Thematic Categories of Environmental Issues

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Thematic Categories:

1) Air Quality
2) Water Quality and Quantity
3) Energy (Efficiency, Renewable, Cleaner Traditional Sources)
4) Remediation
5) Emergency Response
6) Information Technology and Communication

1) Air Quality

A) Determine a method to capture low-rate, low-pressure releases of high global warming potential greenhouse gases (GHGs) - Sources such as landfill gas seepage, venting of natural gas pipelines, petrochemical processes dealing with acrylonitrile, ethylene, ethylene dichloride, ethylene oxide, methanol and carbon black produce GHGs (including methane and nitrous oxide) that are not easily captured. Applied research on design of capture technologies or life cycle processes (e.g., in carbon black plants) that prevent these low-flow, low-pressure releases could result in significant reductions in GHGs.

B) Integrated Gasification Combined Cycle is a CO_2 capture technique widely touted as a solution for coal fired power plants. However, it is expensive, not generally suitable for retrofitting power plants, and imposed a significant efficiency penalty. As an alternative, develop and/or refine post combustion capture (PCC) CO_2 techniques that can be retrofitted to existing fossil fuel fired sources. These PCC techniques should be cost effective, efficient, and applicable to a wide range of sources, such as coal fired power plants, refineries, cement kilns, etc.

2) Water Quality and Quantity

A) Develop innovative and highly efficient energy saving industrial scale pumps - Municipal water and wastewater utilities generally incur most of their operating costs by electricity consumption. About one eighth of the nation's energy use is for treating and pumping water. Even moderate gains in efficiency could yield tremendous saving in the water and wastewater treatment industry.

B) Monitoring sensors and probes capable of real time detection of microbial and chemical contaminants (including nutrients), coupled with remote telemetry to alert system operators when standards are exceeded would serve to alert downstream water supplies of potential emergencies.

C) Lower cost treatment options for certain contaminants such as arsenic are needed, especially for small systems that lack sufficient customer base to finance expensive ion exchange treatment technologies. Research has been done on less expensive treatment media such as zero valent iron to remove arsenic from water.

D) Management services that emphasize efficiency, product loss prevention, full cost pricing, and asset management could be used in assisting small water systems to remain viable.

E) Provide quality drinking water in sufficient quantity for 50 year horizon - Coastal communities along the Gulf of Mexico are projected to increase in population for the foreseeable future. Some of the communities have marginal or insufficient supplies of drinking water for the increased population or will face continuing threats of saltwater intrusion. Production of desalination technology and plants to convert salt water at a reasonable cost could meet the need. An added benefit is that redistribution of water rights and creation of surface reservoirs with pipeline networks could be avoided.

3) Energy (Efficiency, Renewable, Cleaner Traditional Sources)

A) Develop effective storage devices for renewable energy sources - Many renewable energy sources produce energy at locations and times of day that are inconvenient for widespread use in urban environments with high power demand. A reasonably priced storage system that could store large amounts of energy produced by renewable sources would enable the transfer of such energy (a) over transmission lines during times of the day with highest power demand and/or (b) via portable methods (e.g., physical shipment of batteries to the high-demand urban areas).

B) Develop cost-effective, affordable, zero energy homes for widespread use - There is a need to integrate the various energy efficiency and distributed generation technologies relating to housing into a standardized, replicable, and cost-effective design. This project would focus on design and actual construction of various prototype affordable, residential housing units that are zero-energy and carbon-neutral and that minimize water use. Emphasis should be placed on the use of off-the-shelf, proven design elements that lend themselves to seamless integration into a traditional neighborhood setting.

C) Perfect community digesters for agriculture methane capture - The current state of the technology requires intensive technical oversight of these digesters, with a concomitant loss of cost-effectiveness and overall confidence in reliability. This project would research various techniques for dramatically increasing reliability and independent operation of large agricultural digesters.

D) Develop residential rent-to-own solar and wind turbine installations - Due to the large up-front costs of installations, and considering the tightening in loan markets, many consumers have rejected the installation of residential and/or wind turbine installations. However, these consumers would likely be willing to allow reputable companies install solar and wind solution on their property if it could be done at little to no up-front cost. This could be accomplished via a
rent-to-own business plan in which the installation company rents the equipment to the home owner based on a percentage of the amount of electricity the system saves the consumer.

E) Market / develop new applications for Waste-to-Energy siting tool – The regionally created geographic information system-based screening tool to connect methane sources (landfills, CAFOs, wastewater treatment plants) with potential end-users (natural gas pipelines or industrial boilers) is being expanded nation-wide. Other markets such as bio-mass producers as well as other renewable energy facilities could be created.

4) <u>Remediation</u>

A) Develop innovative processes/equipment for extraction of pollutants from ground water – In many cases, the pollutants of concern in aquifers are present in such quantities that the chemicals could be marketable if separated from other constituents. Sale of the reclaimed chemicals could be used to offset some of the remediation expenses.

B) Develop renewable energy powered pumps for ground water remediation – Many of the contaminated sites that are remediated are in rural and/or remote areas. Having equipment that could be run on solar, wind or geothermal power would reduce the need to extend transmission lines to the site or the use of diesel powered pumps on a 24/7 basis. More efficient pumps would reduce the overall cost to responsible parties or state government agencies that have assumed responsibility for the post-closure operation and maintenance phase.

C) When residential relocation from Superfund sites is required, relocate individuals to sustainable communities including green buildings, energy efficiency buildings, renewable energy powering, smart energy metering, Smart Growth, zero energy consumption, and sustainable surfaces concepts. A business that provided analysis and decision-making tools to local government leaders could facilitate the redevelopment process.

D) Support mass manufacturing for smart meters for using renewable energy to meet electrical needs for remediation/removal. Support mass manufacturing for wind anemometers for state/federal purchase to ground-truth site specific wind resources for renewable energy applications at Superfund sites.

5) Emergency Response

A) Expand the use of methane or hydrogen fuel cell power supplies to municipalities - One of the lessons learned from Hurricanes Katrina, Rita, Gustav and Ike is that the power network is fragile and subject to disruption. And the disruptions can last for weeks at a time. The use of fuel cell technology would allow municipalities and hospitals to maintain operations during these disruptions.

B) For disaster recovery, incorporate sustainability and green building for homes and communities (as described above for the relocation bullet). Modularize for ease of potential future rebuilding. Decentralize with distributed energy to decrease vulnerability to power outages (accidental or man-induced). Support the pilot use of corridor planning (Emerald-to-Green Necklaces) with credits for the use of greenbelt planning.

C) Support the development of robotics for site cleanup and monitoring. Due to unknown hazards found in many locations, emergency response personnel must use highest level of protective gear, which can be bulky and hinder sample collection. The use of robotic devices to enter areas for initial sampling would lower rise to workers and gather information needed for decision-makers during emergency situations.

6) Information Technology and Communication

A) Develop and integrate mapping tools for sustainable urban planning, smart energy planning, and streamlining state and federal requirements (i.e., permitting and NEPA).

B) Develop databases for Superfund/Venture Capital-related green jobs, suggestions for environmental applications for venture capital projects, contact information (for venture capitalists/financiers, developers, landholders, manufacturers, and state/federal regulatory staff), investment tax credits, and sustainability success stories.

C) Develop educational programs for real-time problem-solving of EPA Superfund problems whereby EPA engages the schools/students for emerging technological solutions. Develop school educational curriculum on sustainability concepts (as related to Superfund applications). Develop educational tools for incorporating sustainability concepts into corporate and government daily decision-making (including recycling is more profitable than wasting, spill prevention is more profitable than spill cleanup, zero waste production equates to prevention of Superfund site listing, Energy Star, telecommuting). Develop education and outreach materials (including success stories) for communities to incorporate (waste-related) sustainability concepts including a community certification program (i.e., LEED).