POPA Study
Proposal Template

(1) POPA Study Title:
Liquid Helium: Examination of Benefits of Capital Investment in Recycling

(2) POPA Proposer Name & Contact Information:
TBD

(3) POPA Topical Area (select one):
_X_ Energy & Environment;
__ Ethics;
__ National Security;
__ Physics & the Public;
__ To be determined

(4) Objective:

In the United States, the majority of academic researchers using liquid helium do not recycle and instead the helium vents and is unrecoverable. This would remain a sustainable approach if liquid helium were abundant, inexpensive, and reliably delivered to researchers. Unfortunately, this is not the case.

This study would evaluate the viability of transitioning researchers from venting-systems to closed-systems that recycle helium. This approach is being studied and implemented in other countries – the American Physical Society (APS) can begin the assessment in the United States. While this approach may not work for all researchers, by engaging with researchers, universities, funding agencies and industry, the study can determine who it may be applicable to.

Actionable recommendations may include a proposal to federal agencies, such as the National Science Foundation (NSF), the Department of Energy (DOE) and the Office of Science and Technology Policy (OSTP).

(5) Motivation and Background:

Academic researchers across the physical sciences and engineering disciplines depend on liquid helium to perform experiments and maintain critical instruments. However, helium is a limited, non-renewable resource with large uncertainties in both supply and price. Today, reliable and affordable liquid helium procurement remains a principal challenge for the academic researchers.

APS has a long-standing interest in this issue. On November 19, 1995 the Council adopted statement 95.3, Conservation of Helium, which states helium's importance to our scientific enterprise:

> "The American Physical Society is profoundly concerned about the potential loss of the nation's accumulated helium reserves… In view of the importance of this unique and irreplaceable natural resource to modern science and technology, The American Physical Society urges that measures be adopted that will both conserve and enhance the nation's helium reserves. Failure to do so would not only be wasteful, but would be economically and technologically shortsighted."

This position was re-iterated in 2011 APS-MRS joint report titled "Energy Critical Elements: Securing Materials for Emerging Technologies" stating:

> "In 1995, Congress decided to sell the U.S. helium reserve. The Committee recommends that this decision be reversed and that the United States and other nations develop a long-term strategy for establishing and maintaining a significant helium reserve."

After issuing that report, APS, POPA and the Office of Public Affairs (OPA) took numerous steps to address the near-term issues associated with helium availability including playing a leading role in the drafting and the passage of the Helium Stewardship Act of 2013, which ensures the Federal Helium Reserve remains operation-al until 2022. In the bill, POPA and OPA developed a specific provision that sup-ports research and development of membrane and separation technologies that could secure more helium at the wellhead.

APS and OPA are taking an additional step to address near term issues associated with helium pricing and reliability. Currently, OPA is establishing a partnership with the Defense Logistics Agency (DLA) to create a pilot program that would allow DLA to procure liquid helium on behalf of academic users. By combining its customers' needs, DLA substantially increases its purchasing power and can potentially negotiate better contracts and price for academic users. Additionally, DLA may represent a more reliable helium procurement route – DLA has established relationships with multiple liquid helium suppliers and their customers are not tied to a single vendor. Further, as a federal agency DLA has better ability to enforce breach of contract penalties.

APS, POPA, and OPA have taken these numerous steps as a way to address near term issues. This proposed study would now begin to address the long term issue.

(6) Opportunity:

This is an urgent issue for many of APS' academic researchers. Some researchers have identified the supply of helium as an existential issue – as the price has gone up, they have either abandoned experiments or eliminated postdocs and graduate students.

For the sake of these researchers, it is essential that POPA remains engaged on this issue, as it has been for the past several years.

(7) Approach / Plans:

The Energy Critical Elements report mentioned in Section (5) required knowledge of issues outside pure physics and so it was carried out in cooperation with other organizations and the committee had several non-physicists who were experts in disciplines necessary to having a meaningful study. The committee for this proposed study would have a similar composition.

(8) Participants:

Invited participants include:

Simon Bare (UOP/Honeywell, Physics)*
Michael Lilly (Sandia National Laboratories, Materials Science)*
Janie Chermak (University of New Mexico, Minerals Economics)
Carolyn Duran (Intel, Global Supply Management)
Rod Eggert (Colorado School of Mines, Minerals Economics)
William Halperin (Northwestern, Physics)
Scott Hannahs (National High Magnetic Field Laboratory, Assoc. Lab Director)
Sophia Hayes (Washington University, Chemistry)
Michael Hendrich (Carnegie Mellon University, Chemistry)
Alan Hurd (Los Alamos National Laboratory, Executive Advisor)
Michael Osofsky (Naval Research Laboratory, Physics)

* indicates co-chair of study

(9) Deliverables:
The report would be limited to roughly 25 pages, completed in approximately one year, build on existing APS Policy Statements, and provide actionable policy recommendations.

(10) Duration and Funding:

The anticipated timeline to complete the study and draft report is one year. The Energy and Environment subcommittee will identify and recruit participants and hold an initial planning workshop. Report drafting is anticipated to take several months and a draft report will be submitted to POPA for their approval.

The anticipated cost is approximately $25K and will be funded by POPA. APS has partnered with the Materials Research Society and the American Chemical Society, with each contributing $5K to the study.