

Environment and Natural Resources Trust Fund 2009 Phase 1 Request for Proposals (RFP)

LCCMR ID: C21

Project Title: Future of Energy and Minnesota's Water Resources II

Total Project Budget: \$ \$124,075

Proposed Project Time Period for the Funding Requested: July 2009 - June 2011 (2 yrs)

Other Non-State Funds: \$

First Name: Sangwon

Last Name: Suh

Sponsoring Organization: U of M

Address: 224A Bioproducts and Biosystems Engineering, 1390 Eckles Avenue
Saint Paul MN 55108

Telephone Number: 612-624-5307

Email: sangwon@umn.edu

Fax:

Web Address: www.iel.umn.edu

Region:

County Name:

City / Township:

Statewide

Statewide

Summary: We will conduct an in-depth analysis of climate change impacts on water resources in Minnesota, and analyse the water implications of strategies recommended in the Statewide Conservation and Preservation Plan.

Main Proposal: 0808-1-031-proposal-2009_proposal_water_energy_0818.doc

Project Budget: 0808-1-031-budget-RFP_2009_Budget_suh.xls

Qualifications: 0808-1-031-qualifications-s_suh_bio_sketch.doc

Map: 0808-1-031-maps-mn_water_power_sources.pdf

MAIN PROPOSAL

PROJECT TITLE: The Future of Energy and Minnesota's Water Resources II

I. PROJECT STATEMENT

Since the submission of the original proposal (ML 2008, Chap. 367, Sec. 2, Subd. 4(a)), new information has indicated climate change may have a serious impact on water resources in Minnesota. Additional funding will allow project PIs to expand the original project focus **to include a more in-depth analysis of climate change impacts on water demand and quantity in Minnesota**, as recommended in the peer review for the original project proposal. The PIs will also **link the project more explicitly with findings from the Statewide Conservation and Preservation Plan (SCPP)**. Project partners Sangwon Suh and Laura Schmitt Olabisi have contributed time and analysis to the SCPP Cost Benefit Analysis section. Schmitt Olabisi also served as data analyst and writer for the Energy section of the plan, and project advisor Anne Kapuscinski was the team co-lead for the Habitat section of the SCPP. The project partners are therefore in a good position to integrate insights from the SCPP with this work, by analyzing the water implications of the alternative energy technologies recommended in the SCPP. The additional analyses and coordination necessary to complete the climate change analysis and to integrate the results with the SCPP will require more time and funding compared with the original proposal (see detailed list of deliverables below).

II. DESCRIPTION OF PROJECT RESULTS

The following represent results that will be generated with the additional funding. The original project deliverables include maps of water demand and supply under different potential energy scenarios in Minnesota, and development of an online tool to disseminate the results. These will be completed on the original timescale. The energy scenarios will be expanded with additional funding to include all of the alternative technologies mentioned in the SCPP, including electricity for transportation, geothermal power, and cellulosic biofuels.

Result 1: Analysis of climate change impacts on water quantity in Minnesota **Budget: \$100,000**

Deliverable	Completion Date
1. Map of altered precipitation and evapotranspiration regimes under different climate scenarios	October, 2010
2. Maps depicting altered water supply and demand under different climate regimes	March, 2011
3. Identification of potentially water-stressed areas, analysis of policy/economic implications, suggestions for further monitoring	June, 2011
4. Development of interactive online tool depicting water supply and demand under climate scenarios	June, 2011

Result 2: Analysis of water implications of energy strategies recommended in the SCPP **Budget: \$24,075**

Deliverable	Completion Date
1. Quantification of water requirements of energy strategies in SCPP	July, 2009
2. Spatial analysis of water requirements of SCPP energy strategies (series of maps)	December, 2009
	Total: \$124,075

III. PROJECT STRATEGY AND TIMELINE

A. Project Partners

Project partners Sangwon Suh and Yiwen Chiu will continue to work on the project, and will be joined by Dr. Laura Schmitt Olabisi at Michigan State University (MSU). P.I. Suh will receive \$84,075 of the budget to fund his time, graduate R.A. and postdoctoral time for the climate change research. Schmitt Olabisi will receive \$26,000 to support her time and continued involvement with the project as an MSU faculty member, as she helped to conceptualize and conduct the initial analysis for this project. \$10,000 will go towards the development of the online tool (at U. Minnesota) to disseminate the results of the climate change analysis, and \$4000 will be used for travel and coordination within Minnesota and between the MSU and U of M campuses. Drs. Anne Kapuscinski and Peter Reich will continue to advise the project. In addition, we will leverage the expertise of a large pool of U of M researchers and other state experts on alternative energy technologies, through a USDA/DOE funded project on pathways for biofuel production. This will allow us to address the concern of the original project peer review panel; namely, that we include some alternative energy experts in the project design.

B. Project Impact

Other ongoing studies funded through the LCCMR are examining the impact of climate change on natural systems in Minnesota (e.g. "Minnesota's Water Resources: Impacts of Climate Change- Phase II"; P.I. L. Johnson). Our contribution is unique in analyzing how climate change could affect human water use. This will help planners from state to local scales make decisions about management, zoning and land use over the long term. As the LCCMR and other decisionmakers weigh the costs, benefits, and natural resource impacts of the recommendations in the SCPP, our analysis of the water implications of these recommended strategies will provide additional information to inform decisions. For example, some alternative energy strategies (such as solar and wind) do not require water withdrawals to function, and may be appropriate in water-poor regions of the state. Other strategies, such as geothermal power, may be appropriate for water-rich regions.

C. Time

One year beyond the original time frame to complete.

D. Long-Term Strategy (N/A)

Project Budget

IV. TOTAL PROJECT REQUEST BUDGET

<u>BUDGET ITEM</u>	<u>AMOUNT</u>	<u>% FTE</u>
Personnel		
Sangwon Suh, Assistant Professor, U. Minnesota: Overall project design and coordination (2 years)	\$ 14,275	8%
Postdoctoral researcher, U. Minnesota: Background research, project development; analysis of energy technologies and water demands (1 year)	\$ 32,600	50%
Graduate research assistant, U. Minnesota: Spatial analysis of climate change parameters and water resources (1 year)	\$ 37,200	100%
Contracts		
Laura Schmitt Olabisi, Michigan State University: 2 months summer salary/fringe for two years for integrating climate change and water analysis	\$ 26,000	
Web developer (U. Minnesota): For development of an online tool depicting projections of climate change in Minnesota and effects on water resources	\$ 10,000	
Other		
Travel within Minnesota and out-of-state for consultation with water, energy and climate change experts	\$ 4,000	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	\$ 124,075	

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Remaining \$ From Previous Trust Fund Appropriation (if applicable): For directly related project: The Future of Energy and Minnesota's Water Resources [ML 2008, Chap. 367, Sec. 2, Subd. 4(a)]	\$ 268,000	<i>Unspent</i>
Other Non-State \$ Being Leveraged During Project Period: Faculty PI's will spend additional time on this project not paid for through LCCMR funds.	Unquantified	<i>Secured</i>
Other State \$ Being Spent During Project Period	\$ -	
In-kind Services During Project Period	\$ -	
Past Spending [ML 2008, Chap. 367, Sec. 2, Subd. 4(a)]	\$ 2,000	

Biographical sketch - SANGWON SUH

102 Kaufert Lab., 2004 Folwell Ave., Saint Paul, MN 55108
Tel. 612-624-5307 Fax. 612-625-6286 e-mail: sangwon@umn.edu

(a) Education and Training

Ajou University (S. Korea) Environmental and Engineering B.S. 1998
Ajou University (S. Korea) Environmental and Urban Systems Eng. M.S. 2000
Leiden University (Netherlands) Environmental Science and Engineering Ph.D. 2004
Carnegie Mellon University, Industrial Ecology Postdoctoral Research Associate 2005

(b) Professional Experience

08/05 – present Assistant Professor, Dept. Bioproducts and Biosystems Engineering, College of Food, Agriculture and Natural Resources Science, University of Minnesota.
08/04 – present Associate Fellow, Institute of Environmental Sciences (CML), Leiden University, the Netherlands (Dept. Industrial Ecology)
08/04 – 07/05 Postdoctoral Research Associate, Civil and Environmental Engineering, Carnegie Mellon University (supported by BE: MUSES program)
01/02 – 06/04 Research Scientist, Dept. Industrial Ecology, Institute of Environmental Sciences (CML), Leiden University, the Netherlands

(c) Publications (For the last five years, > 30 journal articles and 2 books)

5 most closely related to the proposed project

Hawkins, T., C. Hendrickson, C. Higgins, H. S. Matthews, S. Suh, **2007**: A Mixed-Unit Input-Output Model for Environmental Life-Cycle Assessment and Material Flow Analysis, *Environmental Science and Technology*, 41 (3), 1024-1031.

Suh, S., **2006**: Are Services Better for Climate Change? *Environmental Science and Technology*, 40 (21), 6555 – 6560.

Suh, S., Huppel, H., **2005**: Methods in Life Cycle Inventory (LCI) of a product, *Journal of Cleaner Production*, 13 (7), 687 – 697.

Suh, S., M. Lenzen, G. Treloar, H. Hondo, A. Horvath, G. Huppel, O. Jolliet, U. Klann, W. Krewitt, Y. Moriguchi, J. Munksgaard, G. Norris, **2004**: System Boundary Selection for Life Cycle Inventories, *Environmental Science & Technology*. 38 (3), 657 – 664.

Suh, S., **2004**: Functions, commodities and environmental impacts in an ecological economic model, *Ecological Economics*, 48 (4), 451 – 467.

5 other significant publications

Huppel, G., A. de Koning, S. Suh, R. Heijungs, L. van Oers, P. Nielsen, J.B. Guinée, **2006**: Environmental impacts of consumption in the European Union using detailed input-output analysis, *Journal of Industrial Ecology*, 10 (3), 129 – 146.

Suh, S., **2005**: Developing Sectoral Environmental Database for Input-Output Analysis: Comprehensive Environmental Data Archive of the U.S., *Economic Systems Research*, 17 (4), 449 – 469

Suh, S., **2005**: Theory of Materials and Energy Flow Analysis in Ecology and Economics, *Ecological Modeling*, 189 251 – 269.

Guinée, J.B., M. Gorrée, R. Heijungs, G. Huppel, R. Kleijn, A. de Koning, L. van Oers, A. Wegener Sleeswijk, S. Suh, H.A. Udo de Haes, H. de Bruijn, R. van Duin, M.A.J. Huijbregts, **2002**:

15

Handbook on Life Cycle Assessment. Operational Guide to the ISO Standards. Kluwer Academic Publisher, Dordrecht, The Netherlands.

Heijungs, R., Suh, S., **2002**: *The Computational Structure of Life Cycle Assessment*, Springer, Dordrecht, the Netherlands.

(d) Synergistic Activities

Associate Editor, International Journal of Life Cycle Assessment (LCA)

Since 2003, Sangwon Suh is serving as an associate editor of the *International Journal of Life Cycle Assessment*, the only journal wholly dedicated to the advancement of science and practice of LCA.

United Nations' Environmental Program / Life Cycle Initiative activities

UNEP's life cycle initiative is currently the largest international organization on LCA since TC207 of ISO. The initiative aims at harmonizing LCA methods and data, building capacity for developing world and disseminating life-cycle thinking. Sangwon Suh is among a dozen appointed members of TF3 and TF5, which are responsible for LCI methodological consistency and LCA capacity building, respectively.

Developing public LCA databases

Sangwon Suh has developed CEDA/MIET databases ver. 1.0, 2.0 and 3.0 from 2000 to 2005. CEDA/MIET is a Life Cycle Inventory (LCI) database for the U.S. that utilizes a comprehensive list of environmental statistics and the U.S. input-output table. It contains information on 1344 environmental interventions generated by 500 industry sectors and around 100 different Life Cycle Impact Assessment (LCIA) methods. The latest version of the database has been adopted by a number of commercial/noncommercial LCA software packages including SimaPRO 6 and CMLCA and is being used by thousands of LCA practitioners world-wide.

Services in professional organizations and committees

Sangwon Suh is active in various professional organizations and committees. Listed here are a selection of them that are relevant for the current proposal: Advisory Committee Member of the Eco-Industrial Development Council (EIDC) (2006 – present); an LCA Steering Committee Member of SETAC-Europe (2003 – 2006); an LCA Advisory Group Member of SETAC-North America (2005 – present); Award Committee Member of the International Society for Industrial Ecology (2007 – present); Technical Committee Member of the International Input-Output Association, Istanbul Conference (2007); Chair of the Input-Output Working Group, SETAC-Europe (2003 – 2006).

Invited speaker

Sangwon Suh has been invited by universities and conference organizers as a keynote or a seminar speaker nationally and internationally. Selected invited speaks: International Eco-Industrial Development Conference in Seoul, South Korea (2006); International Material Flow Analysis Workshop in Tokyo, Japan (2005); Yale University (2005); Carnegie Mellon University (2004); NATO Advanced Science workshop, Hungary (2004); Waseda University, Japan (2003); Institute of Advanced Technology (IST), Portugal (2003); Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland (2002); Norwegian Technical University in Trondheim (2003); University of Tokyo, Japan (2002).

