The Challenge of Going Green

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Planners, Designers, Fabricators, and Operators are under pressure to develop energy-efficient and environmentally friendly systems while also being concerned with first and CapX costs and liability issues. Emerging energy-efficient systems may have less demonstrated durability and performance capabilities than the old tried-and-true technology. Engineers are being pushed to use fewer resources during construction and operation and to have minimal cradle-to-grave impact on the earth. The renowned mathematical physicist and engineer William Thomson once stated, "If you can not measure it, you can not improve it." It is commonly recognized that measuring a value (or not) changes the way we act on it. Einstein once said, "Not everything that can be counted counts and not everything that counts can be counted." Hence, even in today's technology-driven world, which makes collecting and interpreting data cheaper and easier than ever, many well-intentioned, seasoned professionals make assumptions about what matters and the burden of counting and documenting impacts is often forgotten or defined as out of scope. One of the objectives of this paper is to emphasize the importance of sustainability and to raise cognizance so that stakeholders think about going green in a sustainable manner. Some of the suggestions contained herein may be readily doable; others may be feasible in some circumstances yet impracticable in others.

Raising awareness of the opportunities is a key component needed to bring many minds to bear and to vet the acceptability of new technologies as opposed to relying on the old habits of the lonely designer. As part of the efforts to adopt more sustainable habits and to go green, the following items can and should be considered for **every** project whether it be planning, feasibility, R&D, remediation, renovation, demolition, expansion, replacement, or new.

- Measure What You Want to Manage
  - Without collecting adequate, quantifiable data, it will be virtually impossible to identify with any level of certainty the causes of waste and inefficiency or to develop methods that reduce them.

- Numbers enable us to scrutinize, analyze, and draw conclusions about a particular problem.
- Numbers provide us with a way to develop solutions based on quantifiable evidence.
- Numbers are the path by which we can achieve literacy and use the lessons learned.
- Numbers are used to evaluate assumptions, objectives, and goals.
- No Data = No Analysis = No Learning=No Improvements.

- Minimize Total Energy Use and Maximize Use of Renewable Energy
  - Minimize energy consumption by using energy-efficient equipment.
  - Power cleanup equipment through use of on-site renewable energy sources.
  - Purchase energy from providers of renewable resources.
  - "Be Bright About Light"
    - Turn off lights if you plan to be gone for more than 15 minutes.
    - Use natural lighting whenever possible.
    - Replace standard light bulbs with Energy Star qualified bulbs.
  - Adopt "No Idle" policies.

- Minimize Air Pollutants and Greenhouse Gas Emissions
  - Use best management practices and avoid double handling.
  - Minimize generation and transport of airborne contaminants and dust.
  - Use heavy equipment efficiently (e.g., use diesel emission reduction plan).
  - Maximize use of machinery equipped with advanced emission controls.
  - Use cleaner fuels to power machinery and auxiliary equipment.
  - Sequester carbon on site (e.g., apply lime soil amendments, plant trees, revegetate).
  - Use environmentally friendly hotels
  - Manage business-related travel (teleconferences, direct flights, proximity to project, etc.)

- Minimize Water Use and Impacts to Water Resources
  - Minimize water use and depletion of natural water resources.
  - Capture, reclaim, and store water for reuse (e.g., recharge aquifer, drinking water irrigation).
  - Minimize water demand for revegetation (e.g., plant native species).
  - Employ best management practices for stormwater.
  - Consider the use of dry toilets on construction sites.

- Reduce, Reuse, and Recycle Material and Waste
  - Buy Green Products – One of the best things you can do before you buy cleaning products is to read the label. There are products that are biodegradable. These products may be as effective while not being nearly as environmentally damaging.
  - Minimize consumption of virgin materials.
  - Minimize waste generation.
  - Use recycled products and local materials.

- Beneficially reuse waste materials (e.g., use concrete made with coal combustion products to replace a portion of Portland cement).
- Segregate and reuse or recycle materials, products, and infrastructure (e.g., soil, construction and demolition debris, buildings).
- Manage inventory.

- Protect Land and Ecosystems
  - Minimize areas requiring activity or use limitations (e.g., destroy or remove contaminant sources).
  - Minimize unnecessary soil and habitat disturbance or destruction.
  - Minimize noise and lighting disturbance.

- Financial Models and Life-Cycle Costs
  - Use defensible financial criteria for interest and inflation rates, ROI, service life, salvage values, purchase price, operating costs, etc.

- Equipment and Systems
  - A small improvement in the performance of mechanical equipment can reduce electrical consumption and associated costs while simultaneously lessening their environmental impacts.
  - Optimize Power Factors – A power factor correction system uses capacitors to better manage the flow of power from a utility. The capacitors create a condition where the power supply is more constant and the capacitors are used to better supply the varying loads in the facility.
  - Hydraulic Systems – Water requires less than $1/10^{th}$ of the energy that is expended to move a Btu 1 foot when compared to that of pneumatic systems.
  - Right size the pump and motor – A main pump and a backup pump both sized to handle peak load may be over-sized and waste energy. Would two pumps selected at 50 percent flow and full head be more cost-effective? If one pump goes down, the other pump would operate higher up on the pump curve and it could handle any short-term emergency and reduce the usage of the first pump and operating costs accordingly.
  - Automated controls – Use smart controls that can sense when a motor is not needed and shuts the motor off and brings it back on line when needed.
  - Centralize the hydraulic and pneumatic systems to minimize pipe run lengths. Short pipe runs mean energy savings when compared to mechanical systems that are typically banished to the back forty.
  - Calculate the effectiveness of the cooling system; don't rely on rules of thumb. More-efficient chillers can reduce flow fluid rates, which reduce the fan/pump size, duct/pipe size, associated head losses, etc.
  - Consider variable-frequency motors. Load response systems are becoming less expensive, and service life is comparable. Use the horsepower you need, not the horsepower that you have.
  - Insulate as needed. A lot of insulation is not necessarily good. There is an extreme diminishing return in over-insulating buildings and piping systems.

- Toxicity – Anticipate that demands for less-toxic materials are an oncoming onslaught. Use non-toxic materials as opposed to less-toxic materials whenever possible. Do not select a material simply because it is not currently regulated.

- Reusability and Recyclability – Consider the post-project use of the materials being specified. Consider using recycled materials. Recognize that recycled materials may have impurities that are more toxic than that of virgin materials. Consider the longevity and durability of the materials being compared.

- Chemistry – Evaluate the inherent compatibility of a material compared to the use of inhibitors and corrosion control systems. Strive to select the toughest, most inert, and least-harmful material, and use as few materials as possible.

- Safety – Keep in mind the safety of all persons associated with the materials and processes.

- Pollution Prevention – Preventing pollution is more desirable and less costly than minimizing it.

- Waste Minimization – Waste minimization is more desirable and less costly than collecting, treating, and disposing of it.

Environmental Quality Management, Inc. (EQ) is a full-service environmental consulting, engineering, remediation, and construction management firm with a network of offices throughout the United States. EQ's sustainability program ensures that services are delivered and facilities are operated in a more sustainable manner. This means reducing a company's environmental footprint, promoting environmentally responsible business activities, and offering environmentally responsible products and services. For more information contact: Tom Robertson at 800 229-5299 or Bob McCullough at 800 229-7495.