Competitive Renewable Energy Coupled with Its Key Facilitator, Education

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1.0 PROBLEM NATURE AND IMPORTANCE

For at least a generation, the United States has been widely acknowledged to be the world's superpower. Now, many people would agree that this status is in danger.

Recently we have heard of enterprises that are "too big to let fail." We suggest that a more important question is whether American democracy could survive a fall to "also ran" status. Given the degree of hatred manifested toward us by many nations and radical groups, such a decline would be exceedingly dangerous, and possibly deadly to the worldwide hopes for freedom.

Over the centuries, we have established and maintained superpower status through a combination of natural advantages and extraordinary efforts and insights. Here is an arbitrary list and our view of current conditions of these advantages and accomplishments:

- Education – once we could boast of an exceptionally high literacy rate and a steady influx of talented personnel from abroad, but now mere literacy or number of academic degrees issued is almost irrelevant compared with the type of education needed to maximize each American's opportunity to make rational decisions and contributions in the midst of rapid worldwide change. Without the ability to understand today's complexities, we become easy victims of demagoguery, and too many of us substitute parroted slogans for individual research and creative thought.
- Opportunity – once our country was acknowledged to be "the land of opportunity," but now the rapid relative growth of groups ("peoples") that have historically lacked equal opportunity with the dominant peoples lowers our average expectations and faith in our system, and eventually our quality of living.
- Natural resources – some of our classic natural resources appear to be (and in a few cases almost certainly are) in decline, and the development and application of more recently identified resources (e.g., uranium, solar-related, MSW, other synfuels) is hamstrung in part by doubts and misconceptions that thrive among an insufficiently educated citizenry.
- Infrastructure – ours was once a worldwide marvel, but now suffers from the impact of having many elements aging or even in danger of collapse.
- Motivation – a "drive" essential to continued progress but seemingly in decline within important segments of our community, in part resulting from unequal opportunities or rewards, in part from inadequate education and information, and in part from counterproductive response to past failures.
- Diversity – ideally, enriching all our lives through our nation's unique spectrum of talents and ideas, but in current practice a source of debilitating internal conflict.

History suggests that, for any nation, reversing a downward trend in a complex world is extremely difficult. What can any single project do to stimulate such a reversal? There is

a concept that could blossom into such a stimulus. We believe that this concept could be tested on a relatively small scale. The suggested test would involve the combination of (a) comprehensive research into a potential alternative (renewable) energy source with (b) research in distance learning (education) science that is also within reach. Success should generate momentum that could relatively quickly lead to a powerful system that would address all the needs outlined above. We call the ultimate embodiment of this concept the American Spectrum system, directed and administered by an American Spectrum Nonpartison Committee.

2.0 RELEVANCE TO NIST AND OTHER POTENTIAL PARTICIPANTS

In Section 1.0 we argue the extreme importance of the recommended work. But:

- Why is research/technology critical to its solution? Because its solution involves significant changes in the knowledge, attitudes, and life styles of millions of disparate people, and we hold that there currently exists no known vehicle for bringing these changes about in the time available.

- Why is TIP funding essential, why are alternative sources not available? We have yet to find another governmental agency or program whose interests, specialties and charter are broad enough or who would otherwise be willing to sponsor the work recommended herein, which richly qualifies as “high-risk, high-reward science and technology that could achieve transformational results by the end of the TIP funded research efforts”. Nor, for the same reasons (in our opinion) would any state or local government find the cost of the basic research to be a justifiable risk. TIP seems tailor-made for this circumstance. (Proposals for piecemeal applications could perhaps find customers, but this would defeat the primary purpose of finding a comprehensive solution that would not suffer from undesirable ripple or secondary effects.) The above argument also applies to industry and philanthropic entities that might be approached for funding. Our experience with industry and philanthropic entities leads us to believe that they too would attempt to delegate the early research and demonstration work to the Federal government, Again, many large energy-related and information technology organizations would probably be happy to fund the commercialization of relevant elements of our technology when it is shown to be useful and important, and when the cost and profit issues are resolved.

- Who are likely proposers to competition: who is looking for money and why? In our view, the subject matter is so broad that it would require some form of consortium involving businesses, academia, professional societies, and (hopefully former) public servants. The quality and number of bidders would probably be limited by (a) level of belief in the problems and the recommended path to their solution, (b) amount and flexibility of NIST cost sharing and other commitments, and (c) comfort level in working with consortia.

The steps and recommendations that appear in this and succeeding sections are intended

only to clarify the program we advocate and to respond to NIST guidance for White Paper preparation.

3.0 TRANSFORMATIVE APPROACH AND GUIDING ASSUMPTIONS

3.1 Purpose and Scope

NIST guidance for white papers specifies, "A good white paper discusses problems to be addressed rather than a specific technical solution or project. Please do not submit a pre-proposal … " but an "overview of the following: The research (technology or technologies) to be developed; Expected new outcomes and capabilities; and Path to achieving your goals.,"

Subsection 3.2 converts the broad problem statement (Section 1) into a framework for its eventual solution. Subsection 3.3 addresses the research that would need to be developed. The expected new outcomes and capabilities are implied throughout this section and Sections 4 and 5 rather than being listed or discussed separately.

3.2 Postulates

Through consideration of the six critical societal problems enumerated in Section 1.0, we derive the following postulates:

- Education – that adult education should be viewed and treated in a non-traditional fashion, i.e., that it should continue throughout life in a systematic way, and that every citizen can and should have access to effective remote learning mechanisms and be able to access and participate in training that is interactive, continuously geared to each user's level of learning, and inclusive in terms of subject matter. This system should complement rather than replace formal schooling at all levels. Such a system should enable our citizens to make rational choices in the midst of rapid worldwide change. The necessary learning science and technology are present or on the horizon. Many experiences suggest that those on the horizon can soon become reality through vision and hard work. We herein assume their early arrival, and concentrate on their appropriate, widespread application.
- Opportunity – that the rapid relative growth of groups ("peoples") that have historically lacked opportunity equal with that of the historically dominant peoples lowers our average expectations and faith in our system. The desired educational system outlined herein should help lead to equal opportunity, i.e., opportunity for each citizen to reach his or her full potential through ceaseless effort. Ideally, the energy-related research and development effort needed for its own value and for testing of the prototype American Spectrum system would help lead to equal opportunity.
- Natural resources – that we often err with respect to natural resources, implicitly believing that all our natural resources have been identified and measured, when

in fact the nature of, useful amount of, and demand for natural resources have continuously changed. Some classic resources appear to be in decline, and the development of some recently identified resources (e.g., uranium, solar-related, MSW, other synfuels) is often hamstrung in part by doubts that thrive among an insufficiently educated and improperly motivated citizenry. Research science, widespread improved education and motivation could solve this problem for the foreseeable future.

- Infrastructure – that increased prosperity both depends on improved infrastructure and makes infrastructure improvements possible and popular, especially given a more educated and involved public. In addition, our suggested technical approach can help infrastructure by moving some production and consumption closer together, thereby removing part of the pressure placed upon elements such as electric power grids.
- Motivation – that desirable motivation is sharpened by success, dulled by failure, sharpened by critical unmet needs, and dulled by unwise charity from government and misguided social policies. An individually successful continuing education program will stimulate hope and widen opportunity.
- Diversity – that many voices, respecting each other and focusing in an educated way on the above goals and opportunities, could and should create thoroughly reasoned and innovative programs, beyond the capabilities of authoritative and narrower cultures whose lack of empowered diversity would create difficulty in attaining this richness and its collateral benefits.

3.3 Approach

Our envisioned basic approach involves (a) additional research and demonstration on adult distance learning and IT, coupled with (b) parallel research in a NIST-listed representative area (we advocate renewable energy development: we suggest development of a new class of biomass feedstock in otherwise wasted space, together with creation and storage of localized energy resources in nearby areas as a representative science), and (c) coupling the above with investigation into possible subsequent creation of a unifying non-governmental core of scientists (an "American Spectrum Nonpartison Committee") to govern and support what we herein call the American Spectrum system.

The above research and investigation ideally would be followed by an initial demonstration that would (a) indicate whether the problems summarized in Section 1.0 are in many respects amenable to a transformative solution such as that sketched herein, (b) provide evidence that, once the science and path to solution have been clearly presented, targeted cross-sections of Americans can master the science and associated issues well enough to react reasonably or correctly when a spectrum of potentially transformative proposals or presumptions is presented to them, and (c) demonstrate that there is reason to believe that the envisioned computer-based system and process would also be useful when adapted and applied to other major problems such as telecommunications, transportation and finance.

The ultimate goal is to perform landmark work in a representative area (competitive

renewable energy and its key facilitator, education), and thereby set into motion a reversal of what we see as a crisis of confidence in America's ability to maintain its power status and work efficiently so as to improve our quality of life and ultimately that of other nations.

At this stage we envision taking a wider view of what we consider to be one potentially important element of the national energy sufficiency problem than the more restrictive view that evaluates an opportunity in isolation. In our view, the energy sufficiency problem needs a systems approach embracing the entire field of energy; such an approach might minimize the crippling secondary or collateral problems that plague piecemeal solutions. The potential citizen base for which the system is primarily intended also needs a broad view. However, for demonstration purposes, we would have to restrict the problem to energy, financial, and environmental aspects that would clearly be affected by progress in biofuel and energy development and storage science (e.g., a new generation of deep-storage batteries that can safely be stored in and power a home, cumulatively helping ease the load on a troubled electrical grid). The suggested biomass fuel production project could have much wider application than our increasingly urban population is likely to imagine: its success by itself would be an effective technology leverage even if the ultimate American Spectrum system failed for any cause.

3.4 Technical and Scientific Challenge

Relatively small advances in science or technology can lead to large changes in people's lives. This has been especially notable in the case of information technology with its well-known leverage, i.e., the tendency for small advances in technology to ripple through our institutions and our lives and to cause much bigger changes years later (IBM Enterprises posting). This is especially true in the present case, which would ultimately would take advantage of the great rise in computer power (witness the fulfillment of Gordon Moore's prediction that computer processing power would double every 18 months, which it has done for many years). The envisioned process and its underlying database or databases and algorithms would not have been conceivable perhaps a decade ago, and may still present technical challenges that may require considerable innovation. Likewise, our hope would be that the envisioned system would need and inspire the combined efforts of scientists and specialists in the many disciplines involved, as diverse as distance learning techniques, simulation and modeling of physical and cultural systems, transportation, resource exploration and treatment, statistics, and history.

Significant program challenges are likely to include (1) refining and adapting energy and educational methodology that is best suited for this application, (2) creating algorithms and databases adequate for meeting the demands postulated herein, (3) perhaps innovating in the field of cyber security, and (3) obtaining transformative leadership in support of the program until its evident usefulness creates its own market demand (e.g., witness the history of Wikipedia). From this we can infer that certain research technologies are likely to be developed or improved, such as unconventional energy development, interactive distance learning, cyber security, system simulation, computer-based gaming, and real-time system monitoring and adaptation.

4.0 PATH TO SUCCESS

4.1 Selection of Robust Subjects and Scenario

Our suggested goals for the initial subject matter and approach include:

- Timely and significant: it should address a subject that is currently important (among other reasons: quality of needed inputs, residual value in case of project termination, ease of specification)

- Representative: Success here would be a strong indicator that treatment of a range of similar problems would be successful

- Well defined: Permits development of a straightforward process to measure success and define needed improvements

These goals lead to a recommendation that the initial work be centered upon renewable energy, more specifically sustainable biomass feedstock production and electric energy development on otherwise useless sites. The direct potential benefits for this source are obvious. Perhaps not so obvious are:

- The (perhaps surprisingly) large extent or acreage of such lands
- The opportunity it provides for illustrating a comprehensive scientific approach that takes into account collateral or ripple effects on water quality, food production and costs, and potential productive employment of groups that currently lack opportunity and (sometimes) motivation
- The learning challenges and opportunities involved in efficient, ongoing training of the above groups

The scenario or scenarios are also important. They should be realistic in terms of sequence, time frame, and inclusivity. The recommended biofuels/energy investigation and incorporation into a American Spectrum system appears to be well suited with respect to these objectives.

4.2 Research and Demonstration Sequence

In conformity to guidance in the Call for White Papers that the white paper should discuss problems to be addressed rather than a specific technical solution or project, we include here only a few comments on the need for proper sequence.

1. According to its Internet home page, NIST has experts in many of the technologies to be applied to this transformative project, and we assume that NIST has access to other governmental agencies that can and should contribute to the project's success. The broad nature of our concept makes it imperative that the "ducks be lined up" at the earliest possible moment.
2. By its nature, success in research is resistant to time lines and critical paths, etc. However, we visualize a process of applied research with planned demonstrations

that can provide early evidence of the rate and utility of modular growth that is likely to be achieved.

3. Modular development is feasible in the systems and processes we envision, and such development, if properly monitored, can lead to improvement in each succeeding module that is placed on line.

5.0 EXPECTED OUTCOMES

Because of the broad nature of the envisioned American Spectrum system and process, the recommended work can and should have both direct and indirect or unplanned advantages:

- Direct: moving America toward the goals listed in the Call for White Papers as indicated by progress in the goals postulated in Section 2 (societal transformations).
- Indirect: (1) "cross-fertilization" or mutual benefits attainable when specialists in different areas must cooperate to find success (stimulating scientific frontiers on both or all involved areas); (2) barriers lowered and new horizons opened even in cases in which only partial success is attained under this program: for example, unmet needs may be defined (thereby stimulating research in needed areas), and successful individual modules may solve parts of the defined problems and stimulate increased efforts to work together to solve other problems.

In conclusion, we present a preliminary embodiment of the American Spectrum system that might be capable of meeting the challenges described in Section 2.0.

A completed, operational system would include an embodiment of the Education postulate in Section 2.1. It would include interactive distance courses ranging in substance from introductory through first-year college level. Each student (eventually including millions of citizens nearing voting age and beyond) would have some form of secure "password." Data stripped of individual identification will be collected to measure the effectiveness of the lessons and point out needed improvement. The menu would include a range of subjects implied by the Postulates. Each student's secret stored "dossier" will record his or her level of accomplishment and apparent innate capability, and the student will be notified when some portion of completed studies needs to be updated.

With this interactive, real-time teaching device, a given student will progress rapidly though courses that contain little other than previously understood material. No diplomas are issued, and there is no interference with whatever academic work a given student has completed or shall complete.

Scientific subjects up to the level covered in the courses commonly have "right" and "wrong" responses, and progress is relatively easy to measure online and in real time. Other types of needed classes may have a number of "right" answers. The selection and phrasing of questions will minimize this situation, and normalizing follow-up questions

or suggestions will be available for such cases.

The desired effect is to raise the level of debate – humans will always disagree one with another, and greater levels of interest and increases in informed debate may be signs of strong democracies.

As the program gathers momentum, increased, widespread interest and opportunity should stimulate the Nation's scientific frontiers in at least the areas outlined in the White paper request, around which the mature American Spectrum system is constructed. The modular nature and growth of the system provides additional technology leverage for each item addressed in research and development of the system. To the extent that our Postulates are accurate, the cost of lost opportunities is intolerable.