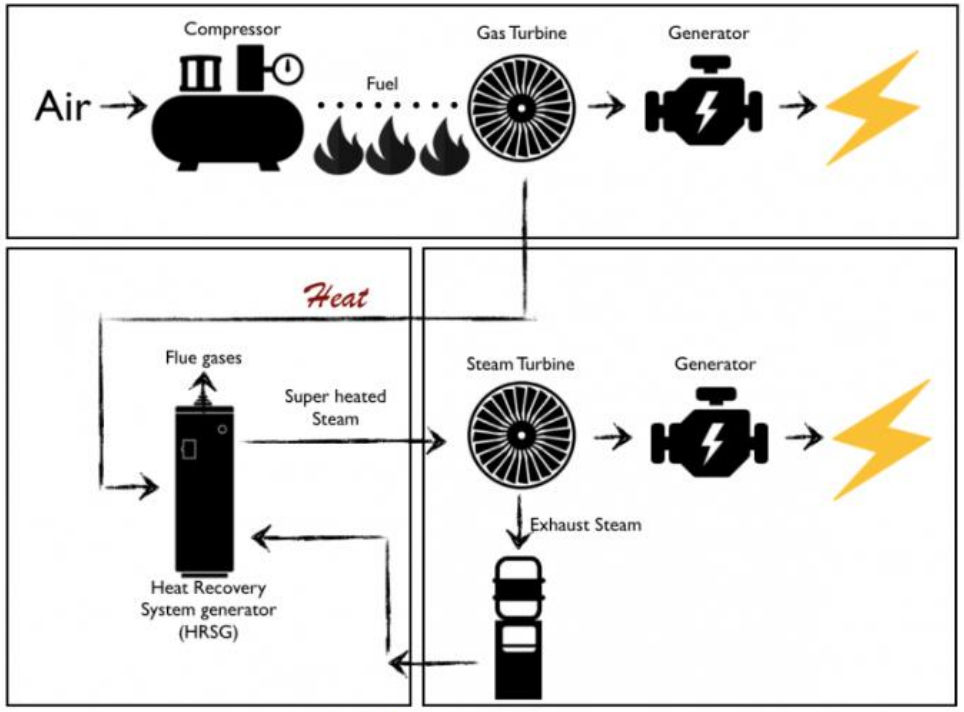
	Intensity Metric	Denominator - #	Numerator - T CO2-eq	T CO2-eq/metric
Carbon per employee (all employees)	T CO2-eq/FTE	338	2,132.32	6.31
Carbon per employee (headquarters only)	T CO2-eq/FTE in SF	81	160.13	1.98
Carbon per square foot of office space (headquarters)	T CO2-eq/Square Foot in SF office	19,000	160.13	0.01
Telecommuting carbon per person (remote workforce)	T CO2-eq/Telecommuting Staff (all remote workers) - including co-location Events	257	206.39	0.80
Commuting carbon per person (headquarters)	Commuting – Average Annual T CO2-eq/WMF Staff	81	56.22	0.69
Carbon impact of events (per event day)	All events - Average T CO2-eq/day	269	786.05	2.92

RENEWABLE ENERGY

Subregion Resource Mix (eGRID2016)													
eGRID subregion acronym	eGRID subregion name	Generation Resource Mix (percent)*											
		Coal	Oil	Gas	Other Fossil	Nuclear	Hydro	Biomass	Wind	Solar	Geo-thermal	Other unknown / purchased fuel	% Renewable
CAMX	WECC California	4.3	0.1	48.4	0.7	9.4	12.1	2.9	7.0	10.6	4.1	0.2	36.78%
ERCT	ERCOT All	25.9	0.0	48.2	0.5	10.8	0.3	0.3	13.7	0.2	0.0	0.2	14.43%
NYCW	NPCC NYC/Westchester	0.0	0.4	64.6	0.0	34.1	0.0	0.9	0.0	0.0	0.0	0.0	0.88%
RFCW	RFC West	49.8	0.4	16.7	0.7	27.6	0.9	0.6	3.2	0.1	0.0	0.1	4.82%
SRVC	SERC Virginia/Carolina	24.9	0.2	29.5	0.1	39.6	1.5	2.8	0.2	1.1	0.0	0.1	5.59%
U.S.		**30.4**	**0.6**	**33.8**	**0.3**	**19.8**	**6.4**	**1.7**	**5.6**	**0.9**	**0.4**	**0.1**	14.96%

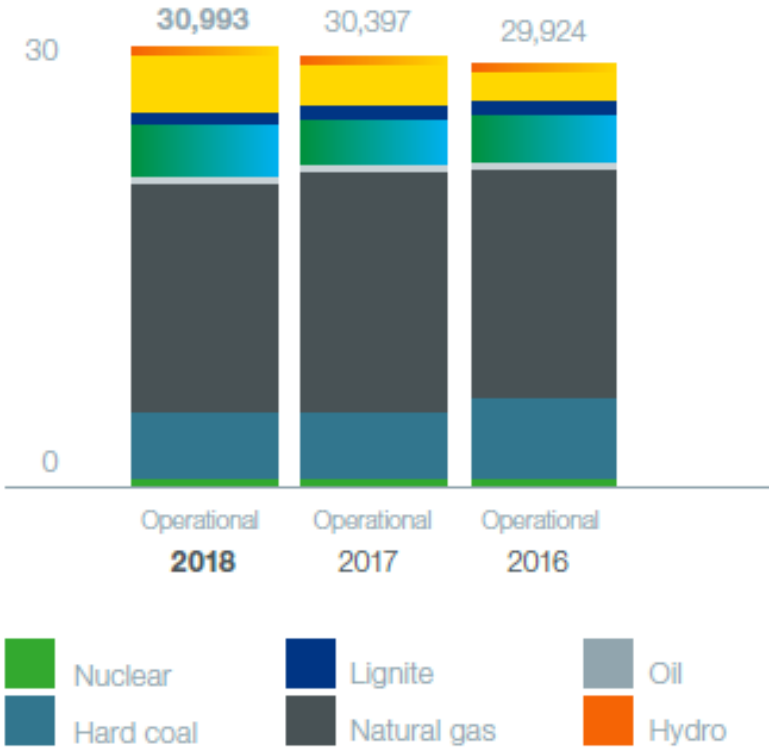
RENEWABLE ENERGY – SINGAPORE

*Approximately 95% of electricity in Singapore is produced from natural gas. Other sources of energy for generating electricity include coal, petroleum products (e.g. diesel, fuel oil) and other energy products. While natural gas is considered the cleanest form of energy source, Singapore continues using other sources to ensure energy security.



Source: https://electrify.sg/content/articles/electricity-generation-singapore/

RENEWABLE ENERGY – NETHERLANDS - TENNET



*In the Netherlands TenneT is the sole grid operator

The EU's 2030 Energy Objectives:

- At least a 40% reduction in greenhouse gas emissions (from 1990 levels);
- At least 27% share for renewable energy;
- At least 27% improvement in energy efficiency

(Source: TenneT Holding B.V. Integrated Annual Report 2018)

DATA CENTERS DETAILED CO2-EQ EMISSIONS BY DATA CENTER/ACTIVITY

Data Center - Activity	T CO2-eq/activity
knams	**1.16**
Municipal Water	**0.00**
Electricity	**1.16**
WWT	**0.00**
eqdfw	**1.28**
Electricity	**1.27**
Municipal Water	**0.00**
WWT	**0.00**
eqord	**1.58**
Municipal Water	**0.00**
Electricity	**1.58**
WWT	**0.00**
eqsin	**22.34**
Municipal Water	**0.03**
Electricity	**22.25**
WWT	**0.06**
ulsfo	**24.85**
Electricity	**8.01**
Municipal Water	**5.51**
WWT	**11.34**
esams	**43.89**
Municipal Water	**0.05**
Electricity	**43.75**
WWT	**0.09**
codfw	**385.81**
Electricity	**384.22**
Municipal Water	**0.52**
WWT	**1.07**
eqiad	**677.42**
Municipal Water	**1.14**
Electricity	**673.94**
WWT	**2.34**

DETAILED EVENTS DATA COLLECTION

Air Travel – Person*km	Co-location Allocation	Movement Allocation
Short Haul	N/A	323,596.40
Medium Haul	432,648.78	2,453,144.24
Long Haul	413,112.72	1,892,350.16

Hotel Stays	Co-location Stays	Movement Stays
All Locations	2,832	2,785

Meals	Co-location Allocation	Movement Allocation
Breakfast	2,832	2,785.00
Lunch	2,832	2,785.00

Water Usage (m3)	Co-location Allocation	Movement Allocation
Usage	1,723.56	1,540.95
WWT	1,723.56	1,540.95

DETAILED EVENTS DATA COLLECTION

Hotels – Locations	Co-location Stays	Movement Stays
Berlin	52	387
CA US	1525	198
Prague	179	336
Spain	37	71
NYC	162	0
Boston	17	0
Philadelphia	17	0
Atlanta	74	0
Minneapolis	24	0
Ohio	0	79
VA	175	0
Dublin	199	0
Chicago	58	0
Vancouver	31	0
Tel Aviv	0	21
South Africa	0	1645
Portland	282	0
Paris	0	13
Chile	0	35

AIR TRAVEL EMISSION FACTORS

Activity	Factor	Source
Air – long (person*km)	0.104138332	EPA 2018 Table 8
Air – medium (person*km)	0.085312028	EPA 2018 Table 8
Air – short (person*km)	0.141202316	EPA 2018 Table 8

COMMUTING - BART

BART Riders Get the Equivalent of 224 Miles Per Gallon

A typical car gets about 21 miles per gallon. A BART rider gets the equivalent of 224 miles per gallon and 422 miles per gallon during the peak commute period. On average, BART is 10 times more efficient than a typical car driven alone (on a passenger-miles per gallon basis of comparison). During the peak commute period BART is 20 times more efficient.

BART Green Energy Quick Facts

- 2016 average number of weekday trips: 433,394
- Average trip length: 14.7 miles
- Gallons of gas saved by avoiding driving (round trip): 1.4 gallons
- CO2e avoided in one average round trip: 27.0 lb CO2e

BART's Energy Regeneration

Conventional BART trains are 100% electric. As the trains brake, BART trains convert their kinetic energy of motion into electrical energy. Some of the energy regenerated during the process is returned to the power distribution system where it is then used by other trains. BART to Antiochtrains use 100% renewable diesel.

An Even More Energy Efficient Future

- BART's new trains will be electric and will offer a variety of sustainable features that reduce energy use and pollution:
- Lightweight aluminum exterior reduces energy use and the aluminum can be recycled when the trains cars are eventually retired.
- White roofs reflect heat and reduce the load on the interior cooling system.
- LED lighting reduces energy use.
- Seats are 74% recyclable by weight.
- Space is dedicated for bikes.

Source: https://www.bart.gov/sustainability/greenfacts