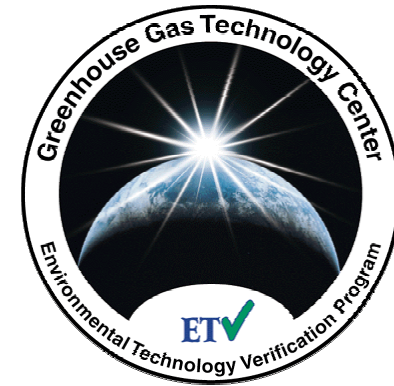




# The Greenhouse Gas Technology Center



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*Finding & Testing Technologies That  
Help Americans and Their  
Environment*



# Topics

- Southern Research Institute Background
- ETV & GHG Center Mission
- The ETV Process
- GHG Emissions
- GHG Center Technology Areas
- ETV in the Oil & Gas Industry
  - Examples of Recent Verifications
- What Next?



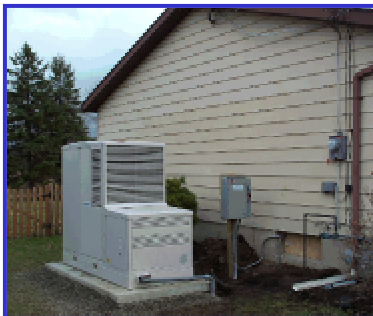
# Background on SRI

- Overview
  - Established in 1941
  - \$70 Million in 2003
  - 600 Employees, 8 Locations
  - Life Sciences, Engineering, Environment, Transportation, Home/National Defense
- Accomplishments
  - 5 Anti-cancer Drugs, 2 in Clinical Trials
  - New Composites and Other Materials
  - Chem., Bio., & Missile Defense Technologies
  - Environmental Technologies



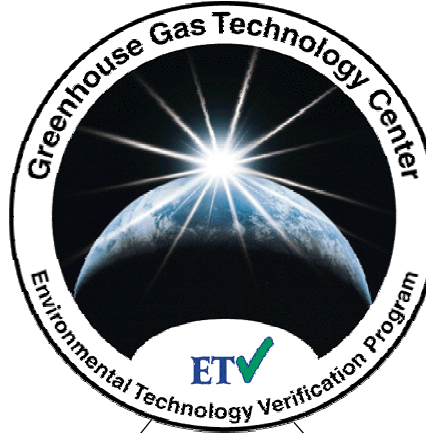
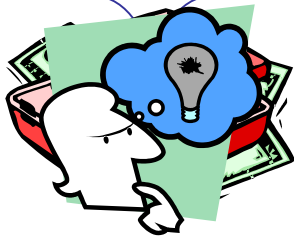
# Southern Research's Environment and Energy Department

Research & Testing of Advanced Energy Technologies: Gasifiers  
Catalysts, Distributed Generation, others.....





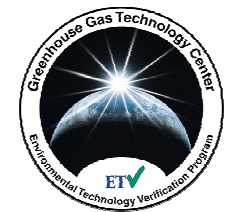
### Vendors & Industry Hosts





# GHG Center Mission




Locate promising GHG mitigation and monitoring technologies, subject them to comprehensive performance testing, report results to the public free of charge..... accelerating the use of good environmental technologies.





# Benefits of ETV

- Accelerated acceptance of new products
- Enhanced credibility via independent, 3<sup>rd</sup> party evaluations
- Expanded exposure through EPA outreach efforts.
- Aid users in technology selection
- Standardized and peer reviewed testing protocols.
- ETV funding to defray performance testing costs

THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM	
  	
<b>ETV Joint Verification Statement</b>	
TECHNOLOGY TYPE:	<b>EMISSION CONTAINMENT AND UTILIZATION SYSTEM</b>
APPLICATION:	<b>SECONDARY SEALING SYSTEM FOR RECIPROCATING COMPRESSOR ROD SEALS</b>
TECHNOLOGY NAME:	<b>SEAL ASSIST SYSTEM</b>
COMPANY:	<b>A&amp;A Environmental Seals, Inc.</b>
ADDRESS:	<b>3213 Texas Avenue      Phone: (502) 634-4796 La Marque, TX 77568      Fax: (502) 637-2280</b>
WEB SITE:	<b><a href="http://www.aagroup.com/esi">http://www.aagroup.com/esi</a></b>
E-MAIL:	<b><a href="mailto:esi.sales@aagroup.com">esi.sales@aagroup.com</a></b>
<p>The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies.</p> <p>ETV works in partnership with recognized standards and testing organizations, stakeholder groups which consist of buyers, vendor organizations and permittees, and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peer reviewed reports. All evaluations are conducted in accordance with rigorous quality assurance protocols to ensure that data of known and adequate quality are generated and that the results are defensible.</p> <p>The Greenhouse Gas (GHG) Technology Verification Center (the Center), one of 12 technology areas under ETV, is operated by Southern Research Institute, in cooperation with EPA's National Risk Management Research Laboratory. The Center has recently evaluated the performance of the Seal Assist System. This verification statement provides a summary of the test results for the A&amp;A Environmental Seals, Inc. Seal Assist System (SAS).</p>	



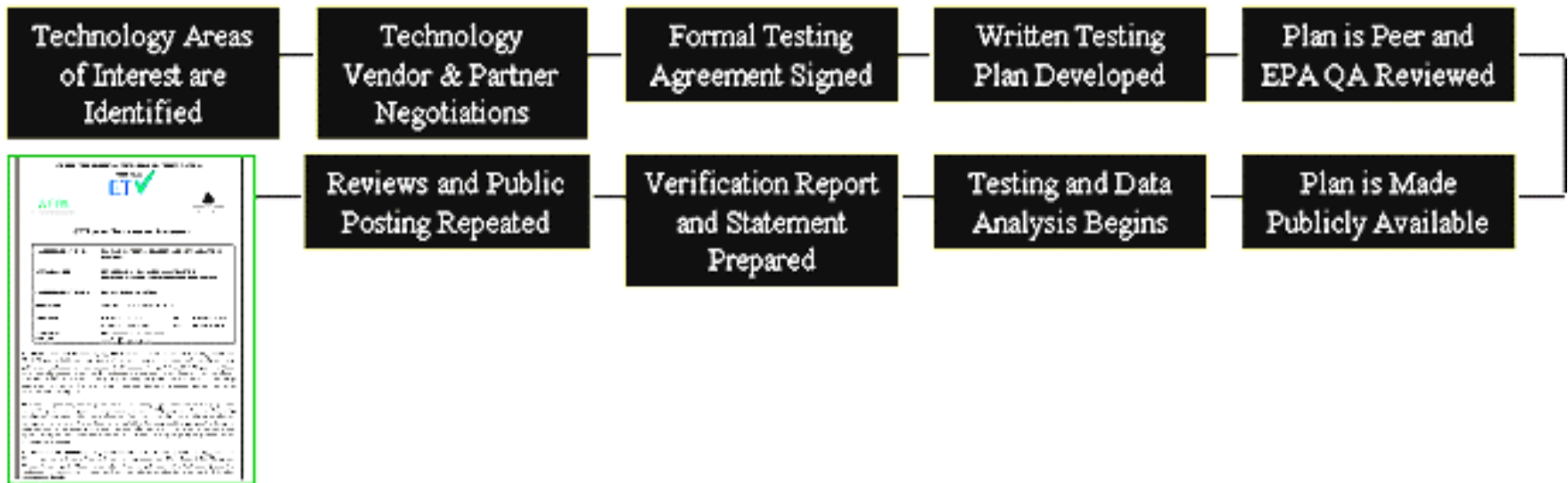
# ETV Requirements

- Commercially available or commercial ready technologies
- Significant vendor cost share
- Previous test data to support technology performance claims
- 6-12 month program schedule
- In-field testing of full scale units (may be site specific)
- Fully public process (All results posted on web)
  - [www.epa.gov/etv](http://www.epa.gov/etv)
  - [www.sri-rtp.com](http://www.sri-rtp.com)
- Don't do comparisons (shootouts)





# The Verification Process



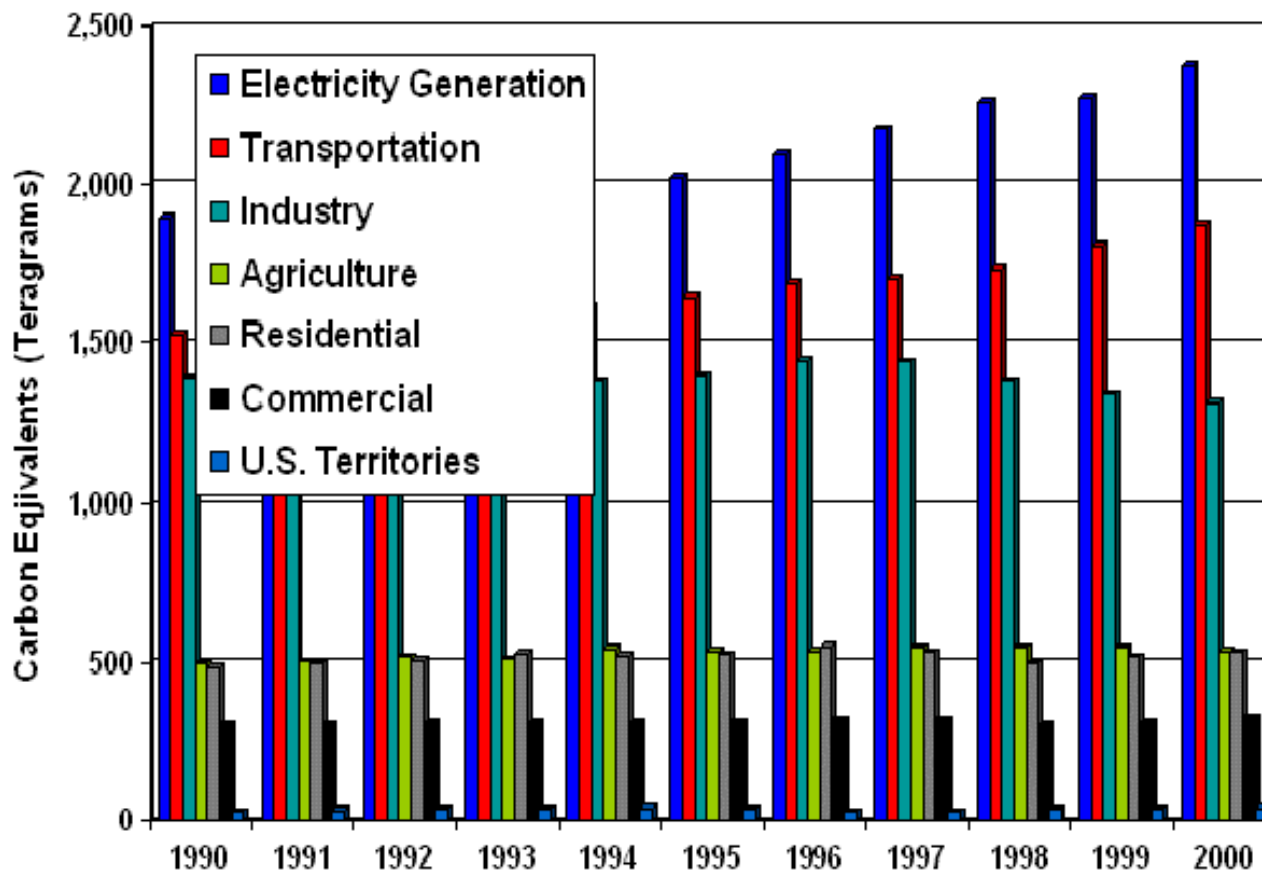


# Verification Parameters

- Greenhouse Gas Emissions ( $\text{CH}_4$ ,  $\text{CO}_2$ , etc.)
- Other Air Emissions (Criteria, Toxics)
- Emission Reductions (vs. baseline)
- Operational Performance
  - Does it do what it is supposed to do?
- Secondary Environmental Impacts (i.e. effluent discharges, solid wastes)
- Energy Savings
- Economics (simple payback)

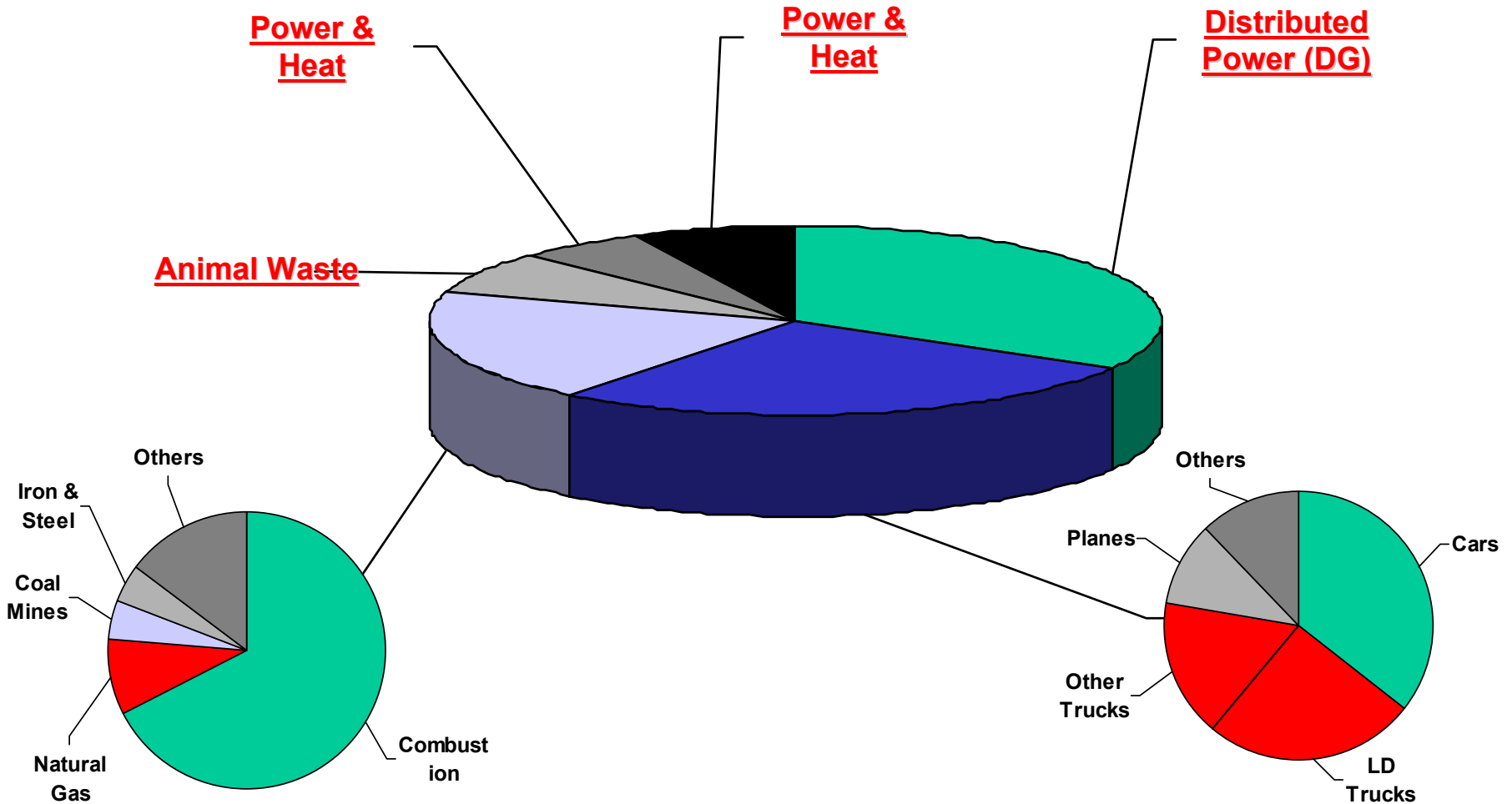


# GHG Emissions





## GHG Emissions in the USA (2001)





# Technology Focus Areas

- Oil & Gas Industries
  - Leak mitigation devices (5)
  - Process technologies (3)
- Transportation Industry
  - Fuels and lubricants (3)
  - Engine modifications (3)
- GHG Monitoring
  - Emissions (2)
- Power Industry
  - Distributed power & CHP - fossil fuel (6)
  - Distributed power & CHP - renewable fuel (5)
  - Renewable fuels conditioning (3)





# Transportation Technology Evaluations

- Focus on Fuel Economy
- Fuels and Lubricants
  - 2 Additives – in process (locomotive, heavy duty)
  - Advanced lubricant
- Engine Modifications
  - Modified cam shaft
  - Crankcase device
  - Gasoline pre-heater





# Sustainable Technologies

- Full Scale Demonstration of Switch Grass Co-firing
- Biogas Production and Use - dairy and swine farm, WWTP's, landfill, SUBBOR
- Distributed Energy Sources Operating on Renewable Fuels – Microturbines and Fuel Cells







# Electric Power Industry



- Pollution Highlights
  - 33% of total GHG's in U.S
  - Regulatory target, especially in dirty areas
- Focus Areas
  - Renewable & bio-energy
  - Distributed generation (DG)
  - Combined heat & power (CHP)



# Oil & Natural Gas Industries



- Pollution Highlights
  - 2% of total GHG's in U.S.
  - 13% of total industry GHG's
  - Air toxic emissions produced
- Focus Areas
  - Production & processing
  - Transmission
  - Distribution (not yet)





# GHG Technologies Evaluated For Oil & Gas

- Leak Capture Technology Evaluations
  - 5 technologies verified, 2 failed
  - 3 transmission, 2 storage
  - Good payback periods
- Process Technologies
  - 2 verified, 1 in process
  - 2 field production, 1 engine
  - Example results (next slide)





# COMM Engineering – EVRU

- Recovers Waste Gases Vented From Crude Oil and Other Storage Tanks
- Test approach
  - TotalFinaElf facility in Texas
  - Verify waste gas recovery rates, system availability, cost variables, GHG and toxic emissions reduced
- Selected Results
  - 140 – 260 Mcfd gas recovered
  - Simple payback of 0.3 years





# Engineered Concepts – Quantum Leap Dehydrator

- Removes Water and Condensable Hydrocarbons From Well Head Gas and Combusts GHG's and HAPS
- Testing Approach
  - Kerr-McGee gathering station in Colorado
  - Verify operational and environmental performance
- Selected Results
  - Toxics removal = 99.74%
  - GHG (methane) venting and flaring is eliminated





# NATCO Thiopaq / Shell-Paques Gas Conditioning System

*System uses a caustic scrubber to remove H<sub>2</sub>S while also digesting waste into S product to reduce hazardous effluent and regenerating and recycling NaOH into the scrubber*

- Completed test of biogas (WWTP) conditioning system
- Planning testing of sour gas treatment system (high pressure) for 2005
- Selected Results for biogas:
  - H<sub>2</sub>S removal efficiency of 99.8%
  - Bioreactor H<sub>2</sub>S vent conc. 929 ppbv
  - 0.12 gal NaOH / 1000 cf biogas
  - 59.2 % S solids product produced





# Ingersoll Rand – Microturbine DG-CHP

- 70 kW Microturbine CHP (*PowerWorks*)
- Field Test Site
  - Elder care facility in Morrisville, NY
  - On-site power use with grid sales
  - Space heat and hot water
  - Natural gas-fired
- Selected Results
  - Total efficiency: 46 - 51%
  - NO<sub>x</sub> emissions: 0.86 ppm
  - Emissions reduced: CO<sub>2</sub> 7%, NO<sub>x</sub> 34%
  - Power quality: met/exceeded IEEE





# Oil & Gas Technologies Of Interest to ETV

- Leak Detection Systems
  - Optical imaging
  - IR cameras
  - Remote Sensing for pipeline leaks (aerial)
  - Low-cost leak detection sensor systems
- Distributed Generation (DG-CHP) Applications in the Oil and Gas Industry
- Advanced Dehydration Technologies
- “Green” Well Completion Technologies
- Others (vapor recovery, seals, pneumatic replacements, repair systems)???





# What's Next for ETV and the Gas Industry?

- Identify technology focus areas
  - “Low hanging fruit”
  - Newer, unproven technologies
  - Obtain stakeholder input (i.e. Gas Star Partners)
- Solicit vendors of specific technologies
- Identify and establish partnerships
- Perform verification testing
- Outreach, outreach, outreach.....