



UTD IMPACT

Utilization Technology
Development

January 2025

Leading researchers, entrepreneurs, universities, governmental agencies, governmental laboratories, customers, manufacturers, and others partner with UTD as a 501(c)(6) not-for-profit organization of utilities to develop and demonstrate affordable new gas solutions for end users, and accelerate the transition to a lower-carbon future.

Development and demonstration of economical new products, systems, and technologies helps customers save money, save energy, reduce GHG emissions, integrate renewable energy (including renewable natural gas and RE-derived hydrogen), and maintain safe, reliable, resilient operation of their homes and facilities with superior environmental performance.

Please contact us if you have any questions about UTD.

Ron Snedic (1.847.768.0572)

Rich Kooy (1.847.768.0512)

UTD helps utilities provide exciting new technologies to benefit their customers and society, while enhancing the impacts of utility energy-efficiency programs.

Utilities participating in UTD serve more than 35 million gas customers in North America.

Together we're shaping the energy future with clean, efficient end-use technologies.

Visit www.utd-co.org for more information.

COMMERCIALIZED PRODUCTS



SMTI ANESI Gas-fired Absorption Heat Pump for Space Heating and/or Water Heating

Provides AFUE-rated efficiency of 140% (~45% gas savings) with ultra-low NOx emissions of ≤ 14 ng/J while using zero GWP fluids, and performs reliably in extreme cold weather. Commercially introduced in 2023 after long-term technology RD&D support from UTD, including laboratory work and prototype field applications in CA, WI, IL, TN and Canada, with support also from U.S. DOE, CEC, NGIF and others.

SMTI ANESI

Scott Reed
818-421-4229
sreed@stonemnttechnologies.com
www.AnesiComfort.com



EC Power XRGI[®] MicroCHP

EC Power's XRGI efficiently produces heat and 24kW of power from the same fuel source. UTD collaborated with the CEC, SoCalGas and others to advance this engine-based micro-CHP system towards compliance with California Air Resource Board requirements. UTD also prototyped its use for multi-unit buildings applications and reported energy savings in technical publications.

EC POWER Inc.

Anders Thorsen
585-205-5127
ath@ecpower.com
www.ecpower.com

COMMERCIALIZED PRODUCTS (continued)



CleanO2 CarbinX™ Carbon Capture

CleanO2's revolutionary CarbinX unit captures CO₂ from the flue gas of boilers and furnaces to reduce GHG emissions, and turns it into a beneficial consumer product. UTD's members provided technology development expertise and support to CleanO2 since 2018 to refine early prototypes and partner with CleanO2 to identify and make product improvements.

CleanO2, Inc.

Jaeson Cardiff
carbinX@cleano2.ca
www.carbinx.com



Yanmar 3-Pipe Engine-driven Gas Pump

Yanmar's 3-pipe, 14-ton Gas Heat Pump (GHP) with variable refrigerant flow (VRF) offers an important energy-efficiency option for the North American market by combining heat recovery with simultaneous heating and cooling. In a 2018-24 field tests, UTD validated equipment performance and published technical summaries of the results.

YANMAR America Corp.

Eddie Caton
770-877-7733
eddie_caton@yanmar-es.com
www.yanmar-es.com



GRIDIRON PowerPlant™ H24 and HA65

The PowerPlant HA65 from GRIDIRON (formerly M-Trigen) provides high-efficiency microCHP with integrated cooling to homeowners, small businesses, and other users. UTD provided technical support for a notable demonstration by partnering with NYSERDA, National Grid, NJNG, and PERC to independently validate performance. UTD also supported GRIDIRON in its optimization of PowerPlant HA65 to minimize emissions, and its development of PowerPlant H24.

GRIDIRON

713-574-4506
info@gridironenergy.com
www.gridironenergy.com



Tecogen Hybrid-Drive Air-Cooled Chiller

Through laboratory validation and other efforts, UTD is supporting Tecogen's commercial introduction of a Hybrid-Drive 100-ton chiller that seamlessly operates on natural gas or electric grid power in order to integrate more renewable energy, reduce operating costs up to 50% compared to all-electric chillers, provide dual-power-source resiliency, and provide efficient hot water as well as chilled water.

Tecogen

Steve Lafaille
617-678-2429
stephen.lafaille@tecogen.com
www.tecogen.com



TMCAqua Energy and Water Recovery

TMCAqua's unique porous membrane technology developed with UTD's support simultaneously recovers both heat and water from boilers, ovens, dryers and similar equipment. It can increase boiler efficiency from 80% to 93% - typically saving customers 15% in energy while also reducing water demand.

TMC Aqua

TMCAqua@green-swans.com
www.green-swans.com/tmcaqua-technology/



U.S. Boiler K2 High Efficiency Gas Boiler

The K2 high efficiency condensing gas boiler offers 95% AFUE with 10:1 turndown, and uses a novel sheet metal burner from Europe. UTD validated its performance via laboratory tests to support potential gas utility MT incentives, and identified pathways to achieve <5 ppm NO_x emissions.

U.S. Boiler Inc.

Craig Eshenaur
717-239-4490
ceshenaur@usboiler.net
www.usboiler.net

COMMERCIALIZED PRODUCTS (continued)

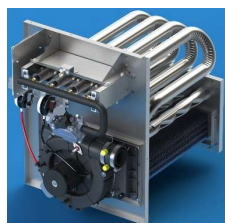


Condensing Dedicated Outside Air System/Rooftop Unit

Condensing heating versions of Munters Dedicated Outside Air System (DOAS) and other rooftop unit (RTU) products increase heating efficiency from 80%-81% to 90%-93%. Multiple RTU manufacturers are now offering DOAS with 90+% efficiencies, facilitated by the availability of condensing duct furnace modules first developed with UTD support.

Munters Corporation

Larry Klekar
210-249-3883
larry.klekar@munters.com
www.munters.com



Condensing Duct Furnace Modules

High-efficiency condensing heating modules developed with UTD support are now available from Beckett Gas and other OEMs, including Heatco, and are being applied to DOAS and other products including Make-Up Air Units available from multiple manufacturers including Aeon, Daikin, and RuppAir.

Beckett Gas, Inc.

Joel Mohar
440-783-7610
jmohar@beckettcorp.com
www.beckettgas.com



Gas Quality Sensor

The Gas Quality Sensor (GQS) uses solid-state infrared light absorption spectroscopy to measure Btu content and composition of natural gas and bio-methane fuels. It provides very fast response (3 seconds) at much lower cost than a gas chromatograph. It was developed with UTD's support and was commercially introduced by CMR Group in 2019.

CMR Group

Julien Moynet
+33 (0) 4 91 11 37 00
julien.moynet@cmr-group.com
www.cmr-group.com



Dettson Chinook Low-Capacity Furnace

This novel low-capacity furnace permits right-sizing for low-load buildings and aids integration with renewable energy and improved building envelopes. UTD researchers identified best application practices and provided supporting technical info.

Dettson

Philippe Verhas
1-800-567-2733
pverhas@dettson.ca
www.dettson.com



iFLOW and Advanced Combination Systems

UTD researchers demonstrated how a forced-air condensing tankless water heater combi system using the iFLOW can achieve 30-50% energy savings relative to best-in-class condensing furnaces and water heaters, and used a rigorous Virtual Test Home analysis to assess annualized performance.

iFLOW

Steve Bagshaw
1-800-985-9227 ext 102
steve.bagshaw@iflowhvac.com
www.iflowhvac.com



S.U.N. Equinox Solar-Assisted Heating System

The Equinox system is a combination solar/natural gas water heating system that uses an efficient evacuated tube design. It can be used in residential, commercial, or industrial locations and can meet 100% of domestic hot-water and space heating needs. UTD validated its energy performance in a field demonstration.

Solar Usage Now, LLC

Thom Blake
260-657-5605
tblake@solarusagenow.com
www.solarusagenow.com



iGEN Self-Powered Furnace

The innovative iGEN furnace generates its own electric power and contains an integrated battery, providing homeowners with continuous heating even during electricity outages. UTD supported the technical refinement of this product with laboratory testing, validation, and recommendations.

iGen Technologies

letstalk@igentechologies.ca
www.igentechologies.ca

COMMERCIALIZED PRODUCTS (continued)



ENERGY STAR® Fryers

Royal Range introduced the high-efficiency RHEF-75 fryer in 2019 - building on the success of the smaller-capacity, high-efficiency RHEF-45 fryer that received the National Restaurant Association's Kitchen Innovation Award and GFEN's Blue Flame Product of the Year Award. Independent testing showed 63% heavy-load cooking energy efficiency.

Royal Range of California

Robert Lutz
951-360-1600
robert@royalranges.com
www.royalranges.com



Low-Oil-Volume Fryers

Marketed by Frymaster as Protector® fryers, this equipment increases energy efficiency while also extending cooking-oil quality and life to provide significant customer savings. Field demonstrations completed by UTD have shown an average savings of \$4,800 per year per fryer.

Frymaster

800-221-4583
www.frymaster.com



ENERGY STAR Conveyor Oven

ENERGY STAR rated conveyor ovens from Lincoln include an advanced energy-management system to reduce energy consumption up to 38%.

Lincoln, a division of Manitowoc Foodservice

260-459-8200
www.lincolnfp.com



ENERGY STAR Convection Oven

This unit showed improved efficiency and 40% energy savings compared to a standard oven during field testing and achieved an ENERGY STAR rating.

Garland

905-624-0260
www.garland-group.com



High-Efficiency Broiler

This broiler features infrared burners and an energy-saving hood that showed an average of 23% energy savings during field testing. It offers more efficient cooking as well as reducing heat gain to the kitchen.

Royal Range of California

800-769-2414
www.royalranges.com



ENERGY STAR Countertop Steamer

A compact, gas-fired countertop steamer for commercial foodservice offers enhanced cooking rates while providing energy savings and reduced water consumption. It was the first gas-fired boilerless steamer on the market and received an ENERGY STAR rating.

Market Forge Industries Inc.

617-387-4100
866-698-3188
custserv@mfi.com
www.mfi.com



High-Efficiency Broiler

The Montague Company commercialized a version of the advanced broiler technology using thermostatic broiler-temperature control and an energy-saving hood. It was recognized with a Kitchen Innovations Award in 2013.

Montague

800-345-1830
www.montaguecompany.com

COMMERCIALIZED PRODUCTS (continued)



L9N

Cummins Westport 8.9L Near-Zero Emission NGV Engine

This 8.9L 320-HP NGV engine is widely used, with 50,000+ engines sold for transit, refuse-collection, and regional hauling applications since 2007. In 2016, it was advanced to become the first engine certified in North America to meet the 0.02 g/bhp-hr optional Near Zero (NZ) NO_x emissions standard (i.e. 90% lower than the current EPA NO_x limit of 0.2 g/bhp-hr).

Cummins Westport Inc.

Yemane Gessesse
812-377-5000
yemane.gessesse@cummins.com
www.cumminswestport.com



B6.7N

Cummins Westport 6.7L Medium-Duty NGV Engine

This 6.7L 240-HP natural gas vehicle (NGV) engine is used in school buses, shuttle buses, medium-duty trucks, and other vocational uses. It went into full commercial production in December 2016. It meets U.S. 2017 EPA GHG requirements as well as NZ NO_x emissions standard of 0.02 g/bhp-hr.

Cummins Westport Inc.

Yemane Gessesse
812-377-5000
yemane.gessesse@cummins.com
www.cumminswestport.com



ISX12N

Cummins Westport 11.9L Near-Zero Emission NGV Engine

This 11.9L 400-HP NGV engine is used in large trucks, buses, and refuse vehicles. Engine sales since 2013 are approaching 10,000 units and 25,000+ engines will likely be sold in N.A. by 2020, yielding emissions reductions and \$600+ million in annual fuel sales. In Model Year 18, it became CWI's second engine certified to meet NZ NO_x emissions standard of 0.02 g/bhp-hr.

Cummins Westport Inc.

Yemane Gessesse
812-377-5000
yemane.gessesse@cummins.com
www.cumminswestport.com



U.S. Hybrid Near Zero Emission Plug-in Hybrid Powertrain

This hybrid powertrain uses a CNG/RNG-powered engine and electric motor in parallel to provide 640 HP and 1770 lb-ft of maximum torque, to increase the use of electricity produced from RE, use less fuel, increase operating range and resiliency, and provide superior operating performance. It was developed with support from DOE, CEC, SCAQMD, SoCalGas, UTD, and others.

U.S. Hybrid

310-212-1200
sales@ushybrid.com
www.ushybrid.com

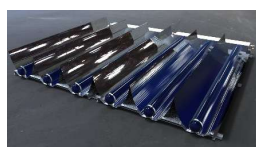


Heat Sponge Economizer for Industrial/Commercial Boilers

In either condensing or non-condensing configurations, this heat recovery system for commercial and industrial boilers (over 140,000-unit market in U.S.) increases boiler efficiency from 80% to a range of 85%-93% (validated by UTD lab testing). It also saves customers 5%-15% in annual energy costs. UTD completed a field test in Utah to validate energy savings.

Boilerroom Equipment, Inc.

866-666-8977
www.heatsponge.com



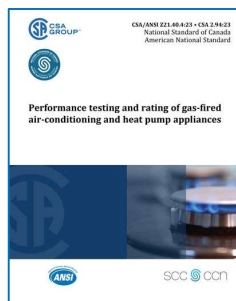
External Concentration Parabolic Collector

This patented, non-tracking, extremely-low-profile concentrator can achieve 200°C (392°F) solar thermal energy to economically serve commercial and industrial facilities and reduce GHG emissions. It can also be integrated with natural gas as a supplemental energy source. UTD provided technical and product development support and experimental validations over a seven-year period.

Artic Solar Inc.

Bill Guiney
904-513-4638
bill@articsolar.com
www.articsolar.com

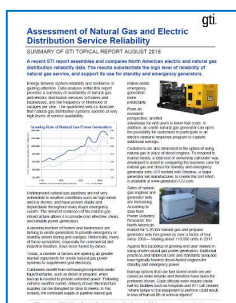
KEY INFORMATION & ANALYTICAL TOOLS



CSA/ANSI Z21.40.4-23/CSA 2.94-2023 Performance Testing and Rating of Gas-Fired Air Conditioning and Heat Pump Appliances Technical Committee Support

ANSI/CSA Z21.40.4 issued in 2023 and was a major upgrade and update to the 1996 edition of this Method of Test for GHPs. Updates included: increasing what can be rated with residential seasonal efficiency metrics; enhanced calculations and test conditions to better reflect systems designed for heating operation; more optional operating points; and expanded scope to include VRF-type engine-driven systems. UTD supported participation on the Technical Task Force that updated the Standard.

Available at <https://webstore.ansi.org>



Reliability, Cost and Environmental Impacts of Standby Generation Systems

Generac's website provides technical information related to emissions, reliability and costs of natural gas generators that was developed with UTD's support. For example, UTD researchers published a white paper that provided new data on the reliability of natural gas service and assisted in the development of a Total Cost of Ownership calculator that compares emissions and costs of natural gas vs. diesel-fueled standby generators.

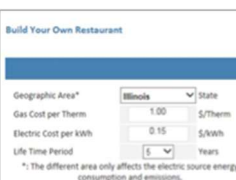
Available at <https://www.gti.energy/wp-content/uploads/2019/02/Assessment-of-Natural-Gas-Electric-Distribution-Service-Reliability-SummaryReport-Jul2018.pdf> and <https://www.generac.com/Industrial/all-about/natural-gas-fuel>



U.S. DOE Building America

Under five separate UTD projects from 2011 to 2021, UTD has developed key information and tools to support the U.S. DOE's Building America research, development, and demonstration program, which helps accelerate use of best practices by residential builders, remodelers, installers, code officials, designers, raters, teachers, and others.

Available at <https://www.gti.energy/BuildingAmerica> and <https://basc.pnnl.gov/library>



Commercial Foodservice (CFS) Equipment Calculator

This website provides the restaurant industry and others with information and tools to determine the economic and environmental benefits of using new, more advanced and efficient CFS equipment. The website was developed with UTD support and has been showcased at several restaurant trade shows. Further enhancements were made in 2024.

Available at <http://cfscalc.gastechnology.org>. For more info, contact Frank Johnson; fjohnson@gti.energy



Commercial Foodservice Energy Monitoring Systems (FEMS)

A real-time energy monitoring system for use in cooking demonstrations, trade shows, test kitchens, and similar venues was developed to help CFS customers better understand the GHG reduction and economic benefits of using higher-efficiency equipment.

For more info, contact Shawn Scott; sscott@gti.energy

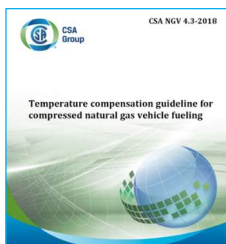
Virtual Test Home

A Virtual Test Home (VTH) in a laboratory was developed with UTD's support. The VTH holistically analyzes equipment and system performance by assessing part-load, annualized performance for various locations. The VTH helps accelerate the adoption of advanced gas technologies (such as GHPs, combis and modulating furnaces) in the marketplace and in performance assessment tools such as U.S. DOE's *EnergyPlus*™ or other energy software.

For more info, contact Tim Kingston; tkingston@gti.energy An overview is also available at <https://nea.org/product-council-documents/virtual-test-home>



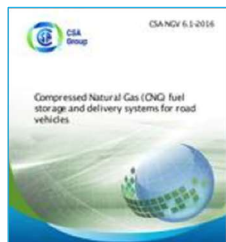
KEY INFORMATION & ANALYTICAL TOOLS (continued)



CSA NGV4.3 NGV Storage and Delivery Standard Technical Committee Support

CSA NGV4.3 was updated in 2022 and specifies requirements for temperature compensation control used to prevent compressed natural gas (CNG) dispensing systems from exceeding a safe fill level of vehicle fuel storage container(s). It contains safety performance guidelines and field evaluation methods for existing dispensing systems. UTD supported participation to lead the Technical Task Force that created the Standard in 2018 and updated it in 2022.

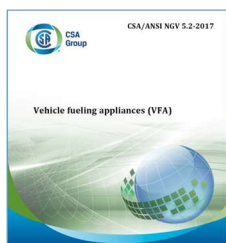
Available at www.csagroup.org



CSA NGV6.1 NGV Storage and Delivery Standard Technical Committee Support

CSA NGV6.1 was introduced in 2016 and defines the requirements for the balance of systems and equipment onboard a NGV, which is not otherwise defined by NGV1 for the receptacle or NGV2 for the storage containers. UTD supported participation on the Technical Committee.

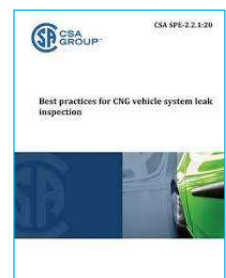
Available at www.csagroup.org



CSA NGV5.1 and NGV5.2 Fueling Appliance Standard Technical Committees Support

CSA NGV5.1 was introduced in 2015 and updated in 2016, and provides mechanical, physical, and electrical requirements for residential fueling appliances (RFAs) that dispense natural gas for NGVs, including indoor and outdoor fueling appliances that connect to residential gas piping. A complimentary standard, NGV5.2 for vehicle fueling appliances (VFAs) in non-residential locations, has been developed and was published in late 2017. UTD supported participation on both of the Technical Committees.

Available at www.csagroup.org



CSA SPE-2.21.1:20 Best Practices for CNG Vehicle System Leak Inspection Standard Technical Committee Support

In 2020, the first edition of CSA SPE-2.21.1 was published. It provided additional specific guidance and best practices to enhance user safety and mitigate potential leaks. Recommendations regarding in-service leak detection, inspection and repair are provided, including leak detection methods. UTD supported participation on the Technical Committee.

Available at www.csagroup.org



CSA NGV2 CNG Vehicle Fuel Containers Standard Technical Committee Support

The sixth edition of CSA NGV2 issued in 2019 and contains updated information and requirements for the material, design, manufacture and testing of serially-produced, refillable Type NGV 2 containers intended only for the storage of CNG for vehicle operation. The 2019 revision includes localized fire tests and conformable storage topics. UTD supported participation to lead the Technical Task Force that created the Standard.

Available at www.csagroup.org



EnergyPlus™ Technical Support/Input

UTD-funded research and publications have provided detailed performance data of high-efficiency fuel-fired heat pumps, innovative combination and hybrid systems, tankless water heaters, and other advanced fuel-fired equipment in order to support continuous improvement to DOE's flagship EnergyPlus whole-building energy simulation program, which engineers, architects, and researchers use to model energy consumption in buildings.

Available at <https://energyplus.net>

TECHNOLOGY ADVANCEMENTS



Hydrogen-Blended Gas in Residential, Commercial and Industrial Applications

UTD is performing substantial research on the blending of hydrogen into natural gas and the performance of blended fuels in many types of equipment commonly used in residential, commercial and industrial applications, such as to assess impacts on emissions, leakage, venting and safety. UTD is also developing new burner technologies that can operate on up to 100% hydrogen fuel, and identifying potential colorants to enhance flame visibility.

Project Managers: Multiple



Robur K18 Gas Heat Pump for Residential Space Heating and/or Water Heating

UTD is supporting the potential introduction into the North American market of Robur's K18 Gas Absorption Heat Pump. This 60,000 Btu/hr thermally-driven air-source heat pump will offer very high efficiency operation, with support from a long-established manufacturer. UTD performed laboratory testing to establish detailed performance curves, which can be incorporated into energy modeling tools in order to accelerate product adoption in North America.

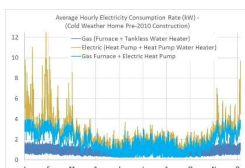
Project Manager: Alejandro Baez Guada



Ultra-Low NO_x Burner

This innovative firetube boiler technology has multiple years of proven successful operation at a Mission Linen Supply facility in California. It improves efficiency and achieves NO_x emissions below 9 vppm, while avoiding the significant efficiency, capital cost, and/or operating cost penalties if conventional Selective Catalytic Reduction or burner enhancements such as external Flue Gas Recirculation and/or High Excess Air firing were used.

Project Manager: David Cygan



Hybrid Fuel-fired and Electric-driven ResCom HVAC Systems

Researchers are evaluating emerging or commercially-available hybrid gas furnace/electric heat pump products in the North American market, in order to identify the more promising hybrid systems and develop installation and operation guides that can help end users accelerate their integration of electricity derived from renewable energy with fuel-fired equipment.

Project Manager: Alejandro Baez Guada



FlexCHP High-Efficiency Ultra-Clean Power and Steam Package

This innovative CHP package allows flexible steam production while meeting stringent California emission levels without a SCR system and across the full range of firing rates — achieving NO_x levels 50% below CARB limits. An installation in California operates with 84+% system efficiency and system emissions well below 9 ppm NO_x. UTD has provided long-term support, including efforts to apply the technology to broader application sizes (e.g. to 400 kW / 400 BHP).

Project Manager: David Cygan



Blue Frontier Rooftop AC Unit with Integrated Energy Production and Storage

UTD researchers are collaborating with Blue Frontier to help accelerate commercialization of its novel desiccant-based cooling technology that provides very high efficiency cooling with a Dedicated Outdoor Air System, in part by assessing in a laboratory prototype the feasibility of integrating on-site energy production in order to further enhance system efficiency, operational resiliency, and the benefit of this unique technology's integral energy storage.

Project Manager: Lee Van Dixhorn

TECHNOLOGY ADVANCEMENTS (continued)



Gas-Fired Warewasher

A gas-fired warewasher is being advanced in conjunction with a leading OEM. The estimated annual savings for restaurant, cafeteria, and other commercial food service operators is \$1,100-\$9,000 per warewasher (depending on size and type) while also saving energy and chemicals, when compared to electrically-heated warewashers that operate at lower temperature and thus require one-time use and environmental impact of chemicals.

Project Manager: Shawn Scott



Cost-Effective Compressor/Expander for Natural Gas and Hydrogen-fueled Vehicles

With UTD cost share and U.S. DOE funding, GTI Energy and the University of Texas, Austin developed a novel approach using a linear motor compressor with only one moving piston. The technology was recently scaled up to 50 SCFM capacity with UTD funding, and gas expansion applications are also being developed. The technology has the potential to significantly enhance CNG and H2 vehicle fueling operations, and a 2024 award selection from U.S. DOE will also advance its potential application as a refrigerant compressor.

Project Manager: Jason Stair



On-Demand Heat and Power System

This unique new technology has received a remarkable three rounds of funding from U.S. DOE ARPA-E, along with UTD and other co-funding support. This technology captures and stores renewable energy (or other resources, including waste heat), augments it with natural gas as needed, and delivers heat and power on-demand to commercial, industrial, and other users. The technology has been demonstrated at a pilot field installation in California.

Project Manager: David Cygan



SMTI ANESI Gas-fired Absorption Heat Pump Residential Water Heater

A field test of five prototype units of this efficient residential Gas-Fired Heat Pump Water Heater was successfully completed in Southern California during 2020, with support from CEC, UTD, SoCalGas and a prospective manufacturing partner. The unit has a projected Uniform Energy Factor (UEF) of 1.20-1.30 and ultra-low NOx emissions of ≤ 10 ng/J. Potential commercial production is being evaluated.

Project Manager: Paul Glanville



Energy Recovery Heat Exchanger

UTD researchers collaborated with CEC to demonstrate in California an advanced recuperator to increase energy efficiency at an aluminum die casting operation. Test results demonstrated 6-16% energy reduction. A 2024 award selection from U.S. DOE will further advance its technical development in 2025-27, in partnership with UTD and many others.

Project Manager: David Rue



Customized Affordable Retrofits of Building Envelopes and Mechanicals

UTD researchers are partnering with Hydronic Shell Technologies LLC (HST) to advance a new technology that can rapidly integrate highly innovative building envelope improvements with next-generation HVAC equipment retrofits to reduce GHG emissions by >50%, while providing significant operating cost savings for and minimal disruption to homeowners, residents in income-eligible housing or multi-family buildings, and others.

Project Manager: Jason LaFleur

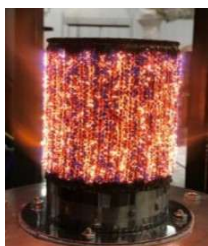
TECHNOLOGY ADVANCEMENTS (continued)



HeatAmp Adsorption Thermal Heat Pump

The product development effort couples a proprietary triple-state sorption technology with a novel product design integration that is expected to yield a family of cost-effective, high-efficiency, robust appliances with few moving parts. Example applications are water heating or combination water/space heating. UTD is helping HeatAmp develop its new product with laboratory testing, validation, design recommendations, and a review of applicable N.A. engineering standards.

Project Manager: Paul Glanville



ThermoLift Ultra-High-Efficiency, Heating/Cooling Vuilleumier Cycle Heat Pump

Vuilleumier cycle-based heat pumps could provide a step-change efficiency improvement over vapor absorption- or compression-based cycles, achieving cooling COP > 1 and heating COP > 2. UTD is working with a leading developer to advance key system components using both computational and experimental analysis, to help achieve performance goals in alpha prototype testing funded by DOE, UTD and others.

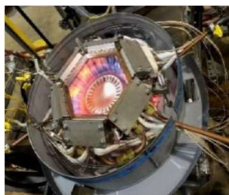
Project Manager: Alex Fridlyand



Next Generation Liquid Desiccant-based, Heat-Driven HVAC System

Liquid desiccant-based systems can efficiently remove moisture from air and reduce the amount of mechanical energy and water required by conventional HVAC technologies that de-humidify, condition, and re-humidify space air. In cooperation with NYSERDA and others, UTD is testing a novel new non-corrosive, non-toxic desiccant in a gas-driven system that offers a potential 30% increase in COP on a seasonal basis over conventional HVAC technologies.

Project Manager: Rich Swierczyna



Self-Powered Water Heaters

Higher-efficiency water heaters typically require the added expense of an electrical connection and are susceptible to power outages unless a separate battery back-up system is installed. UTD researchers have assessed leading thermoelectric generator (TEG) technologies, and in 2024 further analyzed opportunities in coordination with a major OEM to economically integrate TEGs and other technologies into a prototype water heater design.

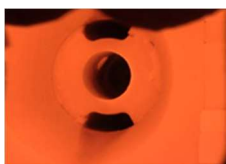
Project Manager: Sandeep Alavandi



Emerging Fuel Cells

UTD researchers experimentally tested and evaluated several fuel cells that are entering (or exploring entry into) the North American market in order to serve residential and light commercial end users. UTD research also identified and optimized the applications that can maximize the benefit of the high efficiency and reliability of these units.

Project Manager: Tim Kingston



FlexGen-H™ High Efficiency, Fuel-Flexible, Ultra-Low NOx Regenerative Burner

UTD is partnering with the U.S. DOE, an industry-leading OEM, SoCalGas and others to develop and test in a laboratory a next-generation 1.5–2.0 MMBtu/hr regenerative high-efficiency burner system that incorporates novel inserts and integrated cooling to: decarbonize process heating and related industrial use sectors such as iron, steel and aluminum by allowing flexible use of up to 100% H₂; and expand potential applications of high-efficiency regenerative operation to more industries when operating solely on renewable or fossil natural gas.

Project Manager: Sandeep Alavandi

TECHNOLOGY ADVANCEMENTS (continued)



CNG/RNG Locomotive

With prime funding from U.S. DOE, UTD and other entities are funding the development of a prototype locomotive that can run on fossil or renewable natural gas to serve Class I, II or III railroads in multi-engine, line-haul service, but achieve Near Zero Emissions and target 20% less fuel consumption than a diesel locomotive.

Project Manager: Bart Sowa



Distributed RNG/Biogas Production

UTD is partnering with leading technology developers such as Chomp Energy to increase renewable natural gas (RNG) or biogas production at end-use customer sites in order to reduce landfill requirements, reduce the transport of food waste, and meet de-carbonization goals. UTD is supporting technical advancements such as improved instrumentation, controls and designs.

Project Manager: Travis Pyrzyński



High Efficiency Convection Oven

UTD researchers tested design changes and innovations to achieve a 10% efficiency improvement vs. best-in-class Energy Star convection ovens. By their inherent design, these ovens constantly flow hot air out of the oven. There are an estimated 650,000-700,000 convection ovens in the US, according to a 2015 DOE study. Discussions with leading OEMs are in progress in order to commercialize this technical advancement.

Project Manager: Shawn Scott



Thermal Ejector Technology to Recover Energy and Water from Hot Flue Gases

In a field demonstration at a large industrial plant in California, UTD researchers partnered with CEC and a major manufacturer to apply a novel new thermal ejector technology which recovers useful process water from the plant's humid exhaust gas, which in turn increases energy efficiency. Opportunities to install the technology at larger scale at other facilities are being sought.

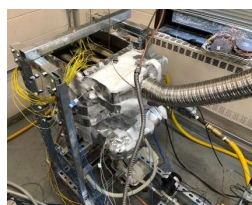
Project Manager: Lee Van Dixhorn



Energy Recovery System for Brewing and Distilling Operations

UTD researchers are testing a novel heat exchange system to recover previously-wasted energy at two micro-breweries in California, with funding from UTD and prime funding from CEC. Project goals include to recover 15-25% of heat from brew kettles, and reduce CO2 emissions by up to 25%, while maintaining superior process operations.

Project Manager: David Rue



Ionic Liquid Technology for Residential and Commercial Gas Heat Pumps

Researchers at the University of Florida and Micro Nano Technologies are partnering with UTD to design and demonstrate an early prototype of a low-cost, ultra-high-efficiency thermally-driven heat pump for residential and commercial water heating or combination water heating/space heating which employs the unique thermal properties of ionic liquids. A 2024 award selection from U.S. DOE will further advance its technical development in 2025-27, in partnership with UTD and many others.

Project Manager: Paul Glanville

TECHNOLOGY ADVANCEMENTS (continued)



High Efficiency and Low Emission Charbroiler

An advanced charbroiler is being created and demonstrated at laboratory scale that has the potential to improve efficiency by 20-30%, reduce particulate emissions by 20-50%, and reduce NO_x emissions by 20-30%.

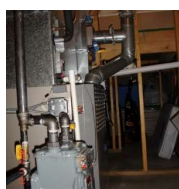
Project Manager: Shawn Scott



Next Generation Infrared Burner

In partnership with a leading OEM, UTD-funded researchers are testing a variety of unique metal foam materials in a laboratory to evaluate their potential performance as next-generation, high-efficiency, rapid-response, low-emission infrared burners that are directly fired with fossil or renewable natural gas. Field tests are in development.

Project Manager: Sandeep Alavandi



Furnace Retrofit for High-Efficiency Heating and Humidification

Tests of a patented Transport Membrane Humidifier (TMH) technology in four homes in Minnesota demonstrated a 14% increase in furnace efficiency while providing humidification without water supply. Interested licensees should contact Rich Kooy at rkooy@utd-co.org.

Project Manager: Dexin Wang



Low NO_x Energy-Efficient Advanced 3D-Printed Nozzle Burner

A novel design for next-generation retention nozzles leverages new additive manufacturing capabilities and equipment. In 2023, UTD is evaluating applications for boilers, water heating and air heating. Laboratory tests have demonstrated a robust, high-efficiency (3-6% increase), ultra-low emissions burner, with >10:1 turndown. It achieved 50%-75% reduction in NO_x emissions compared to current burners, with the potential to reach <5 ppm NO_x.

Project Manager: Sandeep Alavandi

WORKING WITH PARTNERS TO CO-FUND UTD INITIATIVES

In 2024, each \$1.00 in new UTD funding was leveraged by \$7.80 of funding from government and industry partners for related end-use R&D. GTI Energy secured \$37.6 million from federal and state government partners and \$6.5 million from manufacturing partners and other gas industry resources (outside of UTD) for related end-use R&D. Manufacturing partners also provided significant additional in-kind co-funding.

Examples include:

- U.S. Department of Defense (DOD) funding of \$20.9 million for four awards to apply advanced energy efficiency and heat pump technologies, and to develop and demonstrate novel distributed energy resources, in order to reduce GHG emissions and energy use while increasing resiliency.
- U.S. Department of Energy (DOE) funding of \$6.0 million to develop and test an advanced mobile hydrogen refueling system, with pilot deployments at various field sites to demonstrate capability.
- U.S. Department of Energy (DOE) funding of \$5.9 million for two awards to develop innovative fuel-flexible burners and combustion systems to expand use of low-carbon fuels such as hydrogen.
- California Energy Commission (CEC) funding of \$2.9 million to design, build, install and measure performance of two prototype energy-efficient manufactured homes with innovative insulation panels.