



WORLD LP GAS ASSOCIATION

Global Technology Roadmap – Summary

1.0 About this Report

This report presents a summary of the results of the World LP Gas Association's Global Technology Roadmap published during 2009.

The Roadmap was prepared by Ross Brindle, Energetics Incorporated, who facilitated the roadmap workshop. David Tyler, Director at WLPGA, managed WLPGA's roadmapping effort. All comments, questions, and inquiries regarding this summary report should be directed to:

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2.0 Background

The World LP Gas Association (WLPGA) promotes the use of LP Gas worldwide to help foster a cleaner, healthier, and more prosperous world. An important part of this vision is bringing global LP Gas producers, marketers, equipment manufacturers and researchers together to share information about the latest technology developments worldwide through WLPGA's Global Technology Network, GLOTEC.

This network provides a forum for members to exchange information about global technology developments and other innovations that can be used to grow the worldwide LP Gas industry. This network has been operating successfully for more than five years and has enjoyed several notable achievements, including the first and second Global Technology Conferences in 2006 and 2008, respectively.

WLPGA seeks to build on these successes and extend the value of GLOTEC to participating member organizations. To this end, WLPGA developed a Global LP Gas Technology Roadmap, which defines opportunities for global technology collaboration and transfer that will benefit the global LP Gas industry.

The roadmap development process seeks to engage diverse stakeholders from across the LP Gas industry to define a vision for the future and the high-priority technology opportunities that can move the industry toward that vision. GLOTEC can then implement the roadmap by facilitating collaboration on technology development, sharing of technical information, and transferring the best technologies and practices among its members.



3.0 Roadmap Purpose

The broadest purpose of the Global LP Gas Technology Roadmap is to identify promising areas of technology collaboration and transfer that will benefit the global LP Gas industry. Specifically, the roadmap defines an agenda for GLOTEC that maximizes the value of the technology network to participating members and that attracts additional members to participate.

4.0 Results: Trends Shaping the Global LP Gas Industry (2010-2020)

In preparation for the roadmap workshop, WLPGA circulated a questionnaire to all GLOTEC members. This questionnaire was designed to solicit the industry's views on major trends and drivers that will shape the global LP Gas industry over the next 10 years. Responders were then asked to provide their vision of the industry in 2020, based on these trends and drivers and the technology innovations that they hoped GLOTEC could deliver.

The following tables offer a summary of questionnaire responses.

Table 1. Global Trends Shaping the Global LP Gas Industry: 2010-2020

<ul style="list-style-type: none">• Growing concern regarding climate change<ul style="list-style-type: none">○ Carbon cap-and-trade or taxes increasingly adopted○ Growth in renewable energy○ Changes in weather patterns affect heating demand• Slow economic recovery• Growing world supply surplus<ul style="list-style-type: none">○ May put downward pressure on prices○ May be consumed by new petrochemical plant construction• Increasing demand to providing energy beyond the electricity and natural gas grids<ul style="list-style-type: none">○ Strained electric grids look for relief during peaks• Growing need for better tools to manage LP Gas businesses<ul style="list-style-type: none">○ Customer relationship management (ordering, delivery, payment)○ Optimizing dealer management, management of capital assets
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Table 2. Key Trends and Drivers Affecting Developed Economies: 2010-2020

<p><u>General Trends and Drivers</u></p> <ul style="list-style-type: none">• Growing concern regarding climate change<ul style="list-style-type: none">○ Climate legislation increasing cost of LP Gas and other fossil fuels○ Growth in renewable energy• Growth of natural gas grids threatens markets• Increasing attention to environmental performance<ul style="list-style-type: none">○ Sulfur-free LP Gas○ Fuel blends (LP Gas-DME, LP Gas-diesel, LP Gas-biomass) <p><u>Domestic Market</u></p> <ul style="list-style-type: none">• Increased energy efficiency
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- Increased competition from other energy sources
- Some customers may be willing to pay slightly more for “green” or innovative technologies

Industrial/Commercial/Agricultural Markets

- Increasing sensitivity to LP Gas cost, driven by memories of 2008 spike in oil prices
- Increasing efficiencies reduce overall demand
- Increasing opportunities to improve agricultural productivity drives LP Gas demand in agriculture segment
 - Increased use in agriculture as concern about chemicals increases

Transport Markets

- Autogas growth possible with supportive regulations and OEM involvement

Power Generation Markets

- Increasing opportunities for LP Gas-fueled small-scale power generation
 - Gas engine heat pump (GHP) systems
 - Combined heat and power (CHP) systems
 - Renewable hybrid systems
 - Grid back-up and relief
 - Fuel cell systems

Table 3. Key Trends and Drivers Affecting Developing Economies: 2010-2020

General Trends and Drivers

- Growing concern regarding climate change
 - Climate legislation increases cost of LP Gas and other fossil fuels
 - Growth in renewable energy
- Slow economic recovery may delay infrastructure improvements
- Increasing population and rising standard of living drives increased demand
- Supply surplus and increasing operating efficiencies reduces energy costs and fuels market gains
- Increasing attention to environmental performance
 - Sulfur-free LP Gas
 - Fuel blends (LP Gas-DME, LP Gas-diesel, LP Gas-biomass)

Domestic Market

- Increasing cooking and heating markets
 - Growing health concerns with the use of biomass
- Increasing demand for energy in regions not served by electric or natural gas infrastructures pushes LP Gas demand

Industrial/Commercial/Agricultural Markets

- Improved agricultural productivity through pest control, desiccating equipment and animal housing heat
- Providing heating and power for commercial/industrial buildings



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Transport Markets

- Growth in Autogas possible with supportive regulations

Power Generation Markets

- Providing energy beyond electricity and natural gas grids
 - Infrastructure investments stall due to slow economic recovery
 - Grid supplement in areas with less reliable grid-supplied electricity

Table 4. Key Trends and Drivers: LP Gas Industry Processes and Operations

- Increasing productivity and efficiency through enhanced logistics technologies and systems
- Automation in filling plants to increase safety, improve efficiency and improve environmental performance
- Improving product quality to satisfy demands of new applications
- Tracing cylinders with RFID technology
- Improved IT systems to allow administration of custom services and improved dealer management
- Increasing storage capacity in large terminals
- Less invasive and more practical tank testing processes
- Remote monitoring of customer site conditions (liquid levels, equipment condition, etc.)
- Coherent and well designed set of standards for reducing purchasing, operating, and recycling costs for the LP Gas industry and end-users

5.0 Vision of the LP Gas Industry in 2020

The trends presented in 4.0 above will shape the global LP Gas industry in the decade to come. Amidst these changes, the industry will also continue developing and commercializing new technologies that extend the advantages of LP Gas to more consumers in more applications and in more parts of the world.

Based on the trends described above and individual perspectives of GLOTEC members, the vision of the LP Gas industry in 2020 is described below.

Globally, LP Gas will be broadly recognized as a low-carbon fuel that is part of the solution to climate change, not part of the problem. The LP Gas industry will continually and aggressively apply new technologies to increase efficiencies and reduce costs, enhancing the competitive position of LP Gas in energy markets around the world. While LP Gas will be recognized as an important but relatively small part of the global energy supply, it will be a major player in enabling distributed energy solutions, particularly in regions where electricity and natural gas grids do not exist or where these grids are overly burdened and unstable. New uses for LP Gas will continue to emerge, extending the benefits of LP Gas beyond traditional markets and into new areas such as agriculture and marine applications. Global and regional industry collaboration, and collaboration with governments, will assist and accelerate the development and deployment of new technologies.

In developed economies, new applications for LP Gas will continue to fuel industry growth, more than compensating for demand reductions due to conservation and stable populations in these established markets.



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In emerging and transitioning economies, LP Gas will improve the health of millions of people by replacing traditional biomass fuel sources in homes. LP Gas will be accessible in these economies through widespread availability of affordable appliances and highly efficient delivery services. Further, LP Gas will reach far beyond the electricity and natural gas grids, bringing clean, modern energy to people far sooner than otherwise would be possible.

In terms of the LP Gas industry itself, technology will touch nearly every aspect of the LP Gas business, allowing companies to operate safer and more efficiently. New technologies for automating operations, improving logistics, and strengthening customer relationships will drive efficiency gains and cost reductions for LP Gas companies. Innovations in fuel quality management and blends of LP Gas with other fuels will allow LP Gas to be used in applications that demand increasingly stringent fuel quality or environmental performance.

This vision was developed based upon responses to the questionnaire, analysis by Energetics of these responses and the trends and drivers, and discussion among participants at a Roadmap Workshop.

This vision is not intended to be a prediction. Rather, it is a statement of ambition—a future to which the global LP Gas industry aspires. This vision describes the “destination” of the Global LP Gas Roadmap and serves to guide the technology opportunities pursued by GLOTEC.

We hope you find it of value in charting the next 10 years.