Summary of Grand Challenge Projects Selected for Award Negotiations

Applicant	City	State	Project Title	DOE Funding	Non-Federal Cost Share	Total Budget	Project Summary
3M Company	St. Paul	Minnesota	Research Regarding Development of New High Temperature Low Cost Ceramic Media for Use in Natural Gas Surface Combustion Burners with Lower NOx Emissions	$ 295,370	$ 502,926	$ 798,296	The objective of this project is to produce a catalyzed radiant burner media that will function both as burner media and catalyst support for the efficient combustion of natural gas. This media will then be used to produce a variety of radiant burners (replacing electric radiant heaters) for a multitude of applications in process heating and other industries. 3-M is proposing to combine four innovative 3-M Platform technologies (Nanocrystalline ceramics, super active nano gold catalysts, NexTel ceramic products and non-woven materials) in one package. Direct combustion of natural gas to provide radiant heat, instead of its use to produce electricity and then to resistive heat, would save significant energy.
Advanced Electron Beams, Inc.	Wilmington	Massachusetts	Energy Efficient Removal of Volatile Organic Compounds (VOCs) and Organic Hazardous Air Pollutants (o-HAPs) from Industrial Waste Streams by Direct Electron Oxidation	$ 294,880	$ 122,256	$ 417,136	AEB proposes to develop an innovative method of oxidizing organic pollutants at room temperature by injecting electron beam energy in place of using thermal oxidizers which use methane and produce CO2. Preliminary testing has been done on a wide range of industrial solvents and other organic compounds. This project will investigate and quantify the ability of direct electron beam destruction of VOCs and o-HAPs in model industrial waste streams.
Alcoa Inc.	Alcoa Center	Pennsylvania	Optimum Metallurgical Microstructures for Melt Phase Extrusions	$ 297,256	$ 233,558	$ 530,814	Alcoa proposes to develop a novel semi-solid processing technology to produce aluminum parts (replacing current casting, reheating, fabrication) approach. This offers energy saving, emissions reduction, productivity gain and economic benefits. Melt Phase technology consolidates many costly, energy-intensive, and environmentally unfriendly sequential aluminum primary production and product processes into a single-step, continuous operation. Also has the potential to enable manufacturing of unique product shapes and alloys with significant downstream value, which would generate additional energy, economic and environmental savings.
Alcoa Inc.	Alcoa center	Pennsylvania	Membrane Purification Cell for Aluminum Recycling	$ 297,974	$ 99,325	$ 397,299	This will offer huge energy and environmental benefits. Alcoa proposes to Alcoa's proposed Stage 2 concept will focus on development of a novel membrane purification cell to produce pure aluminum from recycled scrap. This can then be used as sweetener, instead of primary aluminum, in processing low grade aluminum scrap - offering huge energy and environmental benefits. The problems encountered in past would be overcome by using fluoride, instead of chloride, bath.
Aspen Aerogels, Inc.	Northborough	Massachusetts	Aerogel-Based Insulation for High-Temperature Industrial Processes	$ 299,960	$ 74,991	$ 374,951	Nanoporous silica based aerogels provide better insulation than other materials in commercial use. Pyrogel XT, a product developed under previous ITP project is successfully expanding its market share for steam pipes (up to 400 C) in petrochemical refineries. The goal of the proposed project is to develop a new insulation material (Pyrogel HT) for high temperature steam and process pipes (450 to 650 C). The proposed project will develop modifications to compositions and processing conditions (used for Pyrogel XT) to make the product (Pyrogel HT) more durable in higher temperature applications (improved water repellency, decreased dusting).
Carpenter Technology Corporation	Reading	Pennsylvania	Alumina-Forming Austenitics: A New Approach to Thermal Degradation Resistant Stainless Steels for Industrial Use	$ 300,000	$ 100,000	$ 400,000	Alumina-Forming Austenitics (AFA) are a new class of stainless steels that offer potential of 10x life improvement over traditional stainless steel; high temperature strength similar to hi nickel alloys, but with the low cost and ease of formability of stainless steels. The longer life would reduce the requirement for new steel - major source of energy and environmental emissions reduction. The goal of the project is to establish relationship between their composition, heat treatment, microstructure and high temperature durability in high temperature environments representative of target applications. The proposed project is aimed at developing modifications suitable for reducing (carburizing and sulfidizing) atmospheres. The use of AFA steel as materials of construction would potentially improve the process efficiency of chemical processing and petroleum refining operations as well as steam boilers for power production, by allowing them to operate at higher temperatures and pressures. This in turn would reduce energy requirement.
Caterpillar Inc.	Mossville	Illinois	Novel Steels for High Temperature Carburizing	$ 291,892	$ 72,973	$ 364,865	The goal of the project is to develop new low alloy steel compositions that would allow case carburizing at higher temperatures without adversely affecting the performance of the product. This would drastically reduce the time requirement. This project seeks to develop a generic molten steel treatment practice for low alloy carburizing steels which will ensure these steels consistently retain a fine austenite grain size when carburized at 1050°C.
Caterpillar Inc.	Mossville	Illinois	Advanced Production Surface Preparation Technology Development for Ultra-High Pressure Diesel Injection	$ 300,000	$ 154,796	$ 454,796	Caterpillar has demonstrated that ultra-high pressure diesel injection provides better fuel distribution which not only reduces the particulate and NOx emissions to meet Tier 4 standards but also improves fuel energy efficiency by 2.5%. However, the parts have failed after a short life under the high stress. The goal of the proposed project is to develop novel design features and surface preparation methods to improve the life and performance of the engine. This would also facilitate the use of biodiesel in these engines. A combination of novel state of the art approaches in computer-aided design optimization, laser shock peening method of surface treatment, and measurement of very high residual stresses (700 Mpa or over 10000 PSI) would be used to accomplish the project goals. These more fuel efficient engines will be used in power production, mining, manufacturing and transportation sectors resulting in huge energy savings and reduced GHG emissions.
Caterpillar Inc.	Mossville	Illinois	Energy Reductions Using Next-Generation Remanufacturing Techniques	$ 241,690	$ 80,565	$ 322,255	The goal of the project is to develop an innovative thermal spray coating process (in combination with laser surface preparation) to provide better metallurgical bonding and durability. The process is called Laser-Assisted Two-Wire Arc (LATWA) process. This process treatment would give a new life to worn out parts and reduce the need for new parts and thus saving energy and environmental emissions associated with their manufacture. The proposed spray coating technologies are designed to overcome the weak mechanical bond at the coating substrate interface.
CCS Materials, Inc.	New Brunswick	New Jersey	HFC Concrete: A Low Energy CO2-Negative Solution for Reducing Industrial Greenhouse Gas Emissions	$ 299,020	$ 82,773	$ 381,793	CCS Materials is proposing a new material - hydrate-free concrete (HFC) for building facades. It will not require Portland cement and thus reduce the energy requirements and CO2 emissions associated with cement manufacture. The first objective of the proposed project is to create a CO2-negative inorganic binding phase that serves as a substitute for Portland cement (PC) in concrete. The second objective of the proposed project is to reduce the energy required to make concrete by 60% and CO2 emissions by more than 90%. These objectives will be accomplished using a patent-pending process called low temperature solidification (LTS).

Ceralink Inc.	Troy	New York	Energy Saving Glass Lamination via Selective Radio Frequency Heating	$ 297,640	$ 121,736	$ 419,376	The autoclaving process currently used for glass lamination in the U.S. is very energy intensive. Ceralink has invented an innovative radio-frequency (RF) heating process for glass lamination that reduces lamination time to just 1-3 minutes and can lower the energy intensity over 90% by directly dissipating RF energy as heat into the vinyl interlayers without heating the glass. The primary objectives of this proposed project are to establish manufacturability potential of the RF lamination process by optimizing the process, evaluating the products and developing commercialization plan. The target markets are automobile window panels and solar panels.
Ceralink Inc.	Troy	New York	Microwave Enhanced Direct Cracking of Hydrocarbon Feedstock for Energy Efficient Production of Ethylene and Propylene	$ 297,232	$ 90,055	$ 387,287	The goal of the project is to perform a concept definition study for potential use of microwave heating and cracking of hydrocarbons in order to reduce the energy intensity of such processes that currently involve indirect heating methods. Initial effort will focus on ethylene, one of the largest volume chemicals produced.
Ceralink Inc.	Troy	New York	Energy Efficient Microwave Hybrid Processing of Lime for Cement, Steel and Glass Industries	$ 293,270	$ 112,566	$ 405,836	Calcination of limestone to lime is a very energy-intensive process representing 90% of the energy required in cement production. Ceralink is proposing to develop a hybrid Microwave Assist Technology (MAT) that uses a combination of microwave and radiant energy to calcine limestone to lime as a replacement of thermal processing. The innovation lies in providing the microwave energy directly where it is needed, to the core of the limestone particles, instead of heating the surrounding air and then relying on heat transfer. This drastically reduces the time requirement for calcination, increases productivity and decreases energy intensity.
Cool Clean Technologies	Eagan	Minnesota	Environmentally Friendly Coolant System	$ 291,150	$ 126,000	$ 417,150	Cool Clean Tech proposes to develop and commercialize a transformational cooling process for machining operations based on use of dry ice CO2 particles in place of traditional petroleum based fluids. The technology offers potential economic, energy and environmental benefits by increasing tool life, decreasing cutting time, and avoided disposal of petroleum based
Eaton Corporation	Southfield	Michigan	Ultracoatings - Enabling energy and power solutions in high contact stress environments through next generation nanocoatings	$ 295,853	$ 77,175	$ 373,028	The goal of the project is to advance the nanocoatings technology to the next higher level of properties (hardness, friction and wear resistance) and for higher pressure applications by developing new compositions (al-mag-borides) and coating methods. This would open additional markets in aeronautical and other industries. The innovation lies in customizing the coating material composition and coating process conditions to obtain desired surface properties for specific applications. The durability of required surface properties avoids mechanical inefficiency with time and this leads to energy savings.
FMC Corporation	Princeton	New Jersey	Waste Heat Recovery and Recycling in Thermal Separation Processes: Distillation, Multi-Effect Evaporation (MEE) and Crystallization Processes	$ 294,767	$ 73,692	$ 368,459	The goal of this project is to perform Concept Definition study of a novel concept - recovering the waste heat rejected during crystallization, distillation, and evaporation and recycle it to the process using a heat pump. The proposed concept shows innovation and originality. The team plans to pursue recovering latent heat using a water-heat powered thermal heat pump and recycling in the process.
Friction Stir Link, Inc.	Waukesha	Wisconsin	Friction Stir Processing for Efficient Manufacturing	$ 250,000	$ 50,000	$ 300,000	The goal of the project is to develop and commercialize Friction Stir Processing to impart desired hardness, wear resistance and low friction resistance replacing much more energy intensive case hardening and coating processes. Compared to current surface hardening techniques, FSP is more energy efficient, has no emission or waste by-products and may result in better tribological performance.
Gas Technology Institute	Des Plaines	Illinois	Advanced Energy and Water Recovery Technology from Low Grade Waste Heat	$ 300,000	$ 75,000	$ 375,000	The goal of this project is to further advance the Transport Membrane technology to condense and recover water and energy from high-moisture waste gas streams. The focus is on new porous and conductive ceramic membrane materials and process waste gas, rather than combustion gas from a boiler. GTI proposes to investigate a corrosion-resistant nanoporous ceramic membrane with good heat conductivity, working on a capillary condensation separation mechanism, to extract water vapor
GE Global Research Center	Niskayuna	New York	Nanostructured Ferritic Alloys: Improving Manufacturing Efficiency and Material Performance for High Temperature Applications	$ 300,000	$ 99,909	$ 399,909	The goal of the project is to develop powder metallurgy fabrication technique to produce turbine wheels out of Nanostructured ferritic alloys (NFAs). This would save energy in manufacturing of wheels as well as allow higher temperature, more energy efficient operation of turbines, which would save fuel. NFA is currently used in nuclear reactors. This project will establish the relationship between composition, processing conditions and high temperature properties, particularly fatigue crack growth, to allow their usage in turbine wheels..
GE Global Research Center	Niskayuna	New York	Use of Microwave for Energy-Efficient Heating in High Temperature Brazing	$ 299,999	$ 75,000	$ 374,999	GE is proposing to develop an innovative microwave brazing process to replace vacuum brazing to save energy and to improve properties. Longer life of turbine and other parts would reduce the requirements for new parts - major source of projected energy and emissions reductions. The better physical properties in the brazed joints would enable repairs of parts that otherwise would be scrapped, resulting in energy and economic benefits.
Georgia Tech Research Corporation	Atlanta	Georgia	Dry Kraft Pulping at Ambient Pressure for Cost Effective Energy Saving and Pollution Deduction	$ 245,085	$ 62,760	$ 307,845	Georgia Tech is proposing to develop a novel pulping technology that can replace the current Kraft pulping technique but with significantly less energy consumption, process cost and environmental pollution. The dry pulping technique would react wood chips with chemical reagents in a dry system at ambient pressure and relatively low temperature as compared to the current Kraft pulping technique that uses NaOH/Na2S solution at high temperature and high pressure. New process idea is simple, yet innovative. It holds promise to reduce energy consumption by 40% and chemical use by 50% over existing
Guided Wave, Inc.	Rancho Cordova	California	Advanced Optical Sensors to Minimize Energy Consumption in Polymer Extrusion Processes	$ 250,000	$ 74,481	$ 324,481	The goal of the project is to develop and demonstrate an advanced on-line sensor for polymer processing. A high rate of scrap recycle is caused due to color problem. The sensor may reduce this recycle significantly. This is unique technique to control plasticizing process.
Hi-Z Technology Inc.	San Diego	California	Ultra Thin Quantum Well Materials	$ 250,000	$ 250,000	$ 500,000	Hi-Z proposes to develop and commercialize thermoelectric devices based on Si/SiGe Quantum Well materials as thin films. ZT values as high as 3 to 7 (compared to 1 - 2 for current materials) are expected which will increase conversion efficiency (thermal energy in hot waste gas to electric energy) to ~ 40% in comparison to 10 % for current materials. Both large volume sputtering and molecular beam epitaxy techniques will be used to produce the films which will be characterized by state-of-the art instruments at HZ and partner laboratories. The electricity so produced will be used in the process thereby reducing the purchased energy requirement, potentially by 25%.
Lummus Technology	Bloomfield	New Jersey	Autothermal Styrene Manufacturing Process with Net Export of Energy	$ 300,000	$ 318,779	$ 618,779	Lummus proposes to develop a new catalyst for production of Styrene that would offer significant energy savings and economic benefits in comparison to current technology. Well documented new technology would reduce the chemical reaction process steps from two to one. New feedstocks are less expensive and less energy intensive. Technology is exothermic rather than current endothermic which would reduce energy requirements. The proposed concept shows very good innovation and originality. Three novel catalyst synthesis processes were previously developed by Lummus. The application indicated that these materials together with the metals and metal oxides known from the literature to catalyze the oxymethylation reactions will lead to catalyst formulations that achieve the targeted commercial performances.

Membrane Technology and Research, Inc.	Menlo Park	California	Novel Membranes and Processes for Oxygen Enrichment	$ 299,044	$ 86,775	$ 385,819	The proposed project is aimed at developing a cheaper and better system for producing oxygen based on a novel membrane material and a novel engineering design. Proposed technology is based on new membranes that are 10x more O2 permeable. Additionally, a countercurrent/sweep membrane design uses ambient pressure air as a sweep to lower the compression power required.
Metal Oxygen Separation Technologies, Inc.	Natick	Massachusetts	Efficient One-Step Electrolytic Recycling of Low-Grade and Post-Consumer Magnesium Scrap	$260,000	$100,000	$ 360,000	Increased us of magnesium, replacing aluminum or steel, offers savings in embedded energy (used to produce the parts) and fuel savings due to lighter vehicle. A major barrier is lack of recycling technology for low-grade magnesium scrap. The goal is project is to develop an innovative process (based on solid oxide membrane in combination with molten salt electrolysis and recovery of magnesium as vapor) to treat low-grade post-consumer magnesium scrap and produce pure magnesium for making new parts. This would reduce the requirement for primary magnesium and result in energy savings and reduced
North Carolina State University	Raleigh	North Carolina	Crude Glycerol as Cost-Effective Fuel for Combined Heat and Power to Replace Fossil Fuels	$ 272,754	$ 68,453	$ 341,207	The goal of this project is to understand and improve the combustion characteristics of crude glycerol, (a low value byproduct of biodiesel production), as a substitute for fossil fuels for both combined heat and power applications in any number of industries. The project will perform a fundamental characterization of crude glycerol combustion and the emissions and ash associated with burning a wide range of crude glycerols in a range of combustion environments. The results of this program will be the ability for biodiesel producers to choose the most cost effective use of their glycerol byproduct; and industrial consumers to increase their economic competitiveness while reducing their carbon footprint.
Northwestern University	Evanston	Illinois	A Hybrid Forming System: Electrical-Assisted Double Side Incremental Forming (EADSIF) Process for Enhanced Formability and Geometrical Flexibility	$ 296,447	$ 74,152	$ 370,599	The goal of the project is to develop a transformation fabrication process (EADSIF) by combining the double sided incremental forming process with use of pulsed electric current to enhance formability. Idea combines promising concepts into one synergistic new manufacturing process for sheet metal that would reduce or nearly eliminate conventional tool-die forming for large scale and mid scale operations. Technology would enable creation of more complex parts while reducing energy requirement and emissions.
Oasys Water, Inc.	Cambridge	Massachusetts	Engineered Osmosis for Energy Efficient Separations: Optimizing Waste Heat Utilization	$ 300,000	$ 128,500	$ 428,500	The project is centered on a transformative waste water treatment technology based on osmosis. It uses low-grade waste heat to treat industrial waste waters. It would use NH3-CO2 as a draw stream. Bench scale testing has already been successful. This project is aimed at developing full scale components for piloting in an industrial facility. The process could expand in desalination market.
Power Environmental and Energy Research Institute (PEER-I)	Covina	California	Methyl Chloride from Direct Methane Partial Oxidation: A High-Temperature Shilov-Like Catalytic System	$ 240,000	$ 60,000	$ 300,000	The goal of the project is to develop an innovative single-step, low temperature (<300 C) partial oxidation process using "designer" ionic liquids and Shilov-like catalysts to convert methane in low grade natural gas directly to methyl chloride, a widely used chemical. Methyl chloride is currently produced from methanol which is mainly produced from a multi-step approach involving higher temperature (>500 C) syngas generation. This would result in significant reductions in energy intensity and GHG emissions.
Rive Technology, Inc.	Cambridge	Massachusetts	Advanced Nanostructured Molecular Sieves for Energy-Efficient Industrial Separations	$ 300,000	$ 461,703	$ 761,703	The proposal is aimed at developing mesoporous zeolite containing adsorbents in simulated moving bed or pressure swing adsorption processes for separations in chemicals and petroleum refining operations as an alternative to energy intensive distillation process. The focus of the project will be on separation of propane from propylene.
SmartKoncept Inc	Houston	Texas	Integrated Ammonia Reactor and Ammonia PSA Recovery	$ 272,513	$ 68,128	$ 340,641	The goal of the project is to develop an innovative process for production of ammonia, by combining an intensified reactor with a PSA ammonia recovery system. In the proposed concept, an enhanced ammonia reactor is tightly integrated with a newly developed ammonia recovery system. In the reactor section, the proposed method will introduce into the synthesis reactor only pure fresh reactants. The new recovery system receives the reactor effluents and achieves complete ammonia recovery. It also recovers the unused reactants and recycles them back to the reactor, pure and free of potential reactor contaminants, (such as ammonia and other inerts). The recycle is achieved without the loss of product or raw material through purge, and without the need for re-compression and re-heat of recycle stream thereby further saving more energy. The technology offers energy, environmental, economic and safety benefits over the state of the art. It can be used for new plants
SolidUV, Inc.	Chelmsford	Massachusetts	High Power UV LED Industrial Curing Systems	$ 300,000	$ 90,265	$ 390,265	The goal of the project is to explore the development of ultra-high power UV LED curing systems that are more efficient, more reliable, lower cost and higher performance than conventional high power mercury lamp systems. This technology will save energy and reduce VOC and HAP emissions by making UV curing attractive to the industries that still use ovens to dry solvent based paints, inks and coatings. By making UV curing systems more efficient, cost effective and reliable, much broader adoption of UV curing in manufacturing plants will become possible. This would result in significant energy savings when compared to today's drying ovens, as well as significant reduction in the emission of greenhouse gases.
Southwire Company	Carrolton	Georgia	Direct Solid State Conversion of Recyclable Metals and Alloys	$ 290,000	$ 80,000	$ 370,000	The goal of the proposed project is to develop an innovative direct solid-state metal conversion (DSSMC) process for converting aluminum and copper scrap into marketable forms without going through melting and casting operations. Friction extrusion and friction stir processing would be combined to converts powders, chips or other recyclable feedstock metals or scraps directly into useable product forms. The project will also demonstrate the feasibility of utilizing nano-particle dispersion strengthened bulk materials and/or nano-composite materials for target applications in future electric power generation and delivery infrastructure and lightweight structures for automotive applications.
State University of New York, College of Environmental Science and Forestry	Syracuse	New York	New Manufacturing Method for Paper Filler and Fiber Material	$ 240,035	$ 114,641	$ 354,676	The project is based on the premise that if the filler content of the paper is increased , there will be a reduction in pulp requirement and that would result in corresponding saving in energy required to produce and process the pulp. However, the filler content can be increased only to the point where it does not adversely affect the paper quality. The goal of this project is to research and develop production and utilization of new filler materials to realize the potential energy and economic benefits of increased filler content without compromising the quality of the paper product.
Structured Materials Industries, Inc.	Piscataway	New Jersey	Low Cost Production of InGaN for Next-Generation Photovoltaic Devices	$ 250,000	$ 65,000	$ 315,000	The goal of the project is to develop a lower cost hydride organometallic vapor phase epitaxy (HOVPE) process for production of InGaN and InAlN materials replacing current MBE or MOCVD processes, which is expected to reduce the energy requirement by reducing time requirement by a factor of 100. These materials have the potential of providing lower cost, more efficient solar cells as well as LEDs and other products for emerging energy industries.

The Boeing Company	Seattle	Washington	Near-Net Shaped Fabrication Using Low-Cost Titanium Alloy Powders	$ 300,183	$ 74,167	$ 374,350	Boeing proposes to develop a transformational process to consolidate low-cost titanium powders into bars, plates, sheets etc and then use friction stir welding to join them and machine them into airplane parts. This would drastically reduce scrap recycle - major source of projected energy savings and economic benefits. The focus will be on utilization of titanium powders produced by emerging methods of extraction with significantly lower energy consumption. The lower material costs, lower energy requirement for fabrication, and lower scrap recycle rate, in turn would enable the low-cost production of titanium components and expand its usage, leading to energy savings in end use.
The Boeing Company	Seattle	Washington	Production of Energy Efficient Preform Structures (PEEPS)	$ 276,833	$ 67,684	$ 344,517	The goal of the project is to develop near-net shape fabrication methods, mainly stir friction joining technology, for aluminum components. This would drastically reduce scrap recycle - major source of projected energy savings and economic benefits. This would potentially reduce the buy-to-fly ratio from 3:1 to 2:1.
The University of Alabama	Tuscaloosa	Alabama	Reduction of Metal Oxide to Metal Using Ionic Liquids	$ 249,822	$ 68,982	$ 318,804	The goal of the project is to develop a transformational low temperature process, based on use of ionic liquids and electrolytic reduction, to replace current high temperature chlorination and carbon reduction processes for production of reactive metals like silicon. The proposed project will address three important criteria, namely; (i) Identification of suitable ionic liquids which will dissolve metal oxides (ii) Solubility of various oxidation states of the metals in ionic liquid, and (iii) electrolysis of the metal oxide dissolved in ionic liquid electrolyte to electro-deposit metal on the cathode.
UES, Inc.	Dayton	Ohio	Multiphase Nano-Composite Coatings for Achieving Energy Optimization	$ 90,000	$ 209,986	$ 299,986	UES proposes to develop and commercialize next-generation super-hard, nano-crystalline and multilayered multifunctional coatings, with at least double service life. The coating materials include nitrides and borides and the processes include Magnetron Sputtering Ion Plating (MSIP) and Large Area Filtered Arc Deposition (LAFAD). The innovation lies in customizing the coating material composition and coating process conditions to obtain desired properties for specific applications. The initial focus will be on cutting tool and metal casting die applications.
United States Council for Automotive Research LLC (USCAR)	Southfield	Michigan	Machining Elimination through Application of Thread Forming Fasteners in Net-Shaped Cast Holes	$ 158,950	$ 43,737	$ 202,687	The goal of the project is to develop the innovative TFF technology (in use for steel) for aluminum and magnesium, the metals of choice for automotive parts. This would significantly reduce the machining requirement - the source of energy saving and economic benefits. There would be likely much larger energy savings in end use - lower weight automotives with more Aluminum and Magnesium parts.
University of California Santa Cruz	Santa Cruz	California	Next Generation Print-based Manufacturing for Photovoltaics and Solid State Lighting	$277,533	$ 70,000	$ 347,533	The goal of the project is to develop a transformational print-based manufacturing process for fabricating photovoltaics and solid state lighting on thin plastic substrates. Photovoltaics produced on barrier plastic substrates operate with an efficiency greater than 10% and a cost less than $.90 per Watt. The process operates at <300C and atmospheric pressure in comparison to current processes at >600C and vacuum. This results in lower cost and over 50% reduction in both the energy intensity and greenhouse gas emissions. The project will demonstrate that low-cost print-based manufacturing currently used by Add-vision to produce printed OLEDs is applicable to the fabrication of photovoltaics.
University of Michigan	Ann Arbor	Michigan	Ultra-High Efficiency and Low-Emissions Combustion Technology for Manufacturing Industries	$ 252,179	$ 64,502	$ 316,681	University of Michigan proposes to develop a transformational Relatively Homogeneous Combustion (RHC) process that promises significant advantages over state of the art in terms of fuel flexibility, combustion efficiency and environmental emissions. The proposed concept shows outstanding innovation and originality. The technology combines technical approaches often thought at odds with each other in pursuit of highly improved performance.
University of Minnesota	Minneapolis	Minnesota	Solid Fuel - Oxygen Fired Combustion for Production of Nodular Reduced Iron to Reduce CO2 Emissions and Improve Energy Efficiencies	$ 299,919	$ 97,118	$ 397,037	The project aims to develop a novel concept of using solid biomass and coal fuel to supplement natural gas in a direct reduction process for iron production. This is a potential further improvement to Messabe Nugget process. The demonstration of Torbed reactor for the torrefaction process to convert biomass to char is innovative. While this technology has been demonstrated in other countries, it will be its first use in USA.
University of the Pacific	Stockton	California	Research and Development of a New Silica-Alumina Based Cementitious Material Largely Using Coal Refuse for Mine Backfill, Mine Sealing and Waste Disposal Stabilization	$ 279,019	$ 88,137	$ 367,156	The central goal of this project is to research and develop a new silica-alumina based cementitious material largely using coal refuse as a constituent that will be ideal for mine backfill, mine sealing and waste disposal stabilization. Silica-alumina based cementitious material is an environmentally friendly alternative to ordinary Portland cement which consumes 400 trillion Btu of energy annually and emits 82 million metric tons of carbon dioxide per year in the U.S. Unlike Portland cement production which requires a high temperature (1200°C~1540°C) process and two energy intensive grinding processes, the proposed material can be produced with one grinding process and a low temperature (500ºC~800ºC) process upon successful development. Most importantly, because silica-alumina based cementitious material does not require limestone, a large source of carbon dioxide emission will be avoided.
University of Utah	Salt Lake City	Utah	A New Method for Production of Titanium Dioxide Pigment - Eliminating CO2 Emission	$ 249,576	$ 62,500	$ 312,076	The goal of the project is to develop a new process (combination of roasting and leaching) to replace high temperature chlorination process for production of TiO2 powder, offering potential for reducing energy intensity. The process eliminates carbon reduction step and thereby eliminates large CO2 emissions. The proposed technology is an innovative process to replace current TiO2 process.
Velocys, Inc.	Plain City	Ohio	Distributive Distillation Enabled by Microchannel Process Technology	$ 299,990	$ 75,000	$ 374,990	The goal of the project is to develop an innovative distributed distillation process using multi-channel approach, to replace current distillation columns. The project would ascertain the industrial viability and benefits of microchannel distillation. Early experiments have verified effective, controlled, and highly efficient separation of close boiling mixtures, but the economic viability and manufacturability of commercial scale, microchannel distillation units is yet to be determined.
Wireless Industrial Technologies, Inc.	Oakland	California	Reduction of carbon footprint and energy efficiency improvement in aluminum production by use of novel wireless instrumentation integrated with mathematical models	$ 266,314	$ 66,578	$ 332,892	The proposed research is to employ novel instrumentation to determine the current distribution within Hall cells (large electrolytic cells employed in the primary production of aluminum) with the objective of reducing GHG emissions and improving energy efficiency. The sensors used in this instrumentation will use magnetic field sensing to determine and wirelessly communicate, in real time, the currents in cell components adjacent to the sensors. Preliminary work at Wireless Industrial Technologies (WIT) has shown that these currents give an early warning of incipient anode effects thereby providing an opportunity for minimizing anode effects.