Helium
Calmer seas ahead?

CEC Tucson June 2015 –
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<table>
<thead>
<tr>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>A rare gas with properties highly looked for</td>
</tr>
<tr>
<td>6 key applications in high end sectors</td>
</tr>
<tr>
<td>A sophisticated process requiring a unique expertise</td>
</tr>
<tr>
<td>2014 overview</td>
</tr>
<tr>
<td>Evolution in the 2000’s: strong changes at play</td>
</tr>
<tr>
<td>Many challenges implied for market players</td>
</tr>
<tr>
<td>The helium market offer vs. demand issue</td>
</tr>
<tr>
<td>Adjusting for the end of the “BLM buffer” era</td>
</tr>
<tr>
<td>In a nutshell…</td>
</tr>
<tr>
<td>Air Liquide, a major player ready for the new paradigm</td>
</tr>
</tbody>
</table>
A rare gas with properties highly looked for

- Helium is classified as a **noble gas** (such as argon, krypton, xenon and neon).
- It is **inert**, colorless, odorless and non-flammable.

- **Lowest boiling point of all elements** (-269°C)
  - **Strong cooling properties**

- **Very low molecular density** (only hydrogen is lighter)
  - **Can lift anything** in the air

- **High-level thermal conductivity**
  - **Perfect carrier gas**

- **Extremely low solubility**
  - **Essential to underwater decompression**
Six key applications in high-end sectors

MRI (Magnetic Resonance Imaging)
- Magnet cooling (a single MRI scanner requires approximately 700 liters of helium per year)

Rockets & Satellites
- Systems cooling & fuel pressurizing

Fiber Optics
- Highly purified glass preform creation & fiber cooling

Liquid form
- 40% volumes

Gaseous form
- 60% volumes

Electronics
- Production cooling

Breathing Atmospheres
- Faster, easier and safer decompression

Chromatography & Laboratory Applications
- Carrier gas & purge gas, zero gas or neutral atmosphere gas

NB: there are several other sectors for which Helium is a key molecule: leisure (balloons), airbags, welding…
A sophisticated process requiring a unique expertise

From extraction...

- **EXTRACTION**
  - Limited sources

- **PURIFICATION**
  - Filtration and pressure-swing adsorption **on-site**

- **LIQUEFACTION**
  - Liquefaction **on-site**

- **PRIMARY TRANSPORTATION**
  - In highly insulated cryogenic ISO 37,000-L containers

... to delivery

- **STORAGE**
  - Liquid: 65-L to 1,000-L
  - Gas: 3 to 160m3

- **SECONDARY TRANSPORTATION**
  - Dedicated fleet of trailers

- **CUSTOMERS**
A limited set of sources…

… but undergoing a deep reorganization
2014 overview: a limited set of sources

Only about **10 sources** to meet a constantly growing demand.

Current production volume: **7,500 ISO loads**
Helium needs to be transported from production zones to 3 main consumption areas.
The rise of the production in Qatar brings **new logistics constraints** on the worldwide level.
Evolution in the 2000’s: strong changes at play

Evolution of helium production in recent years and projection in the coming years

- USA: 4,700 ISO loads
- Algeria: 500 ISO loads
- Russia/CE: 400 ISO loads

2000: 5,600 ISO loads
Evolution in the 2000’s: strong changes at play

Evolution of helium production in recent years and projection in the coming years

- USA: 4,450
- Algeria: 800
- Middle East: 1,900
- Russia/CE: 200
- Darwin: 150

2000: 3,600 ISO loads
2014: 7,500 ISO loads
Evolution in the 2000’s: strong changes at play

Evolution of helium production in recent years and projection in the coming years

- USA: 3,000
- Algeria: 800
- Middle East: 2,000
- Russia: 6,000 – 7,000
- Darwin: 150

2030: 17,500 ISO loads

2014: 7,500
2030: 11,600
Many challenges implied for market players

**ECONOMIC CHALLENGES**
- **BLM index** is becoming erratic and unpredictable. Should it remain the reference?
- Rising and volatile cost
- Need for **product reliability management** – not all sources produce with the same reliability

**TECHNOLOGICAL CHALLENGES**
- Increasing **transportation** issues
- Growing need for **recycling** processes

**GEOPOLITICAL CHALLENGES**
- Risk associated with the new production areas
Looking ahead

A market likely to alternate between periods of excess demand and of excess offer

A historic market reference depleting quickly

A need for all stakeholders to better anticipate price evolutions
The helium market offer vs. demand issue

Evolution of helium production and demand on the 2000 – 2030 period

Hypothesis:
- A 3% yearly helium market growth (result of marketing studies for the 6 main markets)
- New sources projects realized as announced (Riley Ridge, Doe Canyon, St John, Qatar 3, GazProm)
- GazProm to deliver 4,400 ISO per year by 2030 (46% of the WW supply)
Adjusting for the end of the “BLM buffer” era

➔ Since 2012, the BLM annual capacity is decreasing. Its extinction is anticipated for the early 2020’s.

➔ Reduction in the BLM output will put an end to its capacity to act as the market buffer it has been for half a century.

BLM production vs. capacity 2003 – 2014

- BLM production adjusted in periods of lower demand (55% vs. capacity in 2003, 63% in 2009)
- New challenges:
  - BLM reserves decrease
  - Increasing quality / reliability issues
In a nutshell…

1. A **new paradigm** is appearing on the helium market
   - The US-dominated phase is ending…
   - … as is the buffer protection the BLM stocks provided

2. **New frontiers** open as new production areas develop

3. **Challenges arise** along with these, for which all markets players need to prepare
   - Cost-related
   - Technological
   - Geopolitical
Air Liquide, a major player ready for the new paradigm

**SOURCING CAPACITIES**
- Helium primary **sourcing volume multiplied by 3 since 2000** (market share rising from 11% to 19% on the same period)
- **Diversified portfolio** of helium sources around the globe

**KNOWLEDGE & EXPERTISE**
- Historical presence on the market = **know-how and experience**
- **Cryogenic expertise** including helium liquefaction and purification equipment

**WORLDWIDE PRESENCE & SUPPLY CHAIN**
- One of the largest fleets of **helium trailers** in the world
- Operating a significant number of filling centers in **Europe, Asia and the Americas**
- Among the main players on the offshore market (**sites in more than 90% of offshore supply bases**)

**STRONG INNOVATION CAPABILITIES**
- Direct involvement in **major international projects** like ITER, the International Thermonuclear Experimental Reactor, and the Large Hadron Collider (CERN)
- Heading innovation in **helium recycling**
Q & A session
Back-up slides
Air Liquide at a glance

**WORLD LEADER**
IN GASES, TECHNOLOGIES AND SERVICES
FOR INDUSTRY AND HEALTH

Present in

**80**
COUNTRIES

MORE THAN

**50,000**
EMPLOYEES

MORE THAN

**2 MILLION**
customers and patients

10 Research & Development centers
15 Engineering centers

Around **300** patents per year

2013 Revenue: **€15,225 million**
2013 Net profit: **€1,640 million**
Strong logistics capabilities

FLEXIBILITY
in supply to match
CUSTOMER NEEDS

MORE THAN
500
facilities worldwide

Present in
80
COUNTRIES

A network of more than
10,000
distributors

PACKAGED GASES
- Strategically-sited filling centers to serve customers within a 200km radius
- Standardized filling units for product consistency across the world
- The easiest to use cylinders and valves on the market, for safer, more ergonomic and efficient use of gas (SMARTOP™, ALTOP™)

BULK SUPPLY
- Our dispatch centers are located in the heart of industrial basins
- World-class logistics ensuring improved supply reliability to 4,000+ customer sites
- Automatic re-ordering through self-powered wireless telemetry units (monitoring supply level on-site)