

## Fifty Questions

### What Business and IT Officers Need to Know about their Campus' Carbon Emissions

1. Did your CEO sign the American College and University Presidents Climate Commitment (ACUPCC)? \_\_\_\_\_
2. What is the total CO<sub>2</sub>-equivalent emissions footprint of your campus? \_\_\_\_\_ metric tons/year.
3. Besides CO<sub>2</sub>, what are the other five greenhouse gasses covered by the ACUPCC? \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.  
Of these, which gas has the greatest overall effect on global warming? \_\_\_\_\_
4. What other protocol, besides the Kyoto Protocol, regulates atmospheric emissions? the \_\_\_\_\_ Protocol
5. What percentage of your campus' plan to reduce carbon emissions depends on...
  - energy-efficiency retrofit projects? \_\_\_\_\_%
  - future on-site renewable sources? \_\_\_\_\_%
  - procurement of green or carbon-neutral power? \_\_\_\_\_%
  - behavioral changes that reduce the campus' carbon footprint? \_\_\_\_\_%
  - increasing on-campus student residency? \_\_\_\_\_%
  - procurement of emissions credits? \_\_\_\_\_%
6. Why will it take so long to change the concentration levels of atmospheric greenhouse gases, even if developed economies move quickly toward climate-neutrality?  
\_\_\_\_\_
7. What is today's average CO<sub>2</sub> concentration in the earth's atmosphere? \_\_\_\_\_ parts/million
8. A metric ton weighs how many pounds? \_\_\_\_\_ lbs.
9. What is the current, approximate market price for a metric ton of CO<sub>2</sub>-equivalent emissions credit? \$\_\_\_\_\_
10. What percentage of your institution's student body lives on campus? \_\_\_\_\_% (Do you understand why this is a "green" metric?)
11. What is the primary fuel source...
  - of *procured* energy for your campus? \_\_\_\_\_
  - for fuel combusted *on* your campus? \_\_\_\_\_
12. What percentage of your procured power is from renewable sources? \_\_\_\_\_%  
What percentage is carbon-neutral? \_\_\_\_\_%

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13. Does your campus have a combined heat and power plant?  
If so, how large? \_\_\_\_\_ MW  
Does it include thermal storage? \_\_\_\_\_ If so, how much? \_\_\_\_\_
14. What type of building is the most intensive energy consumer on your campus? \_\_\_\_\_
15. What form(s) of renewable energy generation is/are most likely to prove feasible on your campus?  
\_\_\_\_\_
16. Does your campus policy require procurement of ENERGY STAR products whenever available? \_\_\_\_\_
17. Apart from clean laboratories and vivaria, what lab building on your campus has the highest air-changes per hour (ACH), and what is the number? \_\_\_\_\_ building,  
\_\_\_\_\_ ACH
18. How about the laboratory building with the lowest ACH? \_\_\_\_\_ building, \_\_\_\_\_ ACH
19. What is the lowest maximum-temperature specification among all your data center components for which ventilation air is required? \_\_\_\_\_ degrees F.
20. What is the actual operating temperature in your data center? \_\_\_\_\_ degrees F.
21. If the operating temperature is significantly lower than the lowest component temperature specification, what is the reason? -- a margin of safety for reliability, pressure from equipment manufacturers, data center personnel comfort, longstanding practice, or some other reason?  
\_\_\_\_\_
22. Does your data center organize racks and aisles into warmer aisles and cooler aisles? \_\_\_\_\_  
If so, do you take measures to prevent air mixing within racks by using blocking panels? \_\_\_\_\_ Do you enclose the tops of aisles? \_\_\_\_\_
23. Does your data center use an on-site "CRAC" air-conditioning unit? \_\_\_\_\_
24. Is cooled air provided to your data center via a fixed-volume fan or a variable-volume fan? \_\_\_\_\_
25. Who, specifically, sets the temperature and humidity specifications for your data center(s)? \_\_\_\_\_
26. How often does the humidity of un-air-conditioned (outside) air fall outside of allowable humidity specifications for the equipment in your data center? \_\_\_\_\_ days/year.
27. Is your UPS system inside your data center, outside the data center in air-conditioned space, or outside the data center in un-air-conditioned space?  
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28. Has your data center(s) had an energy audit within the past year? \_\_\_\_\_  
If so, have you performed retro-commissioning of your data center HVAC and controls? \_\_\_\_\_
29. On your campus, what percentage of monitors comprise CRTs? \_\_\_\_\_%
30. How does your campus get individual users to use, rather than deactivate, sleep features?  
\_\_\_\_\_
31. Do you have a working relationship with your...  
campus' chief facilities engineer \_\_\_\_\_  
the person who heads HVAC services \_\_\_\_\_  
the campus energy manager \_\_\_\_\_
32. Are you planning an energy-efficiency retrofit project that will pay for itself through energy savings? \_\_\_\_\_  
If so, what is the simple savings ratio in terms of years of payback? \_\_\_\_\_ yrs.
33. What are the comparative costs per ton of cooling generated on your campus via a CRAC system vs. a building-based HVAC system?  
\$/\_\_\_\_\_/ton for CRAC vs. \$\_\_\_\_\_/ton for HVAC
34. What do you consider the best metric or ratio to measure overall units of computing output per unit of energy input? \_\_\_\_\_ per \_\_\_\_\_
35. Do you monitor peak electrical demand of your server and cooling equipment? \_\_\_\_\_  
If so, do you schedule work off-peak (when feasible) in order to reduce peak electrical demand and carbon emissions? \_\_\_\_\_
36. Are you encouraging the use of shared, rather than individual, printers? \_\_\_\_\_
37. Are you implementing server consolidation techniques such as blades or virtualization? \_\_\_\_\_
38. If your data center has multiple CRAC units, do you have inter-unit control mechanisms in place to enable them to operate more intelligently (e.g., avoid one unit humidifying while the other unit is dehumidifying, temperature inconsistencies, etc.)? \_\_\_\_\_
39. Are you specifying servers with high-efficiency power supplies and variable-speed fans? \_\_\_\_\_
40. What range of temperature differentials have you measured between air entering and air exhausted from your servers? \_\_\_\_\_ degrees F.  
How about the hot aisle/cooler aisle temperature differential? \_\_\_\_\_ degrees F.
41. Are you solving data center "hot spot" issues in proximity to problems, or by compensating throughout the entire HVAC zone? \_\_\_\_\_

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42. Is cabling within racks organized so that it does not impede exhaust airflow out of the racks? \_\_\_\_\_
43. Are your new servers, storage, and related equipment running at 208VAC or higher? \_\_\_\_\_
44. Approximately how many computing clusters are distributed across your campus outside of centrally-managed data centers? \_\_\_\_\_  
Of these, how many are closet-sized clusters: \_\_\_\_\_; office-sized clusters: \_\_\_\_\_; decentralized data centers: \_\_\_\_\_.
45. Of these distributed computing clusters, roughly what fraction exists in settings that are *more* energy-efficient (than central data centers)? \_\_\_\_\_%  
What fraction is in *less* energy-efficient settings? \_\_\_\_\_%  
And, what fraction exists in settings that are essentially *equivalent* to centralized data center(s) in terms of energy-efficiency? \_\_\_\_\_%
46. What are the three lowest-cost-per-unit-of-efficiency measures you can implement in your data center? \_\_\_\_\_,  
\_\_\_\_\_, and \_\_\_\_\_.
47. What is the average vehicle ridership (AVR) for your campus? \_\_\_\_\_
48. What is the approximate cost increment, as a percentage of total project cost, for a LEED Gold building (newly constructed)? \_\_\_\_\_%
49. What is your campus design goal for illumination efficiency for new construction -- for typical labs and offices? \_\_\_\_\_ watts/SF
50. Does your campus have a student green advocacy group? \_\_\_\_\_  
If so, do you know the leaders' names? \_\_\_\_\_