

April 27, 2018

Vermont Phosphorous Innovation Challenge

Synopsis – Vermont’s Phosphorus Innovation Challenge is designed to support solutions for reducing phosphorus loading to Vermont’s landscape and waterways by harnessing opportunities that innovative technologies and developing markets may offer. Vermont is looking for entrepreneurs that can demonstrate reliable phosphorus management solutions at scale. Successful processes and products will reduce phosphorus pollution, as well as create business and economic development opportunities. The State of Vermont is interested in actively supporting the successful entrepreneurs; possibilities include providing customized support, incentive funding and future market opportunities. It should be noted that this brief overview is not intended to be a comprehensive assessment of Vermont’s phosphorus challenge.

History – Farmers discovered the value of phosphorus as a nutrient essential for plant growth in the early 20th century and developed chemical fertilizer formulations that allowed for the inexpensive and convenient addition of phosphorus to improve crop yields. The significant agricultural benefits of phosphorus led to a surge in the import of phosphorus fertilizer starting in 1925, which peaked in the 1950s. The legacy of imported fertilizers has been an accumulation of phosphorus in Vermont’s soils.

Vermont’s waterways are very sensitive to even small amounts of phosphorus in runoff, which can fuel undesirable plant and algae growth. Excess soil phosphorus, combined with wet weather runoff and soil loss - exacerbated by intensifying weather patterns - has been one of the pathways for increased migration of phosphorus from the landscape to our rivers and lakes, in addition to contributions from development, infrastructure, forestland and other natural systems.

Since the first Vermont agricultural water quality rules were written in the late 1980s, farmers have taken significant steps to reduce soil loss and improve the precision of nutrient application in order to help address phosphorus pollution. One of the most significant and widely-adopted techniques is nutrient management planning which seeks to direct the application of livestock manure consistent with the nutrient needs of the crop being grown. The nutrient management planning process has been one of the successful strategies for reducing the annual statewide agricultural phosphorus surplus. And while today’s farmers operate under effective nutrient management plans, there is still the accumulated legacy of historic fertilizer imports found in many agricultural soils that can contribute to pollution in local waterways, which needs to be addressed.

Vermont’s Water Quality Impacts – Vermont is committed to improving water quality in its lakes and rivers because of the important values those waters have for the State. Excess phosphorus causes nuisance plant growth and algal blooms that can make the water unattractive for recreational use and potentially unsafe. Under Act 64, Vermont’s Clean Water Act, the State will spend more than \$1 billion over the next 20 years to reduce phosphorus pollution. This includes essential, foundational investments in conservation measures and best management practices to reduce phosphorus losses from farms; wastewater treatment; improved management of stormwater runoff from developed communities and roads. In parallel with these efforts, we must address Vermont’s phosphorus imbalance and stop accumulating additional phosphorus in Vermont’s soils. Ultimately, achieving a balance between phosphorus imports and exports is essential to ensuring sufficient treatment practices to achieve our long-term water quality goals.



The phosphorus market - In addition to the water quality impacts associated with excess phosphorus losses from the land to our waterways, the continual use of phosphorus without recovery will ultimately deplete a finite resource essential to food production and human health. Reclaiming phosphorus captures value that might otherwise be lost.

Other aspects of the market – It is anticipated that successful market-driven or -supported solutions for phosphorus recovery and reuse may tap other revenue streams associated with phosphorus recovery. Examples include the recycling of large fibers in dairy manure as animal bedding and compost and topsoil products sold for residential and/or bulk use that incorporate recovered solids. In addition, many phosphorus recovery strategies readily couple with opportunities to capture the energy content of the waste via anaerobic digestion for use directly as renewable natural gas, or in energy generation.

New approaches – Tapping innovative market solutions can be a more cost-efficient approach to solving problems that we have traditionally attempted to solve through regulation or blunt force technologies. With our expanding knowledge about composting, digestion of organic solids, energy capture, and soil chemistry, we may be closer to finding a new, cost-effective solution (or solutions) that reduces phosphorus losses from Vermont’s landscape and potentially provides business and economic development opportunities.

Ongoing Commitment to Conservation – We are not seeking to supplant our existing phosphorus mitigation strategies and our commitment to the implementation of best management practices and conservation measures. We are looking for parallel solutions that assist in solving the problem outlined below.

The Phosphorus Innovation Challenge, in a nutshell – Identify one or more technologies that:

- Capture, and ideally reuse, phosphorus, reducing the risk of pollution to our waterways;
- Convert the collected manure or other organic wastes to energy, recycled fertilizers, or other products; and,
- Determine the amount, if any, of state support required for these technologies to be viable.

Details on the Vermont Phosphorus Innovation Challenge are outlined on the following pages. We look forward to working with all who are interested in applying.

Sincerely,



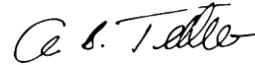
Phil Scott
Governor
State of Vermont



Julie Moore
Secretary
Vermont Agency of Natural Resources



Michael Schirling
Secretary
Vermont Agency of Commerce and
Community Development



Anson Tebbetts
Secretary
Vermont Agency of Agriculture,
Food and Markets



THE REVERSE PITCH

Stages, Timeline, and Criteria

Stage One - Preliminary Round

A. On April 27, 2018, invitation issued for proposals to develop “proof of concept” for a process / technology that removes phosphorus from manure or other waste streams and makes the recovered phosphorus available for beneficial reuse. Eligible proposals are anticipated to include: biological processes (composting, aerobic digestion, anaerobic digestion, etc.); thermal processes (gasification, pyrolysis, etc.); and, chemical processes (struvite recovery, phosphorus removal, etc.). Proposals for technology that addresses phosphorus in Vermont waterways (e.g. once it has reached Lake Champlain or tributaries) may be considered.

B. By May 11, 2018 prospective applicants are encouraged to email their intent to participate in the challenge to terry.smith@vermont.gov. This deadline will not be used to exclude teams but, rather, to assess space and resource requirements for subsequent portions of the process.

C. On May 21, 2018 a meeting with interested parties to field questions and discuss the initiative will occur. The meeting will take from 1-3pm at the ANR Annex (190 Junction Rd, Berlin, VT). Questions may also be submitted via email to terry.smith@vermont.gov. The closing date for questions about Stage One will be May 25, 2018. Answers to questions received during the May 21 meeting and those received via email will be posted to the Phosphorus Innovation Challenge website by June 1, 2018.

D. Stage One responses should be no more than 5 double-sided (i.e., 10 single-sided) pages, and should include the following elements:

- Contact information for Principal Investigator;
- Project overview or abstract (100 word count);
- Description of project objectives;
- Narrative describing the proposed process or technology;
- Description of the team and its qualifications (resumes may be attached, will not count toward the page limit);
- Budget for how award money will be used to fulfill project objective(s).

E. Stage One responses must be received, via email, by 5pm on July 6, 2018.

F. Some or all of the teams submitting responses to Stage One will be selected to make an in-person presentation to the Evaluation Team in August 2018. The Evaluation Team will be comprised of subject matter experts, scientists, entrepreneurs, and State officials, and will judge the responses based on criteria including:

Primary Criteria

- Projected ability to recover phosphorus;
- Cost effectiveness (estimated cost per pound of phosphorus recovered or reused).
- Strength of the project team. Teams are encouraged to demonstrate a variety of expertise including but not limited to the science of the approach; entrepreneurial talent; and, business acumen.

Secondary Criteria



- Project feasibility and readiness, including whether a demonstration of similar technology has been successfully deployed elsewhere.
- Constructability, adaptability, and deliverability.
- Operability, including maintenance requirements.
- Sustainability, including opportunities for reuse of recovered phosphorus or other materials.
- Other possible sources of investment or financing.
- Co-benefits (e.g., addresses other pollutants, waste streams or societal needs).

G. Additional Information

- Teams can originate anywhere, but Stage Two funding will only be made available to prototyping projects that are feasible to construct and operate in Vermont; applications with pre-identified Vermont partner(s) will be more competitive.
- Up to five (5) project teams will be selected to receive awards and proceed to develop proof of concept, including a business case, and a working prototype(s). Up to \$250,000 in total funding is available for award. At the conclusion of Stage One selected project teams will generally be given 120-days to develop and prototype of their solution. In the event that a proposal requires more than 120-days of development that should be noted in the Stage One response.
- In the event a team enters Stage One with a prototype already developed, they remain eligible to compete for an award amount necessary to allow them to demonstrate their solution at Stage Two – including such things as development of a business case.
- We reserve the right to reject any and all solutions proposed at any stage of this initiative and at the sole discretion of the State of Vermont.

H. Protecting Confidentiality of Proprietary Information

Our primary goal for this project is transparency. However, we recognize that innovators and entrepreneurs responding to this challenge may be submitting details about proprietary intellectual property.

Responses will become a public record under State law. Please segregating such segregate all proprietary and confidential information on a separate page and marking is mark as appropriate - e.g. “Proprietary,” “Confidential,” or “Trade Secret.” Please do not mark the entire response confidential. The State will maintain the confidentiality of all proprietary and confidential information which a responder can plausibly justify as exempt under Vermont State law. The State may agree to enter into a non-disclosure agreement in a form acceptable to the State.

Overview of Stages Two and Three (subject to modification)

Stage Two - Semi-final Round

Stage Two work will include prototyping, business case development, and a demonstration. Prototypes and other pertinent details will be demonstrated to the Evaluation Team in late 2018.

Criteria for judging solutions at Stage Two will largely mirror those used in Stage One, but with an appropriate increase in the level of detail expected in a successful response. They are anticipated to include:

- Demonstration of the process / technology ability to recover phosphorus from waste for beneficial reuse.
- Value proposition, including estimated cost per pound of phosphorus mitigated.
- Efficacy of the business model or sustainability model, including (any) investment. required by the state to have the project remain viable.



- Demonstrated understanding of permitting/regulatory requirements.
- Ability to scale the solution(s).

At the conclusion of Stage Two one or more project teams may be selected to receive awards to support the scaling and implementation of their processes / technologies. Consideration will be given to solutions and business plans that:

- Leverage funding from other sources;
- Are able to be constructed before the end of calendar year 2019;
- Have identified market opportunities for product produced, if applicable.

Stage Three - Final Round

One or more processes / technologies may be chosen for investment in construction and operation of the solution in Vermont. Funding at this stage may consist of state, philanthropic or private investment. Funding awards will be scaled based on the estimated cost per pound of phosphorus mitigated. Other elements that will be considered in determining the level of investment in process or technology are anticipated to include:

- Intellectual Property rights;
- Rights to profit from commercialization;
- Ability to raise capital and investment from entities besides the State of Vermont.

