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Inherently Sustainable Design

By: Kenneth H. Nelson, P.E.

Energy crisis....

Calls for conservation....

Lots of buzz about solar energy and renewable fuels...

Talk of hybrid vehicles and mass transit...

Dire predictions of population pressure and resource shortages....

Dire predictions of climate change...

Of course it works . . . but is the return on investment sustainable?

Dateline? 1971. That's right, we heard all of the themes in today's headlines forty years ago. (Except the climate change prediction of the 1970's was that we might be heading into a period of global cooling.) The first Earth Day was held in 1970, and the drumbeat of the environmental movement has continued ever since. There has been much argument about the origin and motives behind all the public policy initiatives that have ensued. My purpose in this article is to lay out some basic engineering principles that apply no matter what side of the political argument you come from because competing in a global marketplace does not afford us the leeway to base our investments of time and money on anything less than sound engineering.

I remember our founder Waldemar, who had seen so many history-changing events in his life, taking it all in stride. As we stood together in the early 1970's looking at an experimental solar collection array that took up several acres of land, he commented it was all well and good, but that this huge capital investment and land impact would produce only about as much power as the engine in his car. He was born in 1916 and had seen many years of human folly by that time, and as a descendant of a history professor was aware of centuries more of the foibles of human nature. His observations as the environmental and energy conservation movements unfolded were those of an engineer who had been involved in meeting economic needs in markets ruled by the immutable laws of physics and thermodynamics rather than politics. He had seen the growth of the modern industrial economy in a period when projects lived or died by brutal laws of natural economic selection enforced by physical scarcity of materials and capital. That experience gave him a skeptical view of any policy initiative that ignored those natural laws, and subsequent events validated his point of view.

For example, in the late 1970's and early 1980's, as crude oil prices rose, there was talk of substituting ethanol for some of the nation's automobile fuel needs. Propelled by a generous tax credit, industrial scale ethanol plants sprang up. A few years later, as crude prices fell and the public tired of the transfer payments embodied in the tax credit, the ethanol plants abruptly closed. Recent news has covered the spectacular failure of a solar power company that had received a government subsidy of over 500 million dollars. Light rail projects proposed at the federal level ostensibly to reduce automobile traffic and thereby emissions have run into resistance at the state level due to projections of budget overruns. And the beat goes on with one

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Of course it works . . . but can it survive without significant subsidies?

"green" initiative after another going down in flames.

So why have such supposedly beneficial projects failed? It is because they have not made sense within the framework of physical laws. Does this mean we should abandon efforts to pursue alternative energy technologies and conservation efforts? Certainly not, but it does mean we should evaluate their ability to compete in the marketplace based on thermodynamics and physics rather than politics and sentiment. If you bring a truly better product to the market, it will in the long run succeed in spite of, rather than because of, tax and policy treatment. If on the other hand your business model depends on artificially imposed transfer payments, sooner or later the people from whom the money is being transferred will get fed up and overturn the legislation behind it. So for long term survivability, talk with an engineer to get a handle on the fundamentals before launching your "green" venture.

Excellent engineering design is inherently efficient. Its goal is to make the best use of materials, to do the most with the least in the simplest manner possible. The current interest in "green" design and "sustainability" is nothing more than a restatement of the fundamental goals of good engineering. To the extent that public policy encourages truly efficient and sustainable design, it makes sense. But policies that push ideas without a sound basis in physical reality can do great harm and have unintended consequences. For example, when the use of corn to make ethanol as a fuel supplement recently exploded due to favorable policy treatment, the resulting price rise caused hardships in developing countries where corn was a primary food source. And ironically, given the total environmental impact of planting, fertilizing, harvesting, transporting, and fermenting the corn into fuel, it is fair to ask how rational the policy promoting it was in terms of true "carbon footprint" impact. In fact it has been reported that ethanol production can use nearly as much energy to produce as it supplies. An astute thermodynamic analysis which took into account the lower energy content per gallon might also change the sentiment of drivers who are not getting the same mileage when they fill up with blended fuel.

There is currently a lot of interest in battery powered cars which will be recharged from the utility grid. In some advertisements, these are described in glowing terms as "zero emission" vehicles. To anyone who has studied thermodynamics, such a claim can only make them shake their head at the lack of understanding or disingenuousness of the people making the claim. In point of fact, a rechargeable battery powered car is a very inefficient way to use a unit of fuel to provide transportation. There are losses in the generation, transmission, battery charging, and final use of the electricity in the motor; and a comprehensive calculation of these losses would show how inefficiently the energy in a pound of fossil fuel was converted into rotation of the wheels. Energy recovery during braking is a benefit, but unfortunately, this benefit is greatly overshadowed by the overall system inefficiency as described above. In fact a case can be made that electric cars actually increase carbon emissions when analyzed through sound engineering by obeying the laws of physics and thermodynamics as they apply to the complete process. One might argue that some of the power on the utility grid is produced by means which do not use fossil fuels, such as solar, wind, hydroelectric, or nuclear generation. But the first three of these sources represent a very small percentage of the total generating capacity worldwide, and nuclear power has the potential to cause hazards which will last for centuries. So the cars advertised as "zero emission" are in fact using power mostly generated by fossil fuel combustion or by nuclear fission, and using it very inefficiently.

A rational assessment of these factors might change the sentiment of the purchasers of these cars through the realization that energy usage actually increases with electric car usage, creating the exact opposite effect they may have been attempting to achieve.

It is important that we as a nation make decisions about consumption and investment that are based on the laws of physics and thermodynamics because if we do not, in a globally competitive economy we will ultimately fall behind other countries that do heed them, and unintentionally waste valuable resources. We need to be wary of efforts to subjugate populations and the sovereignty of nations to

ideologues who push policies that are not based on sound engineering principles and the laws of physics. History is littered with examples of environmental and economic disasters that have resulted from such policies.

During the 1970's, the U.S. car industry was scrambling to meet hastily implemented emission standards, which resulted in some ridiculous solutions that affected performance and mileage. Overall quality suffered due to the reallocation of engineering talent from activities that might have actually improved performance to efforts to meet arbitrary criteria driven by ideological policy. Meanwhile, the Japanese car industry was concentrating on more efficient vehicles that inherently met the emission standards and were also economical to operate, so they gained tremendous market share. The badly executed policy implementation in the U.S. contributed to the decline of our car manufacturing industry. As engineers, it is our professional duty to point out in our interactions with the public when proposed policies are at odds with sound technical principles.

I wish all good luck to those who endeavor to develop "green" products or incorporate "sustainability" features into their projects. I just ask that you do a rational analysis of the technical facts and base your actions on physics rather than sentiment or politics. Technological advancements will be made that improve our use of energy and natural resources, but these advancements will be based on the laws of physics and sound engineering practices. Forcing changes through legislation alone will retard true technological advances, waste resources, and sour public opinion. Engineering is truly the "foundation of civilization", as stated by our founder, and can be relied upon as so many times in the past to solve our current technological challenges.

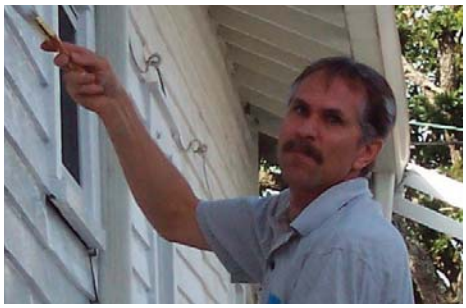
As in so many instances, we can sometimes best prepare for the future by looking to the wisdom of the past. I remember talking with my grandmother in the early 1970's when recycling became a hallmark of the environmental movement. She was born in 1884 and had seen the world transition from an agricultural to an industrial economy. Her comment on recycling was that when she was growing up, everyone used any manufactured item at least three times because of the inherent economic value and labor it represented. They would use it first for its intended purpose; then when it broke or wore out, they would adapt it for an alternate use to salvage any functional utility it still had. Finally, they would "recycle" it in the current sense of recovering the basic materials for reprocessing. By utilizing things so efficiently, her generation managed to achieve the ultimate task of sustainability, which is after all to sustain the survival of the human race.

Fuel or food, which is more important?

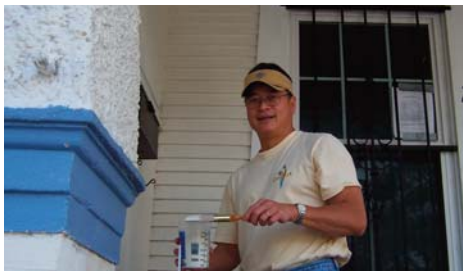
Rebuilding Together - 2011

NELSON employees are always ready to assist in the Preservation Resource Center's (PRC)Rebuilding Together project. This year PRC recognized NELSON as one of their "old timer" teams and we could not be prouder of the volunteer hours our employees and their families have given to the PRC over the past 15 years.

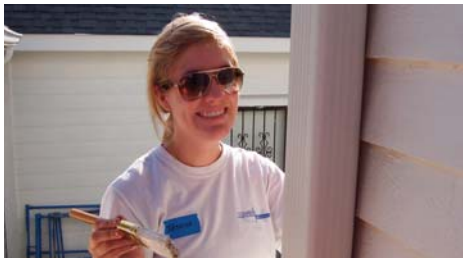
Top (l to r) Bill Landry, Ginger Dodge, Anthony Beard, April Antoine-Batiste, Rebecca Dorsa, Rachel Dorsa, Joel Dorsa. Bottom (l to r) Bo Harris, Andre' Oneal Batiste, Bill Berg.



Tony Hoffman



Thi Dao



Jessica Shambra

2011 Nelson Employee Recognition Dinner

Continuing a longtime tradition, the firm hosted a gathering on Thursday, October 6th, at Ralph Brennan's Heritage Grill to celebrate milestone anniversaries of staff who have served us continuously for twenty years or more. Our 20 year honorees were Thi Dao - a Staff Engineer in our New Orleans Civil and Environmental Department and Robert Olivier - Assistant Vice President and head of our Architecture Department. (No 25 year anniversaries occurred this year.) Celebrating 30 year milestones, we honored Joe Lawton - Vice President of the firm and head of our New Orleans Project Management Department and Son Van Nguyen – Senior Designer in the New Orleans Civil and Environmental Department.

Six employees were honored for thirty-five years of service. They included three members of our New Orleans Civil and Environmental Department: Ambrose Amedee – Senior Designer, Jerry Hanafy – Staff Engineer, and Tom Wells – Senior Vice President and Department Head. Also honored were James Lane – a founding member of the Houston office, Director , Treasurer/CFO and upcoming Executive Vice President, Sal Perez – Senior Designer who leads the drafting effort in our New Orleans Electrical Department, and Stephen Pumilia – Vice President of the corporation and the upcoming Head of our New Orleans Mechanical Engineering Department.

It is difficult to express the extent of our appreciation for this dedicated group. Their loyalty, talent and continuing efforts are what make it possible to offer the caliber of service to our clients which we all strive for. Heartfelt thanks from management go out to these individuals and their families for sharing so much of their lives with us.

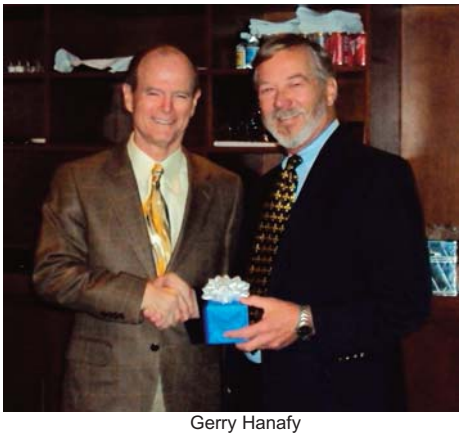
Robert Olivier, Charles Nelson

Steve Pumilia

Ambrose Amedee

Jim Lane

Thi Dao

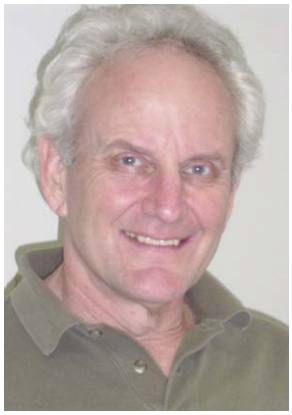


Gerry Hanafy

Joe Lawton

Tom Wells

Son Nguyen



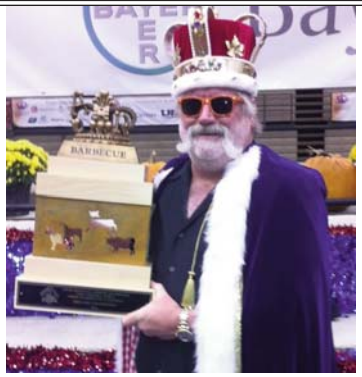
Gerald J. Vetter, P.E.

Gerry Vetter, Senior Environmental Engineer in our Civil and Environmental Engineering Department, recently completed training and certification in the DOE Steam System Specialist Qualification program.

This program is part of the Industrial Technology Program and Save Energy Now initiative run by the U. S. Department of Energy. The steam system best practices program provides a process for comparing steam system management to best practices and developing an energy and economic model of a facility's current system from which upgrades can be evaluated.

The DOE's Industrial Technology Program embodies a basic precept of conservation, which is paraphrased as "the cheapest unit of energy is the one that is never used in the first place."

This certification demonstrates NELSON's expertise in conducting energy efficiency assessments, which are required by the EPA's new rule on limiting emissions of hazardous air pollutants from industrial boilers and heaters. The energy efficiency assessments help define the best available control technologies should a facility find itself subject to "major source" permitting requirements for greenhouse gases.



Ron Walker, a senior designer in our Civil/Environmental department was recently crowned the 2011 American Royal Grand Champion at the 32nd Annual World Series of Barbecue in Kansas City, Mo. This is the largest competition in the World. In addition to competitions, Ron has cooked for our fundraising barbecues the last couple of years in our New Orleans office. His delicious barbecue is enjoyed by the employees, and New Orleans Children's Hospital benefits from the fundraiser.

SERVICE ANNIVERSARIES - 2011

35 Years

Ambrose G. Amedee, Jr.
Gerald W. Hanafy
James B. Lane
Sal Perez
Stephen M. Pumilia
Thomas W. Wells

30 Years

Joseph R. Lawton III
Son V. Nguyen

20 Years

Thi H. Dao
Robert C. Olivier

15 Years

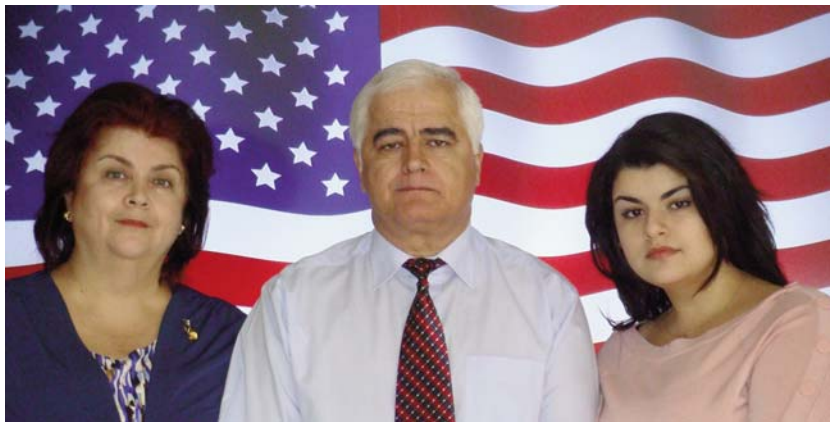
Steve J. Babin
Dalton J. Cantrelle, jr.
Hugh Carmichael
Joel S. Dorsa
Joseph C. Fontenot
Leanne M. Geohegan
Robert W. Griffin
Gregory J. Guillot
O.L. Haas III
David S. Montgomery
Thomas C. Nguyen
Jason Ortis
Luan V. Tran

10 Years

Christine R. Childers
Kenneth C. Leaber
Steven R. Simon
Sid E. Walker III

5 Years

Nancy H. Autin-Germany
Tajiri S. Benjamin
Vincent H. Bologna
Joel D. Borst
Susan B. Calamia
James C. Cheron
William M. Cobb
Gary W. Cravey
James M. Daigle
Gordon V. Fogleman
Jason A. Frisch
Tiphanie D. Giroir
Thomas B. Grehan
Richard Halliburton
David A. Hallner
Eugene A. Harris
Daryl J. Hattier
Jesse Hemeter
Kevin P. Houghton
Anca Iordache
Lauren F. King
William C. Kirby
Larry T. Koepplinger
Stan P. Lafaver
Ben Louviere, Jr.
Liem Chanh Ly
Raphael A. Magnotta
Sheila M. Mahoney
George H. Massey III
Francisco J. Merchan
Debra M. Mitchell
Marco A. Palacios
Marta Palacios
Thu T. Quach
Michael Roberson
Sachin R. Seldekar
Jess B. Shelley
Audrey Thomas
Laren M. Tushim
Marie A. Vonderheide



Anca, Paul and Alice Iordache sworn in as United States Citizens on August 17, 2011

The Iordache family arrived in the United States from Romania in May 2006 . Their careers and background drove them to leave Romania and move to the United States to work in oil and gas engineering. Anca and her husband were both immediately employed with engineering companies the same year they arrived in Houston. Anca, a chemical engineer, was hired by Waldemar S. Nelson and Company in December 2006. Their daughter Alice enrolled in college and graduated from the University of Houston in May 2011. On August 17, 2011 all three became American Citizens at the Oath Ceremony. Anca and her family are proud and very grateful for the professional and personal life they have here in the United States.

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