

Charles E. Benson

Mr. Benson is a Principal of ENVIRON International Corp. His work focuses on the development and application of advanced energy technologies. He specializes in controlling air pollutants, increasing efficiency, improving productivity, and utilizing alternative fuels. Highlights from his natural gas supply project experience are provided below.

- For a major natural gas pipeline company he is developing gas quality standards to accommodate the introduction of imported liquefied natural gas (LNG) through three proposed terminals. A wide range of end-use equipment in the residential, commercial, and industrial sectors has been assessed to establish new interchangeability standards that will enable the safe and effective utilization of imported LNGs.
- For a large local natural gas distribution company (LDC), he is evaluating proposed changes to existing gas quality standards. As part of this effort he has reviewed residential and commercial appliance test data as well as historical data on gas compositions distributed in the region. He has also provided advice on field data to be collected in support of modifying the gas quality standards. Natural gas sources being evaluated include traditional domestic natural gas, imported LNG, and natural gas produced within the region.
- For Southern LNG, a liquefied natural gas import terminal owner, he directed the development of guidelines for compositions of imported LNGs that can be successfully distributed. A workshop was held with key stakeholders to address LNG interchangeability issues. Then residential, commercial, and industrial applications were assessed to define acceptable LNG compositions. The resulting recommendations will significantly expand the range of LNGs that can be distributed through the Elba Island terminal.
- For a large local natural gas distribution company, he established gas quality standards to enable the introduction of imported liquefied natural gas. In this project, performance data were collected from hundreds of residential appliances in customers' homes. Through statistical analyses, the performance characteristics of the entire population of appliances in the region were estimated. These results, coupled with gas interchangeability analyses, enabled the establishment of sound guidelines that protect the safety of the LDC's customers. Nitrogen blending and hydrocarbon stripping options were assessed as means to improve the interchangeability of the imported gases with the domestic supply.
- For a consortium of energy supply companies (BP, Shell, Statoil, Dominion, Washington Gas) he directed a project that determined compositions of imported liquefied natural gas that can be safely distributed to a major metropolitan area. Specific activities included gas interchangeability analyses, testing of residential appliances, field performance measurements, assessment of key industrial and power generation applications that utilize natural gas, and evaluation of nitrogen blending to improve the interchangeability of imported LNGs.

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- For a local natural gas distribution company, he directed an evaluation of requirements for introducing imported liquefied natural gas into their system with minimal customer impact. The program included gas interchangeability analyses, laboratory testing of appliances, a field survey of appliance performance, and an evaluation of air blending to improve LNG interchangeability. Based on this guidance, the distribution company now safely supplies vaporized LNG to their customers.
- For several proposed liquefied natural gas import terminals, including BP's planned Crown Landing facility, he has directed the development of LNG interchangeability guidelines. Each project has considered the local customer base as well as the range of natural gas compositions recently distributed in developing sound guidelines.
- For a local natural gas distribution company, he developed guidelines for operation of their propane-air peak shaving plant. Interchangeability analyses were performed to define the optimum ratio of propane-to-air and the maximum send out capacity. These guidelines were specified to avoid performance issues in residential appliances such as lifting, yellow tipping and incomplete combustion.

Mr. Benson holds a Bachelor of Science degree in Mechanical Engineering from Bucknell University and a Master of Engineering degree in Mechanical Engineering from the University of Florida. He has actively participated in the American Flame Research Committee (AFRC) and the International Flame Research Foundation. He organized and chaired the AFRC's International Symposium on *Emissions Reduction and Energy Conservation: Recent Progress in Combustion Technology*. He currently serves as the AFRC's Treasurer. Mr. Benson is a member of the Combustion Institute. He is the inventor of twelve patented combustion technologies.

Prior to joining ENVIRON, he was a Vice President of Arthur D. Little, Inc. and manager of their Energy and Transportation Sector. While at Exxon Research and Engineering Company, he managed combustion R&D activities, developed industrial burners, designed fired process heaters, and consulted in combustion technology for Exxon's worldwide operations.