Agency Recommendation Summary:

Twenty new faculty positions for Clean Jobs and Industries are requested by Washington State University to bolster hot new employment-producing initiatives just as the state is at a critical economic crossroads. These positions in basic and applied science, and engineering, lead to new technologies that reduce the state’s reliance on foreign oil; enable rapid and sustainable adaptation to climate change; maintain or enhance Washington’s competitive advantage in agriculture; minimize greenhouse gas emissions; and, improve soil, air, and water quality.

Fiscal Details:

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<tr>
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<th>2011-12</th>
<th>2012-13</th>
<th>2011-13</th>
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<td>General Fund State</td>
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<td>12,004,000</td>
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<td>Total</td>
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Package Description:

This proposal will boost new developing industries in energy management, renewable energy, biofuels and the environment, while ensuring the ability of Washington State’s rural and urban areas to adapt to the effects of climate change. Much of the funding request is for one-time research startup dollars so the cost of this program in future biennia will actually decline substantially (negative bow wave.) The permanent costs of this initiative are limited to $3 million per year. But the benefits will increase by many magnitudes in future biennia. It will add significant strength to already successful WSU programs in its strategic priority areas of clean technology and plant science.

The additional investment will return millions of dollars to the state annually in research grants, the results of which will ensure the growth and competitiveness of the clean technology and agricultural sectors of Washington’s economy. WSU research in clean technology has boomed to attract more than $16 million in grants and contracts expenditures in FY2010, compared to a respectable $5 million just a couple years ago. WSU’s strength in plant science has attracted increasingly large extramural grant funds with the Agricultural Research Center receiving nearly $50 million in research awards in the most recent year. Clean Energy jobs grew 9.1 percent from 1998-2007, compared to an average growth rate during this period of 3.7 percent. There are 390 companies in Washington involved in clean technology. Washington’s agricultural industry, which is heavily dependent on WSU’s plant science research, employed 160,000 with a total economic impact on Washington of $38 billion in 2009 [WSDA].

Successful funding of this request will lead to ten new senior faculty positions and ten new junior faculty positions and provide $13 million in one-time start-up funds to jump start the state’s economy. The immediate impact of these new faculty positions includes $10 million per year in additional grant expenditures; 90-100 additional graduate students enrolled
Creating Clean Jobs and Industries
Collaborative jobs-producing multidisciplinary economic development research
teaming up scientists from engineering to integrated plant sciences

annually; and 40-80 additional undergraduate students per year gaining research experience and preparation to secure family-wage jobs in cutting-edge technologies.

Background:
WSU’s “Clean Technology” instructional programs are in high-demand and are already attracting record numbers of students to the WSU engineering program. These programs recently led to WSU’s top ten ranking nationally among clean technology research universities. WSU’s ranking as the #2 most productive plant science faculty in the United States and #13 most productive and highly cited plant and animal faculty in the world have made WSU a highly sought destination for graduate and undergraduate education in plant science with over 850 undergraduate and graduate students in the plant science related programs.

The research and instruction conducted in clean technology includes smart power grid, air quality research; environmental engineering research; advanced materials research emphasizing renewable energy; and bio-processing and bio-energy engineering research. These are disciplines that are often separated in a university setting. But at WSU, faculty, undergraduate students, and graduate students from historically different disciplines are intertwined in a common effort to solve the most pressing issues of the state’s environment and its economy.

Building on its great strength in plant science, WSU is developing a high-tech approach to plant improvement called phenomics. This new technology will generate crops with superior ability to cope with changing climate. The technology consists of a high-throughput automated system that uses sophisticated cameras and rapid data reduction to recognize individual plants that do well in dry, hot or nutrient-poor, or other environmentally stressful conditions. The plants identified in the phenomics facility can then be used in WSU’s plant genetics and breeding programs to develop better-adapted plants with even more resistance to the stresses for use in our agricultural systems. Crop varieties based on this technology will allow Washington to remain productive in the face of environmental challenges. The request for additional faculty in clean technology and plant science supports the efforts of existing outstanding research teams that include National Academy members, Regents Professors, and other nationally recognized research leaders.

In clean technology, new faculty positions will be added to teams working on:

- Smart Grid power engineering
- Sustainable Design and Low Impact Development
- Biofuels and Bioproducts
- Advanced Materials

In plant science, new faculty positions will be added to teams working on:

- Phenomics, which is rapid adaptation of plants to the effects of climate change; and,
- Photosynthetic, water, and nitrogen use efficiency
- Environmental biophysics and water management
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Areas of Concentration:

The request for additional faculty supports the efforts of these outstanding research teams:

Smart Power Grid

The WSU Electric Power Engineering program, led by National Academy of Engineering member Dr. Anjan Bose, is internationally-renowned for its work that focuses on the safety and reliability of electrical power transmission or “smart grid.” WSU researchers are working with Avista on a $38 million project funded by the U.S. Department of Energy that would make Pullman the first Smart-Grid community in the region. Our immediate needs are for 2 faculty positions in power, addressing efficiency, control and protection of electric energy, including renewable energy, at all levels of power generation, transmission, distribution, and consumption. The 2 positions are as follows:

- Senior position in power systems and control
- Junior-level position in power electronics – complements the above area and addresses industry/agency constituencies such as Boeing, Fluke, PNNL, DOE.

Sustainable Design and the Environment in the Age of Climate Change

Climate change is happening and we must adapt. Sustainable infrastructure development and the green building movement have been adopted faster than any recent movement in the design, engineering, and construction fields. With over 40% of our total US energy consumption used to operate our commercial and residential buildings, this trend is well founded. WSU’s faculty brings together interdisciplinary teams to collaborate on development of technologies relating to the energy, material, and water use in our built environment and agricultural systems. Improvements are needed for both existing and new infrastructure to better manage storm water runoff, minimize environmental impacts from urban and agricultural systems, improve habitat connectivity, and reduce soil, air and water pollution. Our immediate needs are for 13 faculty to add to our capacity in this important research endeavor:

Low Impact Development:

- Soil chemist to work at WSU-Puyallup in low impact development
- Storm water management and hydrology: watershed protection, water quality, low impact development
- Water resources scientist to focus on development of more efficient uses of water for agricultural, industrial, and domestic systems in the near-urban and rural areas
- Life cycle analysis in agricultural, rural, near-urban, and urban systems
- Geotechnical engineering: recycled materials for structural fill and transportation, carbon capture in geology and materials, interface of foundations and ground-source heat systems
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Green Buildings
- Building physics and environmental controls: heat and mass transfer, thermal properties of materials, building envelopes  
- Air quality: indoor environmental quality, emissions from building materials

Adaptation to climate change in agricultural systems
- Water resource faculty who will work on small watershed hydrology  
- Environmental biophysicist to work on the interface between plant systems and the environment  
- Plant phenomicist to lead our growing efforts in phenomics  
- Plant scientist to enhance our understanding of plant photosynthesis to interface with plant breeding efforts.  
- Plant physiologist to address water and nutrient use efficiency in plants  
- Plant physiologist/microbiologist to address nitrogen fixation as a means to reduce fossil-fuel-based nitrogen in agricultural systems.

Bioenergy and Bioproducts
WSU has existing strength in many, but not all relevant aspects of biofuels, bioproducts, and bioenergy. With faculty in Pullman, Prosser, and Tri-Cities addressing this topic in engineering, plant science, and economics departments, a world-class research strength exists that has only a few important voids in its capacity. This request deals with three of them.
- Bioseparation and Process Development engineer.  
- Silvaculturist, specializing in intensive culture of woody species  
- Life cycle analysis in agricultural, rural, near-urban, and urban systems (same position is documented above in Adaptation to Climate Change)

Advanced Materials for Renewable Energy
The development of advanced materials will be critical for future innovations in renewable energy production and storage. Advanced materials development plays critical roles in increasing solar energy efficiency; developing fuel cells that operate on alternative fuels; producing long-life, light-weight batteries; facilitating hydrogen production and storage for hydrogen as a fuel source; and new catalyst development for biofuels. WSU materials researchers include Dr. Grant Norton, co-founder of a start-up company that has developed nanomaterials for use in catalysis for renewable energy and carbon capture for Greenhouse Gas mitigation. Dr. Norton and his colleagues have also patented a unique nanospring technology that solves the problem of hydrogen storage for automobile applications. Our materials engineers are also working with the Boeing Corporation on the development of strong yet lightweight composite materials that improve fuel efficiency, as well as development of advanced materials for fuel cells that will be important for the More Electric Airplane.
Advanced materials development is also key for the economic well-being of critical industries in the state, such as Boeing and REC-Silicon. Our immediate needs are for 4 faculty targeting critical needs in advanced materials engineering:

- Advanced nanomaterials for energy storage
- Composite materials development and applications in energy efficiency
- Catalytic materials for energy production, fuel cells
- Materials for extreme environments

Calculations:

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<th>FISCAL DETAIL TABLES - CREATING CLEAN JOBS AND INDUSTRIES</th>
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Note: One-time costs of $9,000,000 and $4,000,000 are included in 2011-12 and 2012-13 respectively. Ongoing costs are $3,004,000.