

Idea Submission Form

Briefly respond to the questions below as they apply to your idea, as some questions may not be applicable to your type of project. In addition to the information requested below, a preliminary budget and timeline should be submitted. You may provide other supplemental information with your submission; however, it is not required.

Applicant Information	
Project Title: PropaneSaver Recovery Systems Prototypes Development, Distribution, & Education: Development of Several Models of Patented PropaneSaver Recovery Systems to Auxiliary Tank(s) during Fueling Transfer for both Stationary & Mobile Retailers; some for both vapor & liquid recovery. Recruiting Propane Industry Hands-On Feedback from Short-Run Manufacturing ~4,000 Innovative Prototypes to Nearly End Emissions at Fill. Nationwide Education on How Simple PropaneSaver "Plumbing" Devices Vastly Reduce Air and Ozone Pollution during Fills, co-opting regulatory issues.	
Applicant Name: Michael Siegler	Title: Inventor, Patents Owner, Manufacturer
Organization: PropaneSaver Recovery Systems dba. I plan to receive the PERC grant via Profits for Non-Profits , a 501(c)3 a subsidiary of the Harry Singer Educational Foundation ; & form a corporation soon for manufacturing licensing agreements.	
Email: PropaneSaver@gmail.com	(831) 359-8640 Telephone 2024 Eureka Canyon Road, Corralitos CA 95076
Estimated Amount Requested: \$500,000 with \$200,000 allocated first year	Estimated Total Project Cost: \$500,000 over 3 years
Co- or Other Funding: TBA: propane retailers/wholesalers; tank/hose/nozzle mfrs venture capital; academia; eco-donations	Co-funding Organization/Source: TBA: PERC and NPGA members, patent licensing agreements to manufacture industry standards' prototypes
Estimated Start Date: November 2015	Estimated End Date: November 2018+

NUMBERED ADDENDA, ACRONYMN, GLOSSARY FOLLOW THIS GRANT R&D REQUEST / AVAILABLE UPON REQUEST: SMALL MARKETING INITIAL INVESTMENT, GENEROUS ROYALTY PERFORMANCE ON USA PATENT LICENSE WITH GLOBAL OPPORTUNITIES



1. Idea Information
Project Description <ul style="list-style-type: none"> Briefly describe the proposed project. Identify the need for this project, your proposed solution, and the primary benefit this project will provide to the end user

1. IDEA INFORMATION

1A. Briefly describe the proposed project:

I, Michael Siegler, propose to the *Propane Education and Research Council* the development of a quantity ~2,000 in two series of several patented PropaneSaver Recovery System prototypes, innovated with hands-on research from recruiting retailers to ideal usage in stationary fills of cylinders & tanks, mobile truck delivery fills, and vehicle fills. This grant includes PERC education of the industry and public that PropaneSaver Recovery Systems devices used during fills, will save money in retailers' & customers' pockets, while also vastly reducing costs associated with external pollution. As the inventor of patented methods with 2 claims for apparatus and 8 method claims for recovery of fugitive propane gases in the fill nozzle prior to disconnection from a customer's filled tank (>15% of escaped propane); venting propane into air (<85% of escaped gas) via a Fixed Maximum Liquid Level Gauge (FMLLG) visual safety outage valve on hundreds of millions of metal tanks; & liquid recovery on bobtails; I require a grant from PERC to make these new solutions a practical reality in phases:

- development of several PropaneSaver Recovery Systems prototypes, field-testing, & feedback
- R&D of PropaneSaver patented routes including: a FMLLG recovery system preserving the visual indication that the portable cylinder is at 80% capacity, along with disconnect vapor/liquid recovery, and bobtail requirements for an in-line sealed pump for liquid recovery
- PERC standards for putting PropaneSaver compatible nozzles with bleeder ports in service
- recruiting, contracting, licensing device manufacturing, distribution, & retailer training
- retailer evaluation & innovation to propane industry with insurance riders and new standards
- promotion of PropaneSaver wisdom, versus regulators' looming limitations on propane fills
- education of customers, retailers, clean air associations, and politicians.

The R&D of simple PropaneSaver prototypes routed to recovery tank(s) for stationary fillers, mobile delivery trucks, and vehicles are very low cost, as compared to costly systems trying to stuff excess pressurized propane back into the same supply tank it came from, previously requiring all kinds of electronic anti-explosion safety systems. Lackluster adoption of industry standards depending on such klutzy expensive systems, is reasonable. In contrast, **PropaneSaver devices are simple plumbing requiring only training on reading gauges, opening & closing valves, and can be easily installed onto most current fill nozzles, standardized auxiliary tanks, and sometimes customer's FMLLG fittings; all to be developed and distributed as prototypes with this grant.** Recovered propane can be sold instead of wasted into the air, paying for market adoption of PERC's ideal prototypes within a year.

Retailers to millions of residential/business tanks, and warehouses filling 450,000 forklifts per week using gauges and infrequently FMLLGs, will negotiate lower occupational safety insurance when capturing remaining fugitive vapor/liquid at disconnect. Customer awareness of PropaneSaver will favor retailers using PropaneSaver devices on transfers to portable cylinders with much less smell and special handling currently required. Newer composite cylinders are transparent so the liquid level can be seen to a fill line and do not have an FMLLG; PropaneSaver in combo can achieve FULL VAPOR RECOVERY now as an example. Opaque metal cylinders using a PropaneSaver prototype FMLLG add-on, plus capturing excess pressure in the fill nozzle, will achieve the ideal of nearly NO EMISSIONS. This will boost propane's reputation to be a truly clean-transfer method as is gasoline and CNG.

PERC can proudly state that within 3 years, this project has begun to curtail ~973-million pounds of unburned propane vapors from the top 50 retailers alone [see chart Part 8], escaping into the atmosphere every year. PERC/PropaneSaver education will assist retailers achieving new lower ozone standards. Propane is a Volatile Organic Compound (VOC), included in President Obama's 2011

Executive Order 13563 for a 65 parts per billion ozone smog standard to be enforced by the U.S. Environmental Protection Agency. Business Roundtable notes 59% of America out of compliance. US Senator Inhofe quantifies implementing the ozone smog standard in multiples well over EPA's estimated \$15-billion annual loss in jobs. Local county air quality boards are discussing 60ppb ozone standards. Two major Air Quality Pollution Control District Boards in California have already mandated its within their authority to reduce propane vapors on fills (Los Angeles & Ventura) during high smog days. The 2009 PERC R&D Roadmap cites the need for developing new technology in the marketplace as a key challenge, specifically **“developing equipment to reduce or eliminate fugitive emissions”**. Why? PERC knows continuing to vent in the face of regulators and the public, will cause severe restrictions that could collapse the entire propane retail industry's profitability.

Shown: A basic **PropaneSaver Recovery System** to recover from the supply hose nozzle's excess pressurized propane at the nozzle's threaded bleeder fitting. This occurs prior to a nozzle disconnect, after filling a customer's tank. The propane vapor is routed to an auxiliary recovery tank (not the supply tank):

See patent number and an explanation use diagram following this discussion of different types of PropaneSaver Recovery Systems



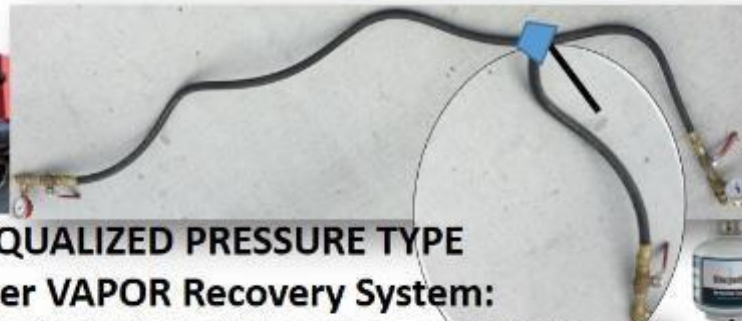
There are several embodiments of PropaneSaver Recovery Systems apparatus in my patents:

TYPE 1A EQUALIZED PRESSURE PropaneSaver Recovery System: The recovered propane of the **first two customers** from two initial captures will place 2 x ~2-ounces = 4 oz into an auxiliary recovery tank at +40 to ~50 pounds per square inch (psi) in a typical portable 20# cylinder at ~58-degrees Fahrenheit. The purpose of saving the propane besides ending air pollution (without a pump) is to sell and **pre-fill** dispense 2oz of recovered propane to the NEXT (third and onward) customers' cylinders. **The NEXT (third) customer cylinder is pre-filled with ~2 oz back going through the PropaneSaver hose & opened valves/gauges** equalizing the pressure of ~50 pounds per square inch (psi) between the two tanks with ~25psi each. Pass it along. Then the PropaneSaver valves are closed and the supply tank hose is opened with the supply nozzle. From the third customer on, it is a repetitive process until you encounter a customer who has some liquid in their tank and is coming to top it off full for a big party or a trip in an RV. In that eventuality, the TYPE 1A auxiliary recovery tank *cannot pre-fill the top-off customer's tank because it already has a higher residual pressure in it; thus a Type 1B is required.* For retailers whose incoming cylinders are routinely emptied out, then TYPE 1A PropaneSaver can pre-fill dispense otherwise wasted propane back through both valves. The PropaneSaver's first valve, with a gauge a few inches from the customer's valve attached to the nozzle, also serves the anti-pollution service of discovering if the new customer's steel opaque tank is actually empty or not. This averts relying on inaccurate external temperature gauges or even opening the FMLLG to "see".



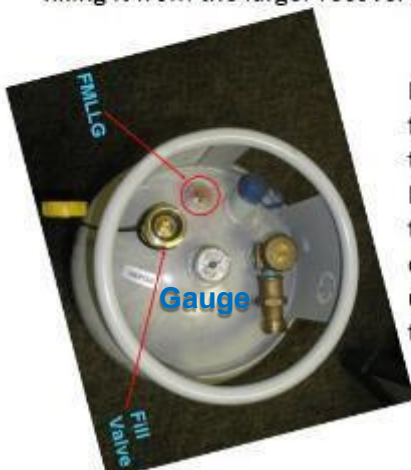
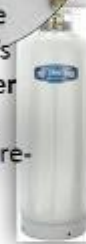
**TYPE 1A EQUALIZED PRESSURE
PropaneSaver VAPOR Recovery System**
from customer tank, via nozzle,
to PropaneSaver, to recovery tank.

Best use: pre-filling empties with
2oz from the 4oz previously gathered
in recovery tank from first two prior customers



**TYPE 1B EQUALIZED PRESSURE TYPE
PropaneSaver VAPOR Recovery System:**

Typical retailers have a minority of cylinder customers who have a tank to be topped-off that has liquid pressure still in it. Their excess supply hose nozzle's pressure **will still be recaptured, but routed through a Y-valve to a 2nd larger auxiliary tank** to accumulate excess pressure from such top-off customers.
Best use: ~2oz can be routed back to the next "empty cylinder" customer by pre-filling it from the larger recovery tank accumulating from such "top-offs".



Because some more expensive cylinders for vehicles like forklifts have gauges, users do not completely empty them but want to top them off; nor do they use the FMLLG much at all. Thus, the recovery issue is to capture the excess pressure in the nozzle at disconnect. Type 1A or TYPE 1B PropaneSaver Recovery system would be useful to a warehouse. If FMLLG use is more common, then TYPE 2A would be more logical.

TYPE 1B EQUALIZED PRESSURE TYPE PropaneSaver VAPOR Recovery System: Typical retailers have a minority of cylinder customers' who have a tank to be topped-off that has liquid pressure still in it. Their excess supply hose nozzle's pressure **will still be recaptured, but routed through a Y-valve to a 2nd larger 20-gallon, 40-gallon, or larger auxiliary tank** to accumulate excess pressure from such top-off customers. **The second larger auxiliary tank can keep accumulating quite a few of the top-off customer's excess hose pressure; however, in dispensing it back into to a typical 20# 5-gallon tank, only ~2oz will pre-fill equalize pressure into that size cylinder.**

Getting rid of the accumulated series of 2oz from top-off customers will be a priority for an attendant, until the larger auxiliary tank is empty; then will switch the Y-valve to the smaller comparable size 5-gallon auxiliary tank again. For most customers with "empties", the primary 5-gallon recovery cylinder is most useful for pre-fills until another top-off customer is encountered. Whether the propane dispensed into the customer tank comes from only the supply tank, or one of two auxiliary tanks in a pre-fill, the two sources can be added for the quantity to bill the customer. [Part of the PERC grant may be used to assess statistics of the majority empties and minority top-offs in different uses of propane and seasonal uses. Such statistics can advise whether to have a 40-gallon, 100-gallon, or 500-gallon 2nd auxiliary tank used and or rotated in seasonally. Cylinder exchanges' statistics will vary from fill stations or in addition to fillers.]

Note: Manufacturers of tanks will be able to sell more auxiliary tanks to fill stations, offering safety, convenience, and storing vapor money. Tank manufacturers may also be interested in investing in a PropaneSaver patent manufacturing license similar to retailers & wholesalers of propane to promote tank sales as this grant requests funds to develop prototypes to retain the FMLLG visual alert, yet not vent.

(See various types of PropaneSaver Recovery Systems designs for prototypes on the following pages and a Patent diagram)



TYPE 2A EQUALIZED PRESSURE PropaneSaver VAPOR Recovery System with additional Fixed Maximum Liquid Level Gauge (FMLLG) recovery attachment:



TYPE 2A EQUALIZED PRESSURE PropaneSaver VAPOR Recovery System with additional Fixed Maximum Liquid Level Gauge (FMLLG) recovery attachment for capturing vented propane: This PropaneSaver system is for a fill station with a lower volume of business AND has a cylinder exchange program. The fill station routinely using a single 20# to 40# recovery tank will likely need to switch out a number of 20# to 40# cylinders from an on-site cylinder exchange program to accommodate the higher amount of recovered propane from the additional captured propane from the FMLLG. The customer exchanged empties can be slightly filled with recovered vapor to become “almost empties” storing 4oz each. **The re-filler cylinder exchange company will offer a rebate for the recorded number of “almost empties” while also picking up the “empties”.** The re-filler adds to the vapor. As business grows, the reserve of exchanged “empties” for use in a recorded set of dual vapor recoveries of 4oz for a rebate, requires adding a TYPE 2B arrangement Y-valve choosing between a primary recovery tank and a 2nd recovery tank. However, instead of a larger 2nd recovery tank, an attendant pre-fills many exchanged “empties” becoming “almost empties” switched out from the 2nd PropaneSaver hose coupler. A tallied rebate will come to the fill station from the cylinder re-filler.



TYPE 2B EQUALIZED PRESSURE PropaneSaver VAPOR Recovery System with additional Fixed Maximum Liquid Level Gauge (FMLLG) recovery attachment:

Best use: High volume fill station also with a cylinder exchange program



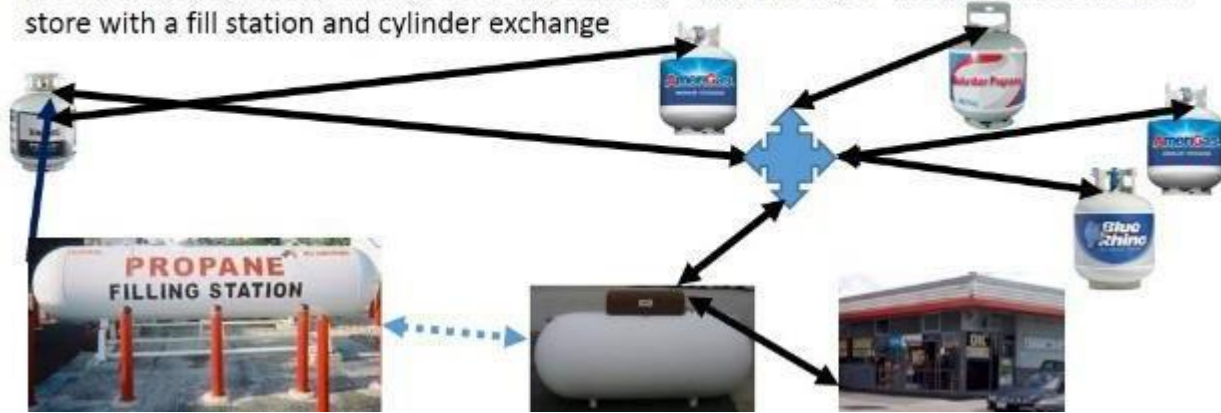




TYPE 2B EQUALIZED PRESSURE PropaneSaver VAPOR Recovery System: Using a Y-valve between a primary and a larger 2nd tank, plus FMLLG capture add-ons, will capture almost all fugitive emissions! It is expected this will become the most common system to accommodate all types of customers.

TYPE 3 EQUALIZED PRESSURE PropaneSaver VAPOR

Recovery System: disconnect recovery + FMLLG recovery from customer tank to pre-fill empty cylinders, or large recovery auxiliary tank, and vapor use by remote location store with a fill station and cylinder exchange



TYPE 3 EQUALIZED PRESSURE PropaneSaver Vapor Recovery System: A remote fill-station that has a high volume of business, and chooses to operate a small store's heating or cooling equipment from propane that it also sells as a fill-station, may wish to install a direct access tube fitting from their PropaneSaver Recovery system hose, or into an auxiliary tank, and or access a cross-over from the main liquid supply tank to the vapor tank in case the vapor recovery tank seasonally runs low. A 2nd auxiliary vapor recovery tank of the 500-gallon size, can hold ~400oz of recovered propane from excess vapor pressure recovered from fills accumulated from top-off customers, which is about equal to 3-gallons of propane constantly replenished from what would otherwise be lost as air pollution. This type of PropaneSaver Recovery System will incorporate TYPE 2B FMLLG recovery add-on as well. If the fill station has an extraordinary amount of business, it might add an in-line pump for \$5000 on the patented PropaneSaver route to stuff more than the equalized pressure into their recovery tank.

TYPE 4 IN-LINE PUMP MOBILE DELIVERY PropaneSaver LIQUID Recovery System: A bobtail or propane delivery supply truck will carry a long PropaneSaver hose tie-wrapped around the larger 100' supply hose, connecting to the nozzle. (A double inside hose can be prototyped or may be available as well). Besides the main liquid SUPPLY tank, a 2nd auxiliary RECOVERY tank of 20# or 40# size or larger would be carried onboard to receive *equalized* pressure fills, but would require switching this tank out likely too frequently. **More practical for long run routes, is adding a \$5,000 in-line pump that could recover liquid propane from the nozzle into the recovery tank.** Recovery from ~256 fills converting to 4-gallons could be achieved this way into a 5-gallon cylinder; which could go back into a cylinder exchange program. (See pictures following)

TYPE 4 PropaneSaver LIQUID Recovery System: Captures disconnect excess vapor and liquid recovery from the nozzle at a customer tank, traveling through a long small hose tie-attached to the supply hose nozzle, back to an in-line sealed pump, to onboard recovery tank. Prototypes may use some existing pipes and modify use of any self-load pump with added valves on a bobtail.



Note: There are other embodiments of the patents that prototyping and feedback will create. PropaneSaver devices manufactured or licensed to larger propane retailers made to *Underwriter Laboratories* (UL) standards or *International Standards Organization* (ISO) approval for example, and inspected by PERC, can fulfill PERC's top priority while filling customers' stationary & portable cylinders, and not the atmosphere. PERC's July 2015 grant to identify by zipcode all uses of propane will identify many more fillers of propane. If PERC would like to subsidize 100% PropaneSaver PROTOTYPE devices or rebate discount thousands more to purchasers, then adjust upwards this grant amount requested to get them into the hands of retailers. PropaneSaver will adjust to PERC's preferred economy of scale. The purpose of this grant is to make prototypes and improve them for many retailer/wholesaler circumstances to inspire demand for mass manufacturing & popular usage.

Note: The August 2015 removal of the federal excise tax per gallon of propane will make Autogas more competitive with other alternative fuels and electric power from fuel-burning powerplants to power electric vehicles. A rise in Autogas vehicles will also make the vapor recovery issue more prominent. Competitive fuel advertising will also make the criticism that propane vapor is not recovered in other uses of propane, not merely reduced emissions on transfer. This point will be moot, IF the patented PropaneSaver Recovery Systems are simultaneously implemented with this rise in Autogas use, while working with nozzle manufacturers and educating retailers. Only in California have reduced-emission nozzles, usually without bleeder ports, made a 30% market penetration. There is an *immediacy of now* to have PERC grant the funds to PropaneSaver Recovery Systems to complete R&D for various retailers, to manufacture, to distribute prototypes, gain orders for ideal systems, and to educate the public and regulators that a significant pollution problem is solved, while saving money. Further, beyond stopping waste of a processed and distributed commodity, this grant with PERC's participation will create an on-going sustainable conservation of a non-renewable resource.

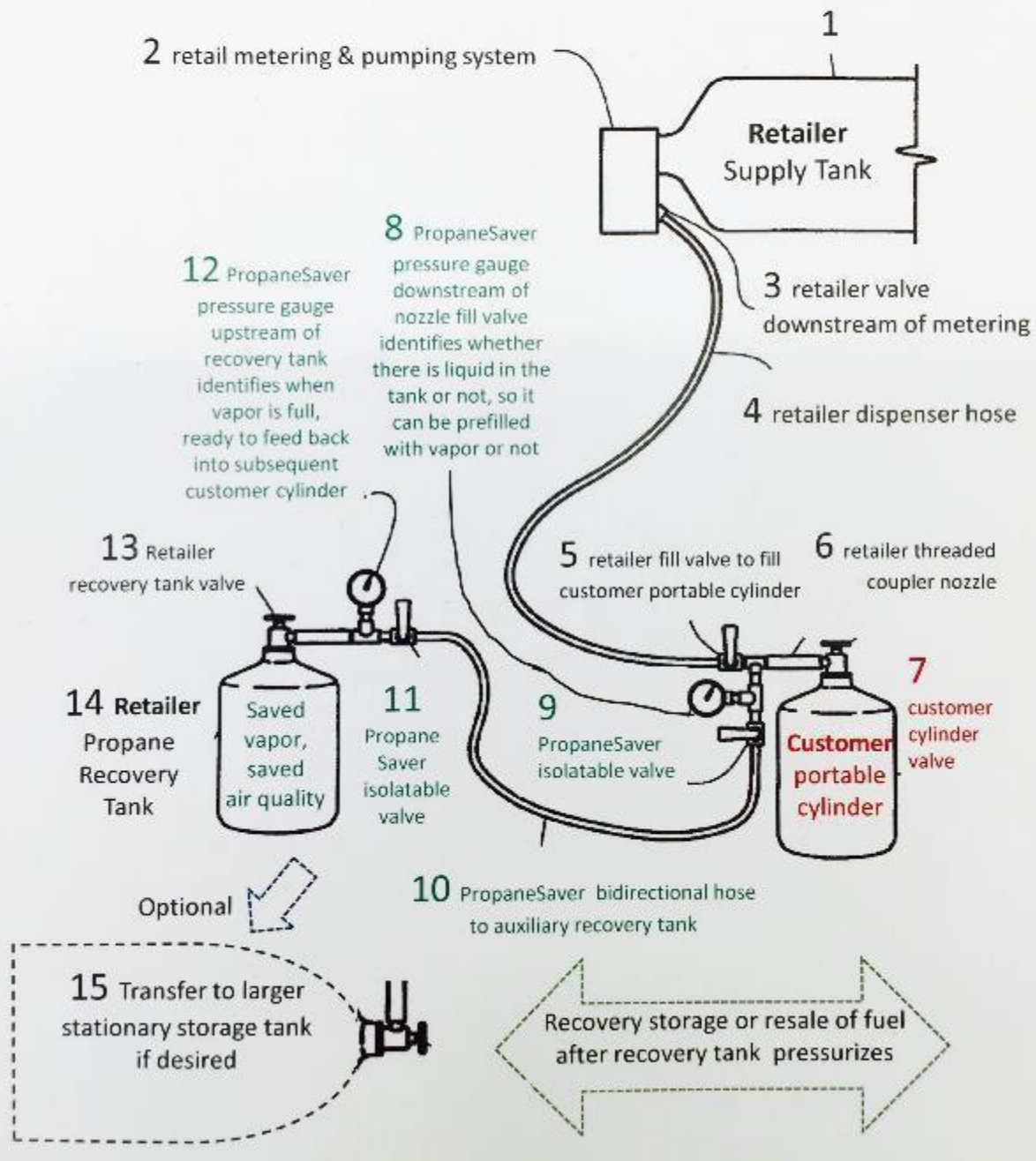
U.S. Patent

Jan. 8, 2013

PropaneSaver US 8,347,922 B2

**Michael Siegler,
Inventor**

Retailer can sell the recovered PropaneSaver fuel to subsequent customer tanks to be filled; or transfer the recovered propane into a larger stationary storage tank for sale.



1B. Identify the need for this project, your proposed solution, and the primary benefit this project will provide to the end user:

In less than 250 fills, the recovered propane from using any PERC R&D PropaneSaver developed prototype device will, from then on, be making money for propane-retailers for years to come, by recovering wasted propane for sale. Retailers may pass their savings (literally) on to customer discounts, compared to the status quo. These economic advantages brought to the propane retail industry courtesy of PERC's R&D grant, will also satisfy public policy goals and appreciation of gas processors' purpose. The manufacture of sets of ~2,000 prototypes for different applications experimented with by retailers, will result in desired feedback to improve the devices with an ideal set of ~2000 more prototypes for mass manufacture, and possible revision of the first ~2,000.

Retailer and End-user primary benefits at the fill including Buying Motive "Safety" and more:

- no cold frostbit fingers
- no breathing propane in a confined warehouse, or even in open space
- no pressure-related eye injuries
- no shoes & clothes being bathed with mercaptan (the rotten cabbage safety smell)
- dramatically reduced explosion danger at fill stations
- no smog or guilt for fugitive propane vapors creating smog – or no frustration watching regulators restrict the propane delivery business out of existence because of air pollution problems that can be solved with this grant prototyping and testing PropaneSaver devices!

(See Addenda 1B for further discussion)

Propane Council Involvement

- In what way is the Propane Council requested to be involved in this project?
- Highlight specifically the areas PERC funding would cover.

2. PROPANE COUNCIL INVOLVEMENT

PERC is requested to provide grant funds in these Tranches A through H for these purposes:

0-6 mo	7-12	13-18	19-24	25-30	31-36	On-going
A \$25k	Development and field-testing of ~2,000 PropaneSaver disconnection recovery vapor systems for portables, forklifts, et al.					
B \$50k	Engineering CADAM draftsman, and assemblers. Development of PropaneSaver FMLLG apparatus.					
C \$0 FMLLG recovery apparatus covered in PropaneSaver patent, any addendum \$ not in grant; later donation to PERC or designee as percent of recovery systems later sold.						
		D \$150k Development of recovery tank with sealed pump on ~15 bobtail trucks.				
		E \$100k Field-testing ~2000 combo PropaneSaver disconnect & FMLLG recovery system combo; add-on revision to ~2000 disconnect units issued in prior field-tests and training.				
F \$50k PERC insurance riders for experimenters with PropaneSaver prototypes.						
G \$75k Recruiting industry retail & wholesale participants, machine shops under prototype manufacturing contract, government observers, and media. When meeting industry standards, then PropaneSaver will offer patent licenses.						
		H \$50k PERC promotion of manufacturing orders of PropaneSaver devices to be reimbursed later from proceeds.				

\$500,000 is the total grant request by Michael Siegler, PropaneSaver patents-holder. Tranches A, B & C of \$75,000 could be utilized immediately, along with Tranches F&G of \$125,000 for recruiting participating propane retailers, travel budget for state-by-state installers/demonstrators for also overseeing field-testing, conducting evaluations, getting feedback for redesigns, and creating cost/benefit reports for mainstream adoption of the PropaneSaver recovery systems is vital. **Initial funding should logically be \$200,000 to launch several initiatives that will converge in productivity and evaluation of prototypes and their demonstration adoption within the first year, although development will continue throughout the length of the 36-month grant.**

At month 13, Tranches D, E, & H will be started with \$300,000. It is expected that Tranche D with bobtail trucks demonstrated improvements will be completed in a year between months 13 to 24.

Tranches E & H will continue on from month 24 through the length of the grant to month 36. It is expected that PERC staff time and PERC's *Propane Consumer Education Task Force* will be prioritized with the grant from Tranches-F&G in making invitations to propane retailers of various types, to participate in experiential evaluation and feedback along with PERC's prior experience, also involving

insurance riders for using a new device. It will be important for PERC to actively secure permissions of wholesalers to modify their equipment that may be on a retail location; and retailers to modify their equipment willingly by a PropaneSaver installer, or by PropaneSaver training any retailer's own company staff. Initial meetings with PERC can quantify how and when to expedite these mutual goals of PERC staff and PropaneSaver priorities. (See Addenda 2 for further discussion).

Strategic Fit and Importance

- What are the potential strategic benefits of this project to the propane industry?
- How does the proposed project support PERC's strategy?

3. STRATEGIC FIT AND IMPORTANCE

3A. What are the potential strategic benefits of this project to the propane industry?

PropaneSaver recovery systems directly address PERC's research & education missions, and PERC's R&D 2009 Roadmap page 6 strategy: by vastly reducing fugitive emissions from filling portable cylinders. The obvious cost/benefit ratio of retailers having PropaneSaver devices, assures retailers of having a job that won't be regulated out of existence. Numerous minor efficiency gains can be won with hands-on recorded feedback in this project. In any time & motion study, the labor time in seconds taken by a retailer to turn two valves and read gauges routinely during each fill with a PropaneSaver recovery system, is 200% less than the value of a couple ounces of propane. The cost of hardware and installation of PropaneSaver systems, will be profitable for years after just a year as an intrinsic cost of doing business, and create more job security & safety.

3B. How does the proposed project support PERC's strategy?

PERC's leadership in promoting PropaneSaver Recovery Systems is requested from the outset, not to be portrayed as a begrudging concession to regulators as a nuisance activity.

PERC should encourage a more upbeat perspective: Wasted propane is foolish fiscally, thus a few seconds recovering otherwise fugitive propane is personally and societally beneficial; therefore enthusiastic participation with PERC and PropaneSaver by retailers and wholesalers is expected in their own self-interest across their Board of Directors and those of the EPA Ozone Board.

Problem and/or Statement of Need

- What problem is this project intending to solve?
- What need will this project fulfill?
- **Solution:** Describe the proposed solution/idea?
- What will the primary deliverable(s) of the proposed work be?

4. PROBLEM AND/OR STATEMENT OF NEED

4A. What problem is this project intending to solve?

Sources of Fugitive Emissions of Propane	20# Portable Cylinders	Other Engine Fuel / on board RVs/ etc.	Forklift Cylinders	Bobtail truck to Customer Tank	Storage to Bobtail Delivery Truck
99% Transfer Disconnection Points	36%	23%	22%	13%	5%
100% FLLG Emissions	36%	25%	22%	13%	4%
Amount Emissions to Air per single transfer	199cc	250cc	199cc	208cc	1,082cc

Source: **Modern Medicine**, *FUGITIVE on the Loose*, by Patrick Hyland, 1JUN2007 quoting the **Fugitive Emissions Report** conducted by the **Western Propane Gas Association** prepared by James J. Keatley of the Adept Group Inc.

PropaneSaver Recovery Systems are focused on solving mobile and stationary retail transfer points' fugitive propane emissions by having patented devices and seek developing prototypes, with a grant from PERC, for vapor and liquid recovery to an auxiliary tank(s). Simple PropaneSaver systems can recover vapor for re-use from millions of transfers made daily.

4B. What need will this project fulfill?

First, filling propane cylinders and tanks with little air pollution at all. Second, stop wasting valuable propane commodity that has come all the way through distribution channels to a remote locale's wholesale or retail customer, into the air. In addition to fugitive emissions at the disconnect release of pressure, up to another 85% of fugitive propane vapor emissions filling portable cylinders are because the Fixed Maximum Liquid Level Gauge is left open during an entire fill, instead of just during the last anticipated half gallon. PropaneSaver has the objective with PERC in this project of capturing all such FLLG emissions *while preserving its visual indication function* that a customer's tank is filled with liquid to 80%. This FLLG vapor capture, along the patented PropaneSaver recovery route from the disconnect point to an auxiliary recovery tank, can both be allocated for sale instead of psssed away.

PropaneSaver wants to develop with PERC, systems for bobtail trucks using a sealed pump in-line with the recovery tank to collect liquid propane, rather than just vapor. With a 5-gallon recovery tank, if liquid was collected you could accommodate over ~256 fills. Larger tanks, many more recoveries. More expensive, safety-complicated, electronic systems returning fuel or vapors to a pressurized supply tank only makes costly delivery trucks; whereas PropaneSaver's simple, safe, gauged auxiliary tank systems can be implemented cheaply during either stationary or mobile transfers.

Solution

- Describe the proposed solution/idea?
- What will the primary deliverable(s) of the proposed work be?

4C. Describe the proposed solution / idea:

While there are low emission nozzles, there is no inexpensive *vapor recovery system* for the filling of cylinders / tanks at a filling station on demand, or cylinder exchangers. PERC's Cylinder Exchange Council should be very interested in patented PropaneSaver Recovery Systems operating in volume of millions of disconnections with excess pressure remaining. There is NO direct competition to Propane Saver Recovery Systems that primarily uses a patented but simple inexpensive set of device(s) routing to auxiliary storage tank(s) the vapor and or liquid recovery; whereas expensive systems requiring electronic safety monitoring of high pressure pumps to original supply tanks, do exist that nobody wants to buy.

There are a few bobtail trucks built with these expensive systems routing back to a *supply* tank. Their cost is prohibitive. In contrast, a PropaneSaver system with just a sealed pump in line coupled with a five-gallon recovery tank, a bobtail could do ~256 fills, capturing all the liquid remaining in the nozzle! PropaneSaver is feasible and economical to consider on a propane delivery trucks. Vastly cheaper than the safety concerns inherent to stuffing propane back into a *supply* tank at over \$100,000 on mobile delivery trucks; using a ~\$5,000 sealed pump in line to an on board *recovery* tank (estimate <\$10,000 for outfitting a bobtail) is doable and affordable.

Stationary fill retailers, by advertising their early use of PropaneSaver Recovery Systems, may for a while have a competitive edge over those fill stations not spending a few Ben Franklins. Analogous to the "Intel Inside" computers campaign, PropaneSaver logo and advertisements at a fuel station will attract customers educated by PERC's grant to its anti-pollution features and convenience. PropaneSaver prototypes PERColated with this grant, will cause popular adoption by retailers to reduce air pollution. Efficiency counts. Customers will support the re-use for sale of retailers' propane dollars that otherwise would be *Gone With The Wind*.

4D. What will the primary deliverable(s) of the proposed work be?

Delivered will be series of ~2,000 prototypes proving to be simple, safe, cheap, and effective in recovering propane vapor and liquid in a variety of applications in the wholesale and retail propane transfer activity. Feedback from field test evaluations that will modify the prototypes for a second wave of ~2,000 improved or enhanced models. Additionally, standards of best practice and safety will be obtained along with statistics. Mike Siegler will direct the production of the prototypes and their adaptation from experimenters in the field, and machine shops of wholesalers and retailers recruited to manufacture the prototypes under contract, or patent license agreements also using Stage-Gate software along with PERC and PropaneSaver Recovery Systems.

Further delivery of info-advertising, training, insurance discount negotiations, public relations, and political relations will occur with PropaneSaver Recovery Systems' team. (See Addenda 4D)

Audience/Market

- To whom is the product directed?
- Briefly estimate the market size, rate of growth, and degree and type of competition.

5. AUDIENCE / MARKET

5A. To whom is the product directed?

Primarily, Retailers & Wholesalers of propane with 39 End-Users of propane (See Addenda 5A for list). The prototype PropaneSaver Recovery Systems and product development will be designed & redesigned to fill the needs and fittings for filling all types of propane storage tanks & cylinders.

A secondary but important set of audiences involved with externality factors of propane usage:

- government & NGO officials seeking to reduce or nearly eliminate of air/ozone pollution
- occupational safety insurance companies
- casualty & liability re-insurance companies
- regulators of workers compensation and occupational safety
- media seeking ecology, energy, lifestyle, cooking, home improvement,... news
- proud advertisers of propane for sale and propane accessories

Propane is the 3rd most popular fuel in the world because its clean-burning, and 2nd most popular alternative fuel with portability. Why? Unburned propane does not directly contaminate soil or water; yet propane can become even more popular by solving objections to its current VOC air pollution problems by using PropaneSaver vapor and liquid propane recovery systems. Propane would be thus ecologically sound across the board. In 1990, propane was listed as an approved, alternative, **clean** fuel in the US Clean Air Act. Propane was again listed as a **preferred alternative fuel** in the Energy Policy Act of 1992. Note the distinction. **With the use of PropaneSaver Recovery Systems, propane can regain the status of being cleaner** as the Congressional Propane Caucus can recognize PERC & propane industry's role in protecting us from ground-level ozone that PropaneSaver devices achieve.

5B. Briefly estimate the market size, rate of growth, and degree and type of competition.

PropaneSaver Recovery Systems can be used by approximately 65% of propane sales sold to customers in fill transfers. Solving the air pollution problem with filling propane cylinders and tanks will remove an existential threat to the propane retail industry by limitation of number of fills per county or federal ozone limitations. Thus, limitations to growth will be removed. If propane industry projections currently expect propane use to double in the foreseeable future, it now could triple with encouragement from happy ecologically oriented organizations.

There is no competition. Reduced emission nozzles are not in the league of efficiency of PropaneSaver Recovery Systems. Nothing else is ready to capture fugitive emissions to assist 65% of the propane industry with its externality factors, while making money from what was wasted!

Product and Competitive Advantage

- What unique benefits does this project offer to the audience?
- How does this concept differ from other products/current solutions available to the audience?
- How does this concept provide greater customer benefits compared to current solutions?

6. PRODUCT AND COMPETITIVE ADVANTAGE

6A. What unique benefits does this project offer to the audience?

As to competition with other fuels, Liquid Propane Gas (LPG) at low pressure stores 3.5 times as efficient as Compressed Natural Gas (CNG) and burns slightly hotter than CNG; yet until PropaneSaver patents, little focus was made on vapor recovery and reuse or for sale. This new slight economic advantage pushes propane's utilitarian value ahead of CNG. PropaneSaver Recovery Systems can also assist the penetration of propane into heretofore CNG and gasoline marketplaces that have had their vapor/liquid transfer problems already addressed, but with vastly more expensive pump or sealed arrangements. Gasoline, in particular, has portability problems with small container's vapor & liquid emissions that the propane cylinders will no longer have. This is a competitive edge. Propane's growth curve, though dramatic, has not kept pace with other petroleum fuels' distribution, one reason in this modern era, is lack of vapor retention.

6B. How does this concept differ from other products/current solutions available to the audience?

There are NO products in the same inexpensive category of propane vapor/liquid recovery, because the approach of low equalizing pressure routing to an auxiliary recovery tank(s) is markedly different than expensive high-pressure pumping of excess vapor back to an original supply tank. Gauged tanks and propane powered vehicles do not typically have or use a venting FMLLG as do cylinders. A basic PropaneSaver device recovering vapor prior to disconnect, solves this problem for a variety of vehicles. *Low emission nozzles are still emitting.* PropaneSaver Recovery Systems are unique in their low equalized pressure approach to recapturing what would otherwise blow away, then sell to the next customer. 90% of nozzles with a bleeder port are in place nationwide to accept basic PropaneSaver devices.

Although 20# cylinders account for ~7% of propane use, they account for over one-third of the pollution in transfer fills. Industry leaders, having motivated low emission nozzles' manufacture, might like to phase in a smaller FMLLG in every cylinder within a time frame that would add great cost to every near future purchase of propane, in addition to mandating on cylinders cold temperature sensitive adhesive strips that indicate the level of propane without the venting being open all the time. PERC prototypes of patented PropaneSaver devices will adapt to recapturing vapor from both disconnect release of pressure, and the existing size FMLLG venting problem -- to any existing cylinder brought to them, thus eliminating the competitive regulatory nightmare of half-baked non-solutions making cylinders more expensive and still not solving the emissions problem.

6C. How does this concept provide greater customer benefits compared to current solutions?

A customer can easily observe their contribution or lack of contribution to air pollution, and will choose to deal with PropaneSaver Recovery Systems, while appreciating the savings on propane being essentially recycled.

- Time & Motion studies, will show a 3:1 monetary advantage in the sale of recovered propane, versus the cost of an attendant using a PropaneSaver Recovery System = "Saving Money".

(See Addenda 6 for further discussion)

Technical Feasibility

- Highlight the size of the technical gap and degree of technical complexity involved in the project.
- Demonstrate your degree of aptitude in successfully completing similar projects.

7. TECHNICAL FEASIBILITY

7A. Highlight the size of the technical gap & degree of technical complexity involved in the project:

The technical gap is small and meets all of PERC's legal mission R&D criteria. Patented PropaneSaver apparatus is a simple design. The recovery of propane with a basic PropaneSaver device capturing excess pressure prior to disconnect after a cylinder fill, is comprised of two pressure gauges, two valves, and two crimpable fittings on a flexible propane hose. Its plumbing works easily and well. This grant requests funding to use the same logic with more fittings to also recover fugitive propane from wasted propane vented routinely via the Fixed Maximum Liquid Level Gauge (FMLLG) and transport it to tank(s).

The disconnect recovery system has been successfully tested using a common 5-gallon cylinder as a recovery tank when filling a variety of other portable propane cylinders and tanks. Based on our tests of the **disconnect part** of the PropaneSaver excess pressure recovery system, **the amount of recovered propane is approximately 6.8 cubic inches of propane liquid per fill, or 0.1324 pounds of liquid propane.** Its feasibility can stand alone now if manufactured with prototypes to obtain the retailers' feedback, and trained in its simple use to pass on the recovered propane to pre-fill ~2oz in the next customer's tank.

PropaneSaver recovery devices, both patented and proposed for R&D and promotion in this grant, meet PERC's reason for being, as created in the 1996 Propane Education and Research Act (PERA) **"to promote the safe, efficient use of odorized propane gas as a preferred energy source."** Furthermore, the Propane Education & Research Enhancement Act of 2014 adds to PERA that PERC's purpose in Section 2(a) is **"to enhance consumer and employee safety and training"** and **"to train propane distributors and consumers in strategies to mitigate negative effects of future propane price spikes."**

Even with industry-wide training to momentarily open the FMLLG to see if the cylinder is already filled, and/or postpone its opening during the anticipated last ½ gallon during a fill, most retailers still leave the FMLLG open during the entire filling process. **That bad practice can then account for upwards of an additional 85% of the air pollution released into the air, a typical 0.7500 pounds per fill.** PropaneSaver logic can eliminate this problem too with the \$50,000 portion of the grant requested of PERC for Research & Development of prototypes to solve the problem while still visually signaling the 80% liquid level has been reached. This second recovery apparatus to the FMLLG along the patented PropaneSaver route to a retailer's recovery tank, will be a complete vapor recovery achievement for cylinders. Its now just a matter of matching fittings, short-run mass production, assembly, and distribution to early innovator PERC members. Because PropaneSaver implementation recovers propane foolishly wasted in the air, for sale instead of loss, PERC's R&D effort becomes a *technological strategy that can immediately act as a cushion in a volatile price marketplace* infusing ~\$700-million dollars per year back into the retail/wholesale propane industry. That is also the cost of inaction. Propane may not be renewable energy but it is reusable energy within the distribution system.

7B. Demonstrate your degree of aptitude in successfully completing similar projects:

I think in 3-Dimensional exploded diagrams with a near photographic memory, and am good with scientific formulas. Entrepreneurially, 25 years as owner of Mike's Landscaping installing lawn sprinkler systems, I became very familiar with pressure and volume, including residential design plans for landscaping irrigation systems, timers, valves, and electrical control systems. An extension of my expertise into heat-radiating floors, meant I had to get calcs and workmanship right the first time.



I am familiar with metalwork in a variety of ways including being a member of the Sheetmetal Workers Union Local 104 constructing both sheetmetal structures and residential HVAC. In Fine Arts, I am a jeweler adept at: lost wax casting; silver fabrication & soldering; gold soldering, wax injections; clean castings; bezel & prong settings; twistwire fabrication; cleaning, buffing & polishing. I also hold a California Center for Employment Training (CET) Certificate as an Electronic Technician.

Living 16 years in my remote house in the Santa Cruz redwoods, I routinely fill propane tanks. Like most people, I observed the waste and air pollution at both valves and bleed-off hoses from nozzles. However, my resolve grew to do something about fugitive gases, as my hobby of being a chef grew into my Mongolian Barbeque business, having to fill many propane tanks weekly. I saw the waste and smell permeating everything nearby, and asked, "Can't that be saved?"

I studied large-scale industrial processes with pumps that wouldn't economically scale down to recover 2-ounces of fugitive propane from nozzles' residual pressure after filling small-scale personal 5-gallon propane tanks. I analyzed propane delivery trucks filling tanks at rural homes and businesses. My idea of an auxiliary propane recovery tank(s) was influenced by having been an irrigation specialist. I had a gestalt, why not plumb a new kind of bleeder hose arrangement into ANOTHER cylinder to capture the fugitive gases with valves. 90% of the propane filler nozzles in America have bleeder fittings/valves, while *reduced* emission nozzles without bleeder valves only have a 30% presence in California. I could *nearly eliminate* unburned propane emissions from existing nozzles!

I believe my businessman's view of not wasting money would be as popular as preventing damage to Earth's natural ozone by fugitive propane. I designed and experimented with my system. Achieving 2 patents, one in 2011 with 2 apparatus claims, and a continuation with another patent in 2013 with 8 method claims; I created ideal economical propane vapor recovery systems, not merely *reducing* propane vapor, but *recovering* the valuable propane from anywhere it escapes from now during fills.

I enjoy business travel, hiking, exercise, and am an active swimmer. I pursue something to completion, am a good supervisor and delegator, and I don't give up when encountering obstacles.

Cost/Benefit Analysis

- What is the potential impact? (i.e. new gallons, units sold, persons trained, propane industry resource savings, etc.) (Provide 5 year projections when possible)
- What are the potential risks to achieving the impact? (i.e. fuel price; regulatory, environmental, or legislative considerations; propane marketer support)

8. COST / BENEFIT ANALYSIS

8A. What is the potential impact? (i.e. new gallons, units sold, persons trained, propane industry resources savings, etc.) (Provide 5-year projections when possible.)

TYPE SALES with fugitive emission source	# GALLONS SOLD	DIVIDED BY	EQUALS THIS NUMBER OF FILLS	AMOUNT OF POLLUTION MULTIPLIER	EQUALS POUNDS OF PROPANE POLLUTION
RETAIL	4,411,815,845	4 gallons /fill	1,102,953,961	x	=
Bleeder valve				0.1324 lbs/fill	146,031,104
FMLLG				0.7500 lbs/fill	827,215,471
RETAIL TOTAL					973,246,575
WHOLESALE	2,567,159,823	100 gallons/fill	25,671,598	0.1324 lbs/fill	3,398,990
TOTAL unburned propane pollution as VOC smog starter	Source: <i>LP Gas Magazine</i> Feb 2015: <i>The Top 50 Propane Retailers</i>	Note: The definition of retail and wholesale as self-reported may or may not mean truck delivery		VOC = Volatile Organic Compound = Unburned Propane	976,645,565 pounds of wasted VOC pollution vented from the top 50 propane sellers
976,645,565 pounds of saleable propane wasted into air in status quo	Multiplied by propane vapor expansion in air to diffused equilibrium 270x =	263,698,087,550 pounds of concentrated local polluted air result unburned propane !	Then the Sun creates ozone smog, and the wind diffuses & transports it to you to breathe	What can you do? Capture it before it gets away, and sell it to be cleanly burned	Prototype, Test, Buy & Install PropaneSaver Recovery Systems

POUNDS OF UNBURNED PROPANE WASTED IN TRANSFERS WITH RESULTING SMOG AIR POLLUTION

The US Department of Energy’s National Renewable Energy Lab (NREL) Alternative Fuels Data Center (AFDC) lists only 3,466 stationary propane filling stations of two types: 1) selling in an open public customer nature, and 2) more private commercial internal or government LPG filling stations. However, **the Top 50 Propane Companies have >4,830 outlets** according to *LP Gas Magazine* Feb 2015. This does not account for many in-warehouse filling operations, nor cylinder exchanges like Ferrellgas’ Blue Rhino. Number 3 Suburban owns and services 149,695 portable cylinders. Where there is disconnect pollution at .1324 pounds representing 15% of unburned Volatile Organic Compound (VOC) pollution per cylinder fill, there is also FMLLG venting pollution estimating the other 85% of pollution per fill represented as 0.7500 pounds in the chart. The disconnect from the nozzle of a bobtail delivery truck, is also quantified at 0.1324 pounds lost per fill. **The top 50 propane seller companies release 976,645,565 pounds of a wasted Volatile Organic Compound (VOC) every year, namely unburned C₃H₈ into the atmosphere**, propane’s vapor expansion rate to diffusion is 270x, thus **contaminating 263,698,087,550 pounds of concentrated local polluted air every year! It then is transited by winds to be breathed by you.**

A gallon of liquid propane weighs 4.23 pounds which means there are **230,885,476 gallons being wasted into air per year. At \$3.00 per gallon, the top 50 propane retailers are currently psssing away \$692,656,428 per year!** That could be saved and sold with PropaneSaver Recovery Systems annually from here on forward as a ROI of the mere PERC R&D grant of \$500,000 over 3 years to start things off! After the first year of ramp-up, the succeeding **5 years will glean ~\$4.6-Billion** in recovered propane to sell and **not waste about 1-Billion gallons of unburned propane**, minus minor manufacturing licensing costs to retailers & wholesalers interested in advancing their monetary and **efficiency interests by not manufacturing ~1-Trillion pounds of smog in 5 years.**

Now, if PropaneSaver Recovery Systems were used and most of this recovered for sale and clean burning later, then propane's role in the VOC problem effecting the ozone is significantly diminished, and only CO₂ as a greenhouse gas is of major concern (assuming all propane burners are efficient and don't cause soot or carbon monoxide CO). The pollution to ground-level ozone is reduced drastically, so an offset *down* regarding particulates, per the presidential executive order, is being carried out by the federal EPA. However, that gain is replaced with CO₂ from clean burning propane for more direct carbon trading *up*. Recovered propane vapor to burn with resulting CO₂, is a better alternative than releasing a VOC to create smog, (not to mention profitably being able to re-sell it). Bureaucracies should reflect that trade-off reality in their artificial marketplace of externality factors. Plants breathe well CO₂ and so do humans breathe O₂ not CO & O₃ related smog. If propane retailers and gas processors wish to trade pollution credits in the artificial marketplace they can do so in one of two ways, PropaneSaver and PERC and NGPA members should be willing to trade these credits for the use of prototypes in their pollution reduction campaign over three years; or ignore setting up an artificial marketplace in which half its currency will vanish within 5 years. This could keep the Congressional Propane Caucus busy. The monetary and public relations dollar value might be more important to buy a manufacturing license from Michael Siegler / PropaneSaver Recovery Systems to just start using them to recover real money.

Once every retailer has PropaneSaver Recovery Systems, the pollution problem will largely vanish, so the carbon trading will wind halfway down. Use it now; vs not using it for time immemorial to go beyond the 3 years' implementation period and by 5 years certainly. If the carbon credits can only be used for a one time per site or per truck reduction during the next 3-5 years, then propane retailers and gas processors should get while the getting is good by logging in the difference of propane gas saved for sale instead of making air pollution. Gas Processors, as part of the NPGA board, should adopt PropaneSaver Recovery Systems and assist PERC's prototyping and distribution effort, and secure recognition of its support and pollution credits with the Congressional Propane Caucus and relate that in international trade agreements promoting the sale of such anti-pollution and money saving devices. PERC can lead by example in the USA first.

5-gallon cylinders' 7% of sales do not include the propane mobile deliverers to 48% of propane consumption to residential & commercial customers. **The top 50 propane retailers own approximately 13,000 bobtail delivery trucks.** Outfitting PERC-demonstrator-PropaneSaver-mobile/bobtail-trucks for delivery firms, meet this need as part of this grant. Basically, a PropaneSaver Recovery System on board a bobtail truck using a sealed pump (~\$5,000 each, plus hardware cost ~>\$2,000, plus labor) in line on the patented PropaneSaver route to a recovery tank will recover liquid propane, therefore a 5-gallon cylinder could handle over ~256 fills. This now full cylinder could go directly into a cylinder exchange program. Another empty cylinder will be placed on the bobtail in another on-going effort to prevent more air pollution for profit. The smaller diameter recovery hose route back to the recovery tank that is tie-wrapped along the supply hose, also stores propane

temporarily until its contents are pushed along during the next fill into the onboard *recovery* tank. This installation under \$10,000 does not cost a 1/10th of what other expensive complicated supply tank recovery systems have cost, that nobody wants to buy. This grant requests \$150,000 including \$50,000 for engineering and prototyping, and \$100,000 for installing 10 to ~15 demonstrator PropaneSaver Recovery Systems equipped bobtails. These modified trucks should also be brought to insurance underwriters' attention, satisfaction, and reduce retailers and wholesalers' insurance rates of those who order more of them.

Limited liability through PERC should be arranged for small independent retailers that are willing to be early adopters of PropaneSaver devices. In most cases, retailers will provide their own recovery tanks or cylinders to route the recovered propane vapor or liquid to as a destination, they will then get to sell instead of waste. PropaneSaver Recovery Systems is willing to license the PropaneSaver patents in specific quantities to some larger regional propane deliverers to manufacture and maintain their own equipment, or that is used by their customers. Larger propane deliverers can arrange insurance riders with their own carriers. PERC & PropaneSaver Recovery Systems can handle Quality Assurance and Safety Training in agreements with any licensed patent manufacturers. Part of this grant allocates up to \$50,000 for insurance riders to overcome any monetary objection to liability by modifying equipment with prototypes.

PERC can conduct professional development of state / local evaluators for Certified Employee Training Program (CEPT) skills assessment coordinated with the NPGA.
(See addenda 8A for further discussion)

8B. What are the potential risks to achieving the impact? (i.e. fuel price; regulatory, environmental, or legislative considerations; propane marketer support)

FUEL PRICE PROFIT IMPACT

- PropaneSaver Recovery Systems will mitigate risks to retailers during *both* troughs and crests in the price of propane. The October 2012 price of propane was \$2.37/gallon or \$25.95 per 1-million British Thermal Units (BTU)s. As the price has dropped to as low as \$1/gallon, the profit margin is narrower. PropaneSaver can at least temporarily double or triple current small profit margins with recaptured inventory as pure profit that wasn't there before in prior bad times! PropaneSaver Recovery Systems will assist the current retailers' commitment to propane through this price drop in competition to other fuel sources and erratic subsidy or tax breaks offered by governments. The new efficiency can be considered real profit for a time with PropaneSaver devices. All other capital intensive equipment solutions to recapturing propane vapor & liquid, cause a net income operating loss; and therefore will be resisted by propane retailers especially in the current trough of an economic cycle or condition.

Contra-positively, PropaneSaver Recovery Systems should be welcomed as a new profit center while attendants do much of what they were doing anyway. Whenever the price of propane rises as a more valuable commodity with a price spike, recapturing fugitive gases with PropaneSaver becomes that much more valuable in ratio to profit not there before.

REGULATORY IMPACT

- PropaneSaver can avert severe regulatory issues nationally because it nearly eliminates pollution locally fill by fill, to nationally effecting standards for ozone. Propane's gallon price range fluctuates nationwide from \$1.80 west coast to \$2.99 east coast. In California, the Ventura County and (Los Angeles) South Coast Air Pollution Quality Control Districts have already asserted regulation of propane to reduce the Volatile Organic Compound (VOC) that unburned propane is, venting into the air. Their discussion has been limiting the number of fills, or banning fills during high smog days. They perceive this as politically possible because of the lower price of propane on the west coast. In 2012, there were \$905M in propane sales in California and CA refined 104M gallons or 5.28% of the nation's propane. California is a media center. PERC training videos of California-based PropaneSaver Recovery Systems advancing PERC prototypes, can counter this regulatory trend by largely eliminating the air quality problem the regulators could focus upon, because there will be nothing to focus on.

ENVIRONMENTAL IMPACT

- PropaneSaver Recovery Systems is in harmony with the intent of the most significant environmental initiative by the President of the United States personally, and the Head of the Environmental Protection Agency Gina McCarthy, asked to aggressively promote restrictions on particulates of ozone smog. The administration is seeking allies to justify their position. This direct link between PropaneSaver and public policy was pointed out to the inventor, Michael Siegler, by technology high school students of Economics & Civics teacher Brock d'Avignon as a Real Client Project Based Learning Project. Popular awareness by teenagers is that propane is a Volatile Organic Compound (VOC), included in President Obama's 2011 Executive Order 13563 for a 65 parts per billion ozone standard to the Environmental Protection Agency to enforce. VOCs are only obliquely related to a prior environmentality advocating artificial carbon trading from burned pollution particulates, but not so far away is unburned propane threatening ground-level ozone. In order to buffer opposition to job loss that Executive Order 13563 is causing, the new ozone standards' proponents say on National Public Radio that science supports regulators ordering/legislating an even lower 60 parts per billion as an ozone protection standard. In the education component of this grant, PropaneSaver would like to involve PERC in training young people in fill-safety and cleaner air environmentalism, precisely because of PropaneSaver Recovery Systems causing positive attitudes in handling propane fuel.
- **(Scientists' quality smog instrumentation measuring propane on other planets, and missions to Planet Earth's atmosphere, all create a timeline urgency to capture unburned propane as a VOC, as political and business decision-makers review it, are in Addenda 8B).**

LEGISLATIVE IMPACT AS A SUBTRACTION IN CAP & TRADE

The 2009 American Clean Energy Act created precedents for carbon cap & trade mandating emission allowances on carbon-based fuels which includes natural gas liquids including propane. Propane burns clean in most circumstances leaving CO₂ & H₂O. Not irrelevant is a drastic reduction in unburned propane as a VOC during the next 3 to 5 years. The overall intent is to reduce pollution, however its counted. As PropaneSaver Recovery Systems are implemented, they should be of great value to gas processors' trade subtraction, as that evolves, as well as deliverers held accountable in this artificial externality factors marketplace.

The current practice of venting propane into the air on every fill must immediately change, or the consequence is the propane industry will be limited in fills down to an uneconomical volume for price per unit math to work in 75% of the country. Or PERC can promote PropaneSaver Recovery Systems' prototypes to save the propane retail industry during the next two years from the momentum of National Command Authority (NCA). PropaneSaver is a simple visual technology that any politician, whether favoring free enterprise or regulatory orders, would like a video opportunity with. The dollar value of solving the air pollution problem can be profitable for propane retailers, or be wasted on lobbyists' defensive tactics trying to preserve the status quo of venting negligence. The ideal next cheap solution is not only R&D of PropaneSaver valves on a hose to isolate unburned pressurized nozzle's propane, but adding PropaneSaver to end FMLL's venting on a patented route to a recovery tank(s).

EASE OF GAINING MARKETER SUPPORT

- PERC has learned to subsidize new technologies to gain propane marketer support, sometimes at 100% to promote rapid early adoption. In the 2007 *Modern Medicine* article: *Fugitive On the Loose*, Lesley Garland, Vice President of the Western Propane Gas Association, discussed the **rebate programs of the California statewide PERC only working when the item cost is low for new technology [like PropaneSaver] in the works seeking to reduce fugitive propane such as low emission nozzles**. Industry acceptance, even pump-primed with rebates, has been underwhelming with *overpriced* items that might be mandated by the California Air Resources Board or county Air Pollution Quality Districts. She continues to preach the importance of the issue knowing that state regulators won't stay on the sidelines forever:

"We are doing our best to solve the situation without the government coming and telling us how to solve the problem. The more out front we can be, the better off we are, and the less likely they will come in and mandate something that is expensive and hard to comply with. The majority of propane companies understand that this is going to be a major issue, especially once the regulators get involved. It's not something that is just going to go away. We will talk about this issue at every board meeting and every district meeting and emphasize the importance of taking action now. This isn't something new to them; they have been hearing about it for years."

Eight years have elapsed. Just let me tell you, its time for PropaneSaver to have marketer support and PERC to issue subsidies or rebates to get as many PropaneSaver Recovery Systems prototypes in as many applications as possible.

INSURANCE MITIGATING LIABILITY

- Lowering insurance rates permanently comes from lowering retailers' liabilities in several ways from adopting a simple reliable technology: safety; casualty; occupational; errors & omissions; class action lawsuits over negligence to implement a solution on the table; re-insurance rates of local insurers; political & regulatory. This comes from ending propane gas pooling near the ground, eliminating an explosion possibility; handlers not being bathed in propane from so-called low emission nozzles, eliminating suffering from depletion of oxygen in the workplace; ending breathing or touching ethyl mercaptan odorants requiring time on clean-up. Although PERC can initially cover, as requested in this grant, \$50,000 insurance riders for those retailers field-testing new safer equipment, this discussion is about how long-term discounts for retailers' coverage can be achieved. Early adopters of PropaneSaver devices will find venues to pressure insurers for lower rates. Besides PERC's own in-house insurance & safety leadership, PropaneSaver will address the reduction in insurable situations with insurance and re-insurance firms. Re-insurance firms's actuaries from worldwide meet

annually in Monaco at the Rendezvous en Septembre to listen to speakers about situations, technologies, statistics, or regional trends that can reduce liabilities for insurance companies that they back up in certain nations (like America). American insurers will let them know too.

Have you talked to anyone (for example, experts or customers) about this idea?

- List the people you have talked to about this idea and where they are from. When?

9. HAVE YOU TALKED TO ANYONE (for example, experts to customers about this idea)?

9A. List the people you have talked to about this idea and where they are from. When?

2015:

- **Linda Civitello**, President & CEO, **Breathe California** (an independent projects offshoot of the American Lung Association);
- **Matt Read J.D.**, **Breathe CA of Sacramento**
- **Rich Stedman**, Air Pollution Control Officer, **Monterey Bay Unified**

A HAIKU

PropaneSaver saves
the day in a cleaner way
breathing finer days.

Air Pollution Control District (MBUAPCD) of Santa Cruz, San Benito, and Monterey Counties; Pollution Consultant to PR of China

- **Ann O'Rourke**, Executive Assistant to Rich Stedman; Coordinator, **Annual Air Quality Hero Awards** (PropaneSaver inventor Mike Siegler is a likely nominee 2016)
- **Mike Gilroy**, Deputy Air Pollution Control Officer, **MBUAPCD Engineering Department 2013-**
- **Virginia "Gine" Johnson**, **Monterey Bay Community Power Project** (3 counties), and **Policy Analyst to 5th District Santa Cruz County Supervisor Bruce McPherson**; former leader, **Eco-Action Santa Cruz**
- **Bruce McPherson**, (former California Secretary of State 2005-07, State Assemblyman & Senator) **5th District Supervisor, Santa Cruz County**; Ozone Agriculture Issues with neighboring San Benito County. Regarding PropaneSaver to Mike Siegler to his Policy Analyst, "I like this!"
- **Steve McShane**, **MBUAPCD Board of Directors Vice Chair**, & **Salinas City Council**
- **Ken Talmadge**, **MBUAPCD Director**, & **Carmel-by-the-Sea City Council**
- **Jane Parker**, **MBUAPCD Director**, & **Monterey County Supervisor**, greeter Air Quality Hero Awards
- **Michael Doyle**, **North Star Bio-Fuels**, alcohol emission closed loop systems
- **LaVonne Stone**, Executive Director, **Fort Ord Environmental Health Justice Network**
- **Daniel d'Avignon**, Grant & Venture Capital proposal writer, Economist, High School Civics & Economics Teacher, **PhoneVoter TV & Digital Networks Executive Producer**
- **Arch Hudelson**, **Meeder Equipment**, Bobtail Truck Manufacturing Supervisor, Oregon

2014-

- **Kirsten Linski**, **Eco-Action Santa Cruz**

2013

- **Lesley Garland**, Vice President, **Western Propane Gas Association**

2012-

- **Paul Grady**, COO, **Amerigas**; & **Ed Ferguson**
- **Whitney Okabayshi**, Propane Fugitive Emissions agenda-setter, **California Air Resources Board (CARB)**
- **Chris Khan**, Mentor, **Marina Business Incubator**; Advisor **MBUAPCD**

2007-

- **Moulton's 76 UNOCAL Gasoline & Propane**, Aptos CA, PropaneSaver's 1st project partner

2006-

- **Mike Guth**, **Patent Attorney** for Michael Siegler

2005-

Manfred Siegler, (father), Iowa State University, BS Chemical Engineering '51; Stanford University, MS Nuclear & Mechanical Engineering '66; retired Nuclear Engineer, GE

Include a preliminary budget and timeline.

10. PRELIMINARY BUDGET AND TIMELINE

(Covered thus far in discussion in Section 2, see Chart, Comments, and Addenda 2)

Michael Siegler, inventor and holder of PropaneSaver patents, calls upon the **Propane Education & Research Council** to be true to its mission. PropaneSaver Recovery Systems further asks **PERC** as part of this grant to marshal its allies in the **NPGA**, its 50 state organizations, propane wholesalers' machine shops as manufacturing contractors to be trained under patent or license. The **Congressional Propane Caucus** can take note of PERC's grant to Michael Siegler and PERC's advocacy of a solution eliminating drastically the fugitive propane emissions when filling tanks at the retail level of distribution.

The **California Air Resources Board (CARB)** posted their lament of 3 phases of propane vapor emissions during a transfer fill of a typical cylinder on their official website 20 July 2012 by showing it: <http://www.arb.ca.gov/fuels/altfuels/propane-transfer/propane-transfer.htm> CARB tabled their propane vapor emissions research in 2013, without plans as of 2015 to re-commission such. PERC has



propane-transfer-vid.wmv

a "breather". Inventor Michael Siegler also filed on the prior art of this typical nozzle's bleeder hose's patent, so he would be able to develop his patent to capture the wasted propane vapor or liquid. **PERC** can change the world's pollution ratio based on the irony of an inadequate solution to avoid an attendant being bathed in propane; yet squirting into the air nearby. This exact type nozzle as shown by CARB **becomes a Recovery Nozzle** with a PropaneSaver downstream of the bleeder valve -- that also has a female fitting for PropaneSaver to thread into it.

Any propane deliverer's interest in a drastically more affordable delivery bobtail truck with a PropaneSaver Recovery System to a recovery tank aboard, will still require a \$5,000 sealed pump & smaller diameter recovery hose leading back to the *recovery* tank; but will not have \$100,000 worth of accouterments to re-pressurize propane back into the original *supply* tank. This grant requests \$150,000 to modify enough demonstrator trucks ~15 regionally to show their use and affordability in the second year of this grant. Preliminary efforts will be initiated before that time with the recruiting portion of the grant to propane-deliverers. Priority is to address propane recovery during cylinder fills.

PERC has a wonderful record in quality handling training & certification that can assist retailers and wholesalers to start using the PropaneSaver Recovery Systems with confidence in routine use.

The time is now.

Please review and disburse the first \$200,000 worth of tranches requested by the end of the grant review period.

Thank You,



Michael Siegler

Inventor, Patents-holder,

PropaneSaver Recovery Systems

END of grant request to PERC by Michael Siegler

See ADDENDAS & ACRONYMS

ADDENDA 1B: Identify the need for this project, your proposed solution, and the primary benefit this project will provide to the end user:

Field-test knowledge shared back to this PERC project might include:

- A retailer noticing a placement of a fitting for reaching propane cylinders permanently recessed aboard certain models of recreational vehicles.
- A warehouseperson seeing where an elbow angle fitting in a tight space on a forklift would save a scraped knuckle.
- A bobtail truck driver reconfiguring where a taller vapor recovery tank aboard a mobile propane-delivery truck is practical...

PERC’s invitation to all retailers to experiment, innovate, and report their re-designs to an ideal set of prototypes will assist later mass manufacturing with venture capital, based on pre-orders. The grant budgeted cost of promotion of such orders, will be refunded to PERC from those later sales. For instance, methods to attach and recover the vapor from existing Fixed Maximum Liquid Level Gauges (FMLLG) fuel level safety indicators, will use the patented route of the overall PropaneSaver device to a recovery tank(s). However, no future patenting cost or addendums is part of this grant and will be handled by inventor Mike Siegler.

If retailers choose not to pass the *averaged savings* (minus the 2 prep fills) onto their customers with discounts in a competitive environment, the *National Institute of Weights & Measures* weighs in, (while PERC does not waste money on lobbyists), there is more money available from PERC members to educate the public how effective innovation led by PERC is, and why end-users should buy propane where a retailer advertises they use a PropaneSaver device. The final end-user customer of propane may or may not pay for wasted propane that does or doesn’t go into their cylinder. Think on it.

Ad agencies say any time a product has at least 4 of 21 Known Buying Motives of Humanity, it will be a success; PropaneSaver devices have 8+. For instance, some reasons for “Saving Money” are:

- Recovered propane at filling stations could be used to operate a convenience store’s refrigeration, cooking, and heating. Contra-positively, recovered propane not used to pre-fill, and used instead for the filling station’s buildings, can be amortized across their customer base for a standard discount.
- A propane-powered propane-delivery truck engine can also daisy-chain the PropaneSaver’s recovered vapor into mileage.
- A customer’s empty cylinder *pre-filled* with prior recovered vapor from a recovery tank, could be amortized as payment for ~2-ounces, plus what is metered out from the main supply tank.

ADDENDA 2: Propane Council Involvement

- In what way is the Propane Council requested to be involved in this project? Highlight specifically the areas PERC funding would cover.

PROPANE COUNCIL INVOLVEMENT

PERC is requested to provide grant funds in these Tranches A through H for these purposes:

- A. \$25k development and field-testing ~2,000 PropaneSaver disconnection recovery vapor systems for STATIONARY fill stations. Months 1-6
- B. \$50k Research and Development of FMLLG adaptor to PropaneSaver patented route to vapor recovery tank(s) for STATIONARY fill stations. Months 1-6

- C. Zero \$0 innovation patent filings from field-testing FMLLG and other developments, will not come out of the grant. Michael Siegler will handle this responsibility. Months ~1-36
- D. \$150k Development of 10 to ~15 PropaneSaver recovery tank systems for MOBILE delivery trucks using a sealed pump in-line with PropaneSaver recovery route for maximum liquid recovery. Long small-diameter recovery hose tie-on methods, and dual purpose hose designs. Months 12-24
- E. \$100k Development of ~2,000 PropaneSaver disconnect vapor recovery tank(s) systems for STATIONARY Fill Stations combining the patented PropaneSaver route with ~2,000 or more new add-on FMLLG recovery systems. Months 12-36
- F. \$50k for arranging liability insurance riders for feedback modifications for STATIONARY hands-on experimenters, and for MOBILE delivery hands-on experimenters. Months 1-36
- G. \$75k for recruiting industry retailers' and wholesalers' participation in machine shop prototype manufacturing contracts. After PropaneSaver prototypes are perfected from field-testing and obtaining industry use feedback with government observers; then patent licensing agreements to propane companies will be offered to further fund quality prototypes' manufacturing beyond the scope of this development grant. Months 1-36
- H. \$50k for PERC's promotion of PropaneSaver pre-orders for mass manufacturing, factoring, & fulfillment of orders for PropaneSaver devices from which PERC would be reimbursed per unit sold from patent licensing the manufacturing of PropaneSaver devices. Months 12-36

ADDENDA 4D: What will the primary deliverable(s) of the proposed work be?

Further delivery of info-advertising, training, insurance discount negotiations, public relations, and political relations will occur with PropaneSaver Recovery Systems' team. This work will likely be directed by Brock d'Avignon: B.A Organizational Communications & Public Relations, Teaching Credentials in Technology Education & Industrial Arts, and Social Sciences, a 25-year career in marketing including ramping up entire satellite TV networks and handling 4 presidential candidates. His doctoral research is in the Economics of Percentage As You Earn (%AYE) Finance & Fininsurance. Brock will interface with PERC and NPGA staff to recruit members of relevant propane firms & organizations; liaison with inventor Mike Siegler, handle media relations of PropaneSaver Recovery Systems to small through large target audiences' awareness of the new solution to retaining propane for sale, while drastically reducing air pollution. Other consultants will be recruited or are on stand-by.

ADDENDA 5A: Audience/Market

- To whom is the product directed?
- Briefly estimate the market size, rate of growth, and degree and type of competition.

The market for PropaneSaver Recovery Systems are propane retailers/wholesalers who fill cylinders at fill stations, portable cylinder exchange fillers, wholesalers, and bobtail propane-deliverers to homes and businesses. The 39 target audiences for PropaneSaver devices are those End Customers wanting to save money by not wasting propane into the air during fills:

- barbeques, restaurant grills, outdoor heating lamps
- recreational vehicles' stoves, burners, refrigerators, generators
- forklifts

- residential & business’ furnaces, boilers, water heaters, clothes dryers, refrigerators, chillers, air conditioning & heating
- agricultural generators, irrigation pumps, vehicles, food dryers, field torches
- construction site heaters, sheetmetal firepots, roofing hot tar heaters, asphalt heaters
- smog certification stations
- individual space heaters, gas log fireplaces, remote location electric generators / turbines
- motion picture & theme-park special effects, propulsion of objects, fire & on-going fire
- lawnmowers
- manufacturers in processing such as semi-conductors to deposit silicon carbide; blowtorch soldering & brazing; factories filling aerosol pressurized cans such as shaving cream; glassblowing; fuel cells
- fill stations recovering lots of propane into a large recovery tank could use it to power HVAC, and cut fuel bills for chillers & refrigerators, instead of selling the recovered propane pre-filling portable cylinders, which it could still do.

ADDENDA 6A: Product and Competitive Advantage

What unique benefits does this project offer to the audience? How does this concept differ from other products/current solutions available to the audience? How does this concept provide greater customer benefits compared to current solutions?

Solve the venting and disconnect emission problems by using PropaneSaver Recovery Systems; then the growth curve of propane sales should climb steeper in comparison with other fuels:

1922	233,000 gallons sold
1934	56,000,000 gallons sold
1958	7,000,000,000 gallons sold
2012	15,000,000,000 gallons sold
2020	>>>>>>>more gallons sold because of PERC development of PropaneSaver prototypes, field research, and education

“Saving Outlay of Money” always assists competitive position by appealing to **Known Buying Motives of Humanity** on Madison Avenue, as is better: “Health”, “Recreation”, “Safety”, “Saving Labor” & “Saving Time” (in Clean-up)”, and “Enhancing the Environment”, “Legal Compliance”, “Justice in Externality Factors” are all recognized as Buying Motives related to “Recycling Waste to Sell”. Anything over 4 Buying Motives will make money.

PropaneSaver Recovery Systems are relevant to *two-thirds* of these NPGA statistics:

- Propane contributes \$36.7B to America’s GDP added value.
- The propane industry wholesaled \$8B - \$10B in 2012.
- The USA consumes 15B gallons of propane annually for home, agriculture, industrial, & commercial uses
- 8.1M households depend on propane for one use or another
- 450,000 forklifts use propane and are filled weekly.
- Estimates range between 190,000 to 270,000+ on-road vehicles use propane fuel, and is a growth market for off-road and farm vehicles. These vehicles all go to a typical fill station where portable cylinders are also filled. The larger couplers for these vehicle fills, also release propane into the air at disconnect, which a basic problem that patented PropaneSaver Recovery Systems solves. Despite the lower volume of fills for vehicles as compared to cylinders, it is highly visible as a

target for regulators. PropaneSaver Recovery Systems with PERC grant developed prototypes can solve this in a similar timeframe for several sizes of fittings.

PropaneSaver patents fill a vacuum of thought that manufacturers of propane-fueled vehicles to cylinders heretofore did not address. “Nothing is too wonderful to be true!” said Michael Faraday, inventor.

By finally ending fugitive gas problems of propane fills with a plumbing technology far more cheaply than gasoline fumes being recovered to a supply tank, PropaneSaver devices’ existence will assist aggressive propane marketing to fuel retailers, and gain propane fuel customers from gasoline, just as it has in remote locations -- versus methane piping to valves from too far a distance. Just as the prevalence of gasoline vapor recovery started in smog-concerned California, and is now being used routinely most everywhere in the world by motorists as cited in PropaneSaver patents; so can vapor recovery for the propane industry rapidly be accepted as a “best practice” by consumers and retailers.

Propane requires just 1,220 kilopascals or 177 pounds per square inch of pressure to keep it liquid at 37.8C or 100F degrees; therefore it is currently in a customer range of “Convenience as a Buying Motive” between CNG and gasoline in portability. Propane corrosion versus methane CNG was long ago solved by standardized portable strong storage LPG tanks. That propane cylinders still routinely and inconveniently vent at transfer versus competition that does not vent, can be fixed by this grant, making the slight edge that propane burns slightly hotter than CNG, economically finally a winner.

ADDENDA 7A: Technical Feasibility

- Highlight the size of the technical gap and degree of technical complexity involved in the project.

When PropaneSaver devices are sold, drastically reducing air pollution, enhancing occupational safety during every fill, and conducting experiments with field use feedback from propane retailers to PropaneSaver’s inventor; then Mike Siegler will reward the ingenuity of PERC innovators as well as sponsors who enjoy the reduction of liabilities. This would be a result of PERC’s timely and cooperative R&D of this extension to PropaneSaver Recovery Systems patented apparatus and claims. **Recovering propane otherwise wasted in the air, for sale instead of total loss, is a price reduction strategy that is now possible that can act as a cushion in a volatile price marketplace of propane.** In a world without subsidies, solving real externality factors is good economics for making good neighbors, happy customers, and non-existent regulators. The only regulator that retailers will require for non-emissions are PropaneSaver gauges and valves.

Cylinder fill stations, cylinder exchange services, and bobtail propane delivery trucks will all use types of PropaneSaver devices, just sooner than later with PERC’s grant and leadership to save the industry from worse regulatory fates gaining momentum -- in the absence of a technically feasible set of solutions that are being presented herein. PERC’s PropaneSaver grant initiative will reduce air pollution from 50-million Americans who choose to use propane.

Because the technical feasibility is largely achieved and can be completed with PERC’s grant at time-horizons in 6-month increments of prototypes being developed and manufactured and subsequently distributed, it is imperative that the Congressional Propane Caucus protect an American inventor’s interest, along with PERC’s and the NPGA’s interest worldwide in Trade Agreements as it is implemented nationwide here. Lowered ozone particulate pollution standards that have been

executive ordered by the president are also being negotiated worldwide in three significant trade agreements. President Obama announced a doubling of current investment from other public and private sources to mitigate climate change 30 NOV 2015 at the UN World Conference on the topic. Billionaires Gates, Zuckerberg, Bezos, and Branson have created a “Breakthrough New Energy Coalition” to support this effort. Awareness and coordination with Congresspersons will assist getting these economical anti-pollution devices to the worldwide market first, and holding it before overseas manufacturers try to copycat an American’s and PERC’s PropaneSaver initiative.

ADDENDA 8A: Cost/Benefit Analysis

- What is the potential impact? (i.e. new gallons, units sold, persons trained, propane industry resource savings, etc.) (Provide 5 year projections when possible)

Perhaps PERC can augment this data beyond just the top 50 sellers of propane, pushing the saleable propane wasted to over a billion pounds per year, and the subsequent local air polluted to 270 times that! Our table based on the top 50 retailers of propane should be sufficient to make the case for both saving money and externality factor consequences of ozone smog that can simply be solved by PropaneSaver Recovery Systems being prototyped, tested, manufactured, installed, and popularized through education and training.

- A typical filling station may fill 20 propane cylinders per day. Thus, each filling station may save 2.65 pounds of propane per day, or approximately 967 pounds of propane per year. This is now a saleable commodity again versus \$684 thrown to the wind. Most PropaneSaver Recovery Systems should pay for themselves within the term of the grant for a fill station. In a typical small county that has 20 fill stations, this savings of almost 10-tons of propane per year is not worthlessly releasing VOCs polluting the air, converting to ground-level ozone -- which is smog. PropaneSaver devices will help the bottom lines of deliverers and retailers. Savings could be passed onto customers in a competitive environment while saving the environment, where all people in the supply chain support the use of PropaneSaver Recovery Systems to recovery tank(s). All the units sold of PropaneSaver devices will cause a nearly 100% rise in propane recovery for sale, instead of loss, within 3 to 5 years! A pretty effective positive \$700-million annual potential economic gain and positive environmental impact by lack of \$700-million worth of propane invested in pollution.
- LOOK at the current way a customer views a fill station attendant. First gloves are noticed. What’s their purpose? To keep the smell off the attendant’s hands, yes, but the attendant is also concerned with the extreme cold of frostbite, possible even on a hot day, when the fill nozzle is disconnected. The vented gas from the nozzle is typically sent along a bleeder hose that rests on the ground, blowing propane vapor towards the customer’s sandals, making their feet smellier than usual. If there is no bleeder hose, the attendant can get vapor blowing into their face.

Besides the physical hazards of breathing vented propane, it exploding in a fiery danger that has been traveling low along the floor to an ignition source is one. The smell of mercaptan is a discomfort during a propane fill as currently handled. Its hard to wash off hands or clothes, a problem when a propane-filling attendant needs to interact with other customers and or handle groceries or money, requiring clean-up time. Most all of those occupational hazards and waste of time are rendered unnecessary by PropaneSaver Recovery Systems.

Then just LOOKING at what next goes on, both a customer and retailer have an inner voice: “Look at that coming out the safety valve!” to the current practice of venting vapor out the Fixed Maximum Liquid Level Gauge. Also the release from the fill nozzle: “My money is blowing away!”

says the inner voice to the mind of the customer. "I'm not only paying for what I'm not getting; and what I'm not getting is polluting the planet!"

"Look at that air pollution not going in my tank! There's got to be some way of preventing that!" was the repetitive thought of any customer, and that of the inventor of PropaneSaver Recovery Systems because: "Its in front of me". Let's end this unpopular reaction to wasted propane.

A sense of personal responsibility of wanting to do something about this arises. PERC can satisfy this desire by retailers and customers. Worldwide, billions of pounds of fugitive propane that retailers can recover per year with PropaneSaver Recovery Systems, would extrapolate to first ~973-million pounds of American propane not being in the atmosphere. This jump of adding to a profit that wasn't possible before this PERC grant -- as the world follows America's leadership, and promotion of PropaneSaver Recovery Systems in trade agreements = Advantage America.

As part of this grant request, PropaneSaver could design tests and train evaluators for demonstrated performance in conjunction with perhaps PERC's prior contracts with Industrial Training Services, Inc. PropaneSaver Recovery Systems identifies the need to update instructors in these CEPT certificate courses:

- 2.2 Bobtail Delivery
- 2.4 Cylinder Filling
- Combo of above 2.2 & 2.4
- 4.1 Design/Install Exterior Vapor Design Systems
- 4.2 Appliances & Interior Vapor Distribution Systems [i.e. a filling station choosing to use recovered propane from a recovery tank to run appliances like heaters or refrigeration]
- 5.1 Transfer Systems Operations

Updates on www.PropaneSafety.com and kids safety with propane would also be wise to orient young people to the new norm of capturing fugitive propane with how to operate PropaneSaver devices whether they ever directly use them or not. Students in the last two decades are more educated on recycling and environmental issues than prior generations and may just care enough to develop an economic interest which should lead to safety familiarity while working at a fill-station.

ADDENDA 8B: What are the potential risks to achieving the impact? (i.e. fuel price; regulatory, environmental, or legislative considerations; propane marketer support)

ENVIRONMENTAL IMPACT:

GLOBAL DATA ON VOLATILE ORGANIC COMPOUNDS: UNBURNED PROPANE CHANGING INTO OZONE SMOG



One

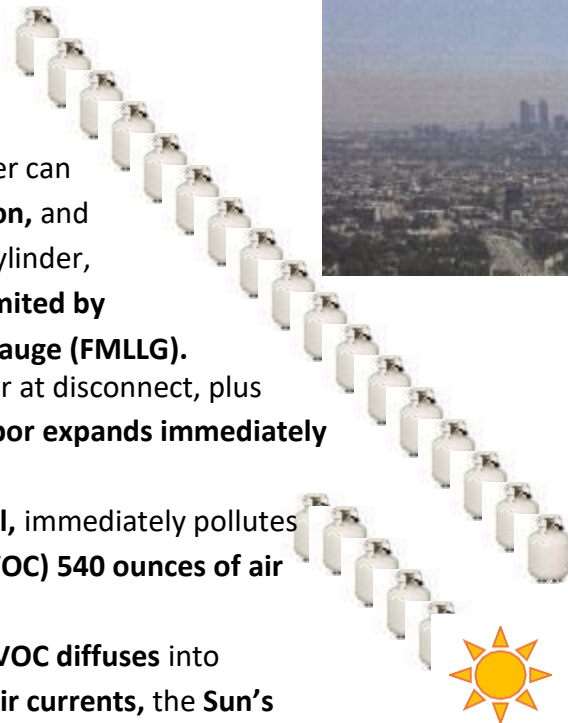
5-gallon Liquid Propane (LP) cylinder can withstand **17x pressure compression**, and does expand with heat inside the cylinder, so for safety sake is filled to **80% limited by the Fixed Maximum Liquid Level Gauge (FMLLG)**.

When propane is vented into the air at disconnect, plus vented via the FMLLG, **propane vapor expands immediately 270x its prior volume.**

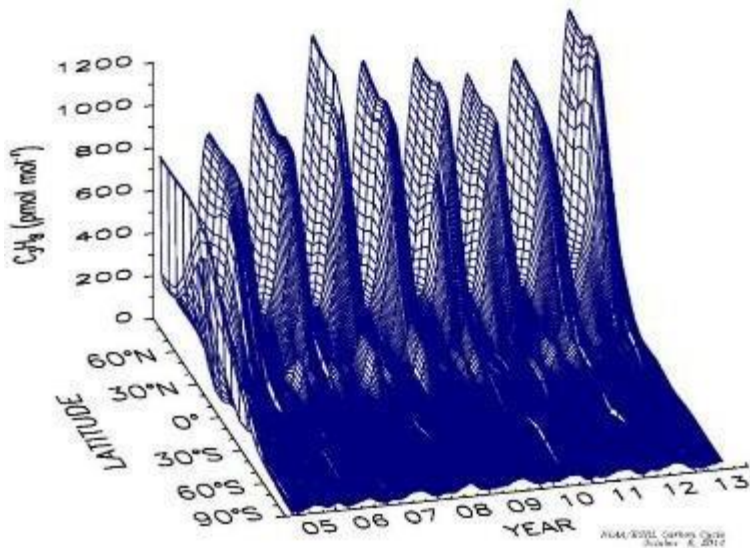
2-ounces of vented propane per fill, immediately pollutes as a **Volatile Organic Compound (VOC) 540 ounces of air equaling 4.2 gallons of air.**

When **unburned fugitive propane VOC diffuses** into even more volume widespread **in air currents**, the **Sun's ultraviolet radiation heats** it in combination with other chemicals that people would otherwise breathe, **creating ozone smog.**

PropaneSaver Recovery Systems retains 2-ounces now wasted for future sale preventing smog swirling. PERC's grant can make these two positives happen.



NASA's Cassini spacecraft's **Composite InfraRed Spectrometer (CIRS)** led the way in analyzing outer gas planets and moons' methane to propane atmospheres during the last two decades. Ground-based

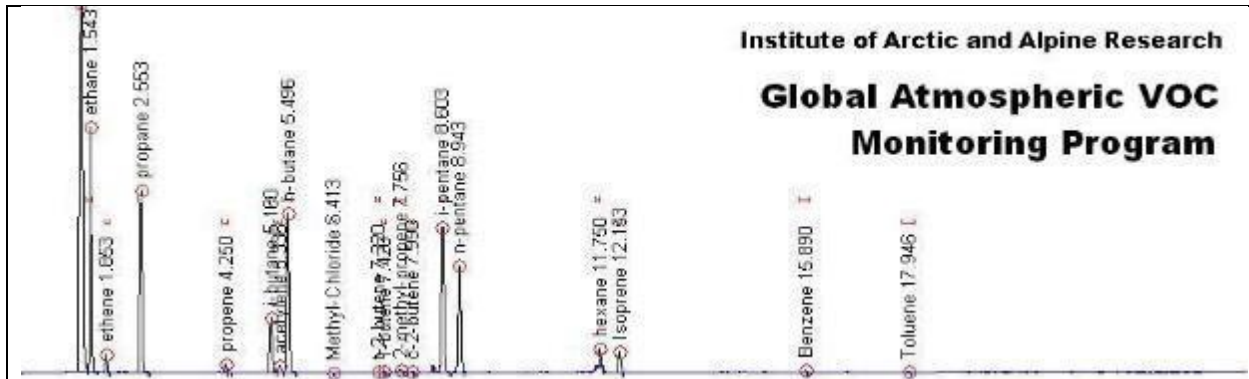


European & American scientists tend to measure pollution in pico-moles or million millionths minus one more decimal place.

This graph shows the use of propane as VOC propane pollution in the northern and southern hemispheres at present. The UN is trying to get the southern hemisphere to stop using smoky dung & wood fuel sources for lung health mostly, favoring propane.

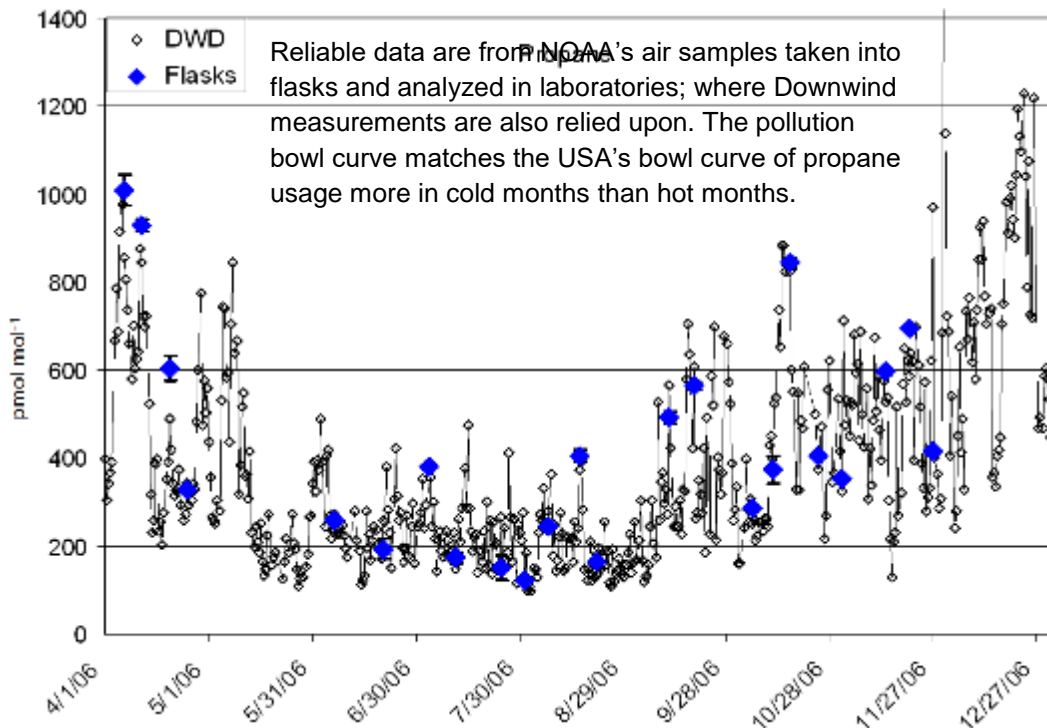
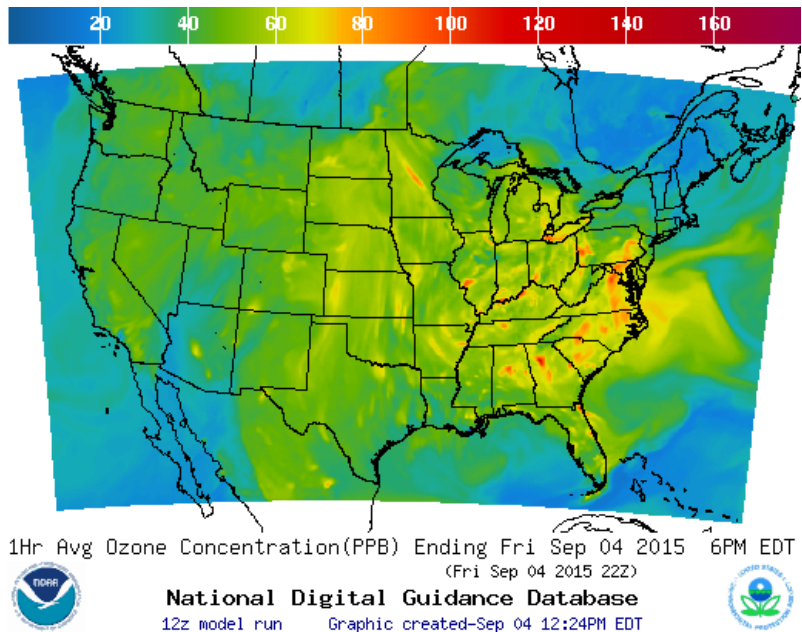
and space-based sensor spectroscopy identifies propane with 27 wavelength bands that could distinguish it from other difficult carbon molecules in a mix. The cfa.harvard.edu/HITRAN2011 Conference made many technical announcements about the detection of abundant propane on other worlds for future resource bases, listed on the [LISA database](#). It is only a matter of time before new **graphene infrared sensors and filters sensors** being launched September 2016 on the new **OSIRIS-REX** asteroid mission to *Near Earth Hazard Object* Cennu, are focused on Earthwatch weather and geo-satellites available for review on the **US Geologic Survey's master public website links** to other agencies. Focusing on ozone smog will get more detailed, isolating unburned propane in air in our era.

Anti-industrial climate change agendas just this August 2015 are calling for a **ban on all federal lands of drilling for oil and gas** to bring the totality of America theoretically to be in macro-accord with President Obama's executive order on ozone smog standards, even though that is disingenuously skewed as the east is the major ozone generator, while the land is in west. The petroleum industry seems quite caught flat-footed on these lock-up initiatives, based on quantification sciences used effectively but in the wrong geography. The dollar value of public relations, lobbying, and awareness does little to diminish politicians' glee in the east. Western objections will be lost in the din of the aggregate appeal that gets the east off the hook politically for a time, by setting region against region; versus demands of equal tyranny for all. Force of law often clouds rational decision-making by institutionalizing standards that ignore changes in technology like **PropaneSaver Recovery Systems** effectively ending propane's contribution to the debate by solving most unburned fugitive propane emissions.



In the **United Nations’ Global Air Quality Watch** by its **World Meteorological Organization’s Institute of Arctic and Alpine Research**, it lists propane among 20 carbon gases present in the atmosphere noting propane is near the least offensive as number 16 but its quantity is in the top five in significance. Four sensors in England identify signature mixes of related chemicals with propane to determine if it came from urban roadways, background urban sources, suburban, or rural sources. The rural areas had higher ground-based ozone smog levels, urban second, and suburban third due mostly to propane’s portability to remote habitats that use it for heating. Propane’s 12-month bowl curve of consumption of higher use in winter and lower use in summer demand is also indicative of this. The **US National Oceanic and Atmosphere Administration (NOAA)** uses 6 permanent stations and 40 set-up sites worldwide bi-weekly or monthly to make the same measurements of chemical reactions with Volatile Organic Compounds causing ground-based ozone forming notably at night after being heated in the day to cause the chemical reaction. NOAA’s ozone website measures its growth nightly and doesn’t bother to post the daytime hours from using InfraRed sensors. Ozone smog formation from unburned VOCs like fugitive propane, is most pronounced in the eastern US and 5x less so in the west; yet the western USA is where eco-advocacy organizations are seeking a political victory because of “ozone smog transit problems” where ironically the eastern seaboard is one big smog puddle. See **Ozone Transport Commission of the Northeastern States** (otcair.org). To illustrate this, a concentration of 19,000 oil wells in remote southern Colorado where propane escapes along with methane bubbling up, creates an ozone smog generation problem 6x higher than that of Houston, Texas; then it travels to Boulder and Denver, adding to and maxing out their urban air quality smog indexes, in addition to tree smog.

A similar traveling of ozone smog glides northward across most of the west. The northwest seems bothered that California cities' unburned VOCs to the south are involved in the slow chemical reactions that occur in the atmosphere enroute to end up as smog in the northwest states. Various regional **PERC** and **NPGA** units may be called upon in the near future to show how they are promoting the mitigation of ozone smog with the adoption of **PropaneSaver Recovery Systems** in urban areas as well as rural, and seasonally as well.



As long ago as the GHW Bush administration, the US lost a "particulate transit war" with Canada when the USA industrial east's **acid rain** was destroying Canadian forest economics transiting by prevailing **northwinds**. The Canadians noticed most North American **rivers run south**. The Canadian prime minister threatened to build a series of Roberson hyper-ion generators on the border which would cause the smog to fall out of the sky creating concentrated acid rain to enter American rivers that would flow back into Americans' faces and farms. [Interview with Roberson Brothers as inventor

and hyper-ion battery catalyst venture capitalist, by d'Avignon 1985]. The US surrendered immediately, and in that first year President GHW Bush caused to be subsidized \$600M worth of scrubbers to powerplants and factories alone. The descendant of that Canadian pollution war is the **World Ozone and Ultraviolet Radiation Data Centre** (woudc.org).

More recently the *"Trans-Pacific transport of reactive nitrogen and ozone to Canada and the US Northwest from Asia"* during Spring is noted in research in the *Journal of Atmospheric Chemistry and Physics* (atmos-chem-phys.net). The **United Nations promotes the use of propane** as an alternative to unhealthy smoky particulates like burning dung and wood in much of the developing world. [2008 Interview with Roy Willis, CEO of PERC <http://youtu.be/54ctiDfPpTw>]. Emerging nations are doing so, far more than American backyard BBQs or contractors, as a heat & year-round cooking source. Thus, propane as the second most popular alternative fuel in the world, will gain more emission focus worldwide and domestically as additional ozone smog travels here. PropaneSaver Recovery Systems can nearly end the retail fill's fugitive propane contribution to this problem, with PERC's leadership grant, starting in America.

That fugitive unburned VOC propane gases figure into these regional windborne squabbles will inevitably cause a focus by federal particulate standards for VOCs, whose new 65ppb standards cause more anxiety as 59% of the country is out of compliance right now. True, a new president could reverse edicts at the stroke of a pen, but the bully pulpit has been used to fuel anti-fuel rhetoric. Using the artificial carbon-based trading pollution credit marketplace as a precedent, something similar may follow to regulate the number of fills of propane in pollution off-sets, if ounces of propane continue to leak at every fill into the atmosphere, versus what? Use of PropaneSaver Recovery Systems is one logical answer.

Two California **Air Pollution Quality Control Districts** in South Bay LA and Ventura have declared their authority to make regulations on propane. The **California Air Resources Board (CARB)** shares regulatory authority with 35 Air Pollution Quality Control Districts in California. CARB did not set the agenda for lower propane emission nozzle development a few years ago, recognizing that initiative came from the hardware manufacturers of nozzles themselves. The lower emission standards for nozzles by manufacturers were perceived as motivated by National Fire Protection Association standard #58 (NFPA58). There were no mandated CARB standards at the time. Like that effort, PERC should realize the solution that can head off such anti-propane-VOC efforts, as an existential threat to propane retailers, is yes, PropaneSaver Recovery Systems. Instead of wasting education dollars and **NPGA** wasting lobbying dollars, there is something cheap that averts the need for all that expensive defense of the undefendable. This grant request is based on the premise that PropaneSaver prototypes need to be manufactured, field-tested, modified, and adopted industry-wide, and favored by consumer awareness as making a good alternative fuel *great* both for the wallet and for breathing better air.

The scientific data from everywhere, NOAA to the **Welsh Air Quality Forum** (welshairquality.co.uk), all end up in Tokyo at the **World Meteorological Organization** (wmo.int) **database** and is downloadable from all their **WMO Regional Meteorological Centres** (WMC)s. The sheer volume of data to be cited is sometimes used politically to overwhelm any debate or any opposition to public policy works picking energy winners and losers with the aristocracy of political pull, no matter how unconnected their subsidies or tax-breaks are to reality or alternate solutions. Trying to educate voters in that research tide along with propane industry organizations, would take more millions of dollars than **PERC** or the **NPGA** has.

So, it is indeed a rare opportunity that the development of a patented set of cheap plumbing can solve all these economic externality factors in reality, and political problems, at far less cost for an entire retail energy industry with an annual return of \$700-million, that was under their noses all along. Thus, PropaneSaver Recovery Systems requests the \$0.5-million grant over 3 years from PERC to implement the prototype devices and help the industry adopt them over 3 to 5 years, then speed licensing and manufacturing, plus let the world know about them to buy them from Americans.

ADDENDA 9: Persons interested or referred to we are planning to meet with:

- **Gina McCarthy, Administrator, US Environmental Protection Agency (TBA)**
- **US Secretary of Energy (TBA)**
- **Governor Jerry Brown of California, plus CA EPA and CARB Administrators (TBA)**
- **Dean Flippo, Monterey County District Attorney, also leads Environmental Crimes Unit prosecution for MBUAPCD Air Quality Compliance Inspectors (TBA)**
- **Lou Calcagno, former 16-year MBUAPCD Board member, Monterey County Supervisor, pro-business point-of-view in fiscal accountability and customer service in formulating environmental regulations (TBA)**
- **Carl Sedoryk, Monterey-Salinas Transit (MST), practical emission control (TBA)**
- **Nicholas DeCosta, Bruce Taylor, Taylor Farms, Greenhouse Gas Emission Reduction (TBA)**
- **Donald Wilcox, Public Works Director, City of Soledad (TBA)**

PropaneSaver Recovery Systems has made no effort to contact propane related media to date:

- Butane Propane News, POB 660698, Arcadia CA 91066-0698, 626-357-2168
- Indoor Comfort Marketing / Magazine, 3621 Hill Rd., Parsippany NJ 07054, 973-331-9545
- LP Gas Magazine, 1360 E. 9th St., #1970, Cleveland OH 44144-1737

ACRONYMS / GLOSSARY with relevant information for PERC:

Auto Gas = Propane: Vehicles operating on propane from a tank with no FMLLG (fillers use a gauge) and using a reduced emission nozzle to fill the onboard reservoir tank. Recent repeal/waiver of the federal excise tax on Autogas will cause competitive fuels to discuss/advertise fugitive emissions from nozzles, and all other propane fill transfer emissions that have not been addressed.

Auxiliary Recovery tank(s) or cylinder(s): The storage location of excess propane pressure exited through the threaded nozzle bleeder port connected to a PropaneSaver Recovery System to tank(s) owned by the retailer or wholesaler. There is a primary recovery tank that can receive twice via the PropaneSaver hose the excess pressure from the nozzle area; then 1 of the 2 portions of the recovered propane is sent back through the PropaneSaver hose to pre-fill with a NEXT customer's tank half of the pressure volume in the auxiliary recovery tank chosen to pre-fill from. (See patent diagram excerpt)

21 Buying Motives of Humanity: The advertising social psychology concept that a product may have 1,000 selling points, but they can be categorized in the following reasons that individuals buy: **Saving Money, Saving Labor, Convenience, Something for Nothing, Health, Safety, Security, Recreation, Environmental Improvement, Knowledge, Justice and Externality Rights, Freedom, Self-Esteem, Legal Compliance, Tastes Good, Good Taste, Prestige, Sex Appeal, Esthetic Beauty or Handsomeness, Saving Time, Adventure or Fear.** PropaneSaver Recovery Systems amazingly has an appeal to 16 Buying Motives (see bold type), when 4 usually guarantees economic success.



CARB or California Air Resources Board: The state agency charged with coping with air pollution's externality factors of human and natural sources, in conjunction with 35 Air Pollution Control Districts that make regulations relevant to VOCs like propane, residual pollution from burning fuel, and smog.

Clean Air Act: Requires the EPA to set public health and environmental **National Ambient Air Quality Standards (NAAQS)** for 6 pollutants: ozone, particulate matter, nitrogen oxides, carbon monoxide, sulphur dioxide, and lead. There are *primary* standards set at a level judged to be "requisite to protect the public health with an adequate margin of safety" and establish *secondary* standards that are "requisite" to protect public welfare from "any known or anticipated adverse effects associated with the pollutant in the ambient air" including effects on vegetation, soils, water, wildlife (loss of species, habitat quality, water, and nutrient cycles), buildings, national monuments, and visibility. (EPA fact sheet for NAAQS, Jan 2010)

Clean Air Scientific Advisory Committee (CASAC): Provides independent advice to the EPA Administrator on the relevant scientific, technical information, and on the standards themselves.

CNG: Compressed Natural Gas (methane)

Concentrated Local Air Pollution: unburned propane expansion to 270x to diffusion equilibrium in air.

Customer tank or cylinder: An owned, rented, or exchange cylinder or tank brought to a propane fill-station or exchange, or a tank next to a home or business that mobile delivery of propane is made to. PropaneSaver Recovery Systems are to capture excess pressure from a supply hose nozzle after filling tanks, and in the case of metal cylinders also capture vented propane from the FMLLG while preserving its visual cue that the cylinder is 80% full and to stop filling.

Cylinder Exchange Services: A retail location where cylinders are bought, then empties exchanged for filled ones for a price, usually found at grocery stores, fuel stations, or trucks come by the remote location and exchange them on call or on schedule. PERC's Cylinder Exchange Council should be interested in benefits of Propane Recovery Systems for both profit and anti-pollution politics.

EPA Ozone Board: Functionaries of the federal **Environmental Protection Agency** charged with the responsibility to reduce ground-level ozone smog particulates 2014-2031 under **President Obama's 2011 Executive Order 13563** for a **65 parts per billion ozone smog standard to the U.S. Environmental Protection Agency**, Administrator Gina McCarthy. Ground-level ozone O₃ sufficient to enter a plant can interfere with the ability of sensitive plants to produce and store food, leading to reduced growth, making them more susceptible to certain diseases, insects, other pollutants, competition, and harsh weather. Ground-level ozone from fugitive VOCs [like propane is currently], can in animals and humans reduce lung function, irritate and inflame airways including causing pain when taking a deep breath and or cause shortness of breath, increase frequency of asthma attacks & respiratory infection, & aggravate chronic lung diseases including emphysema and bronchitis. (EPA fact sheet for NAAQS, Jan 2010)

Field-testing PropaneSaver prototypes: In this grant, the limited manufacture of various PropaneSaver Recovery Systems for different uses, gaining feedback on form and function from retailers & wholesalers

of propane, then modifying them and placing those and revised new versions back into industry scrutiny to set standards by PERC and (re)insurance companies, and assisting the propane industry to meet governmental anti-pollution standards. Then the patent holder will issue manufacturing licenses to those specifications. PERC’s Safety Committee should be interested in insurance issues as well.

FMLLG or Fixed Maximum Liquid Level Gauge, or Outage Gauge, or liquid fuel level gauge valve, or fuel level safety indicator: The device on hundreds of millions of portable opaque metal cylinders designed to contain propane, that when open -- spews not merely vapor but liquid propane to visually clue the filling attendant that the liquid level in the propane cylinder is at 80% capacity and to stop filling. The extra 20% of volume is to accommodate temperature expansion of the liquefied propane gas to the standardized strength within a metal cylinder. A few million composite transparent cylinders generally have no need of them as the liquid level can be seen to a fill line. Bad practice of some/most attendants is to leave the FMLLG open spewing vapor from the beginning of the fill until more intense vaporizing liquid is seen venting out. The current ideal is to leave it closed until the last half gallon is likely reached. It doesn’t happen nearly at all.



This grant is requesting funds to develop prototype PropaneSaver devices fitted to preserve the visual clue in a clear tube or pop-up indicator that the safe 80% liquid level has been reached, while capturing venting propane (being wasted now) economically and polluting the air. Recovery of the FMLLG propane along the PropaneSaver patented route to recovery tanks just makes good sense and economic sense.

Fugitive Emissions: quantity and frequency of unburned propane vapors escaping at various transfer fills from tanks at points along the propane supply chain to the final customer; mostly at nozzle disconnect via bleeder valve into the air, and FMLLG venting which vents even more of a volume of VOC pollution.

Innovation patent: The existing dual patents with claims and apparatus anticipate various embodiments of PropaneSaver Recovery Systems’ inventor Michael Siegler, who has stated in the grant request he will pay for (not at PERC’s expense) the costs associated with further patents if needed by crediting individual PERC members, or at least PERC with a future reward from whatever apparatus was innovated from future licensing agreements with manufacturers, or his own production of PropaneSaver Recovery Systems.

ISO: International Standards Organization: Quality and machining standards set by an internationally.

Liquid Petroleum Gas: (Propane) that is compressible; or when not compressed turns to vapor.

Mobile Retailer of propane: A delivery truck company that uses large or shorter size supply tank trucks called “bobtails” for filling: cylinders, 100 to 500-gallon tanks at the typically rural residence or business of customers with cylinders, which often includes recreational vehicles in situ, warehouses, & farms. Bobtail trucks typically have a long hose to reach and fill the customer’s supply tank. Each fill requires a bleeder valve release of unburned propane into the air, prior to nozzle disconnect. A PropaneSaver Recovery System will route this waste from the bleeder valve on the dispensing nozzle into a small hose

leading back to an auxiliary recovery tank aboard the delivery truck (not the highly pressurized supply tank). The recovery hose is a small hose tie-wrapped to the large dispenser hose with its own valves/gauges. Such a dual direction hose can also be manufactured extruded as a channel part of the exterior or interior of the larger hose routing off to its bobtail truck's *recovery* tank.

National Fire Protection Association standard 58: is credited with motivating the reduced emission nozzles along with fire/casualty (re)insurance companies. As PropaneSaver becomes more widely known, the NFPA may interject itself to set standards mandating it for further saving of money in occupational hazard & health insurance. The Reinsurance industry meets annually in Monaco in September to hear talks on any technology that reduces liability and outlay of money in disasters, class action suits, or human factors. They have to move money around the world to local insurance companies to keep them solvent, especially when actuaries are shown anything from weather statistics, terrorist intent, or technological existence creating negligent liability in class action lawsuits when a solution is on the table and not used. Insurers go proactive to avoid liabilities, and offer discounts to clients to adopt a solution averting problems. PERC's granting this request could be coupled with an effort to reduce retailers/wholesalers insurance premiums because safety and health have been measurably improved with PropaneSaver Recovery Systems.

Nozzle bleeder fitting & valve: A female port fitting into the side of a nozzle that has threads to currently receive a valve to which a bleeder hose can be attached. The open ended hose leads a few feet away from the attendant so the attendant is not bathed in propane and its odorant. The escape of the excess propane pressure from the nozzle whether bathing the attendants hands and face, or with a bleeder hose bathing the ground and feet of customers that might be standing there; is still a wasted commodity worth money as pollution. The bleeder hose has a male fitting that threads into the bleeder valve's female port.

Future use of the nozzle's bleeder port is to attach a PropaneSaver male propane threaded fitting/valve/gauge that can fit into this female port on nozzles that previously wasted propane, in order



to capture most fugitive emissions from excess pressure in the nozzle prior to disconnect. The bleeder *valve* also has a subsequent female threading to receive downstream a male threaded PropaneSaver Recovery System.

There may be some advantages to leaving the bleeder valve as an intermediary to the nozzle port threading for wear -- only if the PropaneSaver is detached for the night and packed away; then the bleeder valve is shut before detaching the PropaneSaver Recovery System. Some older nozzles with a bleeder port/valve should be put back into service; versus the so-called reduced emission nozzles that are still spewing propane back into the faces of attendants. Recent nozzle designs ignored doing anything about the FMLLG venting either, which is often more of a problem than the disconnect pollution and waste of money. PropaneSaver prototypes



will address both issues *with as much existing equipment inventory as possible* to capture about a billion pounds of propane, and the retailers sell it for \$700M.

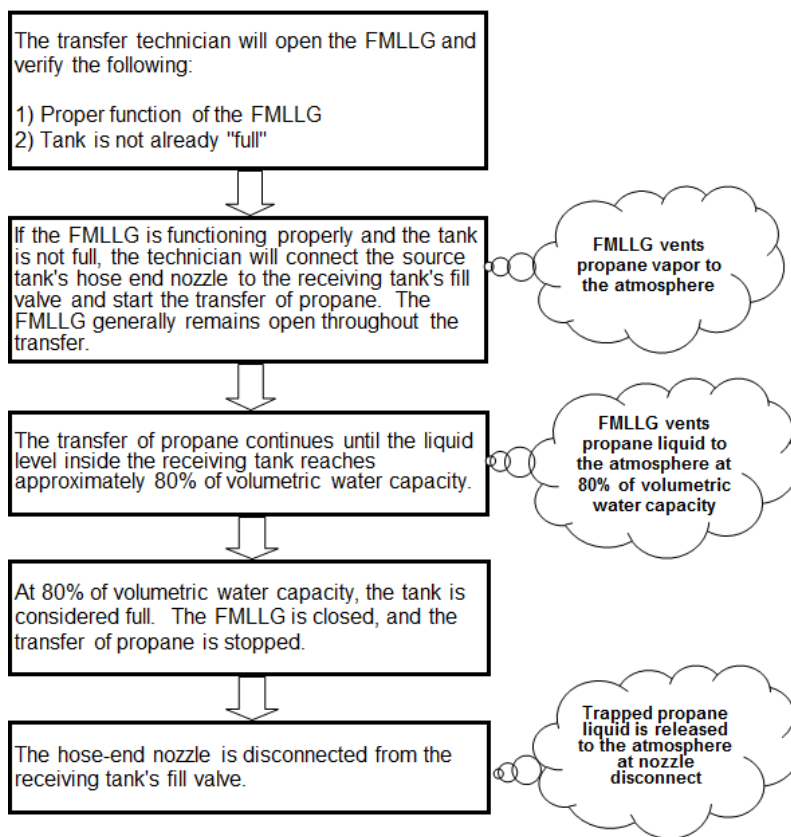
Odorant: added for safety to propane detection that is otherwise odorless and possibly lethal or explosive if undetected. The odorant is either **methyl mercaptan** or **dimethyl sulfide** at 0.4% of volume. Although propane has no chronic toxicity, it can asphyxiate an attendant with oxygen depletion, so the odorant acts as a warning of a gas presence or leak. (Hazardous Materials Handbook p.287)

Ozone, Ground-Level Ozone EPA Standards of Concentrations: The primary standard is averaged over 8-hour periods. The 4th highest 8-hour value at a particular monitor in the most recent year, is averaged with the 4th highest 8-hour values from the previous two years, to create a 3-year average. To meet the standard, pollution's 3-year average must be less than or equal to the standard. The secondary standard is designed to protect sensitive vegetation from adverse effects associated with cumulative ozone exposures during the three months when daytime ozone concentrations are the highest (Summer). The W126 "cumulative peak-weighted index" is calculated during 12 daylight hours 8am-8pm each day, with more weight given to higher concentrations that are more disproportionately damaging to sensitive trees & plants. These are averaged for daily, monthly, seasonal, annual, and 3-year maximum seasonal indexes. The latter is not to be exceeded by 7-15ppm-hours. (EPA fact sheet for NAAQS, Jan 2010) Note: in the grant request that after the daytime UV exposure breakdown of VOCs, ozone completes mixing at night to create even higher than daytime levels, not to mention smog mixing with 100 other chemicals. Agriculture interests in the Big Valley of California are noticing, between higher summertime ozone concentration stress, and drought public water policies, the death of numerous sensitive crops and orchards. (See www.epa.gov/ozonepollution for current information).

Pre-fill: dispensing at a fill-station ~2-ounces of recovered propane vapor to a customer's empty portable cylinder back through a PropaneSaver hose and valve/gauges route from previously recovered 4oz stored in a recovery tank. Or may similarly refer to recovering 2oz or 4oz into a recovery tank from 1 or 2 recoveries of excess pressure from a supply nozzle through the PropaneSaver route to a recovery tank(s) that were previously "empties" in a cylinder exchange program sitting handy at a fill-station. If the recovery tanks are switched out from a supply of exchanged cylinders on hand at a fill-station, then the "empties" are pre-filled with either 2oz or 4oz and picked up by the propane re-filler trucker who will credit the fill-station with those recovered propane ounces in the now "almost empties". It adds up.

Portable Cylinder: refers to a standardized 4-gallon liquid plus 1-gallon heat expansion safety area, commonly referred to as a **5-gallon cylinder** or a **20# cylinder**. Made of either metal or composite and/or transparent materials to handle 17 times compression of liquefied propane and vapor. The metal versions historically and more widely in use, have a Fixed Maximum Liquid Level Gauge (FMLLG) outage vent that visually demonstrates the tank has reached 80% full of liquid and visually clue the attendant to stop filling as propane vapor and liquid spew out. Some new composite cylinders are transparent so an FMLLG is unnecessary as the liquid reaches a seen fill line. Some portable cylinders have an additional temperature strip that changes colors to indicate cold liquid level that can signal to an attendant nearly when to open the FMLLG vapor vent instead of leaving it open during the entire filling process; although the effectiveness of the cold-strip declines with weathering. Each cylinder also has an on/off valve for receiving or dispensing propane.

Figure 3. General Propane Transfer Process



PropaneSaver recovery/pre-fill

hose(s): See TYPES 1A, 1B, 2A, 2B, 3, 4. Types 1A and 2A have a single recovery/pre-fill hose, as would TYPE 4 on a mobile truck only longer. TYPES 1B, 2B, and 3 all have a Y-valve that splits the recovery/pre-fill hose to two hoses or a hub valve for more. The first hose route leads to a primary recovery tank, typically a 5-gallon size to match the size of most customer cylinders at a fill station. The second recovery hose leads to a larger tank; or a hub valve leads to series of small handy “exchange” cylinders storing 2oz to 4oz of recovered propane -- that could not be dispensed back into a customer tank that was not empty, and had residual liquid pressure in it.

PropaneSaver patented route: the concept of propane plumbing devices recovering/pre-filling propane vapor or liquid to an auxiliary recovery tank(s) or subsequent customer tank, and not back to any originating liquid supply tank; and subsequently dispensing the saved vapor or liquid from the recovery tank for payment. Similarly, the PropaneSaver patented route running between the dispensing nozzle and a bobtail truck’s onboard recovery tank, may include an in-line sealed pump to accumulate liquid propane into a recovery tank(s). Similarly, at a busy fill station, an in-line sealed pump could be used to capture liquid propane into a recovery tank. The route is basically: recovery, storage, pre-filling as many subsequent tanks as possible. Any innovations are seen as included within the patented route.

PropaneSaver Recovery Systems, or PropaneSaver Vapor Recovery Systems, PropaneSaver Liquid Recovery Systems, PropaneSaver devices, or PropaneSaver devices: All “doing business as” fictitious business name statements of Michael Siegler referring to any of the patented methods of Michael Siegler to capture unburned propane during a fill transfer from a supply tank to a smaller tank, whether by mobile or stationary dispensing, back to an auxiliary tank, and pre-filling customer tanks, or storing it for a wholesaler to make use of in a mobile delivery context or a cylinder exchange program taking the recovered propane with them. These names will act as a brand in business, the prototyping innovations with PERC participation, educational efforts, for doing business as a 501(c)3, and for licensing contracts for the later manufacture licensing of such PropaneSaver Recovery Systems apparatus.

Recovery Nozzle: A nozzle with a threaded female bleeder port and or bleeder valve that has a subsequent threaded female fitting to receive a PropaneSaver Recovery System (instead of a bleeder hose venting into the air).



Sealed pump in-line: Primary use for on-board a bobtail propane delivery truck, for sending excess liquid & vapor propane along a PropaneSaver Recovery System route from nozzle back along a recovery hose to compress excess liquid & vapor into an auxiliary tank(s) on the truck, not the supply tank.

A sealed pump in-line could also be used in a high volume fill-station for a larger recovery tank. The larger recovery tank that can be used to consume vapor from at a remote locale, or sell pre-fills from.

Stationary Retailer of propane: A cylinder fill-station with an attendant that sells propane transferred from a large stationary supply tank into portable cylinders. An attendant currently connects a nozzle to a cylinder, and at some point during the transfer opens the Fixed Maximum Liquid Level Gauge (FMLLG) to determine when the cylinder is 80% full. Venting of unburned propane currently occurs at the nozzle release of excess pressure from a bleeder valve, prior to disconnect, and venting via a FMLLG.

Supply hose: The hose from any originating liquid propane source that is highly pressurized, pumped, and metered, connecting to a nozzle for dispensing propane to a customer cylinder, residential tank, or warehouse filling from such to a propane powered forklift.

Supply tank: The originating liquid propane repository tank. (See Supply hose).

UL or Underwriters Laboratories: An independent third party used by producers of devices and insurance companies to determine reliability, measure precisely, and see if claims are true. Any standards setting organization such as PERC should have a testing and evaluation protocol as part of its product development tracking.



(VOC) Volatile Organic Compound: Unburned carbon-based molecule that vaporizes at ambient air temperatures. Propane is a VOC. When sunlight hits propane it photo-chemically breaks down into ozone, carbon dioxide, carbon monoxide, and or other elements in the ground-level troposphere and lower stratosphere that make smog particulates that are not healthy to breathe. These are oxidized further combining photo-chemically with other pollutants, particularly NO and NO₂ from 60% transportation sources, to create 100 other compounds in smog, acid rain, and forming many toxic or long-chain molecules. These long-chain molecules, known as PANs, when hit by the Sun's Ultraviolet (UV) rays, will break down *again* into more ozone and other compounds like NO₂. The chemical stew, driven by the Sun's energy, and wind mixing them in transit, recombine to create even more artificial CO₂ as a by-product that contributes to climate change. Although propane does not contaminate ground water, it is temporarily soluble up to 0.64% in water complicating acid rain mixes including sulphuric, nitric, and carbonate acids. (Hazardous Chemicals Handbook p.287-9; and Atmospheric Chemical Reactions, Textbook Chapter 4, Jones & Bartlett Publishers, 2nd revised edition samples.jbpub.com/9780763759391/59391_CH04_0092.pdf)
[PERC may know of alignments in vehicle anti-pollution funding to augment this grant request.]

Warehouse Dispenser of propane: An in-house non-retail stationary supply tank used for company purposes and vehicles like forklifts. The enclosed nature of a warehouse usually has the customer's supply tank outside, but not always the filling apparatus. The release of unburned propane during transfers is currently both an occupational hazard often blowing into the face of personnel filling cylinders, and fire hazard; both are rendered nearly safe with PropaneSaver Recovery Systems. Fugitive propane is heavier than air, with a molecular weight of 44 and pools on the floor or sinks into recesses where electrical ignition sources are. The NFPA Standard 58 being more fully met or exceeded by PropaneSaver measurably improving health & safety, should lower insurance for warehouses using nozzles accepting use of a threaded port to PropaneSaver Recovery Systems.

(WPGA) Western Propane Gas Association: California-based regional propane industry organization, one of several as part of the **National Propane Gas Association (NPGA)**, composed of Gas Processors and propane distribution Wholesalers and Retailers.

Wonderful Proud PropaneSaver song:

I'm a propane savin' man.
I save propane when I can
all throughout this American land.

I'm a propane savin' man.
No need for it
squirtin' in the air,
or gettin' in your hair,
'cause someone out their cares.

I'm a propane savin' man,
I save propane when I can.
Yes, I am
a propane savin' man.