

Rec 1/24/18

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# MTSU Clean Energy Initiative Project Funding Request

There are five (5) sections of the request to complete before submitting. See <http://www.mtsu.edu/sga/cleanenergy.shtml> for funding guidelines. Save completed form and email to [cee@mtsu.edu](mailto:cee@mtsu.edu) or mail to MTSU Box 57.

1. General Information	
Name of Person Submitting Request	
Scott Handy	
Department/Office	Phone # (Office)
Chemistry	615-904-8114
MTSU Box #	Phone # (Cell)
68	
E-mail	Submittal Date
shandy@mtsu.edu	1/24/2018

2. Project Categories (Select One)			
Select the category that best describes the project.			
<input type="checkbox"/>	Energy Conservation/Efficiency	X	Sustainable Design
<input type="checkbox"/>	Alternative Fuels		Other
<input type="checkbox"/>	Renewable Energy		

3. Project Information
<p>a. Please provide a brief descriptive title for the project.</p> <p>b. The project cost estimate is the expected cost of the project to be considered by the committee for approval, which may differ from the total project cost in the case of matching funding opportunities. <b>Any funding request is a 'not-to-exceed' amount. Any proposed expenditure above the requested amount will require a resubmission.</b></p> <p>c. List the source of project cost estimates.</p> <p>d. Provide a brief explanation in response to question regarding previous funding.</p>
3a. Project Title
Environmentally Benign Synthesis Using Electrochemistry: The purchase of an IKA electrosynthesis System
3b. Project Cost Estimate \$ 3100

\$3100 (starter package – 1399; electrode and vial starter kit – 1504, tin electrodes – 197)

3c. Source of Estimate

IKA web site (<https://www.ika.com/laboratory-equipment/products/electrochemistry-kit/products/4265/electrasyn-2.0-package>)

3d. If previous funding from this source was awarded, explain how this request differs?

NA

#### 4. Project Description

(Completed in as much detail as possible.)

- a. The scope of the work to be accomplished is a detailed description of project activities.
- b. The benefit statement describes the advantages of the project as relates to the selected project category.
- c. The location of the project includes the name of the building, department, and/or specific location of where the project will be conducted on campus.
- d. List any departments you anticipate to be involved. Were any departments consulted in preparation of this request? Who? A listing may be attached to this form when submitted.
- e. Provide specific information on anticipated student involvement or benefit.
- f. Provide information for anticipated future operating and/or maintenance requirements occurring as a result of the proposed project.
- g. Provide any additional comments or information that may be pertinent to approval of the project funding request.

4a. Scope: Work to be accomplished

Electrochemistry is a very powerful method in Chemistry. It enables chemistry to be "reagent-free" (as only electrons from electricity are consumed) and avoid the production of large amounts of frequently toxic waste. It is also highly controllable for very specific and clean reactions. Unfortunately, using electrochemistry has been very difficult as it has required a number of different, very specialized, delicate, and expensive pieces of equipment. Just this year, IKA has developed and released an instrument that combines everything in one easy-to-use and fairly inexpensive piece of equipment. Thus, the request in this proposal is for the IKA instrument which will then enable a range of chemistry to be explored both in the Handy research group, in the Advanced Synthesis course in Chemistry (CHEM 4430/4431), in summer research groups (likely some of

which will involve high school students), and perhaps eventually on into the standard sophomore Organic lab courses at MTSU.

The main initial research goals are to expand some work that I initiated a number of years ago on electrochemical cyclization reactions that form products of potential medicinal interest in a very quick and efficient manner (roughly 4 steps). There is the option in this work to actually complete two of the four steps using electrochemistry and to use this to contrast the amount of waste generated between conventional and electrochemical reactions. Many future reactions could be studied as well as this instrument will have a long life and will get much use.

#### 4b. Scope: Benefit Statement

Despite its power and potential for achieving waste-free chemical synthesis, electrochemistry remains mostly ignored technique. Much of this is due to the requirement of having multiple expensive and delicate instruments to conduct such work. The new IKA system overcomes these obstacles and makes electrochemistry available at modest expense and with a very user-friendly interface (much like most of us are used to with touch screens and set-up wizards). Thus, with this instrument, MTSU students can be introduced to a next generation, environmentally friendly synthetic technique and become more directly familiar with the realities of attempting to make synthesis more environmentally compatible.

<b>4. Project Description (continued)</b>
<p>4c. Location of Project (Building, etc.)</p> <p>Chemistry – the Science Building room 3021</p>
<p>4d. Participants and Roles</p> <p>In Chemistry, the main initial user will be myself (Scott Handy) and my students (undergraduates – Asfah Mohammed, Matthew Spock, Garrett Flowers; graduates – Zachary Taylor, Arjun Kafle, Jose Schmidt, Shrijana Bhattarai). This will then expand to those in the Advanced Synthesis class (CHEM 4430/4431) in Chemistry and likely a summer research team project (either URECA or a project SEED team).</p>
<p>4e. Student participation and/or student benefit</p> <p>As mentioned before, there will be heavy student involvement in the use of this instrument at both the graduate and undergraduate level. These students will be exposed to a very powerful, but rarely encountered method of synthesis and be able to explore and directly compare its benefits in terms of waste avoidance and improved yields and selectivity.</p>
<p>4f. Future Operating and/or Maintenance Requirements</p> <p>None beyond the purchase of new compounds for reactions, which will all be covered by departmental, center, or grant funding.</p>
<p>4g. Additional Comments or Information Pertinent to the Proposed Project</p> <p>Two interesting options for future expansion would be an exploration of recyclable solvents (the one area that electrochemistry does not solve, but in which I have expertise) and the combination of this system with a solar array to provide a completely "off-the-grid" system for electrochemistry (which could also make this more amenable for environmentally friendly synthesis demonstrations). These are just thoughts at this point, but could become reality in the near future.</p>

<b>5. Project Performance Information</b>
<p>Provide information if applicable.</p> <ol style="list-style-type: none"> <li>Provide information on estimated annual energy savings stated in units such as kW, kWh, Btu, gallons, etc.</li> <li>Provide information on estimated annual energy cost savings in monetary terms.</li> <li>Provide information on any annual operating or other cost savings in monetary terms. Be specific.</li> <li>Provide information about any matching or supplementary funding opportunities that are available. Identify all sources and explain.</li> </ol>
<p>5a. Estimated Annual Energy Savings (Estimated in kW, kWh, Btu, etc.)</p> <p>NA</p>
<p>5b. Annual Energy COST Savings (\$)</p> <p>NA</p>
<p>5c. Annual Operating or Other Cost Savings. Specify. (\$)</p> <p>Some very modest savings in terms of waste generation that must be disposed of by the institution. Since this is just one system in one lab, the monetary amount will be small.</p>
<p>5d. Matching or Supplementary Funding (Identify and Explain)</p> <p>Chemicals for reactions will be purchased from departmental, Molecular Biosciences, Tennessee Center for Botanical Medicinal Research, and research grant funds. This grant is for the instrument only.</p>

**Linda Hardymon**

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**From:** Scott Handy  
**Sent:** Wednesday, January 24, 2018 2:23 PM  
**To:** Center for Energy Efficiency  
**Subject:** clean energy funding request  
**Attachments:** CleanEnergyProjectFundingRequest2011ScottHandy.docx

Attached to this message is my completed clean energy funding request, which would fall into the "research" category. If you require anything further, please let me know. Thank you.

Scott

Scott Handy  
Professor of Chemistry  
Middle Tennessee State University  
615-904-8114