Sustainability: Raised Expectations for the PetroChem Sector

The world focused on Brazil in June as Rio+20 brought together global leaders to affirm and strengthen sustainability goals. And for good reason, Brazil is perceived as critical to the success of sustainability due to its vast forests, its rising middle class, considerable hydropower and its increasing importance in the global energy sector, among other reasons. Of the BRICS countries, Brazil is arguably the best prepared to lead and implement sustainability measures. And Brazil has much to highlight-- such as Petrobras' LEED Gold Research Facility in Rio.

Over the past 20 years, sustainability has changed from a good thing to do for the planet to an absolute necessity if we wish to have a livable planet not for the "seventh generation" but the generations now alive. Many who read this article could be living through the impact of a 1 meter sea level rise, a 3C average temperature increase, acidification of the oceans, and other challenges to daily life.

The petrochemical industry is not perceived as the sector that particularly waves the green flag. Indeed, BP's promotion of Sustainability has drawn a backlash as mere greenwashing for a decade. Nevertheless, the Green aspects of petrochem projects receive more and more attention at all levels of our corporations. Carbon footprint reduction, greenhouse gas monitoring and reduction, new process designs that eliminate persistent organic pollutants (Green Chemistry), annual reporting according to Global Reporting Initiative's framework (GRI), and other sustainability initiatives are now part of our normal work day.

Engineers understand very well that 83.4% of sustainability is what we have done our entire careers: reducing costs by maximizing the use of inputs—less water, less energy, improved conversion which results in less waste. We were reducing the carbon footprint of our products and processes long before there was a name for it!

The current emphasis on Sustainability helps however, by justifying longer paybacks for certain investments, it stretches us into areas we might not otherwise pursue, it forces collaboration across disciplines, it supports risk taking on innovation necessary to achieve sustainability targets, and it forces a measurement and documentation process to prioritize our efforts.

Sustainability is a very, very broad topic—the previously mentions GRI offers a good summary of the full scope of the economic, social and environmental aspects of the current dialogue. And it is easier to discuss Sustainability in the context of office building and labs, but let's narrow the discussion to those areas of design and construction of more traditional petrochem projects we can directly impact as project managers and engineers.

Project Scope Definition, Budgeting and Siting:

Sustainability must be emphasized during the very first days of the project. Certain questions are relevant during this phase:

- Are sustainability issues a primary justification for the project?
- Do sustainability issues need to be tracked and justified separately from the main project scope?

- What key sustainability measures will be used: kg carbon/kg of product, liters of water/liter of product? How far upstream in the supply chain will we measure and does the data exist from our supplier and vendors?
- If the project is a greenfield, how do site location and site characteristics impact Sustainability? Obvious issues are roof positioning for an effective PV installation, or the possibility of wind power generation. But a hundred other issues, including transportation of goods and employees, surface water, land clearing, waste treatment, environmental and geotechnical matters, the generating methods of local power, the availability of local sourcing of materials for the project, etc., are too often considered after the land has been purchased.
- Does the baseline data exist that we can compare new designs to when we must calculate carbon reduction? A related question is if the baseline data is known to your company or is it industry sector norms?

One suggestion is to use the current standard guidelines/certification schemes--LEED, GRI, ISO, PAS, LBC[1]-- for an initial scan of topics that might need more investigation during the project scoping and justification phase.

Preliminary Design:

This phase is typically used to generate the budget submitted for board approval, as well as specific technologies that support corporate sustainability targets. Do not underestimate the amount of analysis required to forecast carbon reduction, or the time required to work through various alternative technologies that could be considered for energy, waste or water reduction. Some of significant topics addressed in the preliminary design phase include:

- How much on-site renewable energy generation will be pursued? Biogas, PV or BIPV, wind, and solar thermal, for example.
- What alternative power reduction technologies may be feasible—Combined heat and power (CHP), micro-turbine electricity generation, fuel cells, absorption chilling, ground loop heat pumps, etc.
- What extra level of investment for energy savings will be considered: hi-efficiency windows, variable speed drives, hi-efficiency motors, daylight harvesting, green roofs, T5HO or LED lighting?
- How far will water conservation be pursued? Low flush or waterless bathroom fixtures, rainwater harvest and reuse, and steam condensate recovery may be obvious, but other water (primary condensate) reuse, gray water collection and reuse, on-site water treatment using ponds, bioswales or other advanced biological treatments are now active discussions. On the processes side, no once-through cooling waters, or vacuum generated by eductors are allowed by current and pending certification standards.
- The energy intensive unit operations have always been closely evaluated. Pinch Analysis, for example has been in use since the ‘80s, and MVR evaporation has been

[1] Leadership in Energy and Environmental Design from US Green Building Council; Global Reporting Initiative, G3 guidelines; Intl. Organization for Standardization, 14000 family; Publically Available Specification 2030 from British Standards Institution; Living Building Challenge.

saving energy for equally as long. But the Sustainability pressures can help justify additional capital equipment to accomplish greater heat recovery or energy reduction.
- Controls and Automation not only provide measurement that allows us to see where energy could be saved, but provides measurements that support sustainability claims.

Design and Construction:

Much of sustainability discussion involves the materials we specify. Many plastics, PVC and other materials are scrutinized as not very sustainable. The CSR implications of the rare metals supply chain is a current topic. Embodied energy in the materials we buy is challenging to calculate. However, more sustainable alternatives are coming to market. Traditional sustainability approaches, such as recycled and reused materials are available. Construction waste diversion can be utilized. The LEED checklists offer other approaches that we could apply, perhaps creatively, to petrochem projects.

In summary, Sustainability approaches as understood in the Commercial, Health Care, Educational or Residential sectors are be applied in manufacturing and now also in the process industries. The emphasis changes, but the discussion can be quantified as reductions in energy, waste, carbon, greenhouse gases, and other measurements. This is not simple or easy, and those involved find they are often breaking new ground. But this is now understood as a requirement, not an option, by regulators, customers, the financial sector, and the general public.

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